BASIC DESIGN STUDY REPORT
ON
THE PROJECT OF INFRASTRUCTURE IMPROVEMENT
FOR
FISHERY DEVELOPMENT
IN
THE FEDERATED STATES OF MICRONESIA

JULY, 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request of the Government of the Federated States of Micronesia, the Government of Japan has decided to conduct a Basic Design Study on the Project of Infrastructure Improvement for Fishery Development in the Kosrae State and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Micronesia a survey team headed by Dr. Tsutomu Tsuchiya, Overseas Fishery Cooperation Foundation from February 22nd to March 25th, 1989.

The team exchanged views with the officials concerned of the Government of Micronesia and conducted a field survey. After the team returned to Japan, further studies were made. Then, a mission was sent to Micronesia in order to discuss the draft report and the present report has been prepared.

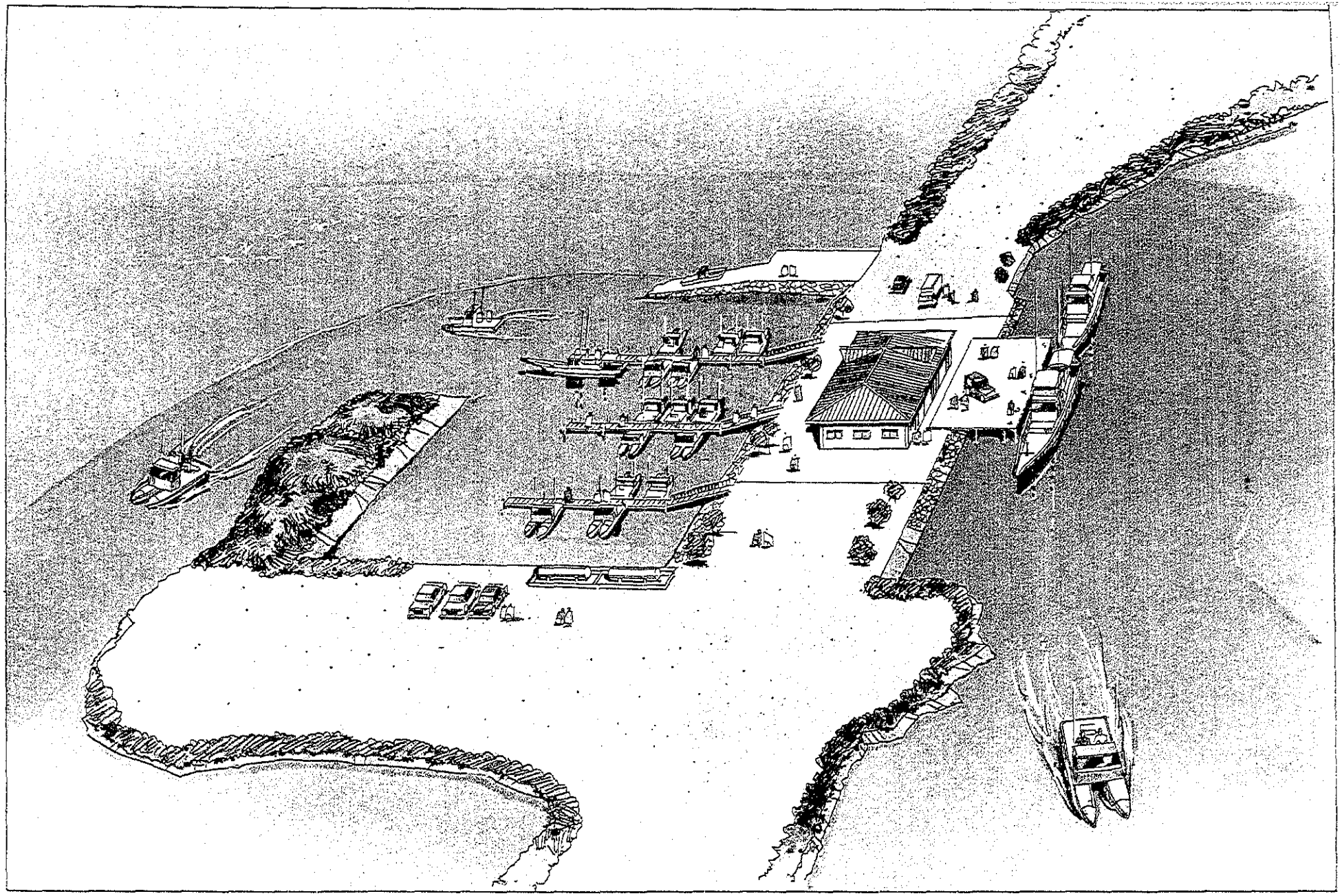
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Federated States of Micronesia for their close cooperation extended to the team.

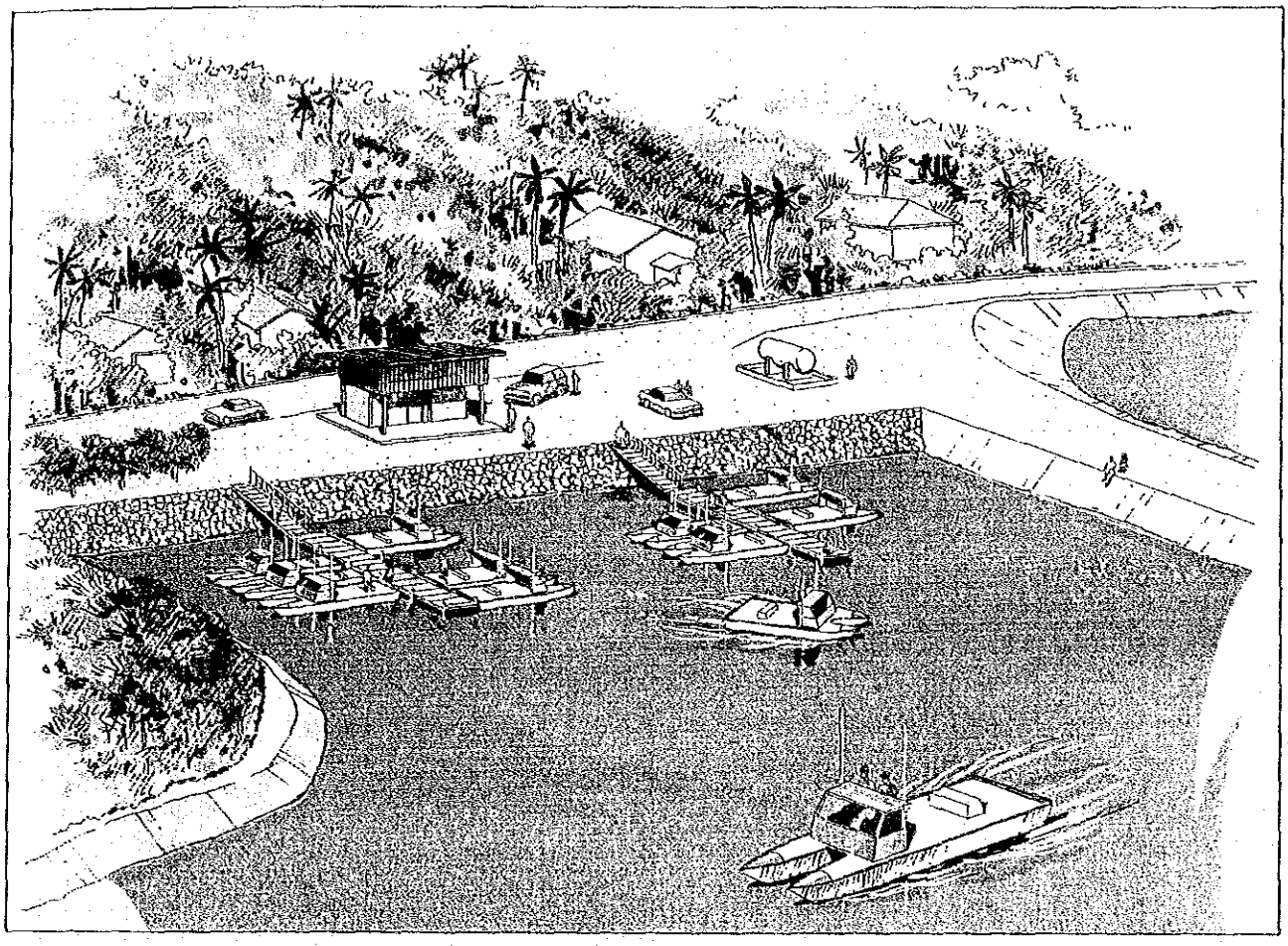
July, 1989

Kensuke Yanagiya

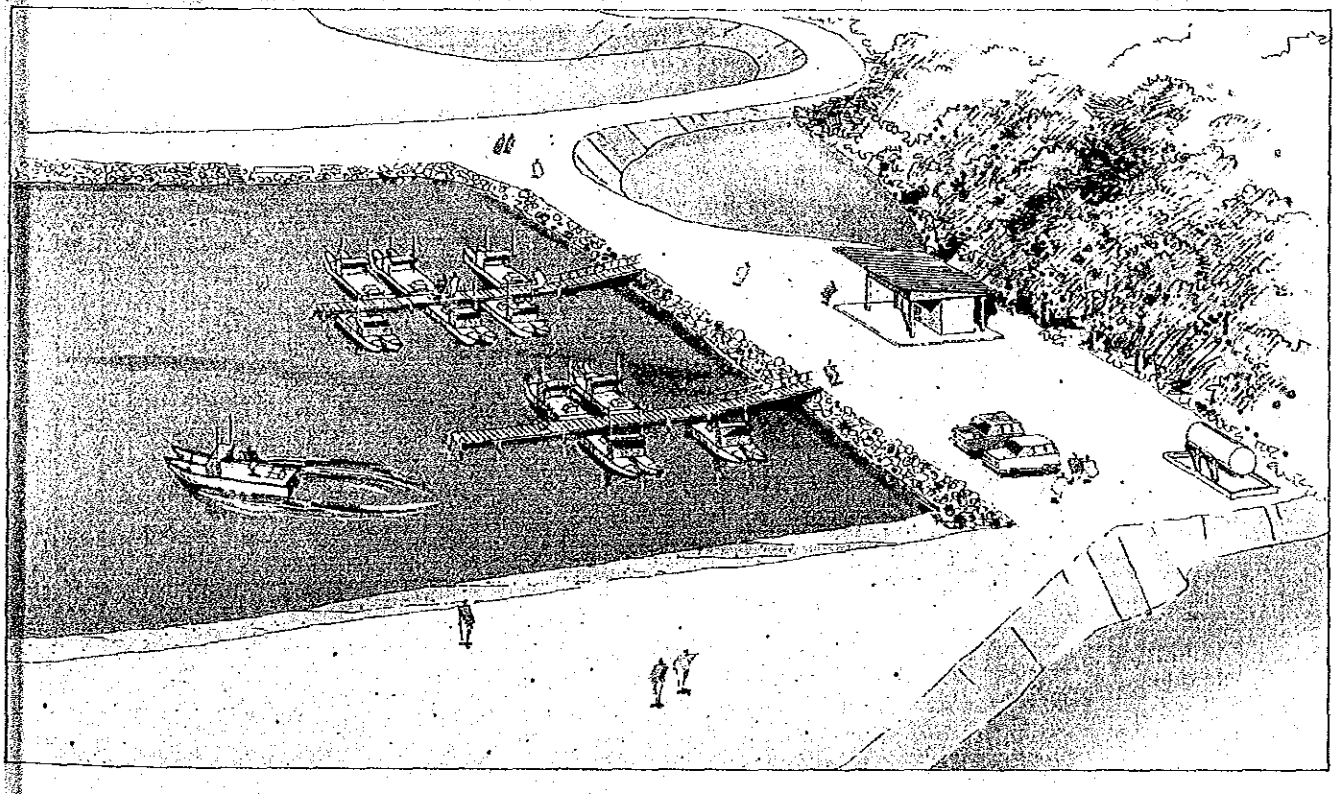
Kensuke Yanagiya
President
Japan International Cooperation Agency



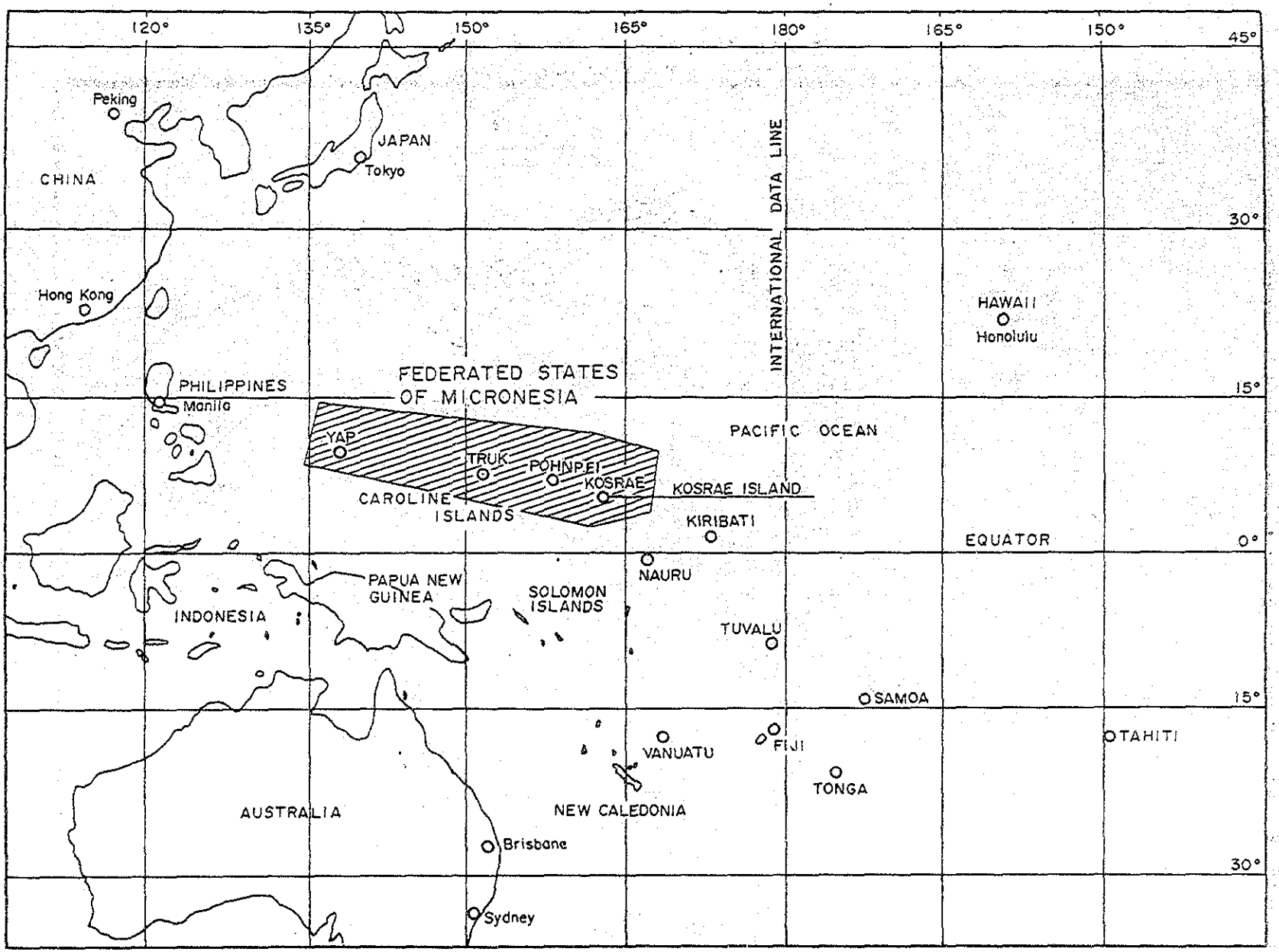
Lelu



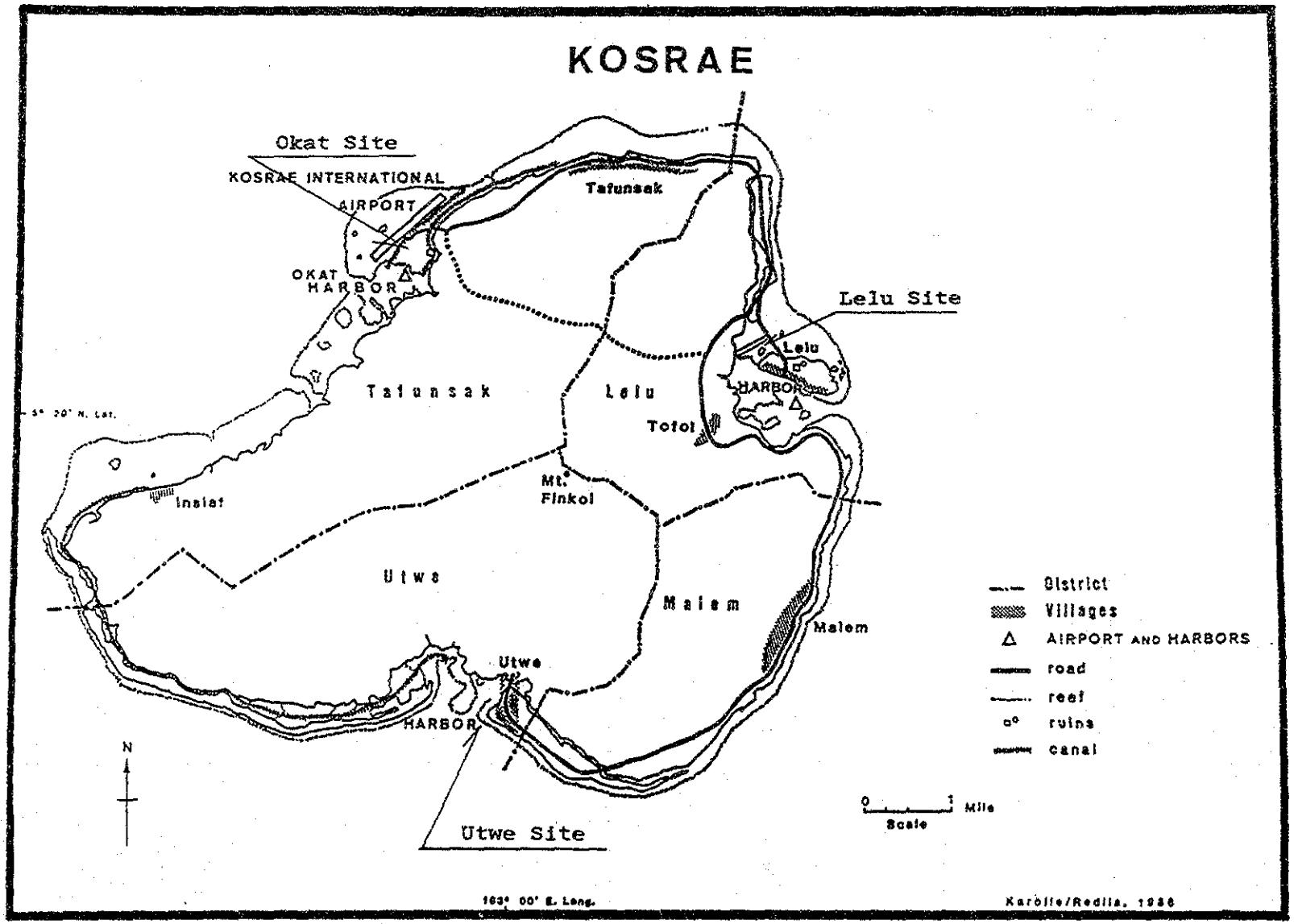
Utwe



Okat



Location of KOSRAE

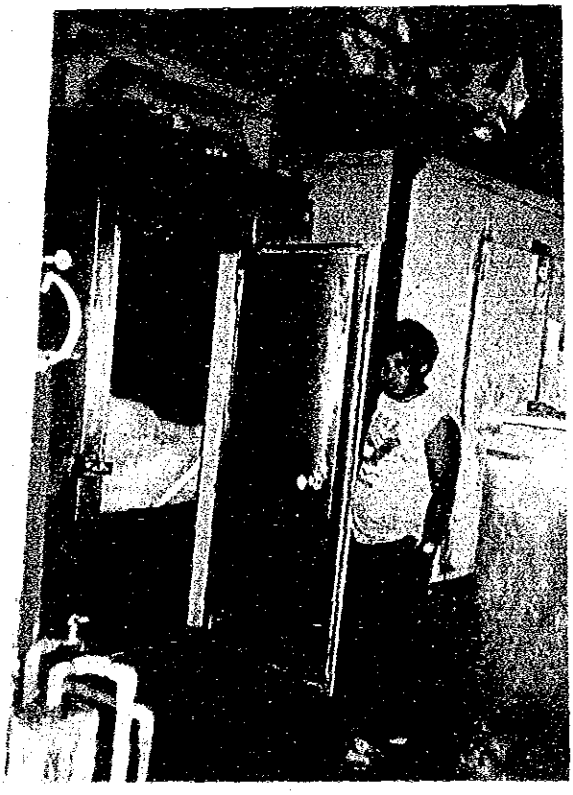


Location of Project Sites

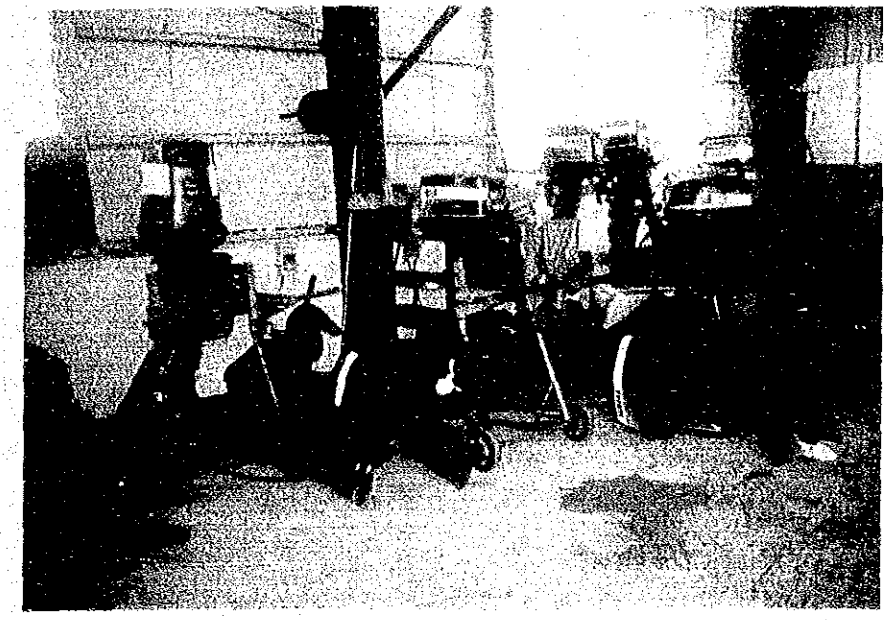
LELU SITE

Existing Facilities

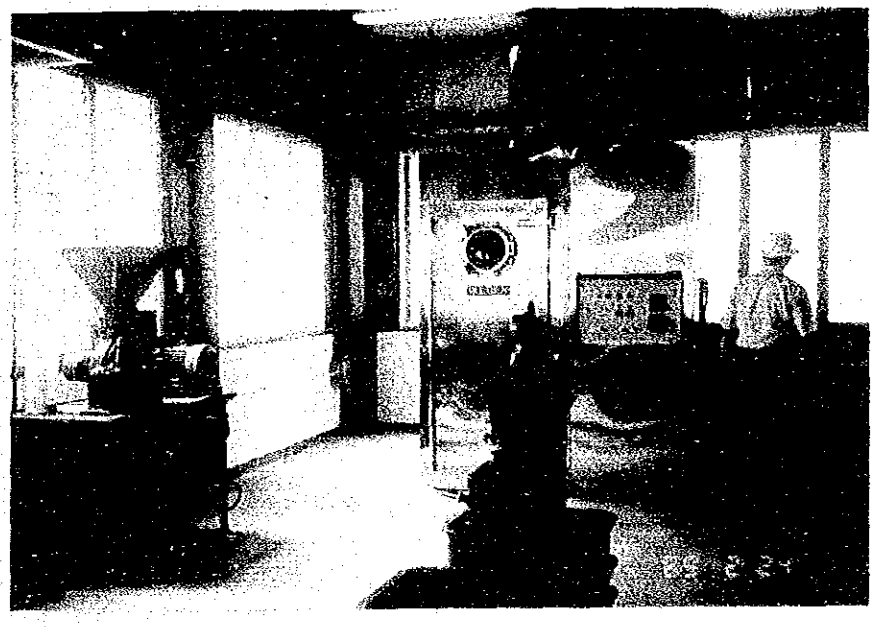
Air Blast Freezer
and Freezing Room



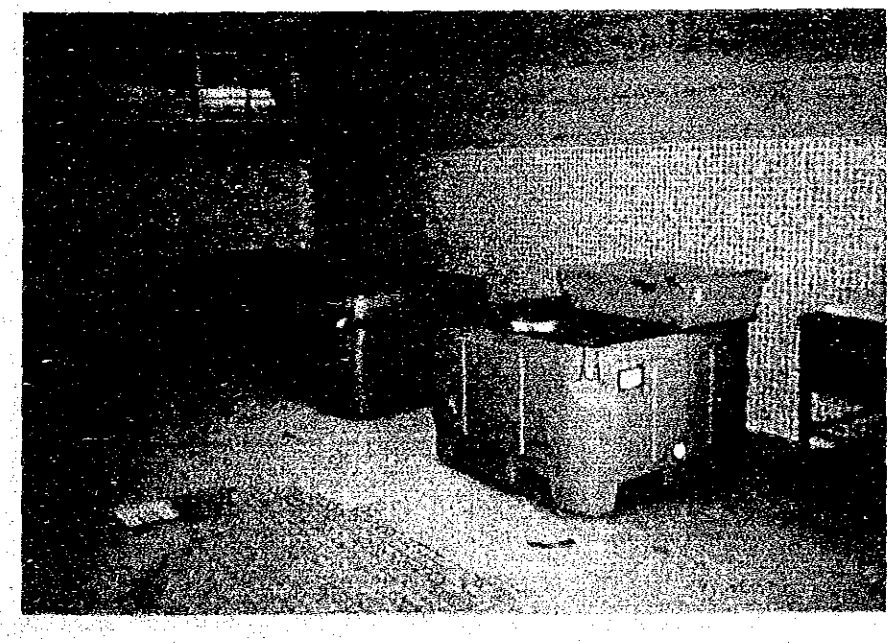
Ice Making Machine



LELU SITE

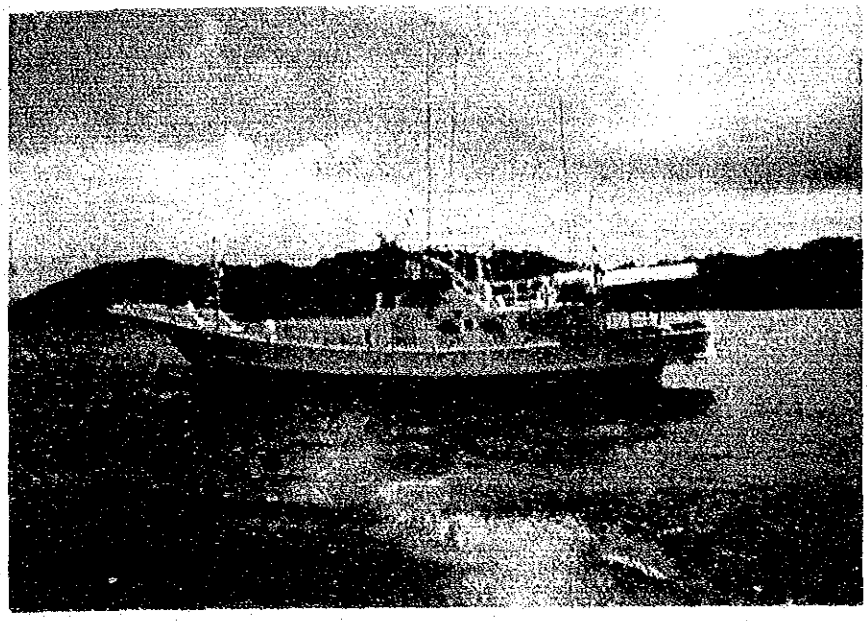


Outboard Engine
Repair Shop

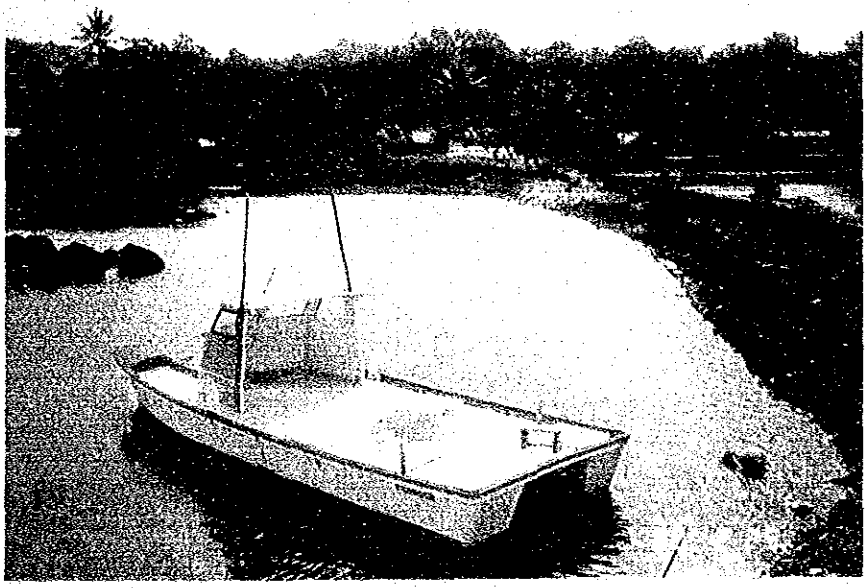


Fish Processing
Plant

Public Market

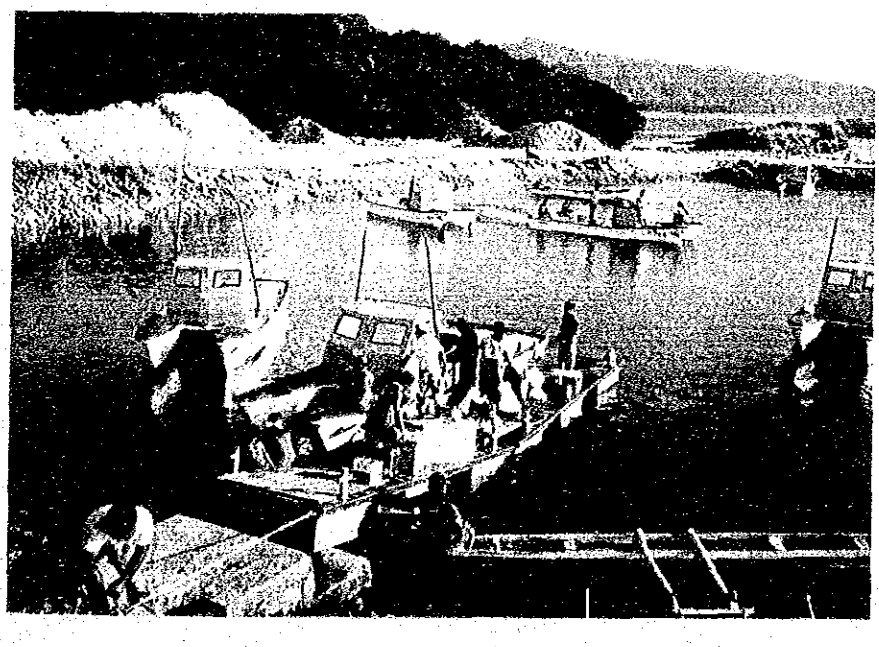


Pole and Line Test
Fishing Boat



UTWE SITE

Proposed
Construction Site



OKAT SITE

Proposed
Construction Site

SUMMARY

SUMMARY

The Federated States of Micronesia (FSM), with its 607 islands, lies in the Western Pacific Ocean and consists of four states, Kosrae, Pohnpei, Truk and Yap. The population of the country is 91,240 with a land area of 702 km^2 and a territorial water area of 2,600,000 km^2.

The water area surrounding the FSM is very rich in tuna and bonito resources and fish catches are much higher than those in the Indian and Atlantic Oceans. The government of the FSM established a 200 mile exclusive economic zone in 1979 and thereafter, foreign fishing boats from Japan, the USA, Korea, etc., are operating tuna and bonito fishing boats there while paying fishing charges to the country. These boats are using pole and line, long line and round haul netting fishing. The total fish catch by foreign fishing boats is estimated at a level of 0.5 million tons a year.

In contrast to the active fishing activities by foreign boats, the fisheries industry of the FSM is not fully developed on a commercial base and has only a few domestic commercial fishing ventures conducted in the Truk State and in some of the main islands.

The First National Development Plan was established for the period 1985-1989 and this period is recognized as an important transition and reconstruction period after the expiration of the United Nations Trusteeship. The plan is a summary and synthesis of development plans of individual states and emphasizes the importance of the development of fisheries. The total budget allocated for developing the fisheries industry amounts to as much as 45 million US$, approximately 32% of the economic sectors, and 13% of the total investments for the above period.

The foreign exchange income of the FSM largely depends on tourism, 54% and an export of copra, 38%. These incomes account for only about one third of the total amount of food imports. The imbalance of import and export in the country is remarkable. The total import in 1983 was 58 million US$, 16 times the total export of 3.6 million US$ in the same year. The import of foodstuff accounts for 22.8% of the total commodity import of about 49 million US$, broken down to rice 42%, canned meat 20% and canned fish 14%. Food imports are characterized by a large share of

rice and canned meat and fish even though they have rich fishing grounds in the surrounding waters of the FSM.

The Kosrae State with the smallest land area among the four states of the FSM has the population of about 6,500. The state has no major promising industry in the private sector, except for fisheries, and the unemployment rate is reported at 21%. A considerable number of Kosraeans work for the state government but the employment in the government sector is not expected to increase because of a planned reduction of the US aid.

To achieve economic independence in the Kosrae State, the Government of the FSM requested the Government of Japan a grant aid to improve the infrastructure for the fisheries industry in the state. The project aims at further promotion of the fisheries industries by providing basic fishery infrastructure for 70 catamaran boats which were donated under the Japanese grant aid in 1985. At the request of the FSM, the Government of Japan decided to undertake a basic design study and the Japan International Cooperation Agency dispatched a study team headed by Dr. T. Tsuchiya of the Overseas Fishery Cooperation Foundation, for 32 days, from February 22nd to March 25th, 1989.

The team studied the fisheries industry and the proposed project sites and conducted a series of discussions with the concerned government staffs of the FSM and the Kosrae State.

According to the results of the site survey, the study team confirmed that:

i) the fish catch drastically increased after introduction of the catamaran boats,

ii) it is necessary to establish a commercial distribution system of fishery products and

iii) promotion of the export of high value fishes is the key factor to improve the financial condition of the state.

Through discussions with the concerned staffs of the FSM, it is agreed that improvement and expansion of the fishery infrastructure should be urgently implemented. The optimal basic design of the project has been worked out by considering the operational and administrative capacities of the state government.

The major project components are listed below:

1. Lelu Site

Fishery Infrastructure:

i)	Wharf	length	34 m
		depth	3 m
ii)	Floating Pontoon	length	70 m
		depth	1.25 m
iii)	Fuel Tank, gasoline	capacity	9.0 kl
	diesel	capacity	6.5 kl
iv)	Slipway	length	18 m

Distribution Facilities:

i)	Building	floor area	10x30=300 m^2
ii)	Ice Making Facility	capacity	2,000 kg/day
iii)	Ice Storage	floor area	7.3 m^2
iv)	Cooling Room	floor area	16.2 m^2

2. Utwe and Okat Sites

Fishery Infrastructure:

i)	Floating Pontoon	length	40 m
		depth	1.25 m
ii)	Fuel Tank, gasoline	capacity	6.0 kl

Distribution Facilities:

i)	Building	floor area	6x6.5=39 m^2
ii)	Cold/Ice Storage	floor area	7.3 m^2

3. Fishing Gears

i)	Ice Boxes for Catamaran Boats	1.6x0.7x0.6 m^3	45 pcs
ii)	Long Lining Fishing Gear (with Hydraulic Pump/Line Hauler to be mounted on the existing boat "Mutunte")		2 sets
iii)	Fish Aggregating Devices		10 sets

4. Others

i)	Small Refrigerating Trucks	2,000 kg	2 Nos.
ii)	Smoking Machine	100 kg/c	1 No.
iii)	Outboard Engine Spare Parts		1 set
iv)	Small Truck	1,000 kg	1 No.

The implementation of the project will require five months for detailed design work, bidding and contract procedures and thirteen months for preparation, mobilization and construction work totaling eighteen months from the exchange of note between the governments of the FSM and Japan.

The Executing Agency responsible for this project is the Department of Resources and Development of the Government of the FSM. After the completion of the works, all the facilities included in the project will be administrated and controled by the Marine Resources Division of the Kosrae State and operated by the Kosrae Island Fishing Cooperative Association. The annual operating expenses are estimated at about 76,000 US$ and this can be covered by the operating revenue from the proposed facilities.

The facilities included in the project are to be used by all the catamaran and other fishing boats working in Lelu, Utwe and Okat sites. The reinforced fishery infrastructure and improved supply of fishery products will greatly improve the fisheries industry in the state. The project is expected to improve the present condition of the fisheries industry and the facilities proposed in the project will help to bring about the economic independence of the state.

This project is justified for its earliest implementation under the Japanese grant aid and will significantly contribute to the fisheries industry in the Kosrae State.

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CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

To establish an economic independence after an expiration of the United Nations Trusteeship, the Government of the FSM has assigned in the First National Development Plan (1985 - 1989) the first priority to promotion of a fisheries industry by cultivating rich fishing grounds in an exclusive economic zone of the country.

A population of the Kosrae State has been sharply increasing and increase of employment opportunity and protein supply is one of essential needs of Kosraean people and the Government of the FSM requested the Government of Japan a grant aid to develop basic fishery infrastructure and distribution facilities to promote the fisheries industry in the state.

At the request of the Government of the FSM, the government of Japan decided to undertake a basic design study and the Japan International Cooperation Agency dispatched to the FSM a Study Team headed by Dr. T. Tsuchiya of the Overseas Fishery Cooperation Foundation from February 22nd to March 25th, 1989.

Detailed analyses have been conducted on present conditions of the fisheries industry in the Kosrae State, the project background, a scope of the project, natural conditions, administrating organizations and conditions of construction materials and equipment.

The Study Team had a series of discussions on the project with the concerned staffs of the FSM and the Kosrae State and results of discussions are summarized in the minutes of discussions signed by both parties. After the site survey, the team made a detailed study on collected data and information and worked out the basic design of the project facilities with appropriate scale and scope by considering an effect of the project to the present fisheries industry in the Kosrae State.

Based on the results of the detailed studies on the project, an adequate basic design of each project component, an implementation plan, a project evaluation, and recommendations have been worked out and presented in this Final Report.

CHAPTER 2

BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2.1 Socio-economic Conditions of the FSM

The FSM is a typical archipelagic country consisting of 607 islands scattering in a wide expanse of the Pacific Ocean in N 0^{o}-14^{o} and E 135^{o}-166^{o} with a total water area of about 2,600,000 km^2. The FSM consists of four states, Kosrae, Pohnpei, Truk and Yap having its capital in Pohnpei. The total population of the FSM is 91,500 with the largest share of 46,000 in the Truk State, followed by the Pohnpei State 27,000, the Yap State 12,000 and the Kosrae State 6,500.

The population of the FSM increases sharply from sixties with an average growth rate of about 3% for the period from 1970 to 1980. The growth rate of population in the Kosrae State is 3.2% for the same period. The male working population is 75.9% of population of age over 15 years or 16,140 and the female 42.3% or 8,940. The unemployed are 2,980 for male and 2,540 for female. Out of the total employed persons in the country, about 50% live under monetary economy and about 56% work for governmental services. The government workers account for more than 60% in the States of Kosrae and Yap. The employment in the government services is not expected to increase due to planned reduction of the US aid and therefore expected high unemployment brought by sharp increase of young generation should be solved by developing domestic industries in a private sector.

The Kosrae Island is located at the easternmost end of the FSM, N 5^{o} 19' and E 163^{o}, 555km southeast of the Pohnpei Island and 600km southwest of Kwajaleine of the Marshall Islands. 70% of land area in the island consists of slopes steeper than 30^{o} connecting to flat areas leading to coastline along which mangrove swamps develop in some places.

The Kosrae State consists of four districts, namely, Lelu, Malem, Utwe and Tafunsak and a center of commercial and political activities is in the Lelu district where the state capital is located. The Kosrae State maintains a closer relationship with the Marshall Islands rather than the other states of the FSM due to geographical and historical reasons. The state is richer in agricultural products than the other states but poorer in basic social infrastructure such as road, port, etc.

Major features of the FSM and the Kosrae State are summarized below;

	FSM	Kosrae
Population	91,240	6,607
Land Area	702 km^2	110 km^2
No of Island	607	5
Location	E 135^o-166^o	E 163^o
	N 0^o - 14^o	N 5^o 19'
Capital	Colonia, Pohnpei	Tofol

Economy of the FSM consists of monetary and self-sustaining systems. The former functions among merchants, government workers, urban laborers, etc. in the capital and main islands while the latter in rural societies in remote islands. Population of the FSM under self-sustaining economy accounts for about 50% excluding school students and in the Kosrae State more than 55% live under self-sustaining economy.

GDP of the FSM in 1983 consists of 44.9 million US$ (42.2%) of agriculture and fisheries and 31.5 million US$ (29.6%) of government services and 12.7 million US$ (11.9%) of retail trades. In these figures included are self-sustaining economic activities of 40.5 million US$ and if excluded, the government services account for 47.8%, the retail trades 19.2% and the agriculture and fisheries 6.5% and thus no major private industry except for the retail trades exists in the country. Monetary economy of the FSM largely depends on government finance which in turn depends on the US aid for more than 80% of its revenue. The government revenue from domestic tax accounts only for 15-18%.

Total revenue of foreign exchange of the FSM amounts at about 3.6 million US$ in 1983 consisting of 54% by tourism and 38% by export of copra. However, the revenues from these two industries are less than one third of total import of foodstuffs. The import of foodstuffs accounts for 22.8% of the total merchandise import of 54.4 million US$ in 1983. The imported foodstuffs consist of 42% of rice, 20% of canned meat and 14% of canned fish and are characterized by a large share of rice and canned fish though the FSM is favoured with rich fishing grounds in the surrounding water.

After expiration of the United Nations Trusteeship, all the countries in Micronesia have treaty with the USA to receive the US aid under the Compact of Free Association. However, amount of the US aid is planned to decrease to a level of half the present level and promotion of export oriented domestic industries has been emphasized as an important target of each country in the region.

The Government of the USA established the Capital Improvement Program in 1978 to improve basic social infrastructure and unemployment condition in Micronesian countries. The FSM has improved an air port, road network, harbour, water supply system, sewerage system, etc., however fishery facilities remain untouched requiring future investment.

2.2 National Development Plan

Water area surrounding the FSM is very rich in tuna and bonito resources with much higher fish catches than those in the Indian and Atlantic Oceans. The government of the FSM established a 200 mile exclusive economic zone in 1979 and thereafter, foreign fishing boats from Japan, the USA, Korea, etc., are operating tuna and bonito fishing by means of pole and line, long line and round haul netting paying fishing charges to the country. Total fish catch by the foreign fishing boats is estimated at a level of 0.5 million tons a year. In 1987, 300 long lining boats, 90 pole and line boats and 150 purse seiners with total foreign fishermen of 7,500 are reported to have worked in the FSM water.

In contrast to active fishing operations by the foreign fishing boats, fisheries industry of the FSM is not fully developed in a commercial base with a few domestic commercial fishing activities conducted in the Truck State and some of main islands.

In the National Five Year Plan 1976-1981 established in 1976, emphasized are improvement of financial condition through rise of productivity in the field of agriculture and fisheries, reduction of governmental expenses and increase of per-capita income by promoting local industries.

The First National Development Plan was established for the period of 1985-1989 and this period is recognized as an important transition and reconstruction period after expiration of the United Nations Trusteeship.

The plan is a summary and synthesis of development plans of individual states and emphasizes importance of a development of fisheries. Total budget allocated for developing the fisheries industry amounts to as much as 45 million US$, approximately 32% of economic sectors, or 13% of total investments for the above period.

2.3 Development Plan of Fisheries Industry

The government of the FSM plans to increase employment opportunity and to develop export of fish to foreign markets by promoting a fisheries industry. To this end, diversification of fish processing methods, marketing of high value fishes in foreign markets and reinforcement of operation and management are planned by providing training, financial assistance and basic fishery infrastructure.

As mentioned previously, the FSM is importing a large amount of canned fish. This is due mainly to unavailability of transportation means of fresh fish from fishery ports to consumption areas, storage facilities and basic fishery infrastructure. A large scale fishing activity conducted in the FSM is represented by bonito fishing conducted in the Truck State by using government owned 21 m boats and four private 15-19 GT boats catching about 450-700t a year. In addition, the Pohnpei, Yap and Kosrae States are carrying out small scale fishery research and development and catching pelagic fish. The fish catches by these boats are minimal, when compared with those by the foreign fishing boats working in the FSM water.

The first export oriented fishing base was developed in Tublon, Truck by the US aid. The base is provided with a wharf and other facilities and is planned to be developed as a large scale fishery complex. In November 1981, 14 t of frozen bonito for raw material for a cannery was first exported to Hawaii. Beside bonito, about 5 t of reef fish were exported by air to Guam and also from Pohnpei, bottom fish are being exported by air to Hawaiian Market. High value fishes such as bottom fish, mangrove crab, lobster, etc. are expected to increase for export in future.

At this stage, when economic independence is required to be urgently established, the development of fisheries industry is recognized as the most important means for strengthening country's economic structure after expiration of the United Nations Trusteeship.

The state government plans to develop a fishery center, a wharf, fish aggregating devices, etc. and set the followings as major objectives of fishery development in line with the National Development Plan:

i) to increase fish catch by small scale fishing to achieve self-sufficiency
ii) to make full use of pelagic fish resources for earning foreign exchange income
iii) to study and develop aquaculture and
iv) to make an administration and control plan of marine resources.

2.4 Outline of the Kosrae State

2.4.1 Existing Condition of Fisheries

Fishing operation using canoe, trap, spear, etc. in the Kosrae State is partly in a transition stage from self consumption to commercial fisheries. A recent introduction of catamaran boats have greatly improved fishing techniques especially for the ones outside a reef flat.

Here, economic value of fishing grounds of the Kosrae State is examined for formulating an appropriate project plan. As can be seen in Fig. 2.1, water area deeper than 3,000 m is included within 12 mile territorial water and this suggests that the fishing ground is not of high economic value except pelagic fish.

Generally speaking sea areas with a sea bed characterized by a projection of reef, a shoal and a sea mount have high productivity, as upwelling currents formed by such topography tend to carry deep sea water which is rich in nutrient salt up to a solar light penetration layer. Therefore, an exploitation of such good fishing grounds is a key factor for efficient fishing activities in the state.

Fishery surveys on tuna long line fishing grounds of the Kosrae State started in 1936, and the data obtained indicate that yellow fin tuna accounts for 74% of total catch while marlin 15% and big eye tuna 11%. There is a remarkable regional difference in scales of fishery resource in the water area of the Kosrae State. For example, considerable differences are found in two sea areas of northern and southern parts of latitude N

5°. The most important difference is catch rates of yellow fin tuna in the two sea areas, while the difference of catch of marlin and big eye tuna is negligible. Different from yellow fin tuna, catch rates of marlin and big eye tuna increase to the north of latitude N 5°. This is because although a part of the sea area to the south of the latitude N 5° belongs the equatorial counter-current, most of the area belongs to the northern equatorial current basin. In the light of this fact, it can be understood that yellow-fin tuna is densely distributed in the equatorial counter-current and that on the other hand the density decreases sharply in the northern equatorial current.

According to survey data collected in 1979 off the Kosrae Island deep sea fish is reported abundant on reef slope. Resource of bottom fish is surveyed to be poor at a depth of 200 m and rich at a depth of 100 m. Besides skipjack there are large quantities of such fishes as black trevally (a horse mackerel family close to white fin crevalle) and gold-tailed jobfish (a similar family to snapper).

A full scale survey on fishery resources in the Kosrae water has not been conducted and a size of fishery resources has not been clarified yet. However, the State Government estimates 10,000-50,000 t of pelagic fish within 200 mile water area based on surveys conducted by the SPC and fish catch statistics of foreign fishing boats.

The resource of bottom fish is surveyed and estimated by the SPC at about 100 t for area deeper than 15 m and 44-200 t for area shallower than 15 m. The shallow reef area has been already cultivated, while the deep area can yield more pelagic fish even with large fish catches by foreign fishing boats. Therefore further effort should be put in developing resources of pelagic fish.

Fish catch for self consumption in the Kosrae State in 1979 was estimated as 100 t inside a reef area and 34 t outside. Fish catch after introduction of 70 catamaran boats is reported to have drastically increased to exceed a self consumption demand. The state government was granted with a pole and line test fishing boat for the purpose of developing private fishery firms of catching pelagic fishes under administration of the Marine Resources Division. However, the boat is not necessarily fully utilized due to difficulty of keeping baits alive.

Numbers of fishermen working in the Kosrae State have been increasing steadily as shown below.

	1985	1986	1987	1988
No. of fishermen				
Part time	50	75	82	90
Full time	15	20	30	40

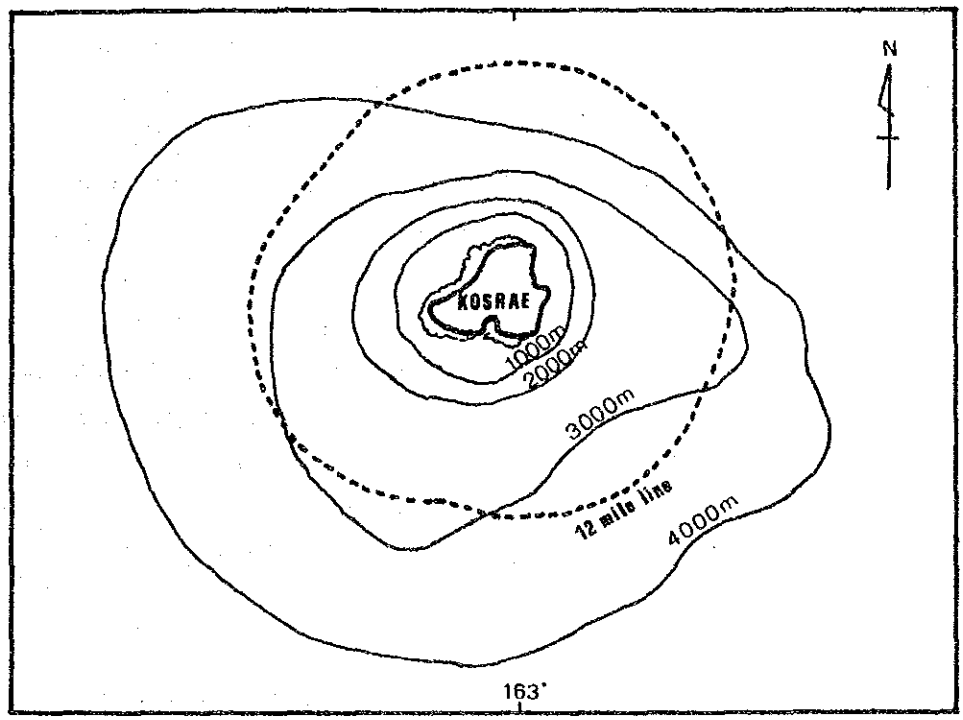


Fig.2.1 Bathymetric Chart of KOSRAE Island

2.4.2 Present Conditions of Fishery Facilities

(1) Basic fishery facilities

Basic fishery infrastructure is not provided well in any of three sites proposed in the project.

In the Lelu site, a 10 m long floating pontoon is provided but its length is not enough to accommodate about 10 boats owned by the Marine Resources Division and the Kosrae Island Fishing Cooperative Association. Therefore, most boats are moored to other boat and some are obliged to be moored to beach slope.

No mooring facility is available in the Utwe site. Water area sheltered by a causeway is provided without any service facilities and a few catamaran boats use it while most of the remainders are moored near coastline.

In the Okat site, the same pontoon as that in the Lelu site is provided in a water area constructed at a time of construction works of a new international airport and harbor. A reclaimed land area and a dredged water area are not leveled nor protected with a rubble slope requiring earth and stone works for constructing a mooring basin. A dredged soil piled at the site is being used for a circumferential road work. Several catamaran boats are using the basin at present.

Lack of an adequate berthing facility hampers an efficient use of fishing boats. At present, most of the catamaran boats are moored along coast near owner's houses and in some cases the boats are unable to sail out at low tide. Also, a damage of abrasion to a hull of boat on a coarse sea bed is observed. Absence of a facility to supply ice and fuel in a fishery port obliges fishermen to spend a considerable time for buying them at a nearby gasoline station and the Lelu distribution center.

Basic fishery infrastructure such as a wharf, a cold storage, etc. need to be urgently developed.

(2) Existing processing/distribution facilities

The State Government of Kosrae places emphasis on improvement of

fishery product processing and distribution facilities and has constructed a public market for sale of fresh fish, frozen fish and processed fish with 13 stalls for retail shops with a total floor area of 194 m^2 and a fish processing plant for producing half-dried bonito and preserved fish boiled in soy with a daily production capacity 1,000 kg and a total floor area of 150 m^2 in Lelu.

As for a distribution system, the Kosrae Island Fishing Cooperative Association works under control of the Marine Resources Division of the Kosrae State, leasing an ice making, a freezing and a cold storage facilities provided under the Japanese grant aid in 1983.

(1) Fish processing plant

Construction of this establishment was completed in 1988 by the State Government of Kosrae in order to improve fish processing capacity in the state. It is located in Lelu adjacent to the existing outboard engine workshop which was granted by the government of Japan in 1987. Total floor area of the building area is 150m^2. The plant has a daily production capacity of 1,000 kg in terms of weight of raw fish and is equipped with machinery for boiling, drying and vacuum packing.

Based on a contract with the State Government, the Kosrae Island Fishing Cooperative Association operates and manages the plant. The manager has received a manufacturing training course in Japan for six months prior to construction of the plant, but an opening of the plant is delayed because of his long injury leave. At present, preparations are under way with a target of starting manufacturing in 1989.

As for a marketing plan, a consumer survey was carried out in September 1988 by sampling half-dried bonito, on which an overwhelming majority considered that a taste of the product is comparable to fresh fish and better than canned fish. Further some respondents expressed opinions that a price of 2 US$/lb would be reasonable, and processing of bonito is believed to be adequately profitable. Sales to consumers would be done through major retail shops and samples would be shipped for trial sales.

2) Public market

The public market was constructed in 1988 by the US aid in order to improve fishery product distribution facilities. The construction site is in Lelu adjacent to the existing ice making and cold storage facilities.

The floor area of the building is 194m^2. This installation houses 13 stalls for retail shops, of which 11 shops sell fresh fish, one sells frozen fish and another sells processed fish. At the time of the site survey, shop tenants were being recruited for a scheduled opening in May 1989.

3) Japanese grant aid in 1981

In order to improve fishery product distribution facilities in the Kosrae State, the Government of Japan extended its grant aid in 1981. With this grant aid, the Government of the FSM planned to improve traditional fisheries on outer islands in order to improve a living standard of islanders by effectively utilizing fishery resources there and thus become self-supporting in fishery products. For this purpose, the Government intended to promote fisheries by installing small freezing rooms in outer islands and transporting fish to main islands.

Under the grant aid, the Kosrae State was provided with the following facilities.

1. Ice making machine (flaked ice), 1.5 tons/day	1 unit
2. Ice storage, 2 tons	1 unit
3. Air Blast Freezer, 480 kg/cycle	1 unit
4. Cold storage (temperature -20° C), 50m^3	1 unit
5. Generators (diesel engine driven)	2 units
6. Small truck	1 No.
7. Ice box,100 l	30 pcs
8. Building	110 m^2

These facilities, as a nucleus of fishery activities in the state, are operated, maintained and managed by the Kosrae Island Fishing Cooperative Association under control of the Marine Resources Division, the State Government of Kosrae.

2.4.3 Fishing Boats and Gears

(1) Fishing boats

1) Catamaran boat

70 catamaran boats granted by the Government of Japan to the Government of the Kosrae State have been distributed to fishermen all over the State, and are being operated on an agreement that an ownership will be handed over to fishermen upon payment of 1,000 US$ and submission of receipts of cumulative fish catch of 8,000 pounds. At the time of the site survey, the agreement has already been completed by 44 fishermen, and their ownership has been transferred from the Government of the Kosrae State to the fishermen. Thirty of these catamaran boats are distributed in the Lelu district, 20 in the Okat district and 20 in the Utwe district. These fishing boats are making substantial contribution to development of coastal fisheries of the Kosrae State. More than 90% of their catch consists of skipjack and the rest consists of such kinds of fishes as yellow fin tuna, common dolphin, chinese mackerel, marlin, etc.

2) Pole and line skipjack experimental fishing boat

The test fishing boat granted by the Government of Japan has sailed on 78 trips in 1987. Such activities as pole and line skipjack fishing, stick held dip net fishing of bait sardine for skipjack fishing and installation of fish aggregating devices have been carried out by the boat. Although results of test fishing carried out from April to November 1987 have not been fully satisfactory, authorities of the State Government acknowledge that positive results have been attained from the standpoint of fishing training.

(2) Fishing gear

1) Trolling

Artificial bait hooks are being used to catch such pelagic fishes as skipjack and small size yellow fin tuna. A fishing efficiency is rather low because of manual handling of fishing lines without a diving board. Also, as most fishermen handle fishing lines without swivels by hands, entangling of the fishing lines causes considerable reduction of fishing efficiency. Fishing skills require improvement in operating a boat and hadling fishing lines at a fish shoal.

2) Bottom line

Bottom line is being used on outer edge of reef with depth of 100 to 200 m. Good fishing spots are determined ocean and tidal currents, sea bed topography, etc. and a fishing ground map should be made available for fishermen for efficient fishing operation.

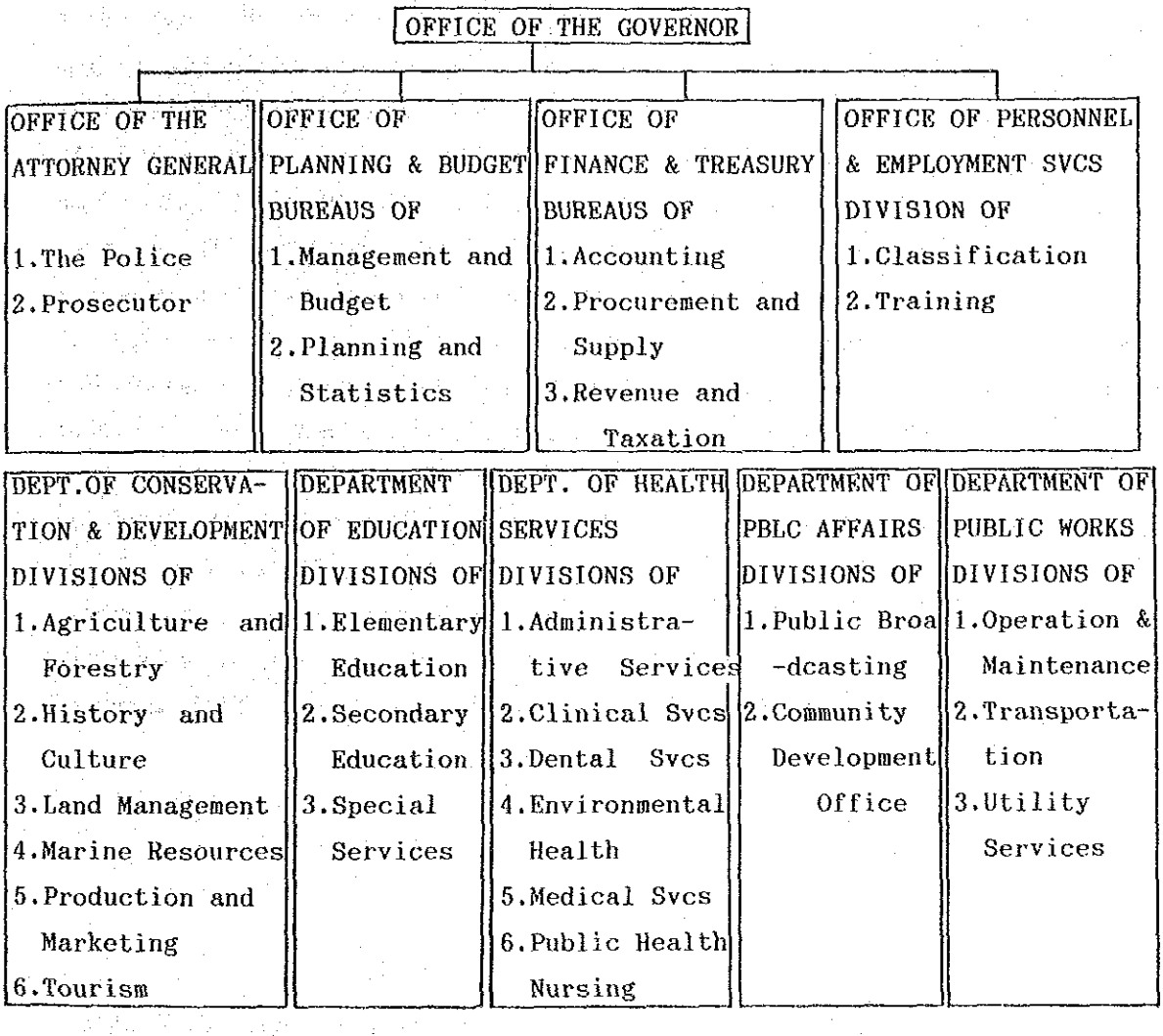
3) Cast net and gill net

Cast net fishing and gill net fishing with FRP boats and canoes are being carried out in shallow waters and channels in a reef. Mangrove crab is also being caught with gaff, claw-shaped fishing apparatuses, etc. This kind of fishing is practiced in a very small scale and mostly as side business by housewives.

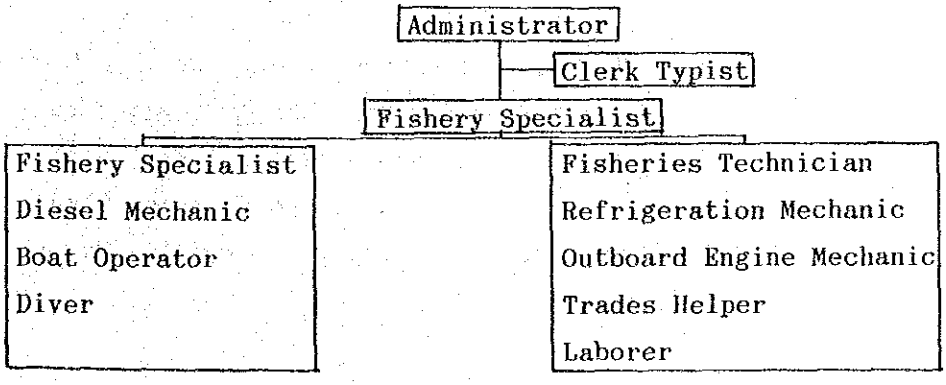
2.4.4 Administration and Operation

Administration of a fisheries industry in the state is conducted by the Marine Resources Division of the Department of Conservation and Development. The Marine Resources Division holds 12 staffs. Organization charts of the State Government and related agencies are shown below;

- Kosrae State Government



- Division of Marine Resources



2.5 Request for the Project

The Government of the FSM has assigned the first priority to development of a fisheries industry by making full use of rich fishery resources in the country's waters for establishing an economic independence.

The Marine Resources Division of the Kosrae State has executed various fishery development plans following the policy of the Government of the FSM and has received Japanese grant aids for two projects. An ice making, an ice storage, a quick freezing and a cold storage facilities of the existing fishery complex were donated in 1981 and are operated by the Kosrae Island Fishing Cooperative Association. In 1985, 70 catamaran boats, a workshop for outboard engine, a pole and line test fishing boat and various types of fishing gears were donated and a drastic increase of fish catch has been achieved through reinforcement of local fishing methods. Beside these projects, the Marine Resources Division has constructed a fish processing plant by its own finance and a public market by the US aid.

Through implementation of these projects, a self-sufficiency in fishery products has been almost attained in the Kosrae State. The request of this time aims at further promotion of fisheries industry to export fresh fish to foreign markets toward realization of an economic independence of the state. To this end, a further efficient utilization of the existing catamaran boats are planned in the project.

Contents of the request for the project are as follows;

i) Lelu

Port Facilities;	Wharf, Dredging, Reclamation, Pavement of Apron, Slipway, Associated Works
Mooring Facilities;	Building, Ice Marking Machine, Ice Storage Quick Freezing Room, Cold Storage, Fuel Tank (Gasoline/Diesel), Relocation of Emergency Generator and Existing Cold Storage, Tuna Long Line Training Boat

ii) Utwe	Reclamation, Seawall, Ice Making Machine, Ice Storage, Fuel Tank (Gasoline), Cold Storage
iii) Okat	Same Facilities as those in Utwe

CHAPTER 3

SCOPE OF THE PROJECT

CHAPTER 3 SCOPE OF THE PROJECT

3.1 Objectives of the Project

The project aims at promotion of a fisheries industry in the Kosrae State. To this end, the catamaran boats and the existing distribution facilities shall be more efficiently utilized by making full use of rich fishery resources in the Kosrae water. The improvement of the distribution facilities will promote export of high quality fresh fish and establish stable supply of fish in domestic markets especially in a poor season and thereby realize a considerable saving of foreign exchange by substituting imported canned meat and fish by local fresh or frozen fish.

3.2 Examination of the Request

The past fishery development projects and their contributions are summarized as below:

- -A cold storage, an ice making machine and an air blast freezer (Japanese grant aid): improvement of freshness of fish and establishment of distribution of fresh and frozen fish
- -70 catamaran boats, a training boat and a repair shop (Japanese grant aid): drastic increase of catch of pelagic fish
- -A fish processing plant (State finance): diversification of keepable fishery products
- -A public market (US aid): establishment of commercial distribution system

Supply of fish protein in the state has been almost met by local fish catch through two projects under Japanese grant aids. Further, supply of fishery products to the entire area of the island through an improved distribution system will be promoted by start up of full operation of a fish processing plant and a public market. To meet an increasing demand, the project together with these projects aims at further promotion fisheries industry by improving a basic fishery infrastructure.

Contents of the project are described in Chapter 2. Most of the project components requested have been justified to be appropriate through studies in the field and subsequent detailed analyses in Japan. However,

the following facilities are not justified for inclusion in the project in the light of present conditions of a fisheries industry in the state and a Japanese grant aid system and thus have been amended through discussions with the staffs concerned of the FSM and the state government as below:

(1) Slipway

A scale of a slipway requested was large enough to uphaul the largest boat owned by the Marine Resources Division. It has been reduced in scale large enough for catamaran boats which are majority of fishing boats in the state. A large size slipway is costly in operation and maintenance and was judged not economically feasible being very low in frequency of usage large boats say once in a year or less. The largest boat can be lifted by a crane owned by the Public Work Department for repair work and this is more practical and economical than a large slipway and thus a reduction of scale has been agreed.

(2) Relocation of the existing facilities

A relocation of the existing generators and cold storage included in the request aims at an efficient utilization of distribution facilities by integrating the planned and existing machinery of similar functions in one room in a new building. The existing generators and cold storage were provided under a Japanese grant aid. A space after relocation in an existing building will be used for a storage area. It is agreed that the relocation work will be done by the state government and a space for relocation will be provided in the new building.

(3) Tuna long line training boat

The request included a tuna long line training vessel aiming at exploiting rich yellow fin and big eye tuna resources in the Kosrae water. The Marine Resources Division possesses a bonito pole and line training vessel donated by the Government of Japan. This vessel is not fully utilized due mainly to difficulty of keeping baits alive and it is agreed that this existing vessel shall be remodeled into a tuna long line and bonito pole line combined vessel equipped with tuna long line fishing gears in addition to the existing pole and line fishing gears.

Such essential project components as refrigerating trucks, ice boxes,

fish aggregating devices, a smoking machine, etc. were not included in the original request but have been requested by the Marine Resources Division at the time of the site survey and included in the project.

3.3 Contents of the Project

Project facilities aim at stable supply of fishery products to islanders and promotion of export industry of fishery products. A commercial system of fish catch collection and low temperature distribution shall be established by arranging cold storages and refrigerating trucks. A proper collection and distribution system and a market mechanism will lead to increase of commercial production, and increased supply of high quality fresh fish will open export markets, by which fisheries can develop into a major export industry of the state. The distribution facilities will be planned at three sites, a distribution center in Lelu and supporting stations at two locations of Utwe and Okat in order to serve an entire area of the island.

The existing distribution center is located on an old runway extended from the causeway connecting the main island and the Lelu island. New fishery complex proposed in Lelu is planned to be developed near the existing one. The existing center consists of a workshop for outboard engines, an ice making machine, a cold storage, a quick air blast freezer, etc. granted by Japan, a public market granted by the USA and a fish processing factory constructed under a state finance.

The distribution stations in Utwe and Okat on the other hand will function as supporting stations for the Lelu distribution center. A construction site in Utwe is in the southeast of the Kosrae Island and a water area for a proposed mooring basin has already been sheltered by a rubble jetty. A project site in Okat is near a newly developed international airport in the northwest of the island. A proposed area has been already dredged and reclaimed for the purpose of developing fishery facilities.

The following basic fishery facilities, distribution facilities, fishing gears and equipment are requested for further improvement of fishery activities in the three stations covering an entire area in the state.

Basic facilities	Lelu:	Wharf, Floating Pontoon, Slipway, Fuel Tank
	Utwe/Okat:	Floating Pontoon, Fuel Tank
Distribution facilities	Lelu:	Building, Ice Maker, Ice Storage, Cold Storage
	Utwe/Okat:	Building, Ice/cold Storage
Fishing Gear		Tuna Long Line Fishing Gear, Ice Boxes, Fish Aggregating Devices
Others		Refrigerating Trucks, Smoking Machine, Spare Parts of Outboard Engine, Small Truck

3.3.1 Basic Fishery Facilities

(1) Lelu Site

i) Wharf

Most of fishing boats owned by the Marine Resources Division such as a bonito test fishing boat, a research boat, a patrol boat, etc. need an adequate mooring facility for efficient and safe operation. The fishing boats owned by the Marine Resources Division are used for the following purposes.

- Pole and line training boat "Mutunte":
  Pole and line fishing 2-3 time/week
- Training boat "MRD Hope":
  Bottom line, Training 2 time/week
- Yanmer 25' FRP boat (2 Nos.):
  Bottom line, Tuna fishing 3-4 time/week
- Catamaran boats (2 Nos.):
  Patrol 5 time/week
- Small skiffs (5 Nos.):
  Trolling, Survey, Transport 2-3 time/week

ii) Berthing facilities for catamaran boats

Most of 30 catamaran boats distributed in the Lelu district are moored near each owner's house by anchoring in a shallow water. Some boats are moored to the existing floating pontoon of the Lelu center. In some cases, boats are unable to sail out at low tide with their bottom touching a sea bed. To improve safety and efficiency of operating the boats, an adequate berthing facilities are required.

iii) Slipway for catamaran boats

A slipway is to be used by the catamaran boats and the other small ones and be constructed in the Lelu site only. Repair works to be done in the slipway include repairs to a damaged bottom of hull, periodical cleaning and painting of hull, etc. requiring on-land works. Periodical maintenance and repair works to the catamaran boats in Utwe and Okat sites are to be done in Lelu. A repair to a damaged bottom should be done by towing boats to the Lelu slipway. A periodical cleaning and painting to a bottom can be done in about two days and annual working days of the slipway for 70 catamaran total at about 140 in a year.

iv) Fuel Tank

Most of fishermen are obliged to spend a considerable time for fueling in a nearby gasoline station and for efficient fishing activities a fuel tank is required near the berthing facility of the catamaran boats.

(2) Utwe Site

i) Berthing facilities for catamaran boats

For the same reason as ii) above, berthing facilities are required for 20 catamaran boats distributed in the Utwe site.

ii) Fuel Tank

For the same reason as iv) above, a fuel tank is required in the Utwe site.

(3) Okat Site

i) Berthing facilities for catamaran boats

For the same reason as ii) above, berthing facilities are required for 20 catamaran boats distributed in the Okat site.

ii) Fuel Tank

For the same reason as iv) above, a fuel tank is required in the Okat site.

3.3.2 Distribution Facilities

(1) Distribution facilities in Lelu

The Lelu distribution center will be built adjacent to the existing public market and the fish processing plant. Major works of the center will consist of such services to fishing boats as sale of fishing gear, ice and fuel oil, purchasing, freezing and processing of fish, and sale of fish to a public market. Refrigerating trucks will be assigned for a low temperature transport of ice and fish to support the sub-distribution stations in Utwe and Okat and also for dispatching fresh fish for export. The center will consist of the following facilities.

1) Ice making facility

An ice making facility is to supply ice to fishing boats, fish markets, a fish processing plant and the three distribution stations in order to keep fresh fish at low temperature.

Atmospheric temperature in the Kosrae State is considerably high throughout the year, and freshness of fish tends to be quickly lost. In order to keep high freshness of fish for a long time,

fresh fish must be ice packed on board.

In order to increase fish catch and improve quality of fish by activating a fishing by the catamaran boats, ice produced at the Lelu distribution center will be delivered and supplied to fishermen through the two distribution stations. As there will be new demand for ice for the public market and the fish processing plant which recently opened, expansion of an ice making capacity is considered to be indispensable.

2) Ice storage

An ice storage is used for storing a necessary quantity of ice in advance in order to supply it within a limited time to fishing boats and distribution facilities. (Storage temperature: -5^{o} C)

3) Cold storage

A cold storage is used for temporary storage of fresh fish to be sold in the market, to be frozen, and to be exported. (Storage temperature: 0^{o} C)

4) Air blast freezer

As fish catch always changes depending on season, tidal condition, etc., fresh fish supply at a time of big catch in most cases exceeds demand, and in such case surplus fish must be purchased, frozen by an air blast freezer and stored in a freezing room. Necessity of a new air blast freezer will be examined by considering a capacity of the existing facility and a required future capacity.

5) Freezing room

A freezing room is used for extended storage of frozen fish which is to be released to fish markets and the fish processing plant when fish catch is insufficient due to poor season or stormy weather in order to ensure stable fish supply and to adjust fish prices. Necessity of an additional facility will be examined similarly as an air blast freezer. (Storage temperature: -20^{o} C)

6) Machine room

Refrigerating machines, an emergency power generator, an incoming panel, a distribution panel, etc. will be housed in a machine room.

7) Cargo handling room

A cargo handling room provides a space for sale of ice to fishing boats, metage, purchase and storage of fish and pre-treatment for freezing. Ice is also loaded here onto refrigerating trucks for transport to the Utwe and Okat distribution stations. Architectural considerations will be given so as to retain freshness of fish and ensure efficient work under meteorological conditions of high temperature and much rainfall throughout the year at the site.

8) Administration office

An administration office is a space for staffs who perform office works for general management, sale of fishing gear, fuel, ice, etc. to fishing boats and purchase of fish. The staffs consist of an administrative manager, a sales manager and clerks.

9) Worker's waiting room

A worker's waiting room is a space for workers and drivers for changing clothes and taking a rest. Workers consist of persons responsible for ice making, freezing and storing. Operation staffs concurrently serve as drivers and perform maintenance and operation of refrigerating trucks.

10) Storeroom

A storeroom provides a space for safe keeping of parts for an ice making machine, an air blast freezer, a refrigerator and an emergency generator, fishing gears, ship's fittings and riggings and stationery of an administration office. It will be provided with racks, shelves and cabinets for storing purposes.

11) Toilet and shower room

One toilet each for male and female and a shower room will be provided for convenience of the staffs, the workers and fishermen.

(2) Utwe and Okat distribution stations

These two facilities are local distribution bases in each district and are the sub-stations supporting the Lelu distribution center. They offer services to the fishing boats in the respective areas and their facilities consist of an ice/cold storage, an administration office and a toilet.

1) Ice/cold storage

An ice/cold storage is a facility to temporarily store fresh fish purchased from fishermen and collected for transport to the Lelu distribution center by a refrigerating truck.

As the stations do not have an ice making machine, ice will be delivered from the Lelu distribution center and stored in the cold storage for sale. It will also serve as a facility where frozen fish supplied from the Lelu distribution center is stored and sold during a season when fish catch falls short of demand. (Storage temperature: 0° C).

2) Administration office

An administration office is a space for a staff in charge of managing and operating the station and also for selling ice, fuel and fishing gears to fishermen and purchasing their fish. The staff consists of an office clerk.

3) Toilet

This is a facility for convenience of the staff and fishermen.

3.3.3 Fishing Boat and Gear

1) Long lining fishing gear and line hauler

The request of the FSM for this project included a tuna long line training vessel. As described in Chapter 2, the Marine Resources Division possesses a bonito pole and line training vessel and this vessel is not fully used as originally planned. In 1987, she made 78 trips and has room for the other activity. To fully use the vessel, she could be equipped with a tuna long lining gear, a hydraulic pump and a line hauler for tuna long line fishing. The boat of the same type and size in Yap as the said boat in Kosrae is equipped with both long lining and pole and line fishing gears and no technical difficulty is found in remodeling the boat.

2) Ice boxes for catamaran boats

Most of the catamaran boats are not equipped with ice boxes. Freshness of fish is a key factor for export and installation of ice boxes and supply of ice to all the catamaran boats are planned in the project.

3) Fish aggregating devices

Fish aggregating devices are to improve fishing efficiency and fuel consumption. Fish aggregating devices granted in a previous project of Japan were installed around the Kosrae Island and their effectiveness was confirmed and are included in the project.

3.3.4 Other materials and equipment

1) Refrigerating trucks

Small refrigerating trucks for low temperature transport will be assigned to the Lelu distribution center in order to supply ice, purchase and collect fish to and from Utwe and Okat and to dispatch fresh fish for export.

2) Fish smoking machine

A fish processing plant which was constructed by the State Government of Kosrae in the Lelu site aims at producing half-dried bonito and is now preparing for opening in 1989. According to a market survey conducted by the State Government, local consumers desire that these products be sold at reasonable prices, and the plant is planning to sell them through retail shops.

In order to enhance sales potential, product diversification was investigated, as a result of which it was judged that production efficiency can be improved by installing a smoking machine because simultaneous production of half-dried bonito and smoked fish will eliminate idle time of work force and make effective manpower assignment possible.

The plant will be managed and operated by the Kosrae Island Fishing Cooperative Association. The products are being considered for local sales and also for export to Hawaii through local marketers.

3) Spare parts for 25 HP outboard engines

Outboard engines and spare parts for the catamaran boats were provided by the government of Japan in 1987. In view of an elapsed period of usage, it is believed that a considerable number of outboard engines will have reached an end of economical service life by the time this project is scheduled to open services. Spare parts for the outboard engines will be provided for continuation of efficient utilization of the catamaran boats.

4) Small truck

At present, a vehicle owned by the Marine Resources Division is one small pick-up type truck only used for transportation of fishing equipment and materials and general purposes. One additional truck will be provided as a necessary transportation equipment.

5) Others

Hand carts for fish and ice handling, plastic containers for carrying fresh fish and ice, FRP tanks for iced storage of export fresh fish, weighing equipments, etc. are also included in the project.

3.3.5 Training Program

For an efficient operation and management of the facilities planned in the project toward an economic independence of the state, various training programs are necessary to the concerned staffs of the Marine Resources Division and the Kosrae Island Fishing Cooperative Association. Major training programs required should include practical knowledge of fisheries, a refrigerator and an outboard engine and the most important is wide knowledge and actual experience of fisheries industry covering wide range from fishing to consumption. The Marine Resources Division has invited foreign experts and sent local staffs overseas for training and achieved good results. Training programs required for this project are listed below:

i) Survey of fishing ground: species, resource scale, fish distribution, oceanographic conditions, etc.
ii) Fishing gear and method: freshness, efficiency, high value fish
iii) Distribution system: professionalization of fishermen, reinforcement of the fishing cooperative association, export marketing

To achieve essential objectives of the above training programs, a long term assistance by an experienced foreign expert is required and a schedule should be arranged in a timely manner by taking into consideration a planned opening year of 1991 of the project. For a refrigerator and an outboard engine, the Marine Resources Division has already sent the staffs overseas to acquire necessary knowledge and the trainees are presently operating the facilities in the Lelu station. The same training will be required to meet expanding fishery activities after completion of the project.

CHAPTER 4

BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4.1 Design Policies

A basic design of the project facilities has been conducted based on the results of detailed analyses on data and information collected during the site survey according to the following basic policies toward promotion of a fisheries industry in the Kosrae State.

(1) To plan facilities which efficiently contribute for increasing fish catch, improving a commercial circulation system of fish and promoting export of fish. The project includes an ice making, an ice storage, a cold storage, etc. and construction of mooring facilities, fuel tanks, etc.

(2) A scale of the project facilities is set so as to eliminate present shortage of capacities by considering future need of expansion to meet increasing fishing boats and fish catch.

(3) The project facilities will be planned by considering natural conditions at the site, the other development plans and ease of maintenance and operation works.

(4) Construction works will be planned by taking into consideration local construction conditions and maximum use of local construction materials and labor to activate local economy.

(5) The Japanese standards of design are basically followed for civil works, architecture, machinery and utilities. Dredging, reclamation and spoil dumping works will be done by following related regulations of the state.

4.2 Natural Conditions

4.2.1 Topography

Topographic maps and sounding charts required for project planning were not available for all the three sites and topographic and bathymetric surveys were carried out in the proposed project areas in Lelu, Utwe and

Okat. Results of these surveys are incorporated in designing the project facilities and are shown in Fig.4.1,4.11 and 4.13 respectively.

4.2.2 Sub-soil Conditions

Sub-soil investigation was carried out in an area of a proposed wharf. As shown in Fig. 4.2, four bore holes were drilled at intervals of about 80 m along the southern edge of an old runway and the results are summarized as follows ;

* sub-soil mainly consists of silty sand layer with N value of 2 - 4.
* bearing stratum exists at around D.L. -30 m inclining toward the east end of the old runway.

4.2.3 Earthquakes

It is necessary to take into consideration a seismic force for a wharf and building design since the island is of a volcanic origin. Though observation data on earthquakes are not available in the Kosrae Island, 0.1 is adopted as a horizontal seismic factor based on design reports for the Okat harbor and relevant data presented in the US technical reports on a seismic intensity in the Caroline Islands.

4.2.4 Meteorological Conditions

Climate in Kosrae is typical tropic and oceanic one with high temperature, high humidity and much rainfall throughout the year.

(1) Temperature and humidity

Average yearly temperature is 27° C and its monthly fluctuation is less than 1° C. Observation record of temperature at Lelu for the period of 1956 to 1978 is shown in Appendix. Humidity is about 85 % through out the year.

(2) Precipitation

Many rainy days are observed and an annual rainfall is about 5,000 mm according to climatic statistics of the past 30 years at Lelu as shown in the Table in Appendix.

(3) Winds

Wind observation has been conducted at the Kosrae airport. According to analysis on one year record from February 1988, the following features are observed;

* dominant wind direction is ENE - SE centering at E
* wind speed falls in the range of 3 - 10 m/s and seldom exceeds 10 m/s.

4.2.5 Oceanographic Conditions

(1) Tides

Tide observation was carried out for 14 days at the old wharf in the Lelu island.
Main tide levels are obtained by a harmonic analysis as follows ;

HHWL	-------	+ 1.84 m
MHWS	-------	+ 1.60
MHWN	-------	+ 1.08
MSL	-------	+ 0.92
MLWN	-------	+ 0.76
MLWS	-------	+ 0.20
LLWL	-------	+ 0.00

(2) Currents

Current observation was carried out in an area in front of a proposed wharf in the Lelu site. In the case of a spring flood tide, current flows from offshore to the existing distribution facilities. While at an ebb tide, the current flows in a reverse direction. Current velocity is observed at less than 0.5 knot, and it is not considered that there is any significant influence of current to berthing or mooring operation of fishing boats.

(3) Waves

The Kosrae island is located at N 5^{o}. Most of typhoons are generated

in this area, and there has not been observed any high typhoon waves. A wave height in front of the proposed sites is small due to energy absorption effect of wave breaking at a reef edge and friction effect over a shallow reef flat. Deepwater waves penetrating into an inner reef area, wind waves generated inside the reef flat and ship waves are taken into consideration to design mooring facilities and rubble slope.

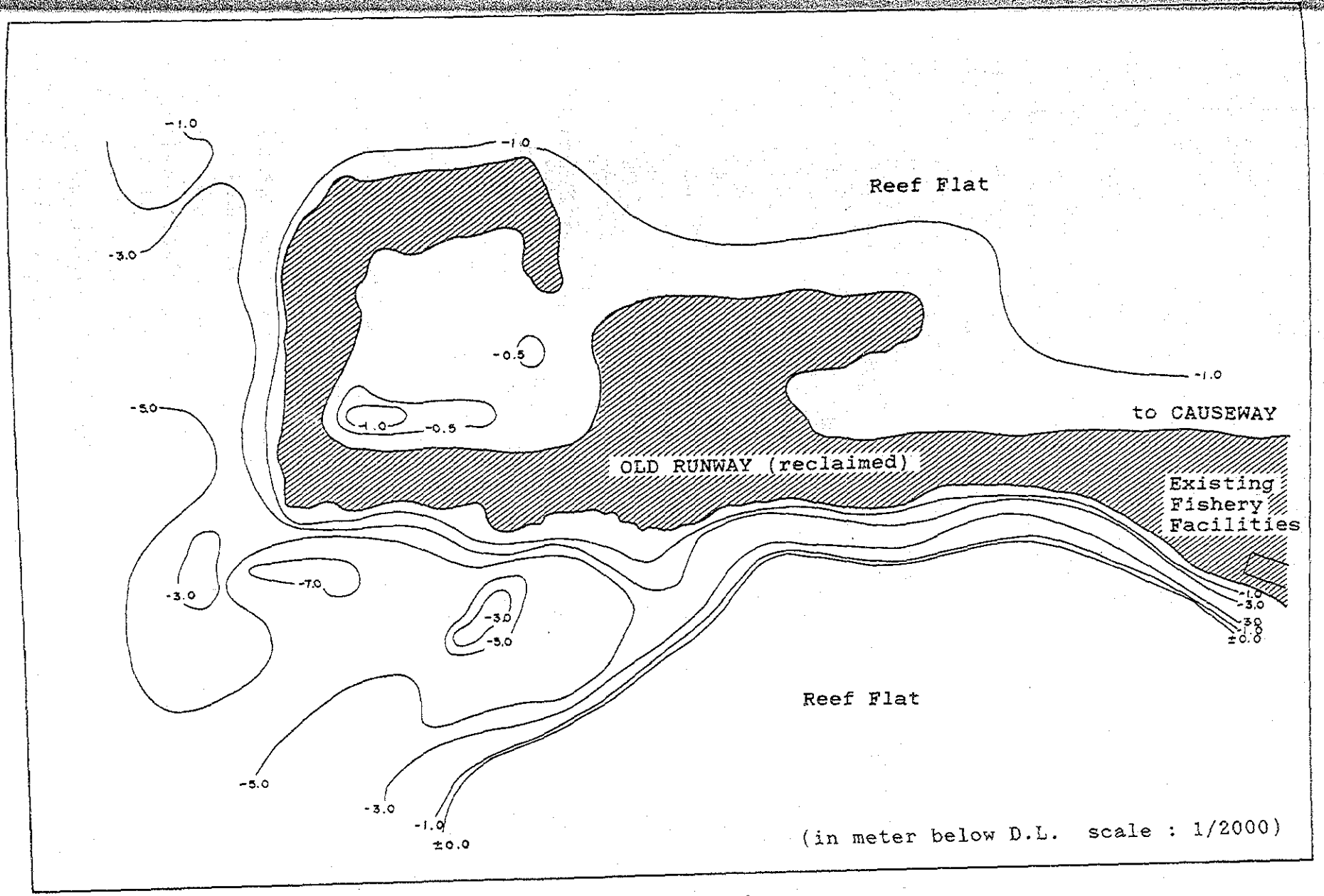
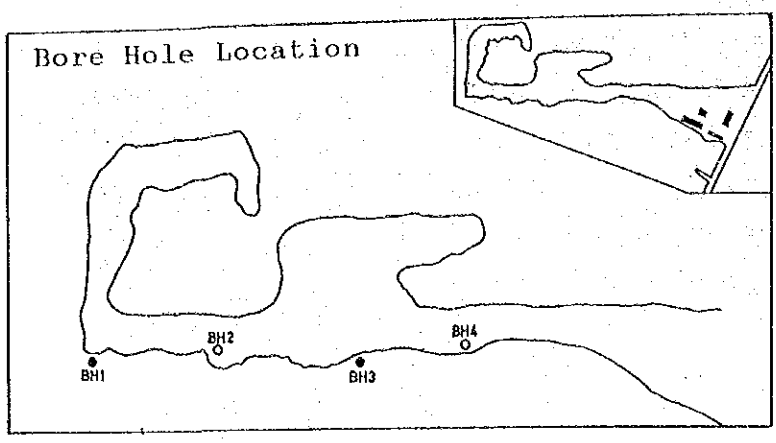
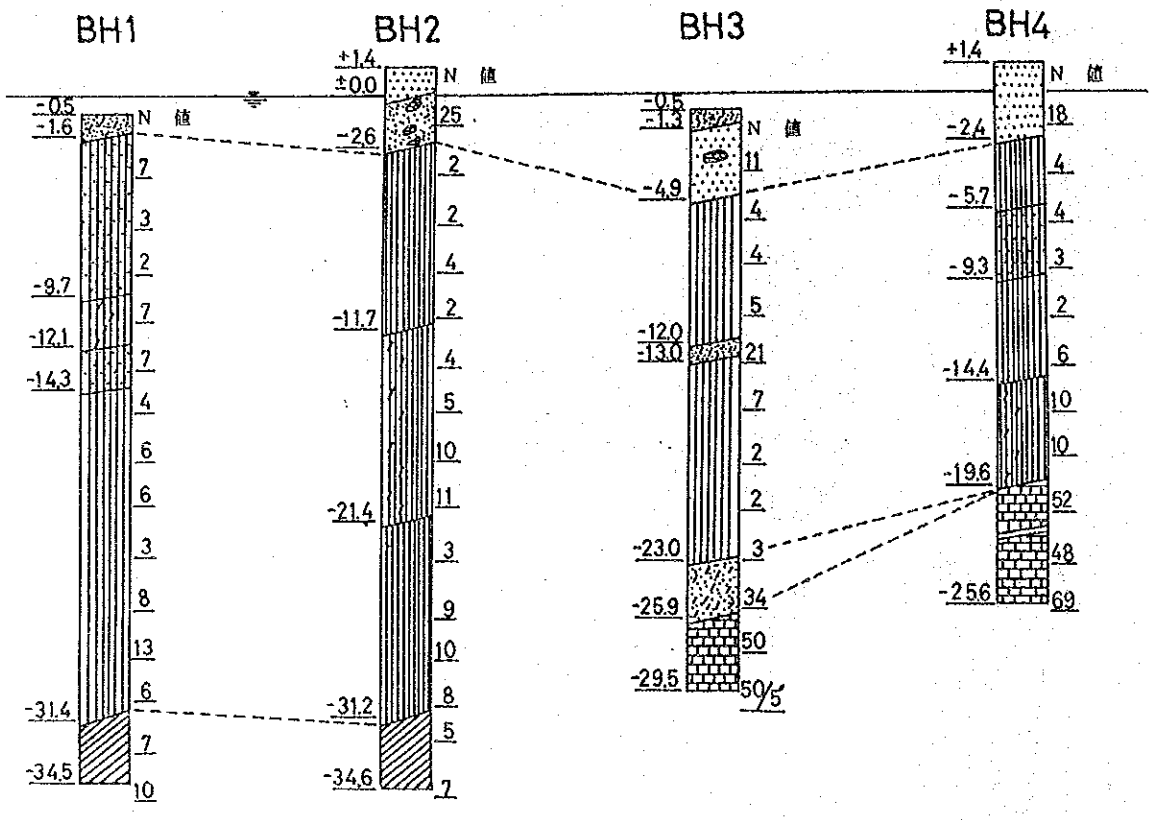


Fig.4.1 Bathymetric Chart, Lelu





Legend :

- GP Gravel-Sand Mixtures
- GM Silty Gravels
- SP Gravely Sands
- SM Silty Sands
- MH Elastic Silts
- CH Fat Clays
- Coralline Limestone

Fig.4.2 Boring Logs