

JAPAN INTERNATIONAL COOPERATION AGENCY

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MARSHALL ISLANDS MARINE RESOURCES AUTHORITY
MINISTRY OF RESOURCES AND DEVELOPMENT
REPUBLIC OF THE MARSHALL ISLANDS

**BASIC DESIGN STUDY REPORT
ON
SMALL-SCALE FISHERY SUPPORT STATION PROJECT
IN
THE REPUBLIC OF THE MARSHALL ISLANDS**

MARCH 1994

Fisheries Engineering Co., Ltd.

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BASIC DESIGN STUDY REPORT ON SMALL-SCALE FISHERY SUPPORT STATION PROJECT IN THE REPUBLIC OF THE MARSHALL ISLANDS
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FISHERIES ENGINEERING CO., LTD.

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THE REPUBLIC OF THE MARSHALL ISLANDS**

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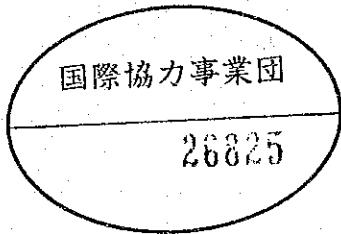


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MARCH 1994

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PREFACE

In response to a request from the Government of the Republic of the Marshall Islands, the Government of Japan decided to conduct a basic design study on the Small-scale Fishery Support Station Project in the Republic of the Marshall Islands and entrusted the study to the Japan International Cooperation Agency (JICA).

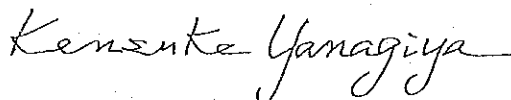
JICA sent to the Marshall Islands a study team headed by Mr. Yoshio Ishiyama, Associate Specialist on Fisheries, Second Basic Design Study Division, Grant Aid Study and Design Department, JICA, and constituted by members of Fisheries Engineering Co.,Ltd., from November 29 to December 11, 1993.

The team held discussions with the officials concerned of the Government of the Marshall Islands and conducted a field study at the study area. After the team returned to Japan, further studies were made, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of the Marshall Islands for their close cooperation extended to the team.

March, 1994



Kensuke Yanagiya
President
Japan International Cooperation Agency

March 28th, 1994

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

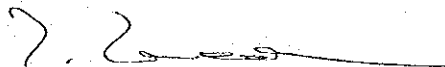
We are pleased to submit to you the basic design study report on the Small-scale Fishery Support Station Project in the Republic of the Marshall Islands.

This study was conducted by Fisheries Engineering Co.,Ltd., under a contract to JICA, during the period November 19, 1993 to March 28, 1994. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation in the Marshall Islands, and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

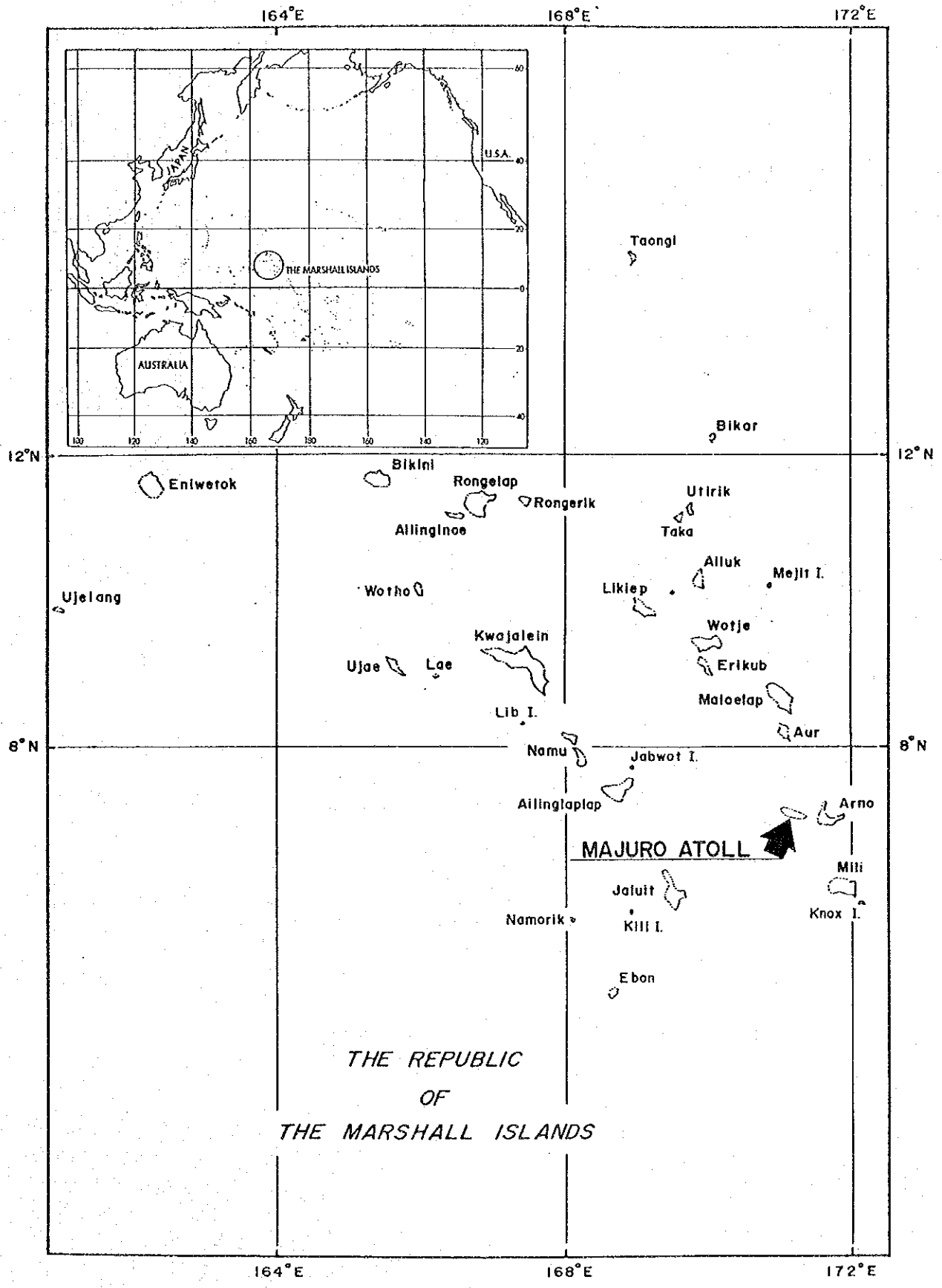
We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, Ministry of Foreign Affairs, and Fisheries Agency of Ministry of Agriculture, Forestry and Fisheries. We would also like to express our gratitude to the officials concerned of Marshall Islands Marine Resources Authority, JOCV Marshall Islands Office and Consulate-General of Japan in Agana for their cooperation and assistance throughout our field survey.

Finally, we hope that this report will contribute to further promotion of the project.

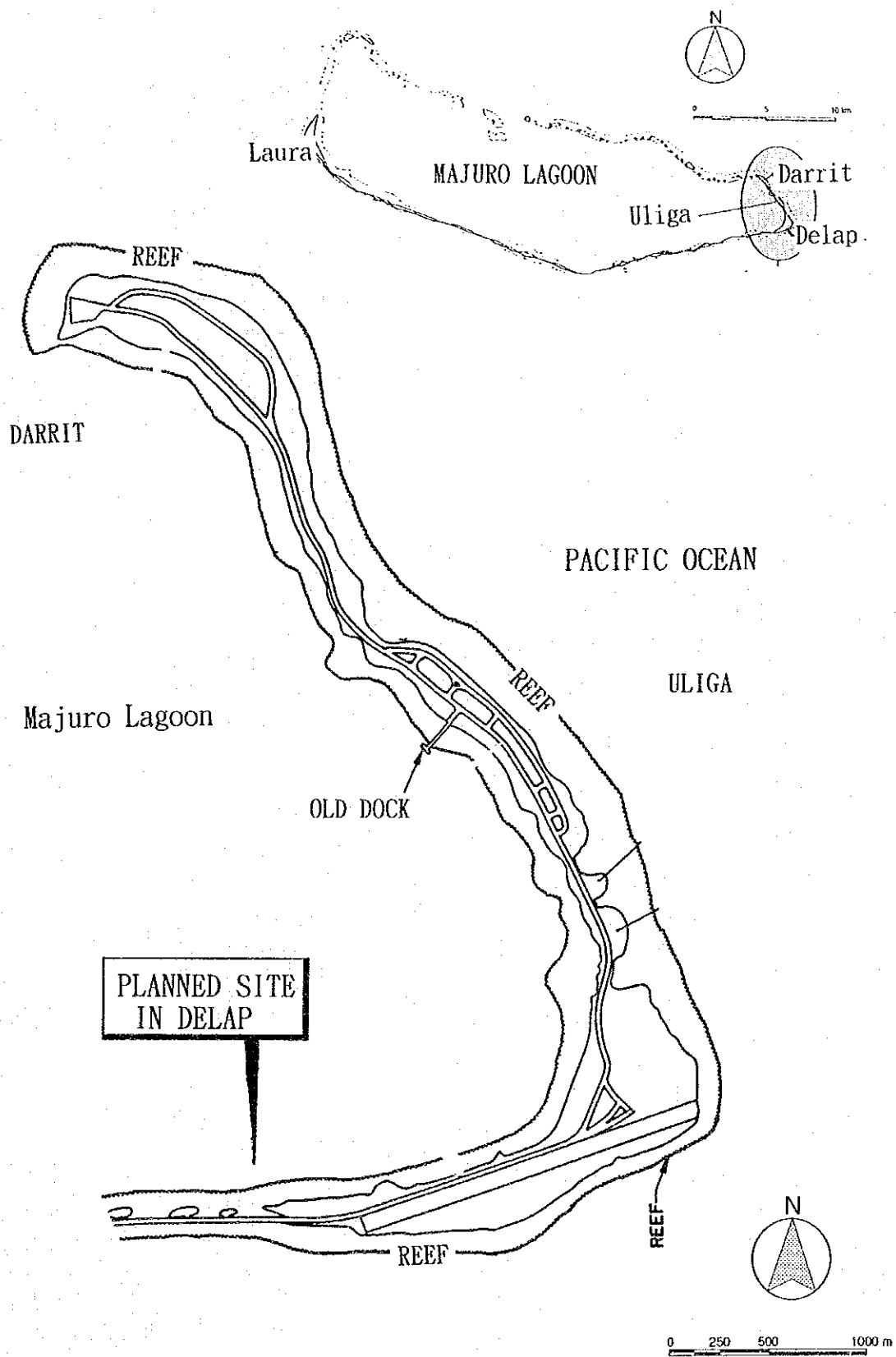
Very truly yours,



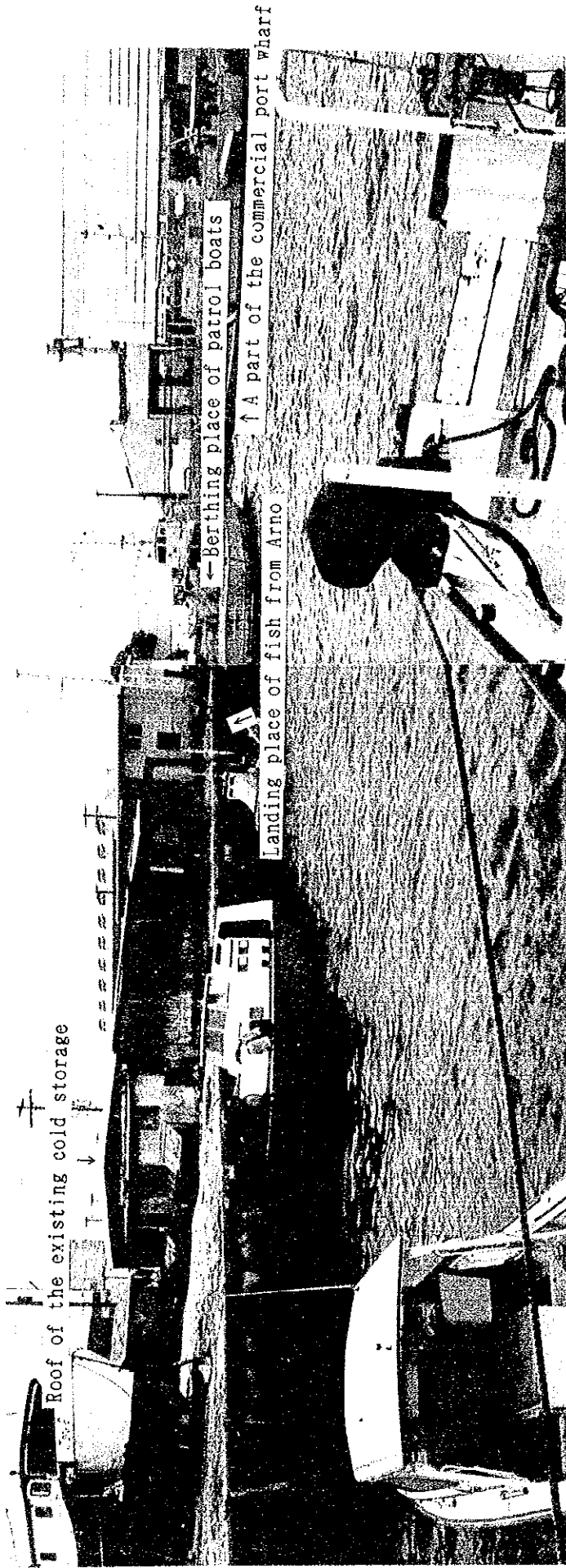
Toyomitsu Terao
Project Manager,
Basic Design Study Team on
Small-scale Fishery Support Station
Project in the Republic of
the Marshall Islands,
Fisheries Engineering Co.,Ltd.



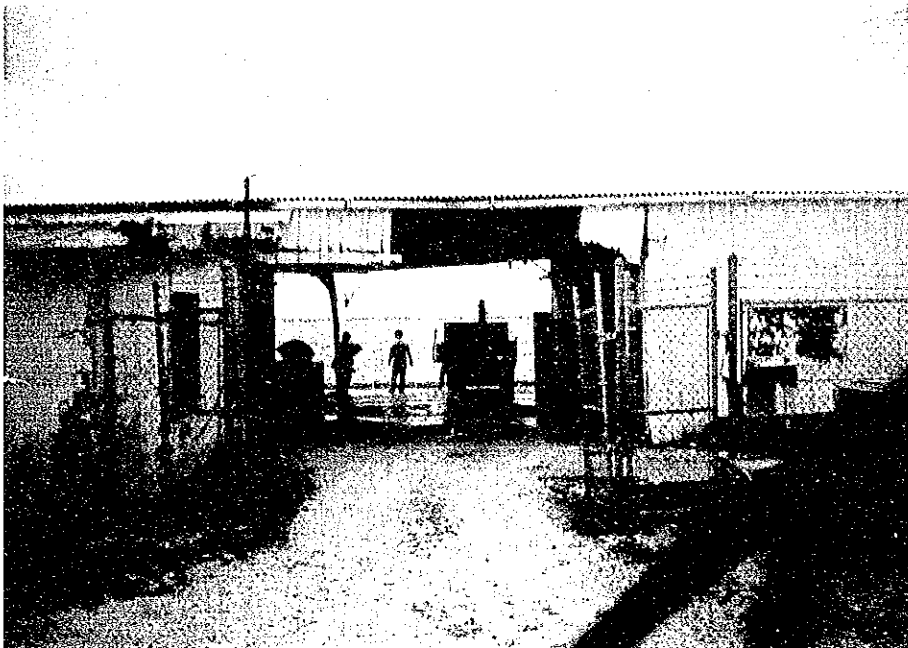
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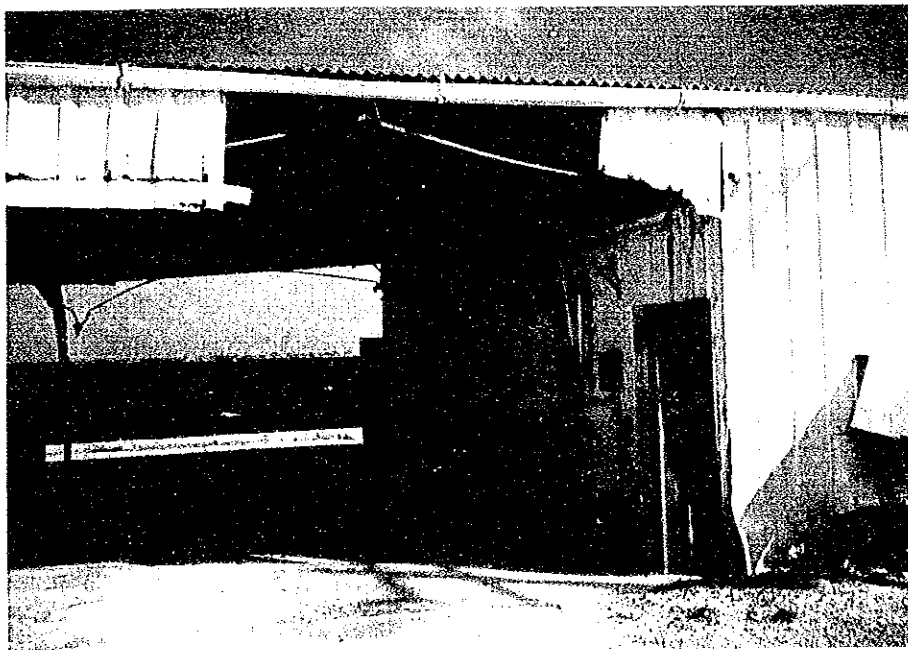
PROJECT SITE



Vicinity of the Project Site



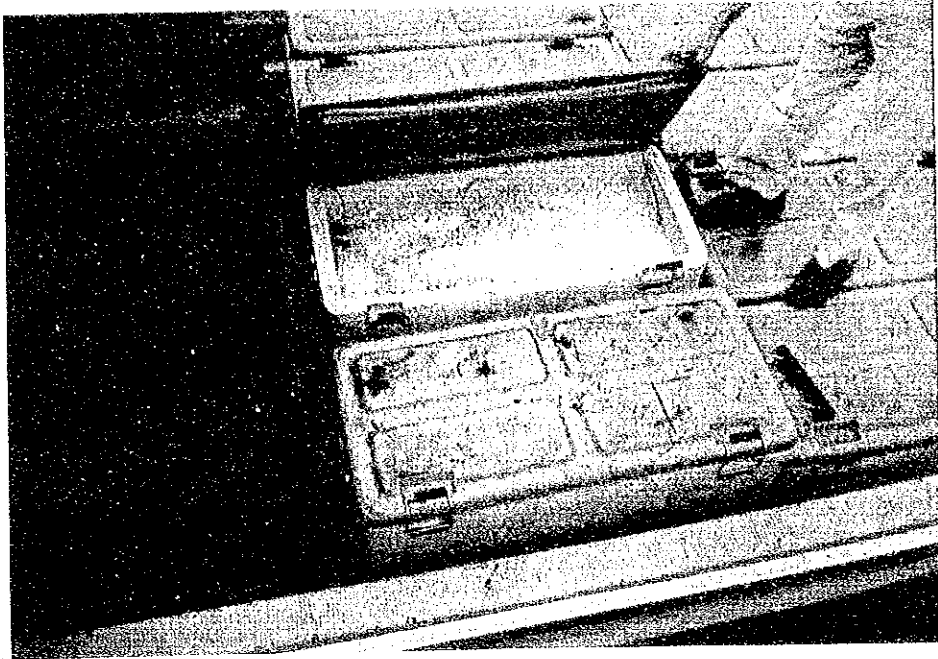
Entrance to the
Project Site



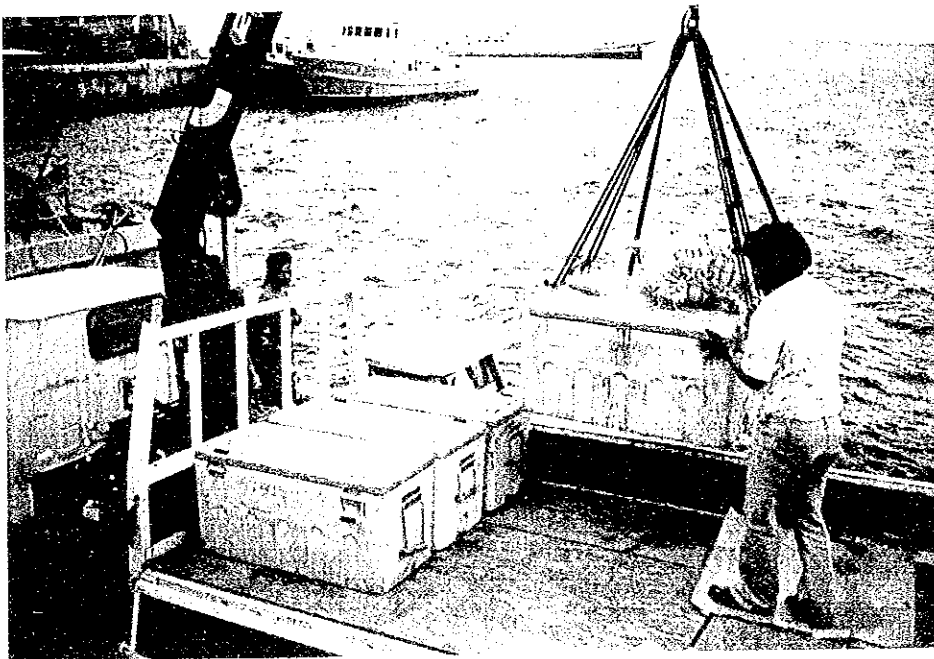
Present conditions
of the existing
cold storage and
covering roof



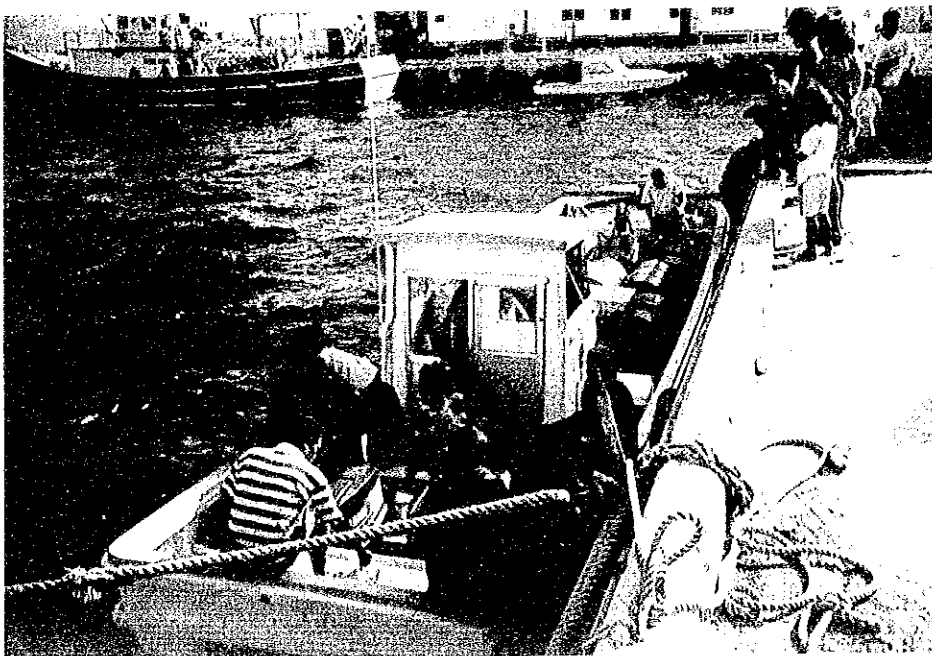
Existing ice plant
and enclosed
office



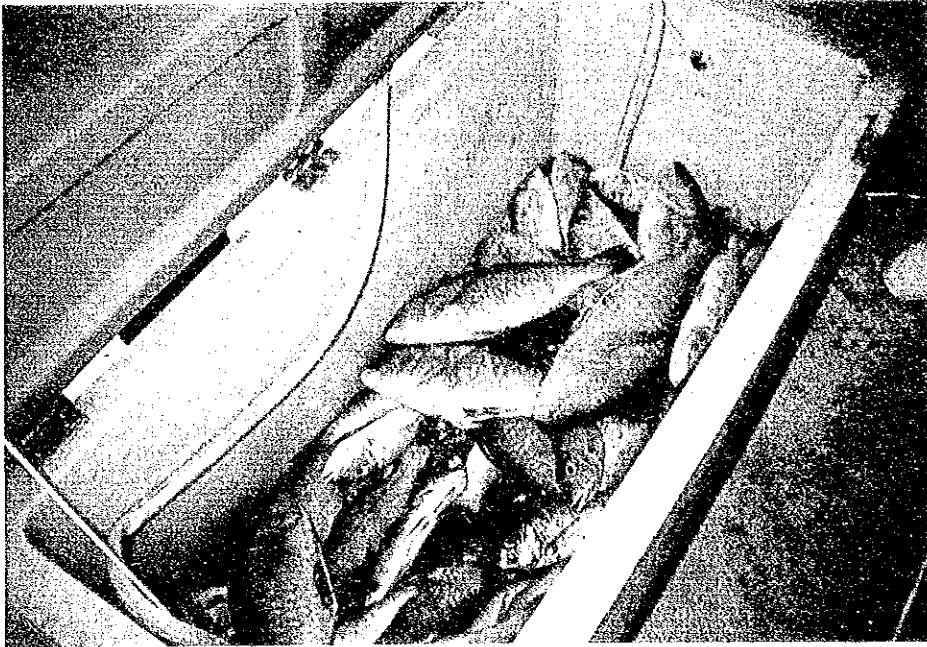
Fish transported
from Arno



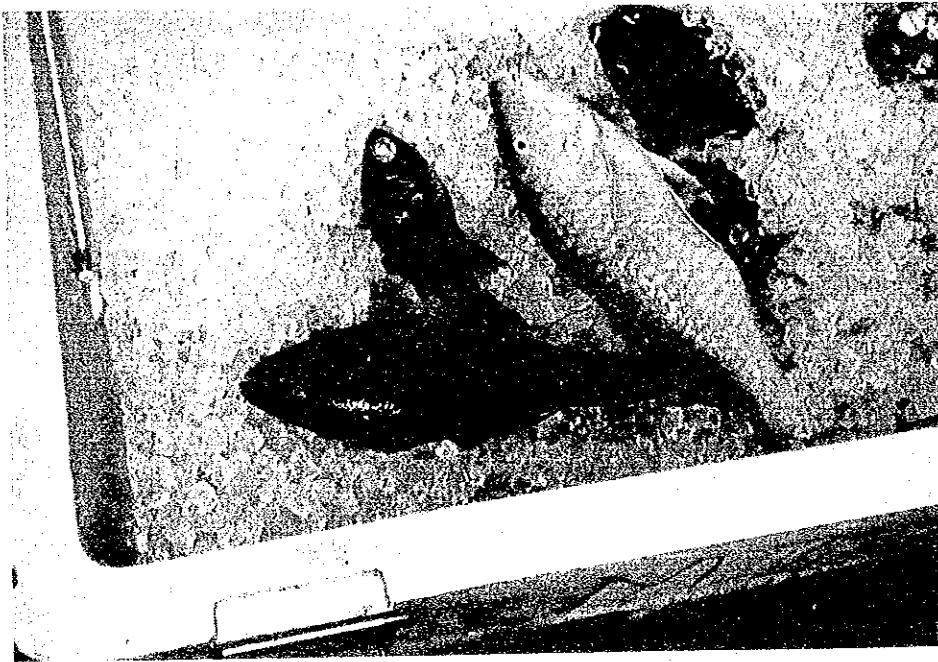
Landing operations
by a truck crane



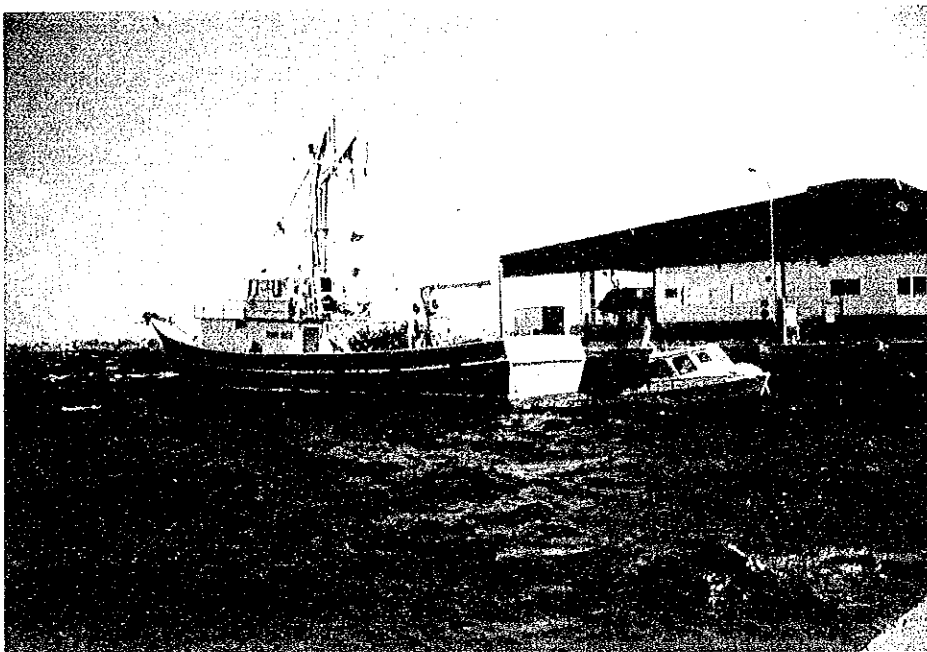
Fuel drums, cargos
and passengers
departing Majuro



Reef fish from Arno
sold at a retail
store in Majuro



Conditions of fish
preserved (line in
Arno atoll)



A tuna longline boat
berthed at the
fishing base
adjoining to the
Project site

SUMMARY

The Republic of the Marshall Islands is situated in the central Pacific between 4-19 degrees North and 160-175 degrees East. Composed of 29 atolls and 5 islands, the country's total land area is quite small (181km²), but it has a lagoon area within the reef of 11,670km² as well as a huge 200 mile Exclusive Economic Zone of 1,942,000km². The resources that presently contribute most to the national economy are copra and fish, but, among the nation's limited supply of developable resources, the Marshall Islands Government, in its 2nd 5-Year Development Plan (1991/92 - 1995/96), has set, as its major objective, the self-development of its rich fishery resources, which have hitherto been developed mainly by foreign fishing vessels. To this end, the Marshall Islands Marine Resources Authority (MIMRA) has been implementing a fishery development plan for the outer islands intended to commercialize the outer island fisheries as a sector with a major potential for achieving sustainable utilization of domestic resources. A plan has been formulated to provide a Small-scale Fishery Support Station geared to the receipt and marketing of catches from the outer islands at the consuming center in Majuro as a means of coping with the steady increase in fish production in these outer islands that has resulted from implementation of the outer islands fishery development plan. A request has been made to the Government of Japan for a grant-aid with which to implement the Small-scale Fishery Support Station Project.

Pursuant to this request, the Government of Japan decided to refer the Plan to a basic design study and the Japan International Cooperation Agency (JICA) initiated this study in November, 1993.

Based on the findings of the field survey and subsequent analysis thereof, the following points for consideration have been established to optimize the contents of the Plan.

- (1) Coastal fisheries in the Marshall Islands have a key responsibility in terms of utilizing the country's available resources for the benefit of the national economy and of providing a supply of animal protein foods for the Republic's population. In the outer islands, fish is the major source of animal protein and so fishing has traditionally been a prime

activity. In the urban areas of the country, on the other hand, where most of the residents are employed by the public and private sectors or self-employed in the service sector, there are virtually no full-time fishermen, so that the local fresh fish supply is inadequate.

- (2) As the agency directly responsible for administering the 200 mile zone, MIMRA has been promoting the outer islands fishery development plan, which seeks to build up fish production bases in the outer islands, while also supplying the means of production. The essence of this program is to furnish various kinds of support to operating groups involved in the commercialization of outer island fisheries for a two-year period and subsequently provide continuing guidance to make these fishing operations independently viable. The outer islands fishery development plan was launched on Arno Atoll in 1988, and this pilot operation has developed to the stage at which some 42 tons of fish a year are now being supplied to consuming markets in Majuro. However, particularly during 1993, sales volume of this Arno fish in Majuro has lagged seriously behind the increasing supply, resulting in a need to expand further distribution outlets for fresh fish.
- (3) The Plan area for this Small-scale Fishery Support Station Project is a 40m section, administered by MIMRA, in the central portion of the 100m fishery dock for small fishing boats in the Delap area in the center of Majuro Atoll. This location presently contains a number of facilities, including a cold storage. While most of these facilities are superannuated, a part of the cold storage is still being used, and it has been determined that it would be advantageous, from the standpoint of the national economy, to utilize these existing facilities wherever possible in this Plan.
- (4) The installation of a floating pontoon, as contained in the original request, has been deemed unsuitable for two reasons. First, wave action is quite severe in the waters in front of the facilities when north-easterly winds blow. Secondly, these waters form part of the main access channel for tuna longline fishing vessels and patrol boats using the neighboring dock. As a substitute measure, therefore, we plan to provide a removable boarding ladder. Also, with respect to the vehicles shown in the request, since MIMRA already has a fleet of vehicles which are well-maintained and in fine operating condition, we have decided that there is little need to provide additional vehicles under the subject Plan.

The facilities and equipment required to achieve the Plan objectives, based on the above findings, are outlined below:

Facilities:

Administration Bldg.	2-story steel frame construction	115.5m ²
	Offices	19.3m ² x 3 rooms
	Meeting room	19.3m ²
	Workshop	19.3m ²
	(for outboard motor repairs)	
	Staff room	19.3m ²
Roof Structure	Steel frame construction, single-story	330m ²
	Cold storage section	169m ²
	Corridor, fish handling space	161m ²
	(including space for installing ice plants)	
Toilet	Concrete block construction, single-story (including a septic tank for soil water)	5.4m ²
Oil storage shed	Concrete block construction, single-story	14.4m ²
Equipment:		
Ice plant	2 tons/day, plate ice, with ice storage bin (4 tons)	2 units
Outboard motors: 25 ps	gasoline powered	15 units
40 ps	" "	15 units
Fishing gear	Hand line, troll line, underwater gear	1 lot
Repair tools for outboard engine	Grinder, compressor, drill, general purpose and specialized tools	1 lot
Containers for fish transportation	15 insulated boxes (160 ltr), 40 plastic boxes (80 ltr), and 40 plastic barrels (50 ltr); 300kg platform scale; 4 chill display cases for use in retail stores	1 lot
Repair equipment for the cold storage	1 cooler unit each for the chill storage and cold storage, partition, and materials for doors and ceiling repairs	1 lot
Removable boarding ladder	Stainless steel stairs, retractable fixing metals, accessories	1 lot

Turning next to the project schedule, since steel frames for the structural materials and vinyl-chloride coated steel sheets for the roof for the Plan facilities will be difficult to procure in the Marshall Islands,

they will have to be brought in by surface water from Japan. Accordingly, the period required for the construction phase of the Plan, including both preparation time in Japan and construction work in Majuro, has been estimated at 7 months, while that for the equipment will require a maximum of 5 months.

The implementing organization for the Plan will, for the time being, be MIMRA, which intends to put a major effort into establishing new distribution channels for fresh fish in Majuro. In the future, however, it is anticipated that responsibility for the facility will be separated into 3 independent activities: carrying out the original fish marketing functions at the Plan facilities, fish production in the outer islands and transport of catches to Majuro, and administrative support geared to economic development in the outer islands through fishery production and distribution activities in consuming centers. The outboard motors and fishing gear included in the Plan will be sold directly to fishermen fulfilling certain qualifications as a means of developing outer islands fisheries, with the sales proceeds to be deposited in an Operating Fund for the facility. From this standpoint, it is fitting and proper that MIMRA become the implementing organ for the Plan facilities, including management responsibilities. Total operating expenses for the Plan facilities have been estimated at \$26,372 per year and total revenues at \$26,845, indicating a rough balance between income and outgo. In order to maintain efficient operations and qualified supervision of the facilities, it is essential that MIMRA devote a considerable effort to this end.

Based on Plan implementation, conditions should be established for insuring the stable continuation of the outer islands fishery development program at Arno Atoll, which is expected to serve as a model for generalized outer island development utilizing domestic resources. It is hoped that, through this Plan, the ratio of unsold fish at Majuro, which is currently rising, will be reduced to 5% from the 6.75% figure recorded in 1992, which would result in increased revenues of \$16,000 from current levels and permit an additional 5,400kg of fish to be used effectively as a source of animal protein. In addition, it is anticipated that fishery development will be stimulated on other outer islands apart from Arno, hopefully making it possible to meet consumer demand without the undue concentration of resource

pressure in particular areas which has given rise, under existing conditions, to serious concern over resource levels for reef fish at Arno Atoll. Based on the above considerations, the Team has determined that there would be major significance in implementing the subject Plan under a grant-aid from the Government of Japan.

PREFACE
LETTER OF TRANSMITTAL
LOCATION MAPS & PHOTOGRAPHS
SUMMARY

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SECTION ONE: INTRODUCTION

The Republic of the Marshall Islands, based on a constitution, has inaugurated an autonomous government in 1979 as a part of the Trust Territories of the Pacific Islands, and in 1986 signed a Compact of Free Association with the United States to attain the independence. The Government of the Marshall Islands has established the national goal of laying the foundations for achieving economic independence by the year 2001 - i.e., during the first 15 years of the Compact of Free Association. Continuing the First 5-Year Development Plan, which was implemented with the start of the Free Association era (1986/87 - 1990/91), in the 2nd 5-Year Development Plan (1991/92 - 1995/96), presently in progress, among the country's extremely limited number of developable resources, major priority has been placed on developing, by the country's own hands, its abundant marine resources, which, up to now, had been developed mainly by foreign fishing vessels. The Marshall Islands Marine Resources Authority (MIMRA) has drawn up a Plan for establishing a Support Station for Small-scale Fisheries, under which facilities, will be established for receiving fish catches from the outer island at Majuro, the main consuming market, with a view to assisting the small-scale fisheries of the outer islands. Now that headway is being made in the pilot operations at Arno Atoll which were started for the purpose of commercializing the outer island fisheries, the Government of the Marshall Islands has requested a grant-aid from the the Government of Japan to implement this Plan.

In response to this request, the Government of Japan decided to conduct a basic design study on the subject Plan. The Japan International Cooperation Agency (JICA) dispatched a basic design study team to the Marshall Islands from November 29 to December 11, 1993, headed by Yoshio Ishiyama, Associate specialist on fisheries, Second Basic Design Study Division, Grant Aid Study & Design Dept., JICA. The Team conducted a study to validate the contents of the request, evaluate the nature and appropriateness of the Plan, the condition of existing facilities, distribution channels for fish products from Arno Atoll, suitability of the Plan site, and the implementation structure for the Plan. The basic understandings reached during the discussions between officials of the

Marshall Islands Government and the Team regarding project implementation were summarized in the Minutes of Discussions, which was signed and exchanged by both parties.

Upon returning to Japan at the conclusion of the survey, the Team analyzed and evaluated the survey findings, assessed the requirement for the requested facilities and equipment, and prepared a basic design covering the composition, technical specifications, and quantities of the equipment. Based on the results of the above study and examination, we have prepared a basic design of the Plan facilities and equipment deemed optimum for project implementation together with a project implementation plan and a project evaluation. The composition of the Team, survey itinerary, list of discussants, and the Minutes of Discussions are shown in the Appendix to this report.

SECTION TWO: BACKGROUND OF THE PLAN

2.1 The Natural Environment:

The Republic of the Marshall Islands is located in the central Pacific between 4-19 degree North and 160-175 degree East and is composed of 29 atolls and 5 islands. Its total land area is quite small (only 181km²), but the country's water areas are vast: the lagoon area of the atolls covers 11,670km² and the 200 mile Exclusive Economic Zone some 1,942,000km². Based on the Census conducted in November 1988, the population of 43,375 lives on 20 atolls and 4 islands, but 67% of the total are concentrated in Majuro Atoll and Ebeye in the Kwajalein Atoll, where the U.S. missile tracking station is located. Thus, there is a huge population disparity between the cities and the outer islands.

Land elevation is low, owing to the atoll topography. Since it is composed mostly of limestone developing from marine life, the organic content is low. Accordingly, excluding copra, there are virtually no agricultural products from which foreign exchange earnings can be anticipated, while the country is far from self-sufficient even in root crops. There are no land-based mineral resources worth mentioning, though there are outcroppings of manganese, mineral crusts, nickel, and cobalt, among others on the ocean bottom.

Annual rainfall at Majuro is 3,440mm, with an average annual temperature of 26.8 degree Celcius. However, north of 8°30' N, the area is influenced strongly by the easterly trade winds, while the area south of this line is characterized by relatively strong northeasterly winds and comparatively low rainfall and temperatures. Tropical cyclones develop only rarely, but, when they do, damage can be extensive, owing to the low-lying topography. These natural conditions, together with the geographical setting -- the Marshall Islands are quite remote from Pacific rim markets -- have created a very difficult environment in terms of economic development.

2.2 Socio-economic Conditions:

Reflecting the extreme paucity of developable resources, the Marshall Islands economy relies heavily on financial aid from the United States, based on the Compact of Free Association. Government revenues during the 2nd

5-Year Development Plan (1991/92 - 1995/96) are planned to average \$60.3 million per year over the Plan period, but some 55% of this income is traceable to the above Compact. This figure though does not include the \$11.8 million lease revenues from the Kawjalein base. 72% of these receipts are used for current expenditures, with another 20% earmarked for debt service, and so the actual amount that the Government can provide for the development plan is only \$5 million per year. The country's main product is copra, produced principally on the outer islands. In 1989-91, average production of this commodity was 4,578 tons per year, and the production trend in recent years has been flat. During 1992, there was a sharp spurt in international copra prices, which is believed to have caused an increase in output, but the average per-capita income from copra over the 3 year period (1989-91) on the outer islands came to only \$46.33 per year. The per capital Gross Domestic Product (GDP) for the Marshall Islands was shown as \$1,583 in 1988, but the majority of the GDP is comprised of direct and indirect government spending, so that only one-fifth is accounted for by production utilizing domestic resources. More than half of national income is generated by foreign aid. As shown in a report from the Asian Development Bank, were this aid to be eliminated from the calculations, the actual per capita GDP in the Marshall Islands would be no more than \$200 - 600 per year.

Products other than copra include handicrafts and harvests of Trochus shell (Trochus niloticus). The former activity is becoming increasingly important as an outlet for women on the outer islands, while the Trochus shells can be exported at prices more than ten times higher than copra for a given unit of weight. At present, apart from the Enewetak Atoll, resources are said to have been largely exhausted. The Marshall Islands Government, therefore, has imposed various restrictions on fishing activity, closures and a permit system on trochus shell collection. The composition of the GDP in 1988, broken down by urban and rural areas, is presented in Table 3.1.

Table 2.1 GDP: RURAL-URBAN COMPOSITION 1988

(in \$ '000)

Sector	Total	%	Urban	% Total		
				Sectoral GDP	Rural Sectoral GDP	
Agriculture	8.923	13.0	2.323	26.0	6.600	74.0
Non-Marketed	6.000	67.2	823	16.6	5.000	83.3
Marketed	2.923	32.7	1.500	45.3	1.600 a)	54.7
Manufacturing	6.703	9.8	6.103	95.5	600 b)	4.5
Non-Marketed	100				100	100.0
Marketed	6.603		6.103	96.7	500	3.3
Electricity & Water		0.9	587 c)	100.0		
Construction	7.636	11.1	7.236	94.8	400	5.2
Wholesale & Retail Trade, Restaurants and Hotels	9.882	14.4	8.682	87.8	1.200	12.1
Transport, Storage and Communications	3.800	5.5	3.700	97.4	100	2.6
Finance, Insurance Real Estate and Business Services	5.942	8.6	5.942	100.0		
Communication Social and Personal Services	25.189	36.7	23.752	94.3	1.437 d)	5.7
TOTAL	68.662		58.325		10.337	

a) Copra Production and Trochus shell & other produce

b) Handicrafts Production

c) No estimates available for rural areas Jaluit/Kili

d) This includes \$US 810 urban to rural transfers, i.e. salaries of national government staff seconded to rural areas

(Source: The 2nd 5-Year Development Plan, Republic of the Marshall Islands, Office of Planning and Statistics, 1991)

2.3 The National Development Plan:

The Marshall Islands Government is well aware that economic independence is impossible to attain without the development of the fish resources in the country's vast economic zone. In the 2nd 5-Year Development Plan for 1991/92-1995/96, as a matter of official development strategy, the top priority in the Government's investment program has been placed on the fishery sector, followed by tourism, and these two sectors are being treated as the main pillars of the country's economy. During the period of this Plan, the development budget targeted at the economic sector is planned to run \$46,860,000, with 67% (\$31,580,000) allocated to the fishery sector. The six national development goals set forth in this Development Plan comprise: a growth in self-sufficiency, increased employment, improved living standards, income equalization between urban and rural areas, and integration and establishment of the state. At the present juncture, the

Marshall Islands economy must rely on imports for all of its consumer and capital goods and raw materials and must also depend on the outside world for the labor, technology, and management resources for utilizing these imports. In order to reform this economic structure, there is no alternative other than expanding effective production based on domestic materials with a view to achieving independent growth without reliance on outside aid. When one considers the country's high rate of population growth, exceeding 4% per annum, as well as the fact that core donations from the U.S., based on the Compact of Free Association, which comprise the main portion of foreign aid, will be slowly decreasing over the life of the 2nd 5-Year Plan by \$4 million a year, it is a national imperative, we believe, to improve current conditions, characterized by a high standard of living supported by financial assistance, and a huge gap between consumer demand and domestic supply, by making optimum use of developable national resources.

As of July, 1991, foreign debt amounted to \$58 million, which had been incurred mainly for the power plant in Majuro, construction of a powder milk plant, and aircraft for Marshall Air. Debt service requirements over the period of the 2nd 5-Year Plan will require an average appropriate of \$11.5 million per annum, a sum that is 5-6 times the level of exports.

2.4 Review of the Fishing Industry:

2.4.1 Fishing Ground Environment and Resources:

The atolls of the Marshall Islands are generally steep. The surrounding seas comprise both deep bottoms and shoals, with only a limited number of sea-mounts or shelves with depths of a few hundred meters. The waters in the southern part of the country south of 8°30' North are in the area of the Equatorial Countercurrent, and the seas of south of 6°N are the areas most strongly affected by this current. The northern waters lie within the zone of the North Equatorial Current, with a westward flow reaching 0.5 - 1.5 knots.

The outer seas are rich in highly migratory species, primarily skipjack and tuna, which are taken by foreign fishing vessels from Taiwan, Japan, the U.S. and other countries. In 1990, an operation was launched to catch fresh tuna by tuna longline vessels for air shipment to overseas markets, based on a joint venture between the Marshall Islands Development Authority (MIDA)

and U.S. and Japanese companies based in Hawaii. Another joint venture with the U.S. is conducted by two skipjack and tuna purse-seine vessels. The total catch in 1990 of skipjack and tuna in the western Pacific, including the Marshall Islands, was about 1,080,000 tons, and it has been determined, on the basis of resource management records over the past 25 years, that the catch has consistently been below potential catch levels. The area of the lagoon surrounding the 29 atolls of the Marshall Islands, is, as already noted, 11,672km² in area, and as coral reefs, have a generally high level of productivity. However, there are no research data shedding light on the level of allowable catches that will insure resource continuity in the Marshall Islands lagoon. So long as sustenance fishing continued as the traditional fishing activity in the outer islands, given their low population, there would be no reason, in our view, to anticipate any resource problems in the lagoon. However, in connection with current exploitation of fish resources in the lagoon, it will be necessary to clarify the methods that will be used to manage these resources.

2.4.2 Fish Production:

(1) Small-scale Fisheries:

For the people of the Marshall Islands, surrounded on all sides by the vast ocean, fishing has traditionally been one of the primary means of livelihood. In most cases, fishing activity is a part-time occupation, combined with the cultivation of copra, fruit, and root crops; thus, there are few full-time fishermen. However, commercial fishing operations are seen in Majuro and on Ebeye Island in the Kwajalein Atoll. Subsistence fishing is conducted in canoes fitted with out-riggers, using paddles and sails, and by even small non-powered canoes rowed only by paddles. Within the lagoon and the outer borders of the reef, the most popular fishing methods are hand-line and spears, while, on the open sea, trolling lines are most general. Catches are consumed either by the fishing household or local residents, with very little commercial distribution in evidence. In the absence of proper storage and preservation facilities, and in view of the close proximity of the fishing grounds, these boats can catch an amount that is deemed adequate for their own needs, and this is tantamount to a voluntary limited on their catch effort. There is no firm data on

subsistence catches but it is estimated that annual per-capita fish consumption in the outer islands runs about 42kg.

The small commercial fisheries targeted at Majuro Atoll, whose population was estimated at over 20,000 in mid-1993, comprise two types of operation. One sector uses outboard powered boats of relatively high horse power owned by Majuro residents. These boats are normally used also as a means of transport and for recreational purposes but, on weekends and holidays, are employed to catch fish not for the fishermen's own consumption but rather for cash sale to supermarkets and other outlets. The other type is based on Arno Atoll, about 40km from Majuro Atoll. This fishery operates under the outer islands fishery development program, which was started with cooperation from Japan and uses 8 outboard-equipped fishing boats, with catches shipped by carrier vessel to Majuro for distribution to supermarkets and small stores.

(2) Large-scale Commercial Fisheries:

Large-scale fishing operations, as presently carried out in the Marshall Islands, are conducted by the tuna longline fleet. The vessels used here are small Florida-type longline boats 25-30m in length overall and 7-8m breadth. As of November, 1993, 13 vessels were operating, of which 6 are registered in the Marshall Islands by local firms. The remaining 7 boats are U.S.-flag vessels chartered by a joint venture between MIDA and a U.S. company. This fishing activity is directed at fresh tuna markets in Japan and the U.S., with the fish shipped by air via Hawaii for fresh market use. Full-scale operations commenced in 1991.

The standard number of operating days per trip runs 10-14 days. The vessels use nylon monofilament for their main lines, with a line extension of 15-20km, along with 2,000 hooks. Fishing grounds are mostly located 60-100 nautical miles from Majuro, and, on the average, 6-7 operations are conducted on each trip. The hooking rate is not known but, from the first third to the middle third of December, 1993, one tuna longliner reported 6 operations and a total catch of 189 fish, including both yellowfin and bigeye. Since 2,000 hooks were used per operation, the hooking rate works out to 1.57%. 20-30 tons of ice are loaded on board for each operation along with 200 boxes of bait. Exports by air of the fresh tuna caught by these boats totaled 333 tons for the period January - November, 1993.

While no figures were available of the profitability of these tuna longline operations, based on the performance over this period, the 13-vessel fleet sailed 139, with export volume per trip averages 2-4 tons. Since there is at present essentially no demand for fresh tuna in the Marshall Islands, the shipments can be considered as the export sales; on this basis, we feel that, on average, there is still considerable room for improvement in catch efficiency and financial performance in this tuna longline fleet. We understand that the joint venture plan of MIDA was predicated on a catch volume of 9 tons per trip, and present volume is only one-fourth of target level.

Fresh tuna air shipment operations in the Marshall Islands are mainly carried out in the fishing base established in Delap in 1985 with a grant-aid program by the Government of Japan. The fishing base facilities include the wharves of 76m and 46m in length, respectively for medium size and small fishing boats, a cold storage of -35°C with 150 tons holding capacity, a chill storage of 5°C with 50 tons holding capacity, an ice plant of 3 ton/24 hours production capacity of 25kg block ice, offices, and fish handling space. As of December, 1993, above mentioned joint venture company was using, under a lease agreement with MIDA, the base facilities exclusively for such operations as fresh tuna landing from longliners, ice supply, bait storage, process and package treatment of fresh tuna for air shipments. Except for the ice plant, which is too small to meet the longliners demand, and the cold storage, which was temporarily ceased operations due to difficulty in obtaining the repair parts, the facilities of the fishing base as a whole were fully utilized for support of fresh tuna export operations in the Marshall Islands which is playing a key role in obtaining foreign exchange to the country. We have then evaluated that, including the 220 tons per day flake ice machines and other renovated areas initiated by the joint venture company, the fishing base has been contributing meaningfully to the development of the tuna longline operations in Marshall Islands.

From the standpoint of the future of the fresh tuna market and effective utilization of resources in Marshall Island waters, efforts are now being placed on the developed of tuna longline fishing based on small-size longline vessels, and plans are being accelerated to build up the strength of these domestic fishing vessels as well as to expand landing by foreign fishing vessels in Majuro. In accordance with this Plan, it may be

noted that, in January, 1994, 22 tuna longline vessels of Chinese registry decided to shift operations for their traditional Palau grounds to the 200 mile zone of the Marshall Islands.

(3) Promotion of Small-scale Fisheries on Arno Atoll:

The outer islands fisheries development project in Arno Atoll was started in 1988 with cooperation from the Overseas Fisheries Cooperation Foundation of Japan (OFCF), to commercialize offshore fishing operations. Under this project, a variety of equipment was provided, including outboard-powered fishing boats, fish carrying vessels, and insulated boxes, while technical cooperation was also implemented involving specialists. In 1990, based on a grant-aid for this plan from the Government of Japan, landing wharves, shore-based facilities, cold storage and other base facilities were installed in the Arno and Ine areas. The fish caught in Arno is preserved in ice to maintain freshness, then transported three times a week to Majuro via carrier vessel for sale directly to supermarkets and institutional customers, such as hospitals and schools. During the 3-years from 1990, when catches under the project were launched on a full-scale basis, through 1992, the average annual catch volume was 38.9 tons (for a monthly average of 3.24 tons), while sales totaled 36.2 tons (3.02 tons per month), yielding proceeds of \$95,300 per year. The technical cooperation program from the OFCF terminated in February, 1993; since that time, operations have been continuing with a 5-man staff under MIMRA supervision. During the 9 month period from March-November, 1993, average monthly catches ran 4.32 tons, with sales of 3.44 tons valued at \$84,000. Sales volume, therefore, has been lagging behind catch volume, which has been on an increasing trend, leading to concern over a growing inventory of unsold fish.

(4) Fish Demand in Majuro:

Fish demand in Majuro has been estimated in the past using various methods. However, given the lack of basic statistics on items essential to the estimating process, such as income distribution, elasticity of fish prices, and consumption by source of animal protein, there has inevitably been a considerable dispersion of estimates. The Household Consumption Survey, conducted in 1991, had not yet been published as of December, 1993 but advance survey findings show fish consumption per household in Majuro to

be 14.5kg/month. Fish consumption in the outer islands was shown as double that in Majuro, while consumption volume in Ebeye was slightly less than in Majuro, at 13.6kg. According to the 1988 Census, there were 2,228 households in Majuro, containing an average of 8.6 persons per household. Using this value, fish consumption in Majuro works out to 20kg/person/year. With a population of 19,664 on Majuro Atoll, the annual demand for fish products there is indicated at about 400 tons.

Within a few kilometers of the DUD district in the heart of Majuro are a very large number of food outlets, including 2 major supermarkets and more than 20 grocery stores. Consumerism has deeply penetrated the urban life-style and, in addition, these stores perform the role of distributing foodstuffs to the outer islands. In estimating the latent demand for fish, in many cases, the imported canned fish products being sold in virtually all of these food outlets were considered a substitutable product, but fresh and canned products are inherently totally different in character from the standpoint of both preferences and degree of preservation, and it is doubtful that the two products are substitutable. At the present time, MIMRA is experimenting with the use of small food stores as a sales channel for fish brought in from Arno Atoll and, in October, 1993, made agreements with 5-6 food outlets in the DUD district, under which they have started a retail sales business, with in-store prices established by MIMRA and with the fish all ice-packed in a chill box. However, to the extent that was verifiable during our field survey, the fish supplied by MIMRA, whether reef fish or skipjack or other migratory species, was all sold at the participating retailers. In terms of a comparison with other sources of animal proteins, while fish prices run 2-2.5 times broiler prices, the people of the Marshall Islands have a rather strong preference for fish products and so, based on the expectation that fish consumption will increase as a result of improved sales methods, the fish marketing program through small food stores, as begun by MIMRA, is felt to have every possibility of achieving a certain degree of success, assuming the continuation of appropriate management and guidance.

2.5 The Fishery Development Plan:

In the 2nd 5-Year Development Plan (1991/92-1995/96), which is currently in progress, the fishery sector has been positioned as a core

sector for inducing economic development in the Marshall Islands, and it has become clear that the government's investment program is being concentrated in areas related to fisheries and demonstrates the extremely high level of expectations for fisheries as a field where the probabilities are highest for attaining a level of development which leads to self-sufficiency through utilization of domestic resources. The development goals for the fishery sector have been established as follows in the 2nd 5-Year Plan:

- To expand domestic production, satisfy domestic demand, reduce food imports, and earn foreign exchange.
- To realize the potential for commercial development of marine resource through commercial-scale tuna fisheries, small-scale coastal fisheries, processing and transshipment of fish catches, and aquaculture business ventures.
- To build a canning base in Majuro directed at catches from tuna fishing vessels.
- To cultivate human resources that will accelerate the development of fishery resources.
- To protect the Exclusive Economic Zone of the Marshall Islands through more economical methods.
- To develop a system for collecting, analyzing, and transmitting information pertaining to fisheries.
- To develop basic facilities in the outer islands to speed up the utilization of fishery resources as a substitute for copra production.

The outer islands fishery development plan is directly concerned with several of the above goals: viz., development of the outer islands, expansion of fishery production, and commercial development of fishery resources. This plan, different from the establishment of sales outlet network in consumer area which is now undertaken under this study, has already been carried out on Arno, Ailinglaplap, Namu, and Likiep Atolls. It is intended to furnish a production base, incorporating a landing wharf and cold storage plant, for the small-scale fisheries, means of production, such as fishing vessels and fishing gear along with carrier vessels, and seeks to establish a distribution base for the production area geared to neighboring consuming areas. MIMRA conceives of an organization based on a fishery cooperative as the key operating organ for the project, based on the

experience gained through the pilot program at Arno. To make it possible for this operating body to conduct the enterprise on a self-supporting basis, for 2 years after the start of the undertaking, MIMRA will provide a subsidy for purchases of fuel and ice and will also support self-sufficient operations through implementation of staff training programs and other means. Finally, it will set its sights on establishing the activity on a commercial basis.

2.6 Background and Nature of the Request:

The development of the outer island fisheries in the Marshall Islands is a key policy for narrowing economic disparities between the islands and urban areas as well as to assure an affluent, stable livelihood for the people on the outer islands. The outer islands fishery development plan was launched in 1989 on Arno Atoll and subsequently started on three other islands, with all of these projects implemented via grant-aid from the Government of Japan. Since March, 1993, 3 years after the effective start of the Arno Atoll venture, based on both grant-aid and technical cooperation from the Government of Japan, this venture has been conducted independently using Marshall Islands staff. Taking advantage of the proximity of the consuming market in Majuro, in recent years, the volume of catch purchases has been on a rising trend but, to cope with this supply, there is a distinct need for a program to expand sales volume as well at Majuro. MIMRA is adopting various countermeasures to this end but, in order to rationalize fresh fish distribution in the consuming markets and expand consumption in Majuro, which is the largest markets in the country for fresh fish products, MIMRA recognizes a need to develop receiving facilities for fresh fish in the consuming areas, where distribution is expected to increase in line with the future progress of the outer islands fishery development projects. MIMRA has, therefore, drawn up a Small-scale Fishery Support Station Project for the consuming areas and, in August, 1993, requested a grant-aid from the Government of Japan for this project. The composition of the requested facilities and equipment required for Plan implementation is as shown below:

- (1) Ice-making plant
- (2) Cold storage facility
- (3) Office and storage area
- (4) Workshop

- (5) Showcase for displaying fish products (for use in retail stores)
- (6) Outboard motors
- (7) Fishing gear and materials
- (8) Fish boxes
- (9) Vehicles

The floating pontoon included in the original request has been deemed inappropriate to Plan and has, therefore, been excluded. This is because of severe wave conditions for floating structure in front of the Plan site, and because these waters are on the main channel for tuna longline and patrol vessels using the adjacent dock. As a substitute plan for the pontoon, we are considering a removable boarding ladder geared to the usage conditions at the dock.

SECTION THREE: CONTENTS OF THE PLAN

3.1 Plan Objectives:

The coastal fisheries development project for the outer islands was launched on Arno Atoll with the objective of commercializing the fishing industry of the outer islands. Under this project, the Arno Atoll Fishery Association (AAFA), which was organized under the aegis of MIMRA, buys the fish caught around the Arno Atoll from the fishermen and transports it on a regular schedule 3 times a week to the consuming market at Majuro for sale. The Marshall Islands Government has positioned the Arno project as precedent for the commercialization plan for the outer island fisheries. The subject Plan is intended to continue and further develop this project, while maintaining a supply of fish for Majuro and, in order to promote fishery development enterprises in the outer islands, will provide a supporting base for small-scale fisheries in Majuro, a major outlet for their catches, and thereby promote the acceptance and marketing of these outer island catches.

3.2 Evaluation of the Request:

3.2.1 Need and Appropriateness of the Plan:

(1) Present Status of the Coastal Fisheries:

Coastal fisheries in the Marshall Islands are composed principally of small operations, primarily in the outer islands, which are conducted within the context of a subsistence economy. These fisheries draw on the available resources in Marshall Islands waters as an integral part of the national economy and play a major role in supplying animal proteins to the nation's population. The small-scale coastal fisheries of the Marshall Islands operate primarily to catch fish on a daily basis for consumption by the fisherman's own household, using traditional simple fishing methods. Accordingly, many households are engaged in these small-scale fisheries and, particularly on the outer islands, the bulk of the residents are engaged in fisheries; in Ailinglaplap, for example, 82% of households fish and, in Jaluit, the percentage rises to 87%. In the outer islands, fish is the major source of animal protein, so that fishing is very active. In the urban

areas, on the other hand, in view of the large number of residents working in the public and private sectors, there are virtually no full-time fishermen. Thus, the supply of fresh fish in these urban areas is chronically inadequate. Annual fish demand on Majuro Atoll is estimated at about 400 tons, but, at the present time, the volume of fish from Arno Atoll reaching Majuro through organized distribution channels is only 50 tons per year. In terms of the comparative prices of animal proteins, fresh fish is very expensive-- 2-2.5 times that of broilers. Thus, it has been determined that demand for fresh fish in the urban markets is by no means small, reflecting a strong preference for fresh fish.

(2) Coastal Fisheries Development Project in Outer Islands:

In the 2nd 5-Year Development Plan, the Government of the Marshall Islands has set as a prime objective the creation of a self-supporting economy and a narrowing of the income gap between urban and outer island areas through the commercialization of small-scale coastal fisheries. In this 5-Year Plan, for purposes of promoting the outer islands coastal fisheries, the intent is to provide basic fish production facilities along with the means of production and a variety of assistance programs. A core operating body in each area takes charge of this commercialization program, providing, over the first two years of the plan, management guidance, staff training, and other forms of assistance for this operating body. Up to now, within the context of a subsistence economy, fish distribution channels were confined to occasional transactions within the outer islands or surplus catches by residents of Majuro Atoll which were sold to retail outlets. But, since the start of the fisheries development program in Arno Atoll, based on assistance from Japan, considerable success has been achieved in organized commercialization of the small-scale fisheries. This sort of commercialization program directed at small-scale coastal fisheries has provided a valuable opportunity to earn cash incomes for the families on Arno, who have few other viable options for a cash income and has also invigorated the local economy.

However, with respect to the sale of fish catches in the major market at Majuro, other than a limited number of supermarkets and other organized outlets, no established distribution channels exist, nor is there any evidence even of spontaneous open-air markets or the distribution structures relating to such a market. Organized activities to enlighten Majuro

residents about fish and thereby expand consumption have only just begun. In addition, there are no facilities for receiving the catches and maintaining freshness. The organization and facilities to support the smooth distribution in consuming areas, which is indispensable to the development of outer island fisheries, are quite inadequate.

(3) Outer Islands Fishery Development Program in Arno Atoll:

As discussed above, AAFA is the main operating organ for the coastal fisheries development program on Arno Atoll. At the present time, fish caught in Arno are bought from fishermen at the fishing bases in Arno and Ine on Arno Atoll and shipped three times a week to the market in Majuro via an AAFA carrier vessel, where it is marketed as fresh fish products. The AAFA vessel is an FRP outboard-powered boat, with no deck and a length of 10 m. Landing of the fish along with that of fuel required for Arno operations is done at the Majuro fishery dock. This dock and shore facilities had been used by the Majuro Fisheries Cooperative Association (MFCA), which was active between September, 1977 and February, 1983. However, with the exception of the dock and a portion of the cold storage, these facilities are no longer operative.

Since the termination of the technical cooperation program extended by the Overseas Fisheries Cooperation Foundation in Japan in February, 1993, the AAFA operation has been continued by a 5-man AAFA staff. The volume of the purchased catches from March-November, 1993 has been increasing steadily, but sales volume in Majuro has not been growing at the same rate as purchases. As a result, concern is being expressed over an increase in the stocks of unsold fish. In 1992, 10 small outboard-powered fishing boats were operating around the Arno Atoll with an annual production of about 43 tons. This fresh fish was delivered to Majuro, and sales of this fish to local retailers and restaurants came to some \$107 million. As a means of dealing with the recent increase in unsold stocks, MIMRA has, in addition to the past outlets for fresh fish among large supermarkets and institutional customers, started experimental marketing of this fresh fish through general food outlets. Development of these new sales channels has only just been started in October, 1993 and so a definite assessment of the program is still not possible. However, based on results to date, we believe that there is a strong likelihood that this new sales method will take root.

The coastal fisheries commercialization venture in Arno is one of development projects for the outer islands being promoted by the Marshall Islands Government. In order to promote fishery development ventures in Mili and Jaluit similar to that in Arno, there is a strong requirement, in our judgment, for the establishment of a distribution facility at Majuro for fish products from the outer islands.

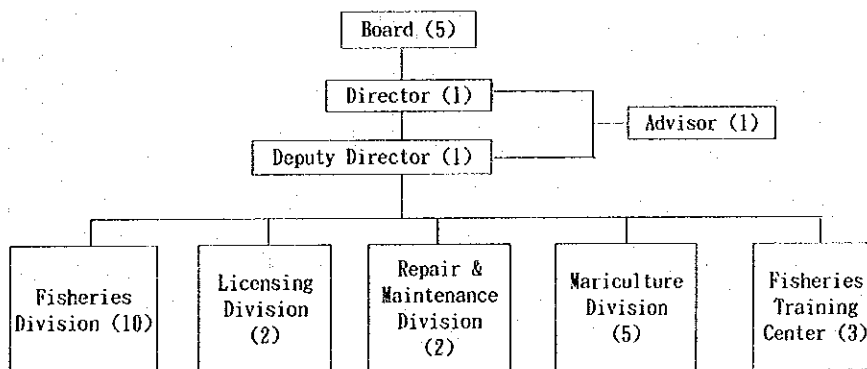
(4) Review of Existing Facilities:

Behind the fishery dock at Majuro, at which the fish brought in from Arno is landed, are a cold storage facility, a 105m² concrete block structure, and a small ice plant. These facilities, including the cold storage, were built in 1977 with aid from the United States, but damage to the 375m² steel frame roof is quite severe, and so its ability to function as a roof has seriously deteriorated. The cold storage, which is covered by this roof, is divided into four compartments: an 80m³ blast freezer, a 140m³ chill storage, a 25m³ ice storage, and a 40m³ anteroom. At present, only blast freezer portion is used for chill storage; apart from the anteroom, none of the other sections are operating. Three compressors have been installed, but only one is currently in operation. The insulating panels of the chill storage are of galvanized steel plate construction, hard foam urethane, with a thickness of 100mm, as the insulating material. Corrosion is developing in part of one section but, in our judgment, the facility as a whole is still quite usable. At present, the anteroom and one portion of the chill storage compartment are being used to store gasoline and diesel fuel drums along with fishing gear and materials. The building bloc is covered by a roof and is divided into a toilet/shower room, office, and storage room. At present, only one portion is being used as space for parts storage and for repair tools. The ice plant was built in 1987 with funding from the Marshall Islands Government, but the compressor is severely damaged and repairs would be difficult. Under the present conditions, these facilities are not suitable for receiving catches from the outer islands or preparing the fish properly for sale in the Majuro market.

3.2.2 Implementation Plan:

The responsible organ for the subject Plan will be MIMRA. This Authority is a government agency organized under 5 Board of Directors,

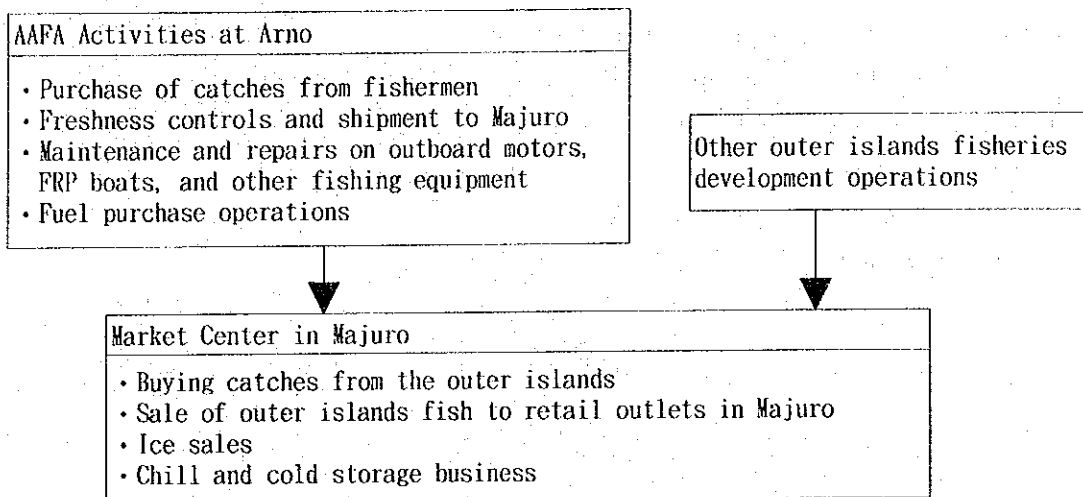
including the Minister for Natural Resource Development, who serves as Chairman; the Minister for Foreign Affairs; the Minister for Interior and Outer Islands Affairs; and 2 directors appointed by the President. MIMRA's responsibilities are broad: administration of the 200 mile zone, management and conservation of living and inanimate resources, fishing permits, and negotiating fishing agreements with other countries. The organization chart for MIMRA is shown below. The present coastal fisheries operations in Arno Atoll are carried out by AAFA under the supervision of the Fisheries Division of MIMRA.



Note: Figures indicate the number of persons deployed as of December, 1993

At present, AAFA supervises operations from the purchase of catches at Arno to the sale of fish in Majuro. However, with respect to sales in Majuro, 2 staff of MIMRA, which has supervising responsibilities for the Arno operation, are stationed in Majuro. Thus, much of the AAFA operation in marketing field in Majuro depends on MIMRA for direction and guidance. As the management structure for the subject Plan, unlike the provision of production based facilities in support of outer islands fisheries development program which had been established by the Marshall Islands Government as one of the goals of the 2nd 5-Year Plan, the operating body for this Plan facilities will have to take charge of catch distribution in consuming areas. For this reason, for the time being, it is considered appropriate for MIMRA to be directly responsible. In the future, we feel it would be proper for its production division, which handles the phase from fish production to transport to the consuming area, and sales division in

the market area, to be organizationally separate, in which case the organizational structure could be designed as follows:



Accordingly, until such time as a suitable operating organization can be established to take charge of sales of outer island catches at Majuro, MIMRA will serve as both the responsible and implementing organ for the Plan.

MIMRA's annual budgets over the past three years have been as follows. The fiscal year for the Marshall Islands Government runs from October to September of the following year.

Fiscal Year	1991/92	1992/93	1993/94
Budget (U.S.\$)	371,400	448,600	448,600

3.2.3 Related Plans:

To date, the outer islands fisheries development project for the Marshall Islands has been implemented on the basis of grant-aid and technical cooperation from the Government of Japan. The project for Arno Atoll has been developing in content and scope as a working precedent for

the outer islands project activities in the Marshall Islands as a whole, based on cooperation from both the Government of Japan and the Overseas Fisheries Cooperation Foundation, based in Japan. The Government of the Marshall Islands is implementing the outer islands fisheries development project as one of the priority policies under the 2nd 5-Year Plan and, in this respect, hopes to be favored by continuing cooperation from the Government of Japan. Thus, there is only a slight connection between the present Plan and projects carried out under other aid programs.

3.2.4 Evaluation of the Requested Equipment and Facilities:

As previously discussed in Section 2.6, the requested facilities and equipment here in order of priority:

- (1) Ice-making facilities
- (2) Chill storage
- (3) Office and Storage
- (4) Workshop
- (5) Chill display cases for fish sales at retail outlets
- (6) Outboard motors
- (7) Fishing gear and materials
- (8) Fish boxes, and
- (9) Vehicles.

The requirements for the above items are examined in the following sections.

(1) Ice Plant

Excluding the small ice-making facilities supplying the limited demand for ice in the small stores of Majuro, 2 ice plants have been built to supply ice to fishermen. One was constructed in 1985 with a grant-aid from Japan within the fishing base in Delap together with a chill and cold storage, producing 3 tons of 25kg block ice per day. The other is a plate ice facility, with a daily output of 220 tons, built in 1991 by a joint venture formed in 1990 between the Marshall Islands Development Authority (MIDA) and a group of U.S. investors, which performs shipping and air cargo services for fresh tuna. The ice from this plant is loaded aboard tuna longline fishing vessels operating out of the above-mentioned base. The company uses the fishing base facilities under a lease agreement with the Marshall Islands Government, but we learned that the facility producing

block ice cannot satisfy the needs of the tuna longliners either quantitatively or qualitatively, and so no plans exist for using this as ice source. Since a considerable future expansion is planned in the tuna longline fleet, shortage is predicted in flake ice for longline use, and this joint venture company has no reserve capacity to sell flake ice to outside customers.

The use of block ice production facilities for the coastal fisheries ventures and other operations apart from the tuna longline fishery should be carefully considered. However, in that case, the management organization of the block ice facility in a part of the fishing base, which is presently used by the joint venture company, would be an organization other than the joint venture, such as MIMRA. However, for a totally different operating structure to function within this facility would require the solution of many problems, such as management responsibility and the burden of operating costs for the facility. In practice, therefore, this option would present many difficulties.

On the other hand, in February, 1993, a chipped ice plant was established on Arno Atoll with a capacity of 360kg/14 hour period along with the shore-based facilities for the project in Arno. But, given the lack of commercial power in that area, power for this ice plant is supplied by an in-house diesel generator of 45kva. Ice produced in Arno is distribution as far away as Ine within the same atoll and is unable to fill the combined demand from the two areas. Freshness control, based on the use of an adequate volume of ice, is essential in terms of strengthening the salability of fresh fish products at Majuro, while there is also a requirement for satisfying ice demand for the outer islands fisheries development programs apart from Arno. As a consequence, there is a clear need for a new ice plant.

(2) Chill and Cold Storage:

The catches brought from Arno to Majuro are packed in ice in an insulated box, with shipments by carrier vessel made three times a week. While the fish is distributed in fresh form, at the present time, only one portion (80 m³) of the existing cold storage at the fishery dock is used to store the small quantity of unsold stocks. This facility formerly served as a blast freezer and is currently operated at about 0°C for storage of this unsold fish. The other parts of the facility are not functioning as a cold

storage unit. This cold storage facility was built in 1977, but was renovated in 1987 with 3 freezing units, of which only one was operative as of December, 1993. The facility is aging and, in addition, uses the Freon R502 as the refrigerant. This substance, however, must be eliminated by the end of 1995 because of the high likelihood of damage to the ozone layer. Thus, it has been determined that, at the very minimum, the freezing units must be renovated.

At Majuro, only a portion of the skipjack and yellowfin tuna is sold in frozen form; the bulk are sold as fresh fish. But as the volume of fish brought into Majuro under the outer islands development project increases, it may be anticipated that there would be times when the temporary cold storage of the fish may be necessary to adjust inventories to supply and demand conditions. In addition, it is anticipated that the tuna longline fleet operating out of the Majuro base, which comprised 13 vessels as of November, 1993, will be joined in 1994 by 22 fishing vessels of Chinese registry. Frozen mackerel and saury are used as bait for the longline fishery, and the vessels belonging to the previously mentioned joint venture company store their bait in a 150 ton cold storage warehouse. However, for the other vessels, it is difficult, even under current conditions to secure cold storage space for longline bait supplies through the use of freezer containers or other means.

From the above, the construction of a new freezer can be expected to make a definite contribution to managing inventories of frozen products as a means of balancing supply and demand conditions. In addition, as a means of building up operating revenues at the Plan facility, it would also, in our view, be appropriate as cold storage space for frozen bait.

(3) Offices:

The three organizations that will be using the administrative offices at the Plan facility may be functionally classified as follows: the managing organ for the Plan facilities; the administrative organ for AAFA operations; and the division of MIMRA with responsibility for overall outer islands fisheries development operations. All three of these entities have one point in common: in that they all report to MIMRA, but, since the purposes and nature of their activities are quite different, it will be necessary to establish 3 separate working areas for each of the administrative organizations. The normal administrative functions to be

supported by these offices must also include a meeting room and a staff room for AAFA employees and crew members on transport vessels.

(4) Workshop:

Equipment checks and repairs on the equipment, outboard motors, and other items at the shore facilities managed by MIMRA will be handled by MIMRA staff. In one part of the existing facilities on the fishery dock, engines for fishing vessels are being stored for repairs, but there are no workshop facilities. It will, therefore, be necessary to provide a workshop equipped with general-purpose and specialized tools for outboard repairs.

(5) Display Case for Fish Sales:

In October, 1993, MIMRA started a pilot sales program through small food retailers in Majuro for AAFA catches, and it is expected that this activity will expand in the future. As of December, 1993, 4-6 outlets in the heart of Majuro were handling this fish. In most cases, the fish are placed in front of the stores in insulated fish boxes which are received from Arno. The general practice at Majuro food retailers is for customers to select products from outside the store over a counter at the front of the store, so that they normally do not actually enter the store to make their purchase. When selling fresh fish, it would surely make better sense to change over from the system of placing the fish boxes in front of the store, where the contents cannot possibly be seen, to use of a chilled show case which would be highly effective as a display medium. However, since the sales program for fresh fish through retail stores is still at the pilot stage, it would be wise to introduce the chilled display case as well on a pilot basis in pace with the development of the program.

(6) Outboard Motors:

In the Marshall Islands, gasoline-powered outboard engines are widely fitted to small FRP boats for transport or fishing use within the reefs. Outboard engines are handled in Majuro at supermarkets and auto dealers. Some of these outlets are equipped with their own workshop facility. While stocks are limited, they sell replacement parts and make repairs on the engines. In the Marshall Islands, there is no registration system for small boats, including those engaged in fishing activity, nor is there any registration system for fishermen or permit system for the small-scale

fisheries. It is difficult, therefore, to determine from official records the number of outboard engines operating in the country. However, drawing on the experience of a Japanese manufacturer exporting outboard engines to the Marshall Islands, we see that, over the 11 year period 1982 - 1992 inclusive, some 700 outboard engines were exported to the country, averaging 64 units per year. Considering the fact that the country is composed of many atolls and small islands, it is evident that the bulk of the small boats equipped with these engines are engaged in fishing operations, including subsistence fishing, while also performing an important role as a transport and shipping medium. Since the useful life of outboard engines is believed to average 4-5 years, it has been concluded that it would be effective, from the standpoint of smooth operation of the Plan facilities as well as providing assistance to outer island fishermen, to sell these outboard engines to fishermen on the outer islands who meet prescribed qualifications and to deposit the sales proceeds in a fund to be dedicated to fishery development.

(7) Fishing Gear and Materials:

The fishing gear in the request comprises hand line, trolling, and underwater gear along with multi-purpose ropes. A variety of standards are in use for all of these items in the Marshall Islands, but the articles requested represent the mainstream of gear used in small-scale fisheries. Proceeds from the sale of this gear will also be deposited in the above fishery development fund.

(8) Fish Boxes:

Plastic insulated fish boxes, with a capacity of 160 ltr are used to transport catches from the outer islands for distribution to retail stores. Damage has developed in the handles and metal fittings on a portion of these boxes, necessitating replacement, while new boxes must also be provided to meet the expanding volume of fish sold through these food retail outlets. These fish boxes will, accordingly, be provided under the Plan.

(9) Vehicles:

A truck crane and pick-up trucks are included in the request. Since the crane will be used to load and unload heavy objects onto and from the carrier vessel, this item will be necessary for Plan operations. However,

inasmuch as a unit is currently in use in the AAFA operation which has been well maintained and is functioning well, there is no need to add another unit for this project. The pickup truck is also a low-priority item, for the same reasons.

(10) Other Items:

1) Removable Boarding Ladder:

The request includes a floating pontoon for convenience in loading and unloading operations from the carrier boat and for boarding and disembarking passengers. However, waves and winds are strong in the waters in front of the Plan site, bearing the full brunt of the northerly winds. In addition, these waters are on the access channel for tuna longline fishing vessels and patrol vessels based at the neighboring dock. We have, therefore, determined that it would not be appropriate to install a floating pontoon and so it has been eliminated from the request. However, since the crown height at the dock is too high for safe boarding and disembarking of passengers, when carrier boat dock during low-tide periods, we have planned a removable boarding ladder as a substitute measure

2) Rainwater Tank:

A rainwater storage tank is included in the Request as a means of securing water supplies for making ice and for general use. However, there is already a concrete rainwater tank at the existing facility with a circumference of about 16m and a height of 2.5m and a capacity of 50m^3 , which we plan to use. But since the pumps attached to this tank are superannuated and the water pipes need to be relaid to accommodate Plan construction, the Plan includes renovation work for these incidental items.

3) Fuel Storage Shed:

The request includes a 5,000 ltr gasoline tank for storing fuel for outboard engine use. However, since the procurement and movement of fuel under the support program for outer island fisheries presently relies on fuel drums, we are considering an oil storage shed under this Plan.

3.3 Outline of the Plan:

3.3.1 Operating Structure:

Under present conditions at the AAFA operation, catches from Arno and Ine are purchased from the fishermen, given treatment for freshness control by ice-packing the fish in insulated fish boxes, and then transported by carrier vessel to Majuro for final sale. These operations are managed by 5 AAFA employees-- 3 from Arno and 2 from Ine--, while 3 MIMRA employees presently manage sales operations in Majuro. It can be said, therefore, that MIMRA's direction and supervision are still critically needed in connection with the organized catch sales program at Majuro. We have concluded that it is most appropriate, under present conditions, for MIMRA staff to take charge of such functions as sales accounting and sales promotion for fresh fish products at Majuro.

The Plan facilities are intended to concentrate primarily on sorting the fish brought in from Arno in insulated fish boxes by species, size, and quality, and coordinate shipments in accordance with demand trends at sales outlets so as to minimize unsold inventories. Incidental operations will include the management of the chill and cold storage facility, ice sales, sales of outboard motors and fishing gear to fishermen, and repair work on outboard engines. As outlined in Section 3.2.2, the core functions in the future will comprise the receiving facility in the consuming market for outer island catches along with purchases of fish catches from production areas in the outer islands, fish sales in Majuro, and ice sales plus storage operations at the renovated chill/cold storage facilities. The operating structure for the Plan facilities has been based on the above conditions.

The fish transport boat from Arno unload their catches 3 times a week (on Monday, Wednesday, and Friday) at the Majuro fishery dock. The maximum elapsed time from catch to unloading at Majuro is 3 days but the fish will have to be maintained at peak freshness. To do this, the fishermen must pack their catch with ice in insulated boxes, while the catches purchased at the fishing base in Arno and Ine must be stored, as received, in these boxes at a chill storage facility. Since distribution at Majuro is geared to fresh fish, sorting and weighing operations must be completed immediately after unloading at the dock. And considering the market conditions up to the previous day, it is desirable that the catches be delivered promptly to the

Majuro markets. Thus, the major part of the operations at the Plan facility will take place on the day the catches are sent to market. However, the 2 AAFA staff who have brought catches from Arno with a carrier boat will be available to participate in these operations at the fishery dock, and so it has been determined that the services of 2 full-time employees will be required at the Plan facilities to ensure speedy delivering operations. With respect to ice sales and storage control at the chill/cold storage facility, these functions can, in principle, be performed by the 2 new full-time employees at times when they are not involved in delivery operations. In emergencies, it is hoped that the 2 MIMRA staff members supervising the fishery development operations will be able to fill when needed. The outboard repair function will be carried out by a mechanic of the MIMRA staff, using the workshop. In addition, sales of outboard motors and gear, mainly to outer island fishermen, should properly be handled by MIMRA people in connection with evaluation of buyer qualifications and the management of the funds generated by these sales proceeds. Based on the above considerations, we believe that 2 persons will have to be newly employed to manage the Plan facilities.

With respect to the distribution of the fishing equipment and materials incorporated in the Plan, it would be desirable to implement these operations with reference to the following points:

(1) Selection criteria for fishermen:

The fishing gear are to be sold to fishermen on Arno Atoll and other outer islands. As a condition of sale, each fisherman will be rated on the following selection criteria:

- Fishing activity levels and other performance factors
- Catch sales to AAFA and other outer island development programs
- Ability to pay for the equipment to be distributed
- Acceptance of the ban on resale of the subject equipment

(2) Selling prices:

The selling prices for the equipment to be distributed should be set below market prices, with a view to providing an incentive to purchasers. One benchmark for pricing would be to waive taxes on the import price. It would be appropriate to consider setting the selling prices about 10% below market prices.

(3) Handling of sales proceeds

As was confirmed in the Minutes of Discussions, MIMRA, the implementing organ for the Plan, will be required to handle the equipment sales proceeds on the following basis:

- 1) Proceeds are to be deposited in a special account, separate and distinct from general revenues.
- 2) The funds are to be used strictly for purposes of fishery development in the Marshall Islands.
- 3) Consultation is required with the Government of Japan prior to use of these funds
- 4) When so requested by the Government of Japan, reports must be made on usage and balance of the fund.

3.3.2 Description of the Plan Site:

Majuro Atoll in the Marshall Islands is located at 7° 7' North, 171° 30' East. It has a land area of about 9.7m², with a lagoon area of 295km². Since this atoll contains the capital, Majuro, it has a problem with population concentration, but the area is endowed with good infrastructure in the form of power, water supply, communications, and international transportation links. The Plan area is the fishery dock adjoining the commercial port in the Delap district in the eastern end of the atoll. This dock was built in 1973 to serve small fishing boats and has a length of 100m. The central section of some 41m is under the control of MIMRA. The width of the dock's concrete apron is 7m, while crown height at the dock is 2.6m, with water depth of some 2.5m in front of the dock. The area administered by MIMRA forms a 40m x 25m section, which is registered as lot "G" in the land register. As already noted, a cold storage plant and other buildings presently stand on the site. Lot "G" parcel is set back some 60m north of the trunk road, but there are no access problems from this road. Even at present, a portion of the existing cold storage unit is operating, and there are no problems with the commercial power supply. Since buildings already occupy the site, it will be necessary to remove some of them to construct the Plan facilities. However, as explained in Section 3.3.3, a portion of the existing facilities will be used in their present form for the Plan. Moreover, we have determined that it will be necessary to specify the methods and scope of the building removal plan when the facility

construction plan has been finalized and actual work gets underway. In addition, there is a possibility that the implementation period and the time required for securing budgetary appropriations from the Marshall Island Government may not be synchronized, while MIMRA's ability to assume fiscal responsibility is limited. In light of these factors, we believe that it will be necessary to absorb the preliminary site work of temporary nature within the scope of the foundation work for the Plan facilities.

3.3.3 Scope and Quantities of the Facilities and Equipment:

(1) Ice Plant:

Ice requirements have been calculated on the basis of the outer island fisheries project at Arno Atoll. Some 10 outboard-powered fishing boats operate at this atoll; each boat purchases about 50 pounds (about 23kg) of ice from the facility, which is loaded aboard the vessel for on-board storage of the catch. When transporting the catch from Arno to Majuro, 160 ltr insulated fish boxes are used. The proportions of ice and fish depend on fish size but, in the case of small reef fish, the ice proportion is higher.

In this project, it is planned to use ice in a proportion of 50% of catch weight when shipping the fish in insulated fish boxes. Based on average monthly hauls for 1993, the annual catch volume can be estimated at about 42 tons, with the ice requirement set at 50% for loading and transport purposes. In anticipation of delivery to retail outlets, the fish shipped from Arno will be weighed and repacked at the Plan facility. It is estimated that there will be an ice loss of 50% of catch weight during temporary storage during these operations. The MIMRA marketing operation for AAFA catches through retail outlets got underway in October, 1993, with 4-6 stores handling the fish as of December, 1993. While displaying the fish for sale at the store front, ice will have to be replenished for purposes of freshness retention, with the replenishment volume project at 100% the weight of the fish to be sold.

The ice-making plant at Arno will also supply ice for the Plan operation. Since the Arno facility has been operating for less than a year, basic data do not yet permit a direct estimate of annual production. However, judging by the ice usage patterns and catch volume, it may be anticipated that at least 60 tons of ice can be produced a year at the Arno facility. This amount will be subtracted from the overall ice requirement.

Summarizing the above calculations, the annual net ice requirement can be planned as follows:

Loaded on outboard boats:	23kg x 10 boats x 300 days =	69 tons
Transport from Arno to Majuro:	42 tons x 150%	= 63 tons
Replenishment at Plan facility:	42 tons x 50%	= 21 tons
Replenishment at retail sales outlets:	42 tons x 100%	= 42 tons
Less: Ice production at existing facility		- 60 tons
TOTAL	135 tons (260 days x 8 hours)	= 65kg/hour

Ice demand at Majuro, apart from the above requirements, also derives from the small-scale fishery on Majuro Atoll. The majority of residents in the central districts known as DUD are salaried employees and so less dependent on fishing than their compatriots on the outer islands. About 120 boats are reported to be engaged in small-scale fishing operations at Majuro Atoll, though most of these are merely part-time fishermen, using Sundays and holidays to fish for their own family tables. While there are certainly some full-time fishermen among them, it is difficult to establish an actual head count of these full-time operators.

In addition to the 10 outboard boats engaged in fishing operations at Arno and Ine, there are said to be about 20 non-powered boats, which also generate some ice demand, though this is far less than that for the outboard boats. It should be noted that the above calculations do not include a provision for the incremental ice demand that would result from the increase in fish production levels that is expected to result from the outer islands development projects, such as the distribution of fishing gears included in this Plan.

Since a number of assumptions must be made in understanding and forecasting the demand for ice based on these factors, we should naturally try to avoid quantitative judgments. However, considering the fact that alternative facilities are not available, we feel that this situation must be dealt with through the Plan facilities. Accordingly, allowing a reasonable margin of error in these demand projections, we have planned an ice production capacity of 80kg/hour.

Two staff will be required to operate the Plan facilities. Considering that their main duties will be to deliver the fresh fish to customers at Majuro on a timely basis, we plan to operate the ice-maker 8 hours daily.

Most of the current ice plants can operate automatically around the clock but, with a view toward insuring proper equipment maintenance, we have concluded that it would be appropriate to limit operations to business hours. A production schedule of 80kg/hour works out to :

$$80\text{kg} \times 24 \text{ hours} = 1,920\text{kg/day} = \text{about } 2 \text{ ton/day}$$

It is vital that downtime on the ice plant due to unexpected breakdowns be held to a minimum in order to maintain ice sale revenues. With a view to strengthening the operating structure, we plan to install 2 ice-makers of identical capacity to permit alternate operation.

The capacity of the ice storage unit, which is intended to cope with changes in demand, is planned at one week's production. Thus,

$$80\text{kg} \times 8 \text{ hours} \times 5 \text{ days} = 3,200\text{kg} = \text{about } 4 \text{ tons.}$$

(2) Cold Storage and Chill Storage Units:

There is presently a cold storage unit, covered by a roof, in the Plan area, of steel frame construction with an area of 375m^2 . One section of this facility (80m^3) is currently being used by the project for Arno Atoll. The catch volume brought in to Majuro from Arno totals 42 tons a year. Considering the fact that this fish is distributed in fresh form, a minimum type of pre-fabricated cold storage unit with a storage capacity of 6.5m^3 should be sufficient to permit temporary storage of the catches. However, considering that:

- 1) a cold storage facility already exists in the Plan site, with a portion of the unit being used for the outer island fisheries development Project;
- 2) by changing the roof and renovating part of the facility, a structure of insulation panels can stand up against future use;
- 3) the net cubic volume inside the existing unit (excluding the ante-room) is 245m^3 . Considering the fact that this facility is public property, it is hardly desirable, from the standpoint of the national economy, to simply abandon or scrap it, we do not plan to build a new cold storage unit but will make use of the existing facility.

The 80m^3 refrigerated section of the existing cold storage facility presently in use is clearly uneconomical for storing catches from the outer islands. On the other hand, since a cold storage unit is needed to store

bait for the tuna longline fishery, a partition will be built in the cold storage section currently being used, with one compartment to be renovated as a -5°C chill storage and the other as a -25°C cold storage. From the operational profitability view point, cold storage operation may generate greater earnings than the chill storage section, however, based on the current usage conditions of the existing cold storage, we plan to divide the space into two identical rooms both for cold and chill storage.

As discussed in Section 3.2.4, there is a need to renovate the existing refrigeration equipment. With a cubic capacity of 40m^3 , an outside temperature of 35°C , and an inside temperature of -5°C , the load capacity for the refrigerator unit, calculated on the basis of prescribed usage conditions, becomes 3,250 watts. Similarly, the load capacity of the refrigeration equipment at an inside temperature of -25°C has been calculated at 3,140 watts. Accordingly, the capacity of the refrigerator for use in the cold storage and freezer units will be given a capacity in excess of the above load capacity, with one unit of each type to be installed.

(3) Building:

The required rooms and functions of the construction facilities for the subject Plan can be conceived as follows:

Type of Space	No. of Persons	Functions
1) Offices	6	This area is to be divided into 3 administrative rooms: one for the 2 full-time employees at the Plan facility; 2 persons associated with AAFA, and 2 MIMRA staff responsible for the outer islands projects.
2) Meeting Room	--	This will be a common liaison facility for the above 3 sections.
3) Workshop	1	One repair mechanic from MIMRA will be stationed here, with space to be provided for specialized and general-purpose tools for outboard motor repairs
4) Staff Room	--	work area for vessel crews and workers at the cold storage facility.
5) Work Space	--	Two ice-makers will be installed in this area. Operations will also include sorting and freshness control for catches brought in insulated fish boxes.

6) Toilet Shed	--	These facilities, to be located in a separate structure, will be for staff use.
7) Fuel Storage Shed	--	This are will accommodate gasoline and diesel oil drums for use in outboard motors and the transport vessels. For safety reasons, this shed will be located away from the main building.
8) Roofing	--	The superannuated steel frames in the roof will be replaced. They will cover the cold storage facility and work space.

1) The offices:

Office space will be provided for 2 full-time employees, who will be hired to manage the Plan facilities, 2 MIMRA staff members in charge of the outer islands project operations, and 2 AAFA employees managing AAFA operations. Since the work of these 3 groups is different, 3 separate rooms will be furnished; with each room to accommodate desks, chairs, a filing cabinet, and bookcase. The required floor area for each room has been set at about 21.2m².

2) Meeting room:

Designed to serve as a place for daily liaison, this area will be equipped with folding chairs and tables. It will accommodate a maximum of 10 persons, including 6 staff and 4 visitors. In the center of the room will be placed 4 tables 0.75 W x 1.8 Lm, surrounded by 10 folding chairs. On this basis, the floor area will be 19.6m².

3) Workshop:

This area will contain a small compressor, hydraulic press, bench drill, and work table for use in repairs on outboard engines, as well as storage shelves and working space for parts and tools. The required floor area is estimated at about 20m².

4) Staff room:

This is intended to serve as common room for the boat crews who carry the catches from Arno and the workers from MIMRA who operate the cold storage facility. Since the users of this space will be constantly changing,

floor space will be provided in line with the lay-out conditions for the other rooms.

5) Work area:

Two ice plants with storage compartment will be installed in this area, with a plate ice production capacity of 2 tons daily. Including surrounding space for maintenance checks, the area will have a floor space of 30-35m². As the operations to be performed here will be principally sorting of catches and ice packing of the fish boxes, the space in front of the ice plant will be most efficient as a work area. Upon completion of these operations, the fish will be delivered to city outlets by truck, and so consideration must be given to ease of entry by vehicles from outside. Accordingly, suitable working space will be provided for this area; based on the overall layout scheme for the facility.

6) Toilet:

As a toilet facility for employees, this area will contain a western-style toilet and wash basin for both men and women. These facilities will be in a separate structure.

7) Oil storage shed:

About 60-70 drums per month, including both gasoline and light diesel oil, will be carried from Majuro to Arno, with an average of 5 drums loaded on each vessel. We will, therefore, provide a space of about 15m², sufficient to allow storage of a maximum of 15 drums at any time, including space for empties.

8) Roof

We plan to change the superannuated steel frames and the roof, which presently covers the cold storage facility. The required area for the existing cold storage section will be about 170m². The roof area for the work area will be calculated from the overall layout plan for the facility.

(4) Outboard motors:

Two sizes of outboard motors are contained in the request: 20 units each of 25ps and 40ps. Outboard engine with gasoline specifications are

widely used in the Marshall Islands, installed on small FRP boats for use in both transport and fishing within the atolls. As an example of one store in Majuro handling Japanese-made outboard motors, at the time of our field survey, 11 models were being sold, ranging from 10-115ps, with the concentration at 40ps and 60ps. Inventories totaled 25 engines. The horse power composition of the 700 outboard engines exported to Marshall Islands by one Japanese manufacturer between 1982 and 1992 showed 56% in the 30ps or less class, 28% between 30ps and 59ps, and 16% 60ps and over. Judging from these cases, engines below 30ps appear to account for over half of all engine sales. But considering the steady increase, year by year, in the output levels of outboard engines, the ratios held by 30 ps and over, or 60 ps and over engines cannot be ignored. Considering the conditions that the Marshall Islands is composed of numerous atolls and small islands, it should be noted that the great bulk of small boats fitted with these outboard engines have a wide range of uses, including fishing, transport and cartage. Thus, in considering the output of the outboard engines, it is necessary to work on the premise that there are a large variety of boat types and sizes. The request for both 25ps and 40ps outboards fully reflects these conditions and so can be considered appropriate.

In government data, the areas on Majuro and Kwajalein Atolls are classified as urban, with all other areas classified as "outer islands". According to the 1988 Census, a total of 3,399 households were engaged in small-scale fishing on a part-time or full-time basis. Of this total, 1,875 were in urban areas and 1,524 on the outer islands. On the assumption that the average annual import figures given above for the past 11 years show annual demand in recent years for the nation as a whole, and that, in accordance with the household breakdown, a latent demand exists for outboard motors on the outer islands, it may be estimated, on this basis, that 30 units per annum are required for these outer islands. Based on the above analysis, we plan to furnish 15 outboard engines of 25ps and 15 of 40ps for distribution under the Plan.

(5) Fishing Gear and Materials:

The request document called for hand line, trolling, and underwater gear together with multi-purpose rope. A variety of standards for these three types of gear are popular in the Marshall Islands, so they certainly constitute the main stream of gear employed in the small-scale fisheries.

In this Plan, we plan to distribute fishing gear to the same number of fishing vessels as for outboard motors -- viz., 30 boats. In our interviews on Arno Atoll, we learned that the outboard-powered boats normally carry a crew of 3 men. On this basis, we plan to use 90 men as the benchmark level for establishing Plan quantities of fishing gear and materials.

1) Hand line:

Hand line is composed of wooden reels, lead lines, fish hooks, sinkers, swivels, and wire snells. The Plan quantities are shown below, with due consideration being given to the degree of wear and tear.

Wooden reels	90	units
Lead lines (2 sizes, 100m/roll)	90	rolls each
Fish hooks (5 sizes)	500	hooks each
Sinkers	500	units
Swivels (2 types)	500	units in each type
Wire snells (2 sizes)	500m	for each

2) Troll line:

We are planning to provide trolling gear directed at small to medium-size surface fish. The gear would include wooden reels, trolling boards, lead lines, and lure line heads. Including spares, we will furnish 60 sets.

3) Underwater gear:

As materials for the spearing fishermen inside the lagoon, we are planning to provide underwater masks, snorkels, foot fins, work gloves with rubber skidproof, waterproof flashlights, and spears with rubber shooter. The Plan quantity will be 30 sets.

4) Rope:

The following types of multi-purpose rope will be provided:

Polypropylene	(2 sizes)	200m rolls	15 rolls each
Vinylon	"	"	"

(6) Containers for fish transportation:

1) Insulated fish boxes:

15 insulated fish boxes are planned, both as replacements for certain damaged boxes presently in use and as spare units for future use. We are also planning to provide plastic fish boxes and fish barrels, along the following lines, for use in sorting catches at the Plan facility:

Insulated fish boxes	160ltr	15 units
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Plastic fish boxes	80ltr	40	"
Fish barrels	50ltr	40	"

2) Scale:

One platform scale is planned for use in weighing catches at the Plan facility. The scale capacity will be 300kg (650lbs), with minimum measurement gradients of 100g (1/4lb).

3) Chill display case for use in retail stores:

The purpose of this case is to enhance the effectiveness of displays at retail stores in connection with the sale of catches from AAFA. We plan to furnish 4 of these chill cases for sales use. The chilling will be done with ice and a freezing machine will not be used.

(7) Removable boarding ladder:

A removable boarding ladder will be provided on the dock to ensure the safe boarding and disembarking of aged passengers and those laden with baggage. During November, 1993, about 120 passengers used the transport vessels. Since use of this ladder will obstruct the use of the dock at other times other than during the boarding of passengers, we are considering a means of removing the ladder when not required. The ladder will be stainless steel construction in the interest of rust inhibition and ease of fabrication.

3.4 Maintenance and Management Plan:

The function of the fishing base under this Plan is three-fold: to provide a landing base in the market area for fish caught under the outer islands project, which was started from Arno Atoll; to create a distribution structure that will facilitate the smooth supply of fresh fish at Majuro, a main population center, and generate a stable consumer demand for this fish; and to create a base under MIMRA administration to reconcile production supply and demand without waste and achieve commercialization of the outer islands fisheries which make use of available resources within the country. Two new employees will be employed in connection with the construction of the Plan base, but the assumption is that the present employees of the AAFA operation as well as the MIMRA people in charge of the outer islands projects will also lend their support to base operations.

Operating Structure

No. of operating days for base: Monday - Friday, 5 days a week, 52 weeks a year, total 260 days/year.

Annual volume of fish to be handled: Monthly average of 3,500kg x 12 mos. = 42 tons (about 92,592 lbs)

No. of operating days for ice plant: 260 days a year

Annual ice production: 640kg x 260 days = 166.4 tons

Operating Expenses

Electricity \$0.13/kwh
Water \$21.10/kl

Operating Revenues

Ice sales
Cold storage services
Facility use fees

3.4.1 Operating Structure:

(1) No. of Operating Days

The base will operate 260 days a year. Since the catches arrive from Arno on Mondays, Wednesdays, and Fridays (3 times per week), operations will be on a 5-day week (Monday - Friday). However, in the future, it would be desirable to develop an optimum operating structure, based on a separation of the three functions: viz., shipment of the catches from the outer islands, sales in the consuming area, and administrative services on behalf of outer islands fishery development.

(2) Volume of Fish to be Handled Per Year:

For the time being, the target will be catches brought in from Arno Atoll. In the future, naturally, when the outer islands fisheries development projects are implemented in Mili and Jaluit Atolls, catches from these areas as well will be handled at the base. At the present time, catches from Arno total 42 tons a year.

At the present juncture, there are two major concerns regarding the outer islands fisheries development operation in Arno. One is the increase in unsold inventories in Majuro, the other relates to resource levels within the Arno lagoon. As a means of dealing with the unsold products, it is expected that, based on support activities at the base under this Plan,

fresh fish sales through small food retailers, as started by MIMRA, will make reasonable headway. As to the resource levels in the lagoon, while no quantitative data have been collected, given the clear indications of diminishing sizes of certain species, as compared with the period prior to the start of the fisheries operation, caution must be exercised so as not to expand present catch levels, at least inside the lagoon.

(3) No. of Days of Ice Plant Operation:

The ice plants will be operated on the same schedule as the fishing base-- viz., 260 days a year. Daily production will be 640kg, or 166.4 tons per year. Since 4 tons of ice will be kept in storage, this should be enough to meet normal demand.

3.4.2 Operating Expenses:

The operating expenses of the base will comprise mainly electricity to operate the ice plant, chill and cold storage; salaries of the new employees to operate the base; and maintenance of facilities and equipment. The water for ice-making purposes will be sourced from rainwater stored in the existing concrete tank, which will be filtered and sterilized prior to use. Thus, water will not be costed for this project. The bases for calculating operating costs are given in Appendix V-1.

(1) Electricity:

For purposes of estimating electricity costs, we have used the standard government rate of \$0.13/kwh, as applied to existing facilities. We have assumed that the ice unit will operate at full load 8 hours/day, 260 days a year, the chill storage at a load factor of 40% and the cold storage at 30%, with both facilities operating around the clock 365 days a year. Power consumption has also been calculated for operation of the workshop equipment, the pump for the rainwater tank, lighting for the building, and air conditioners. Annual consumption will be 67,734kwh, or \$8,810.

(2) Personnel:

The primary personnel cost will be the salaries of the 2 new employees in charge of fresh fish sales at Majuro. One will serve as the general base manager, the other a sales manager. The general manager will have to be

qualified to oversee sales of the catches brought in to the support base from the outer islands as well as operations of the facilities. The salary scale for this post will be equated to the base manager at AAFA, with a salary of \$600/month. The sales manager will be responsible for delivering the fresh fish to customers in Majuro and administering receipts and withdrawals at the chill and cold storage facilities, for which the AAFA salary scale (\$450/month) will be applied. Accordingly, the total personnel cost will be \$12,600/year.

(3) Maintenance of Facilities and Equipment:

The maintenance budget for the Plan facilities and equipment has been calculated at 0.5% of original cost for the building, 2% of the ex-godown price for the ice-making units, chill and cold storage units, other power equipment, and the workshop equipment. These amounts will be accumulated in a special maintenance reserve and drawn on as required. The total maintenance budget has been set at \$4,962/year.

3.4.3 Project Revenues:

Revenue sources at the Plan facilities will include ice sales, cold storage revenue, mainly from bait storage for tuna longline use, usage charges for sorting and other services at the support facility, and interest generated by the operating fund. The bases for calculating project revenue are given in Appendix V-2.

(1) Revenue from Ice Sales:

Annual ice production at the Plan facility will be 166.4 tons. Capacity of the ice unit at Arno is 360kg/14 hour period, based on use of a 45kva in-house generator. The ice is sent to Ine, which does not have an ice-maker. The ice demand at Ine is estimated at 34 tons per year. Ice production costs at Arno, using the small generator, are considerably higher than they will be at Majuro, which is served by commercial power. Thus, the 34 tons ice requirement at Ine, which is currently supplied from Arno, will henceforth be filled from Majuro. Ice prices at Ine run 22 cents/kg (10 cents per lb.) Applying this price, the proceeds from ice sales of 34 tons can be expected to total \$7,480 per annum.

(2) Revenues from Cold Storage Services:

The target product will be bait for tuna longline operations. The anticipated fleet of tuna longline vessels during 1994 will be at least 35 vessels, all of which catch tuna for export in fresh form. Cold storage revenue has been based on 5 of these vessels making continued use of the Plan facilities for bait storage in the cold storage unit. Figuring 1,000kg of bait per vessel loading and 2 operations per month, the monthly storage volume per vessel will be 2 tons, or 10 tons for all 5 vessels. Current imports of frozen bait at Majuro for the tuna longliners are received once a month, making the monthly storage requirement 10 tons. The net floor area of the cold storage is 15m^2 (160 sq.ft.). If, then, space is leased to the 5 tuna longline vessels, each vessel will require 3m^2 (32 square feet). Since the effective height of the cold storage unit is about 2.5 m, the floor area should be able to store a maximum of 2 tons of bait. Setting the storage rate at \$6.00 per month/sq. ft., which was once studied rate for cold storage at the fishing base adjacent to the Plan site, the monthly revenue for 3m^2 (32 sq. ft.) of cold storage space earned from the longline vessel owners will come to \$192 for 400 cases (2 tons) of bait. Thus, the storage charge per case works out to \$0.48, a figure that the vessels can easily afford.

The annual storage revenue for the use of 15m^2 (160 sq. ft.) of floor space in the cold storage unit has been calculated at \$11,520.

(3) Revenues from Facility Usage Fees:

In the future, the Plan base will serve as a marketing center in Majuro for fresh fish brought in from the outer islands. As such, it is expected that it will be capable of independently carrying out its key functions, including purchases of outer islands catches, sales to supermarkets and other retail stores in Majuro, ice operations, and chill and cold storage operations. Under the operating structure for the marketing center, within the parameters of its public-service character, from which it cannot deviate, the facility will be free to set purchase and sale prices, give suppliers an appropriate means of earning cash income, and provide consumers with a constant supply of fresh fish at stable prices. Presupposing this kind of future operating structure, it would be fitting, for the time being, to collect a facility service charge for the catches handled at the support facility. This fee has been set at 5 cents/lb. of fish handled. Since the

annual volume passing through the facility will be 42 tons (about 92,592 lbs.), annual revenues from facility usage fees can be projected at \$4,630.

(4) Interest Income from the Operating Fund:

The subject Plan includes various items that are to be distributed to fishermen on the outer islands. These comprise: 15 outboard motors each of 25ps and 40ps (30 units in all), plus replacement parts and hand line and other fishing gear. As of December, 1993, the market prices for outboard motors in Majuro were in the order of \$2,800 for a 25ps unit and \$3,800 for a 40ps unit. The selling prices for outboard motors under this Plan are expected to exclude the import and sales taxes included in the market price, or roughly 10% below market prices. Accordingly, the reserve fund that will be built up by sales of outboard engines to fishermen in the outer islands can be projected at a total of \$89,100 for the 25ps and 40ps units combined. The fishing gear and outboard parts will be sold at ex-godown prices, which should generate receipts of \$37,000. Thus, the total reserve fund is projected at \$126,000.

On the assumption that the sales of outboard engines, fishing gear, and outboard engine parts will be distributed evenly over a 4-year period, and figuring an interest rate of 3% per annum on these reserve funds, the bank rate paid on time deposits in the area, average interest income over a 10-year period has been set at \$3,215 per year.

3.4.4 Net Income from Operations:

Annual operating costs and revenues for the Plan facilities, as examined above, may be summarized as follows:

Operating Costs

Electricity	\$8,810
Personnel	12,600
Facility and Equipment Maintenance	4,962
Total	\$26,372

Revenues

Ice sales	\$7,480
Cold storage receipts	11,520
Facility use charges	4,630

Interest earned on operating fund	3,215
Total	\$26,845

Based on the above projections for revenues and expenditures, receipts will barely run ahead of costs. Given this tenuous margin of error, it is particularly essential, in operating the Plan facilities, to maintain the management structure outlined in this report and to strive for optimum efficiency in facility operations. In terms of operating expenses, power and maintenance costs must be strictly controlled so as not to exceed projections. And, with regard to revenues, we feel it is also vital to expand the volume of fresh fish passing through small retail stores and make every effort to sell the entire planned supply of 42 tons a year in fresh form.

SECTION FOUR: BASIC DESIGN

4.1 Design Guidelines:

The subject Plan is designed to provide a support base, including ice plant, working area, offices, and renovation of an existing cold storage facility, which is to function as a marketing base in Majuro, a major fish consumption area, for fish catches brought in from the outer islands with a view to promoting outer island fishery development. Among the various development plans of the Marshall Islands, high hopes are held for the subject Plan as a sector capable of development based on domestic resources. The design guidelines for the Plan will be as follows:

- (1) The Plan site already contains a cold storage unit, warehouse, water receiving tank, ice plant and other facilities. These facilities will be under the supervision of MIMRA, the implementing organ for the project. However, except for the 1978-83 period, when the facilities were used by the Majuro Fishing Cooperative Association, they have never been fully used. While many of the installations are superannuated and so cannot be restored, the public-service value of the facilities will, insofar as possible, be incorporated into the Plan facilities for future use.
- (2) The main role of this support station will be to purchase catch from the outer islands and market them in the Majuro market, with MIMRA to serve as the operating body for the time being. It is anticipated that, in the future, these activities will be broken up into 3 specialized areas: fish production in the outer islands and transport of catches to Majuro, sale of these catch in Majuro, and administrative support services for outer island development by encouraging fishing activity. The scale and arrangement of the Plan facilities have been planned to be compatible with this future organizational separation by facilitating close cooperation among the personnel involved in each function.