


No. 01

JAPAN INTERNATIONAL COOPERATION AGENCY
MINISTRY OF RESOURCES AND DEVELOPMENT
REPUBLIC OF PALAU

**BASIC DESIGN STUDY REPORT
ON
PELELIU STATE RURAL FISHERY DEVELOPMENT PROJECT
IN
THE REPUBLIC OF PALAU**

MARCH 1994

Fisheries Engineering Co., Ltd.

GRS

94-056

JAPAN INTERNATIONAL COOPERATION AGENCY
REPUBLIC OF PALAU
BASIC DESIGN STUDY REPORT ON PELELIU STATE RURAL FISHERY DEVELOPMENT PROJECT IN THE REPUBLIC OF PALAU
MARCH 1994
FISHERIES 6
214
89
GRS
17

**BASIC DESIGN STUDY REPORT
ON
PELELIU STATE RURAL FISHERY DEVELOPMENT PROJECT
IN
THE REPUBLIC OF PALAU**

JICA LIBRARY



1115904131

26823

MARCH 1994

Fisheries Engineering Co., Ltd.

国際協力事業団

26823

PREFACE

In response to a request from the Government of the Republic of Palau, the Government of Japan decided to conduct a basic design study on the Peleliu State Rural Fishery Development Project in the Republic of Palau and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Palau a study team headed by Mr. Senichi Kimura, Deputy Director, Second Basic Design Study Division, Grant Aid Study and Design Department, JICA, and constituted by members of Fisheries Engineering Co.,Ltd., from December 12 to 26, 1993.

The team held discussions with the officials concerned of the Government of Palau 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 Palau 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 Peleliu State Rural Fishery Development Project in the Republic of Palau.

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 Palau, and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

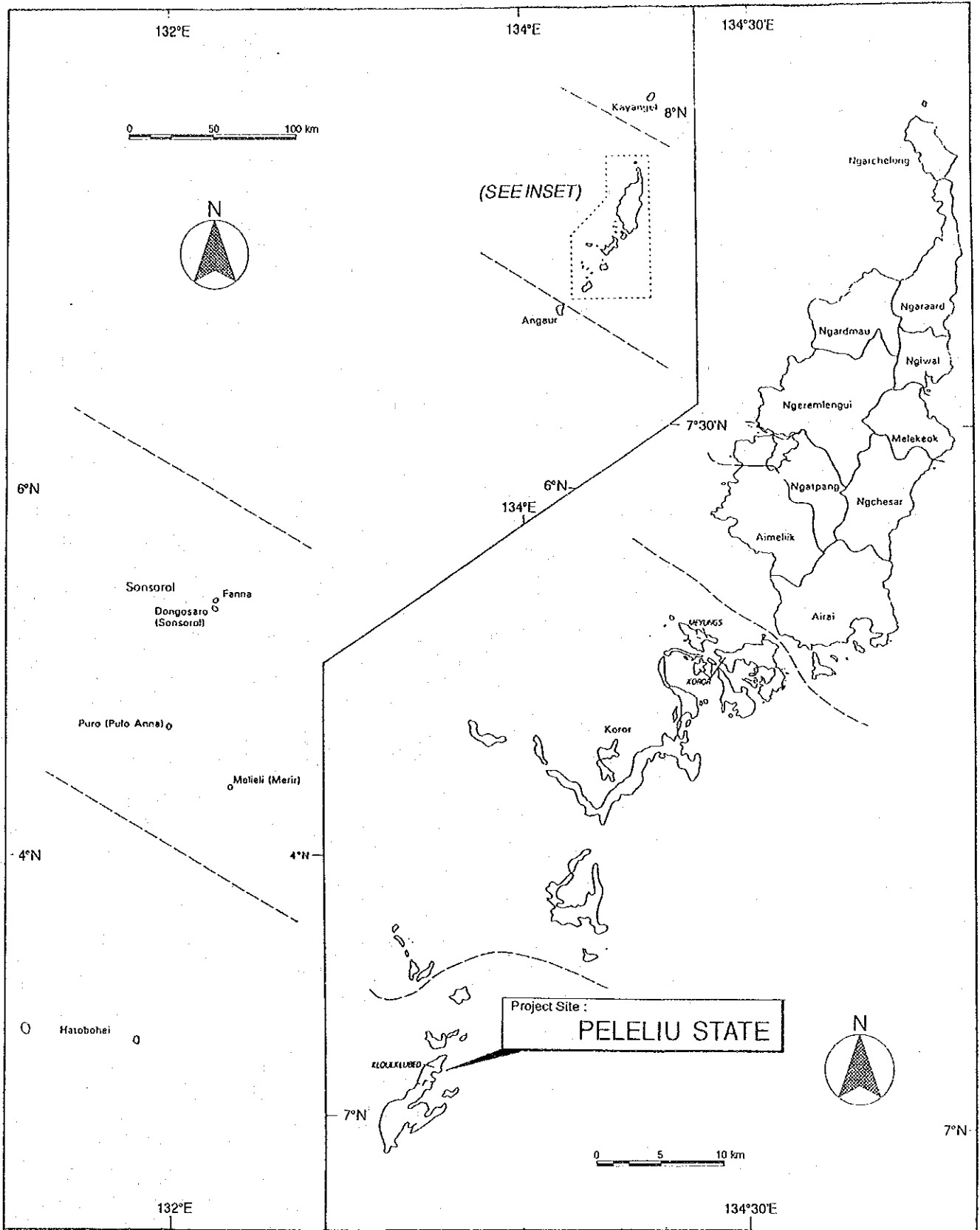
We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, Ministry of Foreign Affairs, and Fisheries Agency of Ministry of Agriculture, Forestry and Fisheries. We would also like to express our gratitude to the officials concerned of Ministry of Natural Resources and Development, Office of Planning and Statistics, State of Peleliu, 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.

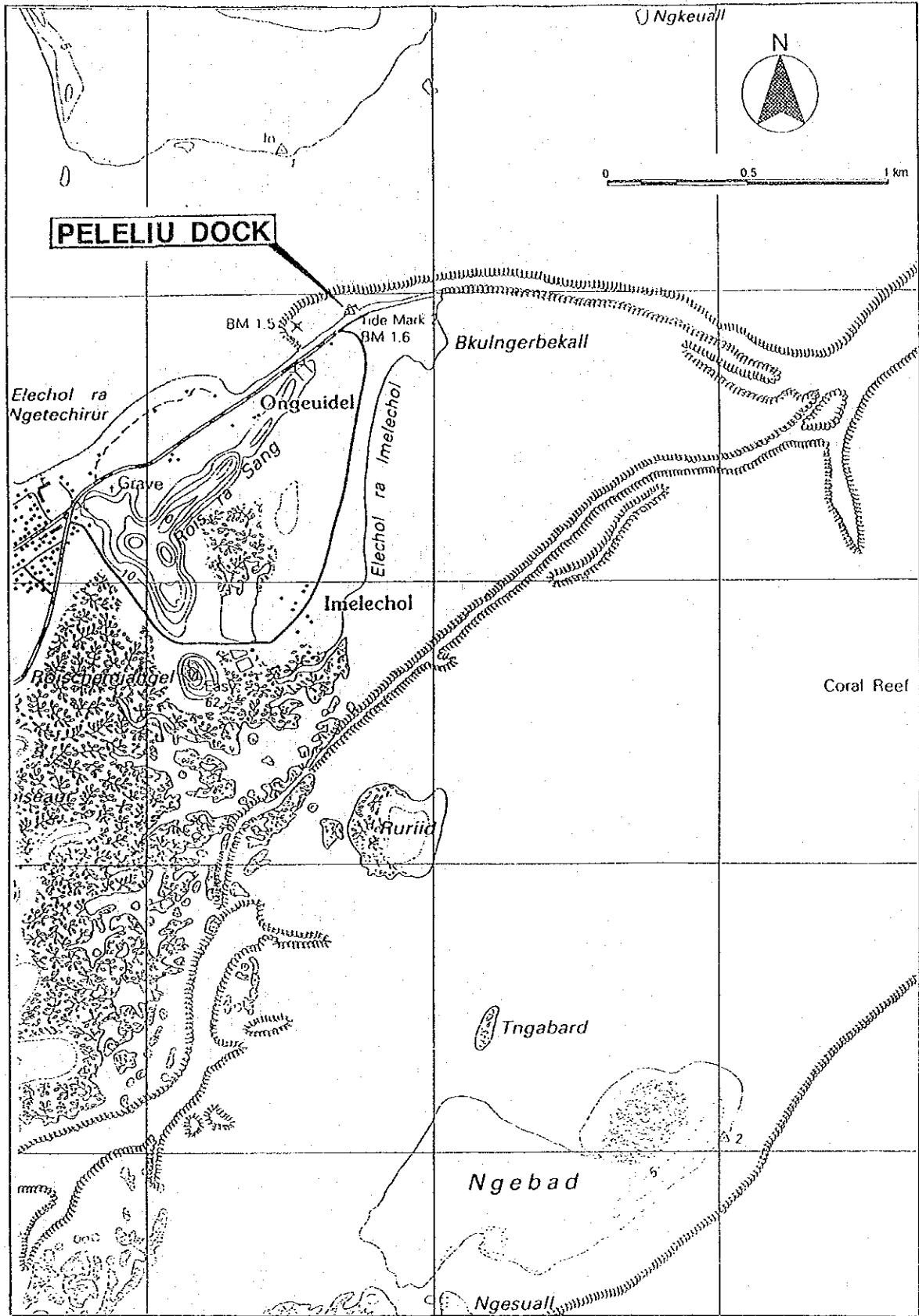
Very truly yours,



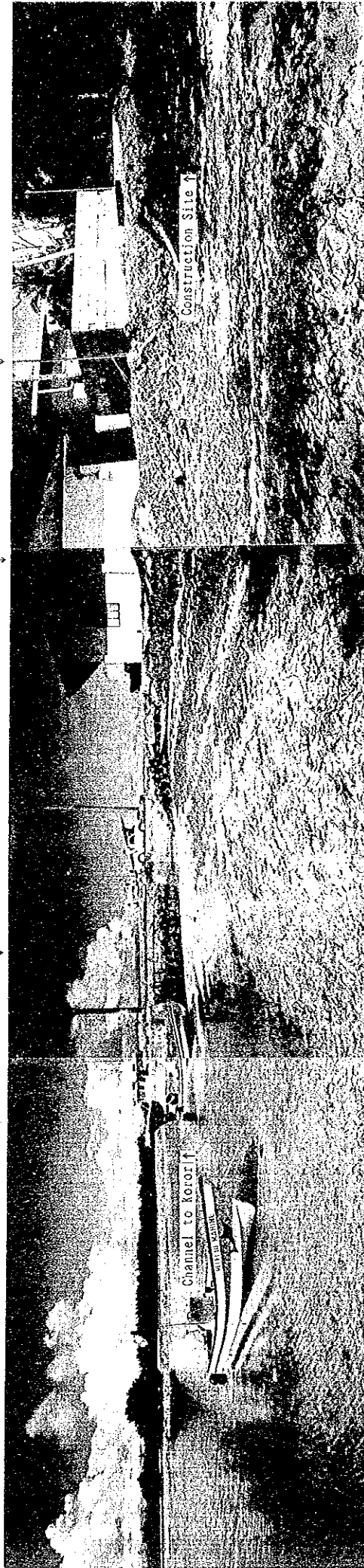
Toyomitsu Terao
Project Manager,
Basic Design Study Team on
Peleliu State Rural Fishery Development
Project in the Republic of Palau,
Fisheries Engineering Co., Ltd.



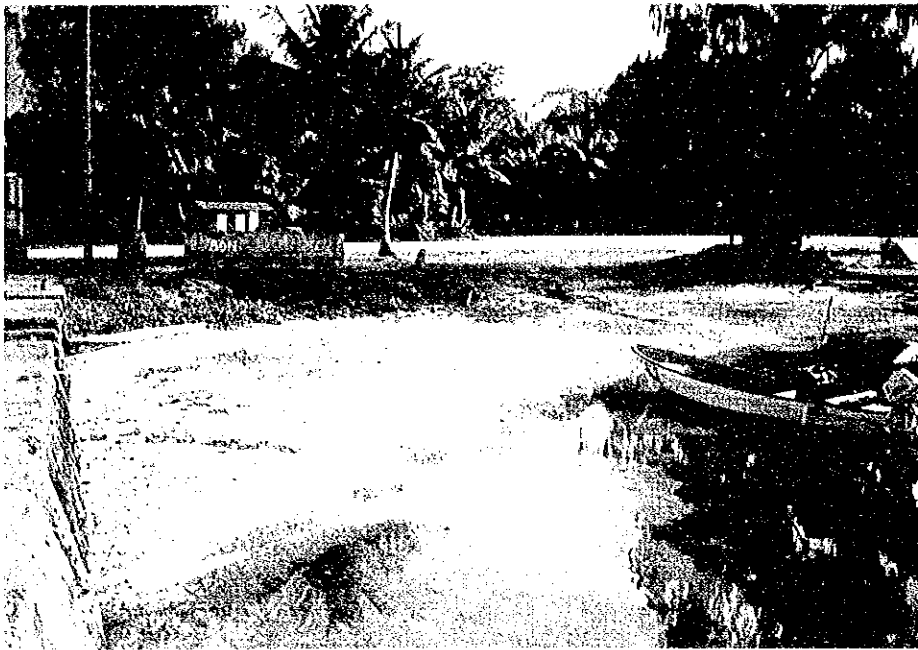
REPUBLIC OF PALAU



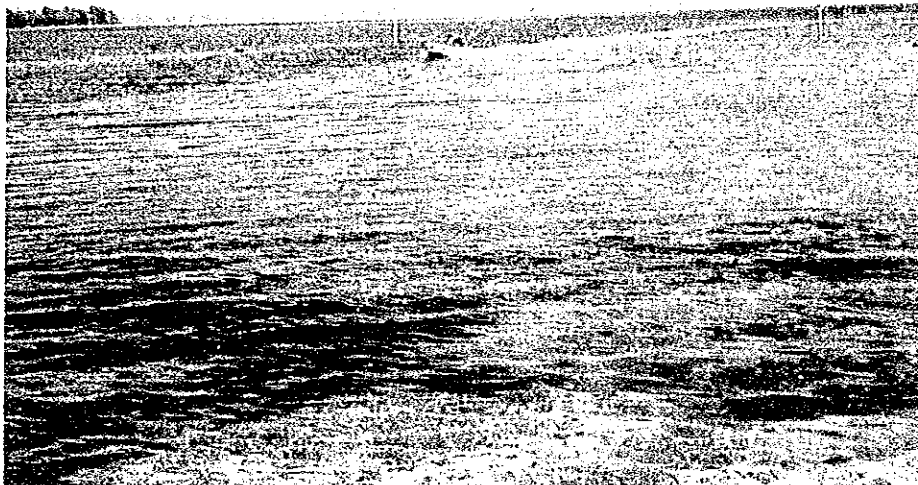
PROJECT SITE



PROJECT SITE



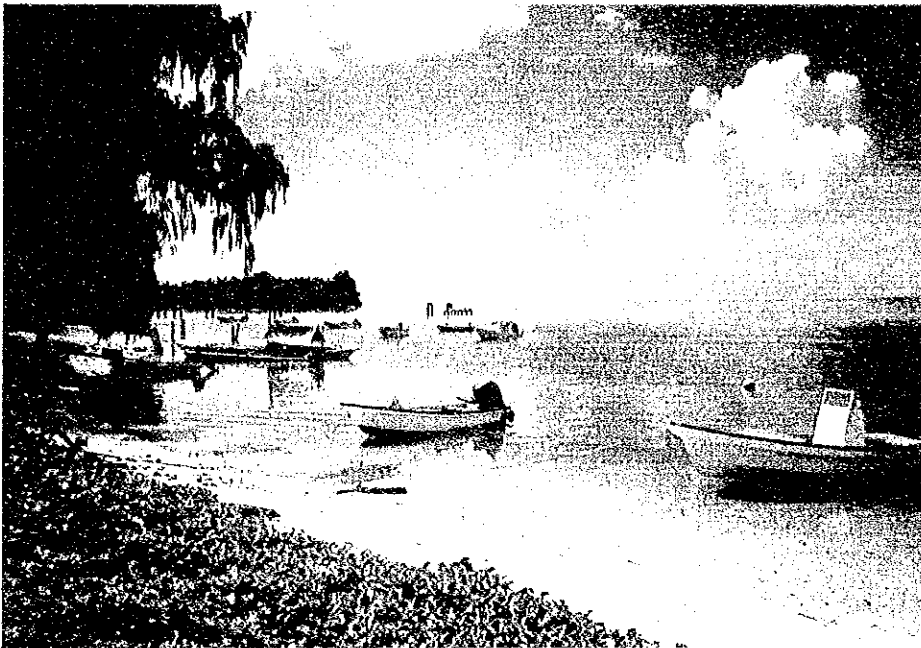
Project site view



Navigation channel
to Koror



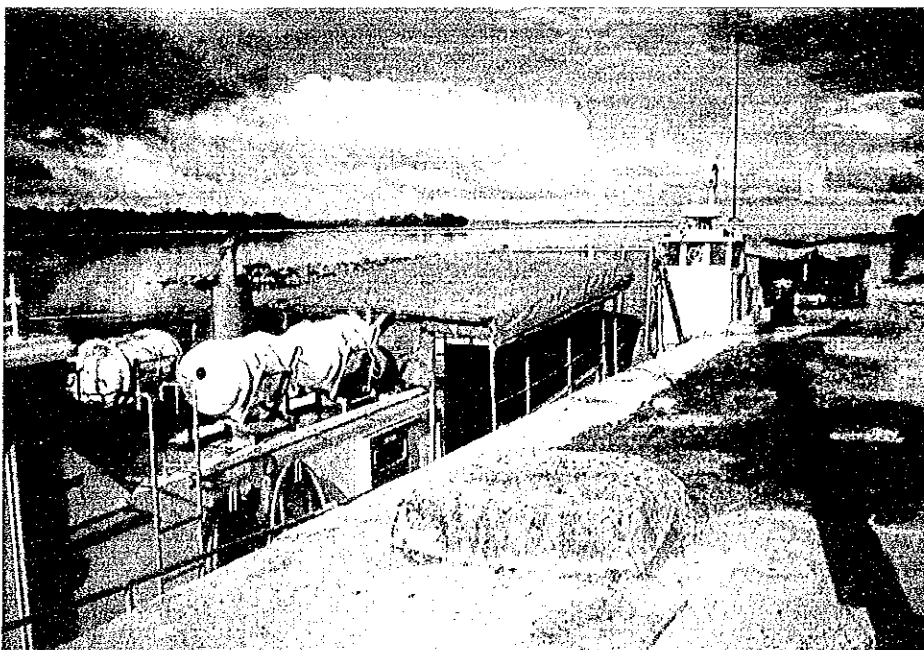
Road to the site



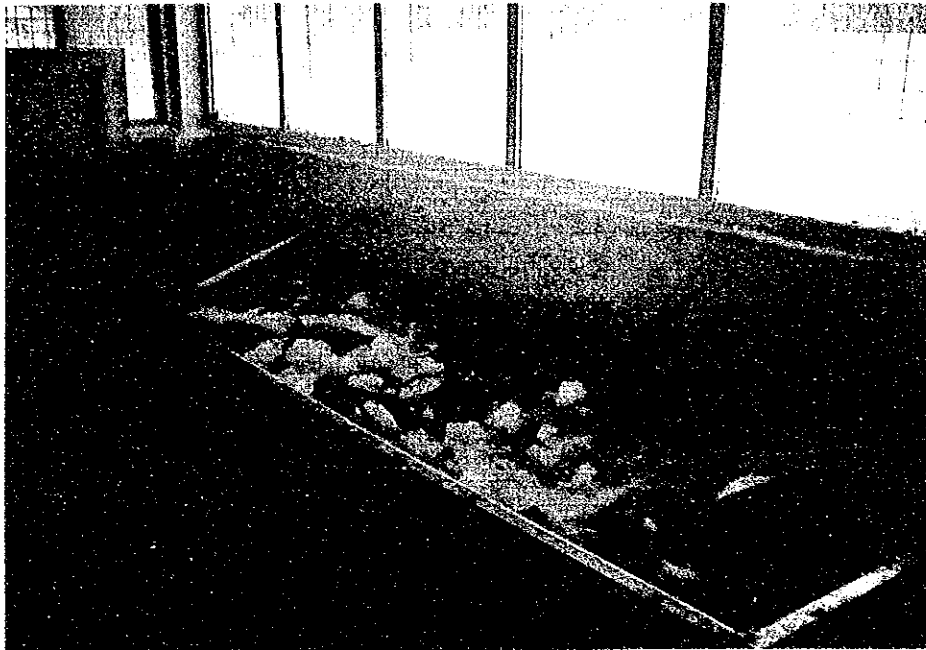
Outboard powered boats
tied up in front of
the Project site



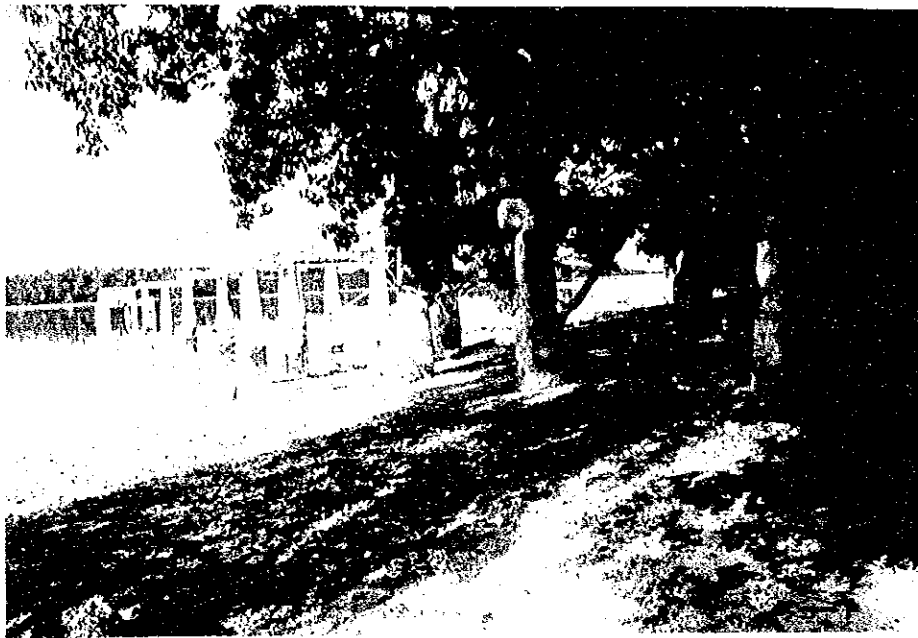
Goods transported by
an individual boat



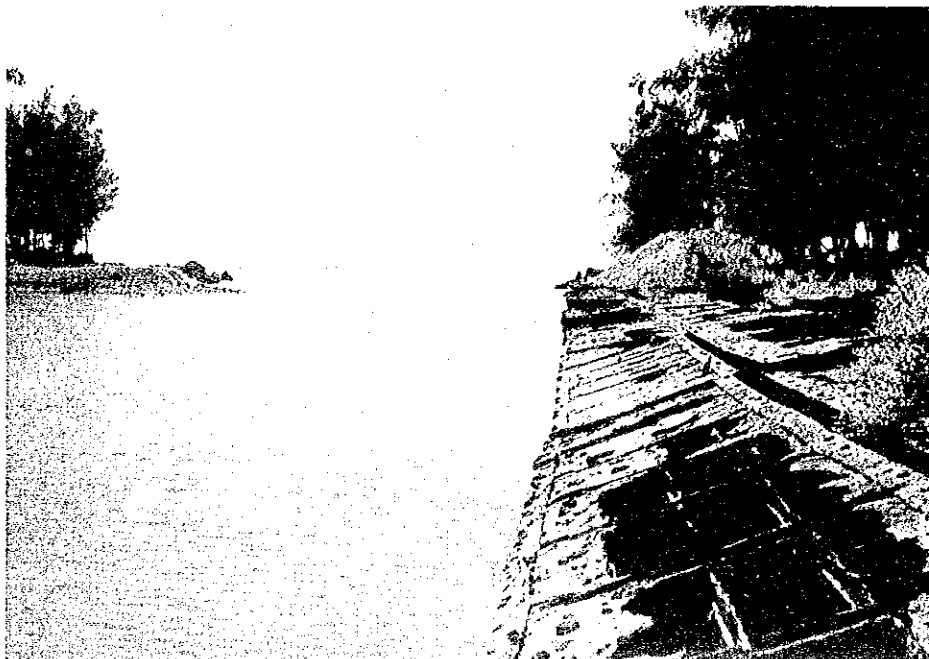
Existing transport
vessels operated by
the State Government
(berthed at Peleliu
Dock)



Fresh fish store
operated by PFFA in
Koror



Loading trestle for
former railway west
of the Project site,
used for phosphate
ore shipments in
1930s



A temporary dock
constructed at the
south-west tip of
Peleliu by the U.S.
military after the
World War II

SUMMARY

The Republic of Palau is located in the middle of the west-central Pacific between 3-8 degrees North and 132-135 degrees East. Based on its geographic characteristics, the surrounding seas are known to possess a huge variety of marine life. The country's land area is 492km² but its 8 main islands are encircled by coral reefs, and the area of the resulting lagoon, including fringing reefs, barrier reefs, and atolls, is 1,660km², triple the country's entire land area. In addition, as a result of a 45km² mangrove area, Palau's coastal areas are endowed with rich waters which are said to be conducive to the reproduction of marine species. According to the Census conducted in 1990, the nation's population totaled 15,122, which is distributed over a total of 16 states: 11 on the main island of Babeldaob plus Kayangel State, north of the main island; Angaur and Peleliu States, just south of the main island; and Sonsorol and Hatobohei States, located approximately 350km and 560km, respectively, southwest of the main island.

Supported by the rich natural environment and traditional land utilization pattern, the share of agriculture and fisheries in Gross Domestic Product (GDP) is quite high, while manufacturing is still relatively small. Employment opportunities are limited in the provinces, which are remote from Koror State, where the population is concentrated, and coastal fisheries constitute one of the limited number of local industries that provide a cash income. For this reason, the Government of the Republic of Palau is promoting, more vigorously than ever, the development of rural fishing villages and has already carried out such projects in four states. A Rural Fisheries Development Plan has now been drawn up for Peleliu State, which is detached from the main island and has a relatively large resident population. A request has been submitted to the Government of Japan for a grant-aid to implement this 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 the subsequent analysis thereof, the following points for consideration have been clarified to optimize the Plan contents.

- (1) Peleliu State is located about 30km across the sea, to the southwest of the main island, Babeldaob. The aquatic animals and plants in the vicinity of Peleliu are extremely rich, offering excellent fishing grounds for reef fish suitable for coastal fisheries operating in the lagoon. In addition, the area above the sea shelf to the south of Peleliu State is an excellent fishing ground for migratory marine species. Given the limited amount of land suitable for agriculture in this state, the coastal fisheries constitute an important source of livelihood for the people of Peleliu, but virtually all cargo movements between Peleliu and the capital at Koror rely on marine transport. Under the present conditions, unless the fishermen use their own small boats to carry their catches to Koror, it is difficult for them to market their products.
- (2) There were 28 outboard-powered boats in Peleliu State as of December, 1993, of which an estimated 10-15 are relatively seriously engaged in fishing activity, though it would be no exaggeration to say that all outboard boats fish to at least some extent. The former Peleliu Fishing Cooperative was forced to terminate operations when its umbrella organization, the Palau Federation of Fishing Associations (PFFA), became inoperative in 1982. However, with the stepped up pace of fishing activity in Peleliu State in recent years, preparations are progressing toward the formation of a new cooperative, and drafts of the necessary ordinances and Articles of Incorporation have already been forwarded to the Ministry of Justice for review.
- (3) At the northern tip of Peleliu State there is a Peleliu Dock 30m long which was built in the 1930s. There is a route through the lagoon to Koror from this dock and so it presently serves as the only port on Peleliu island. However, since parts of the channel between Koror and Peleliu are shallow, the travel time for the existing transport vessels, belonging to the State Government, is controlled by the tides, and so the inability to maintain regular schedules has created a serious problem. In 1983, an ice plant was installed adjacent to the Peleliu Dock, and this facility is currently operated by the State Government.

However, after ten years of constant use, it has become superannuated, with ice-making capacity falling. A new ice plant, therefore, is critically required as ice supply presently cannot meet demand during peak fishing periods.

- (4) The subject Plan forms part of the Peleliu State Fishing Community Development Plan, for which the government of the Republic of Palau requested a grant-aid from the Government of Japan in February, 1993. The superior project is designed to provide dock, ramp, and other facilities in the center of the Peleliu Dock and, by dredging the shallow portion of the ship channel, to enable the two State-owned transport vessels to navigate the channel safely, without regard to tidal movements. The present Plan will furnish the items that have been accorded the highest priority in the above request: viz., an ice-plant and incidental facilities, a fish carrier vessel, and fishing gear. The Plan site for these facilities is a parcel of State-owned land adjacent to the west side of Peleliu Dock. If the low-lying section in one part of the site, which is in danger of flooding at high tide, can be protected by gabion baskets, there should be no problems with respect to construction of the Plan facilities. In the interest of coordinating this Plan with future plans, we have decided that there is little need to provide the floating pontoon called for in the original request.

Based on the above findings, we have summarized below the facilities and equipment that will be required to achieve the objectives of the subject Plan:

Facilities:		
Administration bldg.	single-story RC construction with wooden truss roof	100m ²
	Office for 2-man staff	18m ²
	Work area including space for ice plant	32m ²
	Workshop for repair of outboard motors	20m ²
	Storage area for outboard motors, spare parts & gear	18m ²
	Generator room for installation of emergency generator	12m ²
Toilet/shower	single-story concrete block structure	15m ²
Oil storage shed	single-story concrete block structure	14.4m ²

Equipment:		
Ice plant	500kg/24 hour period, plate ice, automatic	2 units
Water catchment tank	FRP tank 20m ³ , for collection and storage of rainwater	1 unit
Emergency generator	20kva, diesel-powered	1 unit
Fish carrier vessel	Loa 10m, breadth 2.5m, depth 1.0m, FRP, Main engine: diesel, 110ps, Speed: 13 knots or more	1 vessel
Outboard motors	75ps gasoline outboard motors, with spare parts	20 units
Fishing gear	gillnet, hand line, trolling lure	1 lot
Tools for outboard repairs	grinder, compressor, drill, hydraulic press, general-purpose and specialized tools	1 lot
Containers for fish transportation	insulated fish boxes, plastic barrels, platform scale	1 lot
Truck crane	operating radius: 4.5m, lift capacity: 500kg, load capacity: 2t	1 unit

Turning next to the period required for facility construction, combining preparatory work in Japan and the local construction phase, we anticipate a period of about 6 months. With respect to the equipment, the item with the longest procurement lead time in Japan will be the fish carrier vessel, for which 5 months are anticipated.

The implementing body for the Plan will, for the time being, be the Peleliu State Government. In the future, however, when the new Peleliu State Cooperative Association, now in the process of formation, is deemed to be functioning smoothly, operational responsibility for both the facilities and equipment will probably be turned over to the Association. The outboard engines and fishing gear included in the Plan are to be sold directly to fishermen meeting certain qualifications as means of developing the coastal fisheries. The sales proceeds therefrom will be deposited in a Facility Operating Fund. The anticipated operating expenses for the Plan facilities will be \$13,800 and revenues \$16,100. In addition, the expenses and revenues from operations of the three-vessel fleet, including the two existing transport vessels plus the new fish carrier to be provided under this Plan, are projected at \$65,200 and \$75,400 respectively. Thus, looking ahead to the time when the facilities and equipment operation will be transferred to the new Cooperative Association, while operations of the transport fleet, by

virtue of their public service nature, will be left in the hands of the State Government, even when the two operations are so detached, it is expected that they can both be self-supporting.

Based on Plan implementation, there will be a distinct improvement in fish distribution, which in turn will promote greater efficiency in coastal fishery operations. Furthermore, it will be possible, through the introduction of a new carrier vessel, to reduce the volume of general cargo shipments via independent boats, which have been necessitated by the reliance on marine transport from Koror for all daily necessities. The resulting fuel savings have been calculated at about \$12,000 per year, not to mention the huge savings in the time presently required to transport goods in individual boats. The economies realized in time and money can be ploughed back into other forms of production activity, which can be expected to contribute meaningfully to the vitalization of the local economy in Peleliu State. From the above considerations, the Team has concluded that there is considerable significance in carrying out the subject Plan on the basis of a grant-aid from the Government of Japan.

PREFACE
LETTER OF TRANSMITTAL
LOCATION MAPS & PHOTOGRAPHS
SUMMARY

CONTENTS

SECTION ONE: INTRODUCTION.....	1
SECTION TWO: BACKGROUND OF THE PLAN.....	3
2.1 The Natural Environment:.....	3
2.2 Marine Resources:.....	4
2.3 Socio-economic Structure:.....	4
2.4 National Finance:.....	6
2.5 GDP and Balance of Payments:.....	6
2.6 Outline of the Fishing Industry:.....	8
2.6.1 Fishing Ground Environment:.....	8
2.6.2 The Fishing Industry:.....	8
2.7 Fish Distribution:.....	11
2.8 Fishery Administration:.....	13
2.9 Fishery Development Plan:.....	13
2.10 Background and Nature of the Request:.....	14
SECTION THREE: NATURAL OF THE PLAN	16
3.1 Plan Objectives:.....	16
3.2 Consideration of the Request:.....	16
3.2.1 Need for and Appropriateness of the Plan:.....	16
3.2.2 The Management Plan:.....	20
3.2.3 Related Plans:.....	22
3.2.4 Evaluation of the Requested Facilities and Equipment:.....	23
3.3 Outline of the Plan:.....	26
3.3.1 Management Structure:.....	26
3.3.2 Description of the Plan Site:.....	32
3.3.3 Scale and Quantity of the Facilities and Equipment.....	34
3.4 Maintenance and Management Plan:.....	43
3.4.1 Operating structure:.....	44
3.4.2 Operating Costs:.....	46
3.4.3 Proceeds from Project Operations.....	47
3.4.4 Net Surplus from Project Operations:.....	50
SECTION FOUR: BASIC DESIGN.....	53
4.1 Design Guidelines:.....	53
4.2 Design Conditions:.....	53
4.2.1 Natural Conditions:.....	53
4.2.2 Infrastructure:.....	54
4.2.3 Applicable Standards:.....	55
4.2.4 Environmental Conditions:.....	55
4.3 The Basic Plan:.....	56
4.3.1 Site Plan:.....	56
4.3.2 Floor Plan:.....	57

4.3.3 Section Plan:.....	58
4.3.4 Structural Plan:.....	59
4.3.5 Electrical and Mechanical Equipment Plan:.....	60
4.3.6 Construction Materials Plan:.....	61
4.4 Equipment Plan:.....	62
4.5 Basic Design Drawing.....	63
4.6 Construction Plan:.....	75
4.6.1 Construction Guidelines:.....	75
4.6.2 Special Construction Conditions:.....	75
4.6.3 Construction Supervision Plan:.....	76
4.6.4 Procurement of Construction Materials:.....	76
4.6.5 Implementation Schedule:.....	77
SECTION FIVE: PROJECT EVALUATION AND CONCLUSIONS.....	80
5.1 Project Evaluation:.....	80
5.2 Conclusions:.....	82
ANNEX	
I Basic Design Study Team Members.....	87
II Survey Itinerary	88
III Discussants.....	89
IV Minutes of Discussions.....	90
V Others.....	96
V-1 Meteorological Data at Koror Island.....	96
V-2 Breakdown of Operation Costs.....	97
V-3 Breakdown of project Revenues.....	98
V-4 List of the Equipment.....	99

SECTION ONE: INTRODUCTION

In a referendum held in November, 1993, the Republic of Palau ratified the Compact of Free Association with the United States, which had been the country's major pending issue since 1983. The Compact will have a life of 50 years from its effective date; however during its first phase of 15 years period the country will determine its development objectives to achieve economic autonomy. Palau is endowed with a vast lagoon surrounded by coral reefs and, based on its geographic characteristics, belonging to the very center of the west-central Pacific, a tropical zone, it is known that a great variety of marine life exists in the surrounding waters. Against the background of these most favorable natural conditions, the nation is understood to have set its development objectives on sustained utilization of these marine resources, while protecting both the resources and their environment so as to bring maximum benefit to its people. The Republic of Palau has been putting considerable effort into development of its small-scale fisheries targeted mainly at stocks within the lagoon. As a result of these efforts, the rural fishery development program has been carried out in 3 states on the main island, Babeldaob, as well as in Angaur State. These programs have shown positive results in terms of attracting young people to the fisheries by opening a way to obtaining cash incomes via small-scale fishing activities. The government continues to set its sights on the development of these small-scale fisheries and, as one phase of this program, has drawn up a Rural Fishery Development Project in Peleliu State in the southern part of the country and has requested a grant-aid from the Government of Japan to bring this Plan to fruition.

In response to this request from the Government of Palau, the Government of Japan decided to conduct the basic design study for the subject Plan. In this connection, the Japan International Cooperation Agency (JICA) dispatched a basic design study team to the Republic of Palau from December 12-26, 1993, headed by Mr. Senichi Kimura, Deputy Director, Second Basic Design Study Division, Grant Aid Study & Design Department, JICA. The Team validated the contents of the Plan through a series of discussions with concerned officials of the Government of Palau while also conducting a survey and interviews on the present state of fishery production in Peleliu State as well as the Plan implementation structure so as to establish the

background and appropriateness of the Plan and examine the composition of the necessary facilities and equipment. During its stay, the Team also conducted a field evaluation of the Plan site near the Peleliu Dock in the northern end of Peleliu State. The basic points of agreement reached in the course of the discussions on Plan implementation between representatives of the Government of Palau and the Basic Design Study Team were summarized in the Minutes of Discussions which was signed and exchanged by the two parties. After returning to Japan the Team analyzed and examined the survey findings, evaluated the requirement for the requested facilities and equipment and prepared a basic design covering the composition, technical specifications, and required quantities of the Plan items. This report, based on the results of our survey and evaluation, contains a basic design for the facilities and equipment that have been deemed optimum for implementing the subject Plan, along with a project implementation plan and a project evaluation. The composition of the team members, field survey itinerary, names of discussants, and the Minutes of Discussions are included in the Appendix to the report.

SECTION TWO: BACKGROUND OF THE PLAN

2.1 The Natural Environment:

The Republic of Palau is situated in the western Pacific between 3-8 degree North and 132-135 degree East. The country comprises over 500 large and small islands and atolls extending over a distance of about 700km, from Ngeruangi Atoll in the north to Helen Atoll in the extreme south, with a total land area of 492km². According to the Census taken in 1990, the population was 15,122, which reside on only 9 of the country's many islands. Geographically, Palau forms part of the Palau Ridge, extending from the Marianas to the western portion of New Guinea. The country's topography may be divided into volcanic rock and limestone rock formations, springing from a volcanic upheaval, and coral atolls created by coral reef protuberances. The 8 main islands are surrounded by coral reefs, with a lagoon area (including fringing reefs, barrier reefs, and atolls) of 1,660km², triple the country's combined land area. Since the Palau islands belong to a northern tropical convergence belt, they have characterized by high annual temperatures of 27-28°C and high humidity of 80-90%, with a heavy annual rainfall of 3,000 - 4,000mm. Precipitation in Koror during 1992 totaled 3,110mm, while the average annual temperature was 27.5°C. Since Palau is near the point of origin for tropical depressions, it rarely experiences typhoons, but, in 1962, a typhoon was recorded with a maximum wind velocity of over 32m/sec. During the typhoon Mike in November, 1990, which passed some 60km north of the capital at Koror, the latter experienced maximum wind velocity of 37m and recorded minimum pressure of 984.6 hectopascals. This typhoon caused severe damage to Palau's northern states. Normally, however both easterly and westerly winds are as a rule gentle. As a result of the favorable topography and precipitation, forest areas are large, with land forests covering 24,000ha, mangrove forests 4,700ha, and swamp forests 1,600ha. On Babeldaob island, which comprises 75% of the country's land area, a full 75% of the land surface is covered by natural forests, of which over 90% are matured stands made up of tall trees and this superb natural setting has been preserved.

2.2 Marine Resources:

The seas in Palau are known to be a treasure chest of rich and varied marine resources. Some 200 or more small uninhabited islands of limestone rock (umbrella type) are scattered across the highly transparent waters: they are known as "rock islands" for the unique panorama they create. The country is blessed with many such superb tourism resources. The coral resources in Palauan waters are said to comprise 78 classes and 6 sub-groups of some 425 species. Palau has probably the most varied coral habitats in the entire Indian and Pacific area. There are said to be more than 1,000 species of large marine invertebrates, while 920 species of fish have already been identified. With regard to sea turtles, Palau waters are home to hawksbill and green turtles which come there in groups for feeding and spawning. These waters are then important to the reproduction of sea turtles. Habitats for saltwater crocodiles (Crocodylus prorosus) are seen over a large area, and such aquatic mammals as dugongs are known to be found over a wide section of the lagoon west of Babeldaob island as well as in the relatively deep seagrass beds southwest of Koror. As shown above, the seas around Palau abound in a huge variety of marine species whose habitats and resources need to be preserved.

2.3 Socio-economic Structure:

Palau was a trust territory of Japan from 1914 until the end of World War II. In 1947, it was transferred to the United States as a United Nations trusteeship territory but, in January, 1981, the Republic of Palau autonomous government was formed, based on a constitution, and this marked the start of autonomy for the territory. In February, 1982, the autonomous government reached agreement with the U.S. government on a Compact of Free Association but, for the next 10 years, ratification could not be secured in Palau, owing to the non-nuclear clause in its Constitution. However, in a national referendum held in November, 1993, 68.3% of the voters were in favor of ratification, and so the Compact with the U.S. has finally been accepted, paving the way to independence. As of December, 1993, it was anticipated that the Compact would take effect by April, 1994, at the earliest, and October, 1994 at the latest. Against these developments, the Government of Palau has accelerated the drafting of a long-term National

Development Master Plan (NDMP), with 2020 set as its final target year. This Plan is to be accomplished in 5 five-year segments, and is expected to be announced in December, 1994. The initial National Development Plan (for the period 1987-91) has been completed so that, at the present time, no comprehensive developmental plan exists at the national level, though various administrative agencies are drafting implementation plans for individual years. It is felt that the administration of the new President, elected in the general election of November, 1992, will continue to attach a high priority to fishery development.

The Republic of Palau comprise 16 states. Some 70% (10,000 inhabitants) of the domestic population live in the Koror area, which is the center of Koror State, while 5,000 are distributed over the other 15 states. Excluding Koror State, the only state with over 1,000 inhabitants is Airai, adjacent to Koror. Population in the other states is generally in the order of just a few hundred people. The population of Peleliu State, which contains the site for this Plan, has about 600 inhabitants, ranking third in the nation behind Airai. Based on the 2,300 registered voters living abroad, it is estimated that over 5,000 Palau citizens are now living overseas, mainly in Guam or other American territories and in Saipan. Reciprocally, a similar number of foreign, mainly Filipino, workers are residing temporarily in Palau. The 16 states of the Republic of Palau are permitted to have their own state constitutions, so long as they are compatible with the national constitution. Clan system, which forms the traditional social structure, continues to function on the state level. These clans are grouped into the Reklai, covering the states from Aimeliik north, while the Ibedul covers the southern states. The prestige of the clan system has been preserved even in the national constitution; they serve as advisors on both administrative and legislative matters. However, the traditional harmony of government is now breaking down, while a new modern administrative structure has not yet completely taken root. This dichotomous situation gives rise to various administrative and legislative problems at both the national and state levels.

2.4 National Finance:

The Republic of Palau derives its revenues from the following sources:

- (1) contributions from the U.S. Department of the Interior;
- (2) program aid from the U.S. Federal Government;
- (3) taxes; and
- (4) government business revenues.

The core of the national budget is item (1), contributions from the U.S. Department of the Interior. In terms of (2), U.S. program aid, Palau is treated like a U.S. state, with these funds donated for infrastructure purposes, on the same basis as an American state. Tax revenues (3) are used to finance state-run projects or projects resulting from legislation under the supervision of the Palau legislature. Revenue sources under (4) represent income from public utilities.

In the budget for fiscal 1989 (October, 1988 to September, 1989), contributions from the Department of the Interior totaled \$10,084,000, while Federal payments amounted to \$2,727,000. Looking at the accounts for fiscal 1991, national revenues totaled \$30 million of which 60% (\$18 million) comprised transfers from the U.S., the trustee nation, and 40% from local sources. (30% from import duties, income taxes, business and other taxes and 10% from electricity, water and other utility charges, permits, applications and such). In the budget for fiscal 1993, 66% of government expenditures (totaling \$30 million) were directed administrative agencies (63% to the various Ministries and 3% to the President's office). The remaining 34% was disbursed to the courts, public corporations, the legislature, and state aid programs. Among the various ministries, the largest funding (\$6,700,000) goes to the Ministry of Resources and Development (MRD), which covers fisheries, but this reflects the fact this Ministry includes the Bureau of Public Works in addition to the Bureau of Natural Resources and Development.

2.5 GDP and Balance of Payments:

The Gross Domestic Product (GDP) of the Republic of Palau in 1992 totaled \$89,740,000, of which services contributed \$51,920,000 (about 58%). Within the service sector, government agencies are the largest contributors to the GDP, followed by foreign trade, hotels, and restaurants. The agriculture and fisheries sector accounts for \$25,850,000 (some 29% of

total), with fisheries comprising the major share (26% of total). The percentage breakdown of GDP by sector for 1990-1992 is shown in Table 2.1.

Table 2.1 GDP by Sectors

(Unit: 000 US\$)

Sector	1990	1991	1992
1. Agriculture and Fishery	19,943	23,589	25,849
1.1 Agriculture	2,296	2,496	2,647
1.2 Fishery	17,647	21,093	23,202
2. Industry	11,899	11,357	11,973
2.1 Manufacturing	528	633	813
2.2 Construction	8,522	7,015	6,689
2.3 Utilities	2,849	3,709	4,472
3. Services	45,046	48,908	51,917
3.1 Trade	12,014	13,798	14,062
3.2 Hotel & Restaurant	6,258	6,802	8,717
3.3 Transport & Communication	3,371	3,397	4,087
3.4 Finance and Insurance	3,112	3,175	3,271
3.5 Real Estate & Business Service	3,313	3,735	3,702
3.6 Government Services	14,212	15,024	14,356
3.7 Other Services	2,767	2,978	3,723
Grand Total	76,888	83,855	89,739

(Source: National Accounts of Palau, 1990-1992, Office of Planning and Statistics)

As shown in Table 2.1, manufacturing accounts for only a minor share of GDP, principally through food processing, cement manufacture, vehicle repairs and servicing. The economic scale of Palau's manufacturing industries is expanding, though at a very slow rate. The country's primary export products in 1992 were tuna and other highly migratory species (\$27,600,000), followed by reef fish and other marine products (\$22,000,000). Supplies of foodstuffs other than fish products, capital equipment, and virtually all consumer goods are dependent on imports. Total imports in 1990 amounted to \$24,600,000 and, in the first half of 1992, to \$13,500,000. As already observed, tuna accounts for an extremely high share of exports but, considering that almost all of the fishing activity for this species is carried out by joint venture companies, we must assume that a certain degree of the service revenues are offset by capital receipts. Adequate data are not available on the contribution to the balance of

payments from overseas remittances from the estimated 5,000 Palau nationals living abroad or from tourism and other non-trade sources. But it may be inferred that, along with economic aid and loans, receipts on capital account play an important role in the country's balance of payments.

2.6 Outline of the Fishing Industry:

2.6.1 Fishing Ground Environment:

The marine environment in the Palau area is dominated by the North Pacific Equatorial Current and counter-currents flowing in a westerly direction between 5-20° N. During the winter, since the prevailing winds are easterly, the North Pacific Equatorial Current predominates but, during the summer months, the Northern Equatorial counter-current moves northward, exerting its influence at times up to the area around the main island of Babeldaob. These currents flowing in the vicinity of the Palau archipelago constitute an important factor in the formation of the excellent fishing grounds for yellowfin and bigeye, commonly referred to as the Caroline Grounds. As a result, tuna and skipjack fishing vessels from Japan, the U.S., Taiwan, China, the Philippines, and many other countries are operating within the 200 mile Exclusive Economic Zone of the Republic of Palau, which covers an expanse of 180,000km². The bulk of the coastal waters around the Palau islands are coral reefs, with fringing reefs covering an area of 195 km², lagoons 1,137km², barrier reefs 265km², and atolls 65km². There are an additional 45km² of mangroves. These waters are conducive to the reproduction of the country's abundant coastal and marine resources.

2.6.2 The Fishing Industry:

(1) Coastal Fisheries

The coastal fisheries of Palau, at the present time, operate mainly on the reef slopes of the outer reef and in the lagoon area in small outboard-powered boats. In 1992, it is estimated that there were 628 small vessels in the country, with an average length of 6.1m (20 ft.) and an outboard horse power averaging 103ps. While it is true that the coastal fisheries are using this sort of small boat, not all such boats are exclusively dedicated to fishing operations; the bulk are used for transport and cargo handling as

well as recreation. Rather than looking upon these as small fishing boats, they should perhaps be considered as multi-function boats used to support everyday life in the country. In addition to fishing via powered boats, non-powered canoes and bamboo rafts are also used for fishing purposes, while some individuals fish on foot from the shore. The principal fishing methods include spearing gears, hand lines, trolling lines, gillnets, roundhaul gillnets, and baskets. Trolling lines are used mainly outside the reef, and spearing gears and hand lines inside and outside of the reef. Gillnets, roundhaul gillnets, and baskets are principally used within the reef. According to the 1992 Annual Report published by the Division of Marine Resources, the main species landed at the main fish market in Koror during that year included Lutjanidae, Scaridae, Siganidae, Serranidae, Acanthuridae, Lethrinidae, Carangidae, and other reef species, along with migratory species taken in the vicinity of the reef, such as spanish mackerel, rainbow runner, barracuda and skipjack. With respect to the migratory fish, which constitute the main grounds outside the reef, there is a possibility of a slight volume of incidental catches from the offshore fishery reaching the market, but in the case of reef species, virtually all are believed to be taken by the coastal fisheries. Total shipments in 1992 of the above reef species came to about 138 tons, plus 190 tons of other species, resulting in a combined total of 328 tons. The other species included, in addition to migratory species, bivalves and crustaceans, totaling 14.5 tons. Of the grand total of 328 tons, some 6.2 tons were distributed via the market, while another 18 tons of pole and line skipjack were also included. Other important commercial species taken by the coastal fisheries include trochus shells, which are exported as raw material for buttons; edible giant clams, trepangs, mangrove crabs and lobsters. Based on the above-cited Annual Report, in addition to the 328 tons distributed through the domestic market, an estimated 340 tons in 1992 were caught for the fishermen's own consumption.

(2) Offshore Fishery

At present, the dominant pattern of operations in the offshore fishery are categorized as 1) foreign fishing vessels targeting skipjack and tuna purse seine, skipjack pole and line and tuna longline operations, 2) longline operations of Chinese and Taiwanese vessels chartered by Palaun joint venture companies, and 3) skipjack pole and line vessel of 26gt class

operated by a Palaun fishing company. The operations of the foreign fishing vessels includes Japanese skipjack and tuna purse seine, skipjack pole and line and tuna longline vessels based on fishery agreement with a private fishing organization in Japan and American skipjack and tuna purse seine vessels pursuant to multilateral fishing agreements with various Pacific nations. The number of licensed foreign vessels registered in 1992 on the basis of fishing agreements totaled 205 longliners and 45 purse seiners plus attached vessels. The catch by the foreign fishing vessel may be classified into the one unloaded at Koror for air shipment to Japan as fresh tuna and those not landed in Palau.

Two Palau companies charter Chinese and Taiwanese fishing vessels in the tuna longline fishery. As of 1992, one company held fishing permits for 150 vessels, of which 140 are operating, while the other company held permits for 200 vessels, of which about 120 are operating. Export of fresh tuna by these two companies are shipped entirely to Japan: 1,816 tons in 1990, 2,835 tons in 1991, and 2,581 tons in 1992. However, a small portion of their catches were believed to be unreported in 1992. Catches apart from tuna that can be exported in fresh form are stored in the refrigerated warehouse in Koror. While a portion of these catches is shipped to the domestic market, almost all this fish is exported to Taiwan as canned products (1,500 tons in 1992). As shown above, performance of the longline tuna vessels operating under charters is developing smoothly, but, in October, 1993, the Government of Palau imposed a tax of 12.5 cents per kg on fresh fish exports, and there is keen interest in the possible impact this tax will have on export business in fresh tuna.

(3) Mariculture

In 1973, the Micronesian Mariculture Demonstration Center was established in Koror. Initial activity centered on pilot production of rabbit fish fry, but the Center has played a major role in the production of giant clam seeds and in mariculture technology. The achievements of this Center in transferring mariculture technology to other Pacific countries the distribution of giant clam seeds have been highly regarded, and so the MMDC operations are recognized by the Government of Palau as having major significance in terms of the continuing development of mariculture. It is reported that, in 1992, \$157,000 of revenues were earned through the sale of giant clam seedlings produced by this Center. However, this species has now

been listed under CITES (Convention of International Trade on Endangered Species of Wild Fauna and Flora), and, whether the seeds are produced by MMDC or are allowed to mature using mariculture techniques that are wholly performed under artificial supervision, commercial trades in this species are subject to strict restrictions.

MMDC is presently under the direct jurisdiction of the Division of Marine Resources. Recently there has been an expansion in extension and training activities targeted at fishermen, students, and employees of both the national and state governments. Thus, in addition to its original work in disseminating mariculture technology, there are high expectations that the Center will grow as an organ for fishermen's education and research. Current MMDC activities in the field of mariculture, apart from the above-mentioned work on giant clam, are concentrated in three areas: research and conservation of hawksbill turtles, evaluation of the trochus shell resource, and resource management. Future research is also expected to get underway on the breeding and cultivation of soft, hard and Zooanthid corals.

2.7 Fish Distribution:

While a national network for the commercial distribution of fish products has not yet been established in the Republic of Palau, a partial distribution system does exist in the capital, Koror, with overseas markets such as Guam and Saipan, where many Palau nationals are living, and between family members and relatives. These channels are not limited just to fish products; they also handle a fairly large share of the distribution of foodstuffs and everyday necessities. No figures exist on the volume of commercial transactions passing through these distribution channels but, speaking just of fishery products, it is estimated that, in 1992, a total of 750 tons of fish were consumed in fishing families or distributed outside the established market. The exact proportions between direct consumption and distribution outside the market through family and relatives are not available, but, considering the fact that roughly 70% of Palau's total population of 15,000 live in the capital, and that another 5,000 Paluan nationals live abroad, it may be presumed that a substantial volume of fish is being distributed through family channels.

Koror, the main population center, is naturally the prime consumption center in Palau for fish products. The main distribution networks for fish

products in Koror, linking private consumers, restaurants, hotels, and fishermen, include: the Palau Federation of Fishing Associations (PFFA), which buys from and sells to fishery cooperatives and professional fishermen with a relatively high degree of specialization in fishing activity; several large stores that trade directly with the PFFA and fishermen; and restaurants and hotels that process their own house brands from fish purchased directly from fishermen. Of these channels, it is the PFFA which performs the key role in fish distribution as a quasi-public organization.

PFFA was established in 1975 to assist fishermen through the operation of landing and other facilities, but was forced to cease operations in 1982 owing to bankruptcy. In 1983, the government took over PFFA's operations and so, at present, the organization is operated under the aegis of the Palau Fishing Authority (PFA) as a non-profit organization whose main business is managing the landing facility at Malakal port and marketing fish catches. It has a staff of 21 persons, including 15 full-time PFFA employees plus 6 employees seconded from the PFA. 1992 sales totaled: \$601,000: \$405,000 in fish products, \$131,000 in fuel, \$51,000 in ice, and \$14,000 in transport services. Cost of goods sold totaled \$404,000 and general operating expenses \$194,000, enabling the organization to post a small operating profit. Adding in interest income, the reported profit for 1992 came to over \$6,300. Judging from current operating conditions, we have concluded that the organization should be able to operate on a self-sustaining basis in the future.

Overseas demand for reef fish comes mainly from Guam and Saipan. Demand is particularly strong during the Christian Lent season, when much illegally caught fish is exported. In a determined effort to ensure that this lagoon fish, which is in limited supply owing to the stock size of resource in lagoon area, be used primarily to satisfy domestic demand, the Government of Palau has enacted legislation, which took effect in 1993, to ban all exports of reef fish each year between March and July. Exports of reef fish to Guam and Saipan are handled by a small group of specialized dealers, who have secured sales channels for this fish in export markets. One leading exporter is said to have exported 44 tons to Guam in 1992. But, with the imposition of the 4-month ban, this firm ceased export operations in 1993.

2.8 Fishery Administration:

Fishery administration in Palau takes two forms: (1) regulation by the Palau Maritime Authority (PMA) of operations by foreign fishing vessels pursuant to fishing licenses for the 200 mile zone beyond the 12 mile territorial waters; and (2) management by the Ministry of Resources & Development through its Division of Marine Resources, which is responsible principally for coastal fisheries, mariculture, and management of marine resources. In addition, there is the Palau Fishing Authority (PFA), which was established for the purpose of managing government-owned enterprises. It presently guides and supervises operations of the PFFA. Both the PMA and the PFA are independent authorities; they are not under the direct control of any Ministry or Bureau. They operate as public organizations under the supervision of a Board of Directors appointed by the President. We have been told that growing consideration is being given to unifying the administrative set-up for fishery products in Palau, but nothing has yet materialized in this direction.

2.9 Fishery Development Plan:

The first National Plan, covering the period 1987-1991, has now terminated. A new National Master Development Plan, setting forth the long-term objectives and strategies for the post-independence era, is currently being formulated in anticipation of a formal announcement in December, 1994. There is a continuing realization that the seas surrounding Palau are a most precious natural resource for this nation and, in terms of setting future long-range objectives, it is inconceivable that the importance of the ocean as a foundation for long-term economic development and a self-supporting economy would ever be dismissed. The Division of Marine Resources, within the Bureau of Natural Resources & Development of the Ministry of Resources & Development, has, in fact, set the following objectives in the area management and development of fishery resources on the basis of this premise:

- Strategy for creating employment opportunities and income gains through private industry.
- Devising policies for resource management.
- Shifting fishing effort from inside the lagoon to the high seas.
- Efforts in the area of resource surveys and product development linked to the establishment of a firm export base.

- Educational activity to enhance the importance of conserving marine resources.
- Improvement of processing technology.
- Promoting greater participation by state governments in the development, management, and conservation of marine resources.
- Promoting the rationalization of shore-based infrastructure.
- Increasing training opportunities for regional personnel.

The significance that can be read into the above objectives is clear evidence of a serious effort in the following areas: raising efficiency, via private sector initiative, and encouraging a higher degree of participation and involvement by administrative agencies on a national level; an awareness of the need to effect a shift in fishing grounds in light of the limited remaining developmental potential for lagoon resources; development of resource management policies involving the state governments and enlightening the public on the subject of resource conservation; increase the added value of fishery products by raising levels of processing technology and technical qualifications of government personnel.

2.10 Background and Nature of the Request:

In the seas surrounding Palau, a rich ecostructure has been preserved comprising a variety of coral and other marine resources, which enhance reproductivity of valuable species present in this ecostructure that are indispensable to mankind. Whether these resources are taken directly for utilization or used indirectly as tourism resources, there is no question but that utilization of these varied marine resources for the maximum benefit of the people of Palau has become a firm pillar of national policy. In accordance with this national objective, over a 3-year period from 1987 - 1989, the rural fisheries development plan was carried out involving the construction of dock and shore facilities for coastal fishery use in 4 states: Ngarchelong, Melekeok, and Ngatpang on the main island of Babeldaob and the Angaur in the south. The projects were implemented under a grant-aid from the Government of Japan and are attaining a considerable measure of success. As a result, the Government of Palau, in accordance with its continued policy of promoting regional fishery development, has drafted a Rural Fisheries Development Plan involving supporting facilities for the

coastal fisheries, targeting at Peleliu State, which is remote from the main islands. This Plan forms part of the Peleliu State Fishing Community Development Plan for which the Government of Palau requested a grant-aid from the Government of Japan in February, 1993. The composition of the requested facilities and equipment, as required for project implementation, classified by the indicated degree of priority, is as shown below:

Items indispensable for Plan implementation:

- Ice-plant and ice storage facility, generator
- Building(s) (including office, workspace, storage shed, etc.)
- Rainwater tank

First priority items:

- Crane-mounted truck
- Outboard engines
- Fish carrier vessel

Second priority items:

- Fishing gear
- Fish carrying boxes

The floating pontoon, which was included in the original request, has been excluded, owing to the shallow water in the installation area and the difficulty in maintaining the marine steel components contained in the request.

SECTION THREE: NATURE OF THE PLAN

3.1 Plan Objectives:

The Republic of Palau is made up of 16 States, of which 11 are located on the main island, Babeldaob. The remaining 5 States include: Kayangel, to the north of the main island; Angaur and Peleliu to the south; and the more distant Sonsorol and Hatobohei (some 350km and 650km, respectively, from the main island). Thus, land transport between the 5 outlying States and the main island is impossible. Excluding Koror State, which contains the capital and some 70% of the total population, Peleliu is second only to Airai in population, and so there is a large demand for marine transport between Peleliu and the capital city of Koror. Although the seas around Peleliu are quite rich in fishery resources, supporting fishing bases and allied facilities are inadequate. The objective of the subject Plan, therefore, is to activate fishing activity on Peleliu and improve both the processing and distribution of the catches through the construction of small-scale rural fishery support facilities comprising an ice-making plant, workshop facilities, small-size carrier vessel, and fishing gear.

3.2 Consideration of the Request:

3.2.1 Need for and Appropriateness of the Plan:

(1) Geographical Conditions of Peleliu State:

Peleliu is located some 30km south of the main island, Babeldaob. It is a flat lime rock island, presumed to have resulted from a protrusion of reef flats above the ocean surface in prehistoric times. Including two small islands to the northeast, the land area of Peleliu island is 12.7km². Phosphate mining was conducted during the 1930s but, in the closing stages of World War II, the island was the site of fierce battles between the Japanese and U.S. forces. As a result of these engagements and the postwar land moving operations to dispose of wartime wreckage, the island's top soil was almost entirely lost, rendering the island unfit for agriculture for many years. At present, however, 50 years after the war, tree cover has become luxuriant and, in one portion of the island, a recovery has been seen

in top soil, including organic matter based on humus action in these forests. On the other hand, the zoological and floral attributes in the waters surrounding Peleliu State are extremely rich; they contain Palau's largest seagrass beds as well as its second most extensive mangrove forest. In addition, there is an expanse of shallow waters which supports reproduction of fish and other marine organisms and plays an important role in the coastal ecosystem. Excepting only a very small area on the southwestern tip of the island, Peleliu State is completely encircled by a barrier reef and so provides very good fishing grounds for reef fishing, which are suitable to the conduct of coastal fishery operations within the lagoon. In addition, in the vicinity of the sea shelf extending between Peleliu and Angaur, some 10 km to the south, some pelagic species migrate in large numbers, and so this area can be said to be favored by ideal conditions as fishing grounds. However, the movement of goods to the capital at Koror depends almost entirely on marine transport, relying on small-size outboard boats with no decks which sail to Koror inside the lagoon, via an 1.8km dredged channel and a continuing 2.5km natural channel, from a 30m dock constructed during the 1930s at the northern end of Peleliu island.

(2) The Fishing Industry in Peleliu State:

As in the other States, the main fishing methods are spearing, gillnet, and hand lines. The spearing fishery requires considerable physical stamina and so tends to attract mainly younger fishermen for selective catches of fish for which there is a strong demand, while the hand line fishery is conducted by experienced fishermen. Gillnets are generally installed in water channels during low-tide periods. The gillnet boats are operated by two fisherman, with net length normally about 120m. However, 900m gillnets, designed to trap schools at high tide, have been spreading. The use of these large nets has given rise to deep concern in certain areas relative to conservation of fish resources within the lagoon.

As of December 1993, 28 outboard boats were operating in Peleliu State. These boats are multi-use; used to fish for the fisherman's own consumption, to catch fish for the Koror market, and for hauling cargo between Peleliu and Koror. However, given the small supply of agricultural land on Peleliu island, fishing represents an important source of livelihood for the local population. Thus, almost all of the boats are equipped with fishing gear, and it would be no exaggeration to say that every vessel

engages in fishing operations to at least some degree. In addition, there are many fishermen who catch fish with non-powered canoes, spears, or simply on foot. It is estimated that some 10-15 boats are, relatively speaking, seriously engaged in fishing activity. At present, each fisherman takes his individual catches by his own boat to Koror. But to do this, using the spearing fishery as an example, after catching his fish on a night with a new moon -- the most propitious time for this type of fishing--, the next morning, the fisherman must then consume the better part of half a day to take his catch to Koror. By the time he returns to Peleliu, he has to resume fishing, without benefit of proper rest -- which makes for a very arduous existence. Prior to 1992, there were a few talented fishermen in Peleliu who exported their reef fish to Guam, and it is estimated that an average of 4 tons a month were transported to Koror for this purpose. Since 1993, however, as a result of a newly imposed embargo on commercial exports of reef fish during the four month period from March to June, present shipments of reef fish from Peleliu to Koror are estimated at only 900kg per month. Other than catches for the fisherman's own consumption, the actual volume of fish distributed within the State is quite limited. The stark reality is that commercial fishing operations are simply not viable unless virtually the entire reef fish catch is shipped to the capital.

(3) State of Existing Facilities:

A very narrow channel has been excavated at the southwest tip of Peleliu State, making it the only point in the state through which products can reach the island directly from the open sea without having to pass through the lagoon. Following World War II, the U.S. military erected a temporary dock there but this is presently unusable. On the northern edge of Peleliu, as previously mentioned, there is a small-size dock, called the Peleliu Dock, which now serves, so to speak, as the gateway to the state, since it stands at the head of a route to Koror via the lagoon.

Adjoining this dock is a plate-type ice-making plant, with a daily production of 500kg, which is operated by the State government. This facility was built in 1983 and has an ice-making capacity of 1 ton per 24 hour period. At present, however, power is supplied for commercial use only for 12 hours at night and so the plant can only produce 500kg of ice per day. While freshness preservation technology based on ice are well established in the area, since the plant has been operating for over 10

years and its ice-making capacity has been declining due to superannuation, ice supply during the peak fishing season is inadequate. As was discussed in Section 2.7, the former PFFA became inoperative in 1982, as a result of which the activities of the Peleliu State Fishery Cooperative also ceased. However, with the stepped-up pace of fishing operations in Peleliu State over the past few years, preparations are now underway to form a new cooperative, and concrete plans have been drawn up for this purpose, including an enabling ordinance as well as Articles of Incorporation, and these have already been forwarded to the Ministry of Justice for review. There exists no adequate facilities near the Peleliu Dock which will function as the core facility after the new association has been launched by providing an area for the fresh processing of fish for sale in Koror as well as for the repair of outboard motors.

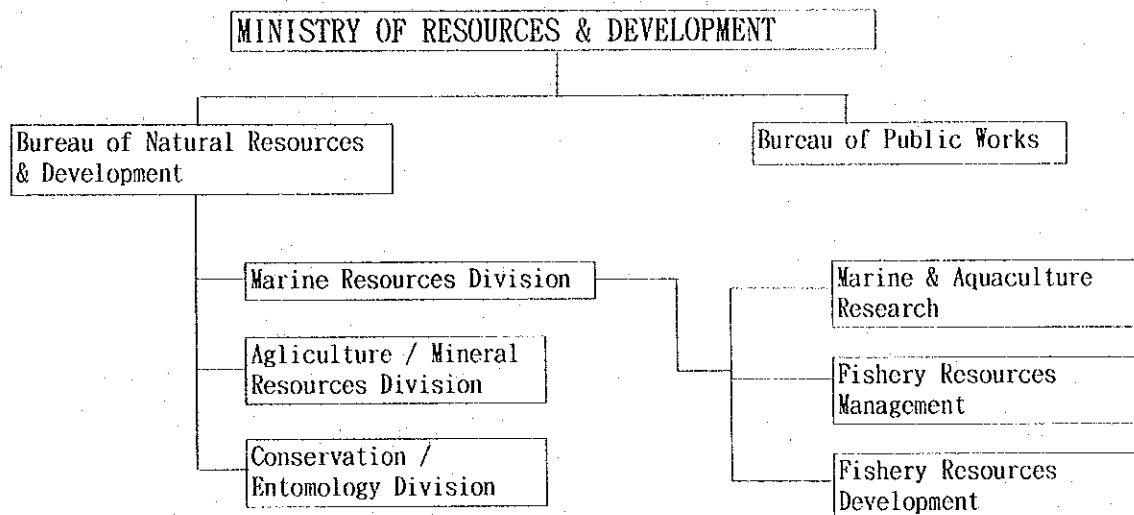
(4) Condition of the Existing Transport Vessels:

Peleliu State operates 2 transport vessels. One is the FRP boat Nippon Maru, which carries both passengers and cargo, with an overall length of 14.98m, breadth of 3.40m, depth of 1.95m, and a main engine horse power of 300ps. The other vessel, also a FRP boat, is the Peleliu Star, a cargo vessel of the landing craft genre with a flap door at the bow, with an overall length of 14.25m, breadth of 3.30m, depth of 1.60m and a main engine horse power of 270ps. Both of these are small-size vessels suitable for cruising in the lagoon but, since the draft at the stern of the Nippon Maru is 1.6m, while that of the Peleliu Star is 1.5m, and since the depth of the channel between Peleliu and Koror comes to only about 1.2m during low tide, trips must be scheduled to avoid such periods. Both vessels schedule 2 regular trips a week between Koror and Peleliu but operate under a major handicap as public service carriers, owing to their inability to maintain punctual schedules because of these tidal influences. Since the Peleliu Star is an all-cargo vessel with a flap bow door, it is ideal for transporting vehicles and similar cargoes to areas that are not equipped with port facilities. For this reason, there are numerous requests from other states for charters, and so operations are relatively profitable. And since the Nippon Maru can carry 30-40 passengers on each voyage, it is often chartered for tourist runs or booked to take people to official events or private ceremonial occasions such as weddings and funerals. It thus plays a public service transport role, and so its financial performance is not

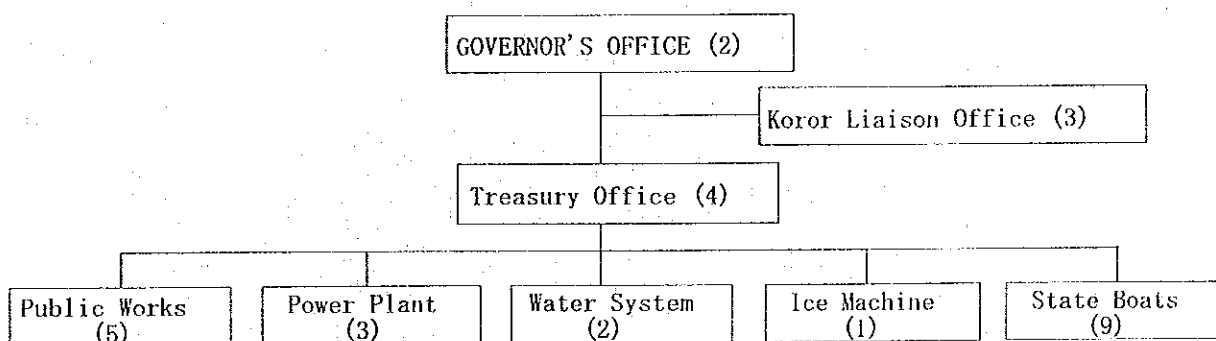
particularly outstanding. A total crew of 9 persons have been engaged in the operation of the two vessels, and the budgets for maintenance and parts are appropriated by the State Government, so that maintenance is excellent. The fare revenues of the two vessels exceeds operating expenses and, if depreciation cost is considered as a part of maintenance overhead for rendering a public service, the present conditions of State transport operations can be evaluated quite highly.

3.2.2 The Management Plan:

The responsible agency for the subject Plan will be the Ministry of Resources & Development, which has organized the Division of Marine Resources to administer coastal fisheries operating inside Palau's 12 mile territorial waters. The Ministry of Resources & Development contains a Bureau of Natural Resources & Development and a Bureau of Public Works. The latter Bureau comprises a Division of Maintenance for maintaining all government-owned facilities, a Division of Public Utilities for administering power, waterworks and sewage facilities, and a Division of Design Engineering for administering public works projects. These agencies supervise all public works projects and lend technical support to all facilities operated by the state governments. The Bureau of Natural Resources & Development, on the other hand, is divided into three Divisions: the Division of Marine Resources (DMR), the Division of Agriculture/ Mineral Resources, and the Division of Conservation/Entomology. The main function of the DMR is to develop and propagate fishery technology for living marine resources, provide guidance on resource management and conservation, promote aquaculture, maintain statistics, and provide guidance to fishermen. The Ministry of Resources and Development has a staff of 235, of which 49 work at the Bureau of Natural Resources & Development, while another 21 persons are attached to the Division of Marine Resources. The organization chart for the Ministry of Resources & Development is shown below:



The implementing organization for the Plan will be the Peleliu State Government. In the future, at such time as the Peleliu State Cooperative Association (PSCA), currently being organized, is deemed to be fully function, it is expected to turn management responsibilities for both facilities and equipment to this new body. The Peleliu State Government has 29 employees, including the Governor. Five are stationed in public works operations, 3 in the power plant, 2 at the waterworks, and 9 operate the State-owned transport vessels. The organization chart for the Peleliu State Government is as shown below:



Figures in () = no. of Staff

Budgets for the Ministry of Resources & Development and the Peleliu State Government are as follows:

(in U.S. \$1,000)

Fiscal Year *	1992	1993	1994
Ministry of Resources Development	6,795	6,703	6,375
Peleliu State Government	266	502	698

* From October of preceding year to September

As explained above, the ordinance and Articles of Incorporation for the PSCA have already been drafted and forwarded to the Ministry of Justice for official review. But, since other states are also moving in this direction, it is difficult to anticipate when the review process for the PSCA will be completed. The Articles of Association of the PSCA expressly state that the new Association will perform a full range of operations for its members, including processing of catches, purchasing, sales, and equipment and facility services. The Association will then be in a position to carry out all required functions as the body administering the facilities and equipment under this Plan. However, the Association is not yet organized and, in any case, even if it were to start operations in the near future, would clearly not be able to perform a management role until it had acquired some degree of operating experience. For the time being, therefore, it is planned that the Peleliu State Government will take direct charge of project operations.

3.2.3 Related Plans:

As discussed in Section 2.9, the subject Plan forms part of the Peleliu State Fishing Community Development Project for which the Republic of Palau requested a grant-aid from the Government of Japan in February, 1993. The Development Project is to provide docks, centered around the Peleliu Dock, which is the target area for the present Plan, along with ramps and unloading facilities as well as shore-based facilities. In addition, it will dredge the shallow sections of the channel leading out of the state so as to make possible safe navigation at all times, without regard to tidal levels, for the two transport vessels now operated by the Peleliu State Government. The Plan therefore covers the items with the highest priority in the Development Project, which are the ice plant and incidental equipment, the

new fish carrier vessel, and fishing gear and materials. In consideration of smooth integration with the PSFCD in the future, the subject Plan will exclude site preparation and dock extension work. In this connection, construction of a floating pontoon, as originally requested, has also been eliminated.

3.2.4 Evaluation of the Requested Facilities and Equipment:

The facilities and equipment that have been requested are summarized below:

Facilities and related equipment

Ice plant and ice storage bin

Administrative office, work area, workshop, storage area, toilets

Rainwater tank

Emergency generator

Fish carrying vessel

Equipment

Truck crane

Outboard motors

Fishing gear and materials

Fish carrying boxes

(1) Ice plant and ice storage bin

The existing ice plant was operating in December, 1993, with a production of 500 kg/day. However, more than a decade has passed since the original installation, and two major repairs have already been performed, so that it is difficult to project a long additional service life in the unit's present condition. And considering the chronic shortage of ice during the prime fishing season, there is an urgent need to installing a replacement ice plant. Also, in view of the small capacity of the existing ice storage chest and its inability to respond to changes in ice demand, there is a clear need to create reserve storage capacity in the new ice chest.

(2) Administrative office, work area, workshop, storage area, and toilets.

An administrative office and work area are needed to perform operations related to catch purchases, freshness control, and shipments. These facilities will eventually become the activity base for the new Peleliu

State Cooperative Association, when it starts operations. A workshop for repairs on outboard engines would also be effective in terms of servicing the local community, since the existing repair facilities in Peleliu State are not equipped with specialized repair tools. The warehouse is required to administer and store the outboard motors and fishing gear and supplies which are to be sold to the fishermen under the Plan. There is also a requirement to provide safe storage space for the fuel oil drums for outboard motors and transport vessels. The Plan site, as the gateway to Peleliu, may be expected to attract a flow of people, from both the state and outside. The location must also be sanitary in connection with the handling of fresh fish, while toilets will have to be installed in a separate building. Given the requirement for effective rust inhibition and the domestic transport of construction equipment, steel frame construction should be avoided for these structures, with RC construction employed wherever possible.

(3) Rainwater tank

No water pipes are installed in the Plan area. While there are plans to extend piping to this area, including the Peleliu Dock, the construction schedule is as yet undecided. Thus, in order to obtain the required supply at the base of water for making ice, cleaning fish, and general purposes, it will be necessary to erect a rainwater tank of maximum possible size. Rainfall in Peleliu State, as in Koror, can be expected to run about 3,100mm per year and, when rainwater is inadequate, tank supply vehicles can be used to supplement the water supply.

(4) Emergency generator

Commercial power is provided during the night-time hours between 18:00 and 6:00 a.m., and is used to operate the ice plant. However, when power is required during the day or during periods of power failure, facility operations should be maintained by installing an emergency generator with a capacity sufficient to run the ice-making equipment.

(5) Fish carrying vessel

The two existing transport vessels operated by the Peleliu State Government must avoid operations during low tide periods, when a portion of the channel to Koror becomes shallow, preventing adherence to regular

schedules. For this reason, the vessels cannot be used to transport fresh fish from Peleliu, which lacks a refrigerated warehouse. Since the fishermen must presently transport their catches to Koror in their own boats, transport costs are quite high. To solve this problem, it will be necessary to introduce a diesel-powered vessel with a draft of 1.2m or less, which could then navigate the channel at all hours, reaching Koror in about two hours. However, the assumption is that the introduction of a new vessel would bring about a reduction in catch transport costs. There is a need, therefore, to study the operating patterns of the existing vessels, with a view to improving cruising performance so as to achieve this objective.

(6) Truck crane

As a substitute measure for the elimination of the floating pontoon in the original request, there is a strong need for a truck crane in the interest of unloading convenience. The crown height at the existing dock is too high for small boats, while, at the time of our field survey, there was no equipment available to perform this function. Accordingly, this truck would not be exclusively for the dock but could also be employed effectively for general applications in Peleliu State.

(7) Outboard motors

Outboard powered boats perform a vital role in Peleliu State, an island remote from Koror, not only for fishing purposes but also as a widely used means of general transportation for the island population. Since the useful life of an outboard motor is believed to run 4-5 years, we have incorporated in the Plan outboard motors for distribution to fishermen. All of these motors would have a similar rating and would be sold to the fishermen, with proceeds from the sales to be accumulated into a fund for use in fishery development. These outboard engines, then, can be considered effective in terms of facility operation and providing assistance to coastal fishermen.

(8) Fishing gear and materials

As in the case of the outboard motors, the Plan provides fishing gear and materials. The significance of these materials is felt to be considerable in the sense that they would be available also to local fishermen who do not sail to Koror. The proceeds from sales of this gear

would also help to build up the fund for fishery development, as discussed under Item (7).

(9) Fish carrying boxes

These boxes will be used to sort catches as well as for ice-packing and transport purposes. At the present time, fishermen use their own boxes. For this reason, a standardized insulated fish box will be used at the facility, which will be important in maintaining freshness and improving the quality of catches.

3.3 Outline of the Plan:

3.3.1 Management Structure:

(1) Facility Functions:

The small scale fishery base which is to be provided under this Plan should have the capability of performing the following functions:

- 1) Purchase of fish from Association members.
- 2) Freshness retention and control.
- 3) Shipments to Koror and sale to the PFFA.
- 4) Ice sales and fuel procurement for Association members.
- 5) Repairs on outboard motors.
- 6) Manage the sales to Association members of the outboard motors and fishing gear included in the Plan.

Let us examine these functions in detail.

1) Purchase of fish from Association members

At present, individual fishermen prepare their fish for sale by packing it with ice in insulated boxes for shipment to Koror and direct sale there to the PFFA or supermarkets. Some with export channels have their fish exported from Koror to Guam, Saipan, or other markets. Accordingly, the fishermen now must shoulder the greater part of the risk between the sale of the catch and collection of the sales proceeds. Under the new system, however, the Plan facility would purchase the fish at the fishing base for distribution out of the island and merge the distribution and sales

channels, thereby maintaining freshness and improving quality while rationalizing distribution on the basis of a reduction in transport costs. But not all of the catch brought into the base would be purchased. It is essential that purchases be limited to fish of a quantity and quality that makes them marketable in Koror. And even more important is the need to keep Association members continuously informed with respect to the types and quantities of fish that can be sold in Koror.

2) Freshness retention and control

These operations involve degutting of the catches brought into the base, washing the fish and sorting by species and size, and packing the fish with ice into insulated fish boxes. Sorting operations by species and size can be handled by Association members using the base facilities, at which time the base will purchase the catches. Ice packing in the insulated boxes and subsequent operations must be conducted by the base, which must also take responsibility for freshness control as commercial products.

3) Shipments to Koror and sales to the PFFA

We have previously pointed out that, inasmuch as the present transport vessels are unable to maintain regular schedules, owing to disruptions caused by tidal factors, individual fishermen are forced to transport their fish to Koror on their own boats. With a draft of 1.2 mm or less, vessels could safely navigate the present channel regardless of tidal schedules. In addition, with the introduction of the new diesel-powered inboard vessel capable of reaching Koror in two hours and the ability to maintain proper schedules, individual fishermen would be relieved of the necessity to transport their own catches. As to sales at Koror, further consideration must be given to future operating procedures at PFFA as well as to demand trends in Koror but, under present conditions, it has been determined that it would be most practical to sell the fish to the PFFA. With regard to exports as well, in accordance with the government's policy of intensifying restrictions by prohibiting exports of reef fish from March to June, we feel that it would be appropriate to entrust this matter to PFFA for the time being.

Operation of the new fish carrying vessel should properly be viewed jointly with that of the two existing vessels. The present Nippon Maru carried a crew of 5, including the skipper, as against 4 on the Peleliu

Star. Both vessels make semi-weekly round trips to Koror but, as will be considered in Section 4.2.4, it is anticipated that, based on the introduction of the new vessel, there will be a reduction in loads of general cargo and passengers as well as in the number of trips made by the existing vessels. On the other hand, the required complement for independent operations by the new vessel would probably be a maximum of 3 persons, and this expense will inflate costs. Accordingly, it will be necessary to amend the present system, whereby crew are assigned to each vessel on a fixed basis. Instead, a flexible working structure should be introduced, whereby crew members would be available for assignment to any transport vessel. On this basis, with the addition of one new vessel to the present 2-vessel fleet, the additional employment requirement would be limited to only one skipper; thus, a consolidated personnel structure can be established for the 3-vessels, based on a 10-man rotating crew, including 3 skippers.

Since the people in Peleliu rely to a very high degree on marine transport, the transport vessels will have to be operated as a public transportation means. Nevertheless, the State Government will have to make a special effort to reduce the financial burden on the general population by adopting a rational transport structure. In connection with the introduction of the new vessel, it is vital that accurate schedules be maintained.

4) Ice sales and fuel procurement for Association members

Along with the scheduled operations by the new vessel, it is anticipated that a considerable quantity of every day necessities will be carried back to Peleliu on the return voyage. Since fishing activity in the state is conducted primarily with outboard boats, there is a large demand for outboard motor fuel. We presume, therefore, that the steady supply of fuel oil to Association members will be a major revenue source for the Association. As to ice sales, this business is already being handled by the State Government and will continued on the present basis.

5) Repairs on outboard motors

The small workshop equipped with a work area for the special tools required for the overhaul of outboard motors, principally on their electrical systems, will provide maintenance service and simple repairs on these engines. The outboard motors will not only be used for fishing operations but also in support of the general life-style of the resident

population. In this respect, the service should not be limited only to Association members but should also be made available to the general public at charges computed on the basis of both direct and indirect costs. Since almost about 30 outboard engines are in operating in Peleliu, repair demand is not likely to develop on a regular basis. Accordingly, technicians will, in principle, be dispatched from Koror as outboard repairs are required. On this basis, it will be sufficient if the fishing base supplies the specialized tools and parts required for engine repairs; there will be no need to hire additional mechanics for this purpose.

6) Managing sales to Association members of the outboard motors and fishing gear included in the Plan

The outboard engines and gillnets, hand lines, and other fishing gear have been included in the Plan primarily to generate working capital for the new Association. These items will be sold to Association members who hold a qualification. However, as distinct from the purchasing operations for fuel oil (cf. Item 4), which are to be carried out at the discretion of the Association, proceeds from the sale of outboard engines and fishing gear will have to be placed in a special account, with sales records and receipts available for inspection at all times.

The base management will be required to assume responsibility for this accounting. The facilities and equipment to be provided under the Plan must be planned with a view to satisfying the above functions. It will also be necessary to prepare a management structure capable of making best use of these capabilities.

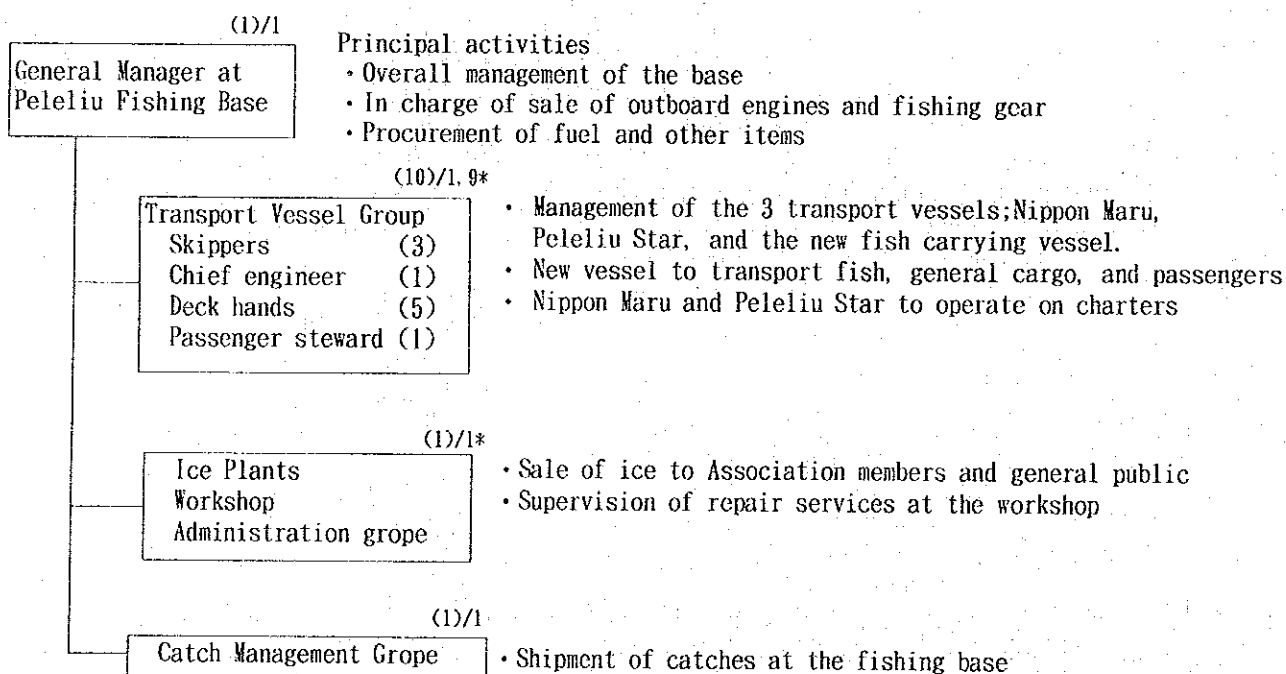
(2) Management Structure:

the implementing body for the Plan will be the Peleliu State Government. The staff currently assigned to the 2 existing State-owned transport vessels comprise 2 skippers, a chief engineer, 5 deck hands, and one passenger steward. The vessels are moored at the dock adjoining the Plan site, while the existing ice plant is located on the shore side of this dock. There is one staff stationed at the ice-making facility.

The Plan facilities and equipment to be installed at the base are to include a new ice plant, a workshop for outboard engines, a new transport vessel, outboard engines, and fishing gear. Accordingly, it is believed that

the additional staffing requirements for base operations will be limited to 3 persons in all: a superintendent to handle functions 1) and 2), a skipper to take charge of function 3), and a general manager to take over functions 4) and 6) while also managing overall base activities. It is expected that the present staff can take responsibility for the new ice plant as well. And, with regard to the new fish carrying vessel, as discussed earlier, the current structure whereby crews are deployed to a particular vessel will be reorganized. Thus, the present vessel complement of 9 persons will be increased by one new skipper, resulting in a new vessel staff of 10 persons: 3 skippers, 1 chief engineer, 5 deck hands, and 1 passenger steward. It will, therefore, be necessary to establish a new operation system for the 3-vessel fleet, involving the introduction of an rotational work system. The mechanic in charge of outboard engine repairs under function 5) will be required only when a repair order comes in, or on a regular cycle of perhaps twice a month. Such technicians can be dispatched on request by the Bureau of Public Works of the Ministry of Resources & Development or by a private outboard sales agent in Koror. The costs for these visiting technicians will be built into the charges for outboard repairs and billed directly to the individuals requesting the work.

The above operating structure may be charted as follows:



Note: Figures in brackets show the number of staff; while the figures following show additional staff. * indicates existing staff

Since the State Government is to take provisional responsibility for the fishing base, the three new employees, as outlined above, will become employees of the State Government. However, it would be desirable in the future for the newly formed Association to assume primary management responsibility for base operations, though the transport vessel group should, we feel, continue as a part of the State Government organization. While the staff at the fishing base would presumably be transferred over to the Association with the change in management, we recommend that a position be created within the State Government to provide continuing supervision and guidance for Association activities.

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) The basic selection criteria for the eligible fisherman will be that, when the new Association will be organized, the fisherman should be an Association member, and that each fisherman will be rated his fishing activity levels and other performance factors, ability to pay for the equipment, and experience in handling and servicing of the equipment.
- (2) 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 7-10% below market prices, since, in case of outboard motor, 3% import tax and 4% receipt tax can be exempted.
- (3) The Peleliu State Government, even after the possible transfer of the operation structure to the Association, will be required to handle the equipment sales proceeds. While the interest from the operating fund shall be transferred to the Association, the funds are to be used for purposes of fishery development in Peleliu, and such usage and balance of the fund have to be recorded and kept for disclosure.

3.3.2 Description of the Plan Site:

Peleliu State is located in the vicinity of 7° N and $133^{\circ}15'$ E, about 40km by the crow flies from the capital at Koror. Transportation between Koror and Peleliu is based largely on outboard powered boats with no deck, and the distance is covered typically in about 50 minutes. The transport vessels presently operated by the State Government do the trip in about 2 1/2 to 3 hours but, in view of the shallow depth of the channel en route, it is sometimes necessary, during periods of low tide, to wait for the next tide. In addition, there is a regular air service (daily except Tuesday) by light aircraft carrying 7 passengers, which link the two localities in about 20 minutes. With regard to communications, the international telephone circuits at Koror were automated in August, 1993, and so overseas telephone service is excellent. Telephone connections between Koror and Peleliu use wireless SSB equipment. Commercial power is supplied between the hours of 18:00 and 06:00 via 300kw diesel generator. At the present time, power lines cover the northwest area of Peleliu including the Peleliu Dock at the northern tip, where the island's population is concentrated. Water supply is drawn from a well and the water is piped, after filtration and purification, to the large population clusters in the northwest section of the island. Water is supplied to all residences for about 1.5 hours every morning.

The Plan site is a flat parcel adjacent to an existing dock, called the Peleliu Dock, at the northern tip of Peleliu State, and the Peleliu State Government has been confirmed as the owner of this land. The Campbeck district at the southwestern corner of the state was also studied as a possible target site. While, in terms of natural contours, it was recognized as an excellent site, directly accessible to the island from abroad, during the summer months, when strong westerly winds prevail, the site is directly buffeted by offshore waves, posing dangers to small-size vessels entering the inlet. In addition, title to the Campbeck site is not entirely clear, while power and other infrastructure is lacking. As a result, it was determined that the Peleliu Dock at the northern end of the state would be more appropriate as the Plan site, which is to be oriented to small boats. A profile of the area around the Plan site is shown in Figure 3.1.

There are no physical obstructions along the natural shore front on the west side of the existing dock. In addition, several coconut palm trees have

been planted along the road separating the Plan site, but no other tree cover is found within the site. In the original request plan, site preparation as well as dock reinforcement work in the lower elevation sections was supposed to be done provisionally by the Palau side. But, as shown in Figure 3.1, since the greater part of the Plan site is above the high water mark, the Plan facilities will not require any special land preparation or dock reinforcement. In addition, the need for a floating pontoon, as originally included in the request, has been dropped, while, in light of the goal of further reducing fiscal burdens for the State Government, as set forth in the superior plan or the Peleliu State Fishing Community Development Project, it has been determined that there is no requirement for either land improvement or dock reinforcement in connection with site preparation for the subject Plan and that it will be possible to cope with these requirements within the scope of the foundation work of the Plan facilities.

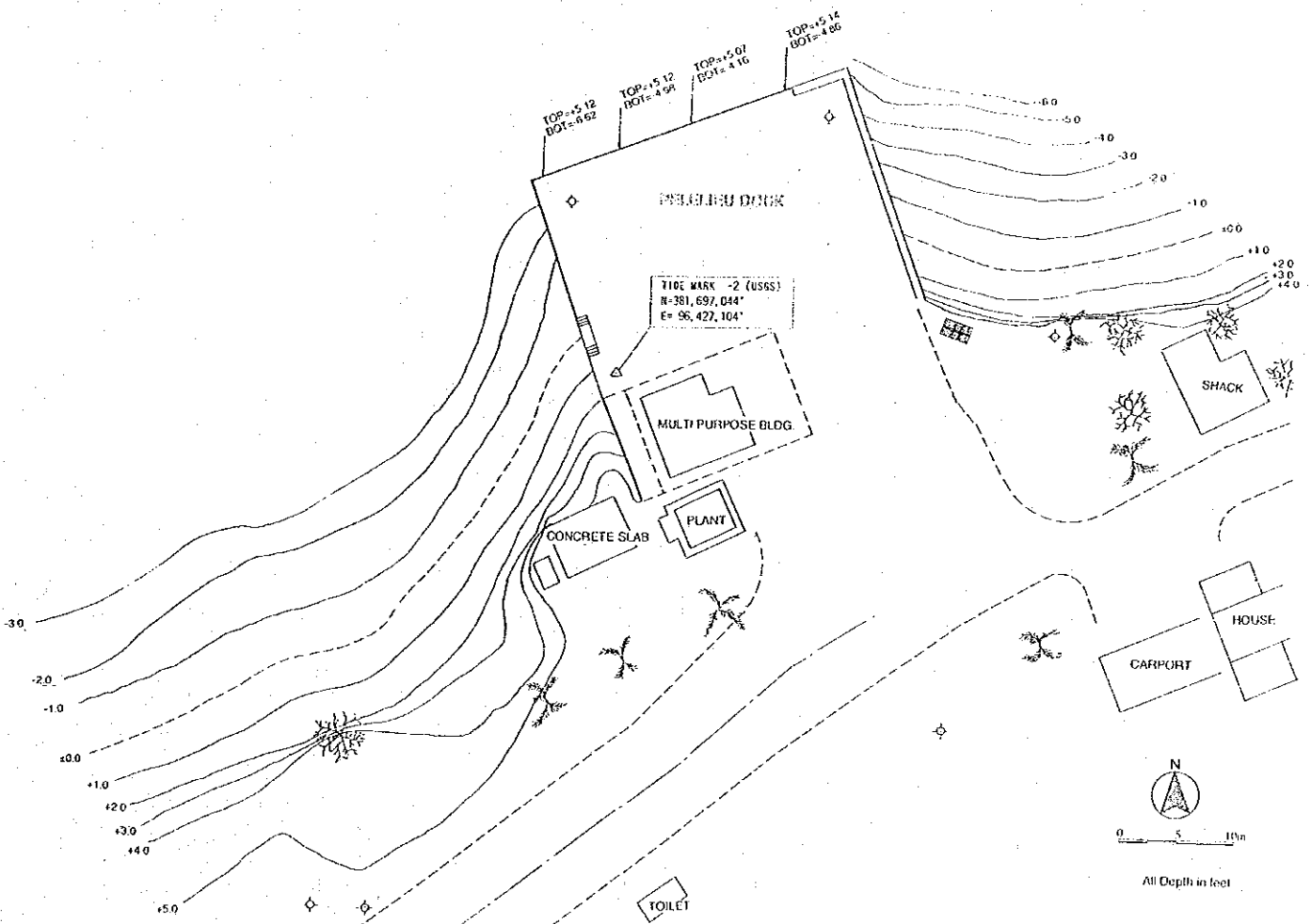


Figure 3.1: Site Plan for the Proposed Site

3.3.3 Scale and Quantity of the Facilities and Equipment:

(1) Ice Plant and Ice Storage Unit:

The capacity of the new ice plant will be set equal to that of the existing unit. The present ice-maker has a capacity of 1 ton/24 hours but, under present conditions, with commercial power supplied only 12 hours a day, its maximum daily output is 500kg. In view of the superannuation of the facility, it is expected that its ice production capacity will gradually decline. In addition, since the capacity of the ice storage bin is quite low, at about 2.5m^3 , ice supply during peak fishing periods may at times be inadequate. The demand for ice in Peleliu State is estimated to be no less than 80 tons per year, but this figure does not take into account any supply shortages that may develop. From the above, the new ice plant will be a plate-type unit with a capacity of 500kg/24 hour period. Assuming the unit is operated 12 hours a day and 300 days a year, its ice output would be 75 tons, which would fall somewhat short of present demand. Allowing for a future increase in demand based on higher ice consumption in order to meet the high freshness standards at the new fishing base and to cope with temporary increases in demand during peak fishing season as well as unexpected breakdowns and maintenance, we have elected to install 2 ice plants of identical capacity, capable of being run alternately or simultaneously. In order to hold down floor height to achieve a rational structural design, we shall use low-standing combined ice-making/ice-storage units. By maintaining the capacity of the ice storage chest at 3.75m^3 or more, it will be possible to store at least 1.5 tons of ice in each unit. Accordingly, with two units, up to 3 tons of ice can be stored, making it possible to respond flexibly to fluctuations in demand.

(2) Administrative office, work space, workshop, storage area, and toilets:

The functions and types of the facilities shown under this heading can be anticipated as follows:

No.	Facility type	Staff Requirement	Functions
1	Office	2 persons	This office will be used by the general manager and the handling manager. It will handle fish purchases and payments as well as sales of outboard motors and other items to fisherman.
2	Storage Area	---	For storage of outboard motors, fishing gear, and replacement parts.
3	Workshop	2 persons	This area is to accommodate the ice plant manager as well as periodic visits by mechanics in connection with repair of outboard engines, and to provide work space for the specialized and general-purpose tools used in outboard repairs.
4	Generator Room	---	This room is to accommodate the emergency generator and fuel tank.
5	Work Space	---	This space will house the two ice plants with a capacity of 500kg/24 hours each. Fish handling operations will be performed in the area directly in front of the ice-making units.
6	Oil Storage Shed	---	As a storage area for gasoline and diesel oil drums for use in the outboard engines and transport vessels. For safety reasons, this shed will be well separated from the main building.
7	Toilet/shower shed (with men's/women's facilities)	---	A detached structure to serve both staff and the public.
8	Rainwater tank	---	To collect water from the roof of the main building for use in ice plant, fish cleaning operations, and for general purposes.

1) Office:

This space will be designed to accommodate 2 staff members and visitors from the Association. It will be fitted with 2 office desks and chairs, a filing cabinet, an auxiliary desk, and a counter. The required area is set at 18m².

2) Storage Area:

This area will hold 20 units of 75ps outboard motors for distribution to fishermen. Storage will also be provided for gear and, primarily, replacement parts for outboard engine maintenance. The outboard motors can

be placed directly on the floor. The other equipment will be stored in 2- or 3-level shelves, with a length of 4.0m and a width of 0.5m. The required floor area will be 18m^2 .

3) Workshop:

This area will accommodate the overhaul and repair operations on outboard engines, repairs on engines and fittings for the transport vessel, and replacement parts for the ice-makers. It will be equipped with specialized and general-purpose tools for use in outboard motor repairs. The bulk of the operations at this facility are expected to be minor. In addition to hand tools, a small compressor, hydraulic press, bench drill, and work table will be installed. Mechanics handling outboard repairs will be dispatched to the workshop at regular intervals to conduct these repairs, but the ice plant manager at the ice plant will be stationed at the facility. In order to facilitate simple reports and record-keeping, desks and chairs will be provided for two persons. Considering the space requirements for these fixtures and operations, the workshop floor area has been set at 20m^2 .

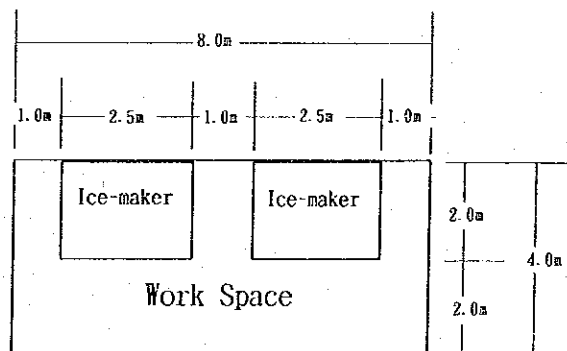
4) Generator Room:

The capacity of the emergency generator will have to be sufficient to operate the 2 ice-makers simultaneously. The required power for the compressor and accessory pumps, fan, and crusher will be about 3.75kw per unit during normal operations. The required start-up power will be about 9.4kw, and so the required generating capacity will be 13.15kw, as it has to add the 3.75kw required to keep the normal operations of one unit. With a load factor of 0.9 and a power factor of 0.8, the theoretical capacity of the generator may be calculated at 18.3kva. On this basis, we have set this capacity at 20kva. The generator will be driven by a durable diesel engine equipped with a fuel tank. Allowing space for equipment checks and maintenance and for convenience in fuel replenishment, we arrive a total required area of 12m^2 .

5) Work Space:

Two ice-making units are to be provided. For structural reasons, the ceiling height of the buildings has been set at 3.0m and so the height of the ice-making units must be held to an absolute minimum. The units will

also incorporate an ice storage compartment. From this standpoint, it is desirable that the unit occupy a small area. Anticipating that an effective height of 2.6m can be secured, and allowing for a 1.5 ton ice storage capacity, the requisite floor space for this area will be 4.5m^2 . Allowing then for the placement of the two ice-makers, with additional space provided in front of the units for opening the door, removing the ice, and packing the fish in insulated boxes, a minimum width of 2m should be secured for this work space. With the planned deployment, as shown below, the aggregate floor area will be set at 32m^2 .



6) Oil Storage Shed:

Both gasoline and light diesel oil are to be transported in drums from Koror. Thus, the fuel for the transport vessels should be supplied insofar as possible in Koror, while holding reserve supplies to a minimum. If we set the required reserve supply of light diesel oil, which is the fuel source for the transport vessels, at an amount sufficient to fill the fuel tanks of all 3 vessels, then the total requirement would be in the order of 1.5kl -- equivalent to about 8 drums. This supply will also be used as fuel for the emergency generator. As to gasoline, assuming that the Association member boats fitted with outboard engines, with an average output of 75ps, are run two hours per day during peak fishing periods, then, as a rule of thumb, one week's supply of fuel should be kept in storage. On this basis, the required amount would be about 1.95kl, equivalent to 10 drums. In the interest of safety, a large storage volume is not desirable, but we feel that, as a public fuel storage facility of the State government, provision should also be made, to some extent, for possible demand from residents under emergency conditions. On the above basis, the oil storage shed should be large enough to permit the safe storage of 20 drums, which works out to

an area of about 15m^2 . As a safety measure, ample provision should be made for fire extinguishers.

7) Toilets and Showers:

A toilet and urinal, wash basin and shower will be provided for men and a toilet, basin and shower for women. These facilities will service both the staff and other persons using the Peleliu Dock. Allowing for efficient placement, the total area for this purpose has been set at about 15m^2 .

8) Rainwater Tank:

Water requirements for ice production will be in the order of 1m^3 per day, including cooling water for condensers. Water requirement for fish cleaning operations are estimated at an average of 0.5m^3 per day. The roof area of the main facility, on which water is to be collected, has been set at about 140m^2 . Based on meteorological data for 1992, the maximum rainfall over a 24 hour period was 120.4mm at Koror. Using this as a benchmark, the amount of water to be stored in the collection area of 140m^2 works out to 16.85m^3 . From these calculations, an appropriate capacity for the rainwater tank at the fishing base could be set at about 20m^3 .

(3) Fish Carrying Vessel:

Fish carrying vessel is intended to make one round trip daily between Peleliu and Koror, transporting fish from Peleliu and bring back fuel in drums from Koror. It is expected that this cargo will be loaded on deck. Since the insulated fish boxes for use in fish transport are planned to have a capacity of about 160 liters, the bottom area will be in the order of 1100 mm x 500mm. The drums will have a standard 200 liter capacity. The carrying capacity is planned at 9 insulated fish boxes and about 6 fuel drums. On the outward journey the drums will be employ, while, on the return voyage, the fish boxes will be empty. The sailing distance between Koror and the Peleliu Dock is about 25 nautical miles. To make a one day round trip and considering loading and unloading time at Koror, the vessel will have to make the one-way trip within two hours. Accordingly, the planned vessel speed will be set at about 13kt. Water depths en route during low tide periods will be 1.2m and so the vessel draft at full load will have to be held to less than this figure. Since the voyage time is to be two hours, there is no requirement for a drinking water tank. And since there will be

no requirement for night-time trips or berthing on the vessel, crew cabins can be eliminated, but navigation and other necessary lights, as required by rules and regulations, must be installed. The main hull specifications have been determined on the basis of the above conditions.

1) Vessel-type; rough arrangement:

We will use the hard chine vessel type, which stresses speed. The steering room will be placed in the center of the vessel, with a deck to be provided in front and to the rear of the steering room to permit loading of cargoes.

2) Principal dimensions:

- 1) Insulated fish boxes will be placed longitudinally in 3 rows, while the 3 fuel drums will be loaded on their sides longitudinally in two rows. On this basis, some 5.3m of length will be required. Some 3m of length will be provided for the steering room, which accommodate an entrance to the engine room. A flared outer deck section will be added at the bow, requiring about 1.5m in this size hull. Thus the overall length of the Plan vessel will be about 10m.
- 2) Vessel breadth requirement comes to about 2.5m, by securing width of about 2m for storing 4 insulated fish boxes plus top rails and stays for the bulwark and fender beams.
- 3) As to depth, based on water depths during low tides, the planned stern draft from the lower end of the shoe piece to water level will be approximately 1m. The depth from the lower surface of the mid-keel to the upper level of the deck should be set at about 0.9m.

3) Vessel speed and horsepower of main engine:

Based on the above hull specifications, if we set a water line length of about 8.5m, under full-load conditions of 1,300kg, and based on calculations shown in "The Power Link Chart for Hard Chine Vessels" (Niwa, 1972), the required engine horse power for a vessel speed of 13kt is estimated at about 110ps. This method of calculations yields only a general estimate of main engine horse power, based on such key factors as vessel weight, vessel speed, and length of water line, and so it will be necessary to adjust these values within a range of 15% to allow for such additional factors as hull efficiency and wave resistance.

4) Fuel Tank;

Let us first calculate fuel consumption for a main engine of 110 horse power. Consumption will be in the order of 175g per ps/hour for a 110ps diesel engine.

$$175\text{g/hr} / 0.84(\text{specific gravity}) \times 110\text{ps} = \text{approx. } 23.0 \text{ liters/hr}$$

Fuel consumption per round trip voyage becomes:

$$23.0 \text{ ltrs/hr} \times 4 \text{ hours} = 92 \text{ ltrs}$$

Fuel will be taken on at Koror but, since daily resupply would be troublesome, a 3-day supply of fuel should be carried at all times:

$$92 \text{ ltrs} \times 3 \text{ days} = 270 \text{ liters.}$$

The fuel tank, allowing for residual oil, will be given the following capacity:

$$276 \text{ ltr} \times 1.1 = 300 \text{ ltr}$$

A tank of this size can be housed either below deck or in the engine room.

5) Hull Material:

The hull material can be steel, aluminum, or FRP but, for the Plan vessel, the materials should be light-weight, non-corrosive, and durable. On this basis, we recommend FRP, which is easy to work with and relatively inexpensive. While this material is the disadvantage of a high waste disposal cost after use, at the present time, substitute materials are not practical, and so FRP would, in our judgment, be a sensible choice.

6) Rigging

Navigation lights, SSB wireless telephone, magnetic compass, and life jackets will be provided.

(4) Equipment:

1) Truck Crane

Since crown height at the existing dock is too high for small vessels, the Plan includes a truck crane, which is to be used in loading and unloading operations for the fish carrying vessel. The fuel drums (180kg when filled) and the 160 ltr insulated fish boxes (80-120kg with iced fish) have been used as examples of heavy items to be carried on board. Figuring 2m from the center of the crane cab to the dock and a vessel width of 2.5m,

the maximum operating radius becomes 4.5m. For safety sake, the lift weight, based on this operating radius, has been set at about 500kg. Load capacity will be set at 2 tons.

2) Outboard Engines

As of the time of our field survey, 28 outboard-equipped boats were operating in Peleliu both for general and fishing use. The total number of outboard engines on these boats was 29, and the Fig. 3.2 shows the frequency distribution of their horse powers.

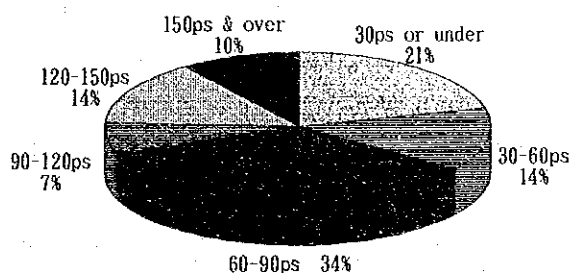


Figure 3.2 Horse Power Distribution of Outboard Motors in Peleliu

The largest concentration is in the 60-90ps range, with one 70ps, four 75ps, and five 85ps units in use. The request specified outboard engines of 75ps, which can be considered an average horse power, based on the current frequency distribution, but, for purposes of small fishing boats, the figure is high in relation to similar examples in other countries. However, in table 3.1, we show the proportions of engines 60ps and over in annual shipments of outboard engines of a Japanese manufacturer to Palau from 1982-1992, a market with which Japanese manufacturers have considerable experience.

Table 3.1 Share of Outboard Engine 60ps or over by Year

Year	1982	83	84	85	86	87	88	89	90	91	92
Share of outboard engine over 60ps	0%	6	27	33	54	57	70	62	71	67	80

As seen in the above example, the trend toward higher-powered outboards is accelerating year by year, and this trend is presently reflected in Peleliu State as well. In light of this demand trend, we deem it proper to set the horse power of the Plan outboard engines at 75ps, as per the request. Considering the need for building up an operating fund at the Plan

facilities, the quantity has been set at 20 units. Figuring useful life at 4-5 years, we may anticipate an average annual demand of 4-5 engines from boats equipped with outboards of 60ps or higher.

3) Fishing Gear

We have examined three types of fishing gear: gillnet, hand lines, and trolling lures.

Gill nets:

We have considered the use of floating gill nets with 3 inch mesh size to accommodate the catch of small-to-medium size fish inside the lagoon. The lines will be colorless nylon monofilament, with a depthwise length of about 1.8m and a stretched netting length of 120m. The nets would be supplied as finished products equipped with floats and sinkers. Since consideration must be given to the future management of lagoon resources, the rapid diffusion of gill nets is not desirable, and so the quantities have been set at 30 rolls, allowing 1 roll per boat, with a reserve netting allowance of 20% for repair purposes.

Hand lines:

Subject to variations based on fishing method and gear size, hand line fishing operations normally involve two fishermen. The Plan quantity for gear and materials, expressed in units per fisherman, is based on the needs of 60 fishermen. The hand lines will be composed of lead lines, fish hooks, sinkers, swivels, and wire snells. Allowing for normal wear and tear, the Plan quantities for each type of material have been set as follows:

Lead lines	5 sizes	100 m/roll	120 rolls each
Fish hooks	5 sizes		1,200 hooks each
Sinkers			1,200 units
Swivels	2 types		1,200 units each
Wire snells	2 sizes		1,200 m each

Troll lures:

The Plan will provide 240 sets of fish hooks, lure heads, and skirts for use as troll lures directed at small-medium size fish, with 500 spare skirts of various type.

4) Containers for fish transportation:

The following transport and handling equipment will be furnished for use in sorting, icing, and transporting catches.

Insulated fish boxes:

We plan to supply insulated fish boxes of 160 ltr capacity, of synthetic resin construction, for use in transporting fish to Koror. A 90 ltr. insulated box is also planned for fish storage aboard fishing boats. We anticipate providing 30 boxes for transport purposes and another 30 for distribution to fishing boats. Fish barrels of 50 ltr capacity will be provided for use in sorting operations at the Plan facility in a quantity of 30 units.

Scale:

We will provide 1 platform scale for weighing catches at the Plan facility, with a weighing capacity of 300kg (650 lbs.) in measurement gradients of about 100g (1/4 lb).

3.4 Maintenance and Management Plan:

The Peleliu State Government will assume responsibility for maintaining facilities and equipment and managing the operations at the small-scale fishing base. In the future, when the new Association is formed and deemed to have acquired adequate management capabilities, it is expected that the operation of the base will be transferred to this Association. As already discussed in Section 3.3.1, a total of 13 employees will be involved in base operations: 3 new employees (general manager, skipper, and handling manager), the 9-man group operating the 2 existing transport vessels as well as the present manager at the ice plant. Mechanics for outboard engine repair will be recruited from Koror, as need, and this function need not be considered in terms of base staffing requirements.

Management Structure:

No. of operating days at the base:
Monday - Saturday (6 days per week), 45 weeks
per year--total 270 operating days a year

No. of operating days for new fish carrying vessel:
same as above

Catch volume to be handled per year:
average of 100kg per month x 12 months = 12
tons per year (about 26,450 lbs.)

No. of operating days for ice plant:
300 days per year

Annual ice production: 250 kg x 300 days = 75 tons

Operating Expenses:

Power: \$0.09/kwh
Fuel oil: \$330/kl (if supplied at Koror)
\$360/kl (if supplied at Peleliu)

Revenues:

Commissions on fish sales
Revenue from ice sales
Sales of purchased fuel

3.4.1 Operating Structure:

(1) Operating Days for the Fishing Base:

Since consumption of fresh fish in Koror peaks on weekends, in figuring operating patterns at the fishing base, which has been located at a most advantageous spot, only two hours sail from Koror, it will be necessary and to good advantage to ship catches on Saturday. Allowing for the closure period (about 1 month) for Trochus shell collection as well as holidays and other non-working days, when fishing activity is slack, it would be appropriate to figure on operating 45 weeks per year.

(2) Operating days for the new carrier vessel:

Operating days for the new fish carrying vessel will naturally be governed by the number of operating days at the base. This figure has, therefore, been set at 270 days or more per year. Since the vessel draft will be held to within 1.0m and it will maintain a speed of 13kt or more, the one-way trip to Koror can be accomplished in 2 hours, without regard to tidal levels. Accordingly, trips will be scheduled on a daily basis-- say, departing Peleliu at 8:30 a.m. and returning to port at 16:30. On this basis, the vessel can be moored in Koror for about 4 hours, which will be sufficient for unloading the catch, selling the fish to PFFA, loading general cargo for the return trip, disembarking and embarking passengers, and taking on fuel.

(3) Annual Catch Volume:

Projecting the annual volume of catches to be handled by the fishing base involves a number of unknown factors.

One is the future trends in lagoon resources, which is currently the major fishing ground in the area. While there is no supporting data or surveys from official sources, there is some concern about the wisdom of permitting major increases in catch effort. The possibility, therefore, of

restrictions being imposed on the more efficient gillnet cannot be excluded.

Another unknown is the ban on commercial exports of reef fish, currently in force from March to June. The factors behind the ban are presumed to include a need for resource conservation in connection with the spawning season for groupers and certain other species; the huge bulge in exports, including those of illegally caught fish, to take advantage of the burgeoning demand, particularly in Guam and Saipan, during the Christian Lent, which occurs during the embargoed months; and the fact that, although this export ban was instituted several years ago, in point of fact, its effectiveness has been diluted by exports made under the guise of gifts to family members overseas, a situation which clearly demands correction. As a consequence, for the time being, these restrictions will surely be vigorously enforced, though, over the longer term, the economic rationale of selling into markets with a strong demand suggests the possibility that eventually the ban will be relaxed to permit limited exports during the proscribed months of selected species and sizes of reef fish.

Taking these uncertainties into account, but relying on the interview findings from our field survey, we have estimated the total catch volume at an average of 1,000kg per month (approximately 2,200 lbs.) for a total of 12 tons (126,450 lbs.) per year. This is believed to be a safe figure from the standpoint of base operations.

(4) Operating Days for the Ice Plant:

Ice plant operations will, in principle, be based on the commercial power supply, which is presently available from 1800 to 6:00 the following morning. Ice production will, therefore, be confined to those 12 hours. Ice demand will naturally develop on days when the base is not operating and so the ideal would be to run the ice plant as many days as possible. However, considering downtime for maintenance, about 300 operating days per year would appear to be a reasonable figure. Since 250kg of ice can be produced in 12 hours, annual output would be 75 tons. While this figure would fall below current annual demand, additional production could be generated during peak demand periods via simultaneous use of the reserve ice-making unit or hooking up the emergency generator during daytime hours.

3.4.2 Operating Costs:

Operating costs at the base will comprise mainly the cost of power to run the ice plant, fuel for the new fish carrying vessel, salaries for the 3 new employees slated for the new base, and maintenance of the facilities, equipment, and carrier vessel. The bases for calculating these expenses are shown in Appendix V-2.

(1) Power

In Peleliu State, at present, household electricity rates are only a flat \$10 per month. The large facilities are all operated by the State Government and so power costs are not calculated. While operation of the Plan facility is to be entrusted to the State Government for the time being, the eventual objective is to turn the operations over to the Association to be newly formed. Anticipating this development, it will be necessary to make the facility self-supporting so that it will not require government subsidies in the future. In this context, electricity costs must be established. The rates we have applied in this analysis are those in Koror, where the rate is \$0.09/kwh for monthly consumption of 2,000kwh or less. Assuming a single ice-maker operates 300 days per year, and that the reserve unit is simultaneously operated twice a month to cope with peak demand periods, power consumption would run 14,580 kwh/year at a cost of \$1,313.

(2) Fuel for the Fish Carrying Vessel

The horse power of the main engine in the new fish carrying vessel will be 110 ps. The vessel will make 6 trips per week to Koror, 25 miles away, which works out to 270 round trips a year. Diesel fuel will be used. Assuming annual consumption of about 24.75 Kl (6,538 gallons), vessel fuel costs will total \$8,168 per year. Allowing an additional 10% for lubricating oil cost, the annual fuel budget for the new vessel will run \$8,985.

(3) Personnel Costs

As discussed in Section 3.3.1 (2), 3 new employees will have to be added for the new Plan facilities. Based on current salary levels in the Peleliu State Government for regular employees, salaries may be established as shown below:

General Manager:	\$450 per month
Skipper	400
Handling manager	300