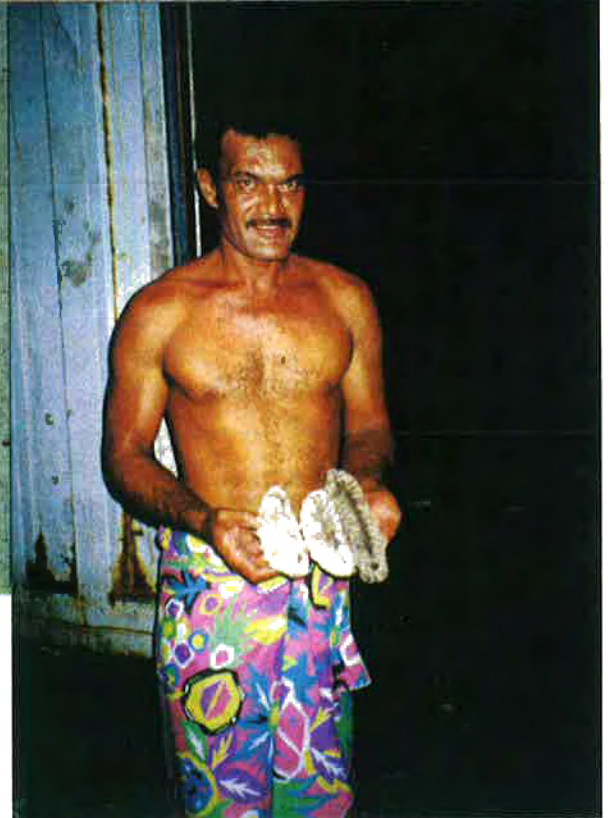


A Study of the Fisheries Sector of Tuvalu



Asian Development Bank

**A STUDY OF THE
FISHERIES SECTOR OF TUVALU**

**WITH RECOMMENDATIONS FOR
COMMERCIAL AND INSTITUTIONAL
DEVELOPMENT**

**Report Prepared Under
Technical Assistance No. 1992-TUV
from Asian Development Bank to
the Government of Tuvalu**

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Photographs:

Front Cover (clockwise from top left): selling skipjack tuna on Funafuti; the fishing boats Tasu (l.) and Manau (r.); Mr. L. Papamau with dried beche de mer (sea cucumber) for export; assorted snapper species caught during fishing trials under the USAID seamount fishing project.

Back Cover: Nukufetau Atoll.

(All photographs by J. Berdach)

Introduction

Under an Asian Development Bank (ADB) technical assistance (TA) project, a Mission team was sent to Tuvalu in January, 1994. The Team included Paul B. McCabe, Economist/Programs Officer (Mission leader), who initiated the TA; James T. Berdach, Fisheries Specialist (team leader); and John A. Maynard, Fisheries Specialist/Financial Analyst. The team's two technical specialists were posted in the country to research activities in the fisheries sector. The principal focus of the study was to evaluate existing constraints to, and opportunities for, further development of fisheries activities, especially commercial, export-oriented enterprises. Initial research was undertaken utilizing existing reports and documents. In addition, a number of meetings involving both Government officials and grass-roots-level artisanal fishermen were organized. These meetings determined both official viewpoints and community opinion. As a result of this input, the consultant team was able to formulate project options which were favorably received by both Government and local community representatives.

Following the review by Government of a draft report submitted in April, 1994, tripartite meetings were attended in August, 1994, by Mr. McCabe and Mr. Berdach, and members of Government. These meetings were convened to discuss the report's findings. The final report contains the minutes and findings of those meetings in their entirety (Annex T). In addition, the final report reflects the points brought to the attention of the Mission team by Government during the tripartite meetings.

Executive Summary

It has been widely quoted that Tuvalu's greatest hope for economic development depends on its ability to exploit its ocean resources. In particular, interest and support for the development of commercial fishing in Tuvalu has been evident for many years, yet no viable commercial projects have emerged. Past attempts at commercial fishing development have failed for a variety of reasons (listed below). Despite these failures, Tuvalu has been able to comfortably provide for the needs of its people through the perpetuation of traditional subsistence fishing activities.

The country now stands at a crossroads: a decision must be made whether to continue along the same path that has been followed for many years, or to take definite strong steps toward establishing a well-planned, well-implemented commercial fishing venture. In addition to possible plans for commercial development, opportunities exist for developing smaller scale, "cottage industry" activities which could complement commercial-scale operations, and provide a viable means of livelihood for a significant number of people.

The initial thrust for the development of a commercial, export-oriented fishing industry will entail capture fishing of Tuvalu's principal commercial fish resources, tuna and high-valued bottomfish. *Proposed herein as the priority components of such a program are: 1) a tuna purse seine operation with an estimated cost of US\$10 million, and an annual operating margin of US\$3 million; and 2) a seamount fishing operation for production of snapper and other high-valued bottomfish species, with an estimated cost of US\$1.125 million, and annual operating margin of about US\$350,000.*

These projects can be implemented without construction of costly shore infrastructure. Onward planning to bring the small-scale fisherman into export fishing will call for the construction of a support base at Funafuti, including vessel service facilities. This project component will initially support about 200 artisanal fishermen and will be expanded to include the fish production for the outer atolls.

Evaluation

The ADB consultant team identified several important constraints which have hindered past development of commercial fisheries activities in Tuvalu. The principal constraints are:

- lack of effective means to transport fish products in quantity to overseas markets;
- lack of supporting infrastructure, especially shore facilities and protected anchorages;
- lack of managerial expertise to successfully guide a commercial venture;
- lack of adequate training of local personnel in the repair and maintenance of onshore equipment, boats, etc.;
- lack of incentives to attract local fishermen to participate in a commercial venture.

Other significant constraints which have been identified include:

- lack of institutional cohesiveness;
- the difficulties of equitably promoting commercial fisheries programs among all communities, especially on outer islands;
- the potential threat of deteriorating nearshore resources as a result of overexploitation by the large population on Funafuti Atoll;
- lack of consistent data-gathering required for accurate assessment of fisheries resources and monitoring of activities;
- lack of suitable marketing centers for local sale and handling of fish.

Strengths which presently can be found within the sector include:

- the abundant pelagic and bottomfish resources which exist in Tuvalu's waters;
- the presence of a labor force which is well-accustomed to working at sea;
- the availability of protected lagoon environments for development of mariculture.

Recommendations

To address the constraints, and take advantage of the strengths described above, the consultant team recommends several programs which are aimed at furthering the growth of the fisheries sector. These are summarized in Section II, "Comprehensive Fisheries Action Plan."

Commercial Fishing Programs

A major constraint to commercial fisheries development has been the lack of engineering studies for construction of ports, harbors, and anchorages. There is currently a proposal to ADB to fund such a study.

Pelagic Fishing

Two principal components are recommended for this program:

- Establishment of a small (two-vessel) commercial purse seine fleet, with a dedicated refrigerated carrier vessel. This enterprise should be set up as a separate corporation under the National Fishing Corporation of Tuvalu (NAFICOT). A firm or individual having expertise in all aspects of commercial fisheries will be hired under long-term contract to undertake the initial management of this enterprise. The carrier vessel will transport skipjack tuna to canneries in Pago Pago, American Samoa, and Levuka, Fiji. Several options for financing of such a venture are discussed in Section 2.A.9.b. Operational details for this program are presented in Annex G.

- Establishment of a fleet of approximately 50 artisanal 'Alia'-type catamarans used to troll for tuna around Funafuti. The viability of this program will depend upon the existence of the purse seining component, which will provide the means of transporting fish to export markets. The artisanal fleet will employ 200 fishermen. The principal catch of skipjack will be off-loaded to a shore facility for storage, then transferred to the purse-seine carrier vessel to be taken to regional canneries.

The artisanal fleet can be expanded to outer islands. This would require establishment of small onshore storage facilities on each island, each with its own power generation capability. Fish could be transferred from outer island storage to the *Nivaga II* (which presently has 15-metric tons (mt) cold storage capability), then to storage on Funafuti, and finally, on to the purse seiner carrier vessel for export.

The artisanal fishing program would operate as part of NAFICOT's commercial activity, but with its main objective to maximize local employment opportunities, rather than maximizing profit for the company. Under a boat buying credit and support scheme, fishermen would be given the opportunity to own their own boats after about four years. The payback on the "loaned" boats would be based on a share of the annual catch sold to the company as cannery fish. The NAFICOT shore facility will support this emerging private sector fishery.

In addition to these two principal components, other options for developing fishing activities at the artisanal to semi-commercial level are described. These include options for a small gill-netting operation and small pole-and-line operation. Details of proposed small-scale fisheries operations are presented in Annex J.

Bottomfishing Program

This program would involve the establishment of a small (three-vessel) fleet, based in Fiji, but fishing for bottomfish on seamounts in Tuvaluan waters. The vessels will be capable of directly carrying fish to Fiji, from which point fish will be transhipped by air to Hawaii. This will eliminate uncertainties, limitations, and high costs of air transport from Funafuti to Nadi. Technical and financial details concerning this project appear in Annex H.

The purse seine and bottomfish projects collectively would require total funding of roughly US\$10-12 million. A possible suggested source is the Commonwealth Development Corporation (CDC) which would require around 30 percent equity participation by the Government of Tuvalu (GOT). While ownership will be by Government to begin with, a plan for privatizing the operation over a 5-10 year period is presented (Section II.A.7.b. and Figure 5).

The above programs would focus on offshore fisheries resources, thus relieving pressure which has been placed on nearshore resources through heavy exploitation.

Market Facility

For both the pelagic and bottomfishing programs, by-catch would be made available for sale to local residents in Funafuti. The establishment of a centrally-located market facility is considered a highly desirable adjunct to these two commercial fishing programs. The existence of a well-managed market would facilitate better distribution, quality control, and sanitary conditions. Such a facility could also serve as an outlet for any products brought in from outer islands. A cooperative management

arrangement between NAFICOT and the Funafuti Island Council might provide the best institutional structure to assure successful implementation and operation of such a market facility. As has been the case in the past, it is anticipated that women would play an important role in the operation and management of the market facility. Annex K presents detailed information regarding the cost of establishing a new Funafuti fish market.

"Cottage Industry" Enterprises

Outer Islands Dry Fish Production

Projects funded by Australia are currently underway on two outer islands (Nanumea and Nukufetau) to establish community fishing centers aimed at dry fish production. Similar programs could be extended to other islands. It is recommended that such an expansion concentrate on establishing low-cost, low-maintenance solar drying facilities, similar to ones operating in Kiribati and Tokelau for production of tuna jerky for export. Such a program is viewed as presenting important small-scale opportunities for revenue generation, employment, and outer island economic development. Technical assistance costing approximately US\$160,000 would be required to initiate a small-scale pilot program. A model for developing such a program is presented in Annex L.

Minor Products; Aquaculture/Mariculture

Some nearshore "minor products" which for the most part have not been subjected to heavy exploitation could form the basis for additional small-scale export enterprises. Such products potentially include, among others, beche de mer, shark fin, lobster, specimen seashells, and tropical fish for the aquarium trade. With the possible exception of lobster, these products have not been used traditionally, and their exploitation for commercial purposes would not significantly affect the availability of resources which local residents rely on for their own use. Since little is known about the extent of such resources in Tuvalu's lagoon environments, Government support for these activities should initially be in the form of research to assess the resources, and to formulate policy guidelines for their sustainable exploitation.

In addition, the biological feasibility of growing giant clam in the lagoon environment in Tuvalu through mariculture has been demonstrated. Research on the aquaculture of milkfish has been started, while research concerning culturing of pearl oysters has yet to be undertaken. It is recommended that Fisheries Department take principal responsibility for carrying out further research on these projects. In addition to investigating possible methodologies, market research would need to be undertaken before culturing of any of these products could be commercialized. The results of successful research efforts could then be transferred either to NAFICOT or directly to the private sector for commercial application. It is recommended that technical assistance to the Fisheries Department in new product development be pursued. Further information covering a selection of possible projects aimed at development of products with export potential is covered in Annexes L, M, N, and O.

Institutional Strengthening and Training

The recent reunification of NAFICOT and Fisheries Department under the Ministry of Natural Resources Development may rectify some of the institutional problems which have hampered the fisheries sector in recent years. At the very least, this restructuring fosters cooperation, rather than competition, between the two agencies, and allows for the possibility of resolving any conflicts at the ministerial level.

Virtually all of the programs enumerated above would require an extensive, long-term training effort. For activities under NAFICOT (i.e., commercial activities and local market), it is suggested that training should be accomplished through on-site, on-the-job programs, with local residents working side by side with a foreign expert. A Terms of Reference is provided in Annex F describing the responsibilities of a "Commercial Fisheries Project Implementation Advisor". The person filling this key position would play an integral role in commercializing the fishing industry in Tuvalu, and in providing training to Tuvaluans to carry on commercial activities in key management positions. In order to assure effective skills transfer, this expert should be under contract for a minimum of five years. The most critical training areas include: commercial business management, marketing, entrepreneurship, commercial vessel operation, boat building, and onshore facilities operation, maintenance, and repair.

For Fisheries Department, the most important needs include training in staff development and management, and in technical areas including statistical analysis, resource evaluation, regulation, and protection. Technical training specific to various projects will also be necessary as these come on-line. A combination of in-country and overseas training will be appropriate for most of the activities carried out within the Fisheries Department. A Terms of Reference describing the responsibilities of a "Fisheries Staff Development and Training Advisor" is provided in Annex P. The individual filling this position will play a key role in assuring that the staffing and training needs within the Fisheries Department are being adequately met.

Both of the above advisory positions can be funded through donor assistance, possibly from the European Union (EU).

To advance fisheries training on outer islands, it is recommended that additional fisheries extension assistants be hired. This will entail additional expense in the recurrent budget. Extension assistants would first receive comprehensive training on Funafuti, and then be assigned full-time on outer islands. Depending on the success of the program, and the interests of the individuals involved, assignment of extension agents may be either on a permanent or contractual basis. Among their responsibilities will be instruction of outer island residents in new methods of fish harvesting and processing. Activities such as fish drying or aquaculture will be developed for both subsistence and commercial application. Other duties will include monitoring of resources; monitoring of fishing equipment needs, including fish aggregating devices (FADs)¹; and liaison with Fisheries Department in Funafuti to provide other assistance as necessary.

In order to generate interest and prepare more people to become involved in fisheries activities over the long term, it is recommended that a program of entrepreneurial training, and a secondary school curriculum in fisheries and marine sciences be developed. The Fisheries Staff Development and Training Advisor would have responsibility for helping to develop these important training and educational programs.

The fisheries projects suggested herein, and future projects in this and other sectors, can have significant impacts on existing fish stocks and similar resources, and on the habitats in which these resources occur.

¹"FADs," or "payaos" are rafts or floats set in deep (800 to 2,000 fathoms) water. A line of palm leaves, old nets, or other "attractors" (about 10 to 20 meters [m] long) attached to the float provides a shelter or habitat around which small fishes aggregate; this in turn attracts larger pelagic species such as tunas, thus allowing increased efficiency of tuna-fishing operations.

In order to assure that adverse impacts are minimized, and that the resource base is maintained at an adequate level to assure sustainable utilization, it is recommended that a review of the present legal structure be undertaken. The purpose of such a review would be to determine what types of laws or regulations, if any, need to be promulgated to better protect Tuvalu's marine resources and marine environment under present conditions, or under conditions believed likely to come about in the foreseeable future. For example, such laws or regulations might provide for licensing of fishing activities to allow for better monitoring capability; prohibition of fishing practices; environmental assessment of major projects; and protection of specific sites of particular ecological importance in reserves or sanctuaries.

As is evident from the foregoing discussion, there is considerable scope to try to bring about improvements in the fisheries sector through a variety of assistance programs. These include technical assistance not only to develop commercial activities, but also to strengthen institutions, train staff, and develop skills in new areas. The recommendations for assistance described herein have been made in an effort to provide the Government of Tuvalu with a "shopping list" of potentially viable projects, and clearly, not all the programs recommended are of equal priority. In order to clarify program priorities, a ranking system is shown in Summary Table 1.²

Conclusions

Implementation of the recommended projects will help to facilitate the overall development of Tuvalu's fisheries sector, particularly with respect to improving opportunities for commercial activities and generation of capital. Benefits of the recommended programs will be felt within the Tuvaluan national economy (in terms of foreign exchange generation); in the private sector (including private fishermen, investors, financial institutions, and foreign technical advisors or partners); and among Tuvaluan citizenry generally (especially with regard to increased employment opportunities, reducing food costs, creating opportunities for women, and encouraging outer islands development).

² This Table correlates closely with information provided in Table 13 of the report.

**Summary Table 1
Technical Assistance Project Priorities**

Project Type	Recommended Project	Project Priority Rating
1. NAFCOT Projects		
Commercial Fisheries Project Implementation	purse seine venture	● ● ● ● ●
	seamount bottomfishing	● ● ● ● ●
	*Alia' small-scale fishing fleet	● ● ● ● ●
	other small-scale pelagic fisheries activities	● ●
2. Fisheries Department Projects		
Staff Development and Training		
Staff Development and Training	Fisheries Department staff training	● ● ● ● ●
	entrepreneurial training	● ● ● ● ●
	secondary education programs	● ● ● ● ●
	new product investigations and feasibility studies	● ● ● ● ●
Market Expansion		
Market Expansion	Strengthening of Statistical Analysis and Data Gathering Capability	● ● ● ● ●
	outer islands tuna jerky production centers/demonstration projects	● ● ● ● ●
Technical Enhancement		
Outer Islands Development	Giant Clam Mariculture	● ● ● ● ●
	Pearl Oyster Farming	● ● ● ● ●
	Milkfish Farming	● ● ● ● ●
Aquaculture		
Other Institutional Strengthening	Legal Review	● ● ● ● ●

Priority Designations:

- ● ● ● ● = highest;
- = lowest.

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LIST OF ABBREVIATIONS

Acronyms

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AIDAB	Australian International Development Assistance Bureau
ARDU	Atoll Research Development Unit
BuDAB	Business Development Advisory Bureau
CDC	Commonwealth Development Corporation
C&F	cost and freight
CFTC	Commonwealth Fund for Technical Cooperation
CPUE	catch per unit effort
DBT	Development Bank of Tuvalu
DWFN	distant water fishing nation
EC	European Community
EEC	European Economic Community
EEZ	Exclusive Economic Zone
EFL	Education for Life
EU	European Union
FAD	fish aggregating device
FAO	Food and Agriculture Organization
FFA	Forum Fisheries Agency
FFV	foreign fishing vessel
FOB	free on board
FSM	Federated States of Micronesia
F/V	fishing vessel
GDP	Gross Domestic Product
GPS	global positioning system
GOT	Government of Tuvalu
ICLARM	International Center for Living Aquatic Resources Management
IFC	International Finance Corporation
JICA	Japan International Cooperation Agency
J/V	joint venture
MSY	maximum sustainable yield
M/V	motor vessel
NAFICOT	National Fishing Corporation of Tuvalu
NFC	National Fisheries Corporation (Solomons)
NZ	New Zealand
PIMAR	Pacific Islands Marine Resources
RMI	Republic of Marshall Islands
SOPAC	South Pacific Applied Geoscience Commission
SPC	South Pacific Commission
SPREP	South Pacific Regional Environment Programme
SSB	single sideband
TA	technical assistance
UK	United Kingdom
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
USAID	United States Agency for International Development

Units of Measure

cm	centimeter
cu ft	cubic foot
ft	foot
ft ²	square foot
ft ³	cubic foot
gt	gross ton
hp	horsepower
h	hour
hr	hour
in.	inch
kg	kilogram
kl	kiloliter
km	kilometer
km ²	square kilometer
l	liter
m	meter
m ²	square meter
m ³	cubic meter
mm	millimeter
mt	metric ton
shp	shaft horsepower
sq ft	square foot
yr	year

SECTION I



SECTION I SECTOR OVERVIEW

A. Introduction

1. Land

Tuvalu, a nation comprised of nine widely-dispersed atolls and low coral islands, lies in the Pacific Ocean between 5° and 10° south latitude and 176° to 179° east longitude (Figure 1). Total land area is 25.9 square kilometers (sq km), making Tuvalu one of the world's smallest nations. In addition to their modest area, the islands do not rise much over 3 meters (m) above sea level.

Atolls such as those found in Tuvalu are believed to have been formed through the growth of coral fringing reefs surrounding central volcanic islands. The subsidence of such volcanic islands below sea level has left the characteristic ring-shaped atolls which are found throughout much of the tropical Pacific today. Atolls, and low coral islands generally, are subjected to constant change brought about through the continuing growth of living corals, as well as through the forces of erosion and accretion brought about mostly by wave action.

The soils of Tuvalu's islands are geologically young, poorly-developed, and infertile. Soils are typically calcareous sands and gravels formed almost entirely of corals and coralline algae. These components sit atop a solid limestone platform. Organic matter is present only as a thin overlying layer in forested areas. On the larger islands, groundwater occurs as a lens of fresh to brackish water under the surface, which floats upon the denser saltwater below; on the smaller islands, groundwater is almost entirely lacking. Vegetation on the islands is dominated by coconut woodland. Other less extensive plant communities include coastal strand, coastal marsh and mangrove swamp, and inland broadleaf woodland. The limited native fauna includes about two dozen species of migratory seabirds, and several species of lizards, insects, and crustaceans. Besides birds, the most conspicuous indigenous animal seen on land is the coconut crab. No native land mammals are known from Tuvalu. By far the greatest numbers of animals found on the islands are introduced birds and mammals, including chickens, ducks, pigs, dogs, cats, and rats, which collectively are of far greater ecological consequence than any of the indigenous fauna.

2. Climate

Tuvalu enjoys a marine tropical climate. Prevailing tradewinds blow lightly from the southeast during May to October; stronger westerly to northwesterly winds blow during the November to April cyclone season (or "westerly" season). Temperatures throughout the country are quite uniform, and little variation is seen from year to year. Mean temperatures typically range from a maximum of around 31°C to a minimum of about 25°C. On the southern islands, the mean annual rainfall is in the 3400 millimeter (mm) range. The drier islands to the north on average receive about 2600 mm annually. Periods of serious drought may occur occasionally on any of the islands.

Tuvalu is situated in an area of the Pacific recognized to be a "spawning ground" for cyclones; in general, once formed, these pass out of Tuvalu, and on to other areas. The most destructive cyclone to hit Tuvalu in recent years was Tropical Cyclone Bebe (October 1972); other, less destructive storms have

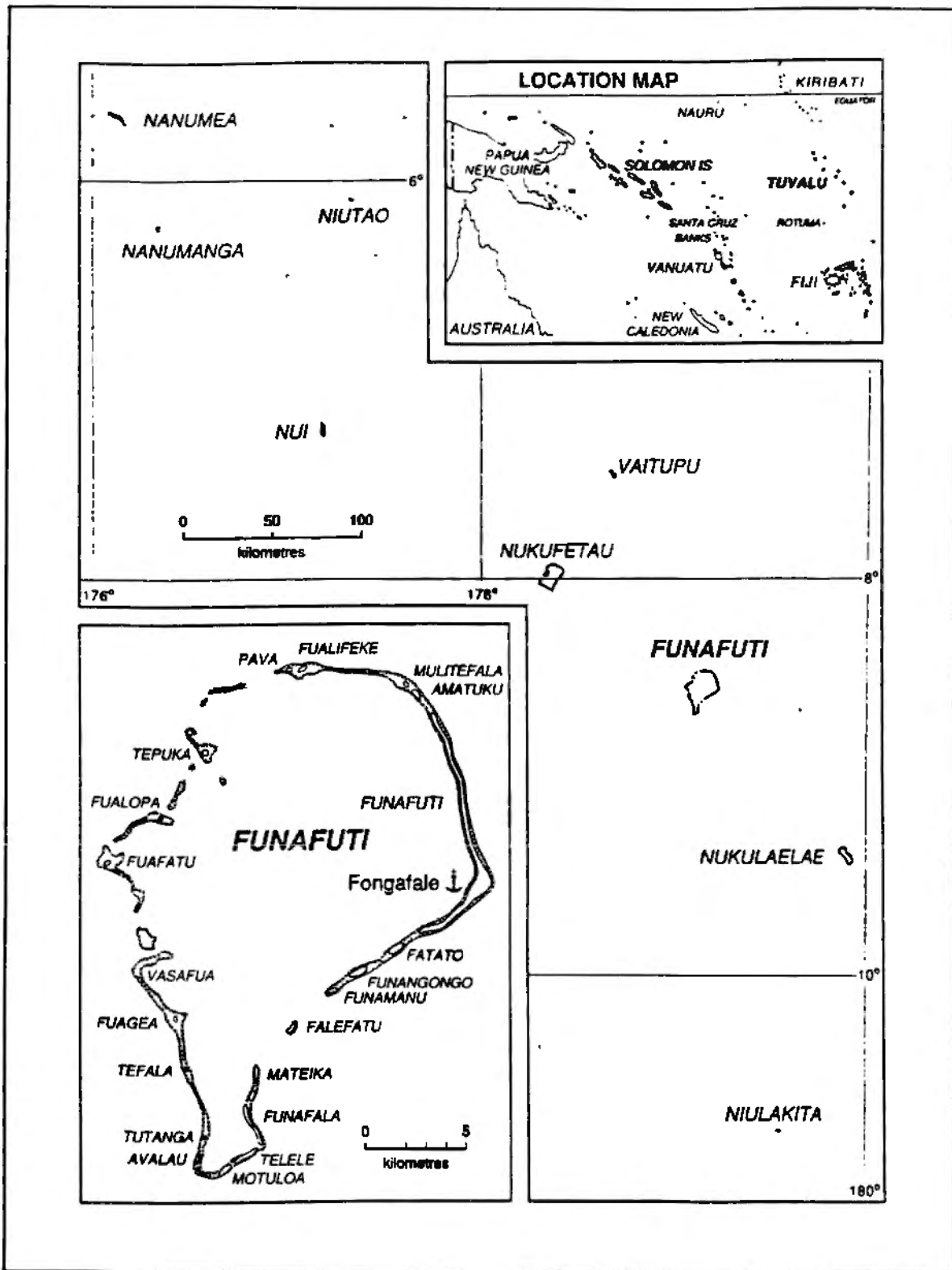


Figure 1. Tuvalu

been Cyclones Ofa (February 1990), Val (December 1991), and Nina (January 1993). Over the last 50 years or so, some increase in cyclonic activity in Tuvalu has been reported.

In recent years, the concept that global warming due to the "greenhouse effect" may over time cause a measurable rise in sea level has gained greater credence within the scientific community. The Intergovernmental Panel on Climate Change predicts that sea level will rise by 20 centimeters (cm) by the year 2020; by the end of the next century a rise of between 40-110 cm is believed possible. The damaging effects of other weather phenomena, such as cyclones and storm surges, would also be magnified with increased sea level. The specter of a significant sea-level rise is of special concern to low-lying island nations, which would stand to lose much of their land area. Tuvalu has been at the forefront among those nations demanding that the international community, and especially industrialized nations, take appropriate action to address this problem.

3. Marine Environment

Tuvalu's marine environment consists of fringing or patch reefs in the shallower waters surrounding atoll islets; patch reefs and relatively barren coralline sand flats within shallow (to approximately 50 m deep) lagoon waters; and a vast surrounding area of deep open ocean. Tuvalu controls an Exclusive Economic Zone (EEZ) covering approximately 750,000 sq km of deep ocean, and has a higher ratio of sea to land area than any other nation. Open ocean waters range to approximately 5000 m at their greatest depth. Scattered throughout the EEZ are many submarine seamounts whose summits may rise to within less than 30 m of the water's surface.

B. Fisheries Resources

Given the limited land resources available to Tuvalu, the living resources of the country's oceans are generally regarded as offering the greatest hope and most likely basis for any long-term sustainable economic development. To date, however, fisheries production has remained primarily a subsistence activity. Including subsistence, the estimated fisheries contribution to gross domestic product (GDP) is approximately US\$470,000 annually, or only around 5 percent of GDP (1990 figures). The protein requirements of the local population have generally been met through exploitation of resources within Tuvalu's shallow-water environments, primarily within the lagoons and along outer reef slopes.

The greatest potential for commercial fisheries development lies with pelagic fishes, particularly skipjack and yellowfin tuna, which inhabit the open ocean waters within the vast Tuvalu EEZ. A number of research surveys conducted by the South Pacific Commission (SPC), including the Regional Skipjack Survey, have revealed that these species exist in relative abundance in Tuvalu waters. In addition, at the peak of activity in the fishery in the mid-1970s, catch rates of pole-and-line and longline vessels operating in Tuvalu waters were promising, and in more recent years, foreign purse seiners have made substantial catches. Finally, although local fishermen have experienced great variations in fishing success, when tuna are available nearshore, ample catches are achieved, exceeding immediate local market demand. Thus, evidence from research surveys, commercial operations, and subsistence/artisanal activities appears to confirm the presence of abundant tuna resources in Tuvalu waters.

Other research has revealed the presence of additional high quality deep bottomfish resources on the outer reef slopes and seamount areas. At present, bottomfish are little exploited, and could support expansion to a commercial level. The area of offshore seamounts is larger than earlier believed. However, while these resources do offer opportunity for further development, extreme caution must be exercised to avoid

resource depletion. Studies presently underway will soon determine the extent of the resource; that information will then be utilized to develop a management plan for the sustainable exploitation of bottomfish.

Nearshore resources, while contributing the most to Tuvalu's subsistence fishery, provide only limited scope for expansion to a commercial level. Some selected high-value products may afford opportunities for the development of small-scale export enterprises. Surveys attempting to assess the nearshore fisheries have not yet conclusively determined the extent of those resources, nor set levels for sustainable exploitation. Initial research has been undertaken on the possibility of establishing aquaculture or mariculture of selected species which might thrive in lagoon or other nearshore habitats.

A more detailed discussion of the three categories of fisheries resources in Tuvalu (pelagic, bottomfish, and nearshore resources) is provided in the paragraphs which follow.

1. Pelagic Resources

a. Tuna

Within the EEZ, substantial offshore fisheries resources exist, particularly pelagic skipjack and yellowfin tuna. Tuvalu is interested in increasing its returns from this resource, both through further development of local fisheries and licensing of foreign fishing vessels (FFVs). To date, because Tuvalu itself has not had the means of directly exploiting these resources, the greatest revenues from pelagic resources have been realized indirectly through leasing of fishing rights to FFVs. Since fishing agreements with other countries do not directly contribute to domestic economic development, the institution of locally-based and locally-owned commercial fisheries businesses is viewed as the most desirable objective in terms of overall development within the sector.

Reliable resource assessments are essential for rational management of pelagic fisheries. The SPC conducted a comprehensive survey of skipjack resources in the south and western Pacific Ocean region from 1977 through 1981. The origins and migratory patterns of the various skipjack stocks were determined by extensive fish tagging programs. The pattern of temporal variation in skipjack abundance was not clearly established although reported catches suggest that there is a greater volume of landings from October through May.

The SPC study estimates that the population size or standing stock available to surface fisheries in the region is about 3 million mt. The current average annual catch in the study region is about 900,000 mt. This average annual loss due to catch represents approximately forty percent of the estimated annual throughput. Hence there appears to be potential for greatly increased catches from the region as a whole, well beyond the quantities under demand by all international markets. Excerpts of the SPC reports are presented in Annex A.

Since tuna are Tuvalu's most abundant natural resource, the "Comprehensive Fisheries Action Plan" (Section II of this report) devotes considerable attention to defining various options for their exploitation. Annexes G, I, J, and L detail budgetary, infrastructural, and operational requirements for each suggested program component.

b. Other Resources

In addition to tuna, sharks are another pelagic resource of possible commercial interest. Pelagic or nearshore sharks are a source for shark fin, a product of value for the oriental specialty food market. Typically the sharks are butchered at sea for fins and tails and the carcasses disposed of. Additional value could be derived by utilizing the edible shark meat. Unfortunately, however, there is a strong cultural stigma against eating this fish. A limited quantity of shark fin has been exported from Tuvalu in test-market trials by a local entrepreneur. It is possible to sell the dry product for US\$45/kilogram (kg) or more. One of the suggested commercial programs (described in Annex J, Section 2) proposes utilization of a "short longline" wherein shark fin would constitute approximately 10 percent of total catch value.

2. Demersal Resources

The outer reef slopes surrounding Tuvalu's islands, and the upper slopes of the seamounts within the EEZ, provide habitat for economically-important demersal (bottom-dwelling) fish, primarily snapper and allied species. In recent years, these resources have been studied in detail under the deepwater bottomfish project, part of the United States Agency for International Development (USAID) Pacific Islands Marine Resources (PIMAR) program. Research to date has shown the existence of what is believed to be a very rich resource which up until now has remained virtually untapped.

a. Deep Slope Resources

Four major surveys of the deep slope stocks of Tuvalu have been undertaken by SPC master fishermen. Most of this activity has been conducted around Funafuti but limited stock assessments have been carried out around Vaitupu, Nukulaelae, Nukufetau, and Nanumea. Catch rates ranged between 6.1 and 16.3 kg per line-hour with a mean of 9.8 kg per line-hour.

The empirical estimate of unexploited biomass for Tuvalu's deepslope resources is 224 mt. It is therefore thought that the maximum sustainable yield (MSY) could be as much as 67 mt per year. If stocks of deep-slope species were fished intensively, the catch per unit effort (CPUE) would be expected to decline to between 3.0 to 8.2 kg per line-hour.

Presently this resource is considered to be underexploited. It does not appear that additional exploitation to serve local markets is likely, because local consumers seem to prefer pelagic species. The deep slope demersal stocks, comprised mainly of high value bottomfish such as snapper, would thus be available to source export markets, where such species are in great demand.

b. Seamount Fisheries

Through the USAID bottomfish project, extensive baseline data have been obtained, and preliminary economic evaluations undertaken, to assess seamount fisheries resource development potential. The 3-year program is to be concluded in September 1994.

During the course of this study new seamount areas have been discovered, and previously identified areas have been further defined as to total area and depth. While MSY is yet to be determined, early indications suggest that yields between 6 to 8 kg per reel-hour are attainable; such rates are better than commercial yields presently being achieved in Tonga, Fiji, and Kiribati. Refining the skills required for

effective targeting of bottomfish will likely result in further improvement of catch rates. Based on earlier survey trials, it is believed that the nation's seamount resource could support a sustainable annual yield of 250 to 400 mt.

Export market trials have recently been initiated; snapper and other bottomfish have been chilled and sent by air, via Nadi, Fiji, to Honolulu, Hawaii. The landed wholesale prices being realized have averaged around US\$12/kg.

The results of the bottomfishing trials suggest that a viable commercial fishery could be established on the seamounts within Tuvalu's EEZ. However, should commercial fishing of the resource be implemented, great care will need to be taken to regularly re-evaluate the resource, since it is particularly sensitive to overexploitation.¹ Further details of the USAID bottomfish project are provided in Annex B. A plan for possible commercialization is presented in Annex H.

A listing describing the representative pelagic and demersal fish resources of Tuvalu is presented in Annex C, Marine Resource Lists (Table C-1).

3. Nearshore Resources

a. Subsistence Production

Nearshore fisheries resources of Tuvalu include the majority of the 300-400 estimated finfish species which occur in the country. Traditionally, Tuvaluans have depended heavily on the more easily accessible resources of the nearshore reef environment for their immediate subsistence needs. A wide variety of reef fish, including groupers, snappers, goatfishes, rabbitfishes, surgeonfishes, and other species, constitute the main edible fish species. Sea turtles, notably hawksbill (*Eretmochelys imbricata*) and green (*Chelonia mydas*) turtles, are also found in Tuvalu. In the past their meat and eggs have been prized as food, while the shell has been used in the manufacture of handicrafts, ornaments, and household articles. Recent regulations restricting the collection of turtles are aimed at curbing overexploitation of what are internationally regarded as endangered species. Stocks of certain invertebrates have also been depleted due to high demand, the most important of which are giant clam (*Tridacna gigas*, *T. maxima*) and giant spider conch (*Lambis truncata*). However, no regulations have been enacted to protect these species.

Surveys in the late 1970s showed 77 percent of all households practicing ocean fishing; 69 percent lagoon fishing; 81 percent reef net fishing; and 78 percent collecting reef fish. All family members may participate in fishing, with the activities of women and young children typically confined to fishing and shell collecting on the reef. These activities enable households to meet their own subsistence requirements for fish, and serve as a modest supplement to household cash flows, on an informal and irregular basis. A 1993 survey on Funafuti showed an average per capita consumption of fish of 0.5 kg per day; this translates to a total consumption of around 730 mt per year on Funafuti. Reported catches in the artisanal sector are 300 mt per year; it is believed that the balance of 430 mt per year is being

¹Unlike more mobile species, bottomfish spend their lives confined to specific sites; without recruitment of individuals from other areas, these sites can be easily overfished. It has been suggested that under the PIMAR program carried out in Tonga, overfishing may have led to a rapid decline in catch rates in some areas.

supplied through unreported subsistence fishing. Information regarding estimated fish catch from all sources is summarized in Table 1.

i. Lagoon Resources

Of Tuvalu's lagoons, Funafuti is the only one in which attempts have been made to assess resources in a comprehensive manner. The SPC assessed the hook rates in the lagoon at about 6 kg per hour, a rate which compares favorably with production volume of lagoon areas in other countries in the region; a 1982 report declared the lagoon resource to be largely underexploited.

On the basis of research conducted to date, there is no evidence to suggest that lagoon finfish resources are being overexploited; additionally, interviews with Funafuti fishermen indicated that catch rates for major finfish species are being maintained. However, both surveys and anecdotal reports from Funafuti appear to indicate that a decline in populations for other prized food species--notably turtles, giant clam, and spider conch--have already begun, most probably due to direct overexploitation.

In coming years, with demographic shifts toward a growing population center on Funafuti, pressures on nearshore resources within the Funafuti lagoon are likely to increase. In the future, fish resources may also be adversely impacted by the effects of increased pollution in the lagoon. As part of an environmental program funded and carried out by the South Pacific Applied Geoscience Commission (SOPAC), the Australian International Development Assistance Bureau (AIDAB), and the South Pacific Regional Environmental Programme (SPREP), effects of dredging in the lagoon are being evaluated with respect to the overall health of lagoon flora and fauna. The outcome of that study will provide valuable information which has implications regarding the continuing productivity of the lagoon and its capacity for sustained harvesting.

ii. Baitfish

The lagoon baitfish resource has been assessed in several surveys during the past 15 years, including bait capture by Tuvalu's own pole-and-line fishing vessel, the F/V *Te Tautai*. The baitfish catch in Funafuti is dominated by a single species, the blue sprat (*Spratelloides delicatulus*), which appears to undergo major fluctuations in recruitment and population size. This, coupled with the limited lagoon area of the nation's atolls, suggests that the total abundance of sprat is not great. Overall, the limited availability of bait in Tuvalu waters will probably remain an obstacle to the development of a major pole-and-line fishery. However, it is likely quite adequate to support a fleet of 5 to 10 small-scale pole-and-line vessels fishing in the vicinity of FADs². A small 12-m class vessel, fishing five poles and requiring only about 10 to 12 buckets (15 to 18 kg) of baitfish per one-day trip, could well prove to be quite productive (such a program is further detailed in Annex J). However, as already demonstrated through past efforts, a larger vessel such as the *Te Tautai*, with its much higher operating costs, cannot prosper with the limited availability of bait.

²"FADs," or "payaos" are rafts or floats set in deep (800 to 2,000 fathoms) water. A line of palm leaves, old nets, or other "attractors" (about 10 to 20 meters [m] long) attached to the float provides a shelter or habitat around which small fishes aggregate; this in turn attracts larger pelagic species such as tunas, thus allowing increased efficiency of tuna-fishing operations.

b. Underutilized Nearshore Resources

While most nearshore resources have been extensively utilized for subsistence, other resources in this zone have been only minimally exploited. These are primarily high-value items for which potential export markets exist, but which are not of importance for local consumption and subsistence use. Generally, the extent of these resources in Tuvalu's waters has not been fully investigated. A number of these species might form the basis for small-scale export activities; the resources are described below.

Beche de mer, or sea cucumber, is a relative of starfishes and sea urchins. Beche de mer is a high-value gourmet item in Chinese cuisine, and is in great demand in markets in most Asian cities. Several tons of beche de mer were exported from Tuvalu in the 1980s; more recently, one or more private fishermen have had some success sending small quantities of beche de mer overseas. Depending on the species and the quality, wholesale prices paid for beche de mer are as high as US\$30/kg. A summary describing different species of beche de mer of commercial importance is provided in Annex C, Marine Resource Lists (Table C-2).

Lobster is another high-value product which, although used in local dishes, has not been heavily exploited. This may be due in part to the fact that efforts to capture local lobster in traps have not proven successful; thus, the harvesting of lobsters in Tuvalu on a larger scale may prove to be more labor-intensive than it is elsewhere. Furthermore, the extent of Tuvalu's lobster resource has yet to be investigated. If significant resources were discovered, and if an effective means were found to harvest them, it is likely that lobsters from Tuvalu could command prices comparable to those currently paid in markets throughout the United States and Asia for lobster from other countries (i.e., between US\$15-\$30 per kg).

Tropical fish for the aquarium trade have formed the basis for a US\$0.5 billion business in the countries of Southeast Asia. Tuvalu's reefs support a variety of colorful fishes, including angelfishes, butterflyfishes, and other species desirable as aquarium fish. As with other "minor" marine products, the extent of the resource needs to be assessed to determine sustainable yield levels; however, it is generally held that aquarium species stand a good chance of surviving periodic, controlled harvesting, since they are usually fast-growing, and are not targeted for other, larger-scale harvesting efforts (e.g., for food use).

A study of Tuvalu's specimen seashells was undertaken by the SPC in 1984. The principal markets for specimen shells exist among collectors in the United States, Europe, and Japan. The results of the surveys conducted for the SPC report, in combination with prior field survey results, showed some 180-plus collectible species of shells occurring in Tuvalu's waters. While prices for most of Tuvalu's shells are in the US\$0.50 to \$5.00 range, some rare species command as much as US\$200.00 to \$500.00 per shell. Marketing of specimen seashells offers some potential for small-scale private enterprise; if carried out at that level, it is unlikely that natural stocks would be significantly depleted.

Precious corals are comprised of two distinctly different types of organisms: black corals, organisms with a protein skeleton, occurring in relatively shallow water; and pink corals, organisms which have a hard calcium skeleton and occur in much deeper waters. Black corals are more accessible than pink corals, and thus subject to depletion through over-collection. Pink coral beds, while much less accessible, have been wiped out in many areas through commercial harvesting. Limited black coral resources are believed to exist in Tuvalu. To date, no pink coral beds have been identified in the South Pacific. It is possible that in the course of regional ocean floor surveys carried out by SOPAC and other research agencies,

pink coral beds might be found in Tuvalu. However, until such time as an economically-significant occurrence is confirmed, there appears to be little opportunity to establish a business based on the harvesting of precious coral. Further information on precious corals is contained in Annex C, Marine Resource Lists (Table C-3).

4. Aquaculture and Mariculture

In addition to capture fisheries, the culturing of a variety of marine organisms may be feasible in the sheltered lagoon and aquatic environments of Tuvalu's atolls. Aquaculture and mariculture are areas of considerable interest, since, once successfully implemented, they allow for resource renewal, rather than relying on harvesting of vulnerable natural stocks which can be depleted. Species which have been subjects of potential interest for aquaculture and mariculture include milkfish, eucheuma seaweed, trochus, pearl oyster, and giant clam.

Without exception, aquaculture or mariculture activities have not been developed to a commercial level of production in Tuvalu to date. However, several research studies and pilot projects have begun to investigate the feasibility of establishing small-scale aquaculture and mariculture operations to enhance fisheries output.

Giant clam (*Tridacna* spp.) is in high demand for meat (adductor muscle, mantle, and other parts) and shell. A drastic decline in natural stocks in Tuvalu's lagoons has been reported due to overexploitation. Giant clam culture is appealing due to the high value of the product and its potential use for both local consumption and export; in addition to providing a potential product of economic value, giant clam mariculture offers a means for recruitment supplementation to replenish depleted natural stocks.³

Funds provided by a Food and Agriculture Organization (FAO)/United Nations Development Programme (UNDP) supported a stock assessment survey of giant clam in the lagoons of Funafuti, Nukufetau and Nukulaelae. A second assessment was carried out as part of an Australian Centre for International Agricultural Research (ACIAR) giant clam project surveying Nanumea and Nui. An outgrowth of the survey work was the development of a culturing program. "Seed stock" of about 1,000 small clams of a non-native species (*Tridacna derasa*) were imported from Palau and planted out in the Amatuku area of Funafuti lagoon. Approximately 10 percent of the clams are believed to have died in the early stages of transplantation as a result of predation by a mollusk (*Cymatium* sp.). About 800 more clams were destroyed during Hurricane Ofa. More recently, a number of the transplanted clams have disappeared, apparently as a result of poaching. About four years after their initial introduction, about 130 individuals are still surviving. At around 25 cm width, these clams are now at mature spawning size, and they have been gathered into "clam circles" in order to be more easily monitored and protected, and so that spawning can be encouraged.

Despite the small number of clams remaining of those originally transplanted, the giant clam project has demonstrated the biological feasibility of growing clams in Tuvalu; what has not been determined is whether such an activity, if expanded, could have a commercial or practical application. In a Fisheries Department review of the progress of the giant clam project in Tuvalu, it was recommended that all collection of giant clams be banned; that public education concerning giant clam conservation be

³In Fiji, stocks of the increasingly rare *Tridacna gigas* (largest of all clam species) were successfully reintroduced.

instituted; that no new clams be introduced from other countries into Tuvalu; and that growth of the existing cultured clams be monitored. Clearly the conservation of the remaining natural clam stocks is a priority. However, it seems that a more intensive effort at culturing is also warranted. Further information on giant clam species is provided in Annex C, Marine Resource Lists (Table C-4).

Milkfish culture has been considered as a means for increasing supplies of fish both for direct consumption and for use as bait for a skipjack fishing industry. Milkfish is being widely cultured in brackishwater ponds throughout Southeast Asia, and is regarded as a desirable food fish. On Funafuti, naturally-occurring populations of milkfish are found in ponds and borrow pits. Most of the lagoons also have natural stocks of milkfish. A 1992 survey conducted under the FAO South Pacific Aquaculture Development Project studied potential for milkfish culture on all islands. Based on the overall favorability of physical and biological parameters, and successful production in two subsistence-use ponds on Vaitupu since the 1970s, the mission recommended that milkfish aquaculture could be developed in ponds and lagoons on most islands. Milkfish production could provide an alternative source of fish protein during the "westerly" season, when it is more difficult to obtain ocean fish.

In order to introduce successful milkfish culture, it would likely be necessary to eradicate the tilapia fish which occur in most ponds. Tilapia, originally introduced to Tuvalu some years ago, are aggressive territorial species which out-compete most other pond fish. Eradication could be accomplished by use of rotenone (a safe but effective chemical poison used for this purpose), or possibly dynamite charges. Once cleared of tilapia, ponds could be re-stocked with milkfish fingerlings.

A Fisheries Department review of the 1992 FAO study suggested that any project undertaken start out by making use of those ponds which would require the least earthmoving and contouring; several ponds on Funafuti fit this requirement. Expertise for guiding the implementation of such a project exists among the Filipino aquaculturists who have been successfully culturing milkfish for decades. If a pilot project proved successful on Funafuti, the culturing program could be extended to other islands. Since Vaitupu already has a small, functional milkfish pond, this would be a logical place to begin to expand operations. Nanumaga, Nanumea, Niutao, and Niulakita all have ponds which could be utilized for milkfish culture. The possibilities of culturing other desirable pond fish, such as mullet, could also be explored.

Farming of pearl oysters has been considered for Tuvalu. The SPC conducted an initial assessment of the resource in 1990. The assessment found only a handful of individual pearl oysters surviving in Tuvalu's lagoons, despite the fact that prevalent ecological conditions in Tuvalu are likely suitable for pearl oyster growth (given the warm tropical waters and sheltered lagoon habitats which are available). It is apparent that Tuvalu's natural stocks of pearl oyster have been depleted due to overexploitation.

Historically, pearl farming has not been possible in areas where natural stocks have been lacking. Recently, however, significant progress has been made in producing pearl oyster "spat" under hatchery conditions; introduction of hatchery-raised spat into Tuvalu's lagoons might provide a feasible means for Tuvalu to enter the pearl farming business.

*Trochus*⁴ is a shell used to produce mother-of-pearl, principally for the manufacture of buttons. Major markets for the product, either the raw shell or button "blanks," are in Japan and Korea. The South Pacific (most notably, New Caledonia) has accounted for roughly 65-70 percent of annual world production, with the balance coming from Asia. Efforts to introduce trochus for the purpose of developing commercial production have met with some success (e.g., in Cook Islands). A program aimed at producing trochus shell in Tuvalu began in 1984. Initially, 200 live animals were imported from Fiji, followed by another introduction in 1987. In 1988, 5000 live shells were brought from Cook Islands, and air-dropped at Nukulaelae, Nukufetau, and Funafuti. A regulation banning the collection of trochus was intended to provide protection of the introduced stocks. Regrettably, according to local sources, the program was not widely publicized early on, and, shortly after the air-drop occurred, fishermen unaware of the purpose of the project were seen filling sacks with trochus.

While monitoring undertaken in past years suggested that the introductions were not surviving, there has been some indication more recently that offspring had been produced (in very low numbers) by some of the original brood animals. Continued monitoring will be required to track growth and recruitment rates in order to ascertain future feasibility and economic potential for farming of trochus. Continued protection of remaining shells is essential if there is to be any hope of establishing viable breeding populations.

In other developing countries in Asia and the Pacific, notably Kiribati and Philippines, commercial-scale seaweed culture has been implemented, with generation of substantial export revenue. Colloids⁵ are typically extracted from the seaweeds for use in the food, drug, and cosmetic industries. *Eucheuma* seaweed, imported from Kiribati, was brought to Funafuti lagoon in 1988 for growing trials. Additional trials have also been carried out in Nui lagoon. The trials have been only partly successful due to adverse weather conditions and technical problems. While other trials may be conducted in the future, this should not be a priority area. The main constraints to commercial viability are high freight costs from Tuvalu to potential markets, and generally low market price for the product. In light of those factors, it is unlikely that Tuvalu could successfully compete with other, more established producers. Furthermore, possible deleterious environmental effects of introducing seaweeds (*Eucheuma* are not known to occur naturally in the country) to Tuvalu have yet to be thoroughly investigated.

Priorities and levels of feasibility for possible aquaculture and mariculture projects for Tuvalu are summarized in Table 2.

C. Current Production

1. Introduction

Fish production by Tuvalu fishermen is entirely for household subsistence and for sale in village markets. All commercial fishing is carried out by foreign distant water fishing vessels operating under license agreement within Tuvalu's EEZ. The catch and efforts statistics for local fishermen are deficient.

⁴*Trochus niloticus* is the principal species of commercial importance.

⁵Kappa- and iota-carrageenans are economically-important colloidal substances derived from *eucheuma*.

However, if commercial fishing is developed as a local industry statistical data must be developed in order to properly manage the industry's marine resources.

2. Fleet and Manpower

Most local fishing effort has been concentrated on offshore trolling for tuna, either from motor-powered canoes or aluminum skiffs. These vessels are generally in the range of 3 to 4 m in length and powered by outboard motors in a range of 15 to 50 horsepower (hp). They can operate only at short range and have limited catch carrying capacity. Typical fishing trips are of short duration, generally four to six hours, with a two to three man crew. An estimated 150 such vessels operate fairly regularly, perhaps two to three days per week, with per-trip production of 20 to 30 kg. Of that number, about 20 vessels fish at least four days a week to supply the Funafuti retail fish market.

Figure 2 and Table 3 show the distribution of artisanal boats on each island. While this data is indicative, there is no precise data available regarding the number of persons engaged in fishing activity. It can be assumed that most households engage in some form of fishing activity for subsistence.

Previously, a number of boats donated through foreign aid projects were in operation. These vessels were used in various trial projects, including a craft evaluation project, a Share Fisherman Scheme aimed at commercializing small-scale fisheries, and other research and extension activities. Over the years, the majority of those boats have fallen into disrepair as a result of neglect, storm damage, or lack of adequate parts for repair. Table 4 shows the history of most of the vessels which have been operated by Government in recent years.

3. Equipment and Methods

Most of the fishing effort has been concentrated on trolling for tuna in outer reef areas. This is the most productive method of fish capture and the pelagic species, mostly skipjack, are preferred by the market. Handline fishing within the lagoon and on the outer reef slopes is the second most productive capture method. Relatively little effort is devoted to fishing within the lagoons, most of that being by subsistence fishermen using cast nets or baited hooks.

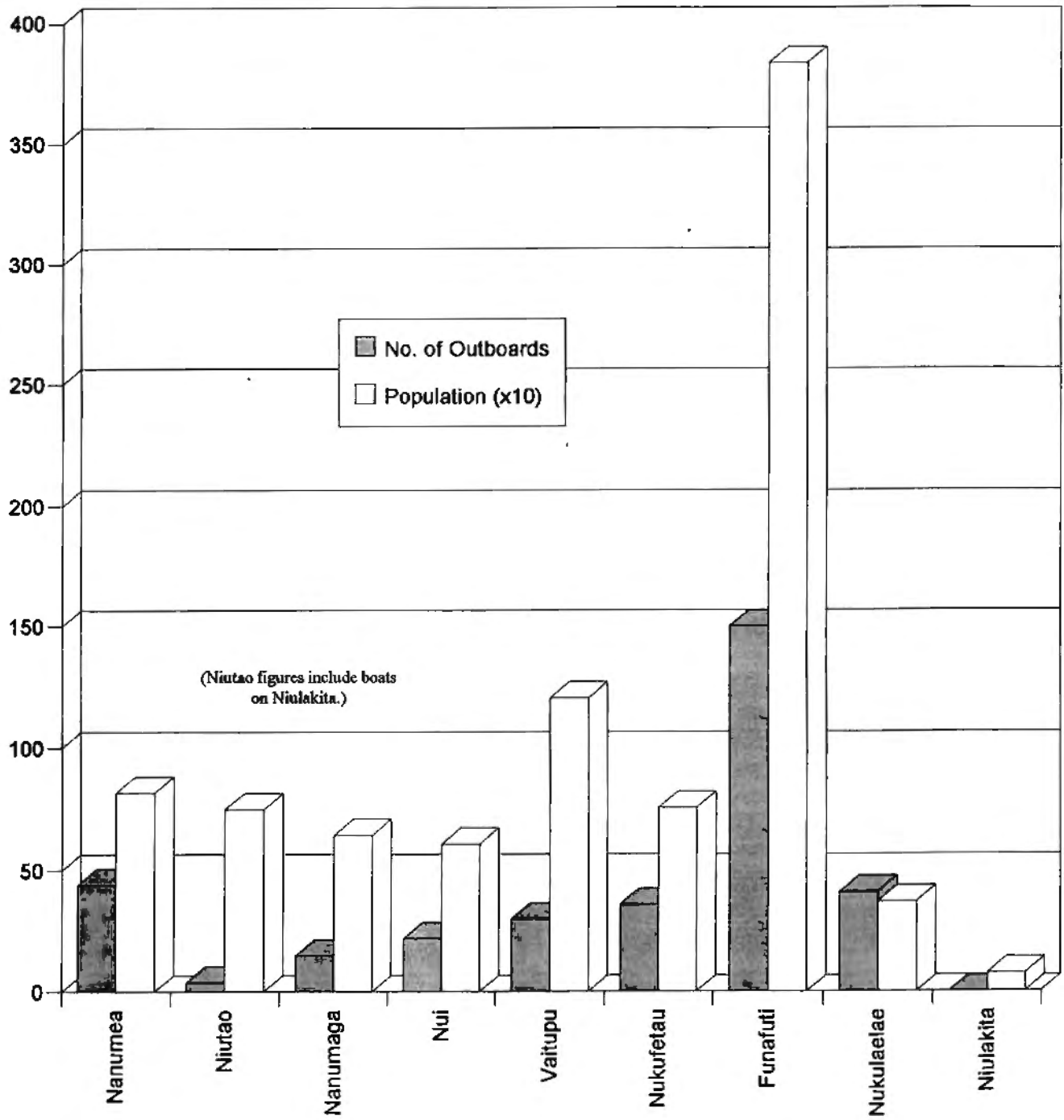
4. Catch and Economic Return

As already indicated, local fish catch has been used principally for subsistence, and secondarily to fill local market need. Total annual production, achieved through fishing by both privately-owned and Government-owned vessels, has remained at a relatively small scale, averaging about 300 tons annually nationwide.

The local Funafuti fish market receives fish daily and pays the fishermen between A\$1.25-2.00/kg. This is the best possible marketing result. Most often the catch is left with the market vendor on a consignment basis. Towards the end of the day the price may fall drastically if there is an oversupply.

On the average, a fisherman supplying the local market may realize net earnings between A\$2,000-3,000 per annum. All the vessels are equipped with outboard motors which use petrol costing A\$0.75 per liter (A\$2.85 per gallon) which represents the greatest single operating expense.

Figure 2. Tuvalu Artisanal Fishing Fleet (Relative to Population, by Island)



Population figures from Reynolds, 1993. Boat figures based on Fisheries Department survey, 1993-1994.

5. Processing, Distribution, and Marketing

a. Local Market

The local retail marketing of fish is limited to an open-air area in the Funafuti village market area. Vendors receive supplies of whole round fish on consignment from a small number of fishermen who regularly supply them. The fish are displayed on boards supported by boxes. There is no use of ice or any attempt at making attractive displays.

Pelagic species such as tuna, wahoo, rainbow runner, mahimahi and occasionally, marlin, are the market preference. Some reef fish varieties such as snapper and grouper are also available. Flying fish is another market favorite.

The majority of catch is produced and consumed by artisanal fishing families who often share their catch with relatives, friends, and neighbors. This is especially true in the outer island communities.

The only processing carried out, other than limited sun drying in outer islands, has been an experimental fish smoking project using fish smoking cabinets. Smoked fish, primarily tuna, is of excellent quality but not regularly produced or available.

None of the existing industrial freezers and cold storage chambers in the country are in working order. If they were put in good repair, several different types of quality fish products could be processed for local marketing.

b. Export Market

Export activities in the fisheries sector have been practically nil. Until the 1990s only very limited trial shipments of beche de mer had been made to Hong Kong, some of these by a private producer/exporter. The processing and marketing of this product needs further understanding and it would be timely to bring in some technical assistance to help develop this industry.

Recent export trials of chilled bottomfish species have been carried out under the USAID bottomfish project. Market trials have involved air freighting small quantities of fish to Honolulu. The major constraint to developing this fishery into a regular and viable export business is the lack of adequate and reliable air cargo service out of Funafuti. Most of the productive seamount areas are in the southern region of the Tuvalu EEZ, thus it stands to reason that a seamount fishing fleet based in Nadi, Fiji, would have access to frequent flights, with adequate cargo space.

While efforts for export have to date been limited to the activities described above, potential exists for developing other products for export. Among those which offer some opportunity are a number of the "minor products" earlier described (Section I.B.3.b.).

Information concerning the potential market for export of Tuvalu's fisheries resources is summarized in Table 5.

D. Foreign Fishing in the Tuvalu Exclusive Economic Zone

1. Agreements

In the late 1970s, 200-mile EEZs were sanctioned under the United Nations Convention on the Law of the Sea (UNCLOS). For Tuvalu, this established a framework for controlling marine resources in approximately 750,000 sq km⁶ of open ocean.

Tuvalu negotiated its first licensing agreement with a distant water fishing nation (DWFN) in 1980 (with South Korea). Since that time, it has had bilateral agreements with Korea, Japan, Taiwan, and the United States. In addition, as of 1988, a multilateral agreement has been in force between the United States and member nations of the South Pacific Forum. The basic features of the agreements are summarized in Table 6. Recently, United States purse seiners operating in the Tuvalu EEZ under the Multilateral Treaty have had very successful seasons, resulting in the highest fees ever paid to Tuvalu (US\$1.6 million in 1992).

While Government has received significant revenues from licensing agreements with DWFNs who fish in its waters (Tables 7, 8, and 9), especially in the highly productive years 1991-1993, it is believed that, by and large, the amounts paid have fallen short of what has been legitimately owed. Such shortfalls are attributable mainly to the inability to adequately monitor the activities of FFVs in Tuvalu's EEZ; thus under-reporting of catch, or operation of unlicensed vessels, have in many cases gone unchecked.

2. Surveillance

At present, surveillance is carried out in part through informal agreements with commercial air carriers and merchant vessels operating in the region, who report observations of fishing boats sighted in Tuvalu's waters. Surveillance is further supported by Tuvalu's regional development partners, New Zealand and Australia, whose Air Forces conduct periodic overflights. More recently, it has been reported that French Air Force planes have participated in the surveillance effort. In addition, the Forum Fisheries Agency (FFA), established in 1979 to facilitate regional cooperation in fisheries, has been providing assistance in monitoring fishing movements in member countries' EEZs, especially through the maintenance of a register of FFVs, and by providing a centralized telecommunications capability.

One current problem is the inability to direct overflight surveillance into areas where illegal activity is suspected.

Recent commitments made as part of Australia's Defence Cooperation Program promise to enable the Tuvalu Government to better regulate fishing activities, and more accurately assess fees to be charged for catches taken in the EEZ. Additional patrolling of the EEZ by the Tongan Defense Service may also be funded by the Defence Cooperation Program. Under the Australian program, worth approximately \$8 million, Australia will provide Tuvalu with a patrol boat to conduct policing activities. In addition, the

⁶Figure from Forum Fisheries Agency (FFA), Honiara. Estimates of the total area of Tuvalu's EEZ vary widely (reported figures range between 200,000 and 1.3 million sq km). Boundary agreements still remain to be negotiated between Tuvalu and France (Wallis and Futuna), Fiji, and Kiribati. The FFA is presently coordinating the program to delimit the EEZs in the region.

program includes a training component to prepare Tuvaluans to assume responsibilities for operation and maintenance of the vessel. However, a number of concerns have been voiced regarding the overall affordability of operating the patrol vessel, as well as Tuvalu's ability to maintain the vessel over the long-term. Details of the proposed Australian patrol boat program are presented in Annex D.

The outlook for an improved surveillance and patrol capability may in fact be part of the reason why a number of DWFNs, whose past agreements with Tuvalu had lapsed, have recently negotiated new licensing agreements. Within the early part of 1994, both Taiwan and Japan have signed new agreements for licensing of their vessels. It is hoped that the presence of the patrol vessel will force the DWFNs into stricter compliance with EEZ regulations.

One additional area where work is being carried out in the EEZ relates to seafloor mapping for locating seamounts. Recent surveys carried out for SOPAC by a French survey vessel should help to more precisely locate the seamounts in Tuvalu's waters. Once identified, it is important that seamounts be vigorously patrolled, in order to deter poaching.

E. Institutional Framework

1. Introduction

Although Tuvalu's existing marine resources offer considerable opportunity for commercial exploitation, they have for the most part remained underutilized. In addition, none of the aquaculture or mariculture projects undertaken to date have been carried beyond the research trial or pilot project stages. In order to realistically evaluate opportunities to improve productivity in the fisheries sector, future plans to utilize Tuvalu's fisheries resources must be considered in light of prevailing institutional, infrastructural, sociocultural, and environmental conditions.

A formal institutional framework for fisheries exists at two different levels. At the local (island) level, the Island Councils on each of the islands have responsibility for coordinating some fisheries activities. At present, that responsibility is limited to issuing licenses for those fishermen who wish to sell their fish. Some of the Island Councils hope to play an increasing role in the development and operation of community fishing centers, one of which (Vaitupu) has already been established, and two of which (Nanumea and Nukufetau) are presently underway.

As articulated by Government in the *Mid Term Economic Framework Programme* (1992), the long-term goals for the development of the fisheries sector are "to make the fishing industry a major contributor to national output, double its contribution to recurrent revenue, and commence exports." Other shorter-term goals for the sector, enumerated in the same policy statement, include:

- providing for the basic protein needs of the people on a sustainable basis;
- improving returns from foreign fishing activities in the EEZ;
- development of a nucleus of professional commercial fishermen on Funafuti;
- activation of an outer islands fisheries development program; and
- enhancement of technical expertise, management skills and planning capabilities.

At the national level, responsibility for achieving these goals, and for directing fisheries activities in Tuvalu, is currently shared between two separate government entities. One of these, the Fisheries Department, has a mandate to advise Government on fisheries management policy, and to conduct

research pertaining to fisheries resources and those new areas believed to offer potential for economic development. The second entity, NAFICOT, is a Government corporation whose purpose is to further commercial activities in the fisheries sector and stimulate growth of private-sector fisheries. Both entities are charged with conducting appropriate training within their respective areas of responsibility.

Historically, since its formation in 1981, and until the mid-1980s, NAFICOT was part of the Fisheries Department. It then was separated from Fisheries, but remained within the Natural Resources ministry until 1990. In late 1990, NAFICOT came under the Ministry of Finance and Public Corporations; it was felt at the time that this separation would serve to better define the different roles of NAFICOT and Fisheries Department. Regrettably, the split of the two agencies only widened the gap between them, resulting in even greater inefficiencies and lack of coordination. This may have been due to the fact that the two agencies still experienced conflict over a number of poorly-defined areas of responsibility. Similar conflicts appear to have existed, and may still exist, with respect to the use of boats, facilities, and equipment.

Under the present Government (as of early 1994), NAFICOT and Fisheries Department have been reunited within the Ministry of Natural Resources Development; at the very least, this restructuring should foster improved cooperation between the two agencies, and allow for the possibility of resolving any conflicts which may arise, at the ministerial level.

2. Fisheries Department

The official duties of the Fisheries Department have been defined to include the following responsibilities:

- to provide policy advice to Government in fisheries management, research and extension
- to conduct research
- to conduct extension and training programs, and assist NAFICOT with its training needs
- to carry out licensing, surveillance and enforcement activities for FFVs operating in the EEZ.

The principal shortcomings which have been in evidence within the Fisheries Department relate mainly to inadequate staff development and training. A 1988 review of the Tuvalu Civil Service⁷ pointed out that, within the Fisheries Department, there has been no system implemented for positive human resource development, and training and personnel policies have not been well defined. As a result of these shortcomings, the Department's annual reports, its principal planning and informational documents, have not been produced for the last three years. The absence of these documents has made evaluation of progress on various projects extremely difficult, and has hampered effective future planning of projects and programs. A number of projects which have shown some promise (for example, the giant clam mariculture project) appear to be languishing because of a lack of adequately trained staff to aggressively take such projects to their next logical stage of development. One final area which has been problematic has been the transfer of skills from expatriate expert consultants brought in on long-term assignment for

⁷Mackinson, Ian 1988. *A review of the Tuvalu Civil Service*. (June.) As cited in Sutherland et al. 1992.

that express purpose. Often, responsibility for carrying out certain tasks has remained with the consultants, rather than being gradually re-assigned to Tuvalu nationals. Without such transfer of responsibility, no transfer of skills can occur. In those cases where skills have been successfully transferred, often another problem has arisen. This problem, one that the department has had to face repeatedly over the years, has been the loss of several of the most qualified staff who have decided to go abroad for jobs or advanced schooling. Examples include the loss of the former director of the department, and more recently, the loss of the fisheries statistician. Replacement of trained staff is often a time-consuming process, accompanied by significant setbacks; new hires often require extensive additional training. For example, the gathering of statistical data on fisheries resources, project performance, catch statistics, and similar subjects, has slowed dramatically over the last two years due to the resignation of the former department statistician. While a new statistician has been assigned, additional training will be required so that the functions of the position can be effectively carried out. Good statistical information is required for accurate project evaluation, goal-setting, and achievement of objectives for sectoral development.

Finally at issue is the failure to produce an aggressive, creative, comprehensive plan for action within the sector. This has impeded accomplishment of several sectoral goals. Thus, little advice has been given to Government concerning promulgation of new policies and regulations to assure the protection and sustained utilization of fisheries resources. No projects to date have been carried beyond the beginning research and trial phases toward commercial implementation. Clearly, these deficiencies need to be strongly addressed if advancement of the sector is to proceed.

3. NAFICOT

NAFICOT was established to promote and develop commercial fisheries activities in Tuvalu. In pursuing that goal, it was intended that NAFICOT develop cooperative relationships with artisanal and professional fishermen, operate a commercial-scale pole-and-line fishing boat, and run an onshore marketing and fish processing facility on Funafuti.

However, NAFICOT has been plagued by a series of difficulties in pursuing its mission of commercializing fishing activities in Tuvalu. The principal problems are summarized below.

- *Problem #1: Te Tautai.* The *Te Tautai* is the country's only distant-water fishing vessel. This vessel was donated to Tuvalu through Japanese assistance valued at approximately US\$1.8 million. Assigned to be operated by NAFICOT, it was hoped that it could be used for commercial pole-and-line fishing. Pole-and-line activity was carried out in waters of the Solomon Islands for a number of years, with mixed results.⁵ The concept of operating *Te Tautai* as a commercial pole-and-liner in Tuvaluan waters proved infeasible, since the vessel, intended to be used for fishing trips lasting several weeks, could not make use of available bait stocks (Tuvalu's baitfish, short-lived once collected, were unsuitable for fishing trips of such long duration). In addition, the *Te Tautai* was not designed strictly for commercial fishing, but rather as a training vessel. Its powerful, 1100 hp engine has proven far too costly to run to allow for profitable commercial operation, especially since pole-and-line fishing requires consumption of considerable amounts of fuel while chasing schools of tuna. The vessel was clearly

⁵For approximately two years, working under an agreement with the Solomon Islands National Fisheries Corporation (NFC), the *Te Tautai* was manned by an Okinawan crew, and was able to operate profitably. This ended when the management of NFC changed, and the agreement expired.

profitable only for about three years, when it was chartered by the SPC for non-commercial use as a survey vessel in the Regional Tuna Tagging Project.

In late 1993, the *Te Tautai* was transferred from NAFICOT to the Marine Department of the Ministry of Works and Communications, presumably for use in inter-island transport. In fact, since then it has been sitting idle in Funafuti lagoon for most of the time. Whether running or anchored in the harbor, the expense of maintaining the *Te Tautai* in acceptable operating condition is estimated to be as high as A\$2,000/day. Government is presently contemplating ways in which the vessel might be put to productive use.

The overall profitability of NAFICOT has been closely tied to the activities of the *Te Tautai*; details of the vessel's annual activities, and NAFICOT's resultant financial performance, are provided in Table 10.

- **Problem #2: Fish Storage and Processing Center.** An onshore storage and processing facility was built with British and Australian funding. The facility covers some 250 square meters (sq m), and houses processing equipment including three small commercial freezers. The proposed purpose of this center was to enable local fishermen to bring in their fish catch, to be purchased by NAFICOT. In turn, NAFICOT would sell fish to local residents. Within the first few weeks of operation, fishermen supplied the market until the freezers were filled to capacity; the fishermen were told that NAFICOT would not be able to buy more fish until the fish in the freezers was sold. To make matters worse, the fishermen were aware that they could sell fish directly to consumers for a higher price than what NAFICOT was willing to pay. They continued to supply fresh fish directly to the local market, and NAFICOT ultimately had to discard most of the frozen fish left sitting in its freezers. Disillusionment with the program ultimately caused the equipment in the market to fall into disrepair; lacking proper maintenance, the freezers have been inoperative for several years.

- **Problem #3: Inadequate Incentives to Attract the Interest of Local Fishermen.** A "Share Fishing Scheme" was devised with the intention of encouraging local fishermen to use NAFICOT boats and equipment to catch fish. Fishermen were then committed to selling their catch to the NAFICOT market at a predetermined price. The fishermen were paid for the catch after expenses for fuel, wear and tear, and other running costs were deducted. Unfortunately, due to a variety of factors (including high fuel costs associated with operating vessels poorly-suited to Tuvalu's waters), fishermen often lost money for their efforts. Thus the scheme as devised was unsuccessful in attracting participants. A modified share fishing scheme is currently in effect, with only a handful of local fishermen participating.

- **Problem #4: Lack of Means of Transporting Fish to Export Markets.** Even operating at the subsistence and artisanal level, local fishermen were able to meet and exceed the needs of the local market for fish. In order to expand to a commercial level, it would have been necessary to seek additional markets outside of Funafuti. Possible target markets could have been outer island communities, or export destinations. Unfortunately, no means of transport was available to reliably transport fish to such markets in meaningful quantities. The lack of transportation has emerged as the principal bottleneck impeding further commercialization in the fisheries sector.

- **Problem #5: Lack of Adequately Trained Management.** All the problems described above are indicative of a larger deficiency—the absence of managers fully competent to run a commercial fishing venture. Thus before embarking upon any attempt at a commercial venture, an experienced manager should have asked and answered the following simple, yet crucial questions:

- What is the resource, and can it be sustainably exploited?
- What are the manpower requirements for a commercial fishing operation, and what incentives will attract skilled fishermen to the enterprise?
- Where is the market for Tuvalu's fish product?
- How will the product be caught?
- What types of storage and processing facilities are needed?
- How will the product be transported to market?
- What quantities of fish need to be caught to create a commercially viable enterprise, and what capacity is required for boats, storage facilities, etc. to support the activity?

Had these issues been addressed in advance, it is likely that commercialization would not have been undertaken until the key bottleneck of international transport was confronted; fishing vessels suited specifically for Tuvaluan conditions would have been selected; and onshore facilities would have been designed with the capacity to support the efforts of local fishermen at a predetermined level. Clearly, before NAFICOT undertakes to implement any new commercial ventures in the future, serious attention to issues such as these will be warranted.

4. Private Sector

It has been a policy objective of Government to encourage private sector development in all fields. The goal has been difficult to achieve, in light of the narrow private sector capital base which exists in Tuvalu to support such activity.

Because of the lack of a sufficiently broad base of private capital, any efforts at commercial-scale development will need to originate within the public sector, where adequate capital exists. However, in order to fulfill the goals of Government to privatize, it is possible to develop schemes whereby ownership is progressively transferred from the public to the private sector. One such scheme, the privatization of several proposed activities to be initiated under NAFICOT, is presented as part of the Comprehensive Fisheries Action Plan described below (see Section II.A.7.b. and Figure 5).

a. Training in the Private Sector

Lack of training opportunities aimed specifically at the private sector creates a barrier to private sector development. Almost all training programs are presently geared toward management and technical professionals in the public sector. Among its other components, the Action Plan proposes the institution of a program of entrepreneurship training aimed primarily at developing skills among prospective private-sector fisheries businessmen and women (see Section II.C.2.b.i.). Instituting such training programs should provide aspiring business people and entrepreneurs with many of the skills essential to creating their own small-scale businesses.

b. Private Employment

Presently, opportunities for formal employment within the private sector are extremely limited. Once expansion and privatization of commercial fisheries activities occurs in Tuvalu, many new opportunities for private sector employment will become available.

c. Loans to Private Fishermen

A problem related to lack of private-sector capital has been the high delinquency rate on loans granted to fishermen by the Business Development Advisory Bureau (BuDAP; now under the Development Bank of Tuvalu [DBT]). In one component of the Action Plan (see IV.A.7.b. and Annex J), a program is proposed which enables private fishermen to gain ownership of 'Alia'-type fishing catamarans, without the need for loan financing; the boats are basically paid for by deducting a share of the fishermen's annual catch. This scheme thus overcomes a crucial obstacle to private enterprise development.

d. Private Fishermen's Association

Efforts have been made to establish a representative body of private fishermen on Funafuti. This group, the Tuvalu Fishermen's Association, has about 50 participatory members. However, they have not been successful in receiving recognition as legitimately representing fishermen's interests. Such recognition, however, will be an important determinant of the success or failure of any project aimed at involving private fishermen. Therefore, during the consultants' assignment in Funafuti, members of the Fishermen's Association were invited to participate in a series of public meetings intended to provide a forum in which fishermen could express their views on requirements for development of commercial fisheries. Their input led to the refinement of program concepts which had been put forth by the consultants. The meetings also enabled the members of the Association to become informed about the various options and opportunities which were available. The ultimate result of this activity was achievement of a supportive consensus concerning the proposed fisheries development programs. Fishermen were particularly supportive of the private boat ownership program mentioned above (for further details see Section II.A.7.b. and Annex J).

5. Major Assistance and Recent Projects

As is consistent with Tuvalu's policy toward foreign assistance, all the aid in the fisheries sector has been in the form of either grants or technical assistance, with no loan assistance having been provided to date. Principal assistance has come from providers including Australia, New Zealand, Japan, the United States, and UNDP. Further details regarding assistance programs of specific donors is contained in Annex E.

SECTION II

SECTION II COMPREHENSIVE FISHERIES ACTION PLAN

A. Development of Commercial Fisheries

1. Overall Goals and Objectives

Tuvalu appears to be at a crossroads in the development of its fisheries resources. The easy approach is to simply continue assisting the subsistence fishery, which provides enough catch to feed the country's ten thousand people; receive significant revenues from foreign vessel licensing; and, continue as recipient of technical assistance from foreign governments and international agencies.

The alternative is to elevate the fisheries sector to a commercial/industrial level by careful planning of a viable fishing business which would utilize the nation's principal resource. The Government has declared that this choice has been made and it has indicated its intention to take the necessary actions required to develop a major export industry based on the controlled exploitation of its marine resources.

2. Rationale for Development

Tuvalu is a new nation situated in the heart of vast tropical tuna resources, a product ever in demand by American and European consumers. A ready market is nearby at tuna canneries in American Samoa and Fiji which source all of their raw product requirements from neighboring nations through distant water foreign fishing vessels licensed to operate in the South Pacific region. Additionally, high value finfish are located in seamount areas within Tuvalu's EEZ. This resource has already been identified and successful export marketing experiments have been accomplished.

Additionally, Tuvalu has available the resources of young, strong and capable seafarers to meet the manpower requirements of a commercial fishing industry. The local Maritime Training Center on Amatuku islet, Funafuti, has produced hundreds of mariners over the years who can be found manning merchant vessels worldwide.

In view of the available marine and human resources available, the basic requirements for commercial fisheries development are obviously in place.

3. Recognized Development Constraints

Development of commercial fishing activities cannot progress until several critical bottlenecks are removed. These are:

- a) a lack of adequately protected harbors or anchorages in the country, even for small artisanal fishing vessels;
- b) lack of managerial know-how and expertise to undertake planning and implementation of commercial fisheries ventures;

- c) lack of skills to support commercial fishing vessel and shore facility maintenance and repair;
- d) absence of shipping facilities for transport of export quantities of product, either by surface or air freight;
- e) a lack of adequate and consistent data gathering required for accurate monitoring of the state of local fisheries resources and activities; and,
- f) a lack of incentives to attract local fishermen to participate in commercial fishing activities.

All of these constraints can be overcome with planning and timely implementation of required actions.

4. Required Initial Actions

Initial required actions for the planning of commercial fisheries development mirror the constraints noted above in order of priority. Required actions are described as follows:

- a) **Infrastructure.** A recognized firm with expertise in ports and harbors engineering should be engaged to survey and select the best locations for adequate marine infrastructure on Funafuti, where the major fishing support base must be located. Design of the suggested infrastructure and facilities should be prepared. These facilities would include 1) a protected boat basin and 2) a service complex comprised of processing facilities, cold storage, ice plant, and offices.

The engineering study should also include planning for development of necessary infrastructure on outer islands to facilitate fish landings at those locations.

SOPAC has played an important role in studying various oceanographic and bathymetric conditions which might have a bearing on the design of safe harbors and anchorages in Tuvalu. Therefore, their input should be sought during any study intending to identify or design safe harbors, anchorages, or other protective features.

- b) **Management and Planning.** Annex F cites the terms of reference and qualifications for a "Commercial Fisheries Project Implementation Advisor." The person selected would take charge of all planning and project implementation for a minimum term of 36 months assisted by two selected management trainees.
- c) **Skills Development.** Skilled expatriates would be employed on a timely basis to work with and train local counterparts in refrigeration operation and maintenance, diesel engine repair, and fish handling and processing techniques.
- d) **Transportation.** A refrigerated cargo vessel would be acquired to service the proposed two vessel purse seine fleet, transporting catch to cannery markets and returning with fuel and supplies. This vessel would also transport frozen tuna from the Funafuti base produced by small-scale and small commercial fishing vessels.

The Funafuti airport lacks sufficient length to fully meet the freight service requirements for shipment of high-value finfish produced by the seamount fishery. That catch will need to be delivered directly to Nadi (Fiji) airport for shipment to market.

- e) **Resource Monitoring.** The SPC provides a continuing survey of the migratory tuna species in the region. The Tuvalu Fisheries Department will need to establish and maintain a system for adequately monitoring resources of the seamount fishery, lagoons and outer reef. Management programs need to be developed for sustainable utilization of the resources. Needs for staff strengthening in this and other areas is further described in Section II.C.2.b., below.
- f) **Local Fishermen Incentives.** Project planning will establish a market for all catch delivered in good marketable condition and cash settlement will be available on a timely basis. The project aims at making boat ownership available to qualified applicants through 30 percent support provided by a boat-buying credit scheme.

5. Project Planning

There are several choices of projects suitable for achievement of fisheries export goals briefly illustrated under "Commercial Fisheries Project Options" (Section II.A.10, below). Further in-depth study will need to be undertaken to determine the financial viability of these proposed actions and to prioritize their order of development.

For example, the proposed purse seine fisheries component would need to take implementation priority in order to provide sufficient production of frozen skipjack and tuna to support the operation of a refrigerated carrier vessel. With that in place production by small-scale fisheries and small commercial fishing vessels would have a means of reaching export markets.

Project planning will also need to be guided by available financing resources. Careful review of the feasibility studies must be undertaken by the Implementation Advisor and his management trainee staff to ascertain that operating assumptions and cost projections are reliable. Underestimated cost and over-optimistic income projections could lead to disastrous operating results.

6. Project Implementation Procedures

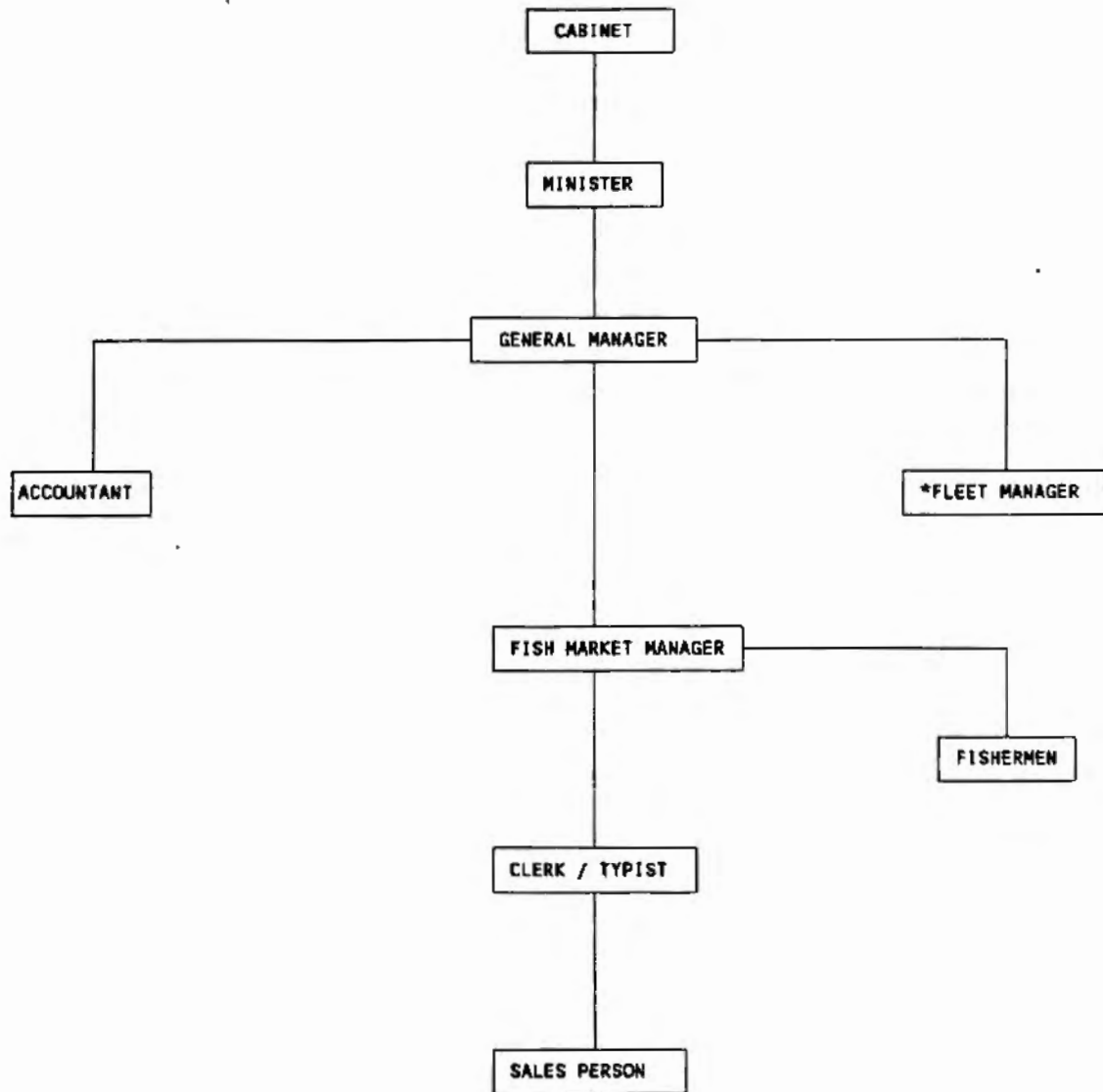
Of basic importance for successful project implementation is a well-conceived and realistic implementation schedule. In order to maintain the momentum of the implementation action, it is also critical to have required funding available as needed; "start/stop" procedures lead to financial losses.

7. Project Ownership and Management

a. Role of NAFICOT

NAFICOT provides the existing framework for the Government's commercial efforts in the fisheries sector, and should be designated as executing agency for the implementation of all commercial project components. The overall management will be directed by the selected Implementation Advisor and two management trainees. Under this top management umbrella each of the project components will have their own management team. Figures 3 and 4, respectively, show 1) the current staff organization of

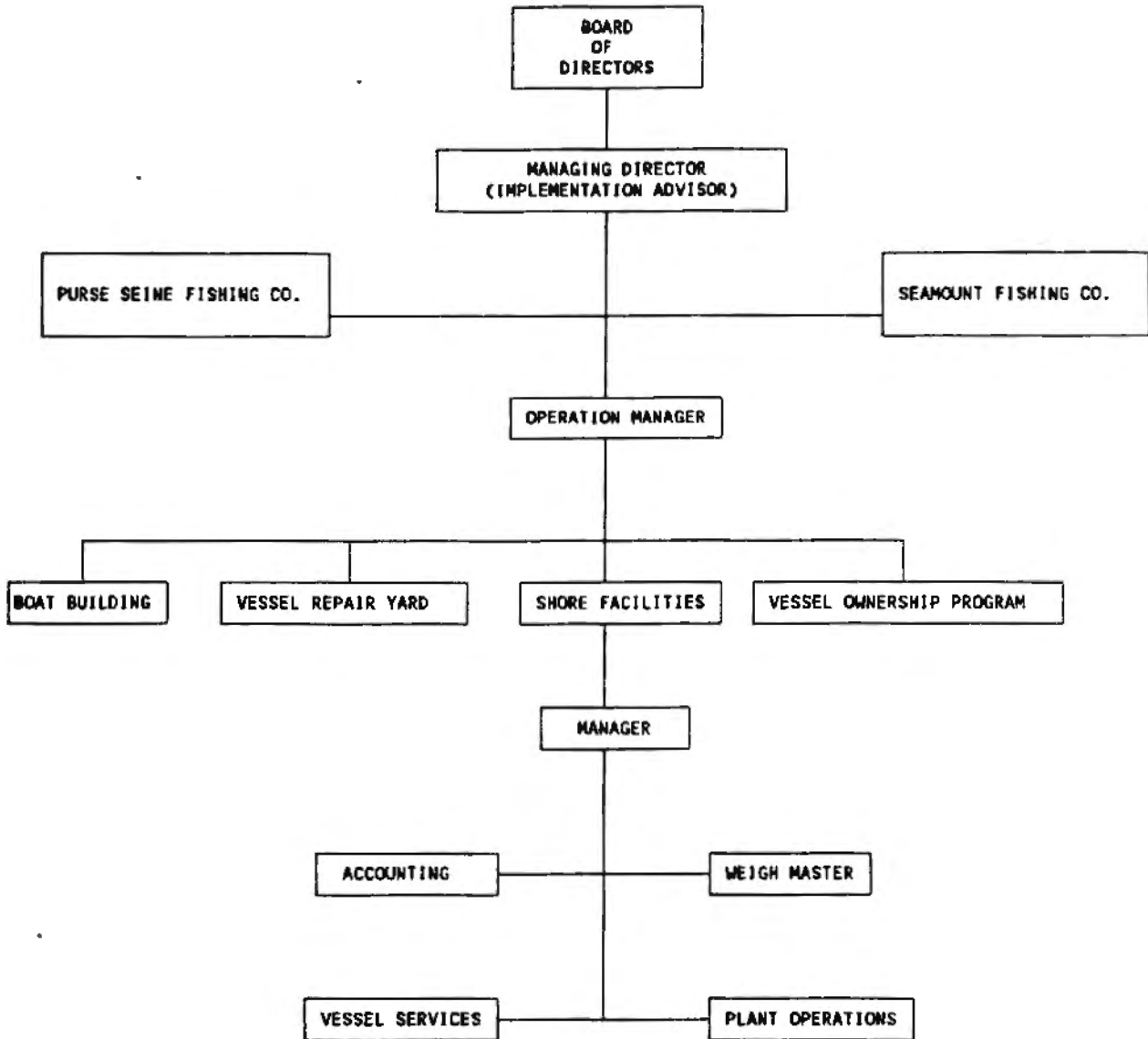
Figure 3
NAFICOT Existing Organization



* Made redundant in 1993 when fishing vessels were unserviceable.

Figure 4

Proposed NAFICOT Management Organization



NAFICOT, and 2) suggested staff organization required for successful implementation of the recommended project components.

b. Ownership - Government and Private Sector

It is suggested that NAFICOT should retain ownership of the commercial fishing fleets, i.e., the seamount fisheries fleet and the purse seine fleet, as well as the boat-building, vessel repair, and shore facility components. Ownership of the proposed 'Alia' small-scale fishing fleet and small commercial fishing fleet will be made available to the fishermen/operators under a Government-sponsored boat-buying credit and support scheme.

It is recognized that there are no existing private capital resources in Tuvalu of the magnitude required for immediate private ownership participation in the above programs. However, such capital resources might be developed over time by institution of a program to privatize NAFICOT. A key component of this program would be in-kind transfer of corporate shares through stock options to qualified individuals. Sales of small amounts of stock to individuals, and sales of larger amounts to institutional investors, would also be possible. The details of a recommended privatization program are described below. The ownership structure as projected at the five-year mark is illustrated in Figure 5.

Five-Year Privatization Program

- Stock options will be offered to the upper-level management team,¹ and paid for by operating bonus. Fifteen percent of corporate shares are set aside for this segment.
- A similar arrangement will be implemented for second-level management and skilled workers, including vessel crews. Up to 10 percent of total shares will be offered.
- Shares will be offered to overseas workers on a regular remittance basis. This would be an open amount, estimated at 10 percent of total shares to be sold over a five-year period.
- Twenty percent of shares will be sold to DBT.

Ten-Year Program (and onwards)

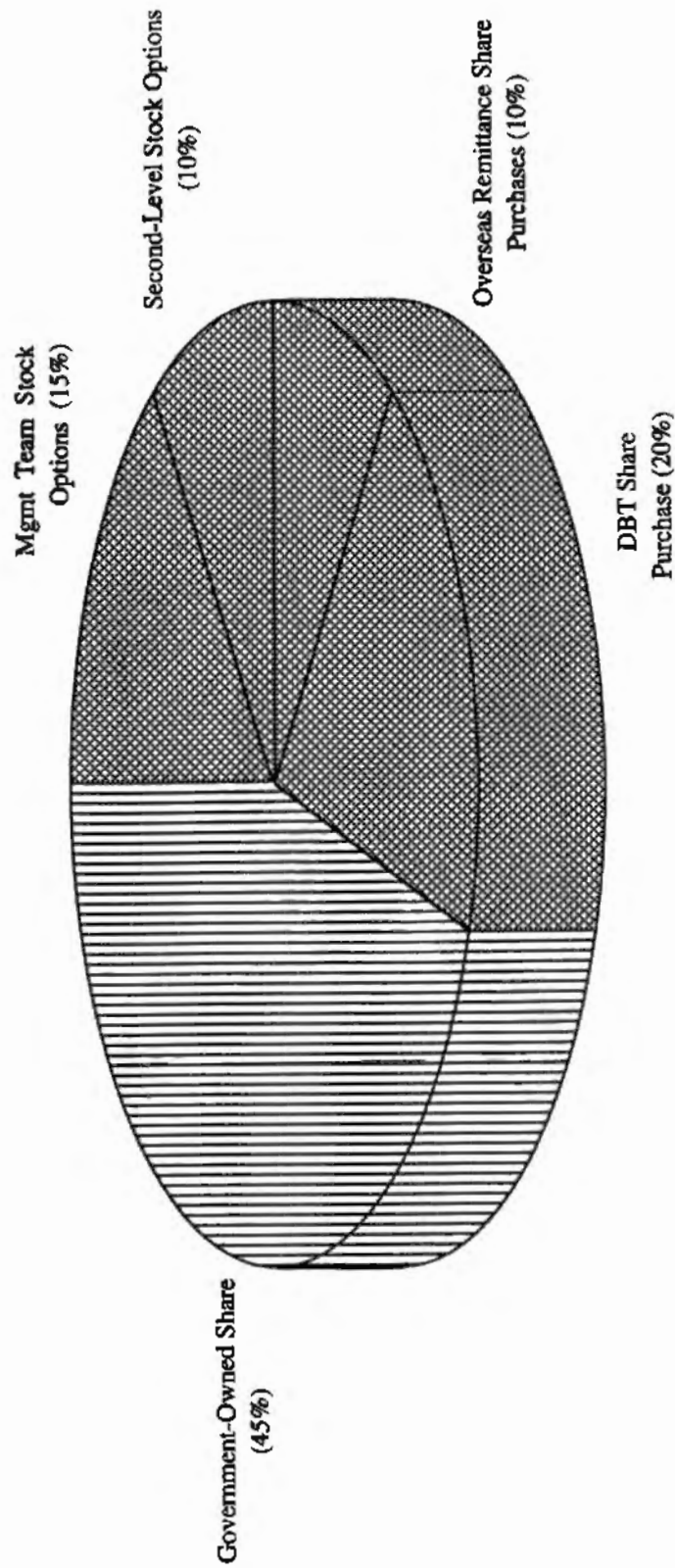
- The remaining 45 percent Government-owned share would be divested to the private sector over a 10-year time frame (or longer).

c. Government Support

The Government must instigate all the required actions to reorganize NAFICOT under the direction of the selected Implementation Advisor and at least two appointed management trainees. When those positions are filled it would be timely to take the first steps toward putting the fisheries development program in motion, starting with infrastructure engineering, component feasibility studies, and selection of second-level management. Aside from financial assistance to implement NAFICOT projects,

¹Chief Executive Officer, Fleet Manager, Financial Manager, Small-Scale Fisheries Manager.

Figure 5. Five-Year Scheme for Privatization of NAFICOT



Government agencies should identify funding sources to enable construction to commence on marine works and site preparation for the shore facilities required at Funafuti and selected outer island locations.

Direct Government financial support will be required for implementation of the small-scale vessel boat-buying credit scheme. This is a very basic incentive to inspire fishermen to work under commercial fishing conditions (i.e., a consistent routine and regular work schedule).

The credit scheme is simple. The Government will offer a 30 percent credit towards the purchase of a fishing vessel. The prospective owner/operator will have 10 percent of landed catch value withheld annually to apply on the balance owing. According to projections for the value of typical annual catch, the final payment would likely be during the fourth year of operation.

8. NAFICOT Operating Returns

NAFICOT is expected to make a reasonable return on investment on the purse seine and seamount fishing operations. Operation of the shore facilities supporting the small-scale and small commercial fishing components should be planned at only slightly better than break-even so that the fishermen can be the beneficiaries. Services should be provided at least possible cost to the boat owners to inspire the greatest possible participation. Export earnings from the small-scale sector will more than repay the Government costs involved in financing the boat buying credit scheme and operational support.

9. Financing Options

a. Infrastructure

Currently there is a proposal to Asian Development Bank (ADB) to fund infrastructure studies under a technical assistance grant. The affected departments of the Government of Tuvalu (GOT) should request that Terms of Reference be developed for a firm of engineers with expertise in ports and harbors design to study best locations on Funafuti and all outer islands for fish landing and processing facilities.

To the extent possible, the engineering consultants should study the advisability of constructing breakwaters and anchorage protection for the small-scale fishing fleet. Studies should include cost estimates and the scope of work to be undertaken. Once the engineering studies are completed, the cost of marine works infrastructure, including recommended options such as dredging, wharf structures, anchorage buoys, or breakwater structures may be borne by an international funding agency.

b. Commercial Fishing Projects

i. Option for Combined Operations

The proposed tuna purse seine fishing company and the seamount fishing company may be combined into a single corporate unit. Together, total financing requirements would be in the range of US\$10 to \$12 million assuming that feasibility studies and a sound business plan are developed. It is suggested that Commonwealth Development Corporation (CDC) may be a proper funding service for a loan and some equity participation. The CDC would require equity funding of at least 30 percent by the GOT. They would be requested to take an additional 10 percent equity position and syndicate a loan for the balance of the financing requirements.

ii. Purse Seine Joint Venture

Given the relatively large capital requirements of the purse-seine project, Tuvaluans may elect to pursue implementation of this component through a joint-venture arrangement, as an alternative to assuming the total financing burden on their own. The project as defined can attract an experienced private-sector, profit-oriented fish production and marketing company. Such an entity could provide management, production and marketing skills on a profit-sharing basis. The joint venture partner would also be expected to provide working capital, or a combination of working capital and equipment (i.e., vessels) equivalent in value to the agreed-upon ownership share.

A joint venture arrangement, if carefully planned and structured, would also provide other benefits for Tuvalu. These would be primarily in the form of on-the-job-training for Tuvaluans in every aspect of commercial fisheries operations, ranging from seamanship to accounting. The joint venture partner would also be expected to play an active role in establishing marketing arrangements with foreign customers.

In light of widespread past problems with government-owned fisheries ventures throughout the Pacific region, and the relative success of privately-held ventures, it is strongly recommended that any purse seine joint-venture company to be established in Tuvalu should have a majority of privately-held shares. One possible arrangement which would achieve this objective is depicted in Figure 6. If such an arrangement were adopted, it might be possible to structure a program to increase Tuvaluan ownership of the company, wherein the foreign joint-venture partner gradually divests its shares, say, over a seven-year period. Tuvalu-based investors (DBT, other private-sector investors, and NAFICOT) would in essence buy these shares, thereby proportionately increasing their ownership in the company.

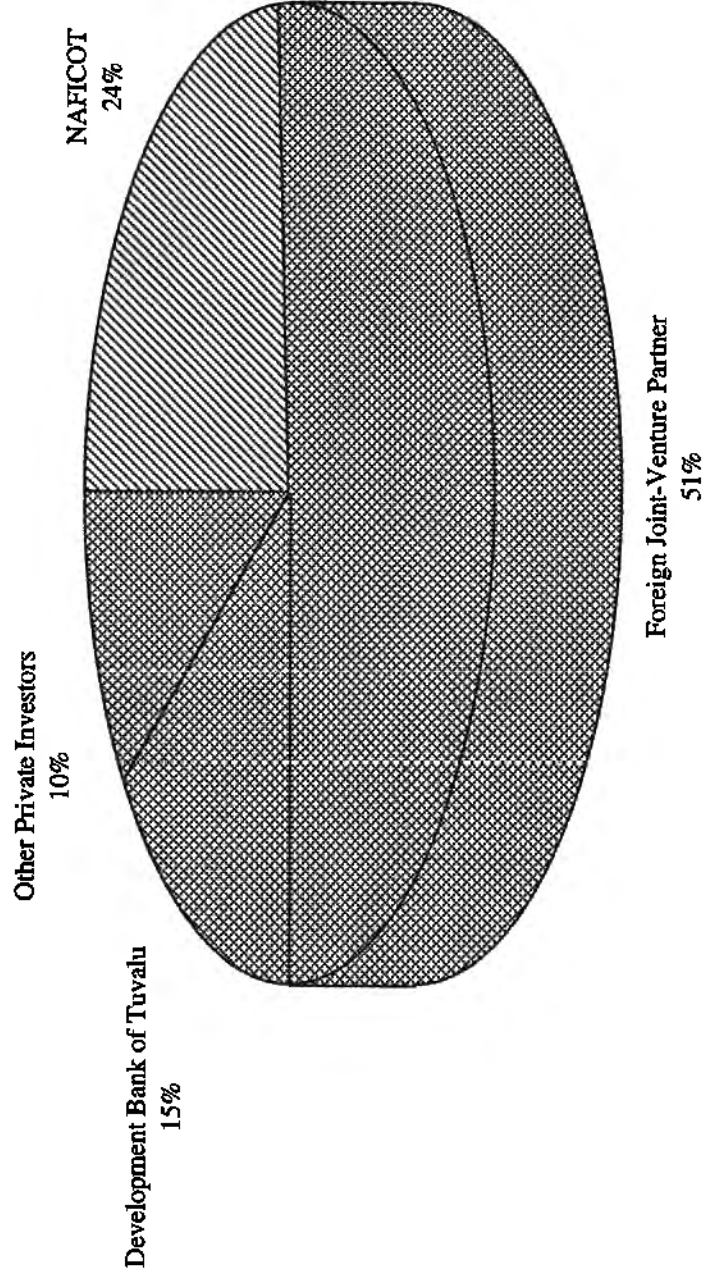
Identification of a suitable joint venture partner will be the first, and certainly the most crucial step in creating such an enterprise. Due consideration must be given to the caveats described in Annex E (Sections 2.b and 2.c.). At the minimum, a suitable joint venture partner should have the following qualifications:

- a proven record of successfully operating a tuna purse-seining venture;
- good marketing connections to regional cannery facilities;
- a sound financial base and the ability to commit adequate working capital to assure the success of the proposed joint venture;
- the ability to identify, locate, and procure suitable vessels for the purse-seine project; and
- the ability to supply skilled managers and employees as required.

In addition to the above key qualifications, the proposed partner should not be encumbered by any significant or potentially harmful litigation.

Expressions of interest in a joint venture arrangement have already been received from a German private company currently operating purse-seiners in Africa. This potential partner would be in a position to provide several vessels for fishing in Tuvalu's waters, and have given preliminary indications of their willingness to train Tuvaluans as described above. Another possibility which may be attractive would be to offer a joint-venturing opportunity to a company of a DWFN (e.g., Korea or People's Republic of

Figure 6. Proposed Purse-Seine Joint-Venture Option



China) which currently has no licensing agreement with Tuvalu, but which has paid licensing fees to Tuvalu in the past, or which currently pays fees to other countries in the region. Such a partnership would enable the DWFN to participate in fishing in Tuvalu's EEZ through an arrangement which is an alternative to the usual licensing fee agreement. The benefits of such an arrangement for Tuvalu would be identical to those already described for joint ventures in general.

iii. Small-scales Fishing Component

The small-scale fishing component is a social project and would not qualify for institutional or commercial financing. Assuming that infrastructure could be put in place under a soft loan arrangement, the GOT should use its own resources to finance the boat-buying credit and support scheme. It is estimated that about US\$1.5 million would be required.

c. Other Required Funding

Commercial Fisheries Project Implementation Advisor

Selection of this consultant should be scheduled at the outset of project planning. Total cost of this 5-year consultancy, including international travel and other costs, is estimated to be US\$568,000. It is suggested that the EU would be a proper source of funds for this technical assistance. The main aim of this consultancy is to train local trainees in management, and develop operational know-how for running a commercial fishing company (see Annex F, Terms of Reference, Commercial Fisheries Project Implementation Advisor).

Were the proposed purse seine project to be undertaken as a joint venture (as described in Section II.A.9.b.ii., above), then the scope of work for the commercial advisor could be reduced significantly, in light of the fact that some of the training, commercial development, and marketing functions would be taken over by the joint venture partner.

Recurrent Expenses

Government would only have responsibility for the investment expenses already described, and would not be obligated to bear any recurrent costs which NAFICOT incurred during its operations. As a semi-autonomous commercial entity, NAFICOT would be responsible to pay the salaries of its personnel and shoulder any other recurrent expenses.

10. Commercial Fisheries Project Options

There are several options which appear to offer viable possibilities for commercial fisheries development in Tuvalu. These options are further described below and summarized in Table 12. More detailed information concerning assumptions is given in referenced Annexes (G through J) which correspond to the various development alternatives.

a. **Purse Seine Fishing Company**

Introduction

The main thrust in bringing Tuvalu into the commercial fishing industry will be the establishment of a pilot purse seine fishing industry aimed at exploiting the abundant skipjack and tuna resources migrating through the country's economic zone.

To date there has been very little monetary benefit for Tuvalu derived from this rich resource, other than modest licensing fees of about 5 percent² of the catch value paid by FFVs. The catch is taken abroad to regional canneries such as those in American Samoa and Fiji and to other more distant destinations in the Philippines and Thailand.

One of Tuvalu's principal constraints to developing an export fishing industry has been the lack of shipping facility. The refrigerated carrier vessel will deliver the catch to nearby markets. It will also deliver catch produced by the small-scale fishery component (see below) as recommended.

The fleet will initially consist of two small tuna purse seiners in the 300 mt capacity class and one refrigerated carrier vessel with at least 750 mt hold capacity. The size of the project is the smallest possible to support the operation of a refrigerated carrier vessel. With good management, it can be expanded to make Tuvalu a major player in the region's tuna production business.

Rationale

An overview of the world tuna industry indicates that the Western Pacific region will continue to dominate the tuna production and canning industry. The region's largest canneries, Van Camp and Starkist in American Samoa and the PAFCO cannery in Fiji, will soon be joined by two large canneries in Papua New Guinea, expanded capacity in the Solomons, and a major canning facility in Kosrae, FSM. Another tuna cannery has also been proposed for Chuuk, FSM; preliminary engineering studies for the facility have begun. Combined, those plants will require daily input of about 1,200 mt of tuna and skipjack. It can be safely assumed that the market for Tuvalu's catch will be in steady demand.

As indicated in the earlier discussion of pelagic resources, and in the excerpts of the SPC survey results presented in Annex A, the skipjack resources in the south and western Pacific Ocean region can support greatly increased catches from the region as a whole, well beyond the quantities under demand by all the international markets.

Operations

i. **Project Vessels**

The fishing fleet will consist of two tuna purse seine vessels of the 410 gross ton (gt) class and two scout boats which are designed to patrol FADs and direct the seiners to the best catch opportunity.

²The extent of catch by FFVs operating in Tuvalu is not well-documented. The estimate of return as a function of catch value is based on known rates for other countries in the region.

The purse seiners are ideally suited for near-base operations. The low horsepower main engine is quite adequate for FAD fishing where schooling fish do not have to be chased and, of course, provides for economical operation. The refrigerated carrier vessel will be a secondhand vessel to be purchased from a selection after canvassing the market. The vessel will be in the 1,000 gt class with more or less 750 mt fish hold capacity. Indicative specifications of the vessels, as well as a description of catch estimates, proposed operations, and maintenance requirements, are provided in Annex G.

ii. Sale of Catch

The Project Implementation Advisor will handle the sale of the catch and arrange for shipment to market by the refrigerated carrier vessel. Each vessel will report its catch and inventory daily in order that the manager can make firm offers to buyers and negotiate sales in an expedient manner. This will keep cash flow at the best possible level.

iii. Estimated Operating Results

As illustrated in Figure 7, prices for cannery-grade tuna, as dictated by supply and demand, have fluctuated considerably in recent years. Price is also dictated by fish weight and species. Giving due consideration to the typical size and species composition of catch in Tuvalu, conservative projections are made for the purse seine project based on an assumed average market price of US\$930/mt.

Annex G contains a table (Table G-1) which illustrates the project's annual catch, catch composition, and value, with annual sales of US\$7.5 million indicated. Operating cost is estimated at \$4.5 million leaving an operating margin of \$3 million and indicating a return on total investment of about 30 percent.

iv. Conclusions

The project described here would put Tuvalu in the tuna export business at a meaningful level. Project risk is minimal considering that the resource and catch rates are already established. Proper management would easily attain the operational goals as set forth by the rather conservative assumptions noted herein.

It is recommended that a full feasibility study should be undertaken to establish the viability of the proposed project and to serve as a credible instrument for banking and financing purposes.

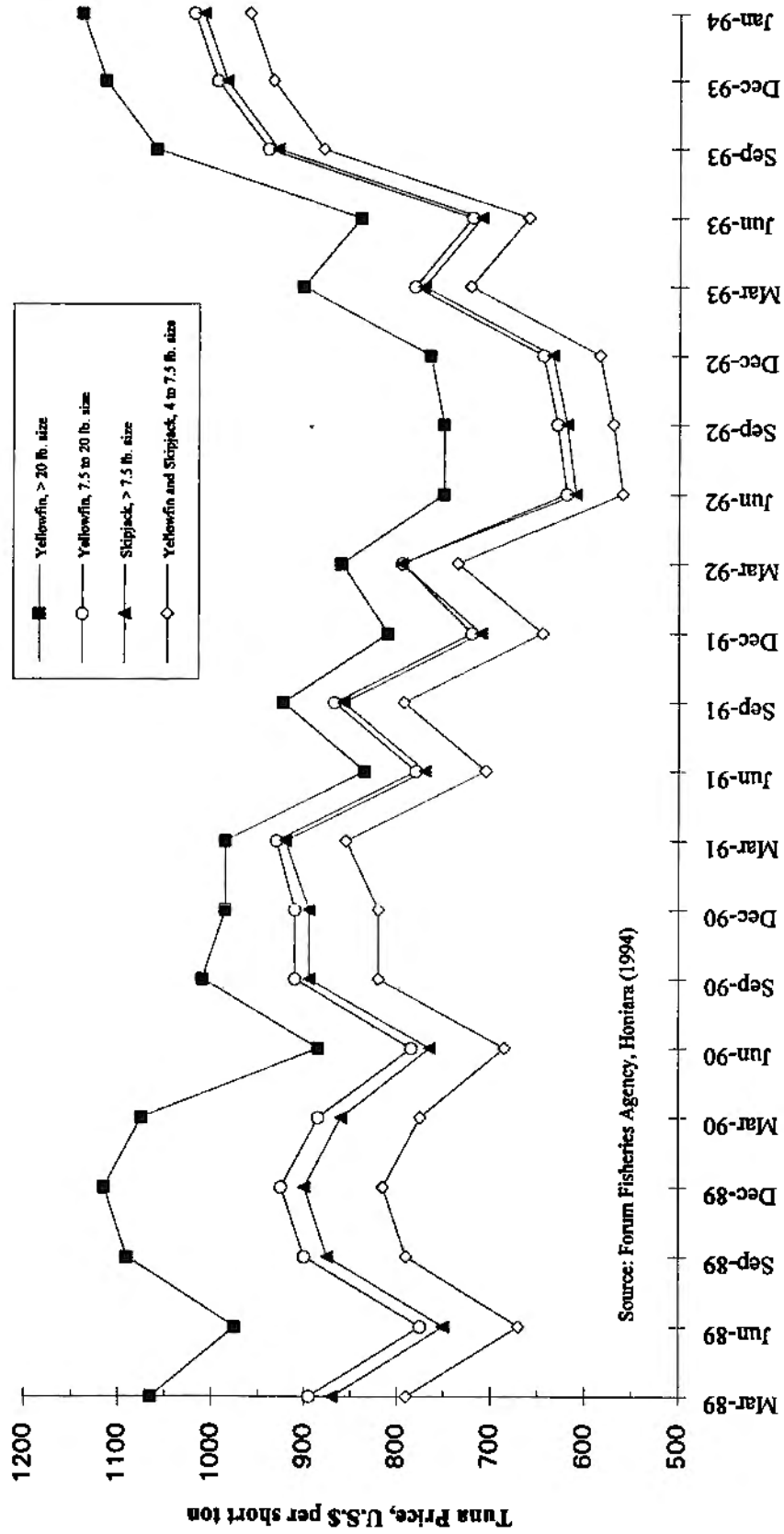
b. Seamount Fisheries

Introduction

Funded by the USAID Pacific Islands Marine Resource (PIMAR) development program, Resource Development Associates (RDA) International has undertaken a project aimed at commercial utilization of bottomfish resources on seamount areas within the Tuvalu economic zone. The project has consisted of the following activities:

- stock assessments of seamount areas;
- actual fishing operations; and
- export marketing experiments to assess the viability of establishing a commercial seamount fishing business.

Figure 7. Tuna Prices, by Species and Size, 1989-1994 (American Samoa Cannery)



These actions commenced during October 1991. The program will be completed in September of 1994. As of the close of the first quarter 1994, data gathered indicates that a highly viable fishing opportunity exists and the resource is sufficient to support moderate exploitation.

Project Plan

The project proposes acquisition of three 15-m class vessels, costing approximately US\$375,000 each. An operations base will be established near the international airport in Nadi (Fiji); from there, the boats will travel to the vast seamount areas in the southern Tuvalu EEZ to conduct fishing operations. The premium catch of deep sea snapper will be air freighted from Nadi to Honolulu in chilled form. The by-catch of other first class species such as dog tooth tuna will be sold to the Fiji fresh fish markets. Based on standard forecasting assumptions, the annual earnings for the project are estimated at around US\$350,000. Information concerning financial and operating assumptions is presented in Annex H.

c. Funafuti Fishing Base

Description

A fishing base will be established at Funafuti to service the small-scale and small commercial fishing fleets including fuel, ice, processing and export marketing. The base will maintain radio contact with all vessels and arrange assistance if needed. The base will occupy a 40 m x 65 m area (2,480 sq m) in the vicinity of the commercial wharf on Funafuti. Site preparation will require filling an area level to a sea wall 60 m in length and 1 m above high water. A 10 m x 20 m pier type jetty will be constructed on piling. The preparation of this project site and infrastructure will be for the account of the Government. Building and equipment located thereon will be for the account of the project. Annual cash flow generated by this component is expected to be around US\$150,000 annually. Annex I presents cost estimates and information on other financial and operational assumptions regarding the fishing base, and a sketch of the proposed facilities (Figure I-1).

d. Small-Scale Fishery

Introduction

This project component is designed to bring the small-scale fishermen into direct participation in export fisheries. The 'Alia' type catamaran (Figure 8), as later described herein, has been selected as the vessel best suited for this fishery. The selection is based on consideration of such factors as: efficiency as a fishing platform, carrying capacity, safety, fuel economy, and acceptability to local fishermen.

The project will be established in Funafuti with the construction of support facilities including a cold storage complex and a boat works capable of delivery of at least two vessels per month. Implementation will cover a three year period from start of boat building activities. Fifty vessels will be commissioned during that time. Following full implementation of the Funafuti component the outer islands will establish the required shore facilities, be supplied with vessels and participate in the project.

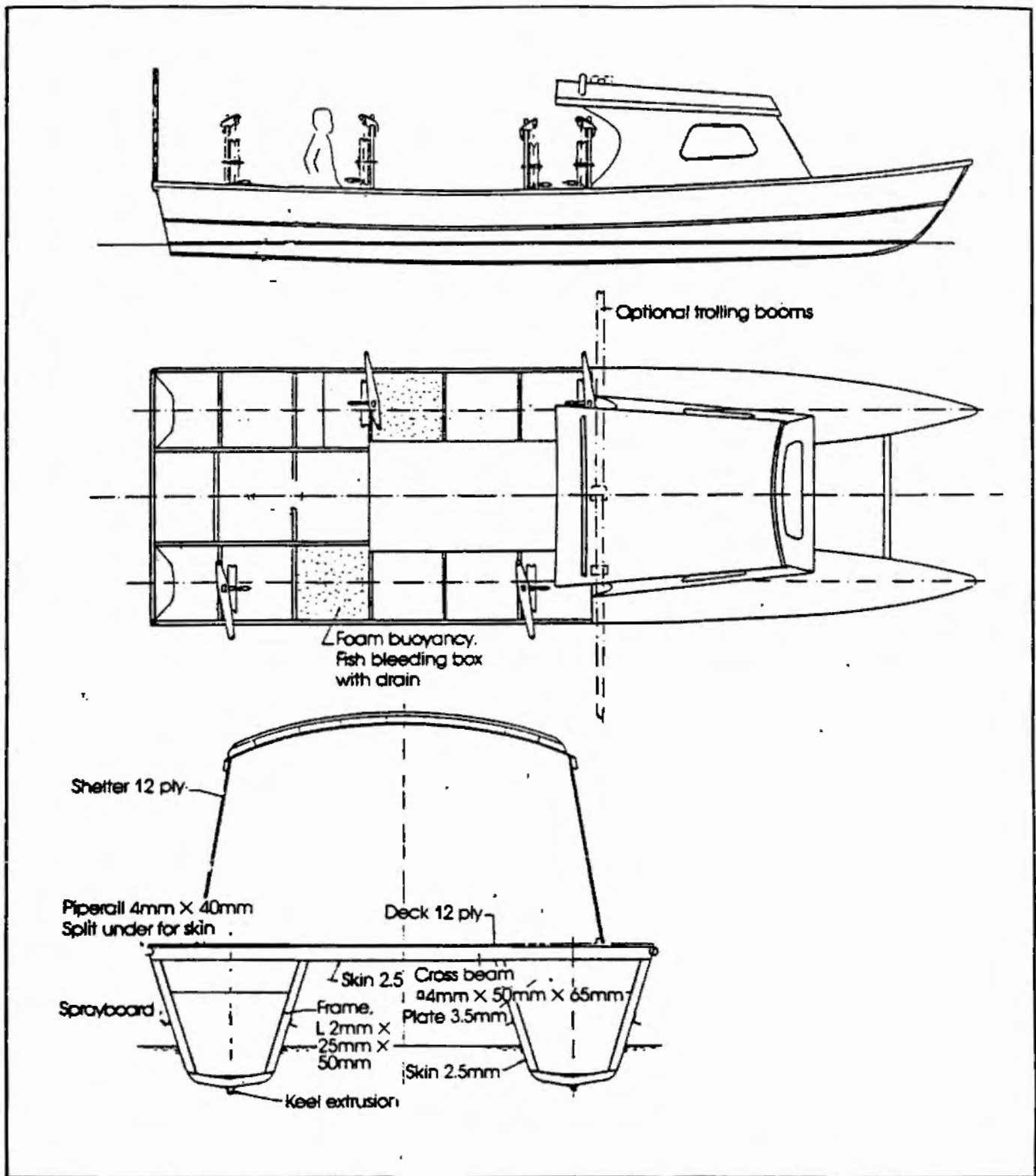


Figure 8. 'Alia' Type Catamaran.

Source:

FAO/UNDP Regional Fishery Support Programme 1987. Artisanal Fishing Craft of the Pacific Islands (based on the work of O. Gulbrandsen and M. Savins). Document 87/5. Suva, Fiji.

Project Plan

Implementation of the first phase on Funafuti will commence when a naval architect is engaged to set up the boat building facility and provide the construction design of the vessels.³ During this same time management will arrange for construction of the required shore facilities, purchase and installation of machinery and equipment, and start-up of operations.

'Alia'-type catamarans will be delivered to selected fishermen-owners known to be capable full-time fishermen. The cost of each vessel, fully equipped and ready to fish, is estimated to be US\$11,000. The project will grant a credit toward boat purchase of 30 percent, or US\$3,300. The fishermen/owners will pay off the remaining US\$7,700 balance by deduction of 10 percent of the value of catch delivered. The fishermen/owners should achieve full ownership of the vessels within four years from delivery date.

Catch produced by Funafuti fishermen will be sent to market aboard the purse seiner refrigerated carrier vessel (see Section II.A.10.a., "Purse Seine Fishing Company," above). When outer island participation is in phase, the project will need to acquire its own refrigerated carrier vessel to service those production stations.⁴

At full implementation of the Funafuti-based component of the project, about 2,000 mt of frozen tuna and skipjack will be produced annually. Value of this catch is about US\$1.7 million C & F cannery, showing a meaningful contribution from the small-scale fishery sector. Cost estimates, and other financial and operational details of the small-scale fishing fleet implementation plan are provided in Annex J. Also described therein are two alternative small-scale fishing programs, one using gill-netting⁵, and a second using pole-and-line.

11. Market Facility

Description

For both the pelagic and bottomfishing programs, by-catch would be made available for sale to local residents in Funafuti. To facilitate better distribution, quality control, sanitation, etc., the establishment of a centrally-located market facility is seen to be highly desirable. Such a facility could also serve as an outlet for any products brought in from outer islands. A cooperative management arrangement between NAFICOT and the Funafuti Island Council might provide the best institutional structure to assure successful implementation and operation of such a market facility. While a market presently exists in the Vaiaku town center on Funafuti, it is in disrepair and inadequate to properly serve the needs of the community, and will become more inadequate as population grows, and as fisheries activities expand.

³Attachment 1 of Annex J contains a letter from Mr. O. Gulbrandsen, naval architect and designer of the 'Alia' indicating his willingness to guide the implementation of a boat-building facility.

⁴It may be possible to utilize the 15 mt cold storage capability of the interisland vessel, *Nivaga II*, to transport fish to the Funafuti fishing base. Based on how the fish-producing capability on outer islands develops, this possibility should be further explored.

⁵This should not be confused with the 30-mile-long drift nets used by Japanese, Korean, and Taiwanese vessels which have been banned because of associated marine mammal kill.

It is projected that the existing market could be refurbished, or a new market facility built, at a cost of US\$20,000. Rough specifications for such a facility are provided in Annex K.

B. New Product Development

There is good opportunity for establishing small-scale entrepreneurs in the marine product export field. Besides pelagic species and bottomfish, other marine products which could form the basis for such enterprises are present, or may be cultured, in lagoon and nearshore areas. These include beche de mer (sea cucumber), giant clam, and others. Further research may point to other resources which could contribute to small-scale sources of income in the future.

Technical assistance might be required for those products whose introduction or capture is difficult, or for which the processing or marketing is complex. In those cases, establishing pilot projects to demonstrate their feasibility would be advisable. Estimated costs of such assistance are roughly in the range of US\$100-200,000 per project. In addition to technical assistance required to initiate such projects, it might also be necessary to hire additional counterpart staff/trainees. Once feasibility were confirmed, required capital to establish a small business would be nominal, perhaps in the range of US\$25,000. Financing in this range could be provided by the DBT. A description of some possible small-scale business projects is provided below.

1. Capture Fisheries

a. Tuna Jerky

Tuvalu's tuna resource can provide the basis for a wide range of capital-generating activities of benefit to different groups of people. Of special interest is the possibility of developing opportunities for bringing the outer islands into the cash economy. Outer island communities face even greater challenges than Funafuti with respect to infrastructural deficiencies. For this reason, small-scale projects which do not require elaborate infrastructure may prove more successful in the outer island environment.

One possible project which may have application is the production of tuna jerky. Such a project would make use of solar energy to dry tuna to produce a high-value, exportable item. A pilot project has been undertaken in Tokelau by SPC. Other projects, which have shown initial signs of commercial success, are underway in Kiribati and Marshalls. Market demand and attractive price levels have been demonstrated through the introduction of a tuna jerky product into retail stores in Hawaii in early 1994; this product sells at US\$3.99/2 ounce package (or US\$70/kg). Prices paid for packaged tuna jerky wholesale are around US\$45/kg. The principal market demand has been seen in Hawaii, Australia, the mainland United States, and Japan. It is proposed that a demonstration project for Tuvalu be established on one of the outer islands which presently has no fishing center. Details of this proposal are provided in Annex L, including a diagram of a small-scale tuna jerky production center (Figure L-1).

Clearly, the opportunity to develop tuna jerky production as a commercial enterprise is not limited to outer islands. An option for developing this activity on Funafuti is also discussed in Annex L.

b. Other Products

Some minor products which for the most part have not been subjected to heavy exploitation could form the basis for small-scale export enterprises. Such products potentially include beche de mer, lobster,

specimen seashells, and tropical fish for the aquarium trade. With the possible exception of lobster, these products have not been used traditionally, and their exploitation for commercial purposes would not significantly affect the availability of resources which local residents rely on for their own use. Since, generally, little is known about the extent of such resources in Tuvalu's lagoon environments, Government support for these activities should initially be in the form of research to assess the resources, and to formulate policy guidelines for their sustainable exploitation. Additional support for this research could be provided under a technical assistance grant. The appropriate agency to carry out that research is Fisheries Department. Following stock assessment, a more detailed feasibility study would be advisable prior to initiation of a commercial enterprise. Funafuti-based export firms could enter into production by teaching agents based on the outer islands the proper techniques of processing or handling. Inventory of finished product could be accumulated in Funafuti for shipment to export markets. Such a scheme could be applied to products such as beche de mer, shark fin, aquarium fish, specimen shells, etc. As an example of one of these, further information about the possible commercialization of aquarium fish collecting is provided in Annex M.

2. Aquaculture and Mariculture

Depending on the product and local desires, development of aquaculture can be geared toward export production, or toward production for local consumption or replenishment of depleted natural stocks. So far, active efforts have been made to transplant or culture a variety of aquatic products, including seaweed, trochus, milkfish, and giant clam. Consideration has also been given to culturing of pearl oysters. Of these, giant clam and milkfish have shown some success, and may offer viable alternatives for producing alternative foods, employment opportunities, and revenue. Pearl oyster, while less proven, offers some potential for developing an export product with high unit value. It is therefore recommended that continuing efforts in aquaculture focus on these three potential products. This will require further research into methods for establishing suitable hatcheries, grow-out facilities, and culturing protocols. The appropriate lead agency for such research is the Fisheries Department.

For giant clam, several objectives need to be accomplished: identifying means to improve survivorship in the early growth stages; investigation of potential markets; and, determination of commercial viability. Once the above issues are addressed, a giant clam project can be more clearly defined, and it will be possible to give realistic cost estimates for implementation. Further discussion about the feasibility of a giant clam hatchery and culturing project is presented in Annex N.

For milkfish, a pilot project could be undertaken by selecting a pond on Funafuti which would require minimal contouring. Implementation of such a project could be guided by an experienced aquaculturist, possibly from the Philippines, where milkfish has been successfully and profitably cultured for decades. If a pilot project proved successful on Funafuti, the culturing program could be extended to other islands. The possibilities of culturing other desirable pond fish, such as mullet, as well as high-value products such as prawns, could also be explored.

Efforts to introduce pearl farming to Tuvalu would require bringing in hatchery-raised spat from an outside source; at present the only hatchery which could supply spat is based at the Natural Energy Laboratory of Hawaii. If introduction was successful, it might be possible to eventually reach a stage at which oyster beds could re-seed themselves and become self-sustaining. Further information regarding prospects for introduction of pearl oyster culture is provided in Annex O.

C. Institutional Strengthening

1. Assignment of Institutional Responsibilities

The recent reunification of NAFICOT and Fisheries Department under the Ministry of Natural Resources Development may help to correct some of the institutional problems which have hampered the fisheries sector in recent years. At the very least, this restructuring fosters cooperation, rather than competition, between the two agencies most concerned with fisheries development. In addition, it allows for the possibility of resolving any conflicts at a higher (ministerial) level.

The underlying cause of the operational inefficiency and ineffectiveness of the two agencies is traceable in part to a lack of clear definition of responsibilities. Government must formulate clear and detailed mission statements and official policy guidelines for both Fisheries Department and NAFICOT. Overlapping of responsibilities of the two agencies is to be avoided, and cooperation between them needs to be strongly encouraged. A review of the areas of overlap or conflict suggests a natural separation of responsibilities could follow a scheme similar to the one proposed in Table 13. The GOT can use this as a basis for clarifying areas of responsibility to be delegated to NAFICOT and Fisheries Department.

2. Training and Staff Development

As already noted, the expertise required to run a commercial fishing operation is presently lacking. Likewise, deficiencies exist in the ability of upper-level Government fisheries personnel to adequately train and develop their staff. In the years ahead, it will be essential to identify, educate, and train talented and motivated future fisheries entrepreneurs, managers, and researchers. This process needs to start at an early level. Only if underlying educational and training needs are met will staff development and advancement within the sector proceed.

a. Training and Staff Development Responsibilities under NAFICOT

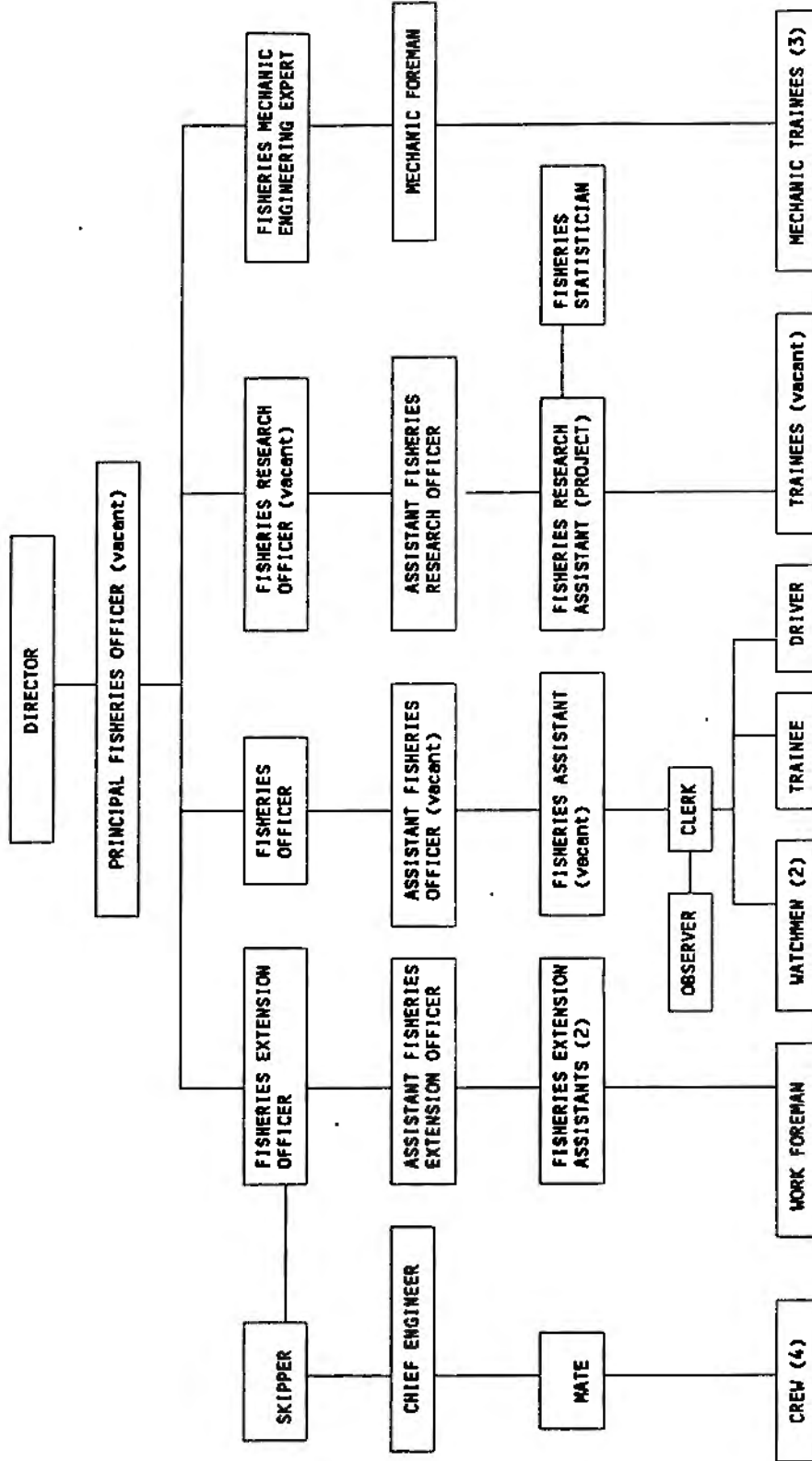
For development of commercial activities under NAFICOT, it is suggested that training should be accomplished through on-site, on-the-job programs, with local manager-trainees working side by side with a foreign expert. The most critical areas of need include training in commercial business management, marketing, entrepreneurship, commercial vessel operation, boat-building, and onshore facilities operation, maintenance, and repair. As earlier mentioned, it has been suggested that a "Commercial Fisheries Project Implementation Advisor" be hired to facilitate the initiation of commercial fishing operations of NAFICOT (see Annex F). Among other responsibilities, this person will have a critical role to play in the ongoing training of NAFICOT staff. At the end of the tenure period of this consultant, it is hoped that most of the skills and knowledge required to perpetuate successful commercial operations will have been adequately transferred to Tuvaluan counterparts. In order to assure effective technology transfer, the Commercial Fisheries Project Implementation Advisor should be under contract for a minimum of five years.

Recurrent Expenses

As already pointed out, additional positions will need to be created to manage and staff new programs proposed under NAFICOT. The Commercial Fisheries Project Implementation Advisor's salary will be paid for from a technical assistance grant. Other new positions within NAFICOT will not entail any new recurrent expenses, since salaries will be paid for out of NAFICOT's corporate revenues.

Figure 9

Fisheries Department Organization and Staffing Chart Existing Structure



b. Training and Staff Development Responsibilities under Fisheries Department

Figure 9 shows the present staffing situation within the Fisheries Department. As indicated therein, several positions are currently vacant, placing further demands on the remaining staff to carry out all necessary functions.

In addition to filling the current vacancies, it is recommended that new positions be created to cover specific areas as the need arises, and as new projects come on-line. For example, hiring of a full-time, "dedicated" Aquaculturist/Mariculturist would be recommended to facilitate new or expanded programs in giant clam culture, pearl culture, or milkfish culture. Responsibilities of this position would include researching the viability of various proposed aquaculture projects; guiding implementation of projects, including establishment of hatcheries, grow-out areas, sanctuaries, etc.; staffing of projects; and marketing.

To advance fisheries training on outer islands, it is recommended that additional Fisheries Extension Assistants (Level 9) be assigned on a full-time basis at outer island sites. To begin with, additional extension workers could be assigned at those outer island sites selected for implementation of suggested tuna jerky production projects. These could be temporary positions assigned for an initial trial period (say, of two years' duration) and could be rotated much like the Island Executive Officer positions are. Among their responsibilities will be instruction of outer island residents in new methods of fish harvesting and processing. Activities such as fish drying or aquaculture will be developed for both subsistence and commercial application. Other duties will include monitoring of resources; monitoring of fishing equipment needs, including FADs; and liaison with Fisheries Department in Funafuti.

Within the Department, the most important training needs are in the areas of staff development and management, statistical analysis, resource evaluation and management, regulation, and protection. Technical assistance projects can help facilitate advancement in these areas. A combination of in-country and overseas training will be appropriate for most of the activities carried out within the Fisheries Department.

Recurrent Expenses

The addition of new public-sector employees will require accommodating the additional salary expense in the recurrent budget. Recurrent expense will be based on the employment levels as indicated above. It is expected that other staffing requirements will be met through technical assistance grants.

To facilitate the hiring and training of new staff, and to improve the training of existing staff (including top-level managers), it is suggested that the services of a "Fisheries Staff Development and Training Advisor" be retained to work within Fisheries Department. This consultant should have extensive experience in public sector institutional strengthening and training, with specific familiarity and technical background in fisheries. All training responsibilities within fisheries (other than those associated with commercial projects under NAFICOT) would fall under the supervision of the Fisheries Staff Development and Training Advisor. The Terms of Reference for this position are provided in Annex P.

As noted in the Annex, the Staff Development and Training Advisor would have responsibility to develop programs to enable the Fisheries Department to better meet its own staffing needs, both by adding new staff where necessary, and improving the qualifications of existing staff.

Training will also be required to foster general growth within the fisheries sector outside the Department. Some of the suggested training and educational programs which would address this need are described below.

i. Entrepreneurship Training

Aside from vessel ownership sponsored by NAFICOT (as part of the 'Alia' small-scale fishing fleet program), there is good opportunity for establishing small-scale entrepreneurs in the marine product export field. Many of these small-scale enterprises would focus on any one of the several potential new products discussed earlier in the "New Product Development" section (II.B., above).

While the concept of creating, owning, and operating a small cash business is somewhat outside the context of traditional Tuvaluan cultural values, a small number of Tuvaluans have shown themselves to possess the interest and drive necessary to succeed in such an undertaking. Such skills can be further taught or enhanced through entrepreneurial training programs.

It would be appropriate for a program of entrepreneurial training to be conducted through the Fisheries Department; alternative arrangements might be to carry out entrepreneurial training through the University of the South Pacific, or through cooperation of the two entities. Funding for such an enterprise could be made available through a small technical assistance grant from a donor agency. To assure continuity of such a program, it should include a component designed to train future entrepreneurship trainers.

ii. Curriculum Development

In order to generate interest and prepare more people to become involved in fisheries activities over the long term, it is recommended that a fisheries and marine sciences curriculum be developed for instruction in primary and secondary schools. This activity would appropriately be included as part of the overall primary/secondary school science curriculum. Other countries (e.g., Maldives) have developed effective instructional materials and successfully incorporated fisheries into the regular secondary school curriculum. In addition, the emphasis on developing relevant career skills is in keeping with the basic premise of the Government's ambitious "Education for Life" (EFL) program. The Fisheries Staff Development and Training Advisor would have responsibility in helping to identify specific career opportunity areas in fisheries which could be promoted through regular educational programs.

3. Legal Review

A limited amount of national legislation deals with fisheries and marine resources, either directly or indirectly, and provides a framework for management and protection of such resources. The principal Acts include the Marine Zones Act, Fisheries Act, and NAFICOT Act. Several other Acts are not principally involved with fishing activities but have an indirect bearing on them. The purposes of these Acts as they relate to fisheries are described in Annex Q.

A variety of actions, including the fisheries projects suggested herein, can have significant impacts on existing fisheries resources, and on the habitats in which they occur. In order to assure that adverse impacts are minimized, and that the resource base is maintained at a level of sustainable utilization, it is recommended that a review of the present legal structure be undertaken. The purpose of such a review would be to determine what types of laws or regulations, if any, need to be promulgated to better protect

Tuvalu's marine resources and marine environment under present conditions, or under conditions believed likely to develop within the foreseeable future. For example, such laws or regulations might provide for protection of threatened species; formal prohibition of deleterious fishing practices; licensing of fishing activities to allow for better monitoring capability; environmental assessment of major projects; and protection of specific sites of particular ecological importance in reserves or sanctuaries.

The legal review could be carried out under a technical assistance grant from an external donor agency. It is estimated that such a review would require approximately one year of full-time technical assistance.

As is evident from the foregoing discussion, there is considerable scope to try to bring about improvements in the fisheries sector through a variety of technical assistance programs. These include technical assistance not only to develop commercial activities, but also to strengthen institutions, train staff, and develop skills in new areas. A summary of suggested technical assistance projects is provided in Table 14.

SECTION III

SECTION III OTHER CONSIDERATIONS

A. Social and Cultural Parameters

1. Wages and Employment

At present, formal employment in Tuvalu is almost exclusively in the Government sector. Government wage rates for unskilled casual labor (Grade 4) vary from A\$0.55-0.80 per hour with 0.65 being fairly typical, and are among the lowest in the region. The top rate for casual labor (Grade 1) is \$1.26 an hour. The comparable unskilled labor rate paid by the private sector is typically in the range of \$0.45-0.50 an hour, which is around 30 percent below the Government rate. For a number of the programs proposed as part of the Comprehensive Fisheries Action Plan, it is projected that earnings can bring private sector wages in line with, and potentially beyond, those offered in the public sector. At the same time, these programs will impart new skills to workers in the private sector. These factors are powerful incentives for greater private-sector participation.

2. Demographics

The current official estimates from the 1991 census indicate that Tuvalu's population could reach between 15-17,000 (an increase of 66-88 percent) by 2021. In the shorter term, some 700 Tuvaluans, phosphate miners and their dependents on Nauru, are expected to return to the country before the year 2000. These expected increases mean that more Tuvaluans will be seeking gainful employment in the years to come. It is believed that many of the workers returning from Nauru (especially those categorized as tradesmen) have the combination of skills and ambition which would be needed to participate in any of the projects described under the Comprehensive Fisheries Action Plan aimed at private sector and entrepreneurial development. In the years ahead, increased activity in the fisheries sector offers perhaps the best chances to accommodate the increasing employment needs of a growing Tuvaluan population.

3. "Work Ethic"

In developing countries generally, and the Pacific Region especially, poor "work ethic" has often been cited as a reason for failure in the attempted implementation of development projects. While it is true that a large segment of Tuvalu's population survives comfortably at apparently modest levels of effort, many Tuvaluans have demonstrated their willingness and ability to work long hours, often away from their families for extended periods of time, in order to achieve a level of economic self-reliance. In particular, the workers on Nauru and their families, and seamen working on European cargo vessels, are representative of this group. It is expected that these same workers, once returned to Tuvalu, will form the manpower nucleus for many of the fisheries development programs proposed herein. For those individuals willing to commit themselves to hard work, the proposed fisheries programs should be quite attractive, since they will afford opportunities for significant cash earnings, while allowing workers to spend a reasonable amount of time in their home country, and in the company of their families.

"Work ethic" is also closely tied to a "sense of ownership." Evidence for this can be seen in comparing activities of Tuvaluan private-sector fishermen to Government fishermen. Research by Patiale and Dalzell (n.d.) showed that during inclement weather, level of effort of Government fishermen dropped significantly, while effort of private fishermen was sustained (Figure 10). The poorly-maintained condition of many Government-owned boats in Funafuti (earlier discussed and summarized in Table 4)

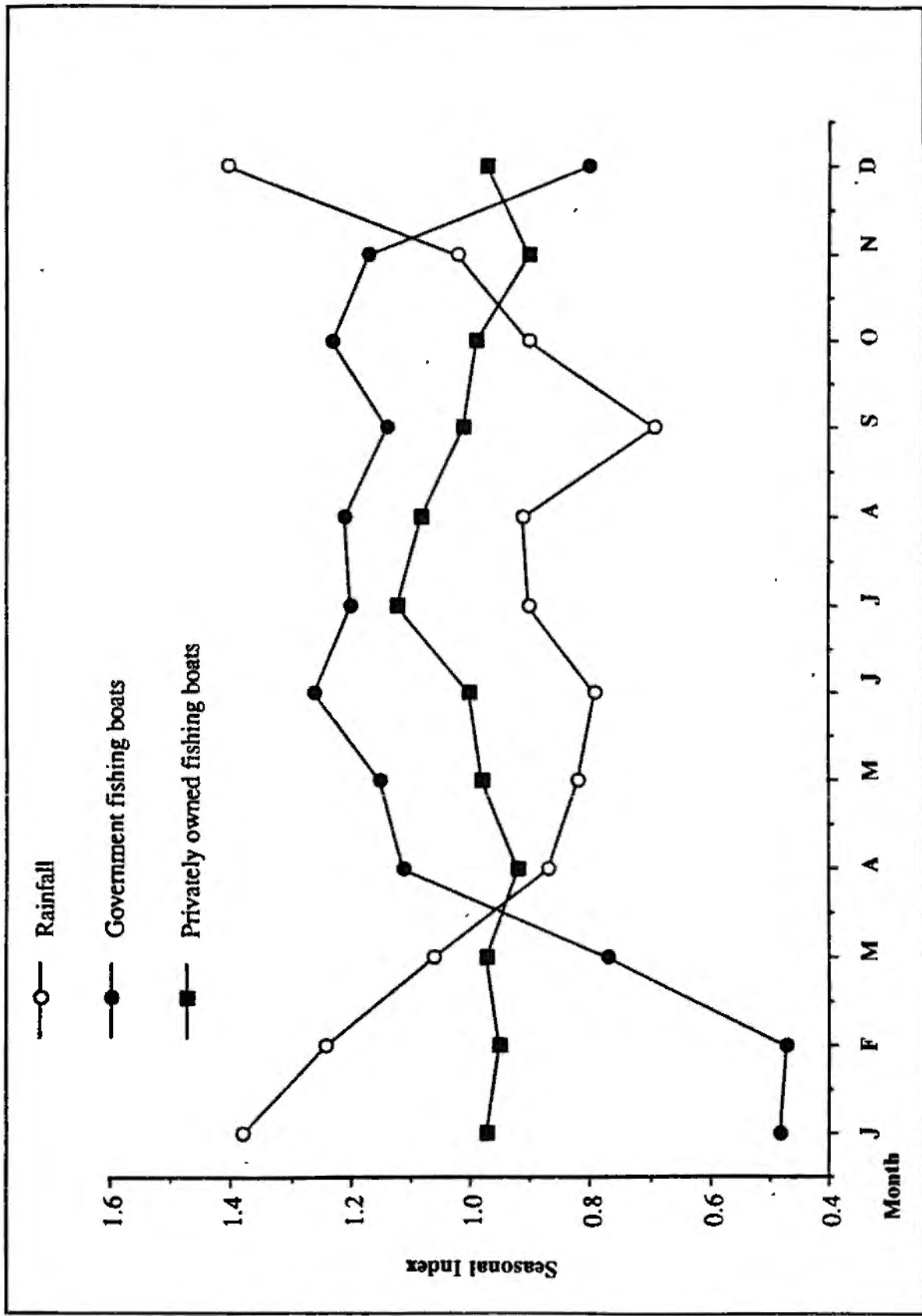


Figure 10. Level of Effort of Tuvaluan Government and Private Fishermen Relative to Weather Conditions

gives further evidence that, without a strong sense of ownership (or in this case, without actual physical ownership), there is little incentive to work. Thus it is felt that improved opportunities for private ownership and privately-based wage-earning will provide greater incentive for higher productivity among Tuvaluans engaged in fisheries activities.

4. Gender Issues: Women in the Fisheries Sector

Women have traditionally played a role in shore-based or nearshore fisheries activities. These activities have included collection of various seafood items on reef flats; cleaning, drying, and processing of fish; and selling fish at market. It seems likely that the majority of women will not seek roles as seafarers in future, but rather will continue to involve themselves in shore-based activities. This is not necessarily the result of any prohibition or prejudice against women pursuing ocean-going employment, but, more likely, the result of personal preference and practical considerations relating to women's responsibilities with their families. Any increase in fishing output will offer improved opportunities to employ women, since more quantities of fish landed will require more workers to clean, process, dry, pack, ship, and sell fish.

Women are under-represented in the formal wage sector as a whole, making up only 38 percent of total paid employees. Women are also outnumbered 2:1 in professional/technical and managerial positions. In the Fisheries Department at present, only one woman occupies a position (at Level 9) higher than clerk. It is hoped that through some of the programs proposed for fisheries education described in Section II.C.2.b.ii., more women may become interested in pursuing careers in fisheries--not only as wage-earners at the lower levels, but also at higher professional levels.

5. Outer Islands Development

Outer islands are disadvantaged in access to a wide variety of services, and to employment opportunities. Upgrading of skills among the outer island work force is critical for unlocking outer island economic potential and optimizing proposed aid investments. Several of the programs described herein propose outer islands development through the utilization of marine resources. The most important of these are the proposals for expanding the 'Alia' artisanal fleet to outer islands to participate in the capture and sale of tuna for export to canneries; the establishment of centers for production of tuna jerky; and the installation of full-time outer islands fisheries extension advisors.

B. Environmental Considerations

1. Nearshore Environment and Coastal Zone Management

Although anecdotal accounts appear to indicate some decline in certain species desired for food, especially in Funafuti lagoon, nearshore reef and lagoon resources appear not to be significantly affected by human activities at the present time; exploitation of resources appears to be proceeding at generally sustainable levels. With the exception of ubiquitous solid domestic litter in Funafuti lagoon (which, while unsightly, is biochemically benign), Tuvalu's coastal environment is relatively pollution-free.

However, with continued population increases, it would be expected that increasing environmental pressures might result from pollution, landform alteration, and overexploitation of resources. Increased human and animal waste entering the lagoon environment could lead to elevated bacterial levels, with resultant disease outbreaks and other public health risks. Increased organic nutrient loading could also

result in algal blooms which choke the corals upon which reef fish and other organisms depend for food and habitat. Other land-based pollution (from petroleum products, batteries, etc.) could produce discharges of toxic substances into lagoons or coastal areas. Lagoon or channel dredging, causeway and seawall construction, and similar earthworks projects, are suspected of being linked with outbreaks of ciguatera poisoning. Major ciguatera outbreaks in future could have serious impacts on the access of the local population to healthful food resources. Finally, intensified exploitation of food fish could result in the direct depletion of nearshore species which much of the population presently rely upon.

The land-sea interface found in lagoons and outer reef slopes is an especially sensitive area environmentally due to its function as a nursery for fish, mollusks, crustaceans, and other marine life. To ensure that sustainable nearshore fisheries resources will exist in the future, management of fishing effort and coastal zone activities will be necessary.

2. Offshore Environment

Generally speaking, it is believed that Tuvalu's offshore marine resources (pelagic fish and seamount bottomfish) have been underutilized. However, the potential degradation of nearshore resources described above would also have implications for pelagic (offshore) fish resources, since the lagoons are breeding grounds for the food fish (baitfish) upon which tuna and other pelagic species feed. Finally, it is believed that at the present time illegal fishing in the EEZ by FFVs occurs, and that catches are routinely under-reported. These occurrences, if allowed to continue unchecked, could have severe consequences for the overall health and abundance of pelagic and bottomfish stocks in Tuvalu's waters. The delivery of a patrol boat to Tuvalu in late 1994, should, however, facilitate more effective protection of the valuable fisheries resources within the EEZ.

3. Environmental Protection and Resource Management

In the face of increasing interest to maximize utilization of marine resources, it is essential that an effective system of resource management be instituted. This entails:

- estimation of MSYs for those marine resources which are to be harvested
- establishment of policy guidelines and licensing of activities which affect the marine environment either directly or indirectly
- reliable monitoring of effort and yield
- evaluation of data
- refinement and adjustment of licensing requirements and GOT policy guidelines, as necessary.

Additional steps which can be taken to reinforce this position are: expert review of the legal underpinnings for environmental protection in Tuvalu, with the view toward promulgating any new laws or regulations required to address specific current and future needs; environmental awareness training; establishment of marine sanctuaries; and formulation of strategies for controlling the harvesting of indigenous marine resources. Institution of such measures will go far toward assuring the existence of Tuvalu's valuable marine resources for sustainable use in the future.

Table 1
Estimated Fish Landings (Metric Tons)
1985-1991¹

Year	Funafuti Atoll										
	Private Fishermen					Government Fisheries					Total, All Sectors
	Pelagic	Reef/ Bottomfish	Total	Pelagic	Reef/ Bottomfish	Total	Pelagic	Reef/ Bottomfish	Total		
1985	- ³	-	104.0	4.2	3.5	7.7	111.7	192.4	304.1		
1986	-	-	88.1	-	-	14.6	102.7	185.0	287.7		
1987	35.7	62.3	98.0	2.3	9.5	11.8	109.8	205.8	315.6		
1988	-	-	99.9	-	-	8.3	108.2	209.8	318.0		
1990	-	-	-	8.3	7.6	15.9	-	-	--		
1991	-	-	165.7	-	-	16.6	181.3	219.4	400.7		

Source: Annual Reports (various); Fisheries Department.

¹ 1989 figures eliminated due to lack of reliable data.

² Estimated by using population multiplier based on Funafuti data.

³ -- = figures not available.

Table 2
Prioritization of Proposed or Ongoing Aquaculture Programs in Tuvalu

Program	Priority	Comments
Giant Clam	high	ongoing research has partially demonstrated technical feasibility; remaining technical problems and economic feasibility need to be addressed
Pearl Oyster	medium	requires more sophisticated methods for culturing; marketing tightly controlled; however, high value of the product, low transportation costs for export, possibility exists of bringing in hatchery-raised spat
Milkfish	medium	can make use of non-intensive, integrated technology; product is high-value food fish
Trochus	low-medium	test trials to date inconclusive, need to continue monitoring growth and reproductive rates
Seaweed	very low	test trials to date unsuccessful; raw product sells for low price/kg, thus additional constraints are imposed by cost of transporting material, competition from other sources

Table 3
Tuvalu Artisanal Fishing Fleet Relative to Population
(by Island)

Island	Population (1991 figures) ¹	Motorized Outboards (1993 figures) ²
Nanumea	818	44
Niutao	749	4 ³
Nanumaga	644	15
Nui	608	22
Vaitupu	1205	30
Nukufetau	756	36
Funafuti	3836	150 (est.)
Nukulaelae	370	41
Niulakita	75	— ³
TOTAL	9061	342 (est.)

¹ Source: Reynolds C. 1993. Water and Sanitation Plan for Tuvalu for the period 1993-2002. Government of Tuvalu (unpublished draft); as cited in Lane, J. 1993. Tuvalu State of the Environment Report (Working Draft).

² Based on Fisheries Department survey of outboard motors.

³ Niutao figures include boats on Niulakita.

Table 4
Status of Tuvalu Government Fishing Vessels

Vessel Name	Description	Length	Engine	Date Put in Service	Present Condition
Moanagali	FAO design trimline launch	8.5m	20 hp diesel inboard	1979 (approx)	out of service as of 1986 (engine unrepairable)
Te Tautai	Japanese-built pole-and-line fisheries training vessel	39m	1100 hp marine diesel	1982	uneconomical to operate as fishing vessel in Tuvalu; occasional service as interisland transport, charter vessel
Sikumoana	training launch	8.5m	20 hp	1982 (approx)	out of service (deteriorated)
-	'Alia'-type Samoan catamaran; aluminum twin-hull	8.9m	40 hp gasoline outboard	1984 (approx)	out of service as of January 1993 (wrecked in Cyclone Nina)
Matakite	Japanese-built training launch	9m	45 hp marine diesel	March 1989	out of service (destroyed in Cyclone Ofa, February 1990)
Taumoana	Japanese-built training launch	9m	45 hp marine diesel	March 1989	operating as NAFICOT commercial fishing boat
Sinamoana	Japanese-built training launch	9m	45 hp marine diesel	March 1989	out of service as of early 1993 (wrecked on reef)
Napoli	Japanese-built training launch	9m	45 hp marine diesel	March 1989	out of service as of late 1993 (mechanical failure)
Moemoeaki	Japanese-built training launch	9m	45 hp marine diesel	March 1989	out of service as of mid-1993 (mechanical failure)
Ta-tau-ika	Japanese-built training launch	9m	45 hp marine diesel	March 1989	operating as research vessel
Manau	Japanese-built research, extension, and training vessel	19m	445 hp marine diesel	November 1989	operating for research (principally RDA/USAID bottomfish project—stock assessment and commercial fishing trials) and extension
Tasu	American-built coastal fishing vessel	15m	225 hp truck diesel	December 1993	operating on charter to GOT in RDA/USAID bottomfish project—commercial fishing trials; reconfigured and not well-suited for Tuvalu waters

Table 5
Possible Fisheries Products for Commercial Export¹

Product	Markets	Estimated Landed Selling Price, Wholesale (US\$/kg)²	Present Constraints
<i>1. Pelagic and Bottomfish</i>			
Yellowfin, Bigeye tuna sashimi	Japan, Hawaii	\$5-\$25 (~\$100)	lack of air cargo capability
Yellowfin jerky	Hawaii	\$40-\$45	lack of local expertise in drying process
Skipjack, for canning	Samoa, Fiji	\$0.85-\$1.00	lack of sufficient surface cargo capability; lack of boats
Snapper	Hawaii	\$5-\$12.50	lack of sufficient air or surface cargo capability; lack of boats
Other Bottomfish (by-catch)	Fiji	\$3	lack of sufficient air or surface cargo capability; lack of boats
Shark's Fin	Hong Kong, Singapore, Malaysia, Taiwan	\$45-\$60 (dry weight)	profitability could be improved if better market for shark meat (as by-product) could be developed

¹ Some species or products included in the table may not be feasible for commercial exploitation in Tuvalu. The reader is asked to refer to the text for further discussion.

² Approximate 1994 prices, unless otherwise noted.

Table 5
Possible Fisheries Products for Commercial Export¹
(continued)

Product	Markets	Estimated Landed Selling Price, Wholesale (US\$/kg) ²	Present Constraints
<i>2. Minor Products (capture fisheries)</i>			
Beche de Mer	Hong Kong, Bangkok, Singapore, Malaysia, Taiwan, Tokyo	\$6-\$16(-\$30)	resource stocks for certain species may be limited
Tropical Aquarium Fish ³	Hawaii, U.S. mainland, Australia	\$0.50-\$20.00 per fish	resource stocks may be limited; transport of live product difficult
Lobster, live	Japan, Hawaii	\$15-\$30	resource stocks may be limited; transport of live product difficult
Precious Coral (black coral)	Japan, U.S.	\$2-\$25 ⁴	resource stocks limited; harvest requires use of SCUBA
Precious Coral (pink coral)	Japan, U.S.	\$125-\$1500 ³	resource stocks occur in very deep waters and are not known in Tuvalu; if discovered, resource would be subject to rapid depletion and slow re-growth
Specimen Seashells	Japan, U.S., Europe	\$0.50-\$200 per shell	resource stocks for some species are scarce

¹ Some species or products included in the table may not be feasible for commercial exploitation in Tuvalu. The reader is asked to refer to the text for further discussion.

² Approximate 1994 prices, unless otherwise noted.

³ Basis of a US\$1 billion industry in Southeast Asia.

⁴ 1986 prices.

Table 5
Possible Fisheries Products for Commercial Export¹
(continued)

Product	Markets	Estimated Landed Selling Price, Wholesale (US\$/kg) ²	Present Constraints
<i>3. Mariculture Products</i>			
Giant Clam ³	Taiwan, Hong Kong, Japan, Australia, U.S., Philippines	\$9-\$11/piece ⁴	mariculture in early research phase; markets untested; long-duration start-up before returns are realized; locally-popular food item prone to poaching
Euclidean seaweed	Japan	\$0.25-\$0.30	low price of export product, high transportation costs create unfavorable market conditions
Pearl Oyster	Japan, other	\$55/gram (\$125/pearl or more)	lack of expertise in growing, culturing, marketing pearls; long-duration start-up before returns are realized
Trochus shell, untreated	Japan	\$2	seeding trials in infancy, limited stocks, brood stock illegally removed
Trochus shell, button blanks	Japan	\$37 ⁵	seeding trials in infancy, limited stocks, brood stock illegally removed

¹ Some species or products included in the table may not be feasible for commercial exploitation in Tuvalu. The reader is asked to refer to the text for further discussion.

² Approximate 1994 prices, unless otherwise noted.

³ Possible uses include shell for ornamental use; flesh (fresh or dried) for food use; live animal for aquarium hobby industry.

⁴ 1986 prices; assumes value at 4-5 years grow-out after stocking.

⁵ 1982 prices.

Table 6
Features of Tuvalu's Licensing Agreements with DWFNs

Nation	Current Status	Comments
South Korea	lapsed	bilateral agreement; formerly fee based on capacity to pay; negotiated annually
Taiwan	new agreement recently negotiated (1994)	bilateral agreement; formerly fee based on capacity to pay, negotiated annually; new agreement is fixed rate for set number of boats
Japan	new agreement recently negotiated (1994)	bilateral agreement; formerly fee based on capacity to pay, negotiated annually; new agreement is on per-trip basis with advance payment covering ten fishing trips
United States	in force	multilateral, regional agreement; flat fee for region increased each year; 15% of total regional fee is divided equally among all signatory countries, remaining 85% is divided among signatories based on share of total catch

Table 7
Revenues Received by Tuvalu from FFV Licensing Fees, 1980-1993

Year	Total Annual Revenue, US\$
1980	40,847
1981	53,105
1982	149,354
1983	182,465
1984	138,890
1985	362,045
1986	267,018
1987	148,784
1988	298,694
1989	378,930
1990	302,750
1991	482,266
1992	2,719,657 ¹
1993	500,000 (est.)
Total Since Inception	6,024,805 (est.)
Average, 1980-1993	430,343 (est.)

Source: Tuvalu Government 1988. *Fourth National Development Plan*, and Fisheries Department.

¹ Approximately US\$1.8 million contributed by the U.S. Multilateral Treaty.

Table 8
Bilateral Access Agreements of Distant-Water Fishing Nations with Tuvalu, 1981-present

AGREEMENT YEARS	AGREEMENT TYPE	VESSEL TYPE (AND NUMBER)	TOTAL FEE AGREEMENT, US\$	RECEIPTS REPORTED BY TUVALU, US\$ (YEAR)*
1. Japan				
1986-1987	mixed		86,213	29,400 (1986)
1987-1988	lump sum		75,578	31,700 (1987)
1990-1991	per trip	pole-and-line (25)	64,125	83,400 (1990)
1994	per trip	pole-and-line (10)	90,000	
2. Korea				
1981-1982	lump sum	longline (115)	92,500	
1983	lump sum	longline (80)	81,690	
1984-1985	lump sum	longline (41)	61,000	
1985-1986	lump sum	longline (44)	65,000	65,150 (1985)
1986-1987	lump sum	longline (44)	72,000	60,343 (1987)
1988-1989	lump sum		90,000	90,000 (1988)
1989-1990	lump sum	longline (81)	140,000	140,000 (1989)
1990-1991	lump sum	longline (60)	154,000	154,000 (1990/91)
1991-1992	lump sum	longline		
3. Taiwan				
1981-1982	lump sum	longline (100)	84,000	
1982-1983	lump sum	longline (70)	81,690	
1985				72,373 (1985)
1987				100,000 (1987)
1988				100,000 (1988)
1989-1990	lump sum	longline (49)	100,000	100,000 (1989)
1994	per vessel	(15)	157,000*	157,500 (1994)
4. United States				
1983	per vessel	purse seiner	8,628	
1984	per vessel	purse seiner	152,593	149,905 (1985)

Source: Forum Fisheries Agency, Honiara (unless otherwise indicated)

*= Data from Fisheries Department, Government of Tuvalu

Spaces left blank where information not available.

Table 9
U.S. Multilateral Treaty Fishing Agreement - Tuvalu Benefits (US\$)

I. Cash Benefits			
YEAR	15% share¹	85% share¹	Total cash benefits
1988-89	134,480	808	135,288
1989/90	110,650	16,606	127,256
1990/91	119,077	258,643	377,720
1991/92	112,812	1,675,877	1,788,689
1993	107,070	180,005	287,075
1993/94 (to date)	148,867	not yet determined	148,867
TOTAL CASH BENEFIT TO DATE			2,864,895
II. Development Benefits			
Economic Development Fund (EDF)			369,018
Technical Assistance Fund (TA)			91,608
TOTAL DEVELOPMENT BENEFIT TO DATE			460,626

Source: Fisheries Department.

¹ See explanation of fee structure in text and Table 6.

Table 10
Activities of the Te Tautai, 1982-1993

Year	Summary of Activities	NAFICOT Profit/(Loss), A\$
1982	Te Tautai received from Japan in April; under management agreement with Ika Corporation, fished in Fiji, sold most of catch to Pacific Fishing Co. Ltd. (PAFCO) cannery in Levuka	n.a.
1983	Under management agreement with Ika Corporation, fished in Fiji, sold most of catch to PAFCO cannery	n.a.
1984	Under management agreement with Ika Corporation, fished in Fiji, sold most of catch to PAFCO cannery	5,836
1985	Under management agreement with Ika Corporation, fished in Fiji, sold most of catch to PAFCO cannery	(216,313)
1986	Under management agreement with Ika Corporation, fished in Fiji, sold most of catch to PAFCO cannery	29,573
1987	Fished in Solomons; catch sold to canneries through National Fisheries Corporation (NFC) Solomons	(37,832)
1988	Fished in Solomons (peak catch of 1,090 mt); catch sold to canneries through NFC	n.a.
1989	Fished for three months in Solomon Islands waters; catch sold to canneries through NFC; remainder of year spent at anchor, refitting, and under charter to South Pacific Commission (SPC) for Regional Tuna Tagging Project	n.a.
1990	Under charter to SPC for Regional Tuna Tagging Project	548,815
1991	Under charter to SPC for Regional Tuna Tagging Project	277,204
1992	Under charter to SPC for Regional Tuna Tagging Project through December	15,284
1993	January through March refitted in Suva; through September chartered to Government of Tuvalu; 21 September transferred from NAFICOT to Marine Department, Ministry of Works and Communications	96,444

Table 11
Recommended Options for Commercial Fisheries
Development in Tuvalu

Method	Vessel Recommendations	Onshore Facilities Recommendations	Baitfish Requirements	Target Species
Purse Seining	two (2) 300-metric ton capacity American-type purse seiner vessels	none required; vessels to be serviced at sea by refrigerated carrier vessel	none	skipjack, yellowfin
Pole-and-Line	trial fishing with two (2) 12m class vessels	brine freezing tanks, flake ice plant, cold storage	live bait caught by floating lift net	skipjack
Gillnetting/ "Short Longline"	trial fishing with one (1) 12m class vessel	brine freezing tanks, flake ice plant, cold storage	none	skipjack, shark
Trolling	fifty (50) 10m class 'Alia' catamarans with 30hp diesel engines	brine freezing tanks, flake ice plant, cold storage	none	skipjack
Bottomfishing (by reel)	three (3) 15.2m class vessels	none required; will use facilities in Fiji for vessel servicing	skipjack/yellowfin caught by trolling	snapper and other high-value finfish species

Table 12
Proposed Areas of Responsibility for NAFICOT and Fisheries Department

NAFICOT	Fisheries Department
<i>General Responsibilities</i>	
Development of commercial fisheries, primarily serving export markets; privatization; business plan development	Research, feasibility studies, resource monitoring and protection, extension, technology transfer
<i>I. Responsibilities Related to Onshore Facilities</i>	
<p>Operation of 'Alia' boatbuilding facility</p> <p>Operation of market center on Funafuti (in cooperation with Island Council)</p> <p>Operation of fish freezing/storage facilities on Funafuti, and on outer islands as they are established</p>	<p>Research and administration</p> <p>Maintenance of research library</p> <p>Operation of computer satellite communications center for EEZ monitoring program</p> <p>Operation of extension training centers on outer islands</p>
<i>II. Responsibilities Related to Fleet</i>	
<p>Operation of purse seine fleet and carrier vessel</p> <p>Operation of commercial bottomfishing fleet (based in 'iji)</p> <p>Initiation of artisanal ('Alia') fleet, with ultimate transfer of ownership of boats to private fishermen</p>	Operation of research, extension, and training vessels
<i>V. Training Responsibilities</i>	
<p>Training for commercially-oriented activities, including:</p> <ul style="list-style-type: none"> ● Business management ● Export marketing ● Seamanship (specific to commercial vessels) ● Equipment operation and maintenance 	<p>Training for research-oriented activities, including:</p> <ul style="list-style-type: none"> ● Fisheries science, aquaculture ● Resource assessment ● Statistical data collection and analysis ● Regulation and licensing <p>Training for staff development, including:</p> <ul style="list-style-type: none"> ● Administration ● Staff training and management <p>Outer islands training, including:</p> <ul style="list-style-type: none"> ● Subsistence fishing skills ● Small-scale boat and engine repair <p>Training for sectoral strengthening, including:</p> <ul style="list-style-type: none"> ● Entrepreneurial training

Table 13
Technical Assistance Recommendations in the Fisheries Sector

Project or Program Requiring Technical Assistance	Objectives	Likely Source of Technical Expertise	Duration of Assistance
1. Projects Under NAFICOT			
Commercial Fisheries Project Implementation Advisor (see Annex F)	train Tuvaluans, lead implementation and start-up operations of commercial projects (purse seine venture, bottomfish project, etc.)	private-sector commercial fisheries expert	5 years
2. Projects Under Fisheries Department			
Tuna Jerky Production (see Annex L)	guide implementation and start-up operations for jerky production in demonstration project, train Tuvaluans	private-sector commercial production/implementation expert	2 years
Giant Clam Mariculture (see Annex N)	design expanded project, including possible hatchery to use for commercial production, stock replenishment; train Tuvaluans	aquatic research institution/consultant	24-36 man-months over 3 years
Pearl Oyster Farming (see Annex O)	design project, test feasibility through pilot program, train Tuvaluans	research and development firm with expertise in pearl hatchery techniques	4-6 man-months over 2 years
Staff Development and Training Advisor (see Annex P)	guide staff development of Fisheries Department, train staff, develop educational and entrepreneurial training programs	public-sector fisheries institutional strengthening consultant	3 years
New Product Investigations	study feasibility of harvesting and marketing beche de mer, aquarium fishes, shark fin, etc.	aquatic research institution/consultant	1 year
Milkfish Farming	design and implement project, train Tuvaluans	commercial private sector expert	2 years
Strengthening of Statistical Analysis and Data Gathering Capability	determine requirements to provide adequate statistical monitoring of fisheries resource utilization	fisheries biologist/statistician	2 years
Legal Review	analyze existing legal framework and recommend new laws or regulations required to protect fisheries resources	natural resources legal expert	1 year

ANNEXES

ANNEX A

SOUTH PACIFIC COMMISSION REGIONAL SKIPJACK PROGRAMME REPORT EXCERPTS

(The following information, excerpted from South Pacific Commission (SPC) Skipjack Survey and Assessment Programme reports, and related reports, presents the results of the Programme's study in the waters of Tuvalu; compares them to the results of the regional study, and to those of other surveys in Tuvalu; and considers their implications for the development of tuna fisheries in Tuvalu.)

Traditionally, tuna fishing in Tuvalu has been conducted from large canoes trolling a few miles offshore, using pearl-shell lures. In more recent years motorized skiffs have superseded canoes in Funafuti. Tuna fishing occurs all year round; however, best catches occur during June and July. Fish average 2-3 kg in weight and catches normally range between 25 to 250 kg per vessel-day. In 1978, the tuna catch in Tuvalu was estimated to be as high as a few hundred metric tons and formed a major proportion of the total Tuvalu fish catch. Fish caught by local fishermen are usually sold on the beach or in the village but there are plans for a central fish market.

Research into the potential for development of a skipjack fishery in Tuvalu dates from 1970 when a United Nations Development Programme/Food and Agricultural Organization, South Pacific Tuna Mission noted the absence of information on bait availability. In 1976, consultants suggested that there was limited potential for a pole-and-line fishery because of the low abundance of live bait. Beginning in 1978, consideration was given to establishing an artisanal skipjack fishery in Tuvalu. The first attempts to assess the skipjack resource were made by the Skipjack Programme during surveys in the waters of Tuvalu in June/July 1978 and July 1980. In 1980, the Fiji-based Ika Corporation carried out exploratory bait and skipjack fishing with two 80-mt pole-and-line boats under the Fishery Permit Agreement. In 1982, Tuvalu received the 173-mt pole-and-line vessel *F/V Te Tautai* as a gift from the Japanese Government. The vessel has since fished for surface tuna in the waters of Fiji and the Solomon Islands but fishing trials in Tuvalu have not been successful because of a lack of live bait.

By far the largest catches from the waters of Tuvalu are taken by foreign fishing vessels. Longline catches of tuna and billfish by Japan, Taiwan, and Korea averaged approximately 2,000 mt in 1975 and 1976, the two years for which complete statistics were available to the Programme. Pole-and-line statistics for the period 1972 to 1978 show that Japanese long-range pole-and-line vessels have taken about 1,000 mt of skipjack annually, excluding the high 1976 catch of 7,500 mt. Tuvalu is on the southern extremity of the area fished by Japanese vessels, and is fished only when pole-and-line fishing in northern areas, closer to Japan, is poor. Therefore previous catches by Japanese vessels are not indicative of the potential pole-and-line catch from Tuvalu waters.

Since Tuvalu declared its 200-mile fishing zone (1 January 1979), fishery access agreements allowing foreign vessels to fish in Tuvalu have been negotiated with Korea, Taiwan, and the United States. The licensing of 137 Korean longliners in 1980 generated revenue of US\$84,000, and in 1981 the revenue from licensing 115 Korean longliners was US\$92,000. In 1981 Tuvalu negotiated an access fee with Taiwan of US\$84,000 for 100 boats. Foreign vessel tuna and skipjack capture in Tuvalu for recent years is noted in Table A-1.

Catch and sighting results from Skipjack Programme surveys suggest that skipjack were in reasonable abundance in the waters of Tuvalu during the June/July survey periods in 1978 and 1980. Available statistics for Japanese distant-water pole-and-line vessels show that in some years high average daily catches in excess of 8 mt per day have been taken between August and December. Further survey work in Tuvalu during the June to October period would appear to merit consideration as this would provide more information on seasonal variability in skipjack and baitfish resources.

The lack of a substantial skipjack fishery in Tuvalu waters at the time of the survey, and the absence of catch statistics after 1978 for distant-water vessels fishing, prevented estimation of many skipjack population parameters for Tuvalu. In other areas of the western Pacific where detailed catch statistics were available, it was found that levels of exploitation within locally based fisheries were well below the turnover rates of the stocks. This, coupled with the very low level of fishing effort by local fishermen leaves little doubt that the skipjack resource in Tuvalu could yield catches much higher than existing levels.

Tagging and recovery data, blood genetics studies, and analyses of parasite distributions suggest that even though there is evidence of population structuring, there are no permanent barriers to the movement of skipjack in the western and central Pacific. Tagging has shown that skipjack from Tuvalu travel to many countries in the region, although distinct patterns in migration were not readily apparent. Few fish were recaptured in the waters of Tuvalu due to the low level of local fishing effort.

These fish came from countries to the South, namely Fiji, Wallis, and New Zealand. Interaction between locally based fisheries in nearby areas of the equatorial Pacific have been shown to be minimal at present, and a similar low level of interaction between Tuvalu and these locally based fisheries is assumed. Due to the international nature of the skipjack resource, however, increases in fishing effort both locally and in other countries, particularly those neighboring Tuvalu, could amplify current levels of interaction. The potential for increased catches of skipjack in the waters of Tuvalu may well be reduced by expansion of neighboring fisheries, and accordingly close attention should be paid to recent increases in purse-seine fishing activity.

Other tuna species in Tuvalu waters include yellowfin, bigeye, dogtooth and, in limited amounts, albacore and southern bluefin tuna. Juvenile yellowfin are often found schooling with skipjack. Adult yellowfin and bigeye are mainly deep swimming and are caught by longline fishing at depths of 80 to 150 fathoms. However schooling adult yellowfin are often surface feeders and are captured by purse-seine fishing.

The South Pacific Commission is currently evaluating a yellowfin tagging program in the region. It is generally believed that the stocks of these large tuna, based on reported hook rates, are not being overexploited.

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Table A-1
Foreign Vessel Tuna Catch in Tuvalu EEZ
(figures in metric tons)

Gear Type	Country	1989	1990	1991	1992	1993
Purse Seine	USA	61	2,952	23,838	5,172	2,427
	FSM				294	
	Australia					
	Taiwan			20		
Pole-and-Line	Japan					
Longline	Korea	5,157	308	69	29	

Source: Forum Fisheries Agency, Honiara
Blank spaces indicate lack of data.

ANNEX B

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT DEEPWATER BOTTOMFISH PROJECT

The deepwater bottomfish project, part of the United States Agency for International Development (USAID) Pacific Islands Marine Resources (PIMAR) program, is being carried out through a cooperative arrangement between the Government of Tuvalu (GOT) and a United States consulting firm, RDA International. Approximately US\$1 million has been authorized for the Tuvalu component. As originally conceived, the project comprised six target areas:

- field survey of potential bottomfish resources (snapper and associated species), primarily on seamounts south of Niulakita;
- fishing trials to determine optimal gear and vessels for exploiting the resource;
- marketing trials (in Fiji and Hawaii);
- development of a resource management plan;
- training; and
- boat construction.

Due to the scheduled closure of the USAID office in Suva, the project will terminate in September 1994. The boat construction component will not be completed under current funding.

Research under the project to date has shown the existence of seamounts of much greater extent than previously realized. These relatively large seamount areas provide ideal habitat for what is believed to be a very rich bottomfish resource, one which up until now has remained virtually untapped. During initial field trials using the *M/V Manau*, in excess of 6,000 kg of deep-sea snapper was caught in 1992. Preliminary results suggested that yields of about 6 kg per reel per hour would be possible; based on more recent trials, that figure has been revised upward to as much as 8 kg per reel per hour, a yield which is better than commercial yields presently being obtained in Tonga, Fiji, or Kiribati. Maximum sustainable yield is yet to be determined, and on that basis, a management plan will be formulated. Due in part to the non-mobile nature of the resource (snapper and other bottomfish are born, reproduce, and die within the same limited area), bottomfish are particularly sensitive to over-fishing. Thus the importance of a sound management plan cannot be overemphasized.

The original project design proposed to utilize a weekly allotment of approximately 1500 kg of air cargo space on Air Marshall Islands flights from Funafuti to transport chilled snapper to Fiji for transshipment to Honolulu. Using the *Manau* and a second vessel, the *Tasu I*, market trials have recently been undertaken; thus far, several shipments of approximately 300 kg each have been sent by air to Honolulu via Nadi. The landed wholesale prices being realized have averaged around US\$12 per kg.

Due to irregularities in service, limited capacity, and high freight rates, transport of fish by air out of Funafuti is a "weak link" in the proposed marketing concept, especially if marketing of commercially-viable quantities is to be achieved. An alternative under consideration is to carry the chilled fish directly by boat from the southern seamounts to Fiji. Under this alternative, valuable by-catch species (e.g., dogtooth tuna) could be marketed directly in Nadi. Until the uncertainties and excessive expense of air service out of Tuvalu are resolved, the option of transporting fish to Nadi by sea seems preferable.

The trial project has already demonstrated the potential viability of a commercial operation; further information to be gathered and analyzed regarding the extent of the resource will help to determine the upper limits of sustainability for such an operation.

ANNEX C

MARINE RESOURCE LISTS

The following tables outline information regarding the taxonomy and/or commercial potential for selected marine products.

Table C-1
Representative Pelagic and Demersal Fishes of Potential Economic Value - Tuvalu

Fish Species, English (Common) Name	Latin Name (Tuvaluan Name)	Comments
1. Pelagic Species		
Skipjack tuna	<i>Katsuwonis pelamis</i> (atu)	potential basis for large-scale commercial purse seine or pole-and-line fishing; important resource for subsistence and artisanal fishing by trolling; dried or smoked for local consumption or export
Yellowfin tuna	<i>Thunnus albacares</i> (takua, kasi)	"
Wahoo	<i>Acanthocybium solandri</i> (paala)	"by-catch" of commercial fishing operations; important resource for subsistence and artisanal fishing by trolling
Dolphinfish, mahimahi	<i>Coryphaena hippurus</i> (masimasi)	"
Pelagic sharks, various species	Charcharinidae (mago)	not culturally-accepted as food source; fins can be dried for export
Flying fish	<i>Cheilopogon</i> spp. <i>Cypelurus</i> spp. (isave)	important resource for subsistence and small-scale commercial fishing; dried or smoked for local consumption or export; also usable as bait for longlining
2. Demersal species (bottomfish)		
Red snapper	<i>Etelis carbunculus</i> (palu malau puku)	caught by bottom line and hand reel; used for subsistence; potential for commercial export fresh-chilled
Longtail snapper	<i>Etelis coruscans</i> (palu malau loa)	"
Flower snapper	<i>Pristipomoides zonatus</i> (palu savane)	"
Opakapaka (pink)	<i>Pristipomoides filamentosus</i> (palu maut)	"
Opakapaka (yellow tail)	<i>Pristipomoides auricilla</i>	"
Red tail snapper	<i>Lutjanus fulvus</i> (tagau)	"
Honeycomb rockcod	<i>Epinephelus merra</i> (gatala liki)	"
Marbled cod	<i>Epinephelus microdon</i> (gatala)	"
Red jobfish	<i>Aphareus rutilans</i> (palupalu sega loa)	"

Table C-2
Commercial Value of Beche de Mer Species

Common Name (Scientific Name)	Relative Market Value ¹
teat fish (<i>Microthele nobilis</i>)	●●●●
black fish (<i>Actinopyga miliaris</i>)	●●●
deepwater redfish (<i>A. achinites</i>)	●●●
surf redfish (<i>A. mauritiana</i>) ²	●●●
stonefish (<i>A. lecanora</i>)	●●●
prickly fish (<i>Theleota ananas</i>)	●●
sand fish (<i>Holothuria scabra</i>)	●● ³
leopard fish; tiger fish (<i>Bohadschia argus</i>)	●●
chalky fish (<i>B. marmorata marmorata</i>) ⁴	●●
(no common name) (<i>B. m. vitiensis</i>)	●
lollyfish (<i>Halodeima atra</i>) ⁵	●
(no common name) (<i>Stichopus variegatus</i>) ⁶	●
green fish (<i>Stichopus chloronatus</i>)	--
pink fish (<i>Halodeima edulis</i>)	--

Sources: Joseph, Leslie 1992. Review of the Beche de Mer (Sea Cucumber) Fishery in the Maldives. FAO/Bay of Bengal Programme; South Pacific Commission 1974. Beche-de-Mer of the South Pacific Islands: a handbook for fishermen. Noumea, New Caledonia.; local interviews.

¹ ●●●● = highest value; ● = lowest value; -- = no commercial value

² Of fairly common occurrence in Tuvalu.

³ Certain varieties of this species may command higher prices.

⁴ Rare in Tuvalu.

⁵ Abundant in Tuvalu.

⁶ May not occur in Tuvalu.

**Table C-3
Pacific Precious Corals**

Genus (common name)	Distribution	Depth	Method of Harvest	Value, US\$
<i>Antipathes</i> (black tree coral)	throughout region	20-80 m	diving with SCUBA gear	\$10-25/kg
<i>Cirripathes</i> (black whip coral)	throughout region	20-80 m	diving with SCUBA gear	\$2-10/kg
<i>Corallium</i> (precious pink coral)	Japan, Philippines, Hawaii, Midway Is.	100-1500 m	dredging with weighted sled	\$100-1500/kg

Table C-4
Genera and Species of Giant Clam (Tridacnidae)

Species	Occurrence in Tuvalu	Comments
1. Genus <i>Tridacna</i>		
<i>T. gigas</i>	shells found, but species believed extinct in Tuvalu	largest species, could be re-introduced to re-stock reefs
<i>T. maxima</i>	species found in very limited quantities	large species which may be suitable for culturing
<i>T. derasa</i>	non-native species introduced for culturing trials	while species grows in Tuvalu, culturing of native species is preferable
<i>T. squamosa</i>	species near extinction in Tuvalu	small species which may be suitable for culturing
<i>T. crocea</i>	absent	
2. Genus <i>Hippopus</i>		
<i>H. hippopus</i>	absent	
<i>H. porcellanus</i>	absent	

ANNEX D

PATROL BOAT PROGRAM

Recent commitments made as part of Australia's Defence Cooperation Program promise to enable the Government of Tuvalu to better regulate fishing activities, and more accurately assess fees to be charged for fish catches taken by foreign vessels operating in the Exclusive Economic Zone (EEZ). Under the program, Australia will provide Tuvalu with a patrol boat to conduct policing activities. The patrol boat program will be administered by the Tuvalu Police (presently part of the Prime Minister's portfolio), who have the authority for law enforcement, search and seizure, and arrest of violators. Observers from Fisheries Department will accompany the patrol boat surveillance voyages.

The program will include funding of a team of trainers and advisors. One of their primary duties will be to prepare Tuvaluans to assume responsibilities for operation and maintenance of the vessel following the initial training period.

It is hoped that the presence of the patrol vessel will force distant-water fishing nations into stricter compliance with EEZ regulations.

A provisional cost estimate for the patrol boat program follows.

**Patrol Boat Project
Provisional Cost Estimate¹**

ITEM	COST, A\$
1. Initial Costs to Australia	
Patrol Boat	\$ 5,500,000
Project Management	123,000
Training (19 persons)	327,000
Advisor Housing	800,000
Patrol Boat Workshop	300,000
Other (boat delivery, travel, per diem, etc.)	<u>372,000</u>
Total	\$ 7,422,000
2. Annual Recurrent Costs to Australia	
Advisors (3)	\$ 200,000
Fuel and Lube Subsidy	150,000
Miscellaneous Administrative	<u>186,000</u>
Total	\$ 591,000
3. Initial Costs to Tuvalu	
Recruiting and Training	\$ 10,000
Travel and Communications	39,000
Other (administrative, medical, uniforms)	<u>13,000</u>
Total	\$ 62,000
4. Annual Recurrent Costs to Tuvalu	
Personnel (19)	\$ 95,000
Slipping Costs	25,000
Training	8,000
Miscellaneous supplies (uniforms, tools, food)	14,000
Other (administrative, maintenance)	<u>6,000</u>
Total	\$ 148,000

¹Source: Office of the Commissioner of Police.

ANNEX E

REVIEW OF MAJOR ASSISTANCE AND RECENT PROJECTS

1. Introduction

As is consistent with Tuvalu's policy toward foreign assistance, all the aid in the fisheries sector has been in the form of either grants or technical assistance, with no loan assistance having been provided to date. Principal assistance has come from providers including Australia, New Zealand, Japan, the United States, and UNDP. Most of the major foreign assistance programs provided to the fisheries sector through 1991 are listed in Table E-1. Further details regarding assistance programs of specific donors is contained in Tables E-2 to E-6, and summarized below.

Australian assistance to fisheries (Table E-2) has been comprised of a mix of training technical assistance, research funding, and contributions of equipment. Projects have been undertaken through several agencies, including AIDAB and ACIAR. Major funding has been provided for fisheries advisors, both within NAFICOT and Fisheries Department. Unfortunately, for the most part, skills required to pass on the responsibilities of these positions have not been acquired by Tuvaluans. At present, funding is being provided for development of two outer islands fishing centers. These projects have suffered considerable delays and cost overruns.

Australia has also been active in providing surveillance assistance in the Tuvalu EEZ, and will be contributing a patrol boat in late 1994. The activities relate directly to the ability of Tuvalu to effectively monitor and assess fees for foreign vessels active in the EEZ.

Japanese-funded projects (Table E-3) have focused primarily on donations of equipment and infrastructure development. These have included the construction of a wharf and Fishing Center on Vaitupu, and donation of several training vessels, including the *Te Tautai*, *Manauli*, and six smaller training craft. The *Te Tautai* performed useful research functions during the Japan International Cooperation Agency (JICA)-funded tuna and baitfish surveys, and under charter to the SPC for use as a survey vessel in the Regional Tuna Tagging Programme. The Japanese have also provided funding for the long-term services of an outboard engine mechanic.

United States funding (Table E-4) to fisheries has been mainly for the deepwater bottomfish project, part of the USAID PIMAR program. Approximately US\$1 million has been authorized for the Tuvalu component (see details of this project in Annex B).

Most of the assistance relating to fisheries coming from New Zealand (Table E-5) has been for blasting of reef channels. Other projects have been primarily research-oriented, and have included studies of ciguatera toxicity, trochus introduction, and seaweed farming. New Zealand has also contributed to EEZ surveillance capabilities through the activities of its military patrols.

The United Nations has funded a variety of projects through UNDP and FAO. Recent assistance to the Tuvalu fisheries sector has come primarily through the in-country Development of Artisanal Fisheries Project, and through the Regional Fisheries Support Programme, a project encompassing assistance to 15 Pacific Island countries. Details of the budget for the former program are provided in Table E-6. The latter program has provided technical assistance for a wide range of small scale projects, including,

among others, training for boat-building, fisheries-related lagoon monitoring, outer islands training courses, fish processing, and equipment repair.

The EU has not provided any assistance to date to Tuvalu under their national indicative program. However, Tuvalu has derived benefit from European funding of the Regional Tuna Tagging Programme implemented by the SPC, and of the Regional Tuna Management Programme implemented through the FFA.

The ADB has only recently become a donor for Tuvalu. The present technical assistance, valued at approximately US\$100,000, is the first project funded in the fisheries sector by ADB. It is likely that any future assistance by ADB would likewise take the form of technical, rather than loan, assistance.

2. Lessons to be Learned from Past Examples in the Fisheries Sector

Some examples of failed fisheries assistance projects in Tuvalu have already been cited. On a broader, regional scale, outside efforts to aid the fisheries sector have generally not lived up to the hopes and expectations of either the donors/partners providing the assistance, or the intended recipients.

The purpose of this section is to call out cases, both from Tuvalu specifically and the region generally, which illustrate pitfalls which must be avoided in designing and implementing constructive, meaningful projects. It is only through a critical review process such as this that steps can be taken to ensure that future planning will be successful.

a. Tuvalu Examples

Following are programs or projects which have fallen significantly short of their expected benefit to Tuvalu.

i. F/V Te Tautai

This vessel is a pole-and-line training vessel presented to the GOT by Japan in 1982. The declared value of this aid package was US\$1.5 million. The vessel has little value for the development of the Tuvalu fishing industry. The bait resources for this type of vessel are not adequate. There are no existing facilities to service the vessel. Fish hold capacity is not sufficient to carry catch to the nearest available market.

The only commercial utilization of the vessel was for trial fishing in Fiji and operation under management contract by the Solomon Island NFC. The most benefit it has provided to Tuvalu was during its operation under charter to the SPC for use in the Tuna Tagging Programme.

Today the *Te Tautai* is at anchor in the Funafuti lagoon, with no clear employment opportunity. Maintenance is costing A\$2,000 per day and a total refit is due which would likely cost at least A\$300,000 (for operating history see Table 10).

ii. Extension Training Vessels

The Japanese Government provided Tuvalu with six 10-m vessels with 45 hp diesel engines to be used for training. The only use for this type of craft would be for training in drop-line fishing on the outer reef slopes. However, Tuvaluan fisherman already are adept at that method. The vessels are too expensive to operate commercially. Due to inadequate care, only two of the original six vessels are presently operative.

iii. Vaitupu Fishing Center

This is a small (approximately 300 sq m) building equipped with apparatus to produce solar power for the operation of two household-type chest freezers. The project included a jetty for a fish landing which was destroyed by high seas almost immediately after it was completed.

Japan valued this contribution at US\$3 million. The consultants estimate the actual cost of the building and solar power equipment to be about US\$350,000. The value of the destroyed jetty is estimated at US\$150,000.

iv. Fish Processing Facility, Funafuti

The Teone fish market and processing center on Funafuti was built and equipped in the early 1980s, primarily with foreign assistance from Australia. It is under the management of NAFICOT. While the building itself is sound, the freezers which it houses are non-functional; their compressors have rusted due to exposure to salt air. In the implementation of this project, inadequate allowance was made for the need to provide on-site refrigeration maintenance capability and spare parts. Even when operative, the freezers were quite expensive to run, requiring about A\$1,000 monthly in electricity. Furthermore, the freezers are too small to be of use for storage of fish for export. The principal usefulness of these freezer units, if functional, would be for keeping fish fresh to supply the local market during seasons when fresh fish was not readily available. At the present time, the only equipment which is functional are several chest-type freezers and a smoking cabinet used to smoke and dry fish.

v. Community Fishing Centers, Outer Islands

Under assistance from AIDAB, plans were developed in the early 1980s to establish Outer Islands Community Fishing Centers on two islands, Nanumea and Nukufetau. The original project concept proposed an "appropriate technology" approach to fisheries development. The intent was that these centers would be established to process fish by natural drying processes (sun, salt, and smoke drying). Fish could then be stored for long periods, and shipped out, as accumulated, to Funafuti and foreign export destinations.

It seemed that this approach addressed the major constraints facing the outer islands in terms of their abilities to develop fish production, especially the obstacle posed by limited availability of transportation. Regrettably, disagreements arose over several issues. Among the points under contention was the question of whether or not these facilities should be equipped with small freezers which could be used to accumulate fish prior to initiating drying runs. Because of such disagreements, serious delays in implementation ensued; only recently, many years after the original project conception, has construction work begun on these centers. Cost overruns have thrown the overall budget for these projects out of proportion with the modest goals they set out to achieve.

b. Regional Projects

The following examples, drawn from neighboring South Pacific countries, are believed to represent case histories of particular relevance and instructive value for Tuvalu.

i. Solomon-Taiyo Fishing Company

This is a tuna fishing and tuna cannery joint venture (J/V) between a Japanese firm and the Government of the Solomon Islands established in Honiara in the late 1970s. The Japanese firm manages the operations and handles all the logistic requirements as well as the marketing of both the catch and cannery product. The Solomon Island Government has not prospered under this arrangement.

ii. Marshall Islands Purse Seine Joint Venture

During 1990 the Government of the Republic of Marshall Islands (RMI) concluded J/V arrangements for the operation of two separate American purse seine vessel owners. The American partners received cash from RMI, 70 percent of the stated value of the vessels. The Americans retained a 30 percent ownership and a contract to operate the vessels.

After about 15 months the RMI Government could see that the operations were losing money and wanted to sell the vessels. The best offer that they received for one of the vessels was \$1.5 million. They had paid \$4.5 million for their 70 percent share.

iii. Federated States of Micronesia Joint Venture

Federated States of Micronesia (FSM) had a very similar experience to that of Marshall Islands, involving three grossly overpriced old purse seine vessels purchased from an Australian firm.

While the above examples highlight some of the failures of development projects in fisheries, there are a few positive examples which can be cited. The M/V *Manau*, a gift from Japan to Tuvalu, is a vessel whose design is appropriate for use in Tuvalu's waters. It has been successfully employed for a variety of functions, including transport, research, and extension training. The recent USAID bottomfish project is Tuvalu's first project aimed at the export of fish to achieve even marginal success. The in-depth market feasibility study component of that project should serve as a model for future projects aimed at commercialization and export.

c. Conclusions

Most of the problems which have arisen in connection with past external assistance projects can be traced to a few major oversights or shortcomings. These are described below, and possible treatment suggested.

- Past failed assistance projects in some cases have exacerbated existing problems, and have cost the recipient country considerable money and time lost in moving toward stated development goals. It is thus crucial that the recipient country be selective in considering projects, and accept only those projects which address a specific need, and which are appropriate for the conditions which exist in the country, taking into account existing infrastructural capability, social concerns, and environmental factors.

- Without providing a budget and training for maintenance and repair of expensive equipment, material contributions will inevitably, over time, be subject to breakdown. Thus donors need to assure that an adequate start-up maintenance budget be provided for, say, the first five years following installation of new equipment or facilities. This should be supplemented by adequate funding and technical assistance to train local counterparts so that they will be able to assume the maintenance and repair responsibilities.
- Recipients need to be aware that avenues other than joint venture should be considered for financing of ambitious projects. While superficially often the easiest alternative, joint venture can result in the local partner losing out on potential profits as the business activity is developed.
- There are numerous other examples where foreign opportunists have taken advantage of small developing countries. Government officials concerned with evaluating proposed projects should seek advice from regional organizations such as the FFA or ADB. Industry consultants could be retained to evaluate these proposals.

Table E-1
Major Fisheries Projects and Programs Receiving Foreign Funding, 1988-1991¹

Project/Program	Total Funding for Period (US\$000)	Source
Commercial fisheries management	345	Australia, Japan, USAID
Fish marketing/processing center	69	Australia, UK
Jetty improvement, slipway	15	Japan
Community fishing centers	900	Japan, Australia
Extension/collection/research vessel	173	Japan
Commercial fishing vessels	264	Japan
Artisanal fishing loan scheme	225	Australia
Extension	150	UN, Japan, USAID
Vaitupu channel improvement	150	Japan
Ciguatera (fish poisoning) survey	18	NZ/ARDU
Foreign fishing agreements	—	none
Delineation	188	CFTC
Surveillance/enforcement	195	FFA
Trochus production	23	NZ, USAID
Giant clam culture	45	Australia, NZ
Milkfish farming	75	FAO, NZ
Seaweed production	23	FAO, NZ
Beche-de-mer	19	Australia, Japan
Restructuring of Fisheries Division	—	none
Training	—	various
Resource assessment	200	USAID, FFA, SPC
Total	3,025	(all donors)

Source: Government of Tuvalu, Fourth National Development, 1988

Table E-2
Australian Assistance to Tuvalu
Fisheries Sector (A\$000, 1988-1993)

Project	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	Total
ACIAR projects: giant clam mariculture, etc.				70.3	25.1			95.4
Outer islands fisheries	12.0	42.4	190.8	98.2	66.8	666.0est	140.0est	1216.2est
Fishery adviser	81.0	73.2	15.9					170.1
Fish marketing and processing	7.0							7.0
TOTAL	100.0	115.6	206.7	168.5	91.9	666.0est	140.0est	1658.8est

Source: AIDAB (1994).

Table E-3
Japanese Assistance to Tuvalu
Fisheries Sector

Project	Fiscal Year	Description	Value, US\$000,000
Fisheries Development	1980	provision of <i>Te Tautai</i> as training vessel for fishing tuna, skipjack	1.6
Fishing Communities Development I	1987	provision of six (6) coastal training vessels, outboard engines, fishing gear	1.3
Fishing Communities Development II	1988	provision of <i>Manauti</i> as training support vessel	0.9
Fishing Communities Development III	1989	Funafuti Fishing Center slipway; trucks, etc.	1.0
Fishing Communities Development IV	1991	Vaitupu Fishing Center; slipway and jetty	3.2

Source: Embassy of Japan, Suva (1994).

Table E-4
United States Assistance to
Tuvalu Fisheries Sector

Project Title	Description	Years in Effect	Total Funding, US\$
South Pacific Fisheries Treaty Program (#879-0011)	boat maintenance, trial fishing/processing, other	1988-1992	354,000
South Pacific Fisheries Development Project (#879-0009)	miscellaneous training (mariculture, NAFICOT, computers); equipment (FADs)	1986-1992	282,000
Pacific Islands Marine Resources Project (PIMAR) (#879-0020)	Bottomfish Stock Assessment, Fishing Trials, Market Trials	1991-1994	1,070,000 ¹
Total			1,706,000

Programs, various	1995 onward	125,000/yr ² (est.)
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Source: USAID, Suva (1994).

¹ Of the total amount appropriated, some 65%, or US\$695,500, has been spent to date.

² From funds allocated under the South Pacific Fisheries Treaty and administered by the FFA.

Table E-5
New Zealand Assistance to Tuvalu
Fisheries Sector

Project Description	Period Funded	Value, US\$000
Reef Channel Blasting - development of new channels and maintenance of existing channels for navigational access between islands and open sea	1993	340
Ciguatera Monitoring - public education and ciguatera testing	1993-1994	22
Traditional Canoes for Niutao - in response to an outbreak of reef fish ciguatera poisoning following reef blasting, provided fishing canoes to enable residents to get beyond reef for fishing	1990-1991	25
Trochus Introduction - Goal to provide alternative protein source and potential for handicraft trade through trochus stocking on reef	1988-1990	24
Seaweed Farming - Project aimed to develop seaweed farming in outer islands for export	1988-1990 (and beyond)	72
Jetty and Slipway Construction - Part of a coordinated program intended to foster small scale fisheries, including fish market, extension program, inshore fisheries development	1983-1984	55
Inshore Fisheries Vessel - Provision of plywood vessel with 20hp motor for fishing in Funafuti lagoon	1981-1983	12

Source: Ministry of Foreign Affairs and Trade, Wellington (1994).

Table E-6
United Nations Assistance to Tuvalu
Fisheries Sector

Development of Artisanal Fisheries* Project Component	Funding, US\$ (rounded)							Total for Period
	1987	1988	1989	1990	1991	1992		
Project Personnel - Experts (Fisheries Extension Advisor, Consultant), UN Volunteer Mechanic, and personnel travel expense	35,500	31,300	5,100	(300)	0	700		72,300
Training - in-service training	4,400	0	0	0	0	6,600		11,000
Equipment - expendable and non-expendable	21,400	3,200	9,800	300	0	2,900		37,600
Miscellaneous - operations, maintenance, sundry	700	100	100	0	0	3,600		4,500
PROJECT TOTAL	62,000	34,600	15,000	0	0	13,800		125,400

Source: UNDP, Suva

ANNEX F

TERMS OF REFERENCE COMMERCIAL FISHERIES PROJECT IMPLEMENTATION ADVISOR

1. Introduction

The Government of Tuvalu plans to establish and implement commercial fishing projects aimed at exploiting abundant pelagic and demersal fish resources within their Exclusive Economic Zone (EEZ). Until the present time, fish capture efforts have been carried out almost entirely at subsistence levels sufficient to meet the limited requirements of village markets. Accordingly, the expertise required for taking the necessary actions to establish, equip, operate, and maintain a commercial fishing company is not available within the country. An advisor with a background of "hands-on" management experience in the commercial fishing business will be required to direct, train, and assist the selected Tuvaluan management team with the implementation and management of the projects.

2. Selection/Required Qualifications

Candidates for the position must have extensive experience in a full range of commercial tuna fishing and management functions including project planning, facilities planning, vessel operations, and the day to day operation of a commercial fishing company. Selection of the Advisor will be made by the Board of Directors of the National Fisheries Corporation of Tuvalu (NAFICOT).

3. Duties of the Advisor

The selected advisor will work with and assist two management trainees assigned to the project by NAFICOT for a term of five years and will direct and advise on the undertaking of the following listed principal functions as well as all other matters relating to the successful implementation and management of the projects:

- a) Advise the Government of Tuvalu on the priorities of project planning. Prepare schedules for implementation and cash flow requirements in order that implementation can proceed without loss of momentum and costly delays.
- b) Prepare an overall business plan for each commercial project component.
- c) Prepare specifications for the project vessels. Distribute bid documents to selected shipbuilding firms in the region or others wanting to participate.
- d) Select an engineering firm to draw up specifications for required shore facilities and prepare bid documents to be distributed to interested bidders.
- e) Prepare a "shopping list" of all materials, equipment, and supplies required for the project. Identify sources for procurement and devise a procurement schedule.

- f) Select the vessel construction bidder and execute the construction and delivery contract.
- g) Advertise in appropriate international fisheries publications for tuna purse-seine vessels and a refrigerated carrier vessel. Review replies and select those which appear to be suitable and conduct an inspection. Negotiate purchase of the vessels selected.
- h) Select a management contractor or joint venture partner and negotiate the terms of affiliation for the tuna purse-seine component of the project.
- i) Recruit personnel, both local and expatriate as required, for the seamount fishing component of the project.
- j) Commence operations of the seamount and purse-seine components. Supervise all aspects of the operations. Monitor vessel locations and daily activities. Coordinate marketing and product shipments.
- k) Following implementation and start-up of the seamount and purse-seine components, commence implementation actions for the troll fishing component. Negotiate a contract for the site preparation and jetty construction; purchase required machinery and equipment; engage building contractor for the construction of the refrigeration complex and other buildings; engage mechanical contractor for the installation and start-up of all systems.
- l) During the same time period of the above actions engage a naval architect experienced in the design and construction of the selected vessel type for the proposed small-scale fishing fleet. Negotiate a suitable contract and proceed with the purchase of required machinery, equipment, and materials for setting up the shipbuilding works and vessel construction.
- m) Engage required personnel for the operation of the shore support facilities. Devise a system for the selection of vessel operators.
- n) During all of the specific tasks of the project implementation procedures delegate, to the extent practical, as many of the actions as possible to the management trainees and second level personnel. The goal of the Advisor is to leave a competent local management team in place at the conclusion of his assignment.

4. Budget

Item	Cost
Remuneration, 60 months @ US\$ 7,000	US\$ 420,000
International travel	60,000
Travel per diem	78,000
Mobilization	5,000
Miscellaneous expense	<u>5,000</u>
TOTAL	US\$ 568,000

ANNEX G

PROPOSED PURSE SEINE FLEET PROJECT

1. Description of Vessels

a. Purse Seiners

Overall length (meters [m])	41.3
Length between perpendiculars (m)	36.6
Breadth (m)	9.5
Depth (m)	4.6
Fish hold capacity (metric tons [mt])	300.0
Main engine - Yanmar (shaft horsepower [shp])	1,100.0
Auxiliary engines - Yanmar (horsepower [hp])	3 x 250
Service speed (knots)	9.0
Fuel tank capacity (cubic meters [cu m])	70.0
Fresh water tank (cu m)	30.0

The vessels will be delivered fully equipped and ready to fish including a nylon net 600 x 125 fathoms and a skiff.

b. Scout Boats

Overall length (m)	12.0
Breadth (m)	3.0
Main engine (shp)	150.0
Auxiliary engine (shp)	20.0

2. Project Cost Estimates

a. Vessels

<u>Description</u>	<u>Estimated Cost</u> <u>(US\$ 000)</u>
Two 410 gross ton (gt) tuna purse seine vessels fully equipped with all necessary machinery, deck gear, navigating equipment, purse seine net, net skiff, ready for fishing operations	\$ 7,000
One approximately 1,000 gt refrigerated carrier vessel	1,500
Two 12-m light/scout boats fully equipped and ready for operation @ US\$225,000	450
Inventory of spare parts for above-described fleet	<u>200</u>
Subtotal (a)	\$ 9,150

b. Fishing Support Construction Costs and Materials

Cost to set and maintain FADs in the fishing area (\$2,500 x 50)	\$ 125
Construct and equip net mending yard	50
Pre-operating expense and working capital	<u>750</u>
Subtotal (b)	\$ 925
Subtotal (a)	<u>9,150</u>
Total Estimated Project Cost	US\$ 10,075

3. Operating Procedures

About 50 FADs will be set in the selected fishing areas. About 25 FADs will be assigned to each scout boat which will constantly monitor them to ascertain which locations have the best fish concentrations. This information will be radioed to the purse seiners and the master fisherman will make the decision as to where the net will be set.

A purse seiner and a scout boat will rendezvous near the selected FAD early evening. If tuna are surface feeding in the area, the seiner will make a set with the net at dusk. Otherwise, the scout boat, equipped with bright lights, will attach to the FAD late evening and keep the lights on at maximum until an hour before first light of dawn. At that point the scout boat will detach the attractor from the FAD and the seiner will slowly circle the scout boat using sonar and fish finders to determine the size and location of the fish concentrations. Just before first light, the seiner will set the net around the scout boat and commence pursing the bottom of the net closed. The scout boat will pull the attractor aboard, proceed over the cork line and reattach the attractor to the FAD raft. The seiner will retrieve the net through the power block winch on the stern and commence brailing the catch aboard and into a tank containing chilled sea water.

After 12 to 18 hours in the circulating chilled sea water, the latent heat will be removed. The sea water will be pumped out and replaced by low temperature heavy brine at about -15°C. The catch will be thoroughly frozen to a core temperature of below -10°C. The brine will then be pumped out and the fish will remain in a frozen state by refrigeration coils around the fish tank held at -25°C.

The purse seiner will call for the refrigerated carrier vessel after it has loaded a catch of about 250 metric tons. The catch will be transferred and the carrier vessel will service the seiner with fuel and supplies.

Trip time will vary. Catches up to 100 mt per "set" are not uncommon, while other sets are not so successful. Our assumption here is based on an average daily catch of 16 mt per fishing day, a conservative estimate based on the catch rate of other vessels presently fishing in the same general area. Thus, some voyages could only last 3 to 5 days and others may be a month long. Vessel activities are further detailed below.

The purse seiners and scout boats will stay at sea and will be serviced by the carrier vessel which will purchase fuel and supplies at the delivery port. The carrier will stop at Funafuti after each delivery trip to load frozen catch produced by the small-scale fleet. Crew replacements for the purse seiners will also be picked up at Funafuti, as required.

Occasionally, if the purse seiner fills its fish holds early and the carrier vessel is not available, it may proceed directly to the delivery port to unload catch and take on supplies. The seiners will report to drydock in Suva annually. During particularly bad weather the seiners may anchor in the lee of an island until the storm has passed.

<u>Vessel Activities</u>	<u>Annual Activity (In Days)</u>
a. Purse Seiners	
Fishing days	246
Steaming days	39
Drydock/repairs and miscellaneous port time	40
Standby - bad weather/delays	<u>40</u>
Total	365
b. Scout Boats	
Fishing days, patrolling FADs	250
Setting/changing FADs	60
Repairs and standby	<u>55</u>
Total	365
c. Carrier Vessel	
Steaming time - 8 trips per year	160
Steaming time - fishing grounds	20
Port time, turn around	65
Fish transfer from purse seiners	100
Drydock and repairs	<u>20</u>
Total	365

4. Vessel Fuel Consumption

Based on the running times of both the main and auxiliary engines during the aforementioned operating schedules, and using recognized fuel consumption formula, it is estimated that annual fuel consumption will be about 7,000 kiloliters (kl). Assuming fuel cost is US\$250 per kl, total fuel purchased will be \$1,750,000 annually.

5. Estimated Catch, Catch Composition, and Value

According to catch rates reported by distant water fishing fleets operating in the same areas as intended for this project, the per-vessel average catch is 16 to 18 mt per day. It is assumed, therefore, that project catch will average 16 mt/day. Thus, an annual catch per vessel of 4,000 mt is assumed, for a total fleet catch of 8,000 mt. Table G-1 reflects these assumptions, plus assumptions regarding the catch composition (based on fleet reports), and ex-vessel value.

6. Vessel Crew Cost

It is assumed that experienced tuna purse seine crews and skills will not be available in Tuvalu. For vessel crewing it will be assumed that required skills will be recruited from the Philippines and deck labor will be recruited locally. A listing of the required crew ratings follows:

a. Purse Seiner

<u>Rating</u>	<u>Number Required</u>	<u>Tonnage Rate</u>	<u>Annual Cost</u>
Captain/Navigator	1	5.00	\$ 18,750
Master Fisherman	1	5.00	18,750
First Mate	1	3.50	13,125
Deck Boss	1	3.00	11,250
Chief Engineer	1	5.00	18,750
Assistant Engineer	1	3.50	13,125
Reefer Engineer	1	3.00	11,250
Oilers	2	1.00	7,500
Winchman	1	1.25	4,687
Skiffman	1	1.25	4,688
Cook	1	1.25	4,687
Deck Hands	9	0.75	25,313
Total Per Vessel	21	40.50	\$ 151,875
Two Vessels	42		\$ 303,750

b. Scout Boats

<u>Rating</u>	<u>Number Required</u>	<u>Tonnage Rate</u>	<u>Annual Cost</u>
Captain	1	2.00	\$ 7,500
Engineer	1	2.00	7,500
Deck Hands	5	1.00	18,750
Total Per Vessel	7	5.00	\$ 33,750
Two Vessels	14		\$ 67,500

c. Carrier Vessels

<u>Position</u>	<u>Number Required</u>	<u>Monthly Salary</u>	<u>Annual Cost</u>
Captain	1	1,500	\$ 18,000
Chief Mate	1	1,000	12,000
2nd Mate	1	700	8,400
Boatswain	1	500	6,000
Deck Hands	12	300	43,200
Chief Engineer	1	1,500	18,000
1st Assistant Engineer	1	1,000	12,000
2nd Assistant Engineer	1	700	8,400
Reefer Engineer	1	500	6,000
Electrician	1	500	6,000
Oilers	3	300	10,800
Deck Hands	12	250	36,000
Cook	1	400	4,800
Galley/Helpers	<u>2</u>	300	<u>7,200</u>
Total	27		160,800

7. Staff Personnel Salaries

<u>Position</u>	<u>Number Required</u>	<u>Annual Salary</u>	<u>Cost</u>
General Manager	1	30,000	\$ 30,000
Operations Manager	1	15,000	15,000
Accountant	1	15,000	15,000
Electronics Technican	1	10,000	10,000
Clerks	3	5,000	15,000
Warehouse	<u>2</u>	3,500	<u>7,000</u>
Total	12		\$ 92,000

8. Annual Vessel Operating Cost

a. Depreciation Schedule

<u>Item</u>	<u>Initial Value</u>	<u>Straight Line Years</u>	<u>Depreciation</u>
Purse Seine Vessels (2)	\$7.0 M	10	\$ 700,000
Scout Boats (2)	0.45 M	10	45,000
Carrier Vessels (1)	1.5 M	10	<u>150,000</u>
Total			\$ 895,000

b. Reserve for Vessel 5 Year Refit (annual)

Purse Seiners	\$ 60,000
Scout Boats	10,000
Carrier Vessels	<u>30,000</u>
Total	\$ 100,000

c. Estimated Cost, Annual Drydock/Repairs

Purse Seiners	\$ 180,000
Scout Boats	20,000
Carrier Vessels	<u>100,000</u>
Total	\$ 300,000

August and September are said to be the lean fishing months in the project area so it is suggested this would be the best time to undertake annual drydocking, maintenance, and repair of the fleet. Drydocking facilities for vessels of the size to be used for the purse seine project are available in Fiji and Townsville, Australia. The scout boats could be drydocked and repaired at the same ports.

Before each purse seine vessel proceeds to drydock, nets would be hauled ashore at the Funafuti base for thorough inspection and replacement of webbing as required.

9. Summary - Annual Operating Cost

a. Variable Cost Items

<u>Item</u>	<u>Amount</u> <u>(US\$ 000)</u>
Vessel Fuel Cost	\$ 1,750
Lube Oil and Filters	85
Salaries and Bonus Payments	
Vessels	599.5
Management and Staff	42.0
Employee Benefits	<u>10.3</u>
Crew Provisions (\$3/man/day)	106
Salt, estimated \$6/mt of catch	45
Net Repairs and Spares	90
FAD Replacements	100
Annual Maintenance (Vessels)	300
Administration Expenses	50
Port Fees, Carrier Vessel	<u>40</u>
Subtotal	\$ 3,268

b. Fixed Cost Items

Insurance			
	Vessels	\$ 295.0	
	Shore Facilities	<u>5.0</u>	\$ 300
Reserve for Five Year Vessel Refit			100
Depreciation Schedules (rounded)			<u>895</u>
Subtotal			\$ 1,295
Total Annual Operating Expense			\$ 4,563

Estimated Operating Margin: \$2,875,000
(approximate 28 percent return on investment)

**Table G-1
Annual Catch Estimate, Composition and Value
for Proposed 2-Vessel Purse Seine Fleet**

Species/Size	Percent of Catch	Quantity (mt)	C&F Price (US\$000/mt)	Value (US\$000)
yellowfin, > 10 kg	7	560	1,100	616
yellowfin, 5-10 kg	20	1,600	1,020	1,632
skipjack, < 1.8 kg	7	560	500	280
skipjack, > 1.8 kg	61	4,880	960	4,684
bonito	5	400	565	226
TOTAL	100	8,000	930¹	7,438

Price reference: 15 February 1994 from monitored tuna deliveries to American Samoa canneries.

¹ Rounded figure; reflects weighted average ex-vessel value.

ANNEX H

PROPOSED COMMERCIAL SEAMOUNT FISHERY PROJECT

1. Equipment

<u>Vessel Description</u>	<u>Metric</u>	<u>English</u>
Length Overall	15.2 m	50 ft
Breadth	4	13
Depth	2.3	7.5
Marine Engine	200	
Aux. Engine	25 hp (15 kw)	
Fishhold capacity	20 m ³	700 ft ³
Max speed	9 knots	
Service speed	7.5 knots	
Fuel capacity	5000 l.	
Fresh water tanks	3500 l.	
Crew accommodations	4 persons	

Electronics

Radar (30 mile)
Weather fax
Searchlight sonar
Echo sounder
SSB radio

Navigation Equipment

Auto pilot
Bridge controls
Magnetic compass
GPS

Refrigeration

Fincoils in fishhold overhead with evaporative temperature of 0°C (32°F) using 3 hp compressor drive.

Optional air conditioning for pilot house and crew quarters.

Deck Equipment

Hydraulic fishing reels, hydraulic anchor winches, required pumps, and all other required machinery, equipment, and furnishings.

2. Assumptions

Fuel Consumption

- a) Main engine (at service speed of 30 l/hr)
- b) Auxilliary engine (3.75 l/hr)

Typical Nine-Day Voyage (Plus Four-Day Turnaround):

- 4 days (steaming to/from fishing areas)
- 5 days (fishing)

Fuel Consumption:

a) Main engine	
Steaming days (4 x 24 = 46 hrs x 30)	2880
Fishing days (5 x 8 = 40 hrs x 30)	1200
b) Auxilliary Engine (9 x 24 = 216 hrs x 3.75)	<u>810</u>
Total Liters	4890

Voyage Production:

6.5 kg per reel/hr	
4 x 12 (48 reel hrs/day; kg/day)	312
65% snapper/35% by-catch (kg/day)	110
Total Snapper (kg per voyage)	1,010
Total By-catch (kg per voyage)	550

Annual Vessel Activity:

a) Voyages (24 per year)	
Steaming days	46
Fishing days	120
Turnaround days	<u>96</u>
Total	262
b) Drydock and repair	33
c) Bad weather delays	<u>70</u>
Total	365

3. Financial Forecast

a) Sales: Snapper (24, 240 kg x US\$13.20)	US\$ 319,968
By-catch (13,200 kg x US\$3)	<u>39,600</u>
Total Sales	US\$ 359,568
	Say US\$ 360,000

b) Operating Cost (rounded)

<u>Item</u>	<u>Amount</u>
Fuel oil (117,360 l x US\$0.28 l)	US\$ 33,000
Lube oil and filters	3,000
Drydocking and repairs	19,000
Ice (50 mt x US\$40)	2,000
Fishing gear and equipment	5,000
Provisions (4 men x \$7/day x 330 days)	10,000
Insurance (4 percent x \$300)	12,000
Shipping containers and jell-pack (800 x \$40)	3,500
Shipping agent and storage, Nadi (\$0.50/kg)	12,000
Air freight (25,000 kg x US\$0.675)	17,000
Brokerage/handling fee (\$1.10/kg)	<u>27,000</u>
Total Direct Operating Costs	US\$ 144,000
Depreciation (\$375,000/10 years/Straight Line)	<u>37,500</u>
Total Operating Cost	181,500
Operating Margin	178,500

4. Administrative Expense (Three Vessels)

a) Salaries

Project Manager	25,000	
Secretary	<u>10,000</u>	\$ 35,000

b) Crew Transportation

Local crew changes	10,000	
Expatriate crew	<u>12,000</u>	22,000

c) Other Administrative Expenses

Travel	10,000	
Communications	5,000	
Miscellaneous office expenses	<u>2,000</u>	<u>17,000</u>
Total		US\$ 74,000

5. Annual Project Operating Results

Operating margin (three vessels)		US\$ 535,500
Less: Administrative expense	74,000	
Crew share (30% of operating margin)	160,000	<u>234,000</u>
Project Annual Earnings		US\$ 340,500

ANNEX I

FUNAFUTI FISHING BASE

Cost Estimates

1. Marine Works/Site Preparation

Prepare a site 1 m above road level 65 m by 40 m with lagoon dredging material and surface with 15 cm reinforced concrete.

<u>Item</u>	<u>Cost (US\$000)</u>
100 lineal meters sheet pile	250
65,000 cubic meters (m ³) dredge fill ¹	65
260 sq m 15 cm concrete surface	130
10 x 20 m jetty w/concrete pile support and concrete surface	<u>150</u>
Total	US\$595
2. Buildings²	
1,440 sq m steel frame, open sided metal roof building	225
Sandwich insulated panels for construction of the refrigerated spaces and iceplant	400
2 level office block, 144 sq m each floor	<u>235</u>
Total	US\$860
3. Machinery and Equipment	
Refrigeration machinery with capacity to operate three 15 ton circulating brine freezers; 10 ton/day flake ice plant; 1,800 m ³ anteroom at 10°C; and, two cold storage chambers of 1,875 m ³ each at -25°C	350
2 hydraulic cranes for lifting fish from vessels alongside wharf (1 ton capacity)	25
2 electric fork lift trucks (1 ton)	100
2 weighing scales	20
500 cold storage fish scows	200
2 crew boats	5
Flatbed truck (5 ton)	20
Pick-up truck	<u>15</u>
Total	US\$735

4. Beginning Inventories		
Machinery/equipment spare parts		75
Plastic (fish boxes)		25
Protective clothing (cold storage)		<u>5</u>
Total		US\$105
5. Office		
Furniture and air conditioners		60
Machinery (computers, etc)		15
Stationery/miscellaneous		<u>5</u>
Total		US\$80
6. Boat Building Facility		
Steel frame, metal clad, metal roof building 30 x 50 m on concrete slab		240
Patterns and jigs		20
Pools and equipment		<u>40</u>
Total		US\$300
7. Beginning Inventories, Boat Building		
All required materials for construction of 15 vessels		150
Beginning operating expenses		<u>50</u>
Total		US\$200
8. Architect and Engineering Cost		
Basic infrastructure (site preparation and jetty)		50
Project facilities		<u>70</u>
Total		US\$120
9. Cost Summary		
a. Basic infrastructure and engineering ³		US\$595
b. Project costs		
Buildings	860	
Architect and engineering	120	
Machinery and equipment	735	
Beginning inventory	105	
Office	80	
Boat-building facility	300	
Boat-building inventory	200	
Initial Cost of 10 FADs (@ US\$3,500)	<u>35</u>	
		US\$2,435

c. Annual operating cost

<u>Item</u>	<u>Cost (US\$000)</u>
1. Fish purchases (2160 mt x \$600)	1,296
2. Annual payroll:	
General Manager	15
Operations Manager	10
Boat-building Manager	15
Boat-building Foreman	10
Refrigeration Engineer	10
Mechanics (2 @ \$600/mo)	15
Radio Operator (2 @ \$400/mo)	10
Weighmaster (2 @ \$400/mo)	10
Forklift Drivers (2 @ \$350/mo)	9
Crew Boat Operators (2 @ \$350/mo)	9
Clerical (3 @ \$400/mo)	15
Labor (8 @ \$250/mo)	24
	(rounded) 150
3. Electric power (1,200,000 kw x US\$0.23)	275
4. Consumables:	
Safety clothing	5
Tools, fish boxes, etc.	5
Vehicle operations	5
	15
5. Administrative:	
Travel	30
Communications	5
Insurance	25
Office supplies	2
	62
6. Freight (2000 mt x \$25)	50
7. Plant maintenance	38
8. FAD maintenance	25
Total	US\$1,805
10. Annual Sales	
1. Frozen tuna (2,160 mt x \$850)	1,836
2. Ice Sales (1,500 mt x \$50)	75
3. Payments on vessels purchase	120
4. FAD maintenance payments	29
Total	US\$2,060

Cash Flow: US\$149,000 Annually

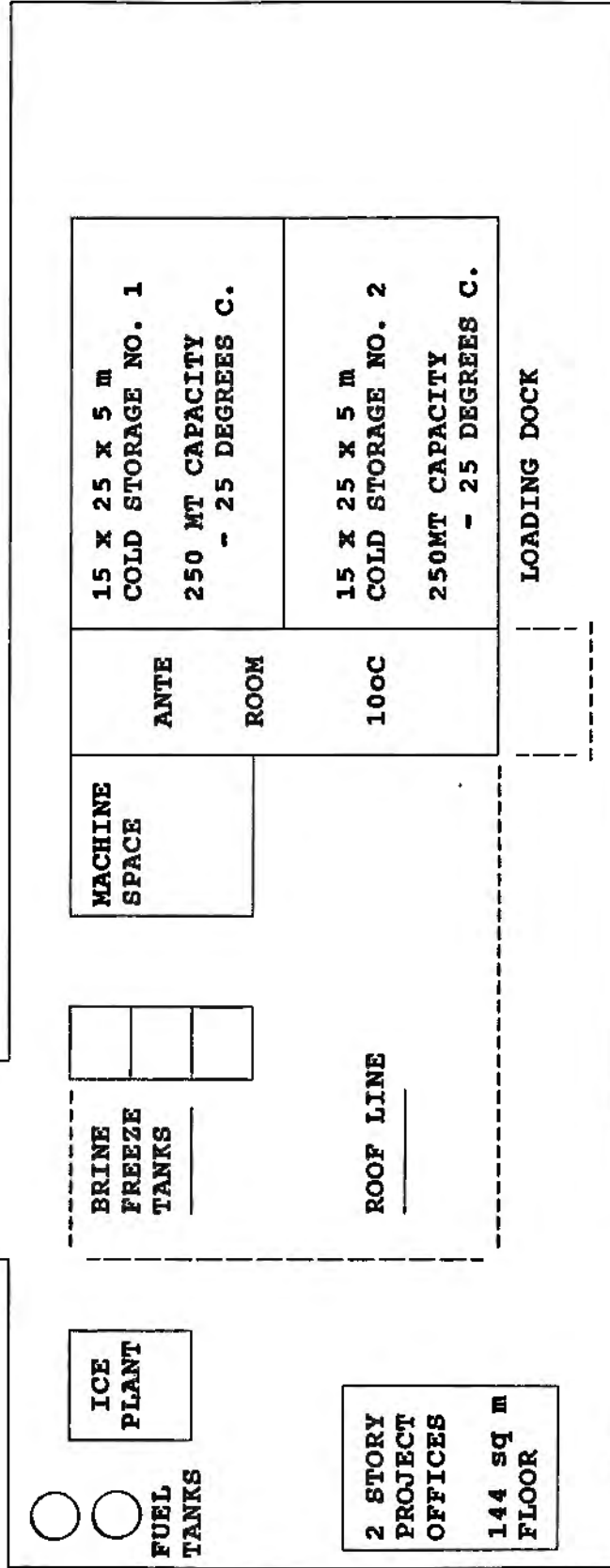
1. It is intended that implementation of this project should not cause any undue adverse environmental impacts. Therefore, it may be necessary to conduct an assessment of possible effects of dredging in the lagoon prior to acquisition of dredged material. However, costing of such an assessment is outside the scope of the present study.

2. **Figure I-1 shows the layout of the proposed facility.**
3. **Basic infrastructure and engineering costs are not chargeable to the project.**

PROPOSED SHORE SUPPORT FACILITIES
FUNAFUTI TROLL FISHING BASE

JETTY
10x20m

Figure I-1



REQUIRED AREA 40 X 62 M

ANNEX J

SMALL-SCALE FISHING FLEET PROJECT

1. 'Alia' Catamaran Trolling Vessel

a. Vessel Description

<u>Component</u>	<u>Metric</u>	<u>English</u>
Hull, overall length	9.4 m	30.8'
Beam, overall	3.0 m	9.8'
Beam, each hull	1.2 m	4.0'
Depth, each hull	1.5 m	5.0'
Cubic measure, each hull	14.4 m ³	508 ft ³
Engine (diesel): 30 shp		
Maximum speed: 13.5 knots		
Service speed: 10 knots		

b. Features

- aluminum hull, 2.5 mm welded
- 5 cm (2 inch) polyurethane insulation all around, both hulls
- Engine mounted aft between hulls. Propeller shaft equipped with universal joint retractable for lift of lower shaft and propeller above hull draft
- Alternator driven off main engine for battery charging and running lights
- VHF radio, magnetic compass

Estimated Vessel Cost

US\$11,000

Attachment 1 of this Annex contains a letter from O. Gulbrandsen, naval architect, indicating his willingness to supervise development of a boat-building facility for construction of the 'Alia' vessels.

c. Fuel Consumption

- Maximum speed: 6 l/hr
- Service speed: 3.6 l/hr

d. Operation Plan

Fishing operations will be in the vicinity of FADs two to five miles outside the Funafuti lagoon. Vessels will travel to the selected areas during early dawn in order to commence

trolling operations at first light. Fishing operations will continue all day. At dusk the vessels will return to base, weigh in their catch, wash down, refuel, and prepare for the next voyage. Vessels will use ice for catch preservation, one weight of ice to two weights of catch. The average work schedule is estimated as follows:

Fishing days	4 days/week x 45	180 days
Rest days	3 days/week x 45	135 days
Bad weather and repairs	3 days/week x 45	<u>50 days</u>
Total		365 days

For each 'Alia' vessel, hook rate working on FAD fish concentrations is projected to be about two skipjack per line hour; using four lines produces about 20 kg per hr. Estimating a 12 hour fishing day this extrapolates to about 240 kgs per fishing day, or 43,200 kg per year.

Using the foregoing assumptions, operating results are noted as follows.

Catch Sales (43,200 kg x US\$0.55)	US\$23,760
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e. Direct Operating Expenses (Rounded)

<u>Item</u>	<u>Amount</u>	<u>(US\$)</u>
Fuel (4 hrs x 6 l x 180 days + 8 hrs x 3.6 l x 180 days = 9,500 l x US\$0.40/l)	3,800	
Lube and filters	200	
Ice	1,500	
Provisions (4 men @ \$3.00/day)	2,000	
Fishing gear and equipment	400	
FAD use and maintenance (x \$.015/kg)	650	
Annual repairs	<u>1,500</u>	
Total	US\$9,150	
Direct Operating Margin		14,610
Less: crew share (50 percent)	7,305	
Payment for vessel	<u>2,400</u>	
Net to Owner		US\$4,905

2. 12-meter Class Gill Netter¹

a. Vessel Description

<u>Component</u>	<u>Metric</u>	<u>English</u>
Hull, overall length	12 m	39.4 ft
Breadth	3.3 m	10.8 ft
Depth	1.8 m	5.9 ft
Fish hold	18 m ³	635 ft ³
Main engine: 125 shp		
Auxiliary engine (10 kw genset): 15 shp		
Maximum speed: 9 knots		
Service speed: 7.5 knots		

Features

- Accommodation for five crew;
- Wooden frame, plywood skin w/fiberglass coat;
- Three inch (8 cm) polyurethane fish hold incubation;
- Superstructure, marine plywood;
- Hydraulic net hauling spool; and
- SSB radio, magnetic compass, 15 mile radar, fishfinder, bridge controls, GPS navigation, and standard safety equipment

Vessel Cost Estimate:

US\$165,000

Fuel Consumption

- Maximum speed: 5.5 l/hr
- Service speed: 3.2 l/hr

Fishing Gear

- 15 cm (6 in.) mesh 2 ply nylon gillnet 4,600 m (15,000 ft) length x 20 m (65 ft) depth
- 175 hook longline

b. Operating Plan

The vessel will be based at Funafuti and will travel offshore to selected fishing areas, an average of 12 hours, scouting for schooling fish at all times. The setting of the lines will occur in the late afternoon. The end of the longline will be attached to the last gill net buoy and the gill net set will proceed immediately after the longline has been set. The

¹This should not be confused with the 30-mile-long drift nets used by Japanese, Korean, and Taiwanese vessels which have been banned because of associated marine mammal kill.

vessel will stay attached to the net all night while drifting. At first light in the morning the net and the longline will be retrieved and the catch will be iced down in the fish hold.

Voyage Plan

Travel to and from fishing areas	1 day
Fishing days	4 days
Turnaround	<u>2 days</u>
Total	7 days

Annual Voyage Estimate **45 Trips Per Year**

Fishing days	180 days
Travel days	45
Turnaround	90
Bad weather delays	35
Repairs	<u>15</u>
Total	365 days

c. Catch Rate and Composition

Using catch data from Sri Lanka vessels of the size and gear type assumed here, voyage deliveries are as follows:

Skipjack	500 kg/day	2,000 kg/voyage
Yellowfin Tuna	100 kg/day	400 kg/voyage
Shark	300 kg/day	1,200 kg/voyage
Miscellaneous catch	30 to 50 kg/day	100 kg/voyage

Shark are butchered at sea for fins and tails, and the carcasses disposed of; however, if handled properly the shark meat could also be sold. The miscellaneous catch consists of other pelagic species such as rainbow runner, mahimahi, wahoo, and other marketable species. The catch value is estimated as follows:

Species	Weight	Landed Value kg	Total Value US\$
Skipjack	2,000 kg	US\$0.55	US\$1,100
Yellowfin	400 kg	US\$0.65	US\$ 260
By catch	100 kg	US\$2.00	US\$ 200
Shark fin (dried)	2.5 kg	US\$60.00	<u>US\$ 150</u>
Total catch value per voyage			US\$1,710
		Say	US\$1,700
Annual Catch Value			US\$76,500

d. **Operating Results (Annual)**

<u>Item</u>	<u>Amount (US\$)</u>
Fuel Oil: 45 days travel = 24 x 3.2 x 453.456 l	
180 days fishing = 8 x 3.2 x 180	4,608 l
Auxiliary engine 4 x 2.25 x 180	<u>1,800 l</u>
Total	9,864 l x US\$0.40/l
Lube oil and filters	280
Ice: 3 tons x 45 = 135 mt x \$50	6,750
Fishing gear and equipment (estimate)	2,250
Provisions (5 men x \$3/day x 180)	2,700
Annual repairs	12,000
Insurance (3 percent x \$140,000)	<u>4,200</u>
Total	\$32,125
Direct Operations Margin	44,375
Less: crew share ²	13,312
Vessel payments ³	<u>23,100</u>
For Captain/Owner	\$ 7,963

3. **Pole-and-Line Vessel**

a. **Vessel Description**

<u>Component</u>	<u>Metric</u>	<u>English</u>
Hull (overall length)	12 m	39.4 ft
Breadth	3.3 m	10.8 ft
Depth	1.8 m	5.9 ft
Fish hold	18 m ³	635 ft ³
Main engine	125 shp	
Auxiliary engine (10 kw genset)	15 shp	
Maximum speed: 9 knots		
Service speed: 7.5 knots		

Features

- wood frame, plywood skin w/fiberglass coat
- 8 cm (3 in.) polyurethane fish hold insulation
- circulating seawater base wells
- marine plywood superstructure w/covered flying bridge for fish spotters

²Crew share is 30 percent of operating margin, \$4,437 each for three crew members.

³Vessel subsidy, \$49,500 by project, selected captain/owner to pay the balance of \$115,500 over a five year period.

- SSB radio, magnetic compass, radio direction finder, standard safety equipment

Fuel Consumption

Maximum speed: 5.5 l/hr

Service speed: 3.2 l/hr

Auxiliary engine: 2.2 l/hr

Fishing Equipment

2 boukiami nets

2 submersible 500 watt lights

2 brailing nets

50 feathered barbless hooks

10 fiberglass fishing poles

b. Operating Plan

An initial fleet of eight vessels will be employed in this fishery. The vessels will be based at Funafuti. Fishing grounds will be in the vicinity of Nukufetau, about 70 nautical miles northwest of Funafuti and Nukulaelae, about the same distance southeast of Funafuti. Three FADs will be positioned in the vicinity of both of those fishing locations.

Each vessel will collect live bait in Funafuti Atoll using its own boukiami lift net and submersible lights. Before dawn the net will be secured and the vessel will proceed to the selected fishing area, fishing as opportunity provides en route.

At last light each day the vessel will anchor inside the atoll and undertake bait capture over night. The net is brailed once during the night and again just before first light to provide sufficient rest time for the crew.

During the fishing day at least three fishermen will use binoculars to search for signs of schooling skipjack or tuna. When a school is spotted the vessel will proceed at full speed to the vicinity and chumming with live bait will commence. Six fishermen will commence poling in the fish. The captain will remain at the vessel controls and the chummer will continue broadcasting live bait until the fish disappear. This process is repeated during the daylight hours.

The daily catch rate varies. The same size vessel in Indonesia will catch from 300 to 2,500 kg per day. A daily catch of 1,000 kg is estimated here.

The vessel will carry a crew of eight men consisting of the captain/owner, engineer and six fishermen. Generally the engineer will act as chummer during catch operations. After four fishing days the vessel will return to Funafuti.

Voyage Plan

Travel to and from Funafuti	1 day
Fishing days	4 days
Turn around	<u>2 days</u>
Total	7 days

Annual voyage estimate: 45 trips per year

Fishing days	180 days
Travel days	45 days
Turn around	40 days
Bad weather	35 days
Repairs	<u>15 days</u>
Total	365 days

c. **Catch Rate**

Estimate 1,000 kg per fishing day for a total of 180 mt per year. There is very little by-catch of species other than skipjack and juvenile yellowfin so it will be assumed that by-catch will be consumed by the crew.

Value of annual catch (180 mt x US\$550) = US\$99,000

d. **Operating Results (Annual)**

<u>Item</u>	<u>Amount</u> <u>(US\$)</u>
Fuel Oil:	
45 days travel (24 hr x 3.2 l/hr x 45)	\$3,456
180 fishing days (18 hr x 3.2 l/hr x 180)	4,608
4 hr x 5.5 l/hr x 180	3,960
Auxiliary engine (12 hr x 2.2 l/hr x 180)	<u>4,752</u>
Total fuel oil (16,876 l x US\$0.40/l)	6,750
Lube oil and filters	350
Ice (150 mt x \$50)	7,500
Fishing gear and equipment (estimate)	1,500
Provisions (8 men x \$3/day each)	4,250
Annual repair	12,000
Insurance	<u>4,000</u>
Total (direct operating cost)	US\$36,350
Operating margin	US\$62,650
Less: crew share ⁴	US\$25,000

⁴Crew share equals 40 percent of operating margin or \$3,570 for each member of the seven-man crew.

Vessel payments³
For captain/owner

23,100

48,100
US\$14,550

³Vessel subsidy, \$49,500 by project. Selected captain to pay \$115,500 balance over five year period.

TO: Jack Maynard
Vaiaku Lagi Hotel
Funafuti, Tuvalu

FAX: 688 - 20503

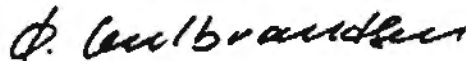
DATE: 10 February 1994

Dear Mr. Maynard

Ref: Your fax 10 February 1994

1. In principle I would be available to provide design services and supervise setting-up of the boatbuilding facility. If I cannot do part of the work, I can recommend other qualified persons.
2. It is technically feasible to equip the Alia with a 30 Hp diesel engine mounted on a platform between the hulls. I have experience from Africa and India with retractable propellers. It is possible to have a universal joint as proposed by you. The economic feasibility will have to be worked out and compared with outboard motors.
3. The Alia design can be enlarged as required to increase fishhold capacity. The question of construction material needs to be looked into: aluminium, FRP or plywood.

Yours sincerely



Øyvind Gulbrandsen

ANNEX K

MARKET FACILITY

1. Rationale

While a market presently exists in the Vaiaku town center on Funafuti, it is in disrepair and inadequate to properly serve the needs of the community, and will become more inadequate as population grows, and as fisheries activities expand. For both the pelagic and bottomfishing programs recommended in the Comprehensive Fisheries Action Plan, by-catch would be made available for sale to local residents in Funafuti. To facilitate better distribution, quality control, sanitation, etc., the establishment of a centrally-located market facility is seen to be highly desirable. Such a facility could also serve as an outlet for any products brought in from outer islands. A cooperative management arrangement between NAFICOT and the Funafuti Island Council might provide the best institutional structure to assure successful implementation and operation of such a market facility. It is projected that the existing market could be refurbished, or a new market facility built, for less than US\$60,000. Rough specifications for such a facility are provided below.

2. Facilities and Costs

Building 8 m x 10 m, screened, with metal roof, timber supports, on concrete slab ¹	US\$45,000
Display tables, concrete or wood and sheet metal construction, water supply, ice chests	<u>10,000</u>
Total	US\$55,000

3. Recurrent Expenses

It is advisable that at least three people be assigned full-time to the operation and maintenance of the market facility. It is estimated that around 80-100 percent of the cost of supporting these positions should come from the national recurrent budget (dependent upon the ability of the Island Council to identify sources of funding for any remaining balance).

Recurrent expenses are as follows:

<u>Item</u>	<u>Cost US\$</u>
Market Manager	\$7,000
Market Assistant	4,200
Maintenance Assistant	<u>4,800</u>
Maintenance, repair, and supplies	<u>4,000</u>
Total Recurrent Expenses and Maintenance Costs	US\$20,000

¹ Refurbishing the existing building could reduce costs by up to 75 percent.

ANNEX L

TUNA JERKY PRODUCTION CENTERS

1. Outer Islands Pilot Project Option

a. Rationale

Tuvalu's tuna resource can provide the basis for a wide range of capital-generating activities of benefit to different groups of people. Of special interest is the possibility of developing opportunities for bringing the outer islands into the cash economy. Outer island communities face even greater challenges than Funafuti with respect to infrastructural deficiencies. For this reason, small-scale projects not requiring elaborate infrastructure may prove more successful in the outer island environment. One possible project which may have application is the production of tuna jerky. Such a project would make use of solar energy to dry tuna to produce a value-added, exportable item. Packaging and labeling which uniquely identify the product (e.g., "pure Pacific tuna"), will serve to enhance marketability. Present prices for packaged tuna jerky are around US\$45/kg, and the product is in demand in Asia, Hawaii, the mainland U.S., and Australia.

b. Project Plan

Initially, this project will seek to establish a pilot facility on one of the outer islands. A foreign expert in tuna jerky production will be brought in to evaluate the feasibility for establishing a tuna jerky project on various outer island sites. The expert will select the pilot project site¹, design a drying unit, and identify manpower requirements. Building on existing knowledge of processing and handling requirements, a drying unit will be constructed and put into operation. Total costs for such a project, including costs for the foreign expert, are expected to be around US\$150,000, which can be fully funded through a small-scale technical assistance grant. Figure L-1 depicts a small-scale drying center. Cost projections are provided below.

During the pilot phase, Tuvaluan workers will acquire on-the-job training as they work with the expatriate advisor. Participants for the project should be chosen based on their desire to eventually establish themselves in the tuna-jerky export business. The pilot project concept, if successful, could eventually be duplicated and put in place as private sector ventures at other outer island sites. The original personnel trained in the pilot program would be able to qualify for small loans through the DBT. It is likely that private fish drying enterprises of a smaller scale than the pilot project could be set up at a considerably lower cost, possibly as little as US\$25,000 or less.

It should be noted that if freezer storage facilities are established in outer island locations as part of the 'Alia' tuna trolling program, these same facilities could be used to accumulate sufficient quantities of fish for jerky production runs, saving the cost of purchasing this equipment independently. Additional cost-savings may be realized if a number of private parties on the same island form cooperatives and share

¹ Since Vaitupu, Nanumea, and Nukufetau already have community fishing centers in place, or planned, the pilot project will be sited on one of the other islands.

key equipment. Expansion into other product lines, such as ordinary dried fish and smoked savory, is also possible.

c. Operational Parameters

Tuna will be purchased from local fishermen and stockpiled. Once a sufficient quantity has been accumulated, fish will be prepared for a production run. Many of the specific procedural requirements for preparation are already known from past trials in Tokelau and Kiribati; however, it may be necessary to adjust the procedure to fit specific conditions which prevail at the selected sites in Tuvalu.

In general, the procedure will consist of cleaning, loining, and slicing the loins, soaking the slices in a marinade, drying the slices, trimming, and packaging the sliced jerky in labeled plastic barrier bags with oxygen scavengers. Packaged fish jerky will be then be boxed to be shipped to export markets.

Approximately 10 individuals will be employed to carry out the functions of management, equipment maintenance, cleaning, butchering, drying, and packing.

d. Start-up Costs:

Materials

<u>Item</u>	<u>Description</u>	<u>US\$000</u>
Facility	As shown in Figure L-1, with solar arrays, washing bay, insect-proof entryway	\$ 3.5
Ice Plant	One 200 kg per day disc-type flake ice maker	4
Generator	One diesel-fueled genset, 10 kw, packaged unit	5
Packaging Inventory	Plastic barrier bags with labels, cardboard packing boxes, oxygen scavengers, etc.	4
Subtotal Materials		\$16.5

Technical Assistance

Remuneration, 20 months @ US\$ 5,000	\$ 100
International travel	20
Travel per diem	15
Mobilization	3
Miscellaneous expense	<u>3</u>
Subtotal Technical Assistance	US\$ 141
Total Investment	US\$157.5

e. Financial Projections

i. Assumptions

Yield: 15 percent, based on past results at Kiribati processing center, and optimal moisture content in finished product

Fish Cost: US\$1.00/kg

Marinade Cost: Estimate \$20 to make marinade for 100 kg fish, fresh weight

Packaging Cost: Estimate \$75 in plastic barrier bags, labels, oxygen scavengers, and overhead to package 23 kg dried product (equivalent to 100 kg fresh weight)

Daily Production: Assume total 55 kg fresh weight; equivalent to 8 kg finished dry weight

Production Days: 135 running days per year (including allowance for days off, maintenance and repair, inclement weather, other contingency)

Freight: Air freight Funafuti to Honolulu, \$1.20/kg

Selling Price: US\$45.00/kg

ii. Cost and Revenue Estimates

<u>Amount</u>	<u>Value, US\$</u>
Annual Production, finished packaged jerky (dry weight) 1,080 kg	US\$ 48,600
Total Revenue	\$ 48,600
Costs	
Labor:	
Manager \$5,000/yr	5,000
Workers (4) \$1,080/yr (15 day/mo, 9 mo/yr)	<u>4,320</u>
Fish (fresh weight) 150,000 kg	7,425
Processing Materials (marinade)	1,350
Packaging	4,000
Shipping:	1,296
Depreciation (10-year straight line)	<u>1,250</u>
Total Costs	US\$ 24,641

Operating Margin: US\$23,959
(15 percent return on investment)

2. Teone Market Refurbishment Plan Option

It would also be possible to put the moribund Teone market facility to good use in housing a tuna drying and jerky production facility in Funafuti. In order to produce a product meeting stringent hygienic standards for all foreign export markets, enclosure and air conditioning of the facility need to be considered. Assumptions regarding this project option are described below:

Assumptions

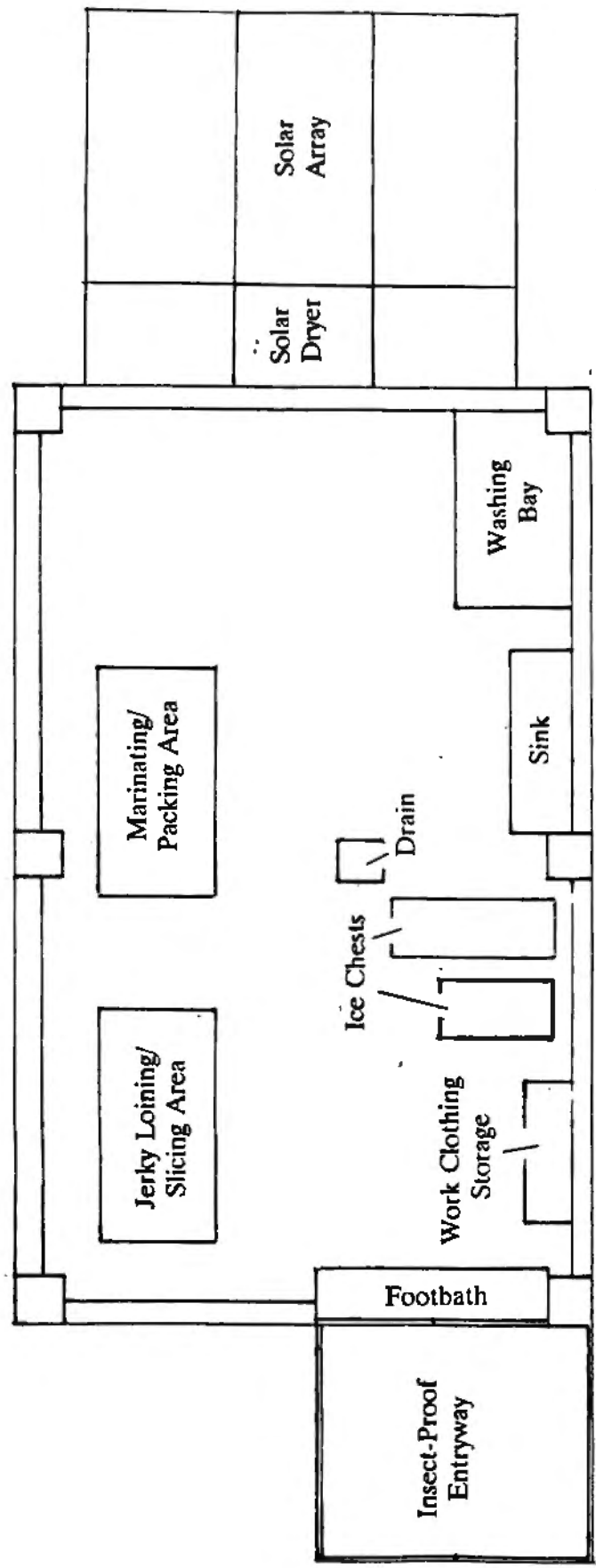
- a. Building:**
Utilize existing NAFICOT building. Re-tile all floor areas and conduct general interior clean-up. Install new doors and windows and prepare the entire processing area for air conditioning.
Estimated Building Cost **US\$ 15,000**
- b. Equipment:**
- | | |
|---|-------------------|
| Dryers (2 @ 50 kg capacity) | \$ 5,000 |
| Marinating tanks (2) with stainless racks | 2,000 |
| Stainless steel tables (2) | 2,000 |
| Vacuum packing machine | 5,000 |
| Refrigeration (rehabilitation) | 5,000 |
| Air conditioning (installation) | 20,000 |
| Hand tools and miscellaneous equipment | <u>1,500</u> |
| Total Equipment Costs | US\$40,000 |
- c. Beginning Inventory:**
- | | |
|---|--------------------|
| Marinade (9 month supply) | \$ 10,000 |
| Packaging (9 month supply) | 20,000 |
| Raw product (1 month; 20 days x 450 kg;
9,000 kg x \$1.50) | 13,500 |
| Other pre-operating expenses | <u>15,000</u> |
| Total Beginning Inventory Costs | US\$58,500 |
| Total Projected Cost Estimate | US\$113,500 |
- d. Production Assumptions:**
- Raw product input is estimated at 30 yellowfin or big eye tuna per day, average weight 25 kg each, total 750 kg/day.
 - Finished product, approximately 15 percent of whole fish weight, 112 kg/day.
 - Working days, 4.5 days per week, 45 weeks per year (say 200 days per year).
- e. Annual Sales:**
22,400 kg/year x \$45.00 **US\$1,008,000**

f.	Annual Operating Cost:	
	Tuna (150,000 kg x \$1.50)	US\$225,000
	Marinade	12,000
	Packaging	26,000
	Labor:	
	Plant Manager	\$ 7,500
	Refrigeration Electrical Engineer	7,500
	Butcher	4,000
	Loin Cleaners (4)	12,000
	Marinade Chefs (2)	6,000
	Packaging Operator	<u>3,000</u>
	Ice (15 tons x \$50.00)	7,500
	Air freight (22,400 kg x \$1.20)*	27,000
	Brokerage fees (x 5 percent)*	50,000
	Electric power*	25,000
	Operating contingencies (10 percent)	<u>40,000</u>
	Total	US\$452,500

Annual Operating Margin: US\$555,500

*Estimated or rounded-off fees.

Toilet/Shower
Facilities
(Separate
Building)



Source: Teikabuti Fishing Co., Tarawa.

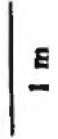


Figure L-1. Tuna Jerky Drying Facility

ANNEX M

TROPICAL AQUARIUM FISH FOR EXPORT

1. Background

Tropical fish for the aquarium trade have formed the basis for a US\$500 million business in the countries of Southeast Asia. Several small-scale tropical fish export businesses also operate successfully around the South Pacific region. As an example, a small tropical fish export business has recently been established in Kiribati; about US\$235,000 of tropical fish (representing 10 percent of the country's total exports) were shipped from Kiribati in 1991, almost entirely the result of this single enterprise.

According to a small operator in Vanuatu, wholesale prices paid for fish shipped to Australia range from US\$0.35 for the more common varieties (e.g., blue chromis) to as much as US\$18.00 per fish (i.e., certain species of angelfish). FOB prices paid per-fish typically average around US\$1.75.

The simplest means of collecting aquarium fish is by herding fish into a "fence net" (a vertical barrier net laid out along the substrate) while snorkeling. Other more sophisticated technologies which may be employed include the use of scuba gear, and specially modified vessels to transport fish. Typically, fish collectors could be paid on a per-piece basis, or salaried with a bonus incentive based on catch.

2. Facilities, Equipment, and Other Material Requirements

Holding tanks are required to stockpile live fish as they are accumulated for shipment. Holding the fish also helps to acclimatize them to confined conditions. A 3,000-liter biologically-filtered tank can accommodate up to 500 fishes. Other required equipment includes fence nets to catch fish, and portable containers to transport fish. A skiff is required for collection activities in more remote areas.

3. Budget and Financing

Rough estimated start-up costs for a small aquarium fish export business are in the range of US\$15,000-30,000. Financing for a venture of this size could appropriately be sought from the DBT.

ANNEX N

GIANT CLAM MARICULTURE

1. Background

Some success has already been demonstrated in growing the introduced giant clam in Tuvalu's lagoon environment. A more intensive effort at culturing giant clam could provide significant benefits for Tuvalu. Principal expected benefits are opportunities for developing export activity and for recruitment supplements to replenish depleted natural stocks.

In order to carry a giant clam project to the next level—an expanded pilot project leading ultimately to commercialization—several objectives need first to be accomplished. The principal of these are:

- investigation of potential markets;
- identifying means to improve survivorship in the early growth stages; and
- determination of commercial viability.

A program being carried out in the Solomon Islands, under the technical guidance of ICLARM, is showing some success. Sources at ICLARM¹ have indicated that the program has been taken up at about 20 village-level ocean nurseries. The principal market for Solomons giant clam is for export of live animals to the overseas aquarium trade for which clams of relatively small size (5-8 cm) fetch prices of US\$2-3 each. The clams are placed in oxygenated plastic bags and shipped to market by air freight.

The aquarium trade is also a logical target market for clams from Tuvalu, since both *Tridacna maxima* and *T. squamosa*, the two species in greatest demand for aquaria, are the two species which occur naturally in Tuvalu. The next logical step to entering this market would be to procure the services of an experienced hatchery culturist to set up a local pilot facility. Technical experts having the required skills can be found through ICLARM or similar aquatic research institutions. Support for technical assistance could be procured through a grant, and would likely require around three years to implement; costs for same would be in the range of \$280,000. It is estimated that all necessary equipment for setting up a hatchery would cost between US\$20-30,000.

A complete summary of start-up costs is provided below.

It is recommended that initially, the Fisheries Department continue its role as the lead agency in furthering efforts at giant clam mariculture. In order to privatize the clam culturing enterprise, it will be the responsibility of the hatchery culturist to begin to train local "farmers" in the care, handling, and marketing of giant clams. The hatchery could provide clam seed stock for sale to clam farmers at or near cost. Seed stock could also be used in a Government-run program to replenish depleted natural populations in Tuvalu's lagoons.²

¹ Dr. John Munro, personal communication.

² In Fiji, stocks of the increasingly rare *Tridacna gigas* (largest of all clam species) were successfully reintroduced.

It should be noted that many Pacific nations have established, or attempted to establish, giant clam hatchery facilities, with modest economic success. Failure is largely attributable to an inadequate evaluation of the market for giant clam products. Should a pilot hatchery facility be established in Tuvalu, it is imperative that a thorough marketing study be undertaken before any commitment towards further expansion of giant clam production be made.

2. Costs

a. Implementation

Technical Assistance:	
Remuneration ³ (30 months @ US\$6,000)	US\$180,000
International travel	40,000
Travel per diem	52,000
Mobilization	5,000
Miscellaneous expenses	5,000
Subtotal Technical Assistance	US\$282,000
Hatchery Facility:	
Subtotal Hatchery Facility	US\$30,000
Total Implementation Cost	US\$312,000

b. Additional Operating Costs

If the GOT decides to aggressively pursue a program in giant clam culturing, it would be advisable to assign two fisheries personnel to the project on a full-time basis. If this were to occur, additional operating costs are listed below.

Salaries (2 mariculturists @ US\$5,000)*	US\$10,000
International travel and per diem	10,000
Maintenance and repair*	5,000
Miscellaneous expenses	<u>2,500</u>
Total Annual Staffing Costs	US\$27,500

*Recurrent costs.

³Should a mariculture hatchery be implemented, it is recommended that a production incentive be added to the Technical Expert's compensation package.

ANNEX O

PEARL OYSTER CULTURE

1. Background

Two pearl oyster species of potential economic importance are the gold-lipped (*Pinctada maxima*) and black-lipped (*P. margaritifera*) varieties. Most interest in pearl-growing has focused on the black-lipped oyster. In places where the black-lipped oyster naturally occurs, the technology for their husbandry is straightforward—the process consists of setting out "spat collectors" to which swimming larvae can attach, and allowing the oysters to grow. Over a period of several years, oysters may produce pearls naturally, or they may be "seeded" to induce pearl production.

Recently, it has become possible to grow oysters artificially from spawning adults in a hatchery.¹ With this new development, it may be possible to introduce and grow oysters in areas such as Tuvalu, where favorable habitat exists for "grow-out," but where natural populations of oysters are severely limited or lacking.

2. Project Outline

A pilot project will be established and a pearl culturing expert (the Consultant) will be hired to implement the project. The first task of the Consultant will be to identify approximately five trial growing sites within the lagoons of Tuvalu. For logistical purposes, it is anticipated that initial growing sites will be located within Funafuti lagoon.

Brood stock (perhaps 20-30 individual, mature oysters are required) will be obtained from a neighboring country, possibly Kiribati or the Marshall Islands.² Brood stock will be provided on a "quid pro quo" basis, e.g., Tuvalu could offer to return a portion of the spat produced to the partner country. Breeding oysters will be sent to a hatchery facility in Hawaii.

The hatchery will conduct "larval runs" sufficient for the production of approximately 20,000 spat. The spat will be grown out to a size sufficient to assure good survivorship. Total time required for spat settlement and grow-out will be approximately two to three months. Cost of the spat production will be approximately US\$60-70,000.

Under the supervision of the Consultant, live spat will be flown from Hawaii to Tuvalu for grow-out at the trial sites. The Consultant will make quarterly site visits over a period of two years to direct the implementation of the pilot project. Local counterparts will be trained during Years 1 and 2; pearl seeding will occur during Year 2; the Consultant will make semi-annual visits to the growing sites to

¹ This technology has been developed by Neil Sims of Black Pearls, Inc., Kailua-Kona, Hawaii. The technology makes use of the special facilities and availability of pure deep-ocean water at the Natural Energy Laboratory of Hawaii.

² The oysters from Marshall Islands are regarded as desirable in terms of the high quality of pearls which they produce.

monitor and report on progress during Years 3 and 4; and pearl harvesting should be possible by Year 4. Total required time input of the Consultant is estimated at six man-months.

3. Project Implementation Costs

Technical Assistance:	
Remuneration (6 months @ US\$ 7,000)	US\$42,000
International travel	40,000
Travel per diem	30,000
Mobilization	5,000
Miscellaneous expenses	<u>5,000</u>
Subtotal Technical Assistance	US\$122,000.00
Spat production	70,000
Miscellaneous materials/equipment (rope, bags, nets, etc.)	<u>5,000</u>
Total Implementation Cost	US\$ 197,000

4. Recurrent Costs

If the GOT decides to aggressively pursue such a program, it would be advisable to assign one fisheries staffperson to the project on a full-time basis. If this were to occur, remuneration costs are estimated below.

Remuneration (mariculturist)	US\$5,000
International travel and per diem	7,500
Maintenance and repair	5,000
Miscellaneous expenses	<u>2,500</u>
Total Annual Recurrent Costs	US\$20,000.00

5. Additional Considerations

It may be valuable to investigate the feasibility of growing pearls in Tuvalu, through implementation of a pilot project such as the one described. Pearl growing has many features which make it attractive for introduction to Tuvalu. Pearls are a high value product which are relatively inexpensive to transport. However, the method of growing pearls correctly requires considerable skill, as well as sophisticated inspection equipment (x-ray analysis) as the pearls develop. The process of pearl formation from initiation to harvest takes approximately four years. Thus to see any return on investment requires a long-term commitment of money and effort. Additionally, the market for pearls is tightly controlled by existing industry interests. Thus, even assuming that a pilot project is successful, these factors will need to be further evaluated before a decision can be made to embark upon a full-scale pearl farming project in Tuvalu.

ANNEX P

TERMS OF REFERENCE FISHERIES STAFF DEVELOPMENT AND TRAINING ADVISOR

1. Introduction

The principal shortcomings which have been in evidence within the Fisheries Department relate to inadequate staff development and training. A 1988 review of the Tuvalu Civil Service¹ pointed out that, within the Fisheries Department, there has been no system implemented for positive human resource development, and training and personnel policies have not been well defined. As a result of these shortcomings, production of the Department's annual reports, its principal planning and informational documents, has been delayed for the last three years. A number of projects which have shown some promise (for example, the giant clam mariculture project) appear to be languishing because they require follow-up by staff who could aggressively take such projects to their next logical stage of development. A number of key positions are vacant, and have been for some time. Finally, hoped-for transfer of skills from expatriate expert consultants brought in on long-term assignment has often not occurred.

Within the Department, the most critical needs are for training in management, statistical analysis, resource evaluation, regulation, and protection. Outside the Department, development of training programs in entrepreneurship, and institution of a fisheries education program at the secondary school level, would serve to further strengthen the sector and potentially prepare more candidates for jobs in fisheries.

This Terms of Reference describes the qualifications and responsibilities for a Fisheries Staff Development and Training Advisor who would be responsible for setting in motion some of these critical training and educational programs.

2. Selection/Required Qualifications

Candidates for the Advisor position must have extensive experience in a full range of institutional fisheries training and management functions, including staff development, extension, and fisheries education. A strong background in fisheries biology, licensing procedures, and statistics is also required.

¹ Mackinson, Ian 1988. *A review of the Tuvalu Civil Service*. June. As cited in Sutherland et al., 1992.

3. Duties of the Advisor

The selected Advisor will work with and assist the Director of Fisheries and the Chief Fisheries Officer² for a term of 36 months and will direct and advise on the undertaking of the following listed principal functions as well as all other matters relating to successful staff development.

- a) Review present programs and activities of the Fisheries Department. Develop models for optimal staffing of present programs as well as for programs of possible future interest.
- b) Advise the GOT on the priorities of staff development. Prepare schedules for implementation, cash flow, and recurrent budget requirements in order that implementation can proceed without undue delay.
- c) Prepare an overall review of staffing and a staff development plan for each of the major functional areas under Fisheries Department, including management and personnel, research, extension, monitoring of the EEZ, and physical facilities and equipment maintenance.
- d) Present to the GOT any requirements for additional personnel, both local and expatriate, as needed for those areas within the Department which are deficient. This should include detailed job description(s) and qualifications criteria. Upon approval of required funding for position(s), supervise the interview and candidate review process. In cooperation with the Department Director, hire qualified candidates as required.
- e) Present a plan to develop and implement an entrepreneurial training program in fisheries. For this program, it may be advantageous to form a liaison with the University of the South Pacific. The plan should include development of a curriculum directed at providing prospective fishermen and other fisheries entrepreneurs with necessary business skills including marketing, accounting, and principles of export trade.
- f) Present a plan to develop a program for secondary-level fisheries education. This plan should include liaison with appropriate local and expatriate educators, curriculum development, and suggestions regarding production of educational materials relevant to fisheries activities in Tuvalu.

4. Budget

<u>Item</u>	<u>Cost</u>
Remuneration (36 months @ US\$7,000)	US\$252,000
International travel	60,000
Travel per diem	78,000
Mobilization	5,000
Miscellaneous expenses	<u>5,000</u>
TOTAL	US\$400,000

² As of March 1994 this position was vacant.

ANNEX Q

TUVALU LAWS AND ACTS RELEVANT TO FISHERIES

This Annex presents a brief synopsis of the various laws, acts, and regulations in existence which have some bearing on fisheries and fishing activities in Tuvalu.

Marine Zones Act: The primary purpose of this Act is to establish and define the internal waters, the archipelagic waters, the territorial sea, the EEZ, and the contiguous zone of Tuvalu. Under this Act, Tuvalu claims sovereign rights to explore, exploit, conserve, and manage the living and non-living resources within the waters under its jurisdiction.

Section 2 of the Act deals with issues of conservation and management, and empowers the Minister responsible for administering the Act to prescribe measures required for protection and preservation of resources, and to regulate activities in the EEZ.

Fisheries Act: This is the major piece of legislation designed to promote and regulate fishing and fisheries industries in Tuvalu. It covers such matters as licensing of local fishing vessels; licensing of FFVs; procedures for establishment and operation of fish processing centers; appointment of enforcement officers; establishment of penalty provisions; authorization of fishing by research vessels; and issuance of regulations to assist in implementation and operation of the Act.

Regulations promulgated under this Act include the FFV Regulations of 1982, Trochus Regulations of 1990 (prohibiting collection of introduced trochus shell), and FFV (United States) Licensing Treaty Order of 1987.

National Fishing Corporation of Tuvalu Act: This Act provides for the establishment of NAFICOT for the purpose of exploitation, processing, and marketing of marine resources of Tuvalu.

The above Acts address fisheries issues in a general rather than a specific way. Within the Acts, especially the Fisheries Act, provision is made to create regulations specific to certain areas as the need arises. This creates a flexible legal framework which can adequately cover the regulation of fishing activities, and conservation and management of fisheries resources.

In addition to the aforementioned relevant Acts, are several Acts which are less directly related to fisheries, but which still have implications for activities within the sector. Of these, the most important are:

- **The Foreshore and Land Reclamation Act**, which defines ownership of the foreshore and seabed;
- **The Wildlife Conservation Act**, which among other stipulations, prohibits hunting and killing of turtles on land;
- **The Merchant Shipping Order**, which establishes rules and procedures for determining liability in the event of an oil spill or discharge at sea; and

- **The *Marine Pollution Act*, which establishes prohibitions and penalties relating to ocean dumping.**

Recently, SPREP has undertaken a review of Tuvalu's laws and regulations relating to environmental assessment and protection. The SPREP review of those laws dealing with marine resources could provide a framework for strengthening of the legal supports for prudent marine resource management.

ANNEX R

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ANNEX S

RESOURCE CONTACTS

The following resource people provided information used in the preparation of this report. Their help is gratefully acknowledged.

1. Tuvalu Government Personnel and Residents

Kamuta Latasi, Prime Minister
Tomu Sione, Governor General
Koloa Talake, Minister of Finance and Economic Planning
Otinielu Tausi, Minister of Natural Resources Development
Mose Saitala, Secretary of Finance and Economic Planning
Taukelino Finikaso, Secretary of Natural Resources Development
Simeti Lopati, Secretary of Natural Resources
Feue Tipu, Assistant Secretary to Government
Seve Lausaveve, Director of Rural Development
Penehuro Hauma, Director of Education
Uili Telavi, Commissioner of Police (patrol boat)
Semu Taafaki, General Manager, National Fishing Corporation of Tuvalu (NAFICOT)
Sautia Maluofenua, Director of Fisheries
Satalaka Petaia, RDA International, Inc., Marine Resources Advisor (USAID Bottomfishing Project)
Loto Pasefika, RDA International, Inc., Master Fisherman (USAID Bottomfishing Project)
Malaki Tihala, Fisheries Officer
K. Ito, Fisheries Mechanic Engineering Advisor
Sikela Ulumutu, Fisheries Processing Officer
Samasoni Auina, Assistant Fisheries Extension Officer
Falasese Tupau, Fisheries Statistician
Juan Chavez, Fisheries Research Advisor
Tilaima Longo, Funafuti Island Executive Officer
Cameron Dick, Crown Counsel
James Conway, Energy Officer
Wolfgang Schroeder, Amatuku Maritime Training Center
The Tuvalu Fisherman's Association (approximately 20 members)

2. Consultants and Foreign Resource Persons

Professor David Forsyth, Economist (for EU), University of South Pacific, Suva
John Stewart, Fisheries Training Advisor, Bay of Plenty Polytechnic, New Zealand
Dr. Garrey Maxwell, Outer Island Fisheries Development Project, AIDAB
Richard Howell, Marine Resources Advisor, USAID, Suva
Dr. John Munro, ICLARM, Manila
Paul Dalzell, South Pacific Commission, Noumea
Hugh Walton, South Pacific Commission, Noumea
Steve Roberts, South Pacific Commission, Noumea
Neil Sims, Black Pearls Hawaii, Inc., Kailua-Kona

Dr. Robert Schroeder, Fisheries Analyst, Western Pacific Fisheries Council
Wayne Haight, Fisheries Biologist, RDA International, Inc.
Mike Savins, Teikabuti Fishing Co., Tarawa, Kiribati
Paul Bartram, Fisheries Consultant, RDA International, Inc.
Peter Wilson, Fisheries Specialist, Honolulu
Richard Fassler, Aquaculture Development Program, State of Hawaii
Phillip Woodward, Chief Cartographer, SOPAC, Suva
Barry Moys, Shell-Pack Seafoods Ltd., New Zealand
Wayne Armitage, Tropical Fish Exporter, Vanuatu
Chris Wheeler, AIDAB
Gary Quince, EC Delegation, Suva
Makoto Yamashita, Japan Embassy (JICA), Suva
Dr. George Habib, Ika Group, Auckland, New Zealand
Barbara Harris, South Pacific Trade Office, Auckland, New Zealand
Brian Mizusawa, Pacific Rim Seafoods, Honolulu, Hawaii
Parviz Fartash, UNDP, Suva
Dr. Stephen Pollard, East West Center, Honolulu
Jerry Thurbon, Electronics Engineer, Transfield ASI Pty. (patrol boat program)

ANNEX T

TRIPARTITE MEETING MINUTES AND FINDINGS

Review of ADB Fisheries Sector Study Report, 3-4 August 1994, Funafuti, Tuvalu

In Attendance:

Mr. Mose Saitala, Secretary of Finance and Economic Planning
Mr. Aunese Simati, Acting Director of Planning
Mr. Simeti Lopati, Secretary of Natural Resources
Mr. Sautia Maluofenua, Director of Fisheries
Mr. Semu Taafaki, Manager of NAFICOT (National Fisheries Corporation of Tuvalu)
Mr. Paul McCabe, Program Manager/Economist, Asian Development Bank (Fisheries Sector Study Mission Leader)
Mr. James Berdach, Asian Development Bank Consultant (Fisheries Sector Study Team Leader)
Mr. John Howe, Asian Development Bank Consultant (Economic Advisor, Planning Department)

1. Introductory Remarks

The ADB Mission Leader opened the meeting by providing background information on the history of the fisheries sector technical assistance, stating that the project was originally conceived during the Bank's first mission to Tuvalu. At that time, Government requested assistance in three priority areas--the Development Bank of Tuvalu, Fisheries, and Planning.

Mr. McCabe went on to point out that as a result of this expression of interest, a Mission Team was hired, and fielded to Tuvalu in January 1994 to carry out the Fisheries Sector Study. Following over one month of field research, the team's draft report was submitted for Government review in April 1994. Mr. McCabe then distributed a copies of a slightly revised version of the draft report to the participants. He indicated that it was the belief of ADB that the report, through its recommendations for project implementation and policy formulation, would promote additionality in funding of fisheries projects, and would be a valuable resource to the Government, the Bank, other donors, and the private sector.

The ADB Team Leader was introduced. He explained the evolution of the most recent version of the draft report, detailing those changes which had been made since delivery of the April 1994 version. The principal recommendations of the report were summarized, including a brief overview of the proposed commercial projects (purse seine operation, seamount fisheries, and small-scale 'Alia' fleet component); training needs, especially in the areas of commercial implementation and staff development; and mariculture and other small-scale projects.

Messrs. McCabe and Berdach emphasized that the ADB study was carried out on behalf of the Government of Tuvalu, from a "neutral" (commercially disinterested) point of view. They explained that

the report presented options for a wide range of fisheries projects, and expressed their hope that Government would find at least several options which appeared attractive.

2. Utilization of Resources in the EEZ and Resource Sustainability

The Secretary of Finance expressed appreciation for the efforts of the Mission Team in providing a good report. However, he expressed the fear that projects of the scale being proposed (specifically, the purse seine and bottomfish projects) might threaten the sustainable viability of Tuvalu's fish resources. The question was raised as to how the fleet size for these operations had been determined. The question of regulating the extent of fishing activities, in order to assure sustainability, was also raised.

As evidence of a possible lack of resources, Mr. Saitala mentioned that certain distant-water fishing nations (DWFNs), such as Taiwan, had claimed during fee negotiations that fishing yields in Tuvalu's waters were poor. He indicated that Tuvalu's licensing fees were lower than that of its neighbors (as an example, Japan pays A\$60,000 per vessel to Kiribati, but only A\$10,000 per vessel to Tuvalu).

Mr. Berdach agreed that sustainability was indeed a crucial concern for the planning of any fisheries venture, but went on to point out that all the projections and proposals presented in the report were based upon the best scientific information presently available. He mentioned that 1) assessment of sustainable yields of skipjack tuna (for the purse seining project) was based on reports of the South Pacific Commission, and 2) acceptable levels of harvest of seamount bottomfish resources were determined from preliminary findings of the studies conducted under the PIMAR USAID bottomfish project. It was acknowledged that changes in the final bottomfish data (due by the end of 1994) might necessitate adjustment of projections for the bottomfish project proposed by the ADB team. Mr. Berdach indicated that the Taiwanese were simply "being good businessmen" in claiming that Tuvalu's fish resources were poor. Evidence to the contrary could readily be found in the fees collected under the U.S. multilateral agreement, wherein the fees are directly linked to total catch in the Exclusive Economic Zone (EEZ). He made the additional point that, were Tuvalu to develop its own purse seine operation, this would provide the most reliable information on catch rates in its own waters, from which information appropriate fee schedules could be developed to strengthen the country's position in future negotiations with DWFNs.

Messrs. McCabe and Berdach pointed out that because of its neutral orientation, the ADB team's findings might be more reliable than the claims put forth by any party with commercial interest.

3. Purse-Seine Project

The Director of Fisheries suggested that a "pilot" purse seine project, i.e., one of smaller scale than that proposed, might be appropriate. He expressed specific concerns regarding the cost of fuel consumed by purse seiners in scouting schools of tuna.

Mr. Berdach replied that, in order for the purse seine project to be viable, a carrier vessel was required. In turn, provision of a carrier vessel dictated that a minimum catch level be maintained, and that this could be accomplished only through a minimum of two purse seine vessels. Thus, the proposal included in the report describes the smallest possible purse seine fleet which would achieve financial viability. It was clarified that, as in all standard purse seining operations, smaller scout boats would be used to search for schools of tuna, thereby reducing the requirement for greater fuel consumption by the larger purse seine vessels.

4. Longlining

Mr. Maluofenua indicated that Tuvalu was interested in looking into the possibility of longlining. Mr. Berdach responded that the target catch in longlining is sashimi grade tuna (mostly yellowfin and bigeye) for the Japanese sashimi market. Since Tuvalu presently lacks runway facilities to support jet transport of chilled fish to Japan it was not considered that longlining would be appropriate at this time.

5. Joint Venture

Mr. Maluofenua mentioned that joint-venturing (for the purse seine and bottomfishing operations) had not been explored as a financing option in the report.

Mr. Berdach acknowledged that this was correct. He explained that the decision to discuss only commercial loan options, with the balance of funding being provided initially by Tuvaluan sources, had been based on Government's earlier indications of the availability of ample funds. This would eliminate the need for pursuing an arrangement with a joint-venture partner. It was felt that Tuvalu would stand to reap the greatest rewards if it could accomplish the financing independent of a joint-venture partner.

A discussion followed wherein it was brought out that Kiribati was presently undertaking a purse-seining joint venture with a Japanese partner, Otoshiro Company. The Fisheries Director indicated his desire to study the results of that effort before undertaking a purse-seining venture in Tuvalu. Another joint-venture project which was discussed was an arrangement between Fiji and a foreign partner (possibly EU), wherein full ownership is to devolve to Fiji after a five-year period. It was also mentioned that a joint venture arrangement could be carried out on a trial basis.

Mr. Saitala indicated that while there were excess funds available in the country to finance "bankable" fisheries projects (through NBT, DBT, and approximately A\$1 million in EC Lome Convention funds), it was preferable to set aside those monies for some of the proposed smaller-scale projects (including the bottomfish project), and seeking a joint-venture partner for the more capital-intensive purse-seine project.

Mr. Lopati brought out the fact that since technical expertise was presently lacking among Tuvaluans in the operation of larger fishing vessels, a joint-venture arrangement might be the best way to address that deficiency.

Mr. Howe mentioned that if a joint-venture were pursued, the joint venture partner might shoulder much of the financial burden of preparing a more detailed financial plan for the purse-seine operation.

As a result of the aforementioned discussions and comments, it was determined that joint-venturing options should receive further attention in the final report.

6. Infrastructure, Boats, and Equipment

In regard to the proposed small-scale 'Alia' fleet project, the General Manager of NAFICOT expressed a concern regarding the absence of suitable storm protection for small boats, whether in the form of breakwaters, improved moorings, etc. Discussion of this issue followed. Mr. Saitala pointed out that the sector study report made mention of a forthcoming ADB transportation infrastructure technical assistance project, and requested ADB to consider the matter in the forthcoming TA. Mr. McCabe agreed that the Bank would look into this aspect during the TA for transportation infrastructure.

Mr. Taafaki further pointed out the regional role of SOPAC in studying various oceanographic and bathymetric conditions which might have a bearing on the design of safe harbors and anchorages in Tuvalu, and urged that their input be solicited for this study. It was determined that this suggestion should be incorporated into the final report.

In recognition of the fact that in the past, use of boats not suitable for Tuvalu's waters had been attempted, Mr. Lopati inquired whether ADB would provide expertise in designing suitable boats for the bottomfish project. Mr. McCabe responded that Mr. Maynard or Mr. Berdach would be able to put Government in touch with competent boat builders and boat designers at the appropriate time.

7. Mariculture Projects

Mr. Taafaki made mention of his concerns regarding the pursuit of mariculture projects in the lagoon environment of Funafuti. With the possible exception of giant clam mariculture, where the resource was dense enough to stay on the ocean bottom, other mariculture products typically were tied to suspended ropes or other substrates for culturing, and were susceptible to damage or loss during storms.

Mr. Berdach responded that this appeared to be true, and that for this and several other reasons, most mariculture projects were considered to be fairly low priority at the present time.

8. Training

In addition to the need for training touched upon by Mr. Lopati, Mr. Berdach mentioned that the report recommended ancillary secondary school instruction to encourage greater interest in the fisheries sector for students considering various career options. Mr. McCabe stated that UNESCO has in the past funded this type of education program. Mr. Saitala furthered that he knew of such a program in the Maldives, and expressed his hope that a similar course of instruction could be developed for Tuvalu.

Mr. Lopati communicated the fact that at present, Tuvalu lacks seamanship training specifically geared toward commercial fisheries operations. Mr. McCabe stated that he was aware of two such training programs in the Pacific which could serve as models--one in Yap (German-funded) and the other in Marshalls (ADB-funded).

9. Donor Assistance

Mr. Saitala expressed the opinion that the successful filling of the position of Commercial Fisheries Implementation Advisor would be key to the overall implementation of the Comprehensive Fisheries Action Plan, and requested that ADB assist in this by funding that position at the earliest possible date.

Mr. McCabe responded that while ADB would be a participant in funding some of the recommended programs, it was still early in the evaluation process, and therefore, its specific role was not yet determined. Mr. McCabe went on to suggest wide circulation of the final report to the private sector and various donor agencies first, in order to generate further interest for investment in the fisheries sector.

10. Policy Decisions

Mr. Lopati described the process for Government review and endorsement of the consultants' final report. He indicated that Cabinet's endorsement of the report, prior to circulation among donors and the private sector, would enhance the acceptance of recommended projects for funding.

Mr. Saitala indicated that it would be desirable for the major findings of the present review to be incorporated as part of the published review document. This was generally agreed to.

In reference to the project priorities outlined in the Draft Report, Mr. Lopati felt that Government might not adopt these priorities in their entirety. The ADB Mission Leader and Team Leader indicated that the prioritization presented in the report was not meant to be a rigid framework, but only a guideline for further decision-making. Mr. McCabe stated that it was the responsibility of Government to ultimately determine which projects were of greatest interest.

11. Closing Remarks

Mr. Lopati expressed the opinion that the Fisheries Sector Study final report would be a useful guidance document not only for short term policy formulation, but also for long term planning over the 10 to 20 year range.

Mr. Saitala expressed thanks to the ADB mission for their support and for undertaking the study.

FINDINGS

The review committee agreed that the following significant points should be emphasized:

1. The attention of Government policy makers should be drawn to the recommendations and programs outlined in Section II of the report, "Comprehensive Fisheries Action Plan".
2. Government should widely circulate the report to the private sector and the donor community in order to generate further interest for investment in Tuvalu's fisheries sector.
3. Because of its requirement for investment of large amounts of capital, the proposed purse seine project should be undertaken with caution. By implementing the project through a joint venture arrangement, the inherent capital risks for Tuvalu could be significantly reduced.
4. The proposed bottomfish project will await the closing findings of the USAID Bottomfish Project in order to ascertain the sustainability of the resource. This project will then be entirely funded through Tuvaluan sources. The Ministry of Finance has a plan underway whereby ownership of the enterprise would be shared among the Development Bank of Tuvalu, the recently-formed Tuvalu Holding Company, and NAFICOT (as majority owner).



Asian Development Bank
South Pacific Regional Office
Port Vila, Vanuatu