BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR REINFORCEMENT
OF
FISHING PORT AND ITS FACILITIES
IN
THE REPUBLIC OF SEYCHELLES

JUNE 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to a request from the Government of the Republic of Seychelles, the Government of Japan has decided to conduct a basic design study on the Project for Reinforcement of Fishing Port and Its Facilities and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Seychelles a survey team headed by Mr. Mitsuyoshi Murakami, Director, Office for Overseas Fisheries Cooperation, International Affairs Div., Fisheries Agency, Ministry of Agriculture, Forestry & Fisheries from January 28 to February 26, 1990.

The team exchanged views with the officials concerned of the Government of Seychelles and conducted a field survey in the fishing port area. After the team returned to Japan, further studies were made. Then, a mission was sent to Seychelles in order to discuss the draft report and the present report was 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 Republic of Seychelles for their close cooperation extended to the teams.

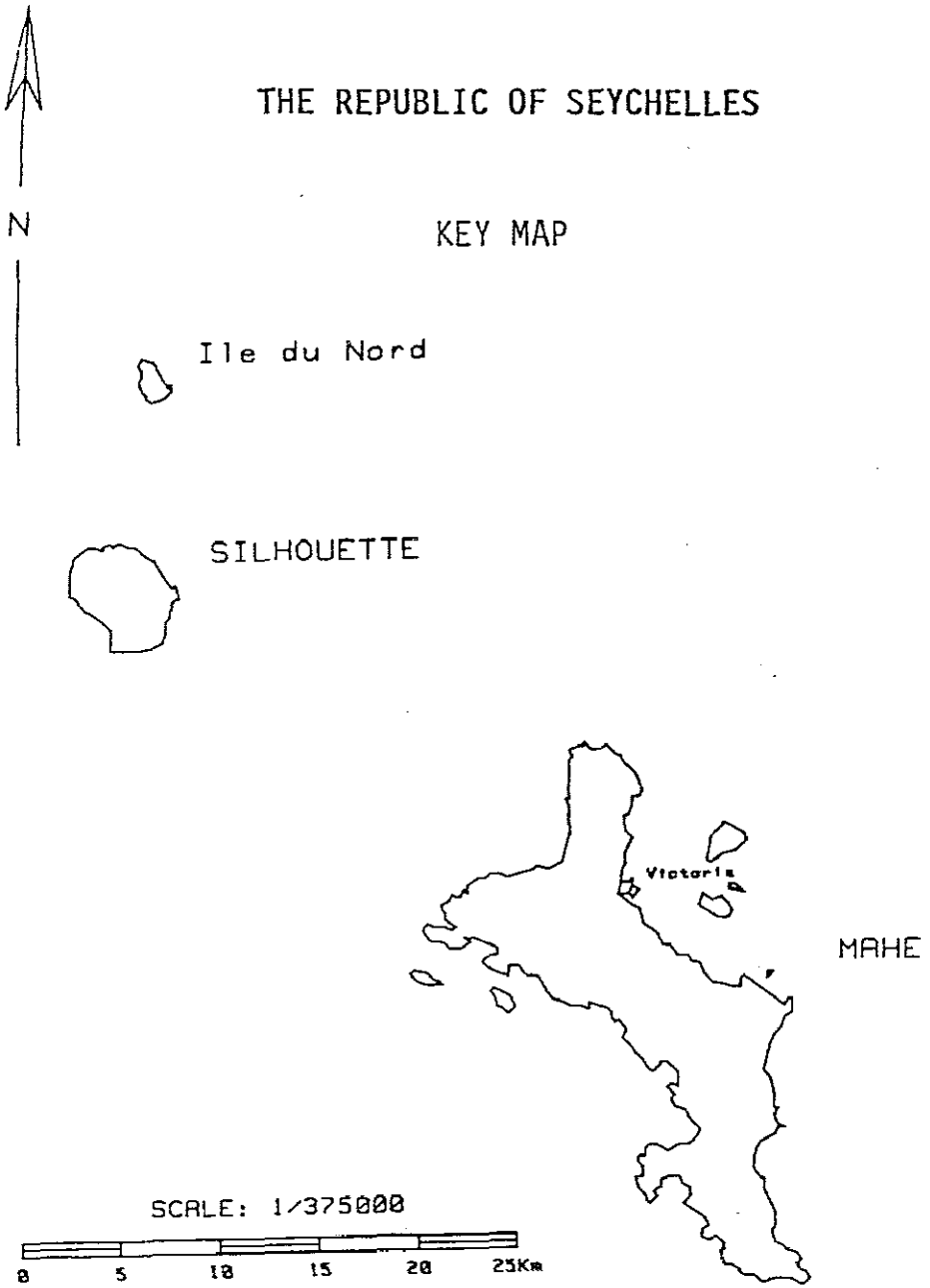
June 1990

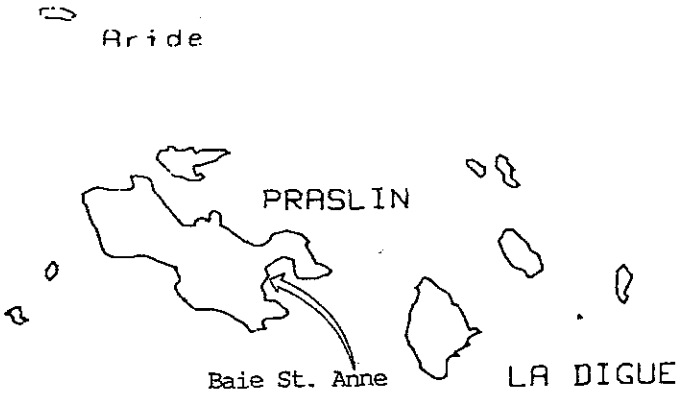
Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

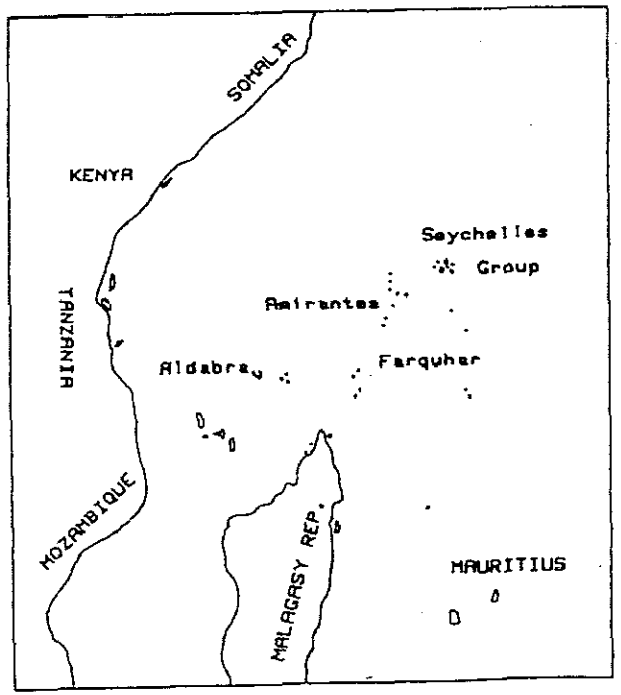
THE REPUBLIC OF SEYCHELLES

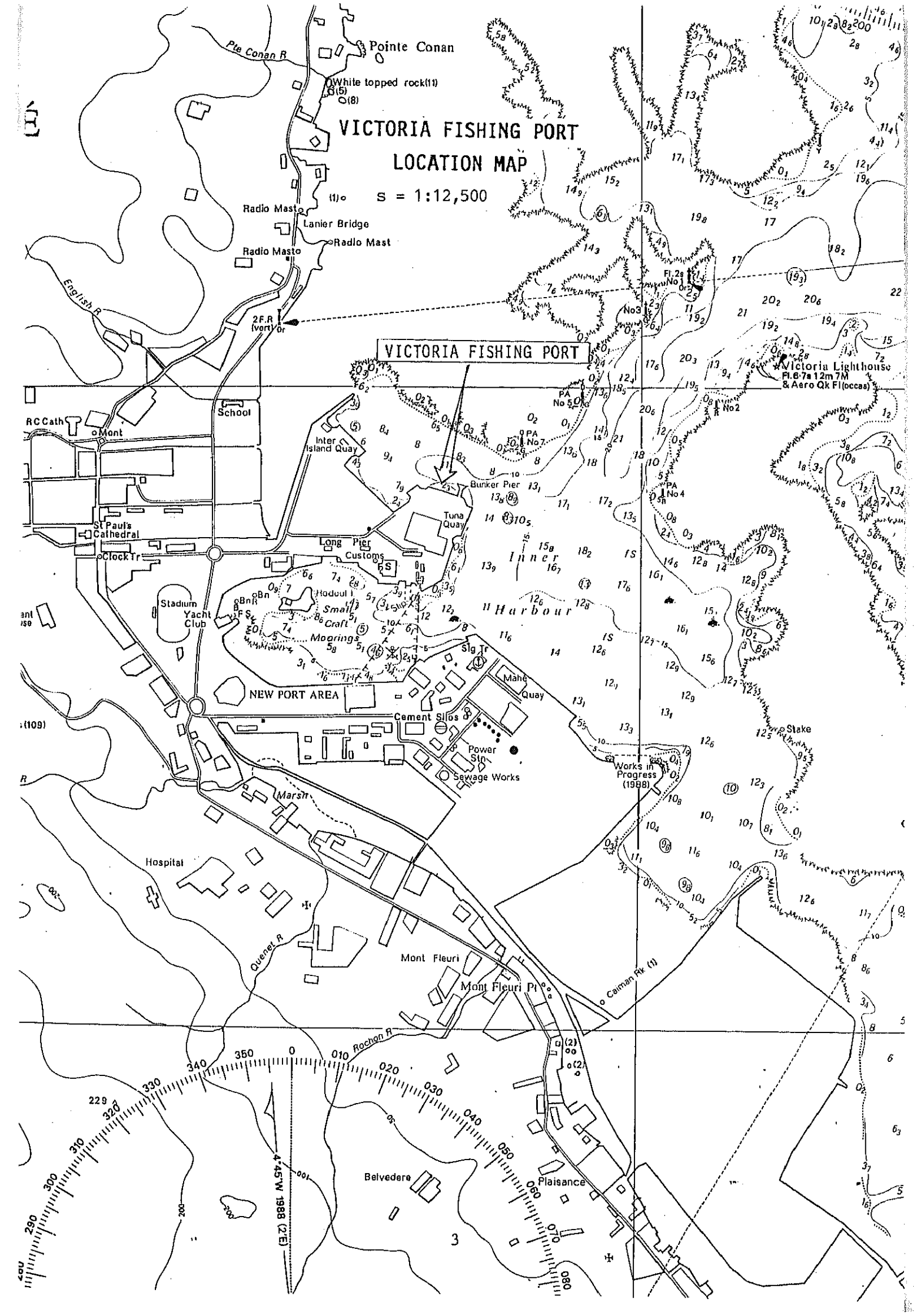
KEY MAP

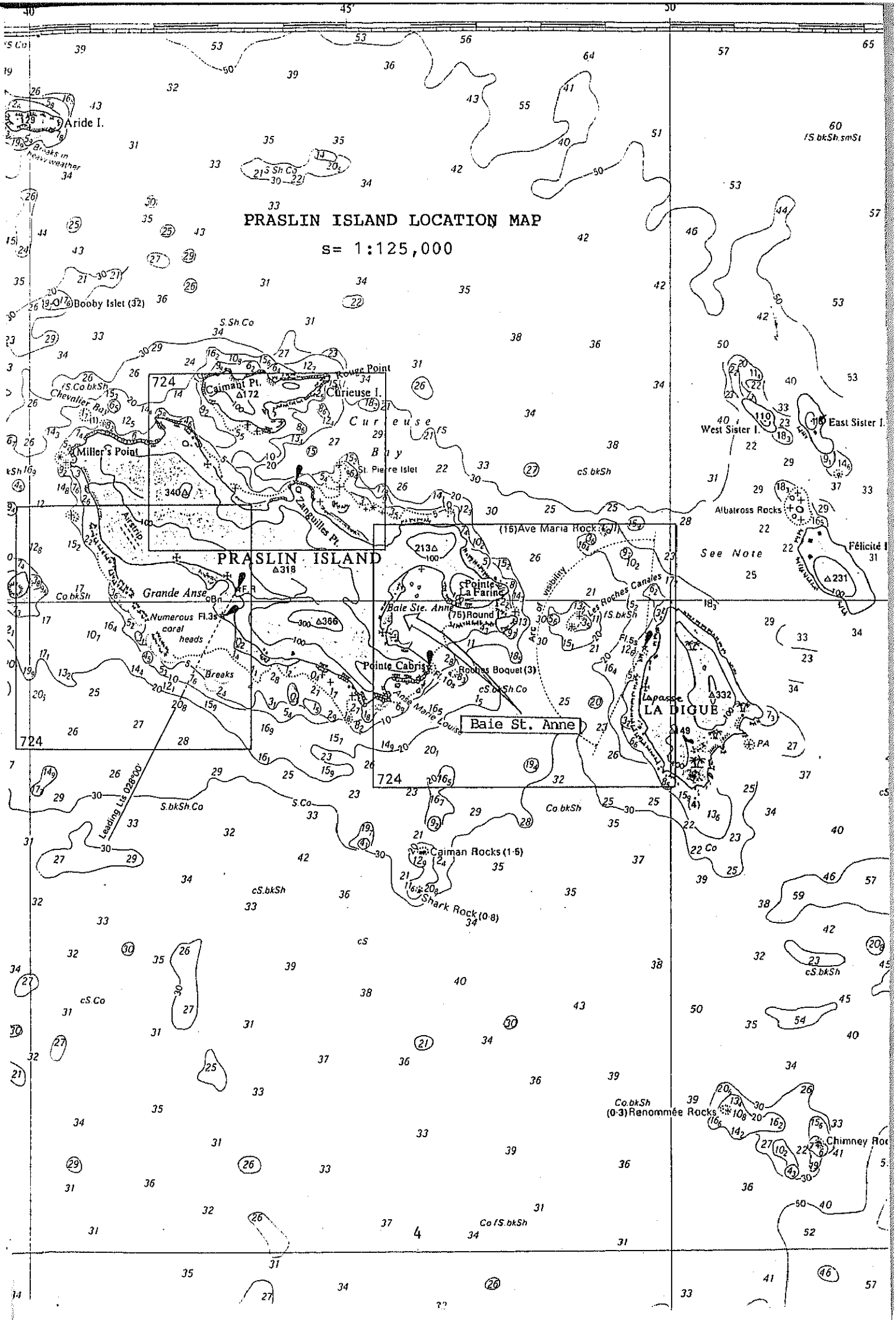


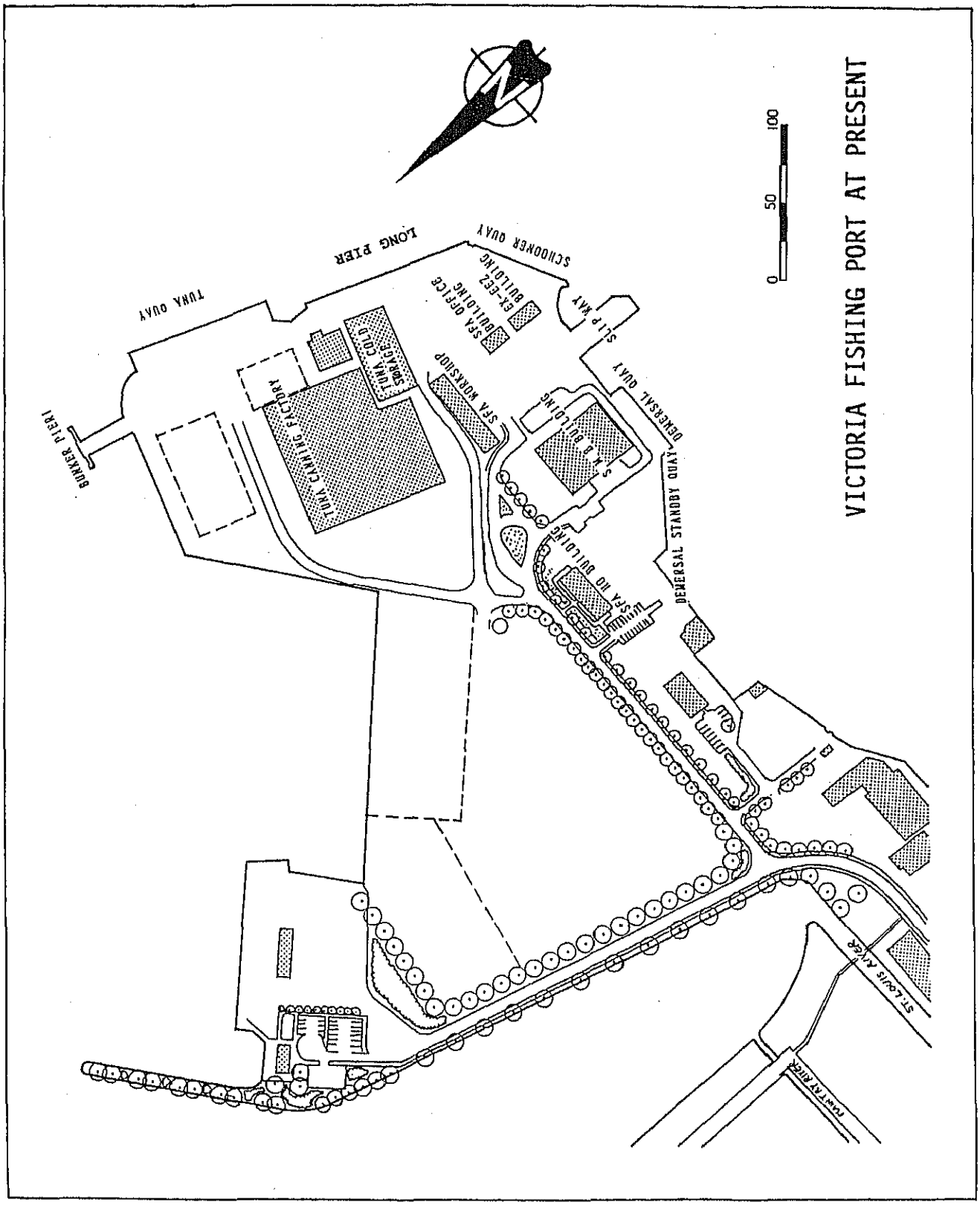


LOCATION OF SEYCHELLES

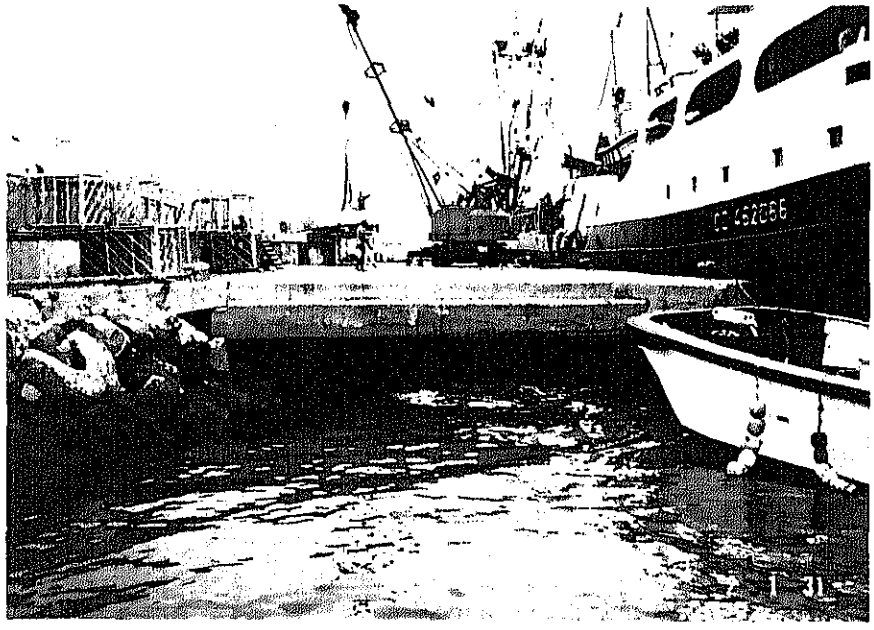



VICTORIA FISHING PORT
LOCATION MAP
S = 1:12,500
Pte Conan R
Pointe Conan
White topped rock(11)
Radio Mast
Lanier Bridge
Radio Mast
Radio Mast
English R
2F.R (vert) Or
VICTORIA FISHING PORT
Victoria Lighthouse
Fl.6·7s 12m 7M
& Aero Qk Fl(occas)
Fl.2s
No1
No3
No2
PA No 5
PA No 7
PA No 4
RC Cath
Mont
School
Inter Island Quay
Bunker Pier
Tuna Quay
St Paul's Cathedral
Clock Tr
Long Pier
Customs
Inner Harbour
Stadium
Yacht Club
Hoduol Small Craft Moorings
NEW PORT AREA
Sig Tr
Mahé Quay
Cement Silos
Power Stn
Sewage Works
Works in Progress (1988)
Stake
Marsh
Hospital
Quenet R
Mont Fleuri
Mont Fleuri Pt
Cayman Rk (1)
Rochon R
Belvedere
Plaisance
4·45°W 1988 (2·E)
3


PRASLIN ISLAND LOCATION MAP
s= 1:125,000
Aride I.
Booby Islet (32)
Caiman Pt.
Rouge Point
Curieuse I.
Curieuse Bay
Chevalier Bay
Miller's Point
St. Pierre Islet
Zanguilles Pt.
Anse Grande
PRASLIN ISLAND
Grande Anse
Numerous coral heads
Breaks
Pointe La Farine
Baie Ste. Anne
Pointe Cabris
Roches Boquet (3)
Anse Marie Louise
Baie St. Anne
Les Roches Canales
LA DIGUE
Lapasse
Ave Maria Rock
Round
Albatross Rocks
West Sister I.
East Sister I.
Félicité I
See Note
Caiman Rocks (1·5)
Shark Rock (0·8)
(0·3) Renommée Rocks
Chimney Roc
Leading Lts 028°00'
724
340
213
318
366
332
231
PA
Co.bkSh
S.bkSh.Co
cS.bkSh
S.Co
cS.Co
Co fS.bkSh
fS.bkSh.smSt
Breaks in heavy weather

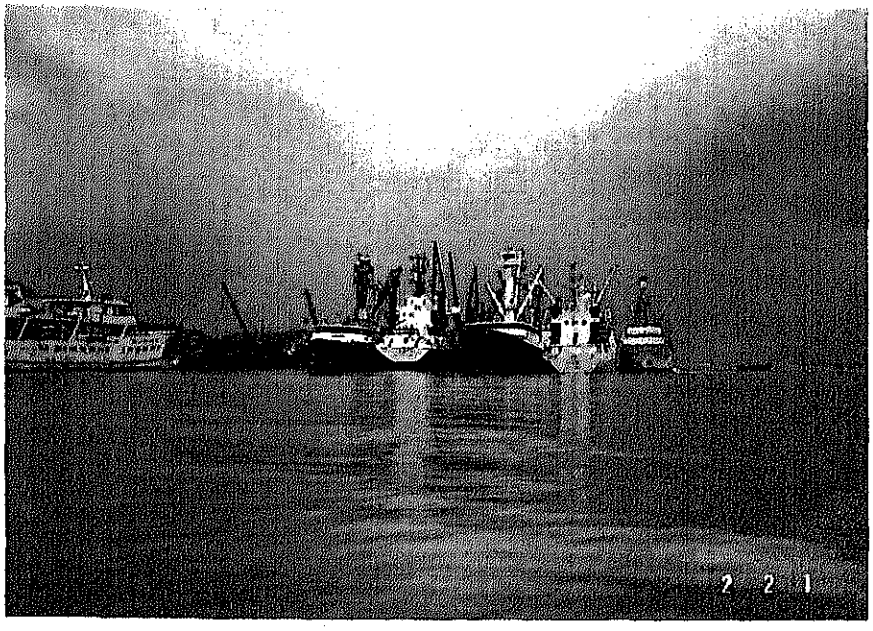

VICTORIA FISHING PORT AT PRESENT
0
50
100
LONG PIER
SCHOONER QUAY
TUNA QUAY
SLIP WAY
DEMERSAL QUAY
BUNKER PIER
TUNA CANNING FACTORY
TUNA COLD STORAGE
SEA WORKSHOP
SEA BOULOING
DEMERSAL STANDBY QUAY
SEA BOULOING
ST. LOUIS RIVER
TOWN RAT RIVER

View of Victoria Fishing Port in Mahe Island



Existing Tuna Quay

Damage
on Existing Long Pier



Berthing Method
for Fish Landing/
Transhipping

SUMMARY

SUMMARY

The Republic of Seychelles (hereinafter referred to as "Seychelles") is an island country located in the southwest portion of the Indian Ocean. It has a population of 66,000. Victoria, the capital, is located on Seychelles' largest island, Mahe.

Being a tropical country, both the temperature and humidity in Seychelles are high. The dry season with prevailing southeast winds is from May to September. The prevailing winds during the October to April wet season are from the northwest.

Seychelles' 200 nautical mile Exclusive Economic Zone covers approximately one million square kilometers of sea, an area that has rich migratory fish resources such as skipjack and tuna.

Seychelles' economy is supported mainly by the tourist industry. However, during the past five years the country's Gross Domestic Product (GDP) has been increasing steadily as a result of the exportation of domestic products, mainly canned tuna. Due to the large amount of imports, the 1988 international balance of payments for Seychelles showed a deficit and the country's financial situation is one of constant debt.

Seychelles' marine industry is characterized by its dual structure of the artisanal fishery that is based on traditional fishing methods and the industrial fishery brought in by advanced fishing countries.

Approximately 400 fishing boats are engaged in the artisanal fishery. The annual fish catch is about 4,000 tonnes. Recently, the artisanal fishery has encountered various problems, such as the aging of working fishermen and the deterioration of fishing boats due to the lack of new boat construction. To counter these problems, the Government of Seychelles has been protecting the fishermen and strengthening the fishery by promoting boat construction. The government also gives priority to the purchase of artisanal fish catches.

The industrial fishery is represented by skipjack and tuna purse seining. Within Seychelles' Exclusive Economic Zone, approximately 50 licensed foreign purse seiners operate. Their annual catch is about 220,000 tonnes (based on 1988 and 1989 catches). During a year's time, 200,000 tonnes of fish are transshipped at the Victoria Fishing Port, the base for purse seiners. Income from the fish catches and fish transshipping coupled with the license fees for foreign fishing boats represent very important sources of revenue for Seychelles.

The tuna canning factory that was built in the Victoria Fishing Port in 1987 has enabled the country to export canned tuna. This, too, has become a very important source of income for the country.

The policies established by the Government of Seychelles in its Third National Development Plan (draft, 1990-1994) are aimed at creating employment opportunities, increasing foreign currency earnings, and rehabilitating the Victoria Fishing Port to make it the central tuna fishing base in the Indian Ocean.

Plans for introducing government-use purse seiners and for expanding the canning factory are already in progress. The government is in this way actively working to develop and to expand the country's fisheries.

The Victoria Fishing Port, the Project site, is located in the northeastern part of Mahe, where the capital of the country, Victoria, is located. The port's waters are extremely calm. The fishing port was developed by dredging, land reclamation and quay construction under the East Coast Project (1985 through 1987). Very energetic fishery activities have been conducted in the port since that time. Unfortunately, due to the lack of quays in the fishing port and the deteriorated condition of the existing long pier quay (constructed in 1981), tuna boats are obliged to berth in multiple rows causing the quay to become extremely congested, and the fish landing and transshipping operations are greatly hindered. In addition, due to the lack of sufficient port facilities, such as an ice making plant, local fishing boats cannot receive adequate ice supplies in a timely manner and, as a

result, their fishing time is limited and maintaining fish freshness is greatly hindered which has an effect on fish prices.

In view of the above background, the Government of Seychelles placed the "Project for Reinforcement of Fishing Port and Its Facilities" (hereinafter referred to as the "Project") as a part of the country's Fisheries Development Project in order to make the port a major tuna fishing base in the Western Indian Ocean and has requested grant aid cooperation from the Government of Japan to rehabilitate the existing tuna quay, construct a new quay, and build port related facilities (ice making plant, etc.).

In response to the Government of Seychelles' request, the Government of Japan decided to conduct a basic design study on the Project and entrusted it to the Japan International Cooperation Agency (JICA). JICA sent the Basic Design Study Team to Seychelles from January 28 to February 26, 1990.

The study team confirmed the background and objectives of the Government of Seychelles' request for the Project, examined the social and economic effects of Project implementation and the appropriateness of implementing the Project under the grant aid programme of the Government of Japan. The team also conducted field surveys to collect related data and a topographic survey necessary for preparing the basic design for the Project. The Team held a series of Project related discussions with officials concerned of the Government of Seychelles.

The field surveys brought to light the following problems at the Victoria Fishing Port:

- The existing long pier quay is damaged and its condition is dangerous;
- Due to the shortage of quays in the fishing port, the port is extremely congested;
- Because the present ice making plant has a low capacity not only in Victoria Port but also in Praslin Island, fishing boats must wait a long time to receive an adequate ice supply; this cuts into the operating time of the boat . Also, without a sufficient ice supply, the maintaining of fish freshness is hindered.

To solve the problems outlined above, the following necessary and optimum size facilities of the Project under Japanese grant aid are planned:

Fishing Port Civil Facilities:

(1) Construction of New Tuna Quay:

Structure type:	Vertical pile pier
Water depth:	DL -7.5 m
Quay elevation:	DL +2.85 m
Quay length:	60 m
Ancillary facilities:	Water/Oil supply facilities 2 nos. respectively

Related Fishing Port Facilities:

(1) Construction of Ice Making Plant (Victoria)

Ice making capacity:	6 tonnes/day
Ice storage capacity:	6 tonnes
Building:	25 m^2

(2) Construction of Ice Making Plant (Praslin)

Ice making capacity	4 tonnes/day
Ice storage capacity	8 tonnes
Building:	25 m^2

Project construction is to be carried out in one phase after the Exchange of Notes are signed, which will cover a seventeen (17) month period (five months for the preparation of the detailed design and tender documents; twelve months for construction).

The agency responsible for Project implementation is the Seychelles Fishing Authority (SFA). After completing the Project facilities, the Seychelles Marketing Board (SMB) and the Port and Marine Services Division of the Ministry of Tourism and Transport will join SFA in the management, operations, and maintenance of the facilities. These agencies have competent and experienced personnel for undertaking the above work.

The costs necessary for management, operations and maintenance are estimated to be SR 340,000/year for the quay and SR 640,000/year for the ice making plants. However, the costs will be financed by the proceeds derived from quay use fees of the increased number of fishing boats (SR 830,000/year) and the sale of ice (SR 1,070,000/year).
Thus no difficulty will be encountered in the operation and maintenance of the facilities after completion.

After Project construction is completed, the fishing boat congestion at the quays will be eliminated and smooth fish landing and transshipping operations will be possible. The revenue from quay fees and from the volume of fish landed and transshipped will increase. Also, an increase in employment opportunities is expected. An efficient fish supply to the canning factory that is to be expanded will be possible, thereby bringing about an increase in factory activities and income.

After constructing the ice making plants, the operation ratio of local fishery boats and the freshness of fish caught by the artisanal fishery will be improved and the export of fresh fish will increase. The quantities and values of the fish to be purchased by SMB will increase as will local fishermen's incomes.

These Project effects will contribute greatly to Seychelles' fishery development as well as to the country's stable economic development. These effects are in agreement with the Government of Seychelles' policies established in its National Development Plan.

In view of the above, it is thought to be worthwhile to implement the Project with grant aid cooperation from the Government of Japan. The early implementation of the Project is looked forward to with great anticipation.

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

The Republic of Seychelles (hereinafter referred to as "Seychelles") has a vast 200 nautical mile Exclusive Economic Zone (EEZ). Within this EEZ the artisanal fishery, based on traditional fishing methods, and the industrial fishery brought in from advanced fishing countries are carrying out active operations. The annual fish catch by artisanal fishery amounts to 4,000 tonnes. The annual catch by industrial fishery amounts to 220,000 tonnes.

The Seychelles fisheries have developed into an important industry. In the National Development Plan the Government of Seychelles has placed strong emphasis on social and economic development by effectively utilizing and developing the country's rich fish resources.

The Victoria Fishing Port, the Project site, in Mahe is carrying out its very important role as the central base for the artisanal fisheries and industrial fisheries that are engaged in skipjack and tuna fishing in the Western Indian Ocean. Unfortunately, the existing long pier quay is damaged and port related facilities are inadequate. The present conditions are hindering the development of the country's fisheries. To solve these problems, the Government of Seychelles made the "Project for Reinforcement of Fishing Port and Its Facilities" a part of the country's Fishery Development Project and requested grant aid cooperation from the Government of Japan for the implementation of the Project.

In response to the request of the Government of Seychelles, the Government of Japan decided to conduct a basic design study of the Project and entrusted it to the Japan International Cooperation Agency (JICA). JICA sent the Basic Design Study Team, headed by Mr. Mitsuyoshi Murakami, Director, Office for Overseas Fisheries Cooperation, International Affairs Division, Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries, to Seychelles from January 28 to February 26, 1990.

The Team confirmed the detailed contents and background of the Government of Seychelles' request and examined the appropriateness of the Project to be implemented with grant aid cooperation from the Government of Japan in view of the Project's social and economic effects. Also, the team

conducted the field surveys that included data gathering and the topographic survey necessary for the preparation of the basic design of the optimum size facilities and equipment for the Project.

During the field survey period the team also held a series of Project related discussions with officials concerned of the Government of Seychelles. The basic agreements related to the Project that were reached by both parties were written up as the Minutes of Discussions and signed by the parties.

In Japan, based on the Minutes of Discussions, JICA analyzed and examined the results of the field surveys, evaluated the Project effects that will influence Seychelles' fishery development and economy and prepared the basic design of the optimum size Project facilities.

As a result, the report "The Draft Final Basic Design Study Report on the Project for Reinforcement of Fishing Port and Its Facilities" was prepared. The Draft Final Report Explanation Team was sent to Seychelles to discuss and explain the contents of the report with officials of the Government of Seychelles from May 22 to June 4, 1990.

The team explained the report and held a series of discussions concerning the contents of the report with officials of the Government of Seychelles.

As a result, this report, "The Basic Design Study Report on the Project for Reinforcement of Fishing Port and Its Facilities", has been prepared to describe the basic design of the optimum size facilities for the Project, Project effects, and the conclusion of the Basic Design Study.

The members of the Study Team, the list of interviewed personnel, the Study Team's itinerary, and the Minutes of Discussions on the Project are listed as data in the Appendices.

CHAPTER 2 BACKGROUND OF THE PROJECT

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2.1 Outline of Seychelles

(1) Country

Seychelles is located in the southwest portion of the Indian Ocean at $4^{\circ}40'$ south latitude and $55^{\circ}30'$ east longitude. It is a typical island country made up of nearly 100 islands. The total land area is 452.5 km^2.

The island of Mahe, where Victoria, the capital of Seychelles, is located, has a land area of 152.5 km^2. Praslin has an area of 37.6 km^2 while La Digue has 10.1 km^2.

The 200 nautical mile Seychelles Exclusive Economic Zone covering nearly 1,000,000 km^2 is an excellent fishing ground.

Seychelles is a tropical country having high temperatures and high humidity. The average high temperature is $29.8^{\circ}C$ and the average low temperature is $24.5^{\circ}C$. The average humidity is 80%. The year may be divided into the dry season from May to September with prevailing southeast winds, and the wet season from October to April with northwest winds. The annual rainfall comes to 2,200 mm. The country is not affected by cyclones.

(2) Population

Seychelles has a population of 66,000 with an annual increase of 0.7% over the past ten years. 88% of the inhabitants live on Mahe, 7% live on Praslin, and 3% live on La Digue. The population density is 330/km^2. Victoria, the capital, has a population of 17,000.

(3) *Economy*

The Gross National Product of Seychelles amounts to 1.29 billion Rupees (U.S. $240 million in 1987). The per capita GNP comes to 19,500 Rupees (U.S.$3,600). The average annual increase over the past five years has been 6%.
The *Gross Domestic Product* (GDP) *is* 1.37 billion Rupees (U.S.$250 million in 1987), with a per capita GDP of 20,700 Rupees ($3,800). (Rupee = Seychelles Rupee)

The ratio of the GDP by industries is shown in Fig. 2-1-1. Transportation, services, and even manufacturing seem intended for tourists. From this it can be seen that the tourist industry has a great impact on the Seychelles economy. The fishing industry only occupies 1.5% of the GDP. This figure only includes the fishing conducted by local fishermen. Due to the statistical method, the tuna related industries are included with other industries. If the tuna figures were included with the fishing industry figures, the GDP ratio would be an estimated 8 to 12% (based on an estimation by the Seychelles government), and it is thought that fishing would be second only to the tourist industry.

In 1988 income from tourism amounted to 433 million Rupees, followed by 57 million Rupees for the export of canned tuna. Canned tuna exports makes up 76% of the total export of domestic products; it is regarded as an important industry for the obtaining of foreign currency. And income from the tuna fishery such as fishing license fees, transshipment fees, fishery port tariffs, etc., amounted to 120 million Rupees per year in 1988, which greatly affects the economy of the country. On the other hand, the import of food products has reached 637 million Rupees causing a deficit in Seychelles' international balance of payments for 1988 (see Table 2-1-1).

Furthermore, the country has a constant debt problem. The national budget for 1990 comes to 1 billion Rupees, of which 400 million Rupees will be appropriated to pay the debts (see Table 2-1-2).

Table 2-1-1 Balance of Payments

Balance of Payments

(R million)

	1984	1985	1986	1987	1988
CURRENT ACCOUNT, NET	-95.4	-132.5	-205.2	-117.8	-50.6
Goods, services & income, net	-185.5	-228.9	-275.5	-236.8	-179.3
Of which:					
Tourism income	278.8	329.9	341.8	374.0	433.1
Exports f.o.b.	35.3	33.1	27.4	45.0	90.4
Re-exports f.o.b.	145.2	166.2	87.8	81.0	79.3
Marine & port charges	13.8	19.2	19.2	20.0	20.7
Imports f.o.b.	-523.9	-597.0	-552.2	-538.4	-637.2
Freight & insurance	-92.8	-105.7	-97.8	-95.4	-112.8
Foreign travel	-48.5	-65.1	-59.1	-66.9	-70.6
Interest : receipts	10.5	11.4	9.7	11.6	12.6
payments	-20.8	-23.8	-29.0	-45.4	-47.3
Transfers, net	90.1	96.4	70.3	119.0	128.7
Of which:					
Official grants	92.4	84.2	86.0	105.0	125.0
Fishing licence fees	12.6	18.0	16.0	27.0	26.8
CAPITAL ACCOUNT, NET	113.7	117.6	206.9	106.4	26.4
Official loans, net (1)	83.7	109.2	159.0	20.9	-52.0
Commercial bank's assets	-12.6	0.6	-3.8	6.9	-5.0
Private capital, net	42.6	7.8	51.7	78.6	83.4
CURRENT & CAPITAL ACCOUNT, NET	18.3	-14.9	1.7	-11.4	-24.2
Errors & omissions	-27.5	12.4	-12.5	35.1	0.5
Change in reserves (2) (Minus sign indicates increase)	9.2	2.5	10.8	-23.7	23.7

(1) This comprises drawings net of repayments by the Central Government, Central Bank and other public sector organisations.

(2) Comprises of external reserves of Central Bank and other public sector.

(Source: Annual Report 1988)

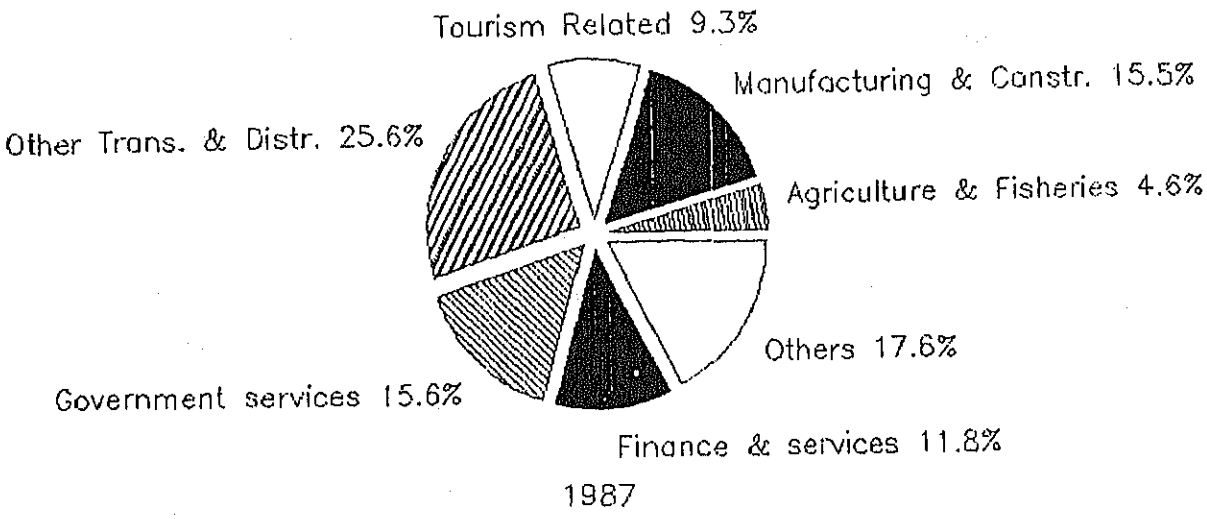


Fig. 2-1-1 Ratio of Gross Domestic Product by Industries (1987)

(Source: Statistical Abstract 1988)

Allocation of Authorised Expenditure	**R'000**
President's Office	5,374
Ministry of Agriculture & Fisheries	14,100
Ministry of Tourism & Transport	47,399
Ministry of Finance	17,094
Department of Defence	78,200
Department of Legal Affairs	2,948
Judiciary	4,380
Department of Audit	1,067
Ministry of Education	134,844
Ministry of Planning & External Relations	9,718
Ministry of Employment & Social Affairs	13,650
Ministry of Health	62,172
Department of Environment	6,700
Department of Industry	3,650
Ministry of Administration & Manpower	12,467
Ministry of Community Development	8,000
Ministry of Information, Culture & Sports	27,800
Pensions & Gratuities	14,800
Public Debt Servicing	400,655
Centralised Payments	208,781
TOTAL	1,073,799

Table 2-1-2 1990 Budget of Seychelles

(Source: 1990 Budget)

2.2 Seychelles' Marine Industry

(1) Outline

Seychelles' marine industry may be divided into two completely different fisheries that have nothing in common with each other. One is the artisanal fishery based on traditional fishing methods. The other is the industrial fishery brought in from advanced fishing countries. Seychelles has a vast 1 million km^2 Exclusive Economic Zone (EEZ), of which 3% is used as fishing grounds by local fishermen.

Fishing has a long tradition in Seychelles. Fishing is not only a source of food supply, but also an important means of obtaining foreign currency. Recently, however, the following problems have emerged which are proving to be an obstacle in the development of the fishing industries:

- Compared to tourism and other industries, the working environment in the fishing industry is inferior. Very few young people seek employment in the fishing industry and the age of those people already engaged in fishery is increasing.
- The fishing boats are getting old.
- As the fishing boats are small, there are great seasonal fluctuations in the scale of the catches, and due to the practice of handline fishing, there is a limit to catch volume.

In order to protect and intensify the country's fishing industry, the government has been assisting the artisanal fishery to improve and modernize fishing techniques and facilities by promoting fishing boat construction and by giving priority to the purchase of fish caught by the artisanal fishery.

Since the Seychelles EEZ was established at 200 nautical miles in 1987, it has been used by foreign fishing boats as a good fishing ground for skipjack and tuna fishing. Mahe's Port Victoria has developed as a base for these activities. For a country that had no major industry other than tourism,

collecting the fishing license fees from foreign vessels to increase revenue was obviously a natural move. As a result, it has greatly contributed to the economic development of the country.

The establishment of a canning factory in 1987 has helped make canned tuna the top domestic export item while the industrial fishery has developed into an important industry. The government not only intends to increase its revenue through the collection of fees from foreign vessels, but also strengthen its own industrial fisheries in the future.

The agency responsible for managing and promoting this double-structured fisheries sector is the Seychelles Fishing Authority (SFA), an executive arm of the government. The processing, distribution, wholesaling and export of fish are the responsibilities of the Seychelles Marketing Board (SMB). Thus, these two agencies will play a very active role in the Seychelles fishing industry.

(2) Artisanal Fishery

Fish landings in Mahe, Praslin and La Digue are separated into coastal and offshore fishery according to the scale.

i) Type of Fishing Boats and Operating Rate

Coastal fishery is conducted by ① Pirogues (boats, non-motorized) ② Boats with outboard engines and whalers (without fish hold) operating within 30 miles of the coastline which is one day's sailing range. Two-thirds of the total artisanal fishery catch is obtained by these boats. Offshore fishery is conducted by ① Whalers (with fish hold) and ② Schooners that account for one-third of the total catch.

The fishing area of whalers is within 60 miles of the coastline, while on the other hand, that of schooners is for within a 150 mile range. These offshore fishing boats have the tendency of operating during the early part of the week

and then lie in port on weekends. Generally, the boats sail once a week. Table 2-2-1 lists the types of boats.

Table 2-2-1 Types of Fishing Boats

Boat Type	Length(m)	Engine (HP)	Fish Hold (tonne)
Pirogue	Up to 5	-	
Outboard engine	5 to 6	10 to 25	
Whaler	8 to 12	20 to 37 (diesel)	1 - 2
Schooner	9 to 16	27 to 60 (diesel)	More than 3

(Source: SFA)

As shown in Table 2-2-2, the total number of fishing boats reached a peak of 445 in 1986. This number has decreased to 406 in 1988. The number of small boats (pirogues and those with outboard engines) involved in coastal fishery has decreased due to the lack of new boat construction, fishermen seeking other jobs, the lack of funds, and the aging of working fishermen. These are the problems confronting the coastal fishery. On the other hand, the number of whalers is increasing whereas big schooners are decreasing. The offshore fishery using whalers has been accepted by the fishermen in terms of funds, catch, operating period and income. There are about 1,000 fishermen in the artisanal fishery and no great changes can be seen. A total of about 6,000 persons including families are estimated to be involved in the artisanal fishery related industry.

Table 2-2-2 Number of Fishing Boats by Type

Type / Year	Pirogue	Outboard Engine	Whaler	Schooner	TOTAL
1984	100	227	39	38	404
1985	125	222	37	21	405
1986	162	209	53	21	445
1987	148	182	60	24	414
1988	135	180	70	21	406

(Source: SFA)

ii) Fish Catch

Total fish catch by artisanal fisheries are shown in Table 2-2-3.

Table 2-2-3 Total Fish Catch by Artisanal Fisheries

(Unit: tonne)

	Year	1985	1986	1987	1988	1989
	January	275	370	317	300	293
	February	275	455	426	361	370
	March	317	333	374	379	382
M	April	440	377	394	539	430
O	May	299	542	358	503	447
N	June	337	505	305	256	311
T	July	323	313	307	275	263
H	August	162	145	159	189	296
	September	329	247	231	256	429
	October	436	479	374	322	374
	November	472	532	306	319	472
	December	400	333	392	644	325
A	Mahe	3,405	4,090	3,418	3,675	3,568
R E A	Praslin & La Digue	660	541	525	668	824
	TOTAL	4,065	4,631	3,943	4,343	4,392

(Source: SFA)

The catch has been decreasing since its 1978 peak of 5,400 tonnes down to 3,750 tonnes in 1983. Recently, however, it has recovered to 4,000 tonnes due to the country's development project.

The catch decreases during the monsoon season from June to August. Apart from this season, however, the average monthly catch comes to 400 tonnes/month.

Table 2-2-4 shows the annual catch per landing area per boat type. It can be seen that most of the catch is made by small coastal boats (pirogues and those with outboard engines) and whalers. The landings at Port Victoria per type of boat are: small boats, 53 tonnes; whalers, 687 tonnes; schooners, 472 tonnes; sports boats, 10 tonnes. This represents a catch of 1,222 tonnes that accounts for 30% of the entire catch.

Table 2-2-4 Fish Catch by Boat Type and Area in 1988
(On foot not included)

(Unit: tonne)

Boat Type / Area	Pirouge & Outboard Engine	Whaler	Schooner	Sports	TOTAL
Mahe Northwest	338	104			442
Mahe Northeast	199	748	472	10	1,429
Mahe East	301	783			1,084
Mahe West	146	274			420
Subtotal	984	1,909	472	10	3,375
Praslin Northeast	264	61			325
Praslin Northwest	166	26			192
La Digue	163	22			185
Subtotal	593	109			702
TOTAL	1,577	2,018	472	10	4,077

(Source: SFA)

The landed species are high-grade fish, such as carangues 32%, job 10%, capitaine 7%, maguerean 7% and red snapper 9%.

The landed fish supplies most of the animal protein source for the people of Seychelles. The average fish consumption in Seychelles is 65 kg/person/year.

Some of the landed fish is purchased by the Fish Division of the Seychelles Marketing Board (SMB) for exporting.

The supply of fine quality fish to tourists has contributed indirectly to the tourist industry which is the country's top foreign currency earning industry.

iii) Export of Marine Products

Marine products have been exported since the mid 1970's. The price of Seychelles' agricultural product exports, such as copra and cinammon, have recently declined on the international market and the government has been trying to increase the export of marine products.

Table 2-2-5 shows the amount of marine products exported by destination. Eighty percent of the exports go to Reunion, followed by England 10%. Expensive fish, such as red snapper, job, and capitaine, are exported. These are made into fish fillets at the SMB's processing facility and are then packed fresh or frozen in insulated fish boxes with ice and sent by air. Most of the frozen fish is exported by regular boats in refrigerated containers or by reefer cargo boats. Only a small amount of the frozen fish is packed with dry ice and sent by air. In 1989 the SMB purchased 1,308 tonnes out of the total catch of 4,392 tonnes, of which 261 tonnes were exported fresh and 445 tonnes were exported frozen.

Table 2-2-5 Export of Marine Products to Designated Countries

(Unit: tonne)

Year / Destination	1985	1986	1987	1988	1989
Australia		2	56	8	-
Bahrain		-	0.3	0.1	-
Denmark		-	2	19	12
England		54	93	84	74
France		69	141	54	21
Italy		1	11	22	14
Japan		-	-	0.2	-
Reunion		159	364	340	561
South Africa		-	5	21	-
United States		-	1	11	1
West Germany		0.1	1	15	21
Greece		-	-	0.5	-
Others		10	0.3	0.1	2
TOTAL	302	295	675	575	706

(Source: SFA)

(3) Industrial Fishery

Seychelles' 200 nautical mile EEZ provides excellent fishing grounds for skipjack and tuna. However, the pelagic fishery grounds have not been developed by domestic fishing boats of Seychelles but have been developed by Japanese and Korean tuna long-line fishing boats before the EEZ was established. Purse seiners from EC countries transferred to this area from the Atlantic Ocean since the early 1980's after a period of successful test operations.

Subsequently, Russian and Japanese purse seiners moved into the EEZ after paying fishing license fees.

i) Tuna Long-line Fishery

Yellowfin tuna caught by long-line fishing within the EEZ are sent to Japan for use as "Sashimi" (raw fish).

Seychelles has tuna long-line fishing agreements with Japan and Korea that grant fishing rights within Seychelles' EEZ. In 1988, 40 Japanese fishing boats and 127 Korean boats had a total of 292 operating months in the area.

101 tuna long-liners use Port Victoria as their transshipping port. They transship their catch while moored to harbour buoys.
In 1988, 12,103 tonnes of tuna fish were transshipped at Port Victoria (see Table 2-2-6).

ii) Skipjack and Tuna Purse Seining

As of Feb. 1990 the following numbers of purse seiners were granted fishing rights by Seychelles: France 20; Spain 22; Panama 1; Mauritius 3; Soviet Union 4; Japan 4, for a total of 54. Table 2-2-7 shows the number of licensed boats entering the area each year.

Due to the exploitation of the new fishing grounds in the Straits of Mozambique and the African east coast, fishing has become possible all year long, increasing the catch per boat. The total catch is shown in Table 2-2-8.

Table 2-2-6 Amount of Catch and the Number of Long-Liners

Year	Total Catch (tonnes)	Catch Rate (tonnes/day)	No. of Licensed Long-Liners	Licensed Period (months)	Transshipped Catch at Port Victoria
1980	3,100	1.16	106	231	-
1981	5,213	1.13	93	189	1,400
1982	9,561	1.42	145	310	3,200
1983	6,200	-	110	202	8,559
1984	-	1.11	102	160	-
1985	-	0.89	67	69	7,002
1986	2,400	1.10	50	102	11,367
1987	6,600	1.23	86	225	14,099
1988	7,459	1.18	167	292	12,103
1989	-	0.98	128	303	8,266

(Source: SFA)

Table 2-2-7 Number of Licensed Purse Seiners Operating in Seychelles' EEZ

Year / Month	1983	1984	1985	1986	1987	1988	1989
Jan.	5	14	49	38	33	39	49
Feb.	5	17	49	38	33	37	49
Mar.	5	22	46	36	33	33	47
Apr.	5	27	45	35	31	38	46
May	5	32	35	34	29	39	45
Jun.	5	32	34	31	30	38	44
Jul.	6	27	28	29	30	43	46
Aug.	7	29	30	32	33	44	46
Sept.	6	37	33	34	38	46	50
Oct.	6	41	36	33	41	43	51
Nov.	13	46	37	33	41	47	52
Dec.	14	49	38	33	41	48	51
TOTAL	82	373	460	406	413	495	576

(Source: SFA)

Table 2-2-8 Total Catch and Transshipped Amount by Purse Seiners

	1983	1984	1985	1986	1987	1988	1989
Total Catch (tonnes)	19,700	98,044	128,584	143,099	163,302	227,655	218,850
Catch Rate (tonnes/day/boat)	11.44	13.03	13.23	15.15	17.97	22.03	18.72
No. of Boats Operated	82	373	460	406	413	495	576
Transshipped Amount (tonnes)	-	-	122,697	126,820	137,172	200,573	(157,093)
No. of Trans-shipping Boats	-	-	304	261	255	324	(268)

(Source: SFA)
NOTE: Figures in parentheses indicate the record until September.

The total catch in 1988 reached 227,655 tonnes, with the stable figure of 218,850 tonnes in 1989. The catch from the EEZ is transshipped to reefer cargo boats either in Port Victoria or while anchored in the harbour basin or at sea. About 90% of the total catch (200,573 tonnes) was transshipped to reefer cargo boats in 1988. According to the SFA, the amount of fish transshipped in 1988 using the quay at Victoria Fishing Port amounted to 82,372 tonnes. About 9,000 tonnes of fish to be canned at the cannery are landed annually at the quay. Fishing license fees from foreign fishing boats amounted to SR 26,000,000 in 1988. The total income including transshipment and port tariffs reached SR120,000,000 in 1988 and is a very important revenue source for the country. The fishery related employment numbers are around 2,000 persons including employees of the cannery, which is 10% of all employment of the country. Most of the tuna caught in the Seychelles EEZ is transshipped. Tuna transshipment is of great importance to the country's economy and employment.

iii) Resources and Fishing Grounds

A cooperative study on the skipjack and tuna resources within the EEZ is being conducted by EC countries and the Soviet Union. The "Nippon Maru" from Japan has also been assigned to the task. The results of the study will soon become apparent. The Seychelles government considers the present number of licensed fishing boats as the limit and

has no intentions of increasing the number of purse seiners operating within the EEZ.

Fishing grounds alter within and around the EEZ according to the movement of the fish. There is a set pattern; the fish move in a clockwise direction in and out of the EEZ.

The main fishing ground is located at 55° - 65°E, 0° -10°S east of Seychelles. However, new fishing grounds have been discovered off the coast of Somalia on the African east coast and in the Straits of Mozambique. Thus, the catch within the EEZ accounts for 20-30% of the catch in the West Indian Ocean. As Seychelles is located near the major fishing ground in the Southwest Indian Ocean, it has a geographical advantage as a fishing base.

iv) Tuna Cannery

With technical assistance from France, a 4-line fish cleaning facility/cannery was completed in June 1987 that is capable of processing 12,000 tonnes of fish a year. About 9,000 tonnes of fish are annually purchased from licensed purse seiners in return for their fishing permits. The facility is under the control of the Seychelles Marketing Board (SMB) and employs 320-370 workers.

It is expected that the tuna canning industry will bring about future economic profits. The total export for 1988 was 4,013 tonnes (56.5 million Rupees). This monetary value occupies 76% of the country's domestic product exports. The fishery is one of the country's very important industries for earning foreign currency. The Government of Seychelles intends to expand the canning factory to increase the revenue by exporting canned products.

(4) Distribution of Marine Products

In Seychelles, fish caught by the artisanal fishery is distributed for domestic consumption or for export through the simple distribution channel as shown in Fig. 2-2-1. There is practically no intervention by middlemen, thus the boat owners may freely select the buyer.

Fish caught by the industrial fishery is either transshipped or sold to the canning factory for export; it is not included in this distribution channel.

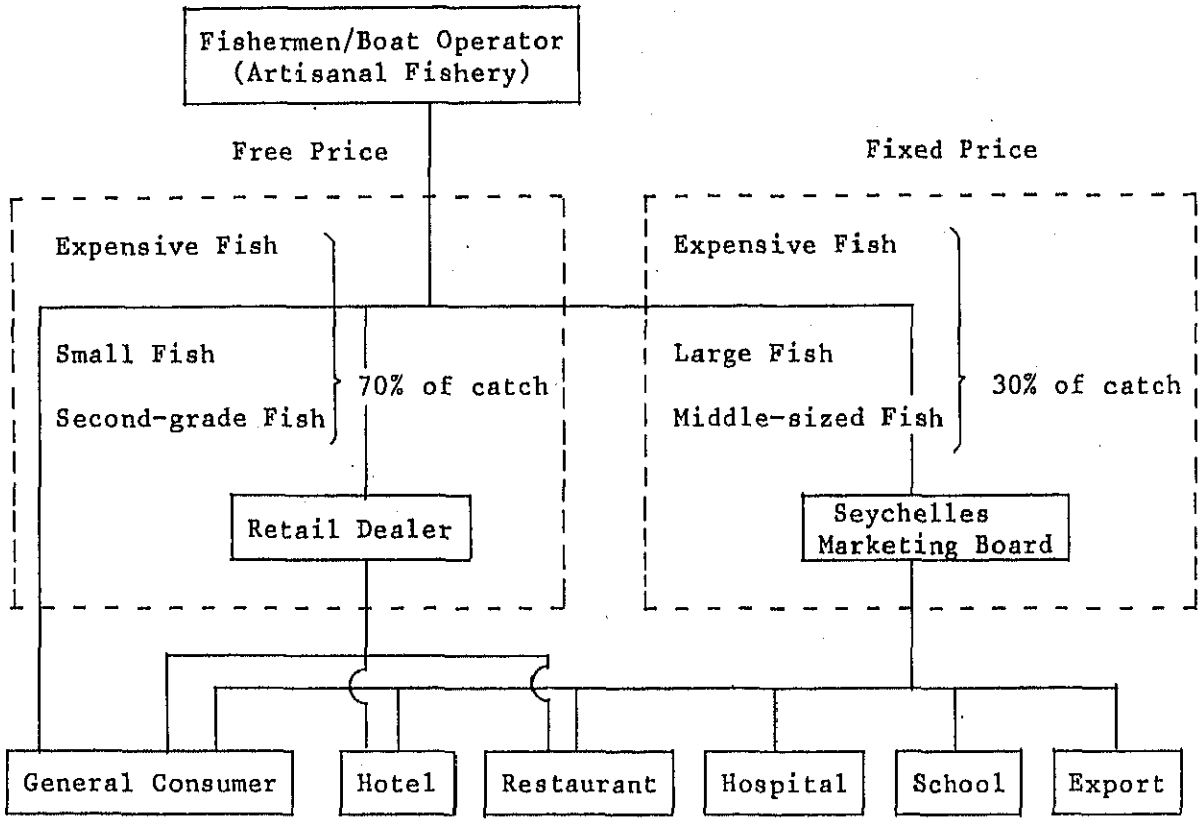


Fig. 2-2-1 Distribution Route of Marine Products in Seychelles

Consumers may purchase fish directly from the boats, or the boat owners may sell the fish at a public retail market. 30% of the total catch is purchased by the SMB and the remaining 70% is purchased by retailers and then sold to consumers. The fish purchased by the SMB is processed into fish fillets, more than half of which are exported.

Traditionally, fresh fish are favored by Seychellois. The fresher the fish the higher the price. Fish are fried, steamed or grilled. The preserving of dry fish is not a common practice.

2.3 Related Projects

(1) National Development Plan

The Seychelles Second National Development Plan (1985-1989) set the following four objectives and actively proceeded with the development of the country:

- To increase employment:
  To increase employment in the manufacturing sector.
- To improve the balance of trade:
  To decrease excessive imports and increase exports of primary products.
- To restore economic growth:
  To promote manufacturing and strengthen the tourist industry.
- To promote exports:
  To develop exportable products and exploit resources in the 200 mile EEZ.

To main objectives of the fisheries sector are the management and development of marine products under the following proposed plan:

- To develop Port Victoria into the primary tuna port for fisheries in the Western Indian Ocean.
- To develop fishing capabilities (fishing techniques) on an industrial scale.
- To develop fish processing techniques for export products.
- To safeguard and strengthen the artisanal fishery.
- To constantly exploit fishery resources.
- To develop mariculture techniques.

The Third National Development Plan (1990-1994) is presently being prepared. According to the draft, the policy of the Second Plan is carried over; however, due to its weak economic base, Seychelles is expecting a flexible aid policy from other countries.

The following major policies have been drawn up for the fishery sector in the Third Plan for encouraging the further development of the fishing industry.

- To increase employment opportunities
- To acquire foreign currency
- To develop links with other sectors
- To promote the stable development of the marine industry
- To preserve marine resources for the long-term prospects of the marine industry
- To make the Victoria Fishing Port the base for tuna fishery in the Western Indian Ocean

(2) Fisheries Development Project

Based on the Second National Development Plan, the East Coast Project was drawn up comprising the construction of the various infrastructures of Port Victoria (the commercial port and the fishing port).

A 3.5 ha. area was secured for the new fishing port and a 5 ha. site was secured for the tuna industry. Another 2 ha. were reserved for the possible future expansion of the fishing industry.

Apart from the 350,000 m^3 being dredged and the land being reclaimed for the development of fisheries, a 92 m long quay having a water depth of 7.5 m (the present tuna quay), a bunker pier and processing facilities were built (see Fig. 2-3-1). A tuna canning factory was built in 1987. It has become the second most important industry after tourism and contributes greatly to the Seychelles economy.

Related projects are being planned for the Third National Development Plan (draft), the major items being as follows:

- To repair the long pier quay
- To construct a new tuna quay
- To enlarge the tuna canning factory
- To introduce purse seiners (3 ships owned by Seychelles)

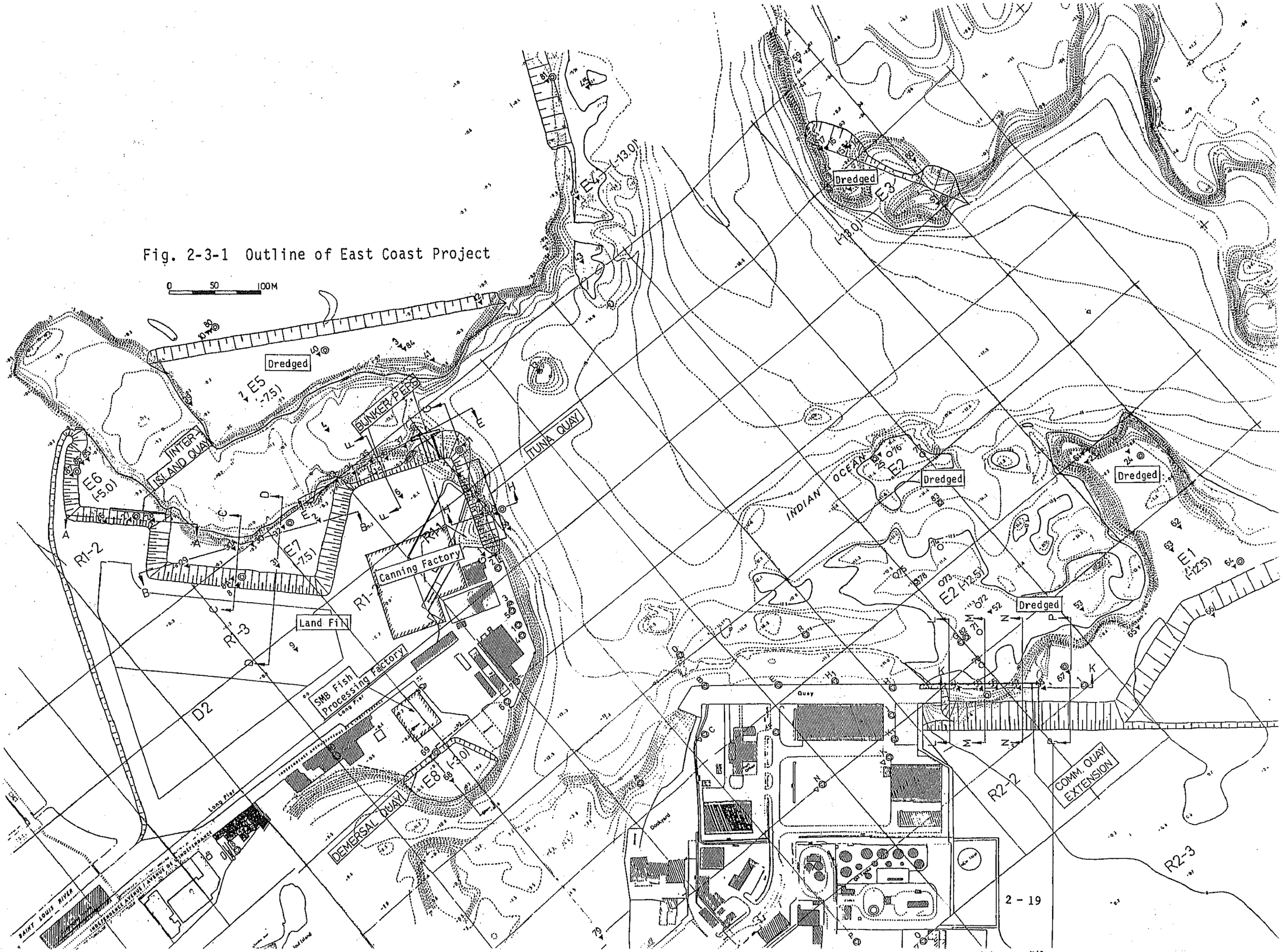
- To construct dry ice, insulated fish-box, and ice making plants
- To build fishing boats
- To develop shrimp farming

Some of the mentioned projects are included in Seychelles' request for grant aid from Japan.

The reasons for introducing purse seiners are to eliminate joint operations with foreign industries and limit the number of boats operating within the EEZ to fifty. The decrease in the number of foreign boats as a result of introducing three Seychelles purse seiners is unavoidable. The purpose of this measure is to convert some of the foreign tuna fishery to Seychelles operations. For this Project, Seychelles has ordered the first three purse seiners from France and hopes to have the second lot of three purse seiners built in Japan. Seychelles also hopes to strengthen the production line of the tuna canning factory and build a second canning factory.

Utilization of the reclaimed fishery related zone is now being planned by the Seychelles Government as shown in Fig. 2-3-2. This plan is aiming at the further development of purse the seine fishery considering the current steady development of this fishery. According to the plan, development of the purse seine fishery as a domestic operation has been included together with expansion of the tuna cannery. Construction of a part of the facilities has been already commenced, which shows the current steady development of fisheries of the country. Since these plans are closely related to this Project, great interrelated effects are expected by realization of the Project.

Fig. 2-3-1 Outline of East Coast Project



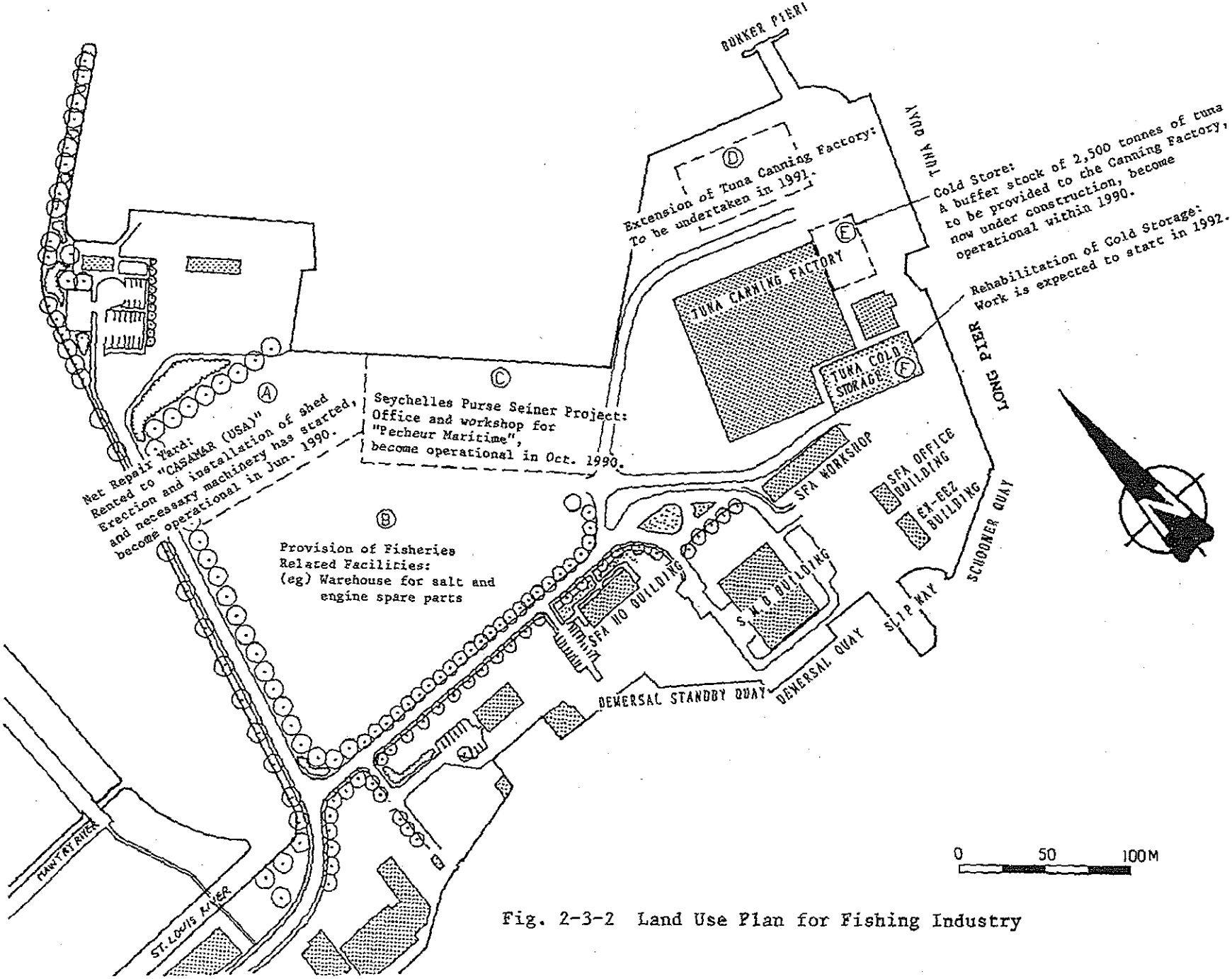


Fig. 2-3-2 Land Use Plan for Fishing Industry

2.4 Background and Contents of the Request

The major objectives of the National Development Plan are to make effective use of and develop the country's abundant fishing resources thereby stimulating a diversified economy, increasing employment and expanding the social and economic bases. From this viewpoint, the development of the fishing industry centering on skipjack and tuna is being carried out. However, hindering the fisheries development project is the fact that the existing quay at the Victoria Fishing Port is damaged and that there is an insufficient number of quays creating a great obstacle to the fish transshipping and landing operations. Further, the existing facilities related to the fishing port are insufficient for the present fishing conditions of the artisanal fishery. The problems at the Victoria Fishing Port and the means to solve them are shown in the chart of Fig. 2-4-2.

Under these circumstances, the Government of Seychelles has included the Project for Reinforcement of Fishing Port and Its Facilities in its fisheries development projects and has requested grant aid from Japan.

The contents of the request are as follows:

1) Port Civil Facilities
   - Repair of existing long pier quay (including repair work to fenders of present tuna quay)
   - Construction of a new tuna quay

2) Port Related Facilities
   - Ice making plants (3 locations, Victoria Fishing Port, Praslin Island and La Digue Island)
   - Dry ice plant
   - Insulated fish-box plant

Refer to Fig. 2-4-1 for Project facility locations.

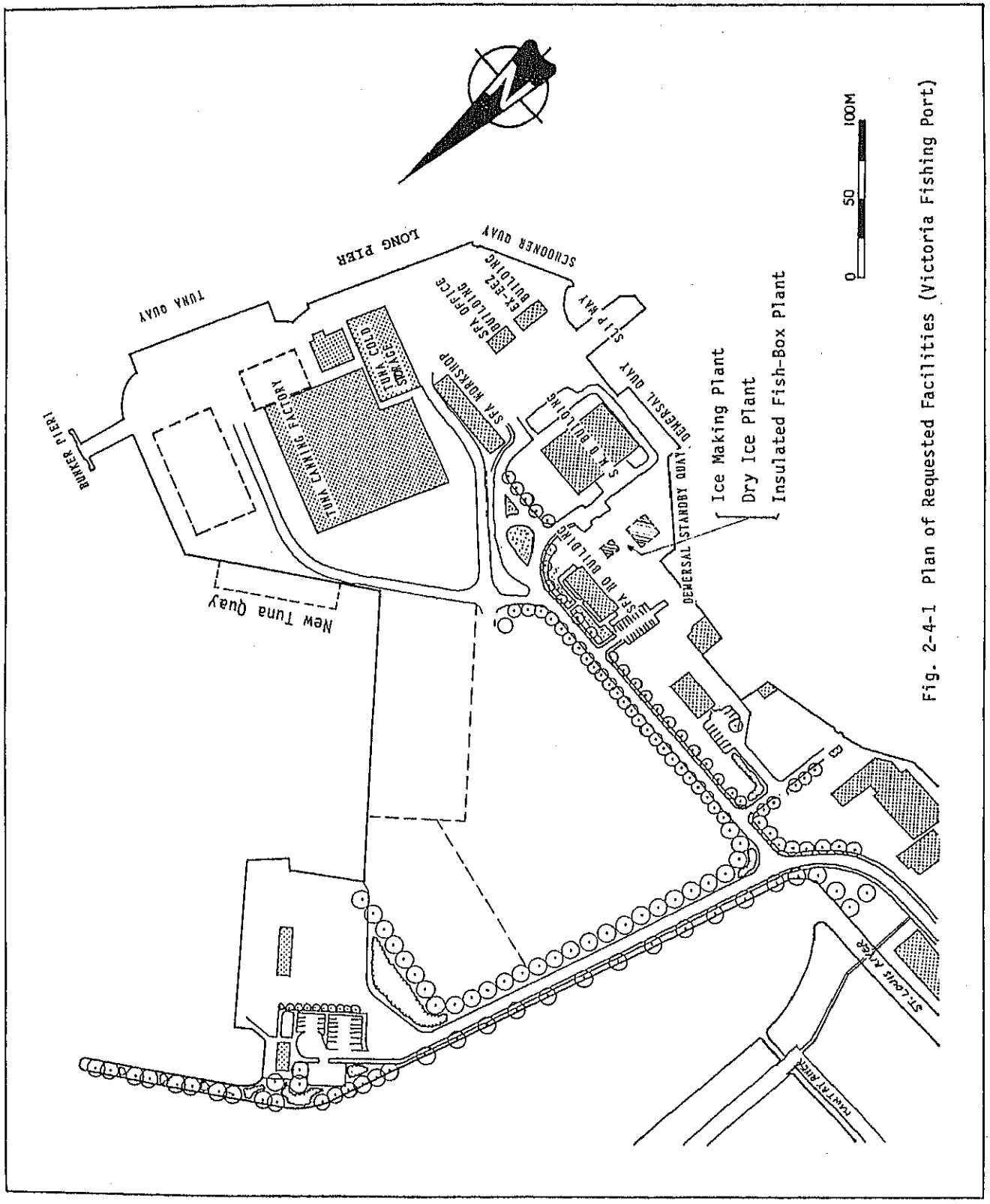


Fig. 2-4-1 Plan of Requested Facilities (Victoria Fishing Port)

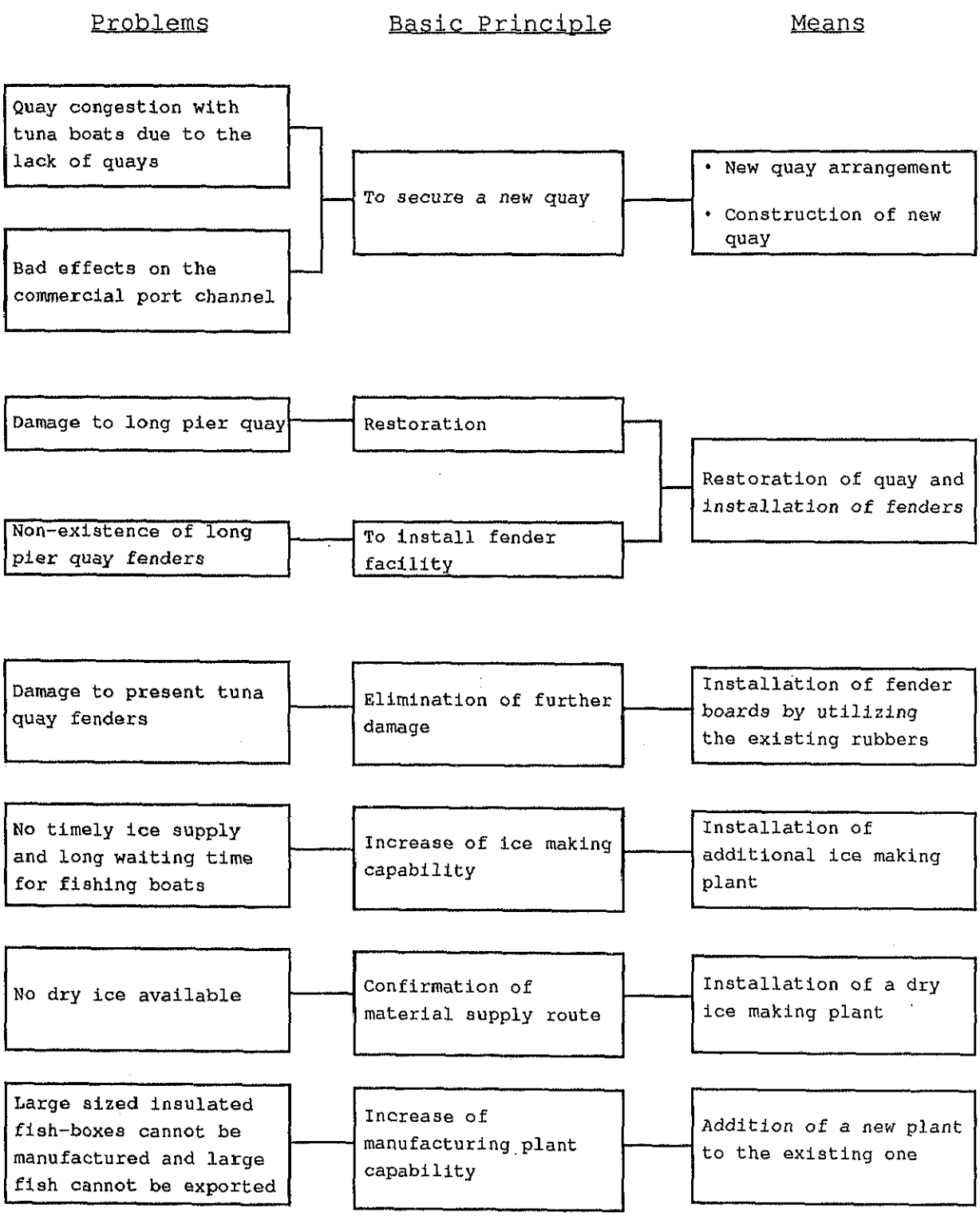


Fig. 2-4-2 Victoria Fishing Port Problems and Means to Solve Them

CHAPTER 3 PROJECT CONTENTS

CHAPTER 3 PROJECT CONTENTS

3.1 Objectives of the Project

The fishing port in Port Victoria is one of the central bases for skipjack and tuna fishing in the Western Indian Ocean. It is an extremely important facility for supporting the Seychelles economy. Presently, however, the following problems at the fishing port hinder the development of the country's fishery:

- There is an insufficient number of quays. The port is heavily congested because the purse seiners operating within the Seychelles Exclusive Economic Zone are obliged to moor in multiple rows for fish landing and transshipping work. The fishing boats cannot be provided with adequate port services. Also, fishing boat congestion affects channel safety at the adjacent commercial port.
- The long pier quay is severely damaged as a result of scouring. The quay is in dangerous condition and is inoperable.
- The existing ice making plant cannot supply sufficient amounts of ice to local fishing boats in a timely manner. The artisanal fishing boats have to wait a long period of time to receive a supply of ice, resulting in shorter fishing times. As fish freshness is not retained, higher fish prices are not maintained. The development of the artisanal fishery has been greatly hindered by these factors. These problems are the same at Praslin and La Digue Islands. The fishing boats based in these islands have to go to Mahe Island for the supply of ice (4 hours one way).

The objectives of the Project are to rehabilitate the fishing port and reinforce its facilities to solve the above problems and to make the fishing port a very important tuna base in the Western Indian Ocean in order to increase revenues from the tuna purse seining operations within the Seychelles EEZ and from exporting more fish caught by the artisanal fishery. By achieving these objectives, the

Project will contribute to the country's fishery development and stable economic growth that are aimed at by the Government of Seychelles in the National Development Plan. These Project effects are as follows:

① After constructing a new quay, congestion by purse seiners will be alleviated and income from port use fees from tuna fishing boats will increase. Also, the boats will have more opportunities to go to sea for fishing which will add to the amount of fish catches and those being transshipped; this will contribute to an increase in revenue. Further, it will be possible to supply landed fish to the tuna canning factory efficiently, thereby increasing the income of cannery related businesses.

② It will be possible to supply sufficient amounts of ice to the local fishing boats at any time. This will result in improved fish freshness which, in turn, will result in the fish commanding higher prices when sold either for domestic consumption or for export. In view of the above effects, the Project will contribute to the activation of the artisanal fishery.

3.2 Evaluation of Request Contents

The contents of the Government of Seychelles' request for the Project are described in Chapter 2, Section 2.4. The following results of the examination of the request's contents were based on field survey findings.

(1) Appropriateness and Necessity of the Project

The main objective of the Project is to contribute to the development of Seychelles' fishery. Because of the characteristics of Seychelles' fishery, Project objectives can be divided into the following two categories:

① Alleviating present quay congestion by purse seiners that operate in the country's EEZ, thereby improving fish landing and transshipping operations, increasing incomes by more fish catches and transshipment amounts, and supplying fish efficiently to the canning factory that is to be expanded under the government's policy. And, as a result, it is to contribute greatly to the development of the industrial fishery.

② The construction of related fishing port facilities to maintain fish freshness, thereby promoting fish exportation and increasing purchases of fish caught by the artisanal fishery and, as a result, contributing to the activation of the artisanal fishery.

As described above, the means for solving the existing problems and to achieve the Project objectives are very realistic. Thus, in view of the objectives and effects of the Project, it is considered to be appropriate and worthwhile to carry out the Project with Japanese grant aid cooperation.

(2) Project Implementation and Management Plan

The Seychelles Fishing Authority (SFA) will be responsible for the implementation and management of the Project.

SFA was established in 1984 for the purpose of promoting Seychelles' fisheries. Since its establishment, it has increased the size of its budget and number of employees, and has been conducting fishery development.

SFA's annual budget was SR4.0 million in 1988, SR4.5 million in 1989, and SR5.1 million (US$950,000) for fiscal year 1990. In proportion to its activities, SFA's budget has increased 11 percent annually. The Fishing Port Section of SFA will carry out Project implementation. It is believed that the Fishing Port Section's present organization will be capable of managing Project implementation in view of its quality and the size of its staff.

After Project construction is completed, the management of the fishing boat berthing and operations at the Project quay will be conducted by the Port and Marine Service Division (PMSD) of the Ministry of Tourism and Transport. The management and maintenance of the port related facilities will be conducted by the Seychelles Marketing Board (SMB). As PMSD has been in charge of the overall management of operations in both the Victoria commercial port and the fishing port, it is considered that PMSD's present organization will be capable of managing the Project fishing port after the completion of construction in view of its quality, budget, and the size of its staff. Judging from the present management conditions of the existing facilities under the SMB's Fish Division, it is also considered that the Fish Division will be able to manage the Project facilities with its present organization once the construction is completed.

The costs necessary for the management, operation and maintenance of Project facilities will be sufficiently financed by revenues from quay use fees and ice sales as described in the next chapter.

By taking into account the scale of the Project and the present activities of the above-mentioned organizations, it can be considered that the Seychelles' side has sufficient managerial capabilities to handle the Project facilities.

(3) Contents of Requested Facilities

To remedy the heavily congested condition at the present fishing port as soon as possible, the urgency of the port rehabilitation plan calling for the repair of the existing quay and the construction of a new quay is considered to be justifiable.

If the damaged portion of the existing long pier quay is repaired properly, the remaining portion can be used as it is. Thus, it is appropriate that the long pier quay be rehabilitated.

As for the construction of the new tuna quay, the proposed construction site has already been dredged and the yard behind the quay site has been reclaimed. Thus it would be practical to incorporate the construction of the new quay in the Project.

Among the above ideas, it is recommended to give a higher priority to the construction of a new tuna quay considering the urgency and the effects on the fishery development plan which is now under way by the Seychelles Government.

The fenders that were installed at the present tuna quay in 1987 are damaged, but not to the extent that they hinder quay use. The damage will not increase if boat berthing operations are conducted carefully. For this reason, fender repair is not included in the Project.

Ice making plants are planned for Mahe Island (Victoria Fishing Port) and Praslin Island (Baie St. Anne) judging from the current condition of ice shortage and fishing boat numbers/fish catch of each site. However, a requested ice plant at La Digue Island is not included in the Project because La Digue is

located very close to Praslin Island, and the plant in Praslin is to be constructed on a scale with sufficient capability to supply enough ice for both islands.

The supply route and cost of carbon dioxide (CO_2) needed for the dry ice plant are not known. The dry ice will be used for exporting frozen fish by air. In view of the present exports of frozen fish using dry ice, it is believed that the income derived from the use of dry ice would be insignificant. It would be more beneficial to promote the exportation of fresh fish. For this reason, the dry ice plant was deleted from the Project.

As for the insulated fish-box plant, it agrees with Seychelles' request that a mold be provided to the existing plant (constructed in 1986 with grant aid from Japan). However, the installation cost can be borne by the Seychelles side with the expected income from increased fish exports. As the Seychelles side has no problems concerning the techniques related to the equipment installation, the provision of a mold was deleted from the Project.

As a result of the examination of the requested items, the following items were included in the Project as appropriate facilities for the Japanese grant aid programme.

① Fishing Port's Civil Facility

- Construction of a new tuna quay.

② Related Fishing Port facility

- Ice making plant construction (at Victoria Fishing Port)
- Ice making plant construction (at Praslin Island)

(4) Basic Policies for Project Implementation

As the Project effects will contribute to Seychelles' fishery development resulting in greater benefits to the country's economy, the means to solve existing problems are realistic, and the Seychelles side's capability to implement the Project were confirmed, and in as much as the Project effects agree with the guidelines of the Japanese Government's grant aid programme, it is considered appropriate that the Project be carried out under Japanese grant aid. Thus, the basic design of the Project was made based on the premise that the Project will be implemented with grant aid from Japan.

The outline of the Project was examined as described below. Some of the requested Project items described above were revised as appropriate.

3.3 Outline of the Project

(1) Executing Agency

The executing agency for the Project is the Seychelles Fishing Authority (SFA) which was established in 1984 based on public corporation laws to promote Seychelles' fisheries.

SFA is an external organization of the Seychelles Government that executes all government policies related to fisheries. SFA is under the supervision of the Ministry of Agriculture and Fisheries and consists of a board of directors nominated by the President of Seychelles. SFA presently has 100 personnel; 27 of them are in the Fishing Port Section.

The management of boat operations and quay fees at the Victoria Fishing Port is conducted by the Port and Marine Services Division of the Ministry of Tourism and Transport which is also responsible for the management of the Victoria Commercial Port.

After Project construction is completed, the fishing port's related Project facilities, such as the ice making plant, will be managed by the Fish Division (having 80 personnel) of the Seychelles Marketing Board (SMB).

In view of the above, SFA needs the cooperation of the Port and Marine Services Division and the Fish Division of SMB. The organization structures and personnel numbers are shown in Appendix 5.

(2) Project Plan

i) Basic Policies

Purse seiners operating within the 200-mile Exclusive Economic Zone of Seychelles land and transship their catches and obtain water and fuel oil supplies at the Victoria Fishing Port's quay. The boats are prepared at the bunker pier for their next fishing trip and then lie to either within the harbour basin or just outside the harbour.

Since the length of the present quay is too short, effective fish landing operations cannot be conducted. The purse seiners that cannot be berthed at the quay are obliged to moor at buoys in the harbour or, as most of the buoys are occupied by tuna long-liners, moor at the commercial quay when it is not being used. Some purse seiners must transship their catches from ship to ship on the high sea.

From the field surveys it was determined that there is a shortage of landing quays.

For the above reasons, the Project quay is planned for use by the purse seiners that operate in Seychelles' Exclusive Economic Zone for their landing and transshipping activities.

Even though the fish catch by purse seiners has increased considerably during the past few years, it is expected that, due to operating methods, it will now remain stable. However, as Project policies are directed at making improvements, it was decided that for Project planning the purse seiners' fish catch should be set at 220,000 tonnes/year and the fish transshipment amount should be set at 200,000 tonnes/year (see Table 3-3-1). Also, the fish landing volume for the canning factory was set at 9,000 tonnes/year (a figure that is in accordance with an

agreement between the Seychelles Government and the fishing boat operators in Seychelles' EEZ).

The number of purse seiners for the planning of the Project was set at fifty (the Seychelles Government wants to limit the number of purse seiners to fifty in the future).

An analysis shows that the specifications of the purse seiners for Project quay design use are 1,300 gross tonnes (G/T) and 70 m in length (LOA) (See Fig. 3-3-1). As seen in the "use record" of the present tuna quay (Table 3-3-5), the sizes of purse seiners using the quay are automatically limited to this figure (1,300 G/T) because of the water depth at the quay and the drafts of the boats.

The Project's ice making plants are designed to meet the local fishing boats' operating manner and their catch volume during the peak fishing season (see Table 3-3-2 and 3-3-3).

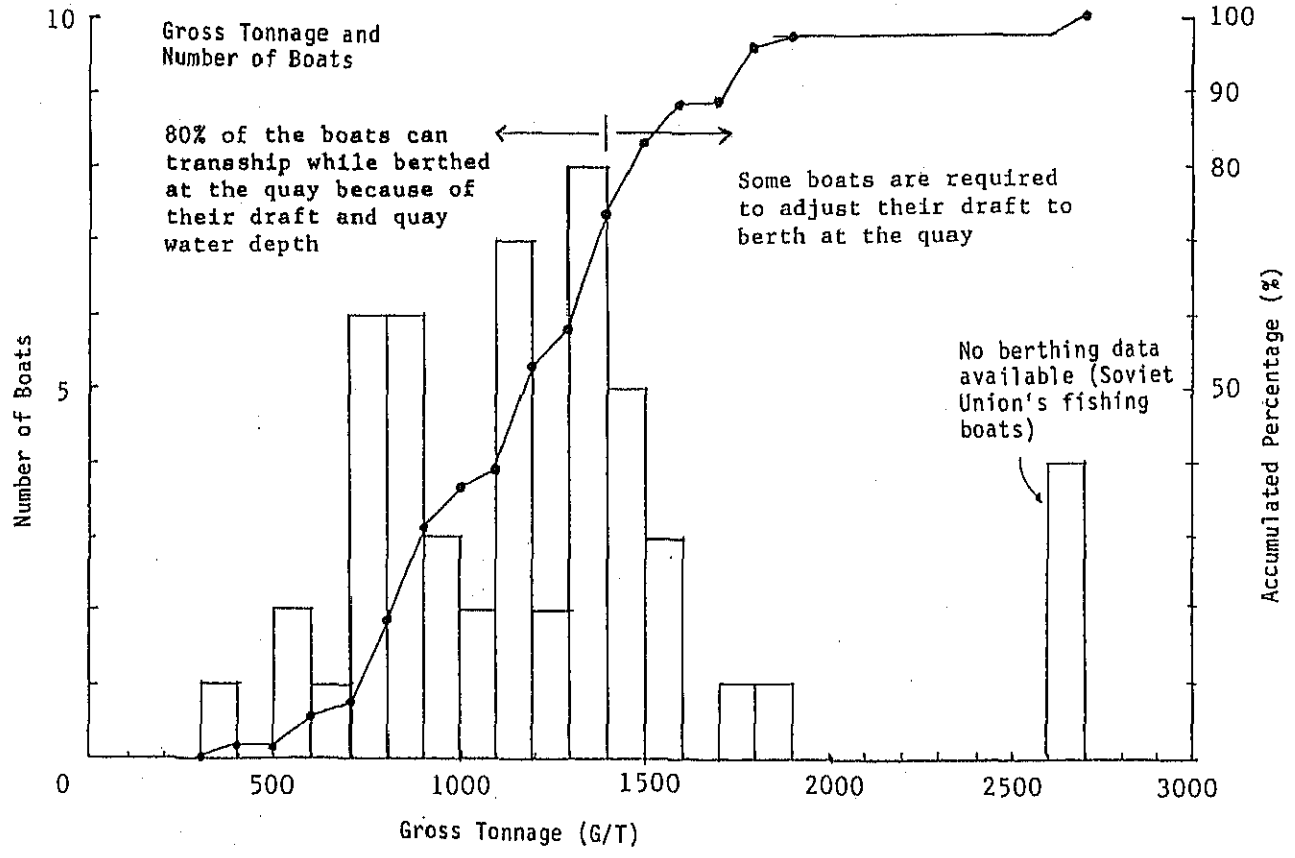
Table 3-3-1 Monthly Total Fish Catch and Amount of Fish Transshipped by Purse Seiners

Year / Month	1988				1989			
	Total Catch (tonnes)	No. of Operated Purse Seiners	Transshipped Fish Amount (tonnes)	No. of Transshipping Purse Seiners	Total Catch (tonnes)	No. of Operated Purse Seiners	Transshipped Fish Amount (tonnes)	No. of Transshipping Purse Seiners
January	16,826	39	14,290	25	17,874	49	24,910	37
February	14,345	37	15,193	28	23,358	49	17,855	34
March	12,324	33	14,990	26	33,930	48	29,712	41
April	13,359	38	6,044	14	22,440	46	24,351	36
May	15,254	39	15,369	22	11,726	45	7,472	15
June	16,625	38	10,193	18	13,808	46	4,029	19
July	13,987	43	16,922	24	10,407	48	11,075	30
August	21,078	44	11,963	27	12,500	50	12,888	24
September	26,139	46	26,820	36	17,209	51	19,801	32
October	28,742	43	25,183	37	55,598	144	*	*
November	19,714	47	22,518	35			*	*
December	29,262	48	21,088	32			*	*
TOTAL	227,655	495	200,573	324	218,850	576	157,093	268

Source: the Seychelles Fishing Authority

*: Figure was not available

Fig. 3-3-1 Numbers and Dimensions of Licensed Purse Seiners to Operate in Seychelles' Exclusive Economic Zone



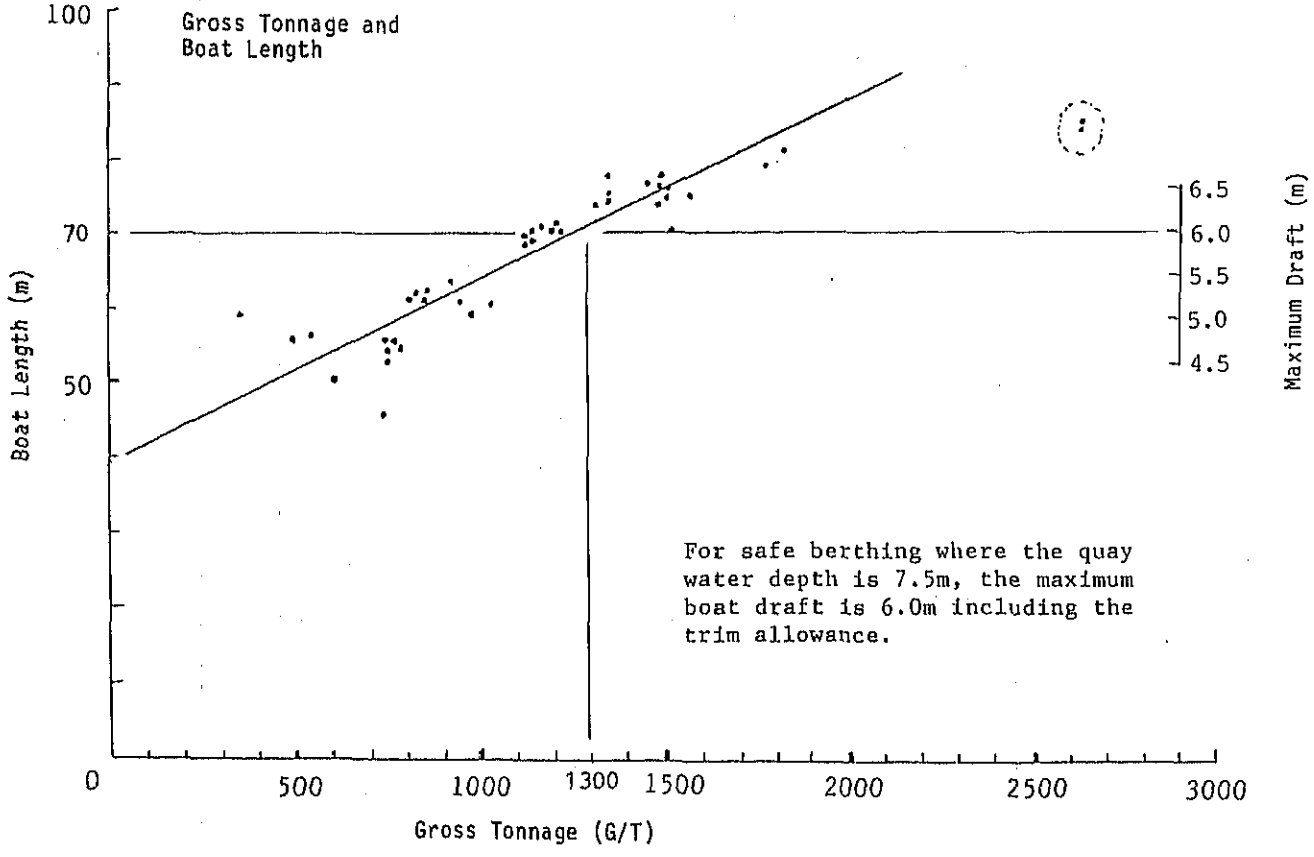


Table 3-3-2 Features and Number of Fishing Boats in Artisanal Fisheries

Boat Type	Features		Number of Operating Fishing Boats*		
	Length (m)	Size of Fish Hold (tonnes)	Mahe	Praslin	La Digue
Large Schooners	21	10	3	-	-
Schooners	9 to 16	3	10	7	2
Whalers (Class A)	10 to 12	2	10	-	-
Whalers (Class B)	10	1	16	1	1
Whalers (Class C)	8	0.5	18	10	6
Outboards & Pirogues	5 to 6	-	260	42	20
Total			317	60	29

Source: The Seychelles Marketing Board (SMB)

Table 3-3-3 Monthly Fish Catch by Boat Type in Artisanal Fisheries (1989)

(Unit: Tonne)

Month	On Foot	Pirogues	Outboards	Whalers	Schooners	Sports	TOTAL
January	2.7	20.6	130.8	104.1	34.8	0.5	293.5
February	2.7	24.4	109.7	174.0	59.1	0.6	370.5
March	1.1	17.1	168.4	133.8	60.3	0.9	381.6
April	3.6	20.9	154.2	200.0	51.0	0.6	430.3
May	3.0	17.1	125.4	250.8	49.8	0.5	446.6
June	1.3	5.8	98.7	160.0	44.7	0.5	311.0
July	1.2	3.9	68.1	141.4	47.2	1.5	263.3
August	3.9	23.0	126.5	122.0	18.4	1.9	295.7
September	2.0	38.3	177.5	158.3	52.7	-	428.8
October	1.8	32.9	120.3	157.5	59.4	2.1	374.0
November	0.5	19.0	93.6	269.0	88.0	1.5	471.6
December	1.5	11.0	81.3	173.1	57.5	0.4	324.8
TOTAL	25.3	234.0	1,454.5	2,044.0	622.9	11.0	4,391.7

Source: The Seychelles Fishing Authority

ii) Estimation of Incoming Fishing Boats

The operating cycles of purse seiners operating in Seychelles' Exclusive Economic Zone are one sail per month year-round (from the Seychelles Fishing Authority).

Of the 50 licensed purse seiners in Seychelles, 40 of them enter port during the peak fishing season to transship their catch to reefer cargo boats (see Table 3-3-1). However, in relation to quay water depth and boat draft, the number of boats that can actually berth at the quay is limited. The specifications of the forty fishing boats that enter port for fish transshipping are not known but, according to the data on licensed purse seiners, only about 80% of them can use the quay. The average amount of fish transshipped during the peak fishing season is estimated to be 700 tonnes per boat (see Table 3-3-4).

Based on the 1988 records of the present tuna quay (Table 3-3-5), the fish transshipping efficiency at the quay is estimated to be 120 tonnes/boat/day.

As there is no fish landing efficiency data available, it is assumed to be the same as the quay's fish transshipping efficiency (120 tonnes/boat/day).

Based on the above figures, the number of days required for a purse seiner to berth, land and transship its catch, and prepare for the next sail was calculated as follows:

Fish transshipment: 700 tonnes/120 tonnes/day	= 5.83 days
Fish landing: 9,000 tonnes/199 boats/120 tonnes	= 0.38
Mooring & Shifting (figures obtained orally)	= 0.30
Water & fuel supplies (figures obtained orally):	= 0.40
Allowance	= 0.30
TOTAL:	7.2 days/boat

Thus, the number of boats operating simultaneously at the quay was estimated as follows:

40 boats/month x 0.8 x 7.2 days/boat ÷ 30 days/month
= 7.68 boats/day.

Table 3-3-4 Average Fish Transshipment per Boat in Each Month

(Unit: tonnes/boat)

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
1988	572	543	577	422	699	566	705	443	745	681	643	659
1989	673	525	725	676	498	475	369	537	619			

(Recapitulated from Table 3-3-1)

Table 3-3-5 Present Tuna Quay Use by Purse Seiners in 1988

Item \ Month	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
Number of Purse Seiners	17	23	23	14	21	16	19	12	15	14	11	14	199
Average Boat Length (m)	67	65	65	61	66	55	66	63	65	66	64	70	
Transshipped Fish Catch (tonnes)	7,750	11,126	11,641	5,766	11,609	4,481	9,659	2,444	5,853	4,380	3,028	4,634	82,371
Average Amount of Transshipped Fish Catch (tonnes/boat/day)	112	126	120	109	125	102	125	81	106	97	86	119	

Source: the Syechelles Fishing Authority

iii) Number of Gangs in the Project

Only one purse seiner at a time transships its catch to a reefer cargo boat (counted as one "gang"). Since two purse seiners cannot conduct fish transshipping operations simultaneously (verified by an oral survey), the satisfactory rate of quay use at the Project port can be obtained by examining how many gangs may be secured in the port. The number of gangs is equal to the number of reefer cargo boats. As calculated in the previous section, the number of gangs required for landing and transshipping purse seiners' fish was determined to be a maximum of 7.68 gangs/day. By taking into account the urgent need for a functional quay and the anticipated Project effects, the construction of a new tuna quay should be given the highest priority. By allowing multiple-row berthing, the method presently being used, four gangs will be required for the Project and they will be assigned as follows:

① Present tuna quay:	2 gangs (5 purse seiners and 2 reefer cargo boats) Allowable berthing: 7 boats in 5 rows
② New tuna quay:	2 gangs (3 purse seiners and 2 reefer cargo boats) To keep the turning basin clear, the allowable berthing at the new tuna quay will be 5 boats in 4 rows.
Total:	4 gangs $\geqslant$ 7.68 gangs

The berthing methods are shown in Fig. 3-3-2.

Only the present tuna quay is being used during fish transshipping operations. Thus, only 26% of the quay use demand is presently being satisfied.

After the completion of the new tuna quay, 52% of the quay use demand will be satisfied.

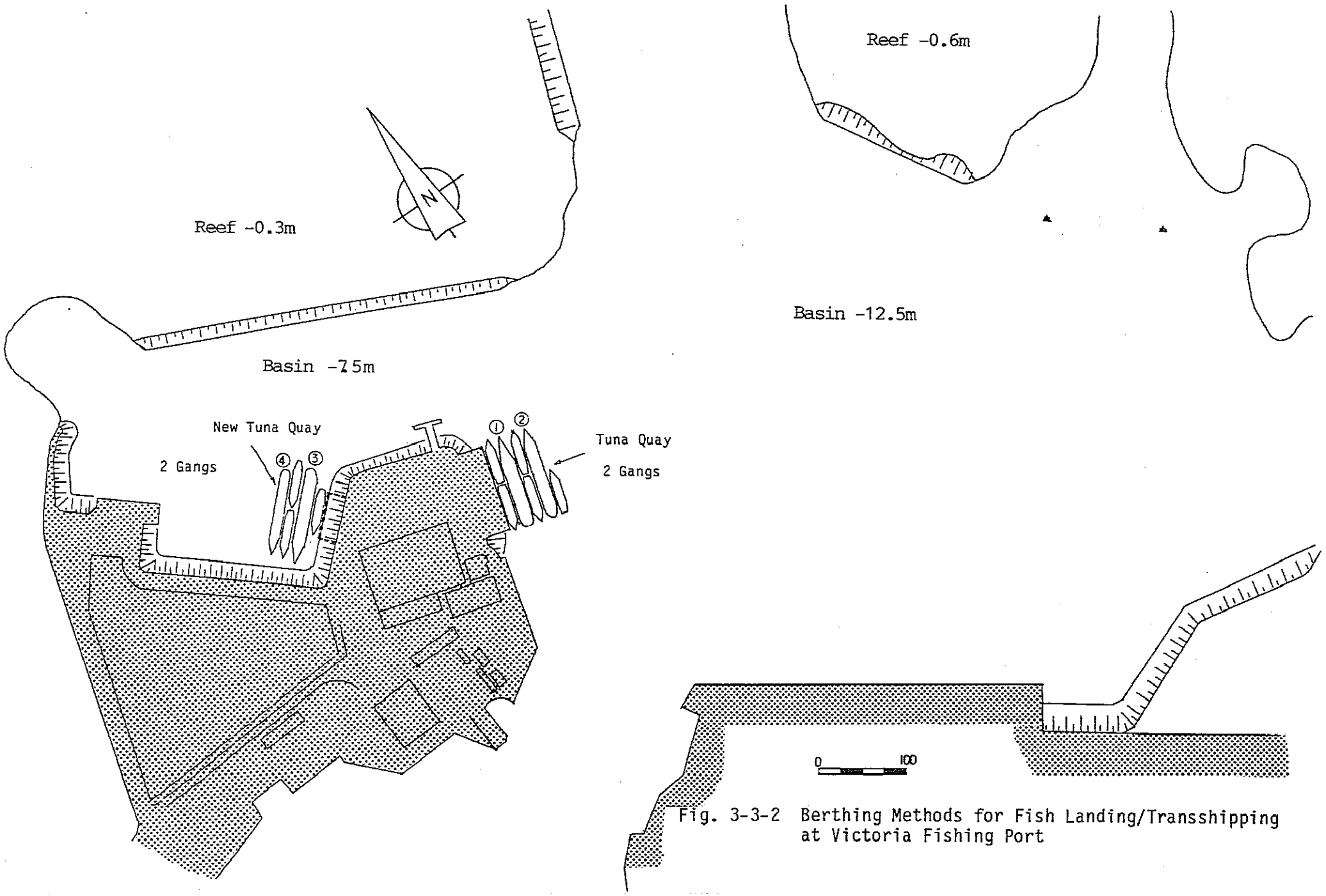


Fig. 3-3-2 Berthing Methods for Fish Landing/Transshipping at Victoria Fishing Port

iv) Estimation of Required Capacity of Ice Making Plants

The ice making plants are to be constructed to have the capacity to supplement the existing ice making plants in the provision of sufficient quantities of ice to the local fishing boats.

The plant to be constructed at Victoria Fishing Port is planned for the boats based at Mahe Island and the plant at Praslin is for the boats based at Praslin and La Digue Islands.

The capacity of the ice making plants will be examined in Chapter 4, Section 4.3.2 (2).

(3) Project Site Location and Its Outline

i) General Conditions

The Project site is located in Victoria which is situated in the northeastern part of Mahe. Victoria is the capital of Seychelles and is the industrial and economic centre of the country. Victoria has a population of approximately 17,000.

The asphalt paved roads running the entire length and width of Mahe are in good condition. Power, water, and telephone facilities are available throughout Mahe.

The Victoria Fishing Port is located at the city's waterfront. It has complex reef formations. The water in the area is very calm. The present fishing port was constructed by large scale dredging, reclamation, and quay construction under the East Coast Project during the 1985-87 period. The port is at the site of the former "Long Pier."

The present cannery was constructed in 1987. Since that time, the fishing industry has become very active.

The Victoria Fishing Port is the central fishing base and the only fishing port which provides landing, transshipment and supplies for the fishing boats operating within Seychelles' 200-mile Exclusive Economic Zone. The port serves artisanal fisheries as well. The port has been functioning as an important facility for supporting the Seychelles economy.

ii) Existing Facilities

Major Victoria Fishing Port facilities are as follows:

- Long Pier Quay
  110 m long, 5.5 m deep (design depth), equipped with two (2) water supply units and two (2) fuel supply units.

  In 1981 the quay was constructed as a pier type structure

by utilizing the former Long Pier. The quay foundations are scoured and the apron slab has fallen. The quay is in dangerous condition. Further, there are no fenders at the quay.

Due to the chronic congestion of fishing boats, the early rehabilitation of this long pier quay is desirable.

- Present Tuna Quay
  92 m long, 7.5 m deep (design depth), equipped with two (2) water supply units and two (2) fuel supply units.

  The quay is a pier type structure constructed in 1987 under the East Coast Project, and since its construction, it has been utilized as the central facility for tuna fishing activities. As this quay is the only facility where unloading and transshipping operations of fish catches can be done, it is always congested, forcing multiple-row berthing.

- Fuel Supply Pier (Bunker Pier)
  The Pier (dolphin type), having a design water depth of -7.5 m, was constructed under the East Coast Project to be used in the supply of fuel to tuna boats.

- Schooner quay
  The quay has a design water depth of -3.0 m and length of 65 m. It is a pile-supported type quay for use by local fishing boats. It is located to the south of the old tuna quay.

- Passenger/Cargo Quay (Inter-island Quay)
  The quay has a design water depth of -5.0 m and length of 105 m + 25 m. It is the inter-island boat terminal. It was constructed under the East Coast Project.

Land facilities are as follows:

- Tuna Canning Factory
  The cannery was built in 1987. It has a 4-line fish cleaning facility capable of cleaning 12,000 tonnes/year of raw material fish.

- SMB Fish Division

  The Fish Division operates the fish treating plant, the ice making plant (capacity: 20 tonnes/day), and the insulated fish-box plant. The Division distributes some of the fish caught by the artisanal fishery to domestic markets and purchases the remainder for export purposes.

iii) Condition of Use of the Victoria Fishing Port

At the Victoria Fishing Port, fish transshippng operations between purse seiners and reefer cargo boats are conducted year-round.

Because the long pier quay is badly damaged, only the present tuna quay is being used and it is very congested. Fig. 3-3-3 shows the normal berthing method at the quay. The use of this method is only made possible because of the favourable sea and weather conditions in the area.

Under the supervision of the Port and Marine Services Division (PMSD) of the Ministry of Tourism and Transport, the purse seiners that have completed their fish landings and/or transshippings are moored elsewhere and the waiting purse seiners then come alongside the reefer cargo boats. These operations take place every one to three days under the supervision of PMSD.

Because of the congestion at the quay, it is sometimes necessary to conduct fish transshipping operations at the harbour buoys, the commercial quay, and on the high sea.

Table 3-3-6 shows the present tuna quay use conditions during the peak fishing period (January through April) of 1989. During January, between 4 and 7 boats occupied the quay for 16 days (no Saturday and Sunday surveys were conducted).

Table 3-3-7 shows the number of days when purse seiners remained in port during 1989's peak fishing season. The figures include not only the fishing boats that berthed at

the present tuna quay but also those that either waited for their fish transshipping turn or idled in port, or those that transshipped their fish at harbour buoys or at the commercial quay. The highest port use was by 11 to 15 boats (32% of the period). More than half of each month, the port was used by more than 11 fishing boats.

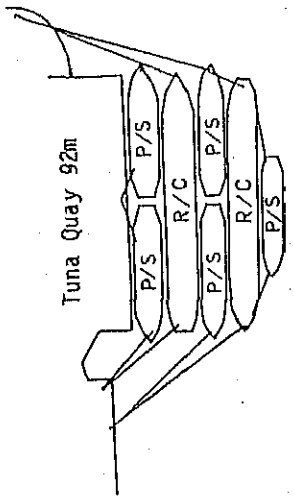


Fig. 3-3-3 Berthing Method at Victoria Fishing Port

Table 3-3-6 Conditions of Use of the Present Tuna Quay

No. of Boats* Used a Day (each)	Use Days per Month				TOTAL	%
	Jan.	Feb.	Mar.	Apr.		
1	-	-	-	2	2	2.9
2	-	-	1	4	5	7.4
3	-	3	2	3	8	11.8
4	1	3	6	4	14	20.6
5	7	5	1	4	17	25.0
6	4	5	4	-	13	19.1
7	4	1	3	-	8	11.7
8	-	-	1	-	1	1.5
Total No. of Surveyed Days	16	17	18	17	68	100

(Tabulated from data provided by the Seychelles Fishing Authority)

* The boat number includes purse seiners and reefer cargo boats.

Table 3-3-7 Number of Days Purse Seiners Stayed in the Victoria Fishing Port

Number of Purse Seiners	Number of Days in Port				TOTAL	%
	Jan.	Feb.	Mar.	Apr.		
4 - 5	-	10	-	4	14	20.6
6 - 10	7	5	5	4	21	30.9
11 - 15	4	2	8	8	22	32.3
16 - 20	3	-	4	1	8	11.8
21 - 23	2	-	1	-	3	4.4
Total No. of Surveyed Days	16	17	18	17	68	100

(Tabulated from data provided by the Seychelles Fishing Authority)

iv) Natural Conditions

The Study Team conducted the following surveys and observations at the Project site:

- Topographic Survey:

Survey period: February 8 through 20, 1990
Surveyed area: Approximately 1.5 ha.
Method: Offset survey
Instruments used: Light wave distance-measuring instrument and a transit

The survey data is listed in Appendix 7.

- Sounding Survey:

Survey period: February 16 through 19, 1990
Surveyed area: Approximately 5 ha.
Method: Lead survey
Instruments used: Lead line and sounding tape

The survey data is listed in Appendix 7.

- Geological Survey (data collection):

The geological survey in Port Victoria was conducted by Norplan (a Norwegian Company) in 1985 for the implementation of the East Coast Project. According to the survey report, hard bedrock composed of strong

granite exists at the depth of -25 to -30 m. Loose or medium dense layers (having less than N-values of 10) composed of coral sand overlay the bedrock. The obtained soil data are listed in Appendix 7.

- Tide Observation:

Observation period:

	February 6 through 21, 1990
Location:	At the northern tip of the present tuna quay
Instrument used:	Water pressure type self-reading tide gauge (Model LRT-2)

There is a two-cycle tide pattern in the area (two high and two low tides appear daily). The tide is relatively uniform.

The datum line (DL) in the area corresponds to the chart datum.

Fig. 3-3-4 shows the tide level diagram of the area. The results of the 15-day tide harmonic analyses are listed in Appendix 7.

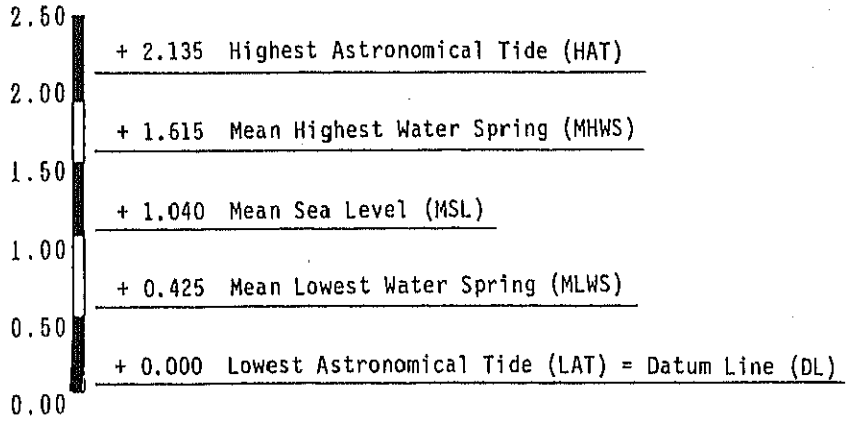


Fig. 3-3-4 Tide Level Diagram

- Current Observation:

Observation period:	February 9 through 10, 1990
Location:	Approximately 100 m off the bunker pier
Instrument used:	Electrical current gauge (Model CM-2)

The current observation was conducted at two levels, 1.0 m below the water surface and 1.0 m above the sea floor, to measure the current directions and velocities. The measured average velocities were 8.7 cm/sec at the higher and 6.5 cm/sec at the lower level. The measured current conditions are listed in Appendix 7.

(4) Outline of the Project Facilities

For effective Project implementation, necessary facilities that are appropriate to be implemented under the Japanese grant aid programme are as follows:

Fishing Port Civil Facilities:

① Construction of a new tuna quay

Related Fishing Port Facilities:

① Construction of an ice making plant (Victoria Fishing Port)

② Construction of an ice making plant (Praslin Island)

(5) Management and Maintenance Plan

The executing agency of the Project is the Seychelles Fishing Authority (SFA). After Project construction is completed, due to their physical locations and functional characteristics, the Ministry of Tourism and Transport (MTT) and the Seychelles Marketing Board (SMB) will join SFA in undertaking the management and maintenance work as follows:

Work	Organization
- Management of fish landing and transshipping operations at the quays - Inspection and maintenance of the quays	Fishing Port Section of SFA
- Management of boat operations at the quays and quay use fees	Port and Marine Service Division of MTT
- Operation and maintenance of the ice making plant and sales of ice	Fish Division of SMB

These agencies have adequate staffs and can provide high quality management for the operations and maintenance of the Project facilities once they are completed. Further, it is believed that the costs necessary for performing the management work will be fully met by revenues received from port use fees and the sale of ice.

Assumed revenues and costs for Project facilities were estimated as follows:

i) Project Quay

The revenue increase resulting from increased quay use by fishing boats (80 purse seiners/year and 20 reefer cargo boats/year) after Project completion was calculated as follows:

- Quay use fees:

80 boats x 1,300 GT x (SR 0.27/GT/day x one day + SR 0.22 x 6.2 days)	= SR 170,000
20 boats x 3,000 GT x (SR 0.27/GT/day x one day + SR 0.22 x 24 days)	= SR 333,000

- Port entering fees:

80 boats x 1,300 GT x (SR 0.53/GT/3 days + SR 0.11 x 4.2 days)	= SR 103,000
20 boats x 3,000 GT x (SR 0.53/GT/3 days) + SR 0.11 x 22 days	= SR 177,000

- Berthing and ship operating fees:

80 boats x SR 210/time x 2 times	= SR 34,000
20 boats x SR 210/time x 2 times	= SR 8,000
TOTAL	SR 825,000/year

(Income other than the above: Additional income from the increased amounts of fish catches and transshipments that can be attributed to the completion of Project facilities is anticipated. Because of the difficulty in estimating the amount of this additional income, no calculations were made).

Costs necessary for the management, operation, and maintenance of Project facilities are expected to be as follows:

- Personnel expenditures:

2 persons x SR 5,000/month x 12 months	= SR 120,000

- Workmen's compensation:

The same as for personnel expenditures	= SR 120,000

- Maintenance & repair costs:

About 1% of facilities' construction costs	= SR 100,000
TOTAL	SR 340,000/year

As a result of the above calculations, it is believed that the costs required for the management, operation, and maintenance of Project facilities will be paid for by the revenue generated by port operations.

ii) Ice Making Plant

Income for the sale of ice to be produced by the Project's ice making plants at Victoria and Praslin were calculated as follows:

- Income from Ice Sales:

(3,200 + 920) tonnes/year
x SR 260/tonne = SR 1,072,000/year

Costs for the management, operation and maintenance of the ice making plants are expected to be as follows:

- Personnel expenditures:

2 persons x SR 3,000/month x 12 months = SR 72,000

- Workmen's compensation

The same as for personnel expenditures = SR 72,000

- Electricity fee:

70 kW·hr/tonne x 4,120/year x SR 1.38 kW·hr
= SR 398,000

- Water fee:

4,120 tonnes/year x SR 13.16/tonne = SR 54,000

- Expendable item costs

About 1% of the construction cost = SR 40,000

SR 636,000/year

As a result of the above analyses, it will be possible to meet the ice plant's management, operation, and maintenance costs with the income from the ice sales.

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4.1 Design Policies

Based on the Project's background and contents as mentioned in the previous chapters, the basic design was prepared in accordance with the following basic policies:

① By taking into account the functions of the existing facilities and the new facilities to be constructed, an adequate overall Project scale should be decided upon.

- The demand for fishing port use must be clearly understood and adequate quay sizes must be secured.

- The types and sizes of the Project's fishing port facilities should meet the needs of Seychelles' fishing industry and distribution system. Furthermore, the management and maintenance costs of Project facilities should be minimal.

② The natural conditions at the Project site should be carefully examined.

- The topography, tide levels, current, and geological conditions in the area should be clearly understood and reflected in the basic design.

③ The structure types, construction methods, and construction materials for Project facilities should be suitable to meet Project site conditions.

- The structure types should not only be suitable to meet the Project site's topographical and geological conditions, they should also be types commonly used in the country.

- Locally obtainable construction materials should be utilized as much as possible. The construction methods should be accomplishable in Seychelles.

④ The Project related rules and regulations of Seychelles should be understood and the basic design should be prepared accordingly. If there are no applicable rules or regulations in Seychelles, related Japanese rules and regulations should be referred to.

4.2 Examination of Design Conditions

Based on the field survey results, the following design conditions were established for the Project.

(1) Natural Conditions

i) Sea Conditions

- Tide Levels

Mean High Water Spring (MHWS):	+1.615 m
Mean Low Water Spring (MLWS):	+0.425 m
Construction Datum Line (DL):	±0.0 m

- Waves

The harbour water is sufficiently calm, but boat waves of 0.6 m should be taken into account.

- Current

According to the current observation results (see Appendix 7), the current velocities and directions are negligible for the basic design -- no current effects are to be considered.

ii) Weather Conditions

- Temperature	24°C to 30°C
- Humidity	80%
- Wind Speed	50 knots/hr. Predominant direction: NW and SE

iii) Geological Conditions

- Earthquakes

No earthquakes have occurred in Syechelles; thus, no seismic force is taken into account in the design.

- Soil Conditions

Based on the existing soil data (survey by Norplan in 1985), soil conditions for the basic design were established as follows:

At the New Tuna Quay Site

▽ Ground Level (GL)

Filled soil:

$\phi = 28^{o}$

$r = 1.8\ t/m^3$

$r' = 0.8\ t/m^3$

DL ± 0 m

Silt and coral sand:

N = 4 to 10

$\phi = 28^{o}$

$r = 1.8\ t/m^3$

$r' = 0.8\ t/m^3$

DL - 20 m

Medium grain sand and hard clay:

N = 10

$\phi = 30^{o}$

$r = 1.8\ t/m^3$

$r' = 0.8\ t/m^3$

DL - 25 m

Granite:

N > 50

where, r = unit weight of soil in air

r' = unit weight of soil in water

N = N-value of standard penetration test

ϕ = angle of internal friction

Fig. 4-2-1 Soil Condition Diagram

(2) Quay Use Plan

i) Concerned Boats

Features of the boats that will use the quays were decided upon based on the boat record examination as follows:

Table 4-2-1 Concerned Boat Features

Features \ Boat Type	Purse Seiner	Reefer Cargo Boat
Gross Tonnage (G/T)	1,300	3,000
Overall Length (LOA)(m)	70	105
Breadth (m)	13.0	14.5
Hull Depth (m)	8.5	9.0
Maximum Draft (m)	6.0	6.0

ii) Boat Berthing Speed

Purse Seiner: 25 cm/sec

Reefer Cargo Boat: 20 cm/sec

iii) Boat Pull Force

15 tonnes (purse seiner's breast lines)

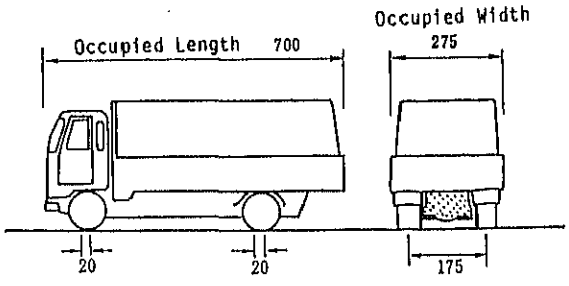
iv) Surcharge

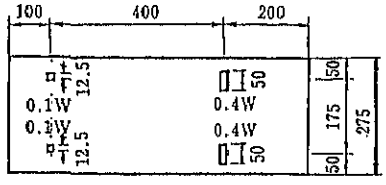
Under normal conditions: 1.0 tonne/m^2

v) Truck Load

Table 4-2-2 Truck Load

	W (t)	0.1W(kg)	0.4W(kg)	b_1 (cm)	b_2 (cm)	a (cm)
T-20	20	2,000	8,000	12.5	50	20





cm)

vi) Crane Load

Type:	20-tonne truck-mounted crane
Maximum load per outrigger:	20 tonnes
Contact area of one outrigger:	1,250 cm^2
Outrigger contact pressure:	16.0 kg/cm^2

(3) Materials

i) Weight of Unit Volume in Air

Reinforced concrete:	2.45 $tonnes/m^3$
Plain concrete:	2.3 $tonnes/m^3$
Steel:	7.85 $tonnes/m^3$
Fill material:	1.8 $tonnes/m^3$
Stone:	2.6 $tonnes/m^3$
Wood:	0.8 $tonn/m^3$
Sea water	1.03 $tonnes/m^3$

ii) Allowable Stress

Structural steel:	1,400 kg/cm^2
Deformed steel bar:	1,800 kg/cm^2
Steel sheet pile:	1,800 kg/cm^2
Reinforced concrete:	
Design strength:	240 kg/cm^2
Compression strength by bending:	80 kg/cm^2
Slab shear stress:	9 kg/cm^2
Beam shear stress:	4.5 kg/cm^2

iii) Corrosion of Steel Materials

Steel materials are to be protected by applying a covering material. Materials that will not be protected should have sufficient corrosion allowances for a 30-year period based on the following corrosion progress speeds (corrosion rates).

Table 4-2-3 Corrosion Rate for Steel Materials

Location		Corrosion Rate (mm/year)
Sea side	Above High Water Level (HWL)	0.3
	Between HWL and Seabed	0.1
	Within Seabed	0.03
Land side	On Land (in atmosphere)	0.1
	In Ground (above residual water table)	0.03
	In Ground (below residual water table)	0.02

(4) Design Standards

As there are no applicable standards in Seychelles for the design of the Project facilities, the following Japanese standards were applied for the basic design of the Project. However, no seismic forces were taken into consideration.

- Standard Design of Fishing Port Structures, Japan Fishing Port Association
- Technical Standards for Port and Harbour Facilities, Japan Port Association
- Building Design Standards, Japan Architect Association

4.3 Basic Plan

4.3.1 Arrangement Plan

By taking into account the existing port area and harbour basin, port facilities for the Project are to be arranged as shown in Fig. 4-3-1.

The location of the new tuna quay was decided upon for the following reasons:

① The turning basin having a depth of -7.5 m is already secured.

② The area has sufficient space for boat mooring (by assuming multiple-row mooring method).

③ Boats can turn easily in the basin.

④ The location will be convenient for transporting the landed fish to the cannery.

The empty space within the SMB's lots will be the optimum site for locating the ice making plant of Victoria.

As for the ice making plant at Praslin, it is planned to be constructed at Baie Sainte Anne which is near to La Digue Island, considering ice supply to the fishery boats at La Digue, too. The location is planned on the land adjacent to the existing fish collection centre (See. Fig. 4-3-2).

The relocation of existing facilities will not be required.

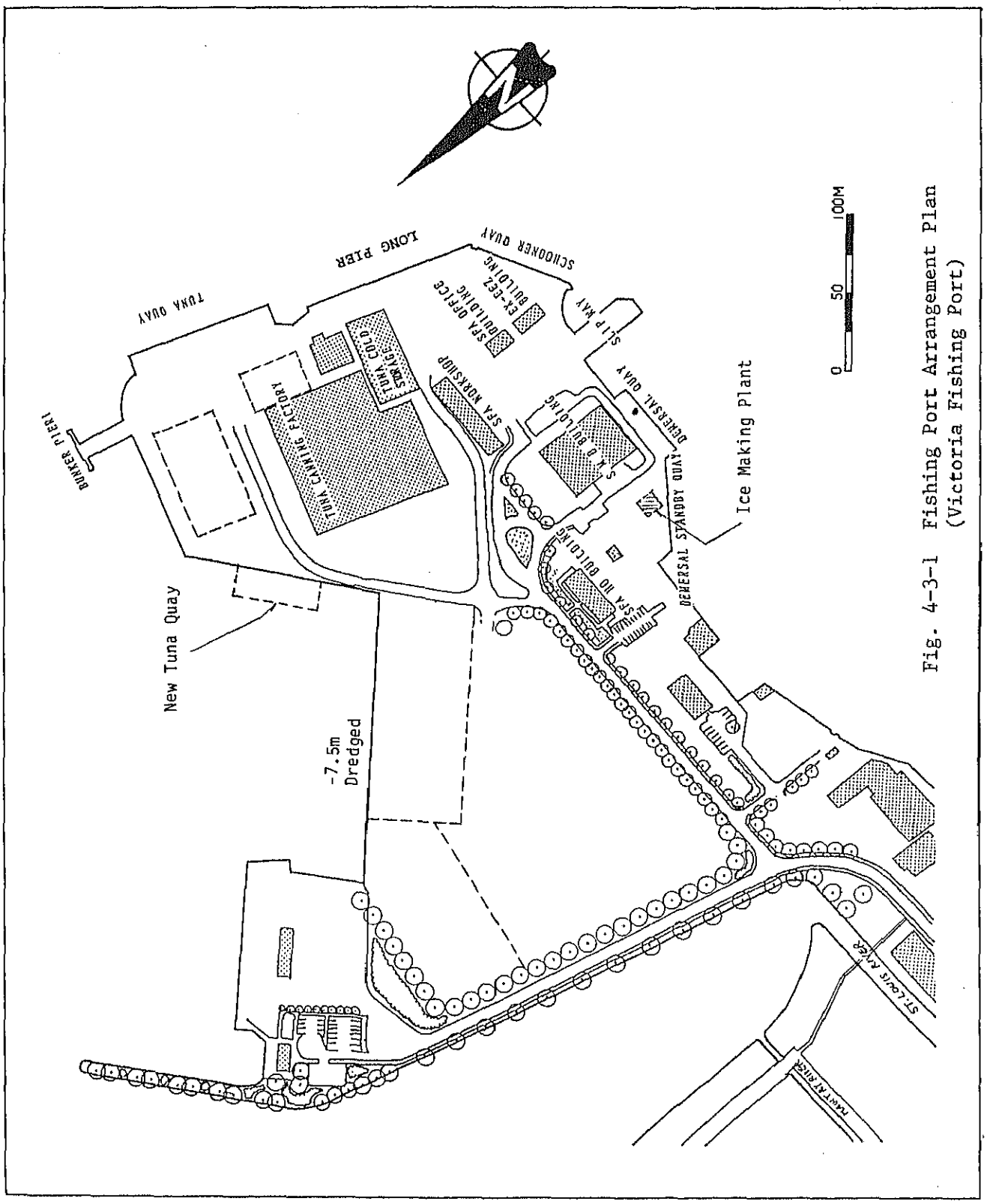


Fig. 4-3-1 Fishing Port Arrangement Plan (Victoria Fishing Port)

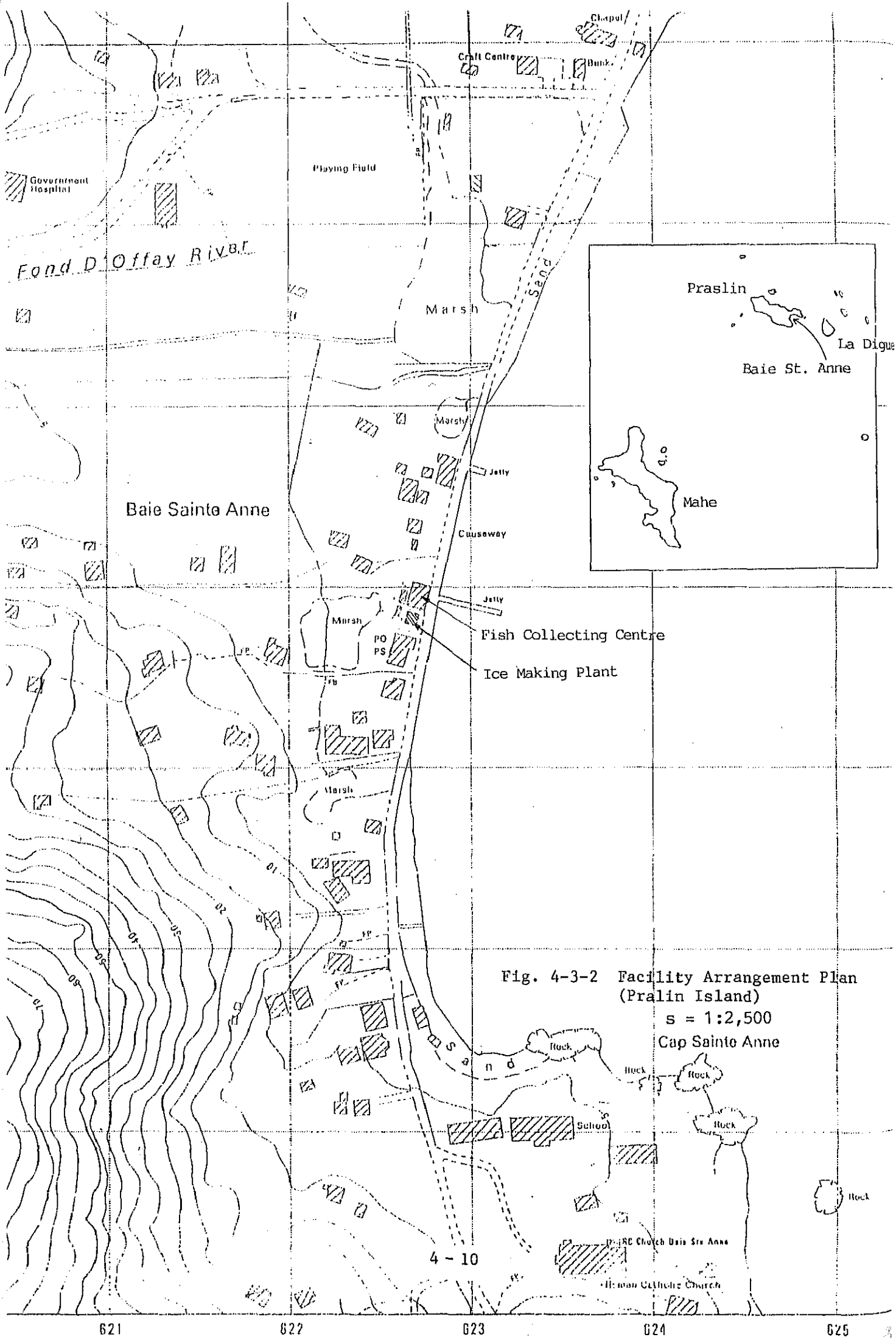


Fig. 4-3-2 Facility Arrangement Plan (Pralin Island)

s = 1:2,500

Cap Sainte Anne

4.3.2 Facility Plan

(1) Determination of Quay Rehabilitation Boundary

i) Scale of New Tuna Quay

The Project's new tuna quay that will have one berthing space and a two-gang space with multiple-row berthing at which purse seiners can effect fish landings and transshipments was decided upon as described in Chapter 3, Section 3.3 (2).

The necessary quay length for continuous berthing is calculated, in general, as 1.15 times the average boat length. By taking into account the situation that boats will be berthed in multiple rows at one berth, the quay length can be determined as the length sufficient for; ① purse seiners' safe berthing and fish landing and transshipment, and ② the safe berthing of reefer cargo boats.

For ①, if the quay length is approximately equivalent to the parallel hull section (about 50 m) of the concerned purse seiners (70 m length overall), there will be no problem in berthing. For fish landing and transshipping it is desirable, in general, to have the quay length equivalent to the apron size (10 m wide and a length that is 1.15 times that of the concerned boat's length overall). Thus, the desirable quay length is 57.5 m = 10m wide x 70m x 1.15/14m (apron width of Project quay).

For ②, in view of boat and quay structure safety, the quay should be extended to the point where the concerned reefer cargo boat will first make contact with the fender while berthing. In general, that point is located at a distance that is one quarter boat length from the mid-ship point either towards the bow or the stern. For quay design purposes, the shift distance from the bow or stern should be included as an allowance. Approximately 3 to 5% of the boat length is considered as the allowance. For these reasons,

the necessary quay length for ② is 60.9 m = (105m x 1/4 + 105m x (3 to 5%)) x 2.

In view of the above, the new tuna quay length was decided upon as being 60 m.

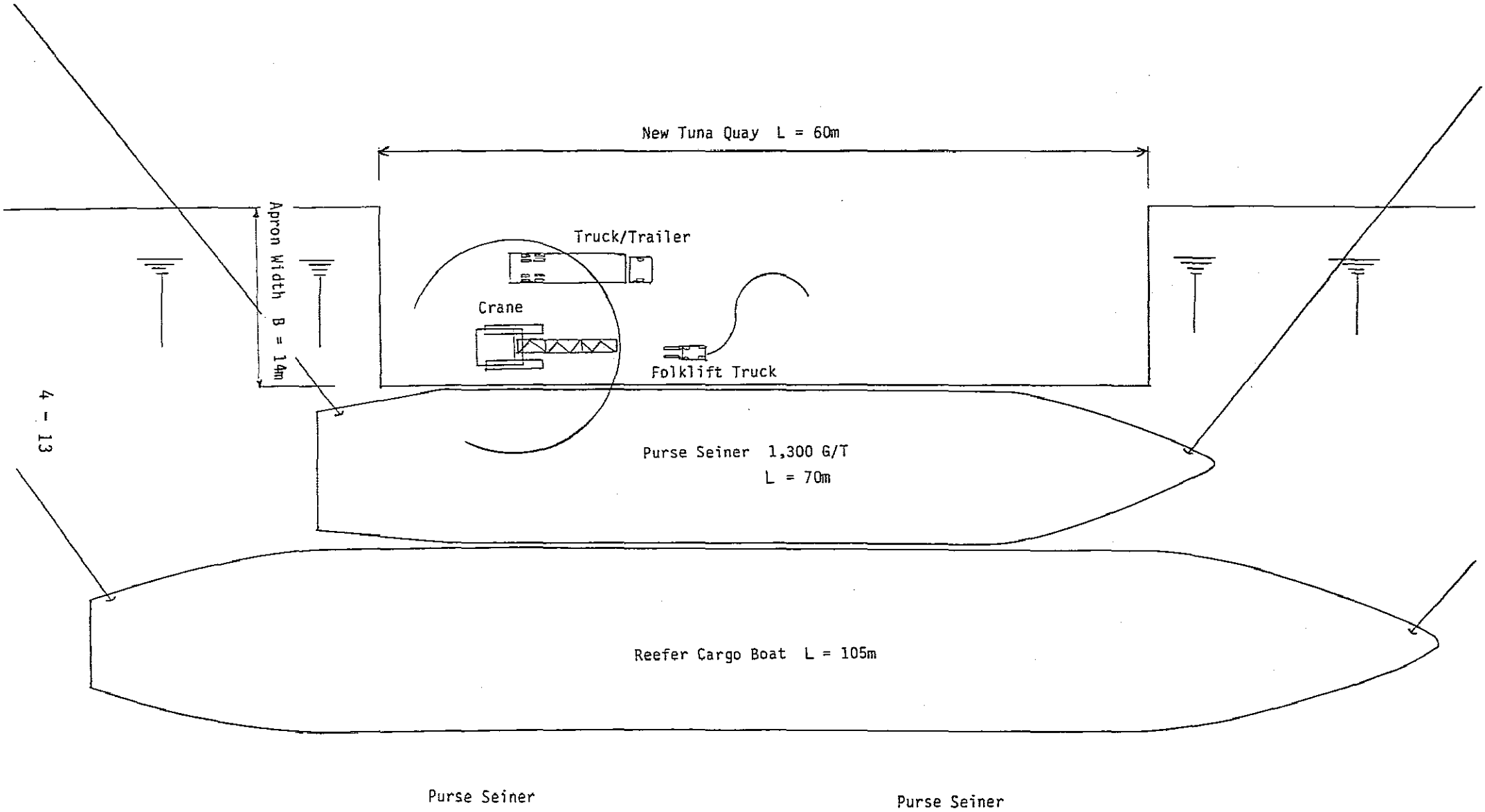


Fig. 4-3-4 Berthing Method at New Tuna Quay

(2) Determination of Related Fishing Port Facilities

i) Ice Making Plant (Victoria Fishing Port)

Based on the basic policies for the Project's basic design, the ice making plant at Victoria will be capable of supplementing the existing ice making plant in supplying sufficient amounts of ice to the local fishing boats in Mahe.

The existing ice making plant operated by the Fish Division of SMB in the Victoria Fishing Port has the following ice making capabilities:

Fishing boat supply:	14	tonnes/day
Cold storage for factories:	5	"
Fish collecting centre:	0.6	"
General sale:	0.4	"
TOTAL	20.0	tonnes/day

(10 tonnes/day capacity x two units, ice storage capacity: 30 tonnes, flake ice)
(source: SMB)

The average fish landing volume during the peak fishing season of each boat type was calculated from Table 3-3-3 and the required ice volume was estimated based on the landing volume, excluding the volume caught on-foot and by sports fishing.

The figures in Table 3-3-3 includes fish landings at Mahe, Praslin and La Digue. The landing volume in Table 3-3-3 should be distributed into each island by numbers and fish hold sizes of the fishing boats as shown in Table 3-3-2.

The ice used for fish transported to Mahe from Praslin and La Digue has been supplied in Mahe. However, it can be supplied in Praslin Island after completion of the Praslin ice making plant.

Table 4-3-1 Calculation of Necessary Amount of Ice
(Victoria Fishing Port)

Boat Type		Small Boat (Pirogues & Outboards)	Whaler	Schooner	Total
No. of Boats Length Fish Storage		260 5 to 6m None	44 8 to 12m 0.5 to 2 tonnes	13 9 to 21m 3 to 10 tonnes	
Fish landing volume during peak fishing season in 1989 (in tonnes)	April	175.1	200.0	51.0	426.1
	May	142.5	250.8	49.8	443.1
	Sept	215.8	158.3	52.7	426.8
	Nov	112.6	269.0	88.0	469.6
	Average	161.5/month	219.5/month	60.4/month	441.4/month
Fish landing at Mahe		130.4t/month	179.6t/month	41.7t/month	351.7t/month
Average monthly operating days (by oral survey)		One day sail x 4 times/week =171.1 days/month	2 to 3-day sail x 1 or 2 times/week =15.0 days/month	5-day sail per week =21.4 days/month	
Fish landing per day (tonnes)		7.6	12.0	1.95	21.55t/day
Ratio of fish to ice		1 : 0.5	1 : 1	1 : 2	
Daily ice necessity (tonnes)		3.8	12.0	3.9	19.7 (= 77t/week)
Ice supplied by existing plant					14t/day
Necessary amount of Ice					5.7t/day

According to ice making plant manufacturers, the smallest unit that can produce 5.7 tonnes/day of ice is a 6-tonne unit. Thus, the ice making plant to be constructed at the Victoria Fishing Port is planned to have a 6 tonnes/day capacity.

Since the fishermen want to have larger chunks of ice than the presently supplied ice flakes, the Project's plant will make plate ice -- the plate ice will be made by an automatic ice crushing machine, following the operating procedures presently being employed.

The ice storage capacity should be based on the relationship between the ice making capability and the supply amount.

In Seychelles, the fishing boats tend to start out on fishing trips early in the week and return to port at the latter part of the week; thus, it is necessary to take into account that ice production will also decrease during the latter part of the week. For a case when a total of 36 tonnes of ice storage are planned (6 tonnes storage for the Project's ice making plant as equivalent to the daily production and 30 tonnes for the existing ice making plant), a sufficient quantity of ice must be stored to meet the large ice demand during the early days of the week. Examination of this procedure was made by establishing the model case shown in Table 4-3-2.

Table 4-3-2 Relationship Between Ice Supply and Storage Capacity (Victoria Fishing Port)

(Unit: tonne)

Day of Week		Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
Ice Storage at the beginning of each day	30t with existing Plant 6t with new plant	36	21	17	27	29	36	36	
Daily Ice Supply	To Schooners	12	8	-	-	-	-	-	20
	To Whalers	18	12	7	5	-	-	-	42
	To Small Boats	5	4	3	3	-	-	-	15
	To others	6	6	6	6	6	6	-	36
	Subtotal	41	30	16	14	6	6	-	113
Storage - Supply		-5	-9	1	13	23	30	-	
Ice Making Volume	Existing:10t x 2 units	20	20	20	10	8	3	-	81
	New: 6t x 1 unit	6	6	6	6	5	3	-	32

In the above table the ice storage capacity (Storage -Supply) on Monday and Tuesday has negative indicators. However, since the production quantity during the supply time (9 hours from 8:00 AM to 5:00 PM), that is; 26 x 9.0/24 = 9.7t exceeds the minus amount, an actual ice shortage will not occur. The model case shown in the table clearly indicates that the ice making plants must be operated to their full capacities during the early part of the week and then, during the latter part of the week, slow down on production.

As described above, the ice storage volume for the Project is to be planned as being 6 tonnes.

ii) Ice Making Plant (Praslin Island)

The capacity of the ice making plant to be constructed at Praslin is planned to make up for the quantity which is short in the production of existing plants for the fishery boats operated based in Praslin and La Digue Islands.

There are currently 3 fish collecting centres of the Seychelles Marketing Board (SMB) at Praslin and La Digue, and ice making plants are under operation for each centre. The capacity of the existing plants are as follows.

Island	Location	Daily Production (ton)	Capacity of Ice Storage (ton)	Type of Ice
Praslin	Baie St. Anne	1.0	1.0	Flake
Praslin	Grande Anse	1.0	1.0	Flake
La Digue	La Passe	1.0	1.0	Flake

50% of the above is supplied to fishery boats and others are supplied to the fish collecting centre and public use. A supply to fishery boats is concentrated in the early part of the week, and late in the week it is used for fish transportation to Mahe. The shortage of ice supply is more critical for the supply to fishery boats.

The shortage quantity at Praslin and La Digue is estimated in the following Table 4-3-3 and Table 4-3-4.

Table 4-3-3 Calculation of Necessary Amount of Ice
(Praslin Island)

Boat Type		Small Boat (Pirogues & Outboards)	Whaler	Schooner	Total
No. of Boats Length Fish Storage		62 5 to 6m None	18 8 to 12m 0.5 to 1.0 tonnes	9 9 to 21m 3 tonnes	
Fish landing volume during peak fishing season in 1989 (in tonnes)	April	175.1	200.0	51.0	426.1
	May	142.5	250.8	49.8	443.1
	Sept	215.8	158.3	52.7	426.8
	Nov	112.6	269.0	88.0	469.6
	Average	161.5/month	219.5/month	60.4/month	441.4/month
Fish landing at Praslin and La Digue		31.1t/month	39.9t/month	18.7t/month	89.7t/month
Average monthly operating days (by oral survey)		One day sail x 4 times/week =171.1 days/month	2 to 3-day sail x 1 or 2 times/week =15.0 days/month	5-day sail per week =21.4 days/month	
Fish landing per day (tonnes)		1.8	2.6	0.9	5.3t/day
Ratio of fish to ice		1 : 0.5	1 : 1	1 : 2	
Daily ice necessity (tonnes)		0.9	2.6	1.7	5.2 (= 21t/week)
Ice supplied by existing plant					1.5t/day
Necessary amount of Ice					3.7t/day

According to ice making plant manufacturers, the smallest unit that can produce 3.7 tonnes/day of ice is a 4-tonne unit. Thus, the ice making plant to be constructed at Praslin Island is planned to have a 4-tonnes/day capacity. The ice type is planned to be plate ice, the same as the Mahe plant.

The ice storage capacity is planned to have an 8 tonne capacity. The total capacity of 11 tonnes including the storage for the existing plants is examined in the following Table 4-3-4.

Table 4-3-4 Relationship Between Ice Supply and Storage Capacity (Praslin Island)

(Unit: tonne)

Day of Week		Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
Ice Storage at the beginning of each day	1t x 3 with existing plant 8t with new plant	11	6	4.5	8.0	10.5	11	11	
Daily Ice Supply	To Schooners	5	3.5	-	-	-	-	-	8.5
	To Whalers	4	2.5	1.5	1.0	-	-	-	9
	To Small Boats	1.5	1	0.5	0.5	-	-	-	3.5
	To others	1.5	1.5	1.5	3	3	1.5	-	12
	Subtotal	12	8.5	3.5	4.5	3	1.5	-	33
Storage - Supply		-1	-2.5	1.0	3.5	7.5	9.5	-	
Ice Making Volume	Existing:1t x 3 units	3	3	3	3	1.5	0.5	-	14
	New: 4t x 1 unit	4	4	4	4	2	1	-	19

In the above table, the ice storage capacity (Storage-Supply) on Monday and Tuesday has negative indicators. However, since the production quantity during the supply time (9 hours from 8:00 AM to 5:00 PM), that is, 7 x 9.0/24 = 2.6t exceeds the minus amount, an actual ice shortage will not occur.

As described above, the ice storage volume for the Project is to be planned as being 8 tonnes.

4.3.3 Basic Design

(1) Design of Civil Facilities of Fishing Port

i) Design of New Tuna Quay

The height of the new tuna quay's crown is to be the same as the crown of the present tuna quay; that is, DL + 2.85 m (see Fig. 4-3-4).

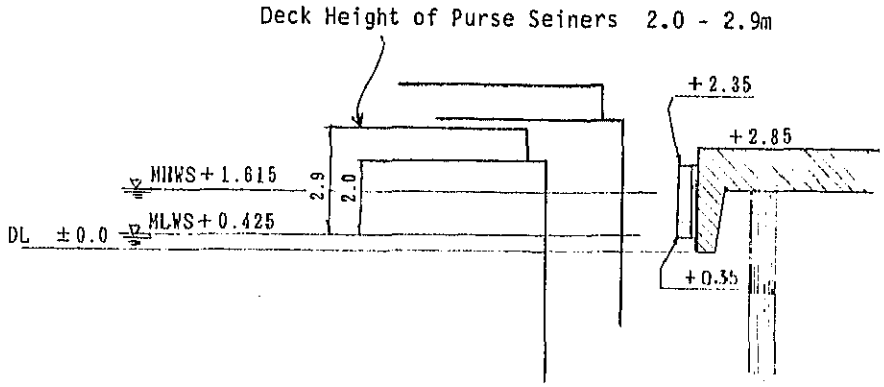


Fig. 4-3-4 Height of New Tuna Quay's Crown and Fender Installation Height

The following structure types can be considered for the new tuna quay:

①Pier type:

The slope behind the pier will be protected by stone and the pier may be widened.

②Sheet-pile earth retaining type:

The width of the pier for fish landing is to be 10 m (required width, in general) and earth retaining will be accomplished by the sheet-pile wall.

③Sheet-pile wall type:

After driving the sheet piles, the area behind the sheet-pile wall will be filled.

④Gravity type:

The quay is to be built with cellular blocks.

These types were comparatively examined as shown in Table 4-3-5. Since the bearing ground at the quay site is not strong, a heavy structure may cause settlement problems. Thus, type ④ was deleted. Type ③ requires a large amount of steel material and is not economical. Type ② requires many construction steps and, as a result, requires a long construction period. For these reasons, it was decided to adopt type ① for the new tuna quay.

500H x 2,000 L fenders are to be installed at 6.0 m intervals to protect boats while berthing at the following speeds (v):

Purse seiner:	1,300 G/T, v = 0.25 m/sec
Reefer cargo boat:	3,000 G/T, v = 0.20 m/sec
Berthing energy (E):	E = 12.0 tonnes/m

15-tonne bitts (for breast lines) will be installed along the sea at 12 m intervals. Further, for the safety of boats berthing in multiple rows, three 50-tonne bollards will be installed as shown in Fig. 4-3-5.

The new quay will be equipped with water supply and oil supply facilities, 2 nos. respectively. Pipes are to be connected to the existing pipes along the present tuna quay (piping length to be embedded: 200m, diameter: 4B).

Fig. 4-3-5 Arrangement of Mooring Accessories

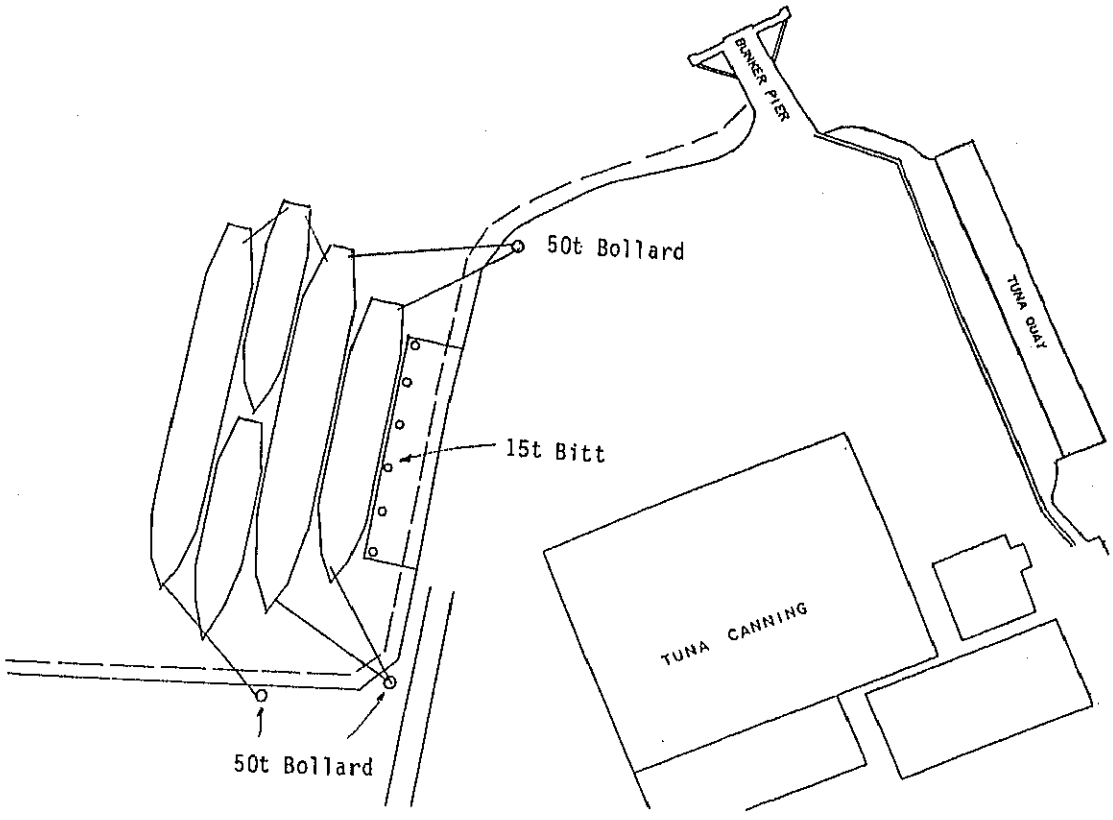
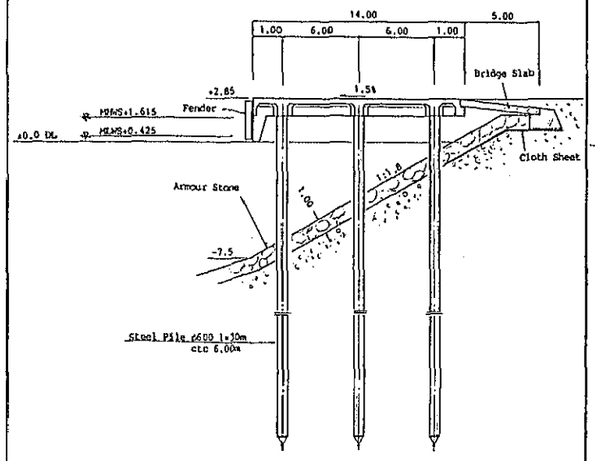
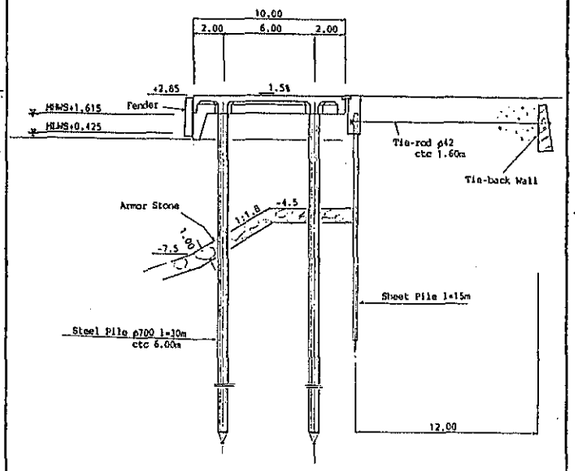
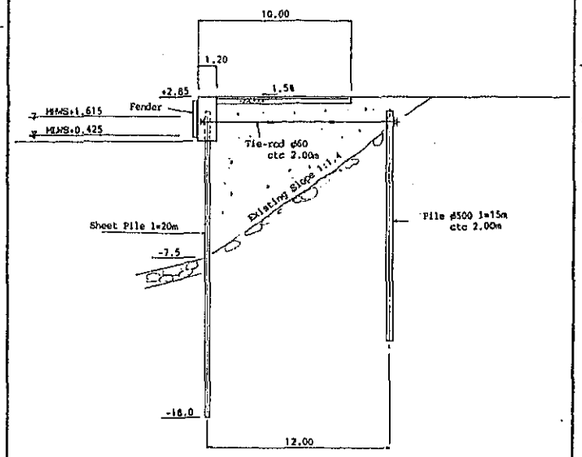
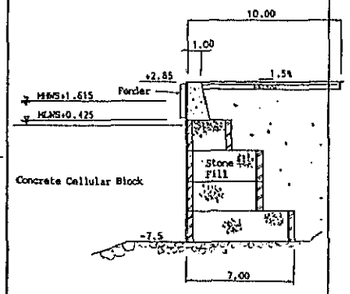


Table 4-3-5 Comparative Examination of New Tuna Quay Structure

Item \ Structure Type	① Pier Type	② Sheet-pile Earth Retaining Type	③ Sheet-pile Wall Type	④ Gravity type
Outline of Structure				
Characteristics	· Requires least amount of materials and is most economical · This type resembles the present tuna quay. This type is familiar in the country. · The slope should be protected against scouring action.	· Requires many construction steps · The pier itself is a common type but it requires sheet piles. Thus, it requires more steel material than type ①.	· The structure is simple and its construction is easy. It requires a large amount of steel material and the construction cost is high. · Requires a large amount of fill material. · The quay apron may settle.	· Since the quay site's bearing capacity is low, the structure may settle. · This type requires extensive ground improvement and the work will be very difficult in Seychelles. Thus, this type was excluded from further comparison.
Materials per 1 m: Steel piles & sheet piles	2.6 tonnes	4.3 tonnes	5.0 tonnes	
Materials per 1 m: Other steel	-	0.1 tonne	0.3 tonne	
Materials per 1 m: Reinforced concrete	15.5 m^3	11.6 m^3	3.4 m^3	
Materials per 1 m: Earth work	20.0 m^3	40.0 m^3	80.0 m^3	-
Materials per 1 m: Covering Material (slope)	21.0 m^3	11.0 m^3	-	
Materials per 1 m: Apron pavement	-	-	8.8 m^2	
Materials per 1 m: Others	Sheet 9.0 m^2	-		
Estimated Cost	100%	113%	108%	-
Evaluation	Recommended			

(2) Design of Related Fishing Port Facilities

i) Ice Making Plant (Victoria Fishing Port)

Specifications for the ice making plant are as follows:

- Ice making unit:

Capability:	6 tonnes/day, 24-hour operation/day Air cooling system
Ice type:	Plate ice

- Ice storage:

Storage capacity:	6 tonnes
Dimensions:	3.0m x 2.5m x 1.8m (Height)

- Power Supply:

For plant:	415 V, 50 Hz, 3 phase
For lighting:	240 V, 50 Hz, Single phase

- Others:

Spare parts necessary to maintain the major portions of the ice making plant.

ii) Ice Making Plant (Praslin Island)

- Ice making unit:

Capability:	4 tonnes/day, 24-hour operation/day Air cooling system
Ice type:	Plate ice

- Ice storage:

Storage capacity:	8 tonnes
Dimensions:	3.5m x 2.8m x 1.8m (Height)

- Power Supply:

For plant:	415 V, 50 Hz, 3 phase
For lighting:	240 V, 50 Hz, Single phase

- Others:

Spare parts necessary to maintain the major portions of the ice making plant.