Cities, Seas, and Storms

Managing Change in Pacific Island Economies

Volume III
Managing the Use of the Ocean

November 30, 2000

PAPUA NEW GUINEA AND PACIFIC ISLANDS COUNTRY UNIT • THE WORLD BANK

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Acronyms and Abbreviations

ADB	Asian Development Bank
AUSAID	Australian Agency for International Development
EACNI	East Asia and Pacific Country Management Unit for Papua New Guinea and Pacific Islands (World Bank)
EASRD	East Asia and Pacific Regional Development and Natural Resources Unit (World Bank)
EAPVP	East Asia and Pacific Vice Presidency (World Bank)
EEZ	Exclusive Economic Zone
FFA	Forum Fisheries Agency
GDP	Gross Domestic Product
MHLC	Multilateral High Level Conference
NGOs	Non-Governmental Organizations
SOPAC	South Pacific Applied Geoscience Commission
SPC	Secretariat of the Pacific Community
TAC	Total Allowable Catch
UNDP	United Nations Development Programme
US	United States of America
US$	United States Dollar

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Executive Summary

As the 21st century begins, Pacific Island countries are being confronted with new challenges and opportunities arising from changes in their physical, social, and economic environment. Pacific Island countries can actively engage in foreseeing and managing the process of adaptation to these changes, or they can have unplanned adaptation imposed on them by forces outside their control.

One of the major areas where managing change will be critical is the interaction between people and the Pacific ocean. Managing the use of this immense ocean and of the increasingly threatened coastal areas will be a key challenge for Pacific Island countries in the 21st century, requiring stronger collaboration among communities, governments and organizations throughout the region.

Three issues related to the use of the ocean offer both great opportunities as well as great challenges for Pacific Island people: the management of coastal areas and their resources, the management of tuna fisheries, and the regulatory framework for seabed mining.

This volume examines how Pacific Island countries could best address these challenges in face of current trends. The key outcome of the report is intended to be an improved understanding of the need for management interventions. The report also argues for a greater collaboration between traditional, national and regional organizations in ocean management, able to maximize their comparative strengths while minimizing the inefficiencies in their interaction.

This volume is divided into five chapters. Chapter 1 provides an overview of the importance of the ocean to Pacific Island people, and describes the key challenges and opportunities the ocean presents. Chapter 2 outlines a strategy for managing coastal areas in the Pacific. Chapter 3 focuses on the management of shared tuna fisheries and on ways Pacific Island countries could optimize their benefits under a new regional management regime. Chapter 4 analyzes the policy and regulatory environment for seabed mining. A summary of key findings and recommendations is included in Chapter 5. Annexes A and B describe the methodology used to value subsistence fisheries and provide relevant statistics. Background studies to this report are cited in *References.*

This volume is the third of a four-volume report entitled "*Cities, Seas and Storms: Managing Change in the Pacific Island Economies*" produced by the World Bank as the Year 2000 Regional Economic Report for the Pacific Islands. In addition to this volume, the series includes a summary report (Volume I); a volume dedicated to the management of Pacific towns (Volume II) and a volume focusing on adaptation to climate change (Volume IV).

The Coast

Coastal areas serve not only as an integral part of Pacific Islanders' culture, but also represent vital sources of food and income. Without subsistence fisheries, countries such as Fiji, Samoa, the Solomon Islands and Vanuatu would have to import an additional US$7-$15 million a year in foods of equivalent protein content. Coastal areas also help support a US$1 billion a year tourism industry, and are important sources of construction and housing materials. And the coral reefs and mangroves that surround the small islands play critical roles in protecting the coastal infrastructure against storms.

For long, the coastal areas and lagoons have been viewed as an infinite source of fish, and a receptacle for much of the waste generated by towns and villages.

This perception has to change. Coastal areas throughout the Pacific are being threatened by

overfishing, pollution, mining, and poor coastal planning, resulting in fisheries depletion and coastal degradation.

These problems are imposing significant economic and social costs on Pacific Island countries. As most communities and economic activities are located at or near the coast, the degradation of the coastal areas has a direct impact onto the livelihoods and well being of Pacific Island people. It is also in the coastal areas that much of the islands' vulnerability to extreme climate events can be found. And coastal degradation could have broader economic impacts: in an increasingly globalized world, the quality of the coastal environment and the management strategies adopted by Pacific Island governments to minimize coastal hazards will become critical factors in investors' decisions on whether or not to invest in a particular country.

Addressing these challenges will require close partnerships between coastal communities and governments. Neither governments nor communities can manage coastal areas on their own. Due to the distances between islands and the existence of customary marine tenure in many islands, government-only efforts cannot succeed in isolation. At the same time, communities need help in controlling threats to their coastal areas that cannot be easily handled at the site level (such as pollution). Collaborative, or co-management partnerships between coastal communities, governments, and nongovernmental organizations (NGOs) will be necessary to effectively manage coastal areas and restore their productivity and functions.

To be effective, co-management partnerships should meet three conditions:

- The roles of coastal communities and their external partners—governments or NGOs—need to be defined clearly, in a way that draws upon the comparative strengths of each partner.
- Effective communication forums─such as island councils─need to be established between communities and their external partners.
- Intersectoral planning among government agencies should be promoted to prevent conflicting or overlapping policies in coastal areas.

These activities do not require large budgets. Rather, they require a commitment from governments and donors to work closely with local level institutions to provide the kind of assistance communities need to manage their coastal areas.

Tuna Fisheries

Pacific Island countries control an Exclusive Economic Zone (EEZ) with the richest tuna fishing grounds in the world: up to a third of the world's tuna catch is caught there, at a value of US$1.3 billion in 1998. Most tuna is caught by distant water fishing fleets, who pay coastal states license fees for the right to fish in their EEZs. These fees represent some 30-60 percent of the total revenue generated by Micronesian countries.

The management of tuna fisheries poses particular challenges to Pacific Island countries. Because tuna are highly migratory, their management requires close regional collaboration. Pacific Island countries and distant water fishing nations have put considerable efforts in recent years in negotiating a new regional convention to manage and conserve the tuna resources of the Western and Central Pacific.

However, poor collaboration among Pacific countries and uncertainties on key aspects of the convention—namely, the financial contributions of member states and the allocation of the total allowable catch—may weaken the Pacific Island countries' ability to maximize future benefits from tuna exploitation in their Exclusive Economic Zones.

The new convention allows coastal states the right to continue to manage tuna resources in their EEZs. Yet the new management regime is likely to require a substantial financial contribution from coastal states, in the order of US$2 million in additional investment costs and US$3 million in annual operating costs. Currently, some 55 percent of the operating costs are funded by foreign aid. If

aid donors shifted their support from the existing vessel monitoring system (which is controlled by Pacific Island countries) to a new regional system supported by the commission (which is controlled also by distant water fishing nations), Pacific Island countries could lose their ability to independently monitor fishing operations on their EEZs. For this reason, coastal states should seek to retain and expand upon the existing vessel monitoring system, and in moving toward a user-pay approach where foreign fleets would shoulder most of the burden of tuna management.

Another issue where future decisions will be critical is the allocation of total allowable catch (TAC) between coastal states and distant water fishing nations. An allocation of the TAC to coastal states as a group (possibly reflecting tuna concentrations on their EEZs), would strengthen the Pacific Island countries' power to negotiate access fees. Any allocation to individual countries, on the other hand, would weaken their negotiating leverage and create incentives for the countries to discontinue regional cooperation.

At present, the only multilateral agreement in the region is the United States Treaty. All other agreements have been negotiated bilaterally. Pacific Island countries cite fears of losing bilateral aid and reluctance to subsidize less-endowed countries as common reasons for this preference. However, multilateral negotiations would give Pacific Island countries the best opportunity to derive optimal access fees, as the coastal states' position would change from that of a small seller of a modest, fluctuating resource to a single supplier of a large and stable resource. Negotiating as a group would also prevent distant water fishing nations from negotiating only with countries offering the most favorable conditions.

The key to success is regional collaboration. To maximize their benefits under the new management regime, Pacific Island countries should collaborate as a group to preserve independent monitoring in their EEZs, retain a fair share of the total allowable tuna catch, and negotiate optimal access fee agreements with distant water fishing nations.

Seabed Mining

Although the exploitation of deep sea minerals is yet to commence, seabed mining could become a reality in the Pacific within the next 10-30 years. The potential for the industry is reportedly large.

Under the Law of the Sea Convention, Pacific Island countries who qualify have until 2004 to extend maritime claims from their 200-mile EEZ to the limits of the continental margin. Extending these claims would provide them with rights to additional seabed mineral deposits that may occur in these areas, and should therefore be completed as a matter of urgency.

Given the potential environmental impacts and the large scale of seabed mining operations, it is critical that Pacific Island countries adopt appropriate seabed mining policies. These policies and subsequent legislation should create a suitable climate for foreign investment, while at the same time establishing strict environment safeguards, independent environmental monitoring, and a forum for public participation in licensing decisions. Pacific Island governments may want to consider the following environmental safeguards in the development of these policies:

- Assess environmental impacts in actual field conditions prior to the issuance of exploitation licenses;
- Adopt a regional code of environmental practice;
- Establish a regional system for independent monitoring;
- Impose strict penalties for pollution;
- Require up front rehabilitation deposits and environmental bonds; and
- Ban seabed mining in areas of high biological value.

Regional collaboration among coastal states will be important not only in surveying areas of the continental shelf, but also in the development of future arrangements for environmental monitoring, and in the drafting and implementation of national offshore mineral policies.

These recommendations are meant not only to assist Pacific Island countries in meeting the challenges of managing the use of the ocean, but also to encourage them to utilize the opportunities it represents. By embracing these opportunities, Pacific Island stand a better chance to use wisely the resources and functions of the ocean, and ensure a continuation of these benefits for years to come.

Chapter 1
The Ocean to Pacific Island People

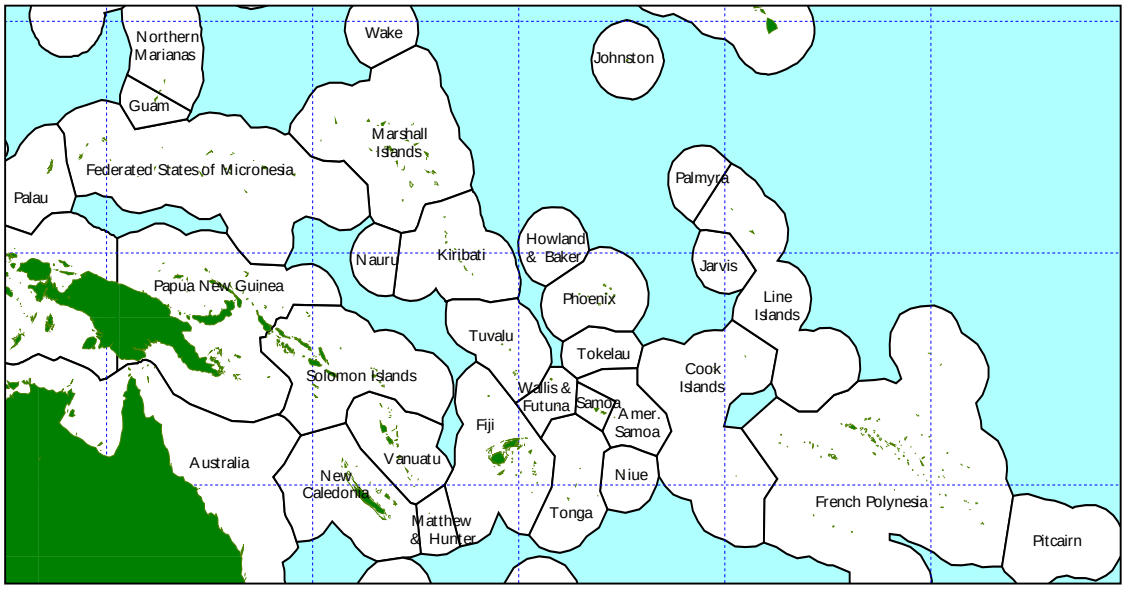
The Pacific Ocean occupies 180 million square kilometers—half of the earth's sea surface and more than a third of the Earth's surface. Scattered in the western half of this immense area are 200 high islands and 2,500 low islands or atolls, which make up the 22 countries and territories of the Pacific Islands (figure 1).

The region's unique geographical characteristics have helped shape the cultural traits of its people. Arriving first to the region, Melanesian ancestors settled in the high islands of the Western Pacific. Faced with abundant resources and a complex topography, Melanesian communities developed largely isolated from one another, leading to a multiplicity of languages and cultural traits. In contrast, the resource-poor islands of Polynesia and Micronesia provided the impetus for sea travels and expansion into the outer edges of the Pacific Ocean.

In this "sea of islands"[1]—where the ocean exceeds land masses by an average factor of 300 to 1 (table1)—the people of the Pacific have developed a unique relation with the ocean that has shaped their sense of place, their economies, and their culture. For them, the ocean is both a shared resource and a source of isolation. It helps define the ways communities communicate and are governed, and it continues to be a source of cultural significance and inspiration.

The relation that Pacific Island people have with the ocean is dualistic. The vast offshore areas—the deep ocean—represent the frontier, a region of underexploited resources of high economic and strategic value. Yet for most Pacific Islanders, it is the coastal areas surrounding their islands that provide the food, income, culture, and recreation that are so important to the Pacific way of life.

Figure 1. The Exclusive Economic Zones of Pacific Islands



Source: Courtesy of Secretariat of the Pacific Community

[1] Hau'ofa 1993.

A. The Nature of the Challenges

Threatened Coastal Areas

Coastal areas in the Pacific are increasingly threatened. Overfishing, pollution, mining, and poor coastal planning are leading to the depletion of fisheries and to coastal degradation, undermining the livelihood of coastal communities. The decline of mangroves and coral reefs is increasing the islands' exposure to cyclones and storm surges (see Volume IV to this report).

Pacific Island governments can no longer afford a policy of inaction. The degradation of coastal areas is imposing significant economic and social costs, leaving coastal communities in need of urgent assistance. Managing the use of coastal areas is a major challenge for Pacific Island countries at current times.

Table 1. Pacific Islands Land and Ocean Areas

Country or territory[a]	*Land area (square kilometers)*	*EEZ*[b] *(square kilometers)*	*Ratio of Ocean to Land Area*
Samoa	2.934	120.000	41
Solomon Islands	29,785	1,340,000	45
Vanuatu	12.189	680.000	56
Fiii	18.376	1.290.000	70
New Caledonia	19.103	1.740.000	91
Guam	549	218.000	397
Tonga	696	700.000	1.006
Palau	500	629.000	1.258
French Polvnesia	3.521	5.030.000	1.429
Niue	258	390.000	1.512
American Samoa	197	390.000	1.980
Wallis and Futuna	124	300.000	2.419
Marshall Islands	720	2.131.000	2.960
Northern Marianas	475	1.823.000	3.838
Fed. States of Micronesia	702	2.978.000	4.242
Kiribati	726	3.550.000	4.890
Cook Islands	180	1.830.000	10.167
Nauru	21	320.000	15.238
Tokelau	12	290.000	24.167
Tuvalu	26	900.000	34.615
Pitcairn	5	800.000	160.000
Total	**91,099**	**27,449,000**	**301**

a. Papua New Guinea is not shown as its large land mass is atypical of other Pacific Islands.
b. The Exclusive Economic Zone (EEZ) is the 200-mile limit sea area surrounding coastal states. Within this area, the Pacific Islands have exclusive rights to exploit their natural resources. Where states have not declared EEZs, or where the main fisheries area did not correspond exactly to the EEZ, data were modified or estimated as appropriate.

Sources: SPC (1999) and GPA (1996).

Neither governments nor communities can manage coastal areas on their own. The distances involved and the existence of customary marine tenure in many islands make it virtually impossible for government-only efforts to succeed. At the same time, communities need help in accessing the technical advice they may require to manage their coastal areas, and in addressing problems—such as pollution and dredging—that cannot be handled at the local level. The challenge will be to use well the comparative strengths of communities, governments, and other stakeholders (such as NGOs), and to develop a common goal for the management of coastal areas that uses each partner to its best advantage.

Tuna Fisheries: Critical Decisions

The deep ocean presents challenges and opportunities of a different kind. Chief among them is the management of tuna fisheries in the Central and Western Pacific, the most important tuna fishing ground in the world.

Because tuna are highly migratory, their management requires close regional collaboration. Pacific Island countries and distant water fishing nations have just concluded negotiations on a new regional convention to manage the tuna resources of the Western and Central Pacific. In contrast with past arrangements, distant water fishing nations would be full members of the commission.

This is likely to influence the outcome of critical decisions—such as the allocation of total allowable catch—which could affect the benefits that Pacific Island derive from tuna fisheries for years to come. The need for the coastal states to carefully review the available options and strengthen their collaboration cannot be over-emphasized.

Seabed Mining: the Future?

Another emerging challenge in the offshore areas of the Pacific is seabed mining. After a long period of hiatus, there has been a recent resurgence in investors' interest in seabed minerals. Several applications for exploratory licenses have been made and are presently being considered. Given the potential scale of these operations, it is urgent that Pacific Island countries adopt appropriate offshore mineral policies.

Under the Law of the Sea Convention, some Pacific Island countries may only have until 2004 to extend maritime claims beyond the 200-mile EEZ, by delineating their continental margin. It is urgent that that they complete the surveys that are needed for submitting these claims.

The three key challenges mentioned above — management of coastal areas, regional collaboration on tuna management, and regulation of seabed mining — are the most urgent issues currently faced by Pacific Island countries in ocean management. Many other challenges and opportunities could emerge in the future. The Pacific Ocean has long been an area of strategic importance for national, regional, and external interests, and they are expected to continue to be a major shaping force in the future.

Chapter 2
Managing Coastal Areas

A. The Value of Coastal Areas in the Pacific[2]

Much of the daily life of Pacific Islanders is spent near the coast. For them, coastal areas are vital sources of food, income, housing materials, tourism, recreation and culture. The coral reefs and mangroves surrounding the islands also play vital roles in protecting the islands against erosion and storm surge.

Food Security. Pacific Islanders depend heavily on subsistence fisheries for their protein needs: seafood represents 28 percent of total animal protein in Fiji and 67 percent in Kiribati (FAO 2000). Estimated per capita seafood consumption (of 21-150 kilograms) is substantially higher than the world average of 16 kilograms per capita (table 2).

Table 2. Value of Seafood to Food Security

Country	*Seafood available for consumption (kilograms per capita)*	*Seafood as percent of animal protein*	*Value of subsistence fisheries to food security (US$ million)* [a]	
			In protein equivalent	*In calories equivalent*
Fiji	51	28	6.7	3.9
Kiribati	150	67	18.0	7.0
Samoa	46	—	13.9	5.3
Solomon Is.	33	77	13.3	11.6
Vanuatu	21	33	14.7	8.9
World Average	16	17	—	—

— Not available.

Notes: For valuation methodology, see annex A. Seafood consumption reflects 1995 per capita seafood supply derived from national statistics.

a. Cost of importing equivalent amounts of protein, or of purchasing substitutes with equivalent caloric content.

Sources: Seafood as percent of animal protein and world averages : 1997 data from FAO (2000). Others: World Bank estimates and Preston (2000).

The value of subsistence fisheries for food security can be gauged by how much Pacific Island country governments would have to pay for imported substitutes if these fisheries ceased to exist (table 2). Fiji, Samoa, the Solomon Islands, and Vanuatu would each have to spend an additional US$7–$15 million a year to import substitutes with similar protein content – equivalent to a 1 to 19 percent increase in annual imports for Fiji and Vanuatu, respectively. Kiribati would require US$18 million in alternative protein sources — equivalent to 38 percent of its GDP. Although many coastal communities now complement their diet with canned fish, the depletion of subsistence fisheries would clearly have significant economic and dietary impacts.

Income. Many Pacific Island households complement their income with occasional sales of coastal products. While only about 20,000 Pacific Islanders were officially employed by coastal fisheries in 1996, an estimated 88 percent of households in Kiribati, 50 percent of rural households in Fiji, and 35–40 percent of households in Samoa fish on a part-time basis (figure 2) (KDOF 1999; SFD 1998; FFD 1997). Access to this opportunistic source of income is particularly important when the prices of agricultural products (such as copra) are low and in areas with modest remittances and scarce formal employment.

GDP and Exports. The contribution of coastal fisheries to Pacific Island country economies is often understated because of the difficulties of

[2] To better understand the challenges faced by coastal communities in the Pacific, the World Bank sponsored, in 1998-99, a study of 31 communities in Fiji, Palau, Samoa, Solomon Islands and Tonga (World Bank 2000a). This section draws on the results of that study, as well as on contributions by John Virdin (Virdin 1999) and Garry Preston (Preston 2000). Contributors to the coastal study are listed in the Acknowledgments.

collecting subsistence data. Fisheries contribution to total exports ranges from 6 percent in Fiji to nearly 90 percent in some Micronesian countries — but this reflects largely offshore tuna catches (table 3). Nonetheless, coastal products such as trochus shells (used in the manufacture of high quality buttons), bêche-de-mer (dried sea cucumber), giant clams, and pearls are significant contributors to national exports. The region exports 2,300 metric tons of trochus shells a year, or 59 percent of the world supply. Pearl exports – primarily from French Polynesia and Cook Islands — generate some US$100 million in annual revenues (Icecon 1997; Dalzell and Adams 1994).

Construction and Housing Materials. Sand, coral, and coastal gravel and limestone are used in construction and landfills throughout the Pacific. In many atoll countries, coastal areas are the only source of construction materials (table 4). Even in countries with potential for quarry or river gravel mining, coastal materials tend to be preferred because of their accessibility and lower prices. In the mid-1990s, the annual extraction of sand—a key ingredient in cement—averaged 15,000 cubic meters in Tongatapu (Tonga) and 70,000 cubic meters in Suva (Fiji) (Howorth 1997).

Table 3. Value of Fisheries to Pacific Island Economies

Country	*Fisheries as percent of GDP*	*Fisheries as percent of exports*
Fiji	5[a]	6[a]
Federated States of Micronesia	2[b]	89[a]
Kiribati	13	27
Marshall Is.	9[c]	89 [a]
Samoa	6	47
Solomon Is.	6	23
Tonga	—	13

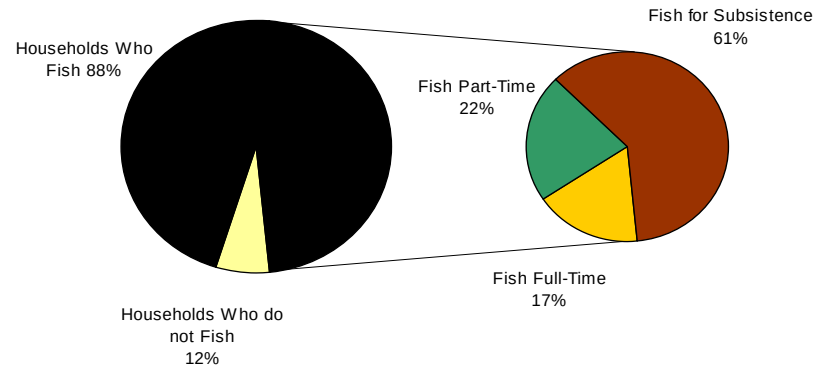
— Not available.
Note: All data are for 1998, except where indicated. GDP and export data includes tuna fisheries, as disaggregated data for coastal fisheries were not available.
a. 1997. b. 1996 c. 1996/7
Sources: IMF and country economic reports.

Table 4. Exploitation of Coastal Materials in Pacific Island Countries

Country	*Coastal Mineral Potential*	*Is Coastal Mineral Extraction a Problem?*	*Are there Alternative Sources of Materials?*	*Is Coastal Stability a Critical Issue?*
Cook Islands	*	***	Yes	***
FSM	*	**	Yes	**
Fiji	***	*	Yes	**
Kiribati	—	***	No	***
Marshall Islands	—	**	No	***
Niue	*	*	No	***
Palau	—	*	—	**
Samoa	*	***	Yes	**
Solomon Isl.	***	**	Yes	***
Tonga	*	***	Yes	**
Tuvalu	—	***	No	***
Vanuatu	**	**	Yes	***

— Not available * Low ** Medium *** High
Source: Adapted from Howorth (1997).

Figure 2. Fishing as an Occupation: The Case of Kiribati



Many Pacific Islanders fish on a semi-subsistence, semi-commercial basis as a way to supplement household income and food. Fishing in which none of the catch is sold is increasingly rare: in Kiribati, for example, fishing households sell an estimated 28 percent of their catch; in Vanuatu, up to 40 percent of the fishing households sell their catch.

Sources: KDOF (1999)
VDOA (1994)

Tourism. Tourism, a US$1 billion a year industry in the Pacific Islands region (table 5), is highly dependent on the quality of the coastal environment. In Palau, for example, tourism is based primarily on marine-based activities such as diving, sports fishing, and sightseeing in marine parks. Sports fishing is also significant in Christmas Island (Kiribati). Another important activity closely related to the coastal environment is yachting and cruise shipping. Passengers from cruise ships accounted for 58 percent of all tourist arrivals in Vanuatu in 1998 (WTO 2000).

Culture and Recreation. Aquatic sports, marine totems, taboos, and traditional rituals associated with the sea are closely intertwined with the socioeconomic fabric of the region. Among the region's most distinctive traits is the presence of customary marine tenure in many islands of the Pacific. Under these systems, coastal communities often treated the land and sea as a continuum, where community boundaries extended from the land to the edge of the reef or beyond. Local management rules governed the use of and access to coastal resources. Although weakened by modern forces, these traditional systems continue to operate in many areas of the Pacific (Vunisea 1996; Hviding and Ruddle 1991; Johannes 1978).

Coastal Protection. Coral reefs, mangrove forests, and other coastal habitats are essential to the survival of small islands (figure 3). Coral reefs act as wave breakers, preventing coastal erosion, and are the key source of sand for much of the Pacific beaches. Mangrove forests help stabilize coastal areas by acting as a buffer between the land and sea. They also prevent land inundation during storms. In Fiji the annual value of this coastal protection is estimated at US$550 million for reefs and US$60 million for mangroves (Sistro 1997; Spurgeon 1992).

Table 5. Estimated Tourism Revenues and Arrivals In Selected Pacific Island Countries, 1998

Country or territory	*Estimated receipts (US$ million)*	*Estimated arrivals (thousands of people)*
Cook Islands	34	49
Fiji	266	371
French Polynesia	354	189
Kiribati	1	14
Marshall Islands	3	--
New Caledonia	110	104
Niue	1	2
Palau	--	64
Papua New Guinea	75	67
Samoa	38	78
Solomon Islands	13	13
Tonga	12	27
Tuvalu	<1	1
Vanuatu	52	52
Total	**959**	**1,031**

-- Not available.
Source: World Tourism Organization Database, February and June 2000

Figure 3. Coral Reefs – Protecting Coastal Areas Against Storms

B. Trends Affecting Coastal Areas

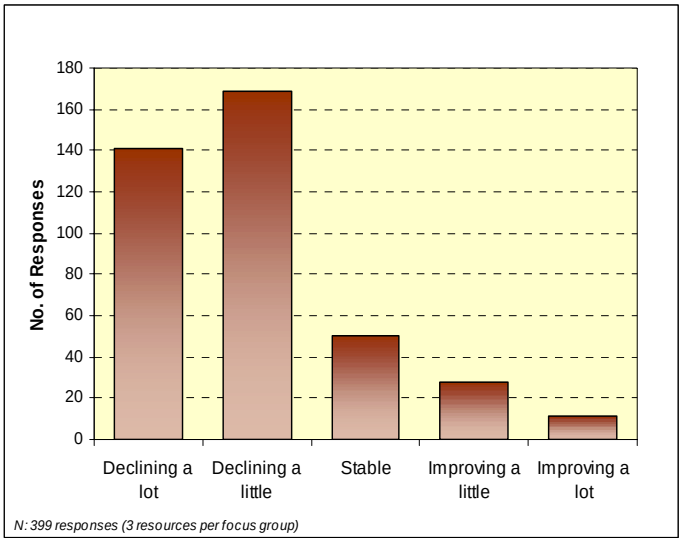
A 1998 World Bank-sponsored coastal survey (see footnote 2) revealed a widespread perception among the 31 communities surveyed that coastal resources were declining. Only 10 percent of the responses perceived that fishing catch per unit of effort had improved over the past decade (figure 4). The main reasons cited for the perceived decline included overfishing, destructive practices such as the use of traditional poisons, more effective fishing technology, pollution, construction of causeways, siltation, and habitat degradation. Coastal resources were perceived to be declining even in isolated sites where population densities remain low.[3]

About half of the community responses to the coastal study perceived coastal habitats to be declining, due primarily to pollution, siltation, destructive fishing practices, development projects, and natural causes (such as cyclones). Coral reefs, coastal lagoons, and intertidal areas were perceived to have declined significantly more than mangroves. In Fiji 19 percent of the coral reefs are now believed to be under high stress, and each year some 90–300 tons of top soil per hectare are lost to erosion—much of it ending up in coastal waters (WRI 2000; Clarke and Morrison 1987; UNEP 1993).

With rapid urbanization the demand for construction materials is rising, leading to unsustainable extraction. In Tonga, for example, beach sand is reportedly removed at rates two to five times higher than the natural regeneration rate (Tappin 1993; Howorth 1997).

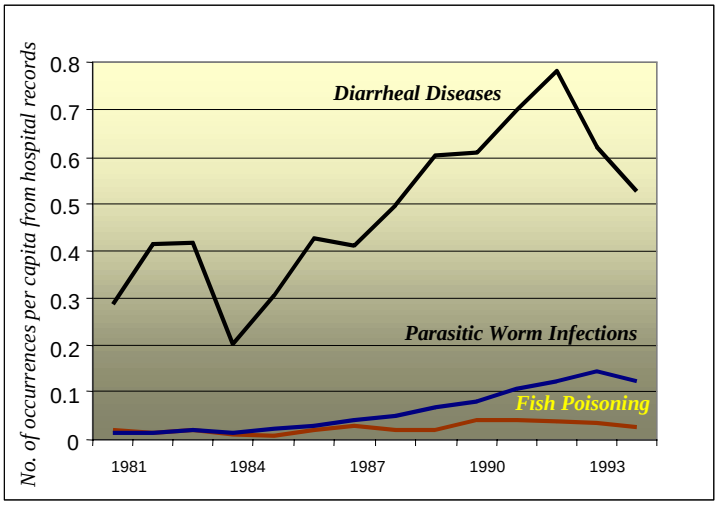
Water pollution is a well known problem in Micronesian towns. In Majuro (the Marshall Islands), the quality of coastal waters deteriorated steadily from 1988 to 1996 (Hicking and Mistry 1995). In the Tarawa Lagoon (Kiribati) all shellfish surveyed within 25 meters of the shore in the mid-1990s showed levels of fecal coliforms exceeding the standards for human consumption (BioSystems Analysis 1995). Water pollution has also been a major cause of a rise in the incidence of waterborne diseases (figure 5).

Figure 4. Community Perceptions of Trends in the Catch Productivity of Coastal Resources



Source: World Bank (2000a)

Figure 5. Incidence of Reported Waterborne Illnesses in Tarawa, Kiribati, 1981-94



Source: Abbott (1996)

[3] Even though the study relied on the perceptions of coastal communities, they were found to be consistent across user groups at the same site (World Bank 2000a). Community perceptions could not be compared with ecological trends because of the lack of a baseline. However, site-specific ecological surveys indicate a decline in the productivity of coastal resources in Guam and some recovery in American Samoa (WPRFMC 1998). Trends in Kiribati are mixed, and could reflect recent technological improvements (KDOF 1999).

What is less known, perhaps, is the perceived impact of pollution on coastal sites (many of them rural) surveyed in Palau, the Solomon Islands and Tonga (figure 6). Overall, the communities surveyed by the coastal study perceived pollution to be the fastest rising threat to their coastal resources.

Damage to coastal areas is imposing substantial economic costs on Pacific Island countries. In Fiji the loss of coral reefs now under high stress could cause economic impacts of over US$33 million a year. In the island of Upolu, Samoa, the losses in productivity of degraded coral reefs resulting from urban pollution amount to nearly US$170 per hectare of reef per year (World Bank 1995b). The practice of harvesting bêche-de-mer and trochus until the resources are depleted — through "boom and bust" cycles — causes significant price fluctuation and hinders the development of processing industries. Coastal degradation is also resulting in infrastructure damages, outbreaks of ciguatera poisoning, and a rise in the islands' exposure to extreme weather events.

Halting the degradation of coastal areas is desirable on ecological grounds, but it is first and foremost a sound economic decision: as the analysis of climate change indicates (Volume IV), improved coastal management is one of the most cost-effective ways to reduce the islands' vulnerability in the future.

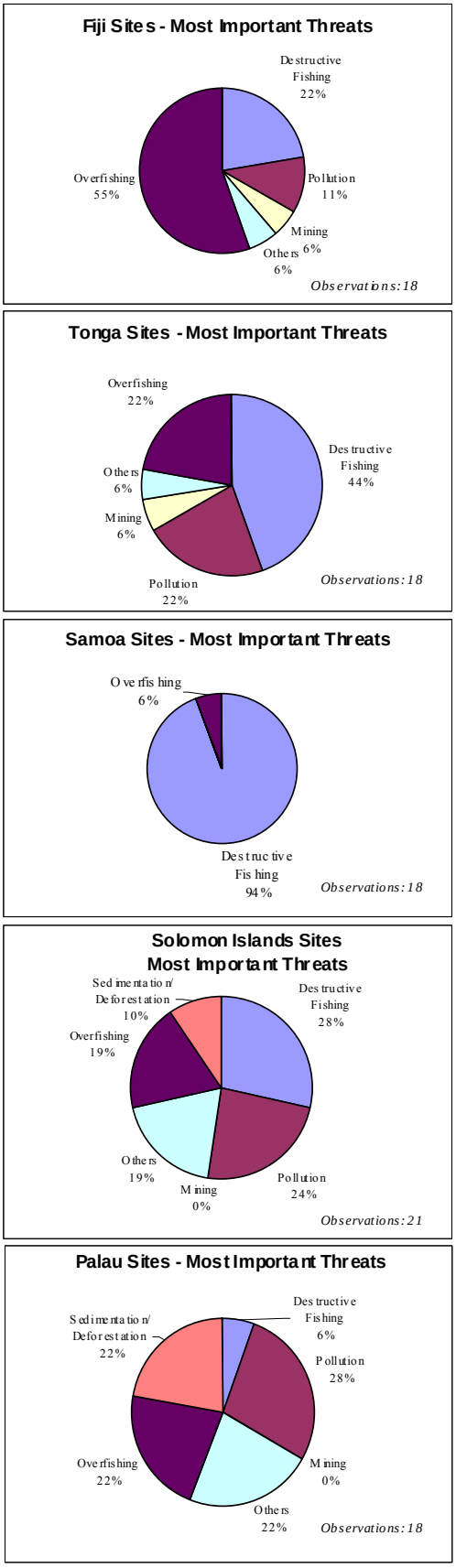
C. Key Challenges and Opportunities

Coastal areas can be managed through a variety of interventions that improve the economic benefits accruing from their use. Management interventions can include closing reef or mangrove areas to allow for natural regeneration, minimizing or collecting waste, prohibiting destructive practices, and constructing coastal infrastructure in ways that minimize their environmental impact.

Helping Communities Manage the Coast

In a region with nearly 3,000 islands, managing coastal areas is a daunting task. Governments in the region have wisely recognized that, for the most part, they lack the staff or budget to

Figure 6. Community Perceptions of Most Important Threats to Coastal Resources



Source: World Bank (2000a).

manage these vast areas and will need to rely on local communities for much of the management interventions.

However, communities also need urgent help. Findings from the coastal study indicate that community-based management is insufficient to address the current threats to coastal areas. Help was perceived to be most needed in:

- Raising the communities' awareness of the need to restrict their own fishing efforts.
- Addressing threats that cannot be handled locally (such as pollution, poaching, logging, and major coastal infrastructure).
- Facilitating the application of customary laws (by incorporating them into by-laws, for example).
- Providing advice on technical aspects of resource management.
- Preventing abuses of power by local leaders.

Improving the Response of Government to Local Needs

Pacific Island Governments in general do not view coastal management as a high priority. Findings from the coastal study indicate that only 23 percent of staff-time at national fisheries agencies is spent on coastal management. Among the 31 sites surveyed, 48 percent had never been visited by a government official to discuss coastal management issues. Distances alone could not explain this finding, as three of the sites that had never been visited were located close to the fisheries agencies' headquarters.

Some of the key impediments are institutional. While traditional Pacific societies were holistic, many modern governance systems are modeled on those of the former colonial powers, with weak central planning and well-defined sectoral agencies. These systems are ill suited to the integrated nature of the challenges facing small islands. Mining and infrastructure, for example, which have important impacts on coastal areas, fall outside the mandate of the agencies that have traditionally been involved in coastal management (fisheries and environment agencies). Fisheries or environmental programs may also be constrained by mandate which prevent them from providing assistance to communities in areas such as tourism development.

Government staff are given few incentives to help communities manage their coastal areas. First, in contrast to infrastructure projects, the results of which are visible and easy to report, management assistance is typically process oriented, and the results are less concrete. Second, extension workers involved in coastal management are mostly junior-level staff who tend to be promoted to "more quantifiable" activities as soon as they acquire the knowledge that would have made them more effective at the community level. Third, finance ministries in some Pacific Island countries expect sectoral agencies to contribute to public revenues. For fisheries agencies, this encourages a focus on license fee collection and tuna fisheries development at the expense of much needed coastal management support.[4] Redeployment of license fee revenue in favor of development activities in other sectors also plays a role in the weak attention paid to coastal management.

Finally, many Pacific Island countries lack the capacity to respond rapidly to the requests of coastal communities. Donor-driven priorities, weak communication links, and strict sectoral mandates are often to blame, but governments also continue to support programs that may be of unproven value to coastal communities. Aquaculture, tuna fisheries and deep slope fisheries, for example, are commonly promoted as income-generating alternatives to coastal fisheries, yet feedback from the communities surveyed under the coastal study indicates that they have not been effective in relieving pressure on coastal resources (World Bank 2000a).

[4] This bias is only likely to increase once the new regional fisheries Commission comes into effect (see Chapter III). The new Commission could absorb an increasing share of fisheries agencies expenditures and organizational priorities, further decreasing the attention given to coastal management (Bob Gillett 2000, personal communication).

D. A Strategy for Coastal Areas: the Co-Management Approach

Coastal areas in the Pacific are facing urgent challenges, which neither governments nor communities can manage on their own. A collaborative partnership between coastal communities, governments and other external organizations—a "co-management" approach—offers the greatest opportunity for Pacific Island countries to manage their coastal areas, reduce vulnerability to extreme weather events, and protect the resources on which so many communities depend. This approach is also consistent with current thinking in the Pacific.

Depending on the location and culture, co-management can be largely community based or more reliant on the government (in town areas, for example). In some communities, the role of the government can be complemented by NGOs or other external partners.

In many rural areas of the Pacific, there are strong traditional decisionmaking processes that can play a vital role in co-management, greatly increasing local participation. Co-management requires working with these traditional institutions, increasing the effectiveness of local governments in meeting local needs, and involving national agencies where necessary. Such a decentralized process has the best chance of being responsive to local conditions and needs.

An effective co-management strategy should therefore:

- ❏ Draw on the strengths of each partner;
- ❏ Ensure effective two-way communication between coastal communities and their external partners; and
- ❏ Establish intersectoral planning and coordination among government agencies responsible for coastal areas.

Box 1. Implementing Co-Management: The Samoa Fisheries Extension Program

The Samoa Fisheries Division launched the Fisheries Extension and Training Project in 1996, under assistance from AusAID. The project was largely demand driven: once the communities requested assistance, extension workers would help them develop Village Fisheries Management Plans. The plans, which took on average 10 weeks to develop, outlined the management rules proposed by the community and the assistance required from the Government. Provided that the proposed rules were compatible with national laws, the project also assisted the communities in making them legally binding through the issuance of by-laws. Once approved, the by-laws were disseminated via radio.

As of mid-1999, 61 villages had adopted management plans. Community management rules included:

Rules	Percentage of villages adopting
Fish sanctuaries (no-take zones)	92
Banning of dynamite and bleach	100
Banning of fish poisons	96
Banning the dumping of rubbish	75
Mesh size limits	73
Banning the clearing of mangroves	30
Banning the removal of sand	13

Satisfaction with the program, as assessed independently by the coastal study, is generally high: among the five countries surveyed, Samoan villages were the only ones that believed the condition of coastal resources would improve in the future. An internal review under the project also found that 86 percent of the villages were implementing management plans at or above average competency.

Despite these achievements, the program is facing several constraints: extension workers are demoralized by overwork, poor salaries, weak opportunities for promotion, and lack of recognition. Several staff have been sent to study abroad, and have not been replaced. Furthermore, communication between the units handling different aspects of the program (such as aquaculture) is weak. At the village level, the most significant problems have been with the aquaculture activities, disputes among villages, and poaching inside the sanctuaries. To keep up with the demand from communities, the program has proposed to "graduate" villages that are performing well, and to drop those that are unsatisfactory. It has also recommended that further attention be given to raising incentives and accountability for extension staff.

The above example illustrates the importance of addressing institutional, communication, enforcement, and conflict resolution issues early on in co-management programs.

Sources: Kallie (1999); Fa'asili (1997); King, Fa'asili and Taua (1998); World Bank (2000a).

Drawing on the Strengths of Each Partner

Communities and their external partners should have clearly defined roles that maximize their comparative strengths. Monitoring compliance with management rules, for example, is best done by coastal communities, while handling urban pollution is an area in which government agencies can have a comparative advantage. A clear division of responsibilities helps achieve results and minimizes the costs of management.

The results of the coastal study (box 2) suggest the following roles for the institutions involved in coastal management:

The Role of Communities. Local communities, and particularly traditional leaders, should be given the major responsibility for managing coastal areas outside towns. Their responsibilities might include:

- Adopting and enforcing local management rules, such as banning sand removal or prohibiting dynamite fishing.
- Managing threats to coastal areas that are within their control (such as local garbage).
- Restricting their own harvesting effort to allow resources to recover (by banning fishing in certain areas, for example).
- Controlling poaching by people from outside the community, in collaboration with the government.
- Mobilizing the community for joint action (such as clean-up efforts).

Box 2. Where is External Assistance Most Needed? Voices from the Village

How can governments and external partners best help communities to manage coastal areas? What kind of assistance is most effective? The results of the 1998 survey of 31 communities reveal several lessons about what seems to work from the perspective of coastal communities:

- *The best partners are honest brokers.* The most valued external partners played the role of 'honest brokers', providing timely and sound management advice to communities upon request. These partnerships often provided little more than technical advice and awareness-building.

- *Communities need external help primarily in five areas:*
  - Catalyzing community action to restrict their own harvesting;
  - Addressing threats – such as pollution, dredging, and siltation – which cannot be handled by communities alone;
  - Harmonizing local management rules with national regulations, to facilitate their application;
  - Obtaining technical advice on demand; and
  - Preventing abuses of authority by local leaders.

- *Alternative income programs have not been effective.* For the most part, communities felt that alternative income generation programs involving aquaculture, tuna fisheries, or deep slope fisheries had not been successful in reducing pressure on coastal resources.

- *Communities need early results.* Communities tend to focus on short-term, tangible results. Creating marine sanctuaries, for example, appeared to play an important role in catalyzing community awareness of the benefits of coastal management.

- ***Some management rules work better than others.*** The following rules were perceived by communities as having the highest compliance:
  - *National rules adopted locally.* National regulations which were seen as relevant and were subsequently adopted by community leaders as local rules were perceived as having significantly better compliance than either purely national or purely local rules.
  - *Simple rules.* Simple rules, such as establishing protected areas (sanctuaries), closed seasons for harvesting, and rules restricting destructive practices were perceived as having significantly better compliance than rules such as size limits, bans on harvests, and restrictions on external fishers. The easier it is for communities to understand and comply with the rules, the more successful they are likely to become.
  - *Rules enforced by buyers or exporters,* such as the crocodile ban in the Solomon Islands, were perceived as being particularly effective.

- *Open access discourages community action.* Open access by outsiders to communities' waters acts as a powerful disincentive for community management. With one exception, all of the 8 open access sites in the coastal survey lacked local management rules. By contrast, all of the 21 communities in restricted access sites had adopted local management rules. In the opinion of a villager "why should we restrict ourselves if these rules cannot be applied to others?"

Source: World Bank (2000a)

The Role of Government Agencies. Government agencies such as Fisheries and Environmental Divisions should provide the enabling support to community-based management and handle threats that are beyond the communities' control. They should be responsible for:

- Providing a legal framework to support community user rights over coastal areas (preferably by establishing exclusive user rights) and recognize community management rules as by-laws.
- Reducing the harvesting of coastal resources through export or point-of-collection restrictions and limits on commercial harvesting licenses.
- Requiring environmental impact assessments for all new projects likely to affect the coast.
- Improving waste management in and around towns.
- Carrying out awareness activities aimed particularly at community leaders.
- Promoting environmental education in public schools.
- Ensuring accountability and transparency in the issuance of fishing licenses.
- Supporting collaborative enforcement with the communities, especially to address threats external to their sites.
- Facilitating consensus-building and conflict resolution among coastal communities for the management of larger areas of the coast.
- Ensuring adequate incentives and technical back-up for extension staff working at the community level.
- Using alternative income-generating activities cautiously. While the purpose of these activities may be laudable, extension staff and scientists are often not well positioned to provide sound business advice to coastal communities. Linking communities with private sector investors may be a more effective way to increase local incomes.

The Role of Other External Partners. NGOs and other local groups (such as churches) can play a pivotal role in catalyzing community action. The coastal study revealed that the partners most appreciated by coastal communities:

- Maintain a long-term commitment to the partnership.
- Act primarily as a catalyst for community-driven decisions. Once information is provided and awareness built, decisions about resource use are made at the local level.
- Rely on existing village institutions and processes as much as possible.
- Produce tangible results early during the partnership.
- Support participatory monitoring, so that communities can see the results of management interventions.
- Promote solutions that have proved to be technically and financially sound.

The Role of High-Level Policymakers. High-level policymakers in Financial and Economic Ministries have a key role to play in addressing the incentives that hinder coastal management. This role includes:

- Recognizing coastal management as an economic and social priority, and reflecting it in national development plans.
- Considering financial and institutional incentives to support intersectoral planning committees.
- Orienting donor assistance toward long-term programs that support coastal zone management.
- Creating incentives—such as opportunities for promotion and recognition—for public servants involved in co-management.
- Removing macroeconomic incentives that discourage government agencies from supporting coastal management. Requiring

fisheries agencies to be net revenue generators, for example, biases their activities toward offshore fisheries development. Public expenditures for coastal management should be protected from such tradeoffs, either by separating licensing and management functions (as done in the Federated States of Micronesia and New Caledonia) or by allowing the agencies to retain license revenues and use them in support of coastal management. This is currently done in the Marshall Islands, where license revenues are used to support a trust fund for coastal management.

The Role of Donors. Donors can play an important role in coastal management by:

- Providing long-term assistance to flexible, intersectoral programs that encourage Pacific Island countries to develop their own solutions to coastal management, and recognizing that programs with a narrow sectoral focus are unlikely to meet the current challenges.
- Adopting a community-driven approach that facilitates local planning and implementation.
- Promoting applied research (such as socioeconomic or rapid ecological surveys), with immediate application at the local level.
- Conducting training programs and workshops primarily in-country, to prevent the loss of capacity and attention to coastal management that can result from attendance at frequent regional meetings.

Ensuring Effective Communication

Establishing an effective two-way communication between communities and external partners is critical to the success of co-management. With government agencies often located far from coastal villages, it is essential that communication links be kept active. Only by institutionalizing the means by which communities convey requests for and receive assistance can the government response become more demand based and effective.

Several lessons can be drawn from the coastal study survey. First, it takes a long time for communities to absorb and process information provided by external partners. Assistance needs to be provided on a long-term basis, and information needs to be conveyed in as many ways as possible (through radio, pamphlets, workshops, and other means). Second, external partners need to be able to respond rapidly to requests for assistance by communities. This requires not only reliable communication channels but also access to information which field workers may not possess. Third, the assistance needs to be able to handle the changing nature of the threats affecting coastal areas.

These lessons pose considerable challenges for Pacific Island countries. Budgetary and staff constraints prevent many government agencies from working in remote villages, and donor assistance is often restricted to particular sectors.

How then can Pacific Island countries best address these challenges? Several recent initiatives suggest three possible solutions:

Find strength in numbers. Joint programs by different government agencies or between governments and NGOs increase the number of field staff assisting the communities, and help ensure that the assistance is multisectoral. The Samoa Visitors Bureau, for example, conducts periodic "road shows" from village to village, at which staff from various agencies—tourism, environment, health, and agriculture—offer advice to the communities. The road shows visit about 20 villages a year. Kiribati has also started sending multisectoral teams to survey its outer islands.

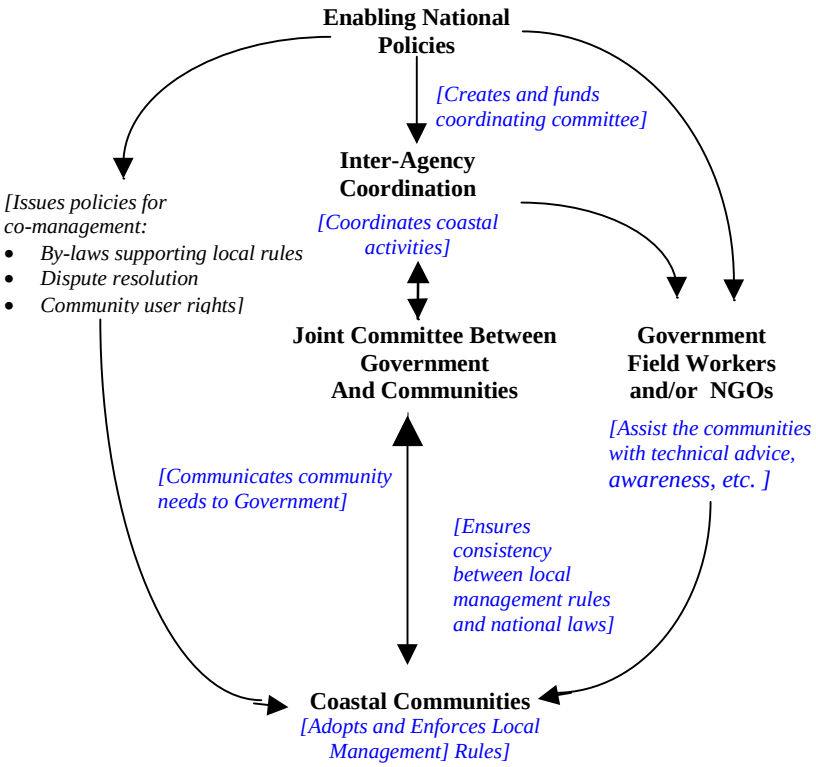
Develop a network of experts. Some of the advice that coastal communities request is highly technical─how to prevent a particular seaweed disease, for example. Field workers need access to a network of specialists who can provide quick responses to these requests and keep them informed of the latest developments. The Secretariat of the Pacific Community could

play a major role in managing such a network by connecting field workers with regional experts through electronic mail.

Strengthen local committees. To the extent possible, there should be a single point of entry for communities seeking external assistance in coastal management. Some examples of local committees of this type are starting to emerge in the region. In the Marshall Islands, the Environmental Protection Agency is working with island governments—in which traditional leaders are represented— to develop coastal management plans. In the Federated States of Micronesia, joint committees made up of community representatives and state governments are starting to address the management of coastal resources. And in Samoa, fisheries extension workers conduct regular meetings with the village-level fisheries management advisory committees (box 1). Some committees─as in the district of Safata, Samoa─are using their increased lobbying power over government agencies to address wider development issues than those for which they were originally formed.

These local committees differ considerably from country to country, but share three major characteristics. First, they rely on local decision-making processes and institutions. Second, they tend to establish a direct communication link between communities and *local* (provincial or state) governments, which are typically more multi-sectoral than national agencies. Third, the committees were generally started through a donor-funded program—although in some cases their operation was later absorbed by state or national budgets.

Figure 7. The Institutional Setting for Co-Management



Coordinating Activities across Sectors

Poor coordination and overlapping mandates are chronic problems for many Pacific Island governments. Sand mining licenses are issued with little consultation with environmental agencies, and coastal infrastructure is often built without assessing its environmental impact. For co-management to be successful, intersectoral coordination among government agencies responsible for coastal areas must be improved. Coordination could take place through an interagency coordination committee, or through a similar forum to that where communities, government and NGOs interact (the Joint Committees shown in figure 7).

Several Pacific Island countries have taken steps to improve intersectoral coordination. In Vanuatu, the managers of the Department of Economic and Social Development and the Department of Fisheries hold weekly meetings to discuss coordination. In Palau, a task force was created to draft the national tuna management plan. The task force, which met weekly, included representatives from environment, marine resources, foreign affairs, tourism, and labor departments, the Attorney General's office, NGOs, and the Association of Governors. In Samoa, the Director of Environment plans to create an interagency committee to address environmental management. One of the ideas proposed is that staff from non-environmental agencies, such as public works, be allowed to represent Samoa at regional environmental meetings. The hope is that this will help broaden national support for environmental management.

Many of these incipient efforts have been spurred by two recent regional initiatives: the Biodiversity Strategy Action Plan, coordinated by the South Pacific Regional Environmental Committee (SPREP), and the Tuna Management Plans, promoted by the Forum Fisheries Agency (FFA). The initial funds allocated to these committees provided the impetus for their operation, and allowed them to start addressing coordination issues outside of the original mandate with which they were created.

This reliance on external funding is a major concern for these emerging initiatives. As funding runs out, some committees may cease to operate. It is essential that governments in the region recognize the importance of these processes and provide funding for their continued operation.

Co-management does not require a large allocation of public expenditures. The Samoa Fisheries Extension Program, for example, operates at an average annual budget of about US$81,000 for on-going assistance to about 60 villages and extension of the program to 10 new villages per year (Legislative Assembly of Samoa 1999; Kallie 1999). In Kiribati the inter-sectoral marine and fisheries surveys cost an average of US$2,300-$5,000 per island (Johnny Kirata, personal communication, April 2000). In the Marshall Islands, the cost of the UNDP-funded coastal management plan for the Majuro atoll totaled US$367,000 for four years of operation (UNDP 1999). Compared with the potential costs of coastal erosion or the loss of traditional fisheries, these investments are well justified.

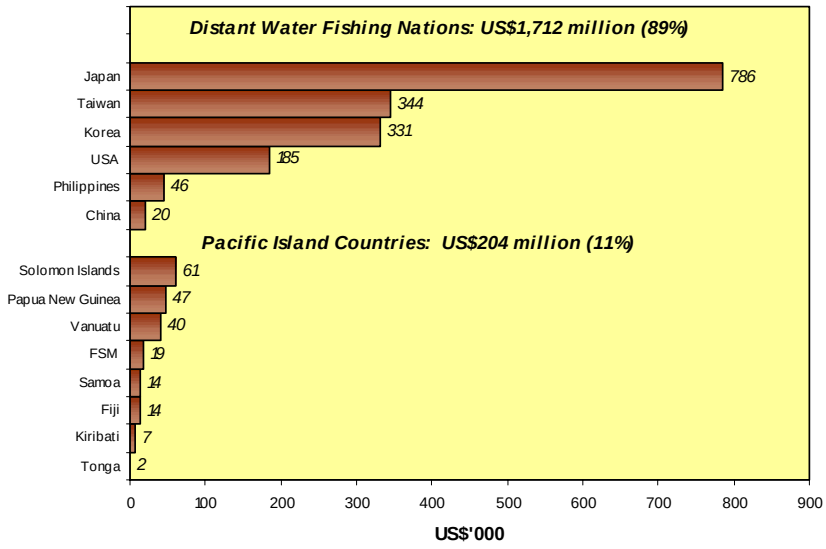
Chapter 3
Managing Tuna Fisheries

A. Economic Importance of Tuna Fisheries[5]

The ocean surrounding the Pacific Islands is the most important tuna fishing ground in the world. It provides a third of the world's tuna catch and 40–50 percent of the total supply to tuna canneries. Annual production during the 1990s averaged nearly 1 million metric tons,[6] with a landed value close to US$2 billion at current times (SPC 2000; FFA 2000).

Despite this value, the share captured by Pacific Island vessels remains modest. Most of the region's tuna is caught by distant water fishing nations, with Japan, the Republic of Korea, Taiwan (China), and the United States the most important players. Catches by Pacific Island country fleets represented only about 11 percent of the total landed value in 1998 (figure 8).

Figure 8. Value of Pacific Island Tuna Catch by Fishing Nation (1998)



In 1998, the landed value of tuna caught in the Central and Western Pacific was estimated at US$1.92 billion, of which some 68 percent (US$1.3 billion) was caught in Pacific Island Countries' Exclusive Economic Zones.

Despite attempts to develop domestic tuna longline fleets and shore-based facilities, the share of total landed value caught by Pacific Island country vessels remains limited to about 11 percent of the total. Less than 0.25 percent of the tuna catch enters the domestic food supply.

Sources: Forum Fisheries Agency; van Santen and Müller (2000); Preston (2000).

Distant water fishing nations pay license fees to Pacific Island countries for the right to fish in their EEZs. In 1997/98 these fees amounted to more than US$54 million. Kiribati, the Federal States of Micronesia, Papua New Guinea, the Marshall Islands, and the Solomon Islands were the top beneficiaries. License fees represent a sizable portion of total public revenue in Micronesian countries, accounting in 1998 for 61 percent of the total revenues in Kiribati and 29 percent of revenues in the Federal States of Micronesia (Kiribati and FSM government statistics 2000).

Pacific Island countries have long sought to increase their benefits from tuna resources, with some success. Starting with the creation of the Forum Fisheries Agency in 1979, countries in the region have collaborated closely in regional tuna management. This collaboration has paid off. Regional initiatives such as the vessel

[5] This section is based on background reports by Van Santen and Müller (2000), Preston (2000), and Freestone and Müller (2000). The authors are also grateful to Johnny Kirata and Bob Gillett for advice and background data.

[6] This figure includes only the Secretariat of Pacific Community statistical area. In 1998 tuna statistics were changed to include the wider Central and Western Pacific, where a total catch of 1.8 million metric tons was recorded (about half of the world's tuna supply).

monitoring system, the regional register system, and joint research costing US$3.5 million a year would have cost close to US$21 million if they had been developed by individual countries.

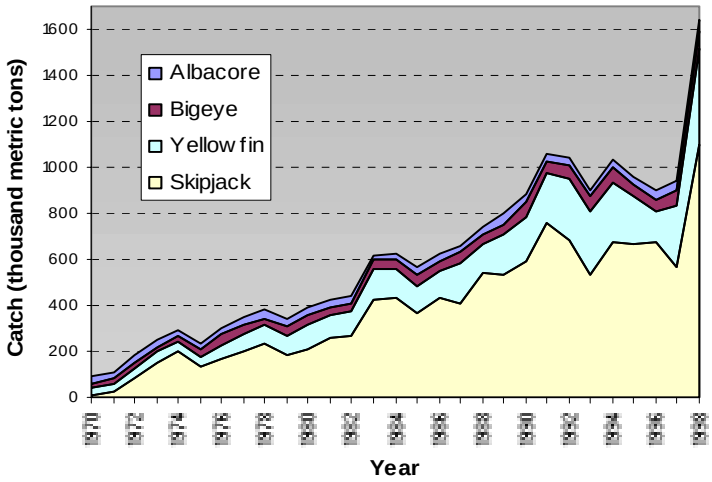
Regional collaboration has also strengthened Pacific Island countries' leverage with distant water fishing nations. The regional register, for example, prevents vessels with unpaid fines or outstanding offences -- vessels who lack "good standing" status – from operating in the waters of any Forum Fisheries Agency country. Foreign vessels have been known to pay fines of US$1 million rather than lose their good standing in the region (Moore 1987).

Several private sector investments in domestic tuna fisheries have also been successful. They include the establishment of transshipment bases in the Federal States of Micronesia and Fiji and the expansion of tuna longline in Samoa and Fiji. Locally based tuna fleets now contribute an estimated US$80 million a year in home port expenditures (Gillett 1997).

Despite these successes, many Pacific Island countries have suffered crippling financial losses from their public investments in tuna fisheries (ADB 1997; FFA and ADB 1998; Cartwright 1999). Notwithstanding early promises of high employment and export value, most public ventures have suffered from poor management, declining tuna prices, and competition from countries with lower operating costs. In all, an estimated US$200–$300 million in past investments has failed to yield minimum economic returns. This means that for the region as a whole, the revenues from access fees have largely been lost through failed local investments.

In 1987 Pacific Island countries collaborated in negotiating the U.S. Multilateral Treaty, which allows U.S. purse seiners' access to waters of Forum Fisheries Agency members. The treaty, which was renewed in 1997, provides for a fixed annual fee of about US$18 million. Fifteen percent of this fee is distributed equally among the 16 members of the Forum Fisheries Agency; 85 percent is paid to states in whose EEZs the fish is caught. Up to 50 percent of this value is paid through aid (Duncan and others 1999).

Figure 9. Tuna Catches in the Pacific Island Region, 1970-88



Tuna resources in the Pacific Island region are believed to remain healthy, despite a substantial increase in catches since 1970. Skipjack tuna is naturally resilient to fishing pressure. Yellowfin and albacore tuna can continue to sustain present levels of fishing. Bigeye tuna, however, is believed to be fully utilized at present.

Source: Secretariat of the Pacific Commission

The U.S. treaty is the only multilateral access agreement in the region. All other agreements have been negotiated bilaterally between coastal states and individual distant water fishing nations. Common reasons offered by Pacific Island countries for this preference include fears of losing sovereign rights and bilateral aid, and reluctance to subsidize less well-endowed countries. As the analysis will show, however, multilateral agreements could be more effective than bilateral agreements in ensuring that Pacific Island countries derive optimal benefits from tuna exploitation.

B. Trends Affecting Tuna Tuna Fisheries

Unlike most tuna stocks in the world, Pacific Island tuna remain healthy (figure 9). The exception is bigeye tuna—found primarily in the high seas of the Pacific—which is considered

fully exploited. Conditions could change in the future, however, and Pacific Island countries have recognized the need to maintain the stocks in good health. If future climate change scenarios materialize, for example, the region could experience more permanent El Niño conditions and a decline in primary productivity in the central and eastern Pacific (Lehodey 1999). This would likely decrease the natural abundance of bigeye and adult yellowfin tuna and could result in unsustainable fishing pressure from longline fleets (see Volume IV, Chapter 5).

C. Key Challenges and Opportunities: the Future Regional Management Regime

The region is on the verge of a historic decision on tuna fisheries. Since 1997 Pacific Island countries and distant water fishing nations have been negotiating a new regional convention to improve the management and conservation of tuna stocks, in accordance with the United Nations Fish Stocks Agreement.

The Multilateral High-Level Conference (MHLC) process, which has just been completed, is expected to result in a new regional convention and commission for managing tuna stocks in the Western and Central Pacific. The commission would allocate catch quotas and implement new arrangements for vessel surveillance in the convention area. In contrast with current arrangements under the Forum Fisheries Commission, distant water fishing nations would also be members of the commission. Pacific Island countries, however, would retain the right to manage tuna resources in their respective EEZs.

The ongoing discussions on the convention, however, have postponed resolution of two major issues: financial contributions by member states, and allocation of total allowable catch, which was left to the commission to decide. It is urgent that Pacific Island countries agree on a common position on these issues which maximizes their future benefits under the new regional management convention.

D. Working Together or Apart: A Strategy for Tuna Management

The strategy outlined here examines how coastal states could increase the benefits from the use of their EEZs under the future tuna management regime. In essence, Pacific Island countries should aim to:

- ❒ Minimize their financial burden in future management arrangements.
- ❒ Maximize their benefits from the future allocation of total allowable catch.
- ❒ Negotiate effectively with distant water fishing nations for access to Pacific Island countries' EEZs.

Minimizing the Financial Burden

Historically, the costs of tuna management in the Pacific Island region have been borne by four key players:

- Distant water fishing nation vessel owners, through access fees and by bearing part of the costs of surveillance and on-board observers.
- Distant water fishing governments, through a share of access fees.
- Donor agencies, through direct aid to Pacific Island countries or to regional organizations such as the Forum Fisheries Agency and the Secretariat of the Pacific Community.
- Pacific Island countries, through direct payments for some of the administration and surveillance costs, and through indirect payments (by a reduction of access fees).

The new management regime is expected to either create new arrangements for vessel monitoring, control, and surveillance, or expand the existing regional systems. Even though Pacific Island countries would retain the right to manage tuna resources in their EEZs, as tuna migrate across EEZs and high sea areas, their management would have to be standardized across the convention area, thus entailing additional obligations for coastal states. New management requirements might include an

Table 6. Estimated Present and Projected Future Costs of Regional Fisheries Management and Administration (thousands of US$)

Cost	*Current costs of ongoing activities funded by*			*Estimated costs of future activities with new convention funded by*		
	Distant water fishing nations	*Donors (aid)*	*Pacific Island countries*	*Distant water fishing nations*	*Donors (aid)*	*Pacific Island countries*
Investment costs						
Installation of vessel monitoring system	5,000	—	—	6,000[a]	—	—
Surface surveillance investment costs	—	120,000	—	—	—	—
Preparation for MHLC	750	1,500	200	—	—	—
Finalizing MHLC and commission	750	1,500	200	—	—	—
Updating equipment	—	500	500	—	1,000	1,000
Total investment costs	**6,500**	**123,500**	**900**	**6,000[b]**	**1,000[b]**	**1,000[b]**
Operating costs						
Regional monitoring, control and surveillance	1,600	8,250	4,370	5,220	8,250	4,370
Regional and national tuna research	—	1,800	500	1,700	1,800	500
Data collection	400	40	600	1,000	40	1,000
Legal review and update	—	50	—	—	300	400
Commission overhead	—	—	—	900	—	850
Fisheries administration	—	1,000	1,500	500	600	1,600
Total Operating Costs	**2,000**	**10,190**	**6,470**	**9,350**	**10,990**	**8,720**

— Not applicable.

Note: Future costs include requirements of new convention in FFA area and in the high seas. For detailed assumptions, see Annex B. Costs of negotiating future agreements with distant water fishing nations are not included in the table.

a. US$8 million if a new vessel monitoring system is adopted.

Source: van Santen and Müller (2000).

effective legal system; vessel observers; regular reporting; improved research; and the strengthening of institutional capacity.

The future commission is expected to have a fund, based on voluntary contributions from members of the convention and aid organizations, to reduce the financial burden on Pacific Island countries. The size of the fund has yet to be determined, but the proposed budget for the first year of the commission—US$100,000—appears to be only a fraction of the future management costs (table 6).

Overall, the new regional management regime is likely to entail substantial incremental costs for Pacific Island countries, on the order of US$2 million (in additional investment costs)[7] and US$3 million (in annual operating costs), including costs likely to be funded through aid. Distant water fishing nations are likely to shoulder additional investment costs of US$6 million and annual operational costs of US$7 million.

The costs of the convention to Pacific Island countries will depend largely on the amount of foreign aid available. Currently, some 55 percent of the annual operating expenditures of tuna management systems are covered by external players, mostly donors. The estimates in table 6 assume this assistance would continue. However, the willingness of aid donors to maintain their support for existing tuna management systems will have a substantial impact on the projected expenditures of Pacific Island countries.

If aid donors shifted their funding from the existing vessel monitoring system (which is

[7] The US$124,400 spent on past investments is considered a sunk cost.

controlled by Pacific Island countries) to a new system supported by the commission (which would be controlled by both Pacific Island countries and distant water fishing nations), the Pacific Island countries could lose their ability to independently monitor vessel operations in their EEZs. A new vessel monitoring system would also require an additional investment of about US$2 million.

To avoid weakening independent monitoring in their EEZs and help curb future costs, Pacific Island countries should collaborate closely to:

- *Retain existing monitoring systems*. Pacific Island countries should seek to use and expand existing systems, such as the FFA–operated Vessel Monitoring System, the Air and Maritime Surveillance and the Regional Register. To the extent possible, the future high seas observer program should be combined with the existing regional observer program.

- *Move toward a user-pay system*. Ideally, foreign fleets should pay for most of the costs of tuna management—as currently practiced in a number of fisheries around the world. A user-pay system would also avoid the dependency of Pacific Island countries on donor aid and on their own limited budgets.

- *Avoid voluntary contributions* to the future commission fund. Voluntary donations tend to be volatile and decline over time. Given the importance of donor support, Pacific Island countries should carefully reexamine the voluntary nature of the fund and its future size. A specific contribution to the fund as a regular part of the commission's budget could be considered.

- *Involve the private sector*. To save costs, Pacific Island countries should examine which management activities might be carried out more effectively by the private sector (the observer program, for example).

- *Encourage distant water fishing nations to effectively monitor their own fleets.* Encouraging distant water fishing nations to monitor their own fleets would reduce the costs of some compliance requirements, such as port transshipment and EEZ entry and exit reporting.

- *Keep independent research and collection of economic data.* Future commission members should agree on a broad regional research program that includes collection of economic and vessel operational data. To preserve its independence, the research program should be executed by the Secretariat of the Pacific Community (SPC) in cooperation with national agencies.

Optimizing the Allocation of Total Allowable Catch

The future commission is expected to determine the total allowable catch (TACs) for tuna fisheries based on principles of biological sustainability (MHLC 1999). The commission is also expected to develop criteria for the allocation of the TAC among member countries.

The allocation of the TAC will inevitably affect the "ownership" of tuna resources. Since the membership of distant water fishing nations in the new commission will confer them collective power over the TAC negotiations, Pacific Island countries need to carefully review the advantages and disadvantages of the possible alternatives.

Among the many alternatives for TAC allocation, two appear most promising:

- ❑ The TAC could be allocated to individual distant water fishing nations and individual Pacific Island countries through a negotiated formula based on tuna concentrations in the EEZ and current catches from the high seas.

- ❑ The TAC could be allocated to distant water fishing nations (as a group or individually) and to Pacific Island countries as a group. Each of the two groups would receive a negotiated share of the total TAC, possibly reflecting tuna concentrations in the EEZs and high seas. Pacific Island countries could then decide internally how to allocate their share of the TAC.

The first option carries considerable risks. It would tie individual Pacific Island countries to a specific quota regardless of the actual distribution of resources in their EEZ. Moreover, without close and sustained cooperation to create a pooled TAC, the potential leverage that Pacific Island countries' would have in negotiating access fees with distant water fishing nations could be substantially reduced. This alternative also creates strong incentives for Pacific Island countries to discontinue their regional cooperation.

The second option appears the most promising. It would broaden and strengthen Pacific Island countries' power to negotiate access fees, because they could opt to negotiate with distant water fishing nations individually, as a group, or by auctioning the quota to individual vessel owners. The only drawback of this option is that it may reduce Pacific Island countries' chances of capturing benefits from the high seas: distant water fishing nations may be able to argue that since Pacific Island countries receive a substantial share of the total allowable catch for surface tuna—as surface tuna are found primarily in their EEZs—distant water fishing nations should receive most of the TAC for deep swimming tuna found in the high seas.

Ideally, Pacific Island countries should argue in favor of the second option prior to the entering in force of the convention. It would be more difficult to reach agreement on this option once the convention is in effect.

Negotiating Collectively with Distant Water Fishing Fleets

Pacific Island countries are individually in a weak position to benefit from tuna fisheries. Tuna migrate in and out of EEZs, and are caught primarily by foreign fleets. At the same time, collection of access fees offers the greatest potential for future revenues. How can Pacific Island countries optimize their benefits from access agreements with foreign fleets?

Many argue that prevailing bilateral license fee agreements benefit distant water fishing nations. But do they benefit the coastal states? The diversity of development objectives and resource endowments among coastal states should not overshadow the fact that Pacific Island countries stand a better chance to benefit from their tuna resources by acting as a group than by acting individually (box 3):

- *Size counts.* Tuna resources negotiated by individual countries are much more modest than they would be if the Pacific Island countries negotiated as a group.

- *Negotiating as a group limits the alternatives open to distant water fishing nations.* By negotiating as a group, Pacific Island countries can reduce their individual negotiating weaknesses and prevent distant water fishing nations from negotiating only with countries offering the most favorable conditions.

- *Net benefits are more important than gross benefits.* Even if the gross benefits of bilateral agreements appear to be greater, the costs to individual Pacific Island countries of monitoring such agreements are likely to be higher than under a multilateral agreement, where costs can be shared among coastal states.

- *A group of countries may be able to afford better negotiators.* As a group, Pacific Island countries would be able to afford top negotiators to argue their case.

Several Pacific Island countries have been reluctant to enter into multilateral agreements, with valid reasons. They feel that multilateral agreements compromise their sovereign rights, or that achieving consensus among Pacific Island countries requires too much time and effort and may lead to significant deviation from national positions. Pacific Island countries with more abundant tuna resources may also resent the fixed share that the U.S. Multilateral Treaty provides to less well-endowed countries. Finally, individual countries may fear that multilateral negotiations could result in a reduction of bilateral aid, a major source of revenue for Pacific Island fisheries divisions.

Box 3. The Benefits of Cooperation, the Costs of Going Alone

The importance of cooperation among Pacific Island countries can be illustrated by a simple hypothetical example. Suppose there are 10 coastal states, 5 of which have extensive EEZs. Tuna aggregate seasonally in these countries but only occasionally in the other five countries. Annual catches fluctuate widely in each country. Two industrial countries want to fish in the EEZ of these coastal states. What would the optimal negotiating strategy be for both parties?

Negotiating Strategy for Industrial Countries

The lowest-cost, lowest-risk strategy for the industrial countries is to negotiate with each individual country and offer low access fees or in-kind aid. If a country rejects the initial offer, efforts could be made to persuade individual decisionmakers in that country. If these efforts fail, the industrial country would approach the remaining four countries with large EEZs. If none accepts the initial offer, the industrial country could offer higher rewards, targeting countries with the largest EEZs and most convenient locations.

It is in the industrial country's interest that no coastal state cooperate with others and that the terms of the negotiation remain secret. To prevent collusion among coastal states, the industrial country could indicate a potential reduction in aid or trade policy restrictions. Since no country knows the position of the others and all realize the industrial country can go elsewhere, they are likely to accept the low offer. Tempting the other industrial country to make a counteroffer may not succeed, as the industrial countries may well exchange key information about each other's positions once they realize they are being "played against one another."

Negotiating Strategy for Coastal States

The best strategy for the coastal states would be to minimize their key weakness: the possibility that the industrial countries will shop around and the fact that they themselves offer access to a fluctuating, migrating resource. This can be achieved by cooperating and negotiating as a group. Such cooperation has other advantages as well: it allows for advance preparation of a joint negotiating strategy, and it allows for the sharing of information among coastal states. Projected net benefits to each coastal state from joint negotiation could be set higher than what could be realistically obtained through bilateral negotiations. Negotiating as a group would change the coastal states' position from that of a small seller of access to a modest, fluctuating resource to a single supplier of a large and stable resource—that is, they would move from being "price takers" to "price setters".

Coastal states may be placed under pressure to reduce their cooperation, but they would have several options with which to counter that pressure. They could offer access to their entire tuna resource to third parties, use geopolitical or international considerations to their benefit, or seek public support for their cause through the media.

Source: van Santen and Müller (2000).

These arguments are valid, but perhaps not overriding. The risk of modifying sensitive national positions could be reduced by using professional negotiators. With the advent of global communications, the time and costs of preparing for multilateral negotiations are also less daunting than in the past. And the costs of supporting less well-endowed Pacific Island countries may be relatively small: in the U.S. Multilateral Treaty, they represent 4 percent of a total revenue of US$18 million. Should a particular Pacific Island country lose out as a result of a multilateral agreement, other countries could agree to compensate it by providing it with a larger share of the access fees.

The impact of aid linked to access agreements can be questionable. Offers of aid reduce the transparency of the agreement, and they may allow distant water fishing nations to subsidize national fleets by paying part of the costs of access from their aid budget. Aid could thus artificially increase the competitiveness of foreign vessels. Overall, the record suggests that aid and in-kind payments may have provided substantially fewer benefits to the Pacific Islands than their total budgets indicate.

Joint Negotiating Strategies for Surface Tuna. The majority of surface tuna caught by purse seiners (skipjack and young yellowfin tuna) are found inside the EEZs of Pacific Island countries: distant water fishing nation fleets are unlikely to operate profitably without access to Pacific Island countries' waters. Coastal states thus have considerable leverage over multilateral negotiations for purse seine access.

In developing their negotiating strategies, Pacific Island countries should realistically assess the benefits of bilateral agreements, and the potential to exceed these benefits through a joint multilateral approach (where no single coastal state would lose out). An umbrella contract with distant water fishing nations, or direct negotiations with private companies—

including new potential operators─could be considered.

Pacific Island countries might also explore the option of reducing the total purse seine fishing effort as a way to increase the profitability of the fleet, and thus their potential to derive higher access fees in the future (box 4).

Joint Negotiating Strategies for Deep-Swimming Tuna. While Pacific Island countries have considerable leverage in surface tuna negotiations, their position is weaker for albacore tuna, which distant water fishing nations can feasibly exploit in the high seas without access to EEZ waters. However, tuna longlining for other species, such as adult yellowfin, requires access to the EEZ of one or two countries with abundant resources to guarantee viable financial returns. With the Japanese sashimi market expanding rapidly, global demand for deep-swimming tuna is also expected to increase.

A different negotiating strategy could therefore be pursued for longliners: countries with abundant resources — the Federal States of Micronesia, Kiribati, the Marshall Islands, Papua New Guinea, and the Solomon Islands— could offer access to their entire combined EEZs, thus increasing the potential profitability and interest of individual distant water fishing nations in negotiating a joint agreement. Coastal states could also use the rapidly expanding momentum in the longline industry to offer inducements to new operators, thereby increasing the number of alternative parties willing to negotiate with them.

Box 4. Economic Management of Tuna Fisheries?

Although regulation of fisheries is generally used to prevent biological overexploitation, the principle can also be used for economic management. To obtain an optimal economic exploitation, investments in fishing should be such that the industry as a whole maximizes its net benefits.

Tuna in the Pacific are not overexploited in biological terms. However, there is some evidence that for surface tuna such as skipjack, there is excess capacity in both canneries and vessels. Profits in the canned tuna industry are under pressure worldwide as a result of the large expansion in catches and canned tuna production, industry consolidation, protected market blocks in Europe and the United States (which stimulate overinvestment), improvements in technology, and expansion of fishing grounds to the Western Pacific and Indian Oceans. As a result, average raw material prices have declined by some 50 percent in real terms over the past two decades.

Tuna fisheries are notoriously difficult to regulate because of the high natural fluctuation in catches and the long-term nature of investments. However, a practical rule of thumb may apply. In the tuna canning industry, transfer prices for raw materials between fishing vessels and canneries determine both vessel and cannery profitability. When tuna are highly abundant, transfer prices are usually very low, cannery operations become more profitable, and vessel operations become less profitable. When tuna are less abundant, transfer prices go up, and catching becomes more profitable. For Pacific Island countries, then, controlling the global production of canned tuna supply is likely to have financial advantages.

Pacific Island countries should consider reducing the purse seine fishing effort in the Western and Central Pacific as a way to improve the profitability of tuna fisheries. While the demand for canned tuna is linked to substitutes such as chicken and pork, transfer prices for raw tuna to canneries have historically shown major swings with changes in supply (as there are no substitutes for the raw material). Given Pacific Island countries' share of the market—some 40–50 percent of the raw material for canneries—a reduction in fishing effort would almost certainly result in an increase in world transfer prices of raw materials. This would enhance the profitability of fishing vessels, increase the potential for higher access fees, and put pressure on the canning industry to restructure and reduce its excess capacity. A recent bioeconomic study (FFA 1999) suggests that a reduction in effort might indeed increase the profits of the fishing fleet in absolute terms.

An immediate reduction in the purse seine fishing fleet could face serious political difficulties. But a gradual reduction could be beneficial. As a long-term negotiating strategy, Pacific Island countries could explore the feasibility of reducing the level of purse seine operations in their EEZs while linking access by new operators to a simultaneous reduction of their fleet in the Indian Ocean. The Palau Agreement—which places a ceiling on the number of purse seiners licensed in the region—provides an effective tool for this approach.

Source: van Santen and Müller (2000).

Pacific Island countries are on the verge of making key decisions that will influence the benefits they derive from tuna resources for years to come. Close cooperation among coastal states is key to their ability to optimize benefits and reduce the future costs of tuna management. Pacific Island countries need to urgently develop a common position to maintain independent monitoring in their EEZs, curb management costs, and expand their ability to negotiate optimal access fees with distant water fishing nations.

Chapter 4
Managing the Seabeds

Seabed mining[8] could become a reality in the Pacific within the next 10–30 years. Exploratory cruises have discovered substantial deposits of minerals in the Pacific Islands EEZs, and investor interest is rising. Adoption of suitable legislation and environmental safeguards to regulate seabed mining is therefore a high priority for Pacific Island countries.

First discovered in the Pacific during the 1950's, seabed minerals comprise three types of deposits: manganese nodules are potential sources of copper, nickel, and cobalt (figure 10); cobalt-rich manganese crusts can contain platinum, nickel, copper, and three to five times as much cobalt as manganese nodules; and polymetallic sulphide deposits are potential sources of copper, zinc, lead, silver, and gold.

A. Economic Potential

The potential for seabed mining in the Pacific Island region is significant (table 7). The Cook Islands EEZ, for example, is believed to contain some 7.5 million metric tons of manganese nodules—a potential source of 32 million metric tons of cobalt, or 520 years of supply at current world demand (Ponia 1999; Clark 1999).

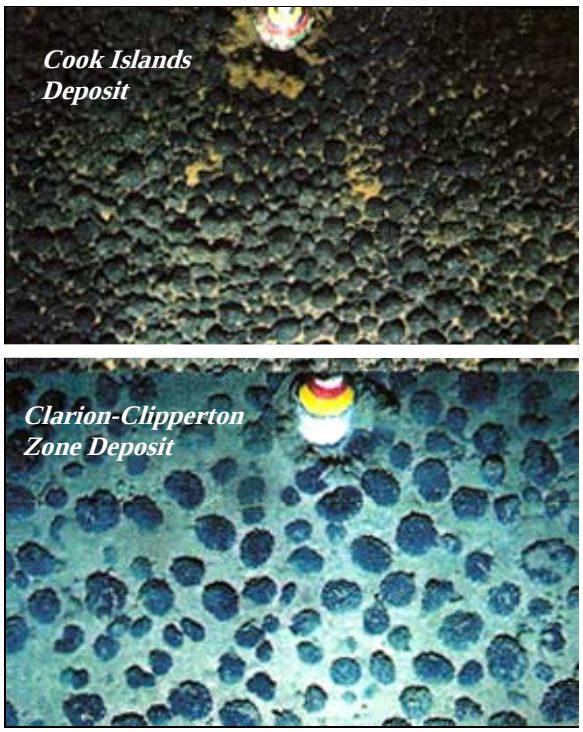
Cobalt-rich manganese crusts deposits have been found in the Federal States of Micronesia and the Marshall Islands. And though their volume is unknown, polymetallic sulphide deposits have been discovered in the Lau Basin in Fiji and Tonga's EEZ, and in the Manus and Woodlark Basins in Papua New Guinea and Solomon Islands. Indications that the Pacific polymetallic sulphide deposits may have a high gold content, with the extracted value potentially as high as US$2,000 per square meter, has led to a recent increase in foreign investors' interest (Clark 1999; Binns and Dekker 1999).

[8] Except where otherwise noted, this section is based on contributions by Freestone and Müller (2000) and by Simpson, McLeod, Kojima and Lum (1999).

B. Trends Affecting Seabed Mining

Despite the rising interest, there is as yet no exploitation of seabed minerals. The technology for extraction of manganese nodules has been developed, but the great depths—4,000–6,000 meters—and current low world prices hinder their commercial exploitation.

Figure 10. Manganese Nodules on a Seabed



Manganese nodules can be so dense that they form carpets on the slopes of abyssal hills. The mineral content of the Cook Island deposits (upper photograph) is believed to be greater than that of the Clarion-Clipperton Zone (lower photograph), generally considered to have the richest nodule fields known.

Photo courtesy of SOPAC.

Table 7. Potential of Seabed Mining in the Pacific: Manganese Nodules and Cobalt-Rich Manganese Crusts

Manganese Nodules			*Cobalt-Rich Manganese Crusts*				
Country	*Average Abundance (kilograms per square meter*	*Nodule Resource (million metric tons)*	*Country*	*Cobalt (million metric tons)*	*Nickel (million metric tons)*	*Manganese (million metric tons)*	*Platinum (million ounces)*
Cook Islands	10.68	7,474	Federated States of Micronesia	17.8	9.96	496.0	34.7
Gilbert Islands (Kiribati)	1.54	100	Marshall Islands	10.6	2.5	281.3	21.5
Phoenix Islands (Kiribati)	4.55	630	Guam	0.6	0.3	15.5	0.7
Line Islands (Kiribati)	4.37	670	Samoa	0.03	0.01	0.8	0.04
Tuvalu	2.74	—					

— Not available

Sources: Simpson, McLeod, Kojima and Lum (1999); Clark and others (1995); Kinoshita and Tiffin (1993).

Investors' attention has recently focused on the exploration of polymetallic sulphide deposits. In 1997 Papua New Guinea became the first country in the world to grant commercial licenses for their exploration, to Nautilus Minerals Corporation (Wanjik 1999). Fiji, New Zealand, and Tonga have since been approached by Australian, Korean, and U.S. interests for similar licenses.

C. Key Challenges and Opportunities

Seabed mining would be unlike any other industry seen today. It would involve high risks (operating costs of exploration vessels run at half a million dollars per expedition); it would operate over vast areas (the Papua New Guinea license covers 5,000 square kilometers [Malnic 1999]); and it would require very large and highly sophisticated machinery. Given its potential environmental impacts, seabed mining is also likely to receive intensive public scrutiny.

Extending National Claims beyond the EEZ

Under the Law of the Sea, the International Seabed Authority is responsible for regulating seabed mining on the high seas. However, Pacific Island countries may extend national claims beyond their 200-mile EEZ by delineating their continental margins. Extending these boundaries could give potential claimants the rights to additional seabed mineral deposits.

Recognizing the Risks and Uncertainties Faced by the Industry

The economic viability of the industry remains untested, even though seabed mining has been a prospect for half a century. Seabed mining operations would likely operate in unstable and small markets, facing stiff competition from mining operations on land. For example, the current global demand for cobalt—used primarily as an alloy in the aerospace industry—is limited to 27,000 metric tons a year. A single seabed mining operation producing 10,000 metric tons of cobalt a year could easily flood the market and depress world prices (Exon 1989; Ponia 1999). Polymetallic sulphide mining could be more profitable in the medium-term, but further analysis of global markets is needed.

Much of the future viability of seabed mining will depend on technological breakthroughs and improvements in mineral recovery rates. Seabed mining policies should therefore recognize the level of risk and uncertainties under which the industry would operate.

Handling Potential Environmental Impacts

Seabed mining could have substantial adverse environmental impacts. For example, manganese nodules would most likely be extracted by collectors towed across extensive areas of seabed. Lifting the nodules from depths of 5,000 meters could also release large amounts of sediment. Simulations by the Metal Mining

Agency of Japan suggest that it may take one to two years for organisms living at the sea bottom to recover from this kind of disturbance of the seabed (Kajitani 1999). The release of colder, nutrient-rich water in the upper water column may lead to a boom in primary productivity, but the potential impact such operations on fisheries and migratory species, such as turtles, is unknown. In addition, mining operations might lead to high levels of wastewater discharge—estimated at 9 metric tons of waste per day for a polymetallic sulphide mining operation (EDF undated)—and to sludge disposal from onshore processing facilities (Ponia 1999). More research will be needed to ascertain the full environmental impact of seabed mining.

The extraction of polymetallic sulphide deposits could have significant impacts on the numerous organisms found at active chimneys. Up to 5,000 organisms have been identified in one square meter of a chimney wall (Binns and Dekker 1999). Among them is a group of bacteria, *Archae*, believed to be among the earliest forms of life on earth. The fact that chimney organisms are able to survive under such extreme conditions—a highly toxic environment with temperatures of up to 300°C—renders them as highly promising for biomedical and pollution control research. Care needs to be taken to ensure that seabed mining does not destroy these potentially valuable resources.

D. A Strategy for Seabed Mining

Seabed mining presents both an immense opportunity and an immense challenge for Pacific Island countries. Given the emerging interest and the potential scale of seabed mining operations, it is essential that Pacific Island countries urgently implement two key actions:

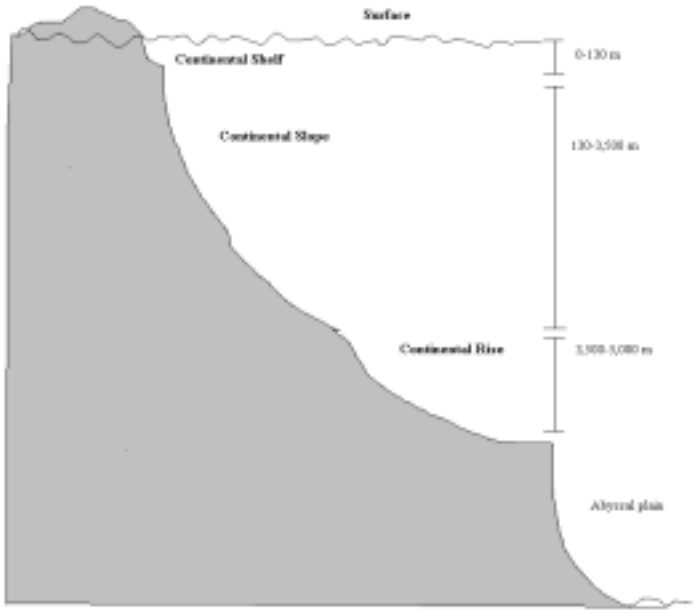
- ❏ Extend their maritime claims to the outer edge of the continental margin.
- ❏ Develop sound national offshore mineral policies.

Extending Seabed Claims

Under the United Nations Law of the Sea Convention, most Pacific Island countries have declared exclusive sovereign rights over resources in their 200-mile EEZs. Pacific Island countries can, however, extend these claims up to the outer edge of the continental margin (figure 11), provided they do so within 10 years of ratification of the Convention—that is, by November 2004—and meet the qualification criteria of the Convention.

Extension of maritime claims over the continental margin would give Pacific Island countries rights over all nonliving resources found in these areas, including seabed minerals, oil, and gas. It would also give them the right to harvest sedentary living resources, such as clams and oysters, and rights over biological communities associated with active chimneys. It would not, however, grant them exclusive rights to migratory tuna resources. Coastal states would also be required to pay a contribution (either in-cash or in-kind) to the International Seabed Authority after the first five years of mineral exploitation (SOPAC 1998).

Figure 11. Transect of a Continental Margin



The continental margin includes three major areas: the continental shelf, the slope, and the continental rise.
Source: SOPAC (1998).

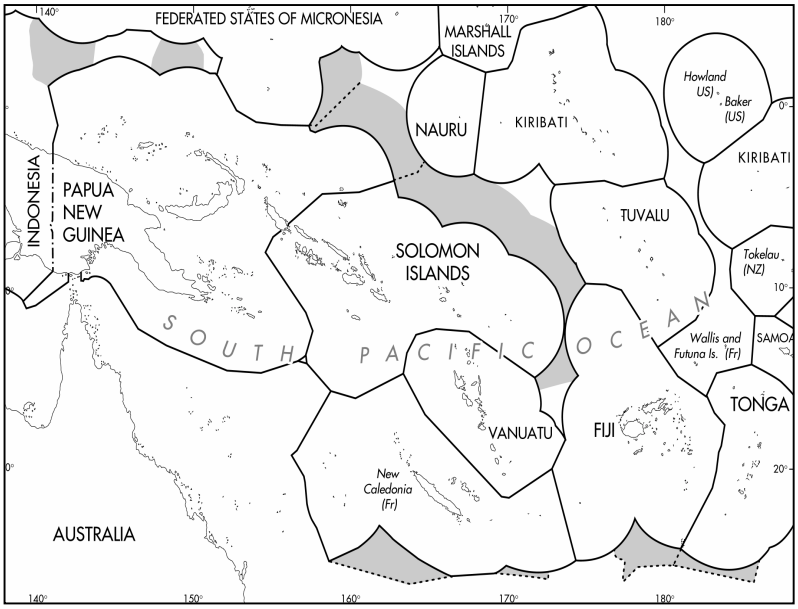
The extension of claims could give Pacific Island countries rights over potentially valuable mineral deposits. Six areas could be claimed, based on surveys conducted by the South Pacific Geoscience Commission (SOPAC) (figure 12 and table 8). Fiji, the Solomon Islands, Tonga, and Vanuatu could potentially claim new polymetallic sulphide deposits. The Cook Islands, the Federal States of Micronesia, Kiribati, the Marshall Islands, Nauru, Niue, and Tuvalu could extend their EEZ to claim deposits of manganese nodules and crusts (Simpson and others; Boyes and Larue 1996).

Pacific Island countries' claims for potential extension of maritime areas would need to be submitted to the International Commission on the Limits of the Continental Shelf. To qualify, a country's continental margin would need to extend beyond the 200-mile EEZ. Pacific Island countries could then claim continental margin areas of up to 350 nautical miles from coastal baselines, or up to 100 nautical miles from the 2,500 meter isobath (a line connecting depths of 2,500 meters) (SOPAC 1998).

Before submitting their claims, countries should complete three major technical and legal steps:

- *Define coastal baselines.* The Law of the Sea Convention allows island states to define archipelagic baselines, which could extend offshore claims by thousands of square miles. Fiji, the Solomon Islands, and Vanuatu have all claimed archipelagic status.

Figure 12. Potential Extension of Maritime Claims



Source: Modified from SOPAC (1998)

Table 8. Continental Margin Areas that Could Be Claimed By Pacific Island Countries

Location	*Area (square kilometers)*	*Potential claimants*
Euripik Ridge	110,000	Federated States of Micronesia, and Papua New Guinea
Mussau Ridge	60,000	Papua New Guinea and Federated States of Micronesia
Ontong Java Plateau	60,000	Solomon Islands, Papua New Guinea
Rotuma Ridge	40,000	Fiji
Tonga-Kermadec Ridge	—	Tonga, Fiji, New Zealand
Norfolk Ridge	12,000	New Caledonia, Australia

— Not Available
Source: SOPAC (1998)

- *Negotiate maritime boundaries with adjacent states.* Once coastal baselines have been accurately delineated, countries need to negotiate the boundaries of the outer shelf with adjacent coastal states. Potentially adjacent claims are shown in figure 12.

- *Survey the outer edge of the continental margin.* SOPAC has completed preliminary work to assess where claims to continental margins could be made. However, more work is needed to meet the data requirements of the Commission on the Limits of the Continental Shelf.

The 2004 deadline for submission of seabed claims puts pressure on key Pacific Island countries to urgently complete these tasks. It would be prohibitively costly for Pacific Island countries to undertake the surveys on their own. Close regional collaboration through SOPAC could help achieve economies of scale in offshore surveying and facilitate the exchange of information needed to help coastal states prepare their claims.

Developing National Offshore Mineral Policies

The granting by Papua New Guinea of two licenses for exploration of polymetallic sulphide deposits in 1997 led to a surge of interest in seabed mining in the region. Following the example of Papua New Guinea, Fiji and the Cook Islands have started to draft national offshore mineral policies. SOPAC has assisted in this process by providing advice to these countries and by issuing general guidelines on marine mineral policies such as the Madang Guidelines (Box 3.5).

Pacific Island country governments have correctly recognized that seabed mining poses a very different set of challenges from land mining. These challenges require new policies that maximize benefits to Pacific Island countries, safeguard the environment, allow public participation in licensing and policy decisions, and provide a conducive environment for foreign investment.

Box 5. Key Principles of the Madang Guidelines

The Madang Guidelines were developed by SOPAC as a blueprint for offshore mineral policy in the Pacific. Key principles include the following:

- ❑ Coastal States should move rapidly to stake claims for extending their continental margins.
- ❑ Nations should minimize the potential adverse impacts of offshore mining on marine environment and on other users of the sea.
- ❑ All exploration licenses should be conditional upon the collection of baseline environmental data.
- ❑ Coastal states should develop offshore mining policies and legislation that are separate from those of inland mining.
- ❑ Nations should ensure that Marine Scientific Research can produce research data while protecting the confidentiality of investors.
- ❑ Coastal states representatives should participate in all at-sea research and exploration to ensure effective monitoring.
- ❑ Marine Scientific Research and the industry should ensure adequate understanding of the life forms associated with actively venting chimneys.
- ❑ Coastal states should consider the risks involved in seabed mining in the development of licensing and fiscal regimes.
- ❑ All commercial offshore operators must carry appropriate insurance.

Source: Adapted from SOPAC (1999).

Maximizing Benefits to Pacific Island Countries. An overriding objective of national policies is maximization of economic benefits. The following general principles are recommended to achieve this objective:[9]

- *Rely on license revenue.* License fees will be the major source of seabed mining revenues for Pacific Island countries in the foreseeable future. The experience of offshore fishing suggests that Pacific Island countries should avoid any direct public involvement in mining or processing.

[9] These recommendations are based on a review of the Madang Guidelines (SOPAC 1999) and the draft Fiji offshore policy (MRD 1999).

- *Split licenses whenever feasible.* If mining areas remain profitable, issuing several licenses for a given area is likely to increase competition and maximize benefits to Pacific Island countries (Clark 1999b).

- *Avoid linking licensing to aid.* Offshore mining licenses should not be tied to aid funds, promises of local employment, or investments in processing facilities. The same principle should apply to tax holidays or reduced license fees in exchange for local investment. Such provisions create inconsistencies that could undermine the credibility of the licensing system, and are likely to result in lower benefits than originally expected.

- *Protect genetic property rights.* Given the potential biomedical and industrial value of organisms associated with actively venting chimneys—where polymetallic sulphide deposits are also found—Pacific Island countries need to adopt regulations that protect their genetic property rights in the event of future discoveries.

Imposing Strict Environmental Safeguards. International concern about the potential environmental impact of seabed mining is growing. The magnitude of the operations will almost certainly guarantee high public visibility. Only by adopting strict environmental standards and communicating openly with the public will the industry and Pacific Island decisionmakers avoid strong negative lobbying by environmental groups (Morgan 1999). The following environmental safeguard principles are recommended:

- *Assess environmental impacts in actual field conditions.* Pacific Island countries should withhold exploitation licenses until the environmental impact of seabed mining has been assessed under actual field conditions. Only then can long-term licensing arrangements be correctly formulated.

- *Adopt a regional code of environmental practice.* Pacific Island countries should develop a regional code of environmental practice.[10] The code should be developed in close consultation with environmental and industry experts.

- *Perform independent monitoring.* Draft mining policies currently give investors the main responsibility for monitoring environmental impacts. The burden of proof falls on external stakeholders to prove that impacts have occurred. This is a key weakness that undermines many environmental regulations around the world. Pacific Island countries should consider setting up an independent monitoring system for seabed mining. The system could rely upon on-site observers or periodic ground and air surveillance. To help defray its costs, the system could operate at the regional level, with support from a share of the mining royalties.

- *Impose strict penalties for polluting.* Once an independent monitoring system is put in place, Pacific Island countries should impose stiff penalties for violators based on a polluter-pay principle. Disincentives for repeat violators—such as withdrawal of licenses to operate in any of the Pacific Island countries' waters—could also be adopted. In addition, Pacific Island countries should require mining operators to develop and exercise comprehensive contingency plans for offshore incidents. Asking investors to post environmental bonds as a condition for licensing could be a way to ensure payment for any major damages that may occur. However, for this to be effective, Pacific Island countries would need to adopt legislation that is consistent at the regional level.

- *Require rehabilitation deposits.* Pacific Island countries should require all mining operators to provide a rehabilitation security deposit, to be refunded upon verification that all structures have been removed satisfactorily at the end of the licensing period (MRD 1999).

[10] Fiji has proposed such a code in its draft mining policy (MRD 1999).

- *Ban seabed mining in areas of high biological value.* With the help of regional organizations, Pacific Island countries could assess which areas should be zoned as off-limits to seabed mining. Off-limits zones could include areas of other important commercial uses, such as established shipping lanes and known areas of high tuna abundance. They could also include areas set aside to protect threatened or endangered species (Wanjik 1999). To comply with the Law of the Sea and the Biodiversity Convention, Pacific Island countries may need to develop regulations that minimize impacts on organisms associated with active hydrothermal vents, and consider designating areas for their protection (Glowka 1999).

Providing for Public Participation. Given the potential magnitude of seabed mining operations, it is important for Pacific Island countries to hold public consultations when developing their national offshore mineral policies, as well as to conduct public hearings on all license applications. Key stakeholders could be invited to participate in decisionmaking, dispute resolution, and benefit sharing. To ensure effective public involvement, policymakers should:

- *Identify conflicting and traditional claims.* Most seabed mining areas will be located outside the territorial sea and therefore beyond community waters. Notwithstanding, potential conflicts between traditional fishing rights and rights of passage and an application for offshore mining may arise. These should be investigated, and stakeholders consulted to obtain their consent or determine appropriate compensation.

- *Hold public hearings.* Public hearings should be advertised for all license applications, and stakeholders allowed a reasonable period of time to voice and discuss their objections. Results of independent monitoring should also be made public.

- *Establish an independent dispute resolution mechanism.* Once licenses are issued, Pacific Island countries should consider an independent forum for dispute resolution—such as the Mining Tribunal in Fiji (MRD 1999)—to enable the hearing of any valid claims from stakeholders.

- *Share benefits and invest in the future.* Seabed minerals are also the patrimony of future generations of Pacific Islanders. To every extent possible, Pacific Island governments should invest a share of mining royalties in trust accounts and ensure that stakeholders with valid user rights receive a fair share of the benefits (MRD 1999).

Creating a Conducive Environment for Foreign Investment. National seabed mineral policies need to recognize that potential investors face severe constraints: a high-risk, high-cost industry with uncertain future viability and unstable markets (Clark 1999b). These constraints should not be addressed by relaxing environmental safeguards but rather by offering a stable and conducive investment environment to attract foreign investor interest. To create such an environment, Pacific Island countries could take the following steps:

- *Simplify the fiscal regime.* The draft seabed mineral policy for Fiji includes 13 different fiscal instruments, including mineral royalties, corporate income tax, dividend withholding tax, carry forwards, and a duty free area (MRD 1999). The fiscal regime should be made as simple and transparent as possible, avoiding exemptions and conditional concessions. Of particular importance to investors will be the elimination of double taxation of profits already taxed by their country of origin (Clark 1999b).

- *Streamline reporting requirements.* Reporting and data requirements before and during the licensing period should be streamlined and clarified. Some of the monitoring requirements now imposed on investors would be better carried out by an independent monitoring system.

- *Provide incentives for long-term investment.* One of the most contentious issues raised by the mining industry is how to deal with uncertainty. Because environmental impacts are not yet fully understood, coastal states might need to supplement mining contracts with additional regulations that may not be known at the time the contract is signed. This is strongly opposed by the industry (Lodge 1999). One possible solution might be to phase the licenses, with the first phase including those activities that are clearly known up front. Renewal of the contract would then be conditional upon acceptance of the safeguards adopted during the first phase (Morgan 1999).

The implications of an independent monitoring system for seabed mining in the Pacific need to be further assessed, as such a system would have to be established at the regional level to be cost-effective. An appropriate forum for such discussions could be facilitated by SOPAC, or by the Marine Sector Working Group of the Council of Regional Organizations in the Pacific.

Chapter 5
Summary of Key Findings and Recommendations

Because of its size, the Pacific Ocean has long been considered by many to be a limitless resource. Such is not the case, however. The collapse of many world fisheries and the degradation of coastal areas in the Pacific are reminders that without careful management, the economic potential of this vast resource may no longer be sustained in the future.

Managing Coastal Areas

Coastal areas in the Pacific are increasingly threatened and in need of urgent attention. Yet the remoteness of many sites and the multiplicity of threats make it difficult for government or community management to succeed on their own. A co-management partnership between coastal communities, governments and NGOs offers the best prospect of effectively managing coastal areas and protecting the resources upon which so many communities depend.

To succeed, co-management should meet three conditions: first, the role of communities and their external partners (governments, NGOs) needs to be clearly defined so as to take advantage of their comparative strengths. Second, coastal communities need effective communication channels with their external partners to ensure a quick response to requests for assistance. Third, intersectoral coordination among government agencies responsible for the coast must be strengthened to avoid conflicting activities (such as issuing sand mining licenses in vulnerable coastal areas).

Several initiatives are emerging to address these challenges, from the Samoa village fisheries program to the island councils in Micronesia. These co-management programs can be maintained at relatively low costs, but will need continued government support to be sustainable.

Pacific Island governments and high level decisionmakers can play critical roles in supporting these efforts by:

- Recognizing coastal management as a social and economic priority.
- Earmarking a portion of fishing and mining license revenues in support of co-management.
- Strengthening local committees and/or island councils where both communities and government agencies involved in coastal activities can be represented.
- Requiring inter-agency coordination at the national level for actions affecting the coast.
- Providing legal support to community management rules through by-law systems.
- Containing threats that are beyond the control of coastal communities (such as pollution).
- Reducing overharvesting of marine resources through license and export controls.
- Linking extension workers to networks of regional expertise for technical support.
- Supporting awareness and environmental education programs, particularly aimed at local leaders.

Optimizing Benefits from Tuna Fisheries

In the offshore areas, the issues affecting the management of the vast tuna resources are both economic and geo-political. As the region approaches the ratification of a new regional convention for tuna management, divisions among the coastal states have become more

pronounced. This could have grave consequences for the Pacific Island countries' ability to maintain independent monitoring in their EEZs, curb their share of management costs, optimize their allocation of the total allowable catch, and negotiate optimal access fees with distant water fishing nations. The importance of developing a common position on these issues cannot be over-emphasized. In particular, Pacific Island countries should:

- Retain and expand upon the existing monitoring systems, rather than develop new systems under the future commission.
- Avoid voluntary contributions to the commission's management fund. Contributions should be specified as a regular part of the commission's budget.
- Insist on a pooled allocation of total allowable catch to the coastal states— preferably prior to the ratification of the convention.
- Negotiate access fees multilaterally with distant water fishing fleets.
- Consider limiting the purse seine fishing effort as a way to raise the profitability of the fleet, and expand the potential for extracting higher license revenues in the future.

Seabed Mining: Preparing for the Future

With investors' interest growing, seabed mining could become a reality in the Pacific in the next few decades. Under the Law of the Sea, Pacific Island countries that qualify for the claims have until November 2004 to extend national claims to the limits of the continental margin – potentially claiming rights over new seabed mineral deposits. Close regional collaboration through SOPAC could help these coastal states to meet the requirements to support their claims.

Pacific Island governments also need to urgently develop offshore mineral policies prior to the issuance of any licenses. The Madang Guidelines and the national marine mineral policies of Papua New Guinea and Fiji, assisted by SOPAC, provide a good basis for the formulation of these policies. Three areas, however, require further strengthening.

First, national offshore mineral policies should provide for the adoption of strict environmental safeguards. These might include:

- Requiring that environmental impacts be assessed in actual field conditions prior to issuing exploitation licenses.
- Establishing a regional system for independent monitoring of environmental impacts.
- Requiring that investors post environmental bonds and rehabilitation deposits to cover potential damages.
- Banning seabed mining in areas of high ecological value.

Second, national policies should provide a forum for public participation in policy and licensing decision. This could include:

- Public hearings for all license applications.
- An impartial dispute resolution mechanism (such as a mining tribunal).
- Identification of conflicting or traditional claims over the mining areas.

Finally, offshore mineral policies should provide a conducive climate for foreign investment, in recognition of the risks and uncertainties faced by the industry. This might include a simplified and transparent fiscal regime, streamlined reporting requirements, and incentives for long-term investment.

Though ocean management has long been viewed as a biological discipline in the Pacific, there is a growing realization that institutional and socio-economic realities play critical roles in ocean use. Managing the ocean is, first and foremost, about managing people. By listening to the concerns and suggestions of their communities, the countries of the Pacific stand a better chance to use wisely the opportunities offered by the ocean and ensure a continuation of these benefits for years to come.

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Annex A
Economic Valuation of Subsistence Fisheries

Subsistence fisheries play vital roles in the lives of Pacific Island communities. Yet because they are difficult to quantify, they are frequently underrated or absent from national statistics.

Of particular importance to Pacific Island economies is the value of subsistence fisheries in food security. Subsistence fisheries are a major source of animal protein in the diet of Pacific Islanders, and a vital contributor to the nutrition of many coastal communities. Yet resources that are not sold in the marketplace cannot be valued by conventional measures. Instead, an indirect valuation method based on their replacement value could be used. How much would it cost to import substitutes of a similar protein content? And how much would coastal communities need to pay to obtain substitutes with a similar caloric content? This can be assessed by estimating the value of a marketable substitute with an equivalent protein or caloric content. The methodology depends on the existence of nutritional and price data for the most likely substitute in each Pacific Island country which, although anecdotal, is fairly reliable.

At the same time, the valuation depends on the existence of statistics on subsistence catch, and here the data in Pacific Island countries are often questionable. In order to obtain estimates of subsistence catch, surveys need to be performed in coastal communities since subsistence production is not recorded (as in industrial fisheries), or observed in the marketplace (like artisanal production). Because adequate subsistence production surveys have not been performed in most Pacific Island countries, the values given rely on estimates of production based on demographics and consumption patterns, or extrapolations from old surveys. While this probably underestimates subsistence production in many areas where fishing gear and technology have improved since the original surveys were performed, in other areas it may actually overestimate the subsistence catch, as sales of coastal products are becoming increasingly frequent (World Bank 1996). Besides these limitations, the estimates may not reflect the full value of subsistence production to food security in isolated coastal communities. In those areas, likely substitutes (often imported products such as tinned fish) would come at much higher prices than the urban market prices on which this analysis is based. These limitations should be kept in mind when using the results of the analysis.

Methodology

The valuation of the importance of subsistence fisheries for food security involves seven major steps:

- Obtain an estimate of subsistence catch.
- Estimate the contribution of finfish and shellfish to the subsistence catch.
- Account for waste during consumption.
- Estimate the nutritional content – protein and caloric value – of the subsistence consumption.
- Determine the price and nutritional content of the most likely marketable substitute.
- Determine the amount of the substitute that yields an equivalent amount of protein or calories.
- Value subsistence fisheries based on the value of the substitute with an equivalent caloric or protein content.

The protein and caloric content are used to depict two slightly different values: from the point of view of Pacific Island policy makers, it is the protein value of subsistence fisheries that is the most relevant. The question here is how much the country would have to pay to import

substitutes with similar protein content (or, if the country is a net exporter, how much it would stand to lose if it had to divert potential exports to domestic consumption). From the point of view of coastal communities, it is often the caloric value that plays the most important role, since nutritional trade-offs are often made based on what it takes to 'fill the family stomach' (see also World Bank 1996).

- *Step 1. Obtain an estimate of the subsistence catch.* Estimates of subsistence production are commonly found in national fisheries statistics or in statistics from the Food and Agricultural Organization of the United Nations. Whenever possible, the accuracy of these data should be checked against other possible sources such as production surveys.

- *Step 2. Estimate the contribution of finfish and shellfish to the subsistence catch.* Beginning with the estimate for subsistence production, it is necessary to first distinguish the proportion of the production that is made of finfish and shellfish, since each will have a different caloric and protein value. Since this distinction is not generally available in subsistence production surveys or estimates, it can be extrapolated from the composition of domestic commercial inshore fisheries. This assumes that the composition of artisanal production—and hence the ratio of finfish to shellfish—is the same as in subsistence production, which may not hold in cases where the more valuable of the two is sold in local markets. Once a ratio is determined, it can be applied to the total estimate of subsistence production to yield the estimated amount of subsistence shellfish and finfish caught in a given year.

- *Step 3. Account for waste during consumption.* The subsistence production numbers for finfish and shellfish represent whole weights, not all of which are consumed. Since subsistence fisheries are valued in terms of their nutritional contribution, the production must be adjusted to reflect the waste not consumed. For this calculation, it was assumed that 51 percent of the whole weight of finfish would result in waste, while 75 percent of the whole weight of shellfish would result in waste (World Bank 1996). Subtracting the waste from the total subsistence production yields an estimate of net consumption of subsistence finfish and shellfish.

- *Step 4. Estimate the nutritional content of the subsistence consumption.* The nutritional content of the subsistence consumption can be derived from Pacific Island Food Tables (SPC 1994). For finfish, the category "reef finfish" was used. For shellfish, the nutritional content of clams was used to represent the nutritional content of shellfish, as clams are commonly consumed at the subsistence level. These estimates assume that the finfish category in the Pacific Island Food Tables is representative of the average finfish consumed at the subsistence level. The following standard nutritional values were therefore used:

  Finfish—109 kilocalories and 19.5 grams of protein per 100 grams of finfish consumed.

  Shellfish—57 kilocalories and 11.2 grams of protein per 100 grams of shellfish consumed.

  Based on these numbers, the net consumption of finfish and shellfish in kilocalories and grams of protein was derived as shown on Table A.1.

- *Step 5. Determine the price and nutritional content of the most likely marketable substitute.* The most likely substitutes for subsistence fisheries were assessed from knowledgeable country sources. In the Solomon Islands for example, the most likely substitute was considered to be skipjack flakes. In Vanuatu, about 65 percent of the substitute was deemed to be canned mackerel, and 35 percent tinned beef. The substitutes were those most likely to be used by the consumers of subsistence fisheries due to cost, availability, or taste. The prices for substitutes were those quoted for urban markets, which as seen before can be an underestimation of the prices in isolated rural areas. Duties and taxes on marketed

substitutes ─ which should be excluded in an economic valuation─were not taken into account, but they are likely to be small given the recent deregulations in countries like Fiji and Samoa. The nutritional composition of the substitutes used was derived from Pacific Island Food Tables (SPC 1994).

- *Step 6: Determine the amount of the substitute that yields an equivalent amount of protein or calories as subsistence fisheries.* Taking the net nutritional consumption of subsistence fisheries, and dividing it by the nutritional content per weight of the most likely substitute results in the amount of the substitute needed to yield an equivalent caloric or protein content to subsistence fisheries.

- *Step 7: Value subsistence fisheries based on the substitute with equivalent caloric or protein content.* Taking the amount of the most likely substitute necessary to yield an equivalent nutritional content to subsistence fisheries, and multiplying it by the price of the substitute gives the final economic value of subsistence production for food security.

Table A. 1. Estimating the Value of Subsistence Fisheries for Food Security in Selected Pacific Island Countries, 2000

	Fiji	*Kiribati*	*Samoa*	*Solomon Islands*	*Vanuatu*
Subsistence Production					
Finfish Production:	18,057	13,743	4,222	13,564	2,697
Total (in metric tons)	11,015	13,331	2,743	8,817	2,428
Consumed (in metric tons)	5,397	6,799	1,345	4,320	1,190
Kilocalories consumed	5,883,111,500	7,410,463	1,465,723,000	4,709,084,926	1,296,528,731
Grams of Protein consumed	1,052,483,250	1,325,725	262,216,500	842,450,973	231,947,801
Shellfish Production:					
Total (in metric tons)	7,042	412	1,477	4,747	269
Consumed (in metric tons)	1,761	103	369	1,187	67
Kilocalories consumed	1,003,485,000	58,749,900	210,497,580	676,524,450	38,435,471
Grams of Protein consumed	197,176,000	11,543,840	41,360,928	132,931,120	7,552,233
Total Nutritional Content (Finfish and Shellfish):					
Kilocalories consumed	6,886,596,500	66,160,363	1,676,220,580	5,385,609,376	1,334,964,202
Grams of Protein consumed	1,249,659,250	12,869,565	303,577,428	975,382,093	239,500,034
Most Likely Substitute	Canned Mackerel (50%) Canned Tuna (50%)	Tinned Fish	Mutton Flaps (40%) Tinned Herring (60%)	Skipjack Flakes	Canned Mackerel (65%) Tinned Beef (35%)
Total amount of substitute needed:					
In Kilocalories	3,409,206	2,378,730	542,115	3,520,006	754,217
In Grams of Protein	5,812,369	6,078,494	1,415,940	4,064,096	1,255,900
Cost of Substitute (US$ per gram)	0.0012	0.003	0.01	0.003	0.01
Total Value of Subsistence Production (US$ millions):					
In Calories Equivalent	**3.9**	**7.0**	**5.3**	**11.6**	**8.9**
In Protein Equivalent	**6.7**	**18.0**	**13.9**	**13.3**	**14.7**

Annex B
Statistical Tables

Table B.1. Estimated Fishery Production in Pacific Island Countries
(in metric tons)

Country	*Offshore (Industrial)*[a]	*Coastal (commercial)* [b]	*Subsistence* [c]
Cook Islands	0	124*	858*
Fiji	3,909	6,653*	16,600*
Kiribati	6,298 [d]	3,240*	9,084*
Marshall Islands	0	369*	2,000
Micronesia	14,043 [e]	637*	6,243
Nauru	0	279*	98*
Niue	0	12*	103*
Palau	0	736*	750*
Samoa	7,052	106 [f, **]	4,400 [g, **]
Solomon Islands	49,390 [h]	1,150*	10,000**
Tonga	571	1,429*	933**
Tuvalu	0	120*	807**
Vanuatu	38,431 [i]	56 [j]	2,045**

Note: All figures for 1998 unless otherwise noted. * 1995 ** 1997/98

Sources:

a Estimates of industrial fishery production are provided by L. Rodwell, Forum Fisheries Agency (personal communication) based on SPC 1998 provisional landings data.

b Unless otherwise stated, estimates of coastal commercial fishery production are from Dalzell, Polunin and Adams (1996).

c Unless otherwise stated, estimates of subsistence fishery production are from Dalzell, Polunin and Adams (1996).

d Partly caught outside Kiribati waters

e Partly caught outside FSM waters

f Samoa Fisheries Division Annual Report 1997/1998

g Samoa Fisheries Division Annual Report 1997/1998

h Central Bank of Solomon Islands Quarterly Review, June 1999

i Caught almost entirely outside Vanuatu waters

j Vanuatu Fisheries Department, Annual Report 1998

Table B.2. Estimated Annual Value of Pacific Island Fisheries *(in millions of US$)*

Country	*Offshore (industrial)*[a]	*Coastal commercial*	*Subsistence*[b]	*Other*
Cook Islands	0[*]	0.3	3.0	4.5[c]
Fiji	14.2	18.3	45.8	1.7[d]
Kiribati	6.6[e]	4.8	13.4	0.7[f]
Marshall Islands	0	0.7	3.1	0.3[g]
Micronesia (FSM)	13.5	1.5	11.2	0.4[h]
Nauru	0	0.6[**]	0.2[**]	0**
Niue	0	0.05	0.5	0
Palau	0	2.4	1.8	0
Samoa	14.3	0.4[i,***]	13.3 [j,***]	0.01 [k,***]
Solomon Islands	61.3	4.3	8.4	2.8 [l]
Tonga	1.6	2.8	1.9	0
Tuvalu	0	0.1	0.7	0
Vanuatu	39.7	1.7 [m]	2.0	0.9[n]

Notes: All figures for industrial fisheries are for 1998, unless otherwise noted
All figures for commercial, subsistence and other fisheries are for 1995, unless otherwise noted
* 1990 data ** 1996 data *** 1997/98 data

Sources and Notes:

a. Estimates of industrial fishery production value provided by L. Rodwell, Forum Fisheries Agency (personal communication), based on 1998 estimated landings multiplied by estimated average price.

b. Note the revised estimates of fisheries subsistence value for food security in Annex A, Table A.1.

c.

Ornamental fish	US$	171,453
Pearl products	US$	4,346,574

d.

Shells, coral, trochus	US$	1,020,000
Pearl products	US$	79,300
Animal feed	US$	306,900
Aquaculture	US$	250,000

e. Includes value of Kiribati vessels fishing and landing their catch outside Kiribati EEZ

f. Estimated value of aquaculture

g. Aquarium fish exports

h. Exports of coral, shell and trochus

i. Samoa Fisheries Division Annual Report 1997/98.

j. Samoa Fisheries Division Annual Report 1997/98.

k. 'Bio-rock' for aquarium trade. Source: Samoa Fisheries Division Annual Report 1997/98.

l.

Shells, coral and trochus exports	US$	2,518,200
Fish meal exports	US$	235,400

m.

Coastal fisheries - commercial:	US$	1,514,364
'Fish exports'	US$	179,400

n. Shells, coral and trochus exports

Table B.3: Estimated Fisheries Trade in the Pacific Islands

Country	*Imports*		*Exports*	
	Volume (metric tons)	*Value (US$ million)*[a]	*Volume (metric tons)*	*Value (US$ million)*[b]
Cook Islands	195	0.48	96	3.29
Fiji[c]	16,854****	21.5****	13,978	26.3[d]
Kiribati	374	0.4	3,083[e]	3.3[f]
Marshall Islands	83	0.3	731[g]	15.4
Micronesia	1,176**	2.0**	10,885[h,*]	73.6[i,*]
Nauru	–	–	–	–
Niue	–	–	–	–
Palau[j]	792	1.84	44	0.2
Samoa	3,234	3.9	24,405****	9.4****
Solomon Islands	107**	0.24**	34,646***	26.8***
Tonga	604	0.8[k]	–	1.4[l,****]
Tuvalu	–[m]	–	–[n]	–
Vanuatu[o]	1,155****	1.6****	145****	0.9[p,****]

Notes: Estimates are for 1996 unless otherwise stated. *1994 data **1995 data *** 1997 data **** 1998
– Not available.

Sources and Notes:

a Unless otherwise stated, data on import values is from the FAO Statistics Yearbook (Commodities), 1996.

b Unless otherwise stated, data on export values is unpublished information provided by the Statistics Bureau, Secretariat of the Pacific Community.

c Source: Fiji Fisheries Division Annual Report, 1998.

d Includes value of aquarium fish exports .

e FAO Fishery Statistics (185 t) plus all the catch (2,998) taken by industrial fishing activities outside Kiribati.

f Asian Development Bank, 1996. Includes value of Kiribati tuna fishing vessels operating outside Kiribati.

g Entire domestic longline catch (616 t) plus 115 t of exports reported in FAO Fishery Statistics Yearbook (Commodities). This figure may be an underestimate as there may be significant additional exports of fish landed domestically by foreign fishing vessels.

h Entire tuna purse seine catch (10,728 t) plus domestic longline catch (153 t) and 4 t of miscellaneous products reported in FAO Fishery Statistics Yearbook (Commodities).

i Asian Development Bank Social and Economic Indicators for Developing Countries (1997).

j The stated values are almost certainly underestimates.

k 502 tonnes recorded in Government trade balance data, plus the 1,062 t of longline-caught fish recorded in the SPC tuna bulletin.

l Kingdom of Tonga Statistical Indicators 2000. Statistics Department, Nukualofa, Tonga.

m An unknown amount of canned fish, and possibly other seafood products is imported to Tuvalu.

n Exports mainly comprise air consignments of fresh deep-water snapper, estimated at about 100 kg/week, and small quantities of dried reef fish .

o Vanuatu Fisheries Department Annual Report, 1998.

p Value includes fish and seafood as well as beche-de-mer, shells, aquarium fish and shark fins.

Table B.4. Estimated Annual Export of Major Coastal Fisheries Commodities from the Pacific Islands Region

Commodity	*Amount (in metric tons)*
Sea Cucumber	1,500[a]
Trochus Shells	2,000[b]
Pearl Shells	400[c]
Pearls	about 1[d]
Deep-water Snappers	300[e]
Giant Clams	20[f]
Live Groupers	Unknown but growing

Source: Secretariat of the Pacific Community
a. Dried, equivalent to 15,000 metric tons of live weight
b. Shell weight
c. Mainly spent farmed shell
d. With a value of more than US$100 million
e. Mainly from Tonga
f. Of abductor muscle

Table B.5. Estimated Employment in Fisheries in Selected Pacific Island Countries

	Formal Employment by Sector (numbers of people)	
Country	*Commercial harvesting*	*Processing/ Post-harvest*
Cook Islands	40[a]	175
Fiji	6,900	5,000
Kiribati	1,131	N/a
Marshall Islands	200	50
Micronesia	1,150[b]	50
Nauru	25	0
Niue	4	0
Palau	800	—
Samoa	720[*]	80[c, *]
Solomon Islands	1,250	1,546
Tonga	1,051	—
Tuvalu	100	5
Vanuatu	250[d]	10

Notes: — Not available. All data for 1996, except *- 1997.
Subsistence fishers are not included (see Chapter 2 of text).
Sources and Notes:

[a] Gillett (1996). Data relates mainly to Rarotonga, as there are few professional fishermen elsewhere in Cook Islands.
[b] 650 full-time, 500 part-time.
[c] A further 3,500 Western Samoans are employed at the two tuna canneries in neighboring American Samoa, 7% of whose fish supply is imported from Samoa.
[d] Does not include crew on foreign fishing vessels operating outside of Vanuatu.

Table B.6. Estimated Per Capita Fish Consumption in Pacific Island Countries

Country	*Commodity balance (metric tons)*[a]				*Apparent per capita supply (kg/yr)*
	Production	*Imports*	*Exports*	*Total supply*	
Cook Islands	1,109	195	96	1,208	63.2
Fiji	35,200[b]	17,533	13,244	39,489	50.7
Kiribati	15,222	374	3,083	12,513	150.0
Marshall Islands	2,985	83	731	2,337	38.9
Micronesia	17,761	1,176	10,885	8,052	72.0
Nauru	376	—	—	376	35.9
Niue	115	—	—	115	54.8
Palau	1,486	70	16	1,540	85.1
Samoa	6,446	3,234	1,772	7,908	46.3
Solomon Islands	64,771	107	36,271	28,607	32.7[c]
Tonga	3,424	604	1,562	2,466	25.2
Tuvalu	927	—	—	927	85.0
Vanuatu	2,512	1,316	113	3,715	21.0
Total				109,253	33.82

Notes: — Not available.

[a] Production, Import and Export tonnages have been converted to live weight equivalent using FAO conversion tables.

[b] An additional 10,000 metric tons of fish meal are noted as having produced. However, 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.

[c] After accounting for fishmeal exports.

Table B.7: Estimated Current and Projected Future Costs of Fisheries Management and Administration *(in US$'000)*

Obligations	*Current Costs of Current Activities Funded by*			*Estimated Costs of Future Activities with MHLC Convention Funded by*		
	DWFN	*Aid*	*PICs*	*DWFN*	*Aid*	*PICs*
Regional Monitoring, Control and Surveillance:						
- Installation of Vessel Monitoring System	*5,000*	--	--	*6,000 a)*	--	--
- Operation of Vessel Monitoring System	850	--	350	1,700	--	350
- Air Surveillance	--	5,000	--	--	5,000	--
- Surface Surveillance Investment Costs	--	*120,000*	--	--		--
- Surface Surveillance Operation Costs	--	3,000	3,000	--	3,000	3,000
- Observer Program	250	250	1,000	3,050	250	1,000
- Regional Register of Vessels	500	--	20	500	--	20
Regional and National Tuna Research:						
- Regional Research by SPC	--	1,800	--	900	1,800	--
- Other Research	--	--	500	800	--	500
- National Research	--	--	--	--	--	--
Data Collection:						
- Catch and Effort of DWFN	400	--	--	1,000	--	--
- Catch and Effort of Local Fleet	--	--	400	--	--	800
- Economic Data	--	20	100	--	20	100
- Compliance	--	20	100	--	20	100
Legal Requirements						
- Review	--	--	--	--	250	350
- Updating	--	50	--	--	50	50
Preparation for MHLC	*750*	*1,500*	*200*	--	--	--
Finalizing MHLC and Commission	*750*	*1,500*	*200*	--	--	--
Overhead MHLC						
- Annual Meetings	--	--	--	150	--	150
- Data Dissemination	--	--	--	100	--	50
- Secretariat	--	--	--	500	--	500
- Scientific Committee	--	--	--	75	--	75
- Technical Committee	--	--	--	75	--	75
Fisheries Administration						
- Annual Reporting	--	--	500	500	--	1,000
- Training and Maintenance of Staff	--	500	500	--	600	600
- Updating Equipment	--	500	500	--	*1,000*	*1,000*
Total Investment Costs (in italics)	*6,500*	*123,500*	*900*	*6,000 a)*	*1,000*	*1,000*
Total Operating Costs	2,000	10,190	6,470	9,350	10,990	8,750

Source: van Santen and Muller (2000) based on data from the Forum Fisheries Agency (FFA).
a) US$ 8 million if a new Vessel Monitoring System (VMS) was to be installed.
Regional Monitoring, Control and Surveillance, Current Costs: VMS installation of transponders: US$4,000 per vessel for 1,000 vessels; equipment at FFA center and national stations, US$1 million. VMS operational costs include US$350,000 for FFA center and US$850,000 for 16 national stations. Aerial surveillance covers 1,000 hours at US$5-24,000/hour. Surface surveillance investment comprises 22 patrol boats at US$5.2 million each and others with running costs of about US$260,000 per annum each.
Observer program: regional program costs US$250,000 per annum. Costs covered by distant water fishing nations (DWFN) estimated to be the same. National observer programs are estimated to cost US$1 million for all Pacific Island countries.
Monitoring, Control and Surveillance, Future Costs: VMS installation costs assumes existing FFA VMS would cater for all vessels fishing in EEZ and high seas. Investment costs include upgrading of existing equipment and expansion of number of vessels to 2,000 (US$3 million), upgrading of equipment at FFA Headquarters, the Commission Headquarters, and National Stations (US$3 million).
VMS operating costs would double for DWFNs to include entire fleet operating in EEZ and oceanic areas. Air and surface surveillance costs would remain at current levels. DWFN observer programs would substantially increase in scope to cover those vessels that operate in high seas. Regional Register costs would remain the same.
Research, Current Costs: estimates for SPC (US$1.8 million) and US$500,000 for all national efforts.
Research, Future Costs: A 50% increase in SPC research costs is assumed to cover high sea areas, to be funded by DWFN; DWFN research requirements would increase by an estimated US$800,000 annually.
Data Collection, Current Costs: estimated at US$25,000 per Pacific Island country; DWFN expenditure assumed to be similar amount.
Data Collection, Future Costs: Requirements will at least double (for PIC) and are estimated to increase 150% for DWFNs.
Legal Requirements, Current Costs: Actual average over several years, to reduce the impact of particularly high costs in recent years.
Legal Requirements, Future Costs: Estimated to require US$40,000 per country, including direct legal support and associated costs of introducing additional legislation.
Preparation of MHLC: actual data.
MHLC Administration Costs: based on current estimates.
Administration Costs, Current Costs: based on US$30-40,000 per PIC for reporting and twice that amount for staff development and updating equipment.
Administration Costs, Future Costs: for DWFN, costs are estimated to increase to accommodate reporting requirements, and double for Pacific Island countries. Staff training costs will increase, and equipment costs for Pacific Island countries will double.

Table B.8. Summary of Marine Mineral Resource Potential of Pacific Island Countries

Country	*Coastal minerals*	*Deep-sea minerals*
Cook Islands	Poor	Very Good
FSM	Poor	Moderate
Fiji	Producing	Good
French Polynesia	Moderate	Good
Guam	Poor	Poor
Kiribati	None	Moderate
Marshall Islands	None	Good
New Caledonia	Producing	Poor
Niue	Poor	Unknown
Western Samoa	Poor	Poor
Islands	Producing	Moderate
Tonga	Poor	Good
Tuvalu	None	Moderate
Vanuatu	Good	Moderate

Source: SOPAC Medium Term Plan (1996)