JAPAN INTERNATIONAL COOPERATION AGENCY

SEYCHELLES FISHING AUTHORITY
MINISTRY OF AGRICULTURE &
MARINE RESOURCES
THE REPUBLIC OF SEYCHELLES

BASIC DESIGN STUDY REPORT
ON
THE COASTAL FISHERIES DEVELOPMENT PROJECT
IN
THE REPUBLIC OF SEYCHELLES

December, 1993

D & A Engineering Co., Ltd., Tokyo

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PREFACE

In response to a request from the Government of the Republic of Seychelles, the Government of Japan decided to conduct a basic design study on the Coastal Fisheries Development Project, and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Seychelles a study team headed by Mr. Ryouzo Kaminokado, Director, office of the Overseas Fisheries Cooperation, Fisheries Agency, and constituted by members of D & A Engineering Co.,Ltd., from September 9, to September 30, 1993.

The team held discussions with the officials concerned of the Government of Seychelles, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Seychelles in order to discuss a draft report, and as this result, the present report was finalized.

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

I wish to express my sincere appreciation to the officials concerned of the Government of Seychelles for their close cooperation extended to the teams.

December, 1993

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

December 1993

Mr. Kensuke Yanagiya

President

Japan International Cooperation Agency

Tokyo, Japan

Letter of Transmittal

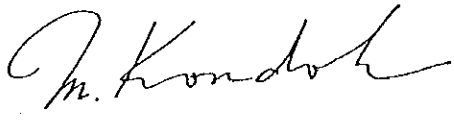
We are pleased to submit to you the basic design study report on the Coastal Fisheries Development Project in the Republic of Seychelles.

This study was conducted by D & A Engineering Co.,Ltd., under a contract to JICA, during the period September 1, 1993 to January 14, 1994. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Seychelles, and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, the Ministry of Agriculture, Forestry and Fisheries and the Fisheries Agency. We would also like to express our gratitude to the officials concerned of the Ministry of Foreign Affairs, Economic Planning & Environment, Ministry of Agriculture & Marine Resources, Seychelles Fishing Authority, JICA Kenya Office and the Embassy of Japan in Kenya for their cooperation and assistance throughout our field survey.

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

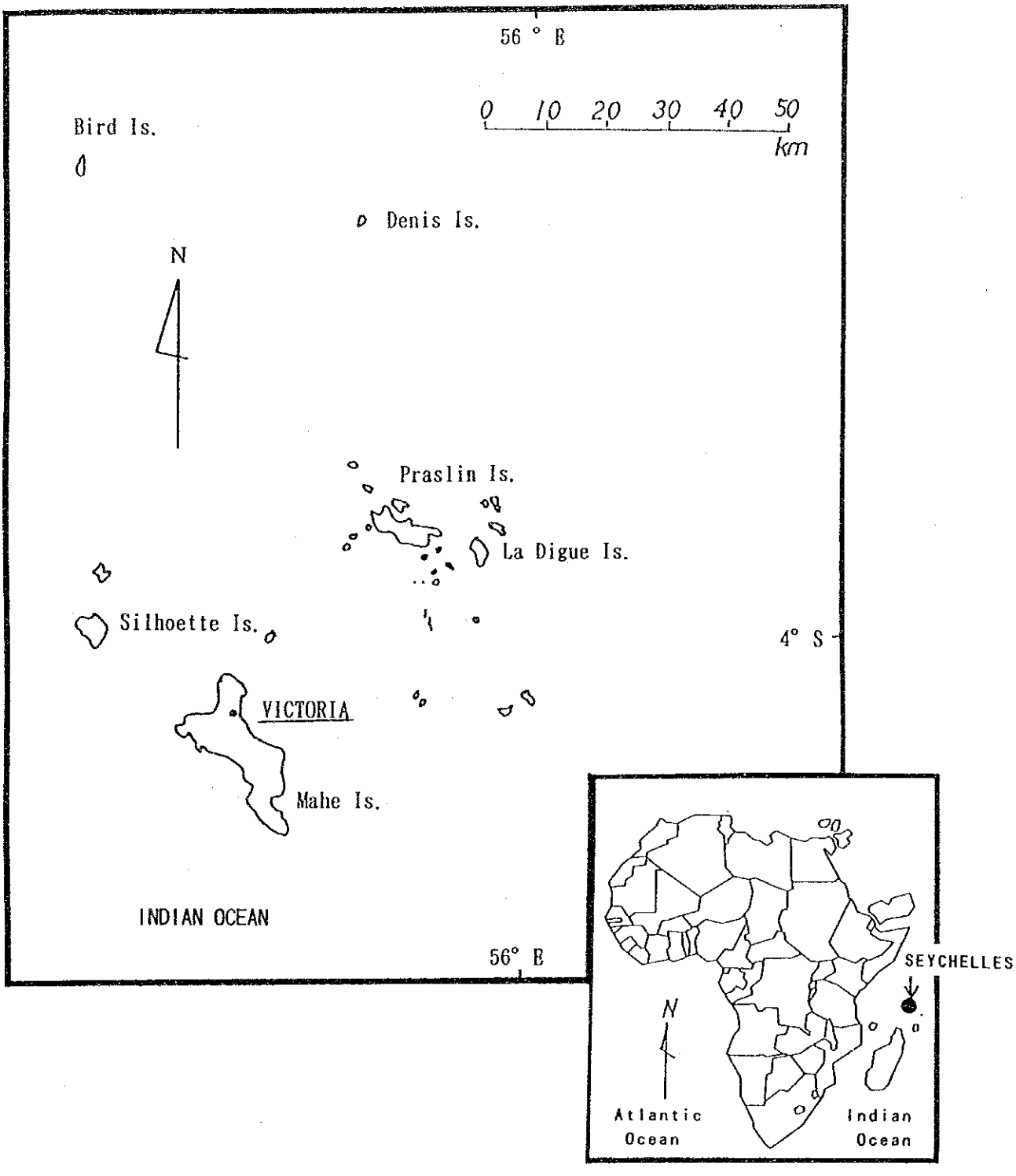
Very truly yours,



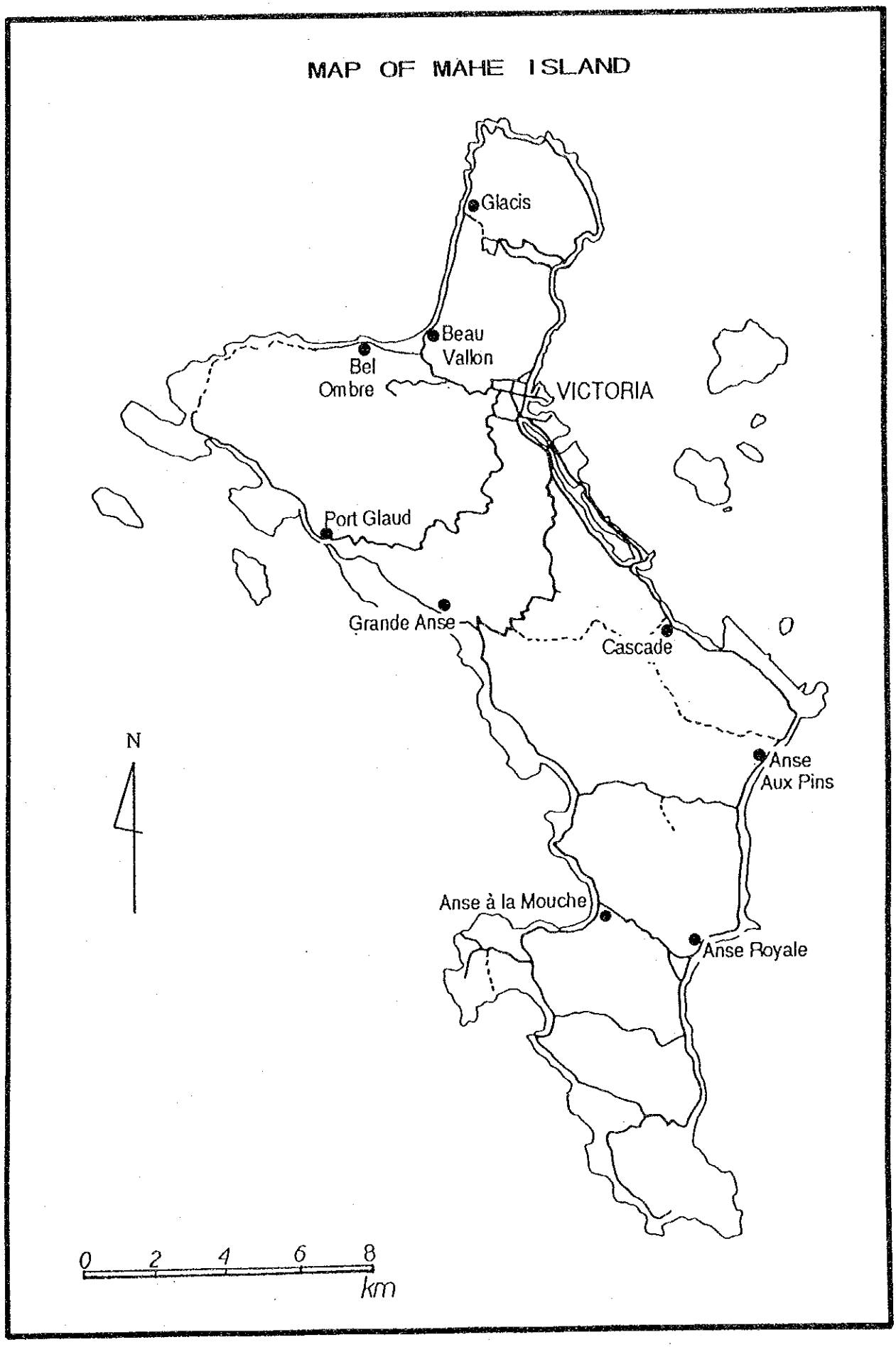
Mamoru Kondo

Project Manager,
Basic design study team on
the Coastal Fisheries Development Project
in the Republic of Seychelles
D & A Engineering Co.,Ltd.

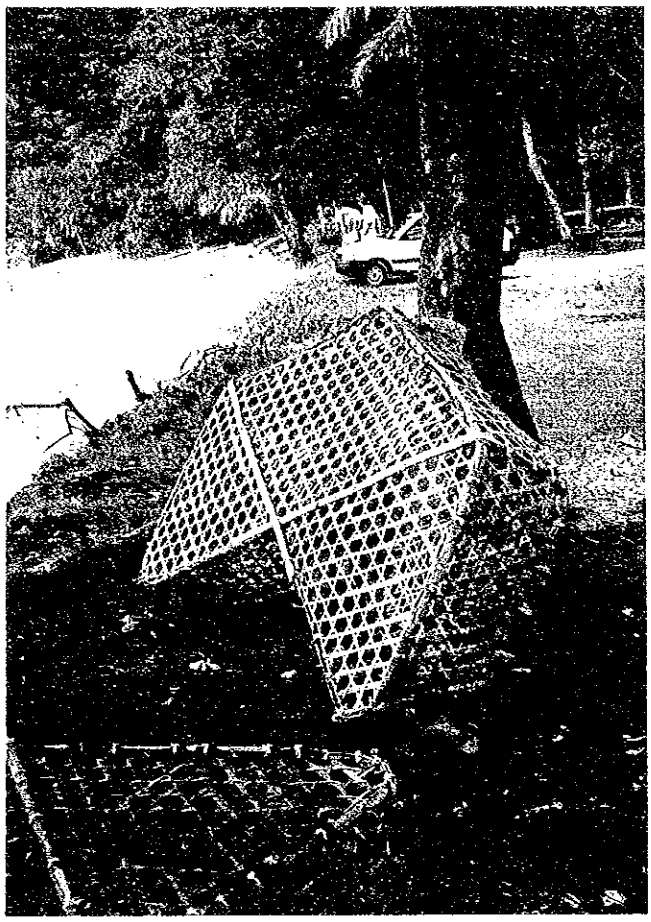
MAP OF THE REPUBLIC OF SEYCHELLES



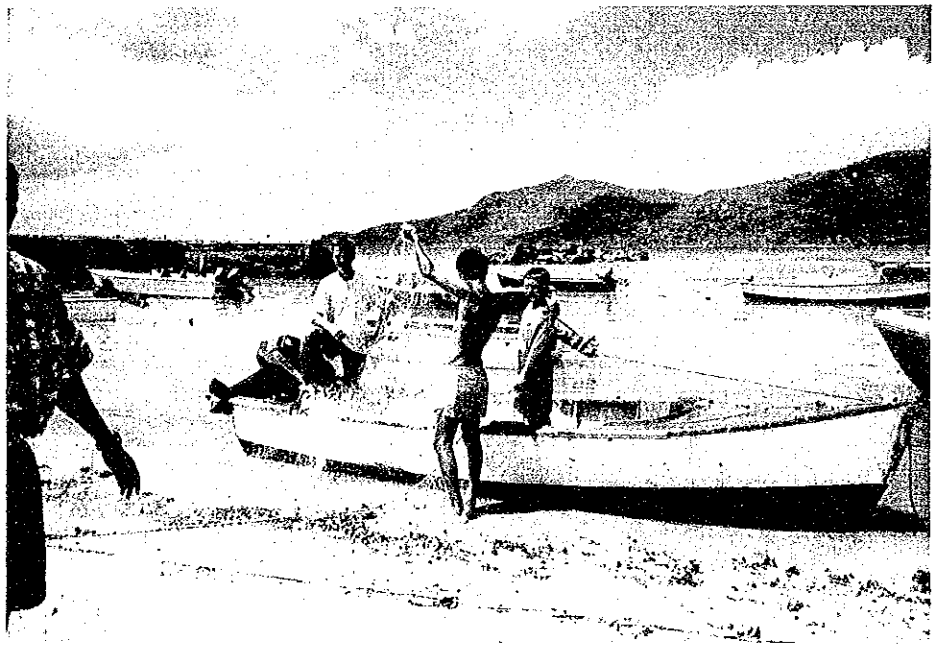
MAP OF MAHE ISLAND



PHOTOGRAPHS



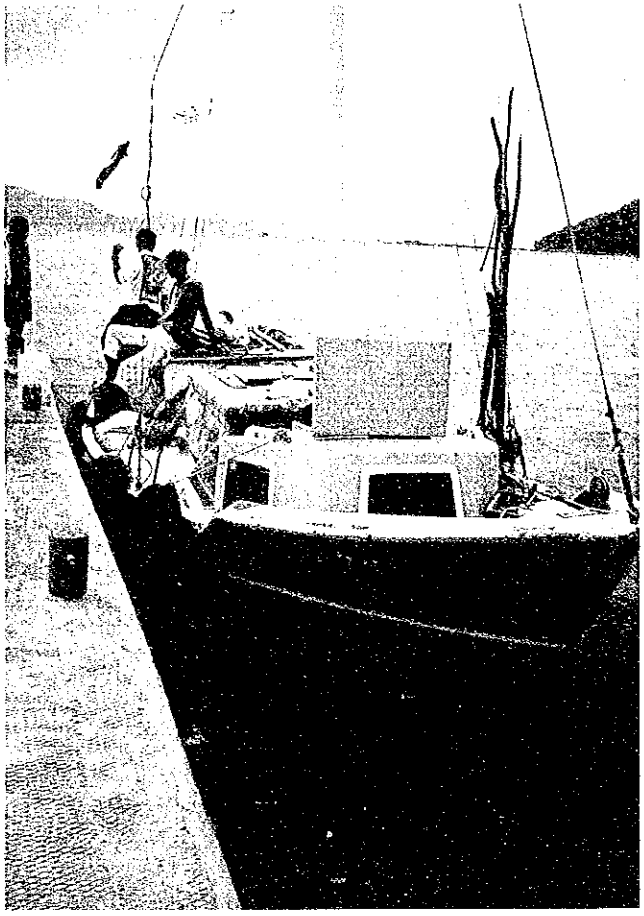
① Bamboo Trap
(Mahe Island)



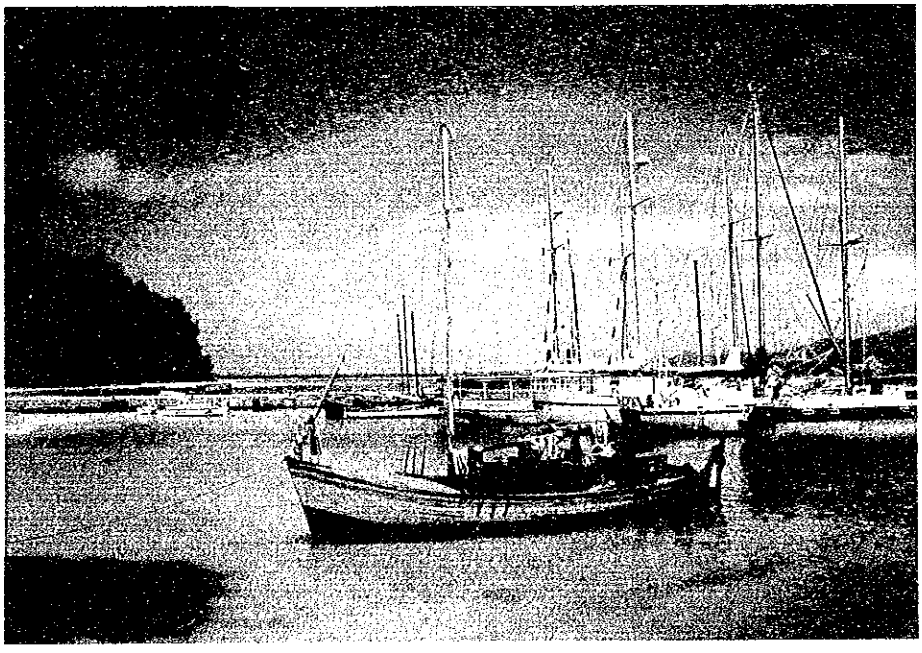
② Outboard engine fishing boat
(Bel Ombre, Mahe Island)

③ Mooring site for the fishing research vessel and New warehouse of SFA on the right side (Victoria, Mahe Island)

④ Proposed site for Ice making plant (Anse la Muche, Mahe Island)



⑤ Small Schooner
(Baie Ste Anne,
Praslin Island)



⑥ Whaler type fishing boat
(La Passe, La Digue Island)

SUMMARY

Summary

The Republic of Seychelles is an island nation in the southwest portion of the Indian Ocean, consisting of some 110 small islands, having a population of about 70,000 and a land area of about 445 ㎢. The climate is of tropical marine, being divided into two seasons; the dry season with a prevailing SE'ly wind from May to September and the rainy season with a NW'ly wind from October to April. Its EEZ covering more than 1,000,000 ㎢ is a prominent fishing ground of tuna and skipjack in the world.

In Seychelles, the tourism is a mainstay of the national economy, and other production and service sectors including agriculture, fishery, transport, communication, and finance has grown up as supporting industries of the tourism.

However, the tourism is affected heavily by the external situation, and hence the national economy is very unstable. Despite a steady growth of GDP since the independence in 1976, import of food stuff and other necessities has increased more and more, resulting in a considerable loss in foreign trade. Besides, in 1993 national budget, Rp 420 million, more than 30% of the total, is allocated for debt servicing purpose. Thus a burden of external debt per capita is very high singular in the world due to the smaller population.

In order to improve such an economic structure that the national economy depends heavily upon a single economic sector, the Government of Seychelles, with foreign assistance, has strived for the development of the fishing industry, taking advantage of abundant fishery resources within the EEZ, by using the Seychelles Fishing Authority (SFA) as an executive arm of the Government in the field of fisheries. As a result, export of canned tuna and frozen/fresh fish products came to account for almost all the export of the country. Now the fishing industry is recognized to be one of the most important industries only next to the tourism.

The Seychelles fisheries with an annual production of some 220,000 tons is divided into two sectors; the coastal fishery carried out by Seychelles nationals only and the industrial fishery for tuna and skipjack in the EEZ. The coastal fishery with some 1,100 fishermen operating a fleet of more than 400 fishing boats is satisfying almost all the fish demand in the country and exporting quality fish to Europe and neighboring countries with an annual

products of about 5,600 tons. The industrial fishery consisting of some 50 purse seiners from EC, Russia, and Japan plus many tuna long-liners from Japan, Taiwan, and Korea is harvesting about 215,000 tons of tuna and skipjack. These licensed foreign fishing vessels are based on Port Victoria, at which some 88% of their catch are transhipped. License fees, transhipping charges, and port charges generated from the foreign fleet account for some 15% of the revenue; a valuable source of the revenue. Also a tuna cannery was established in 1987 at Port Victoria and has become an important foreign money earner through the export of its canned products.

Despite the great potential, the Seychelles fishing industry has several obstacles including aging of the fishery population, and the socioeconomic status of coastal fishermen is rather low.

Under these situations, in the Third National Development Plan 1990-1994, the Government of Seychelles has determined to heighten the role of the fishery in the national economy and, in particular, to restructure the coastal fishery, and formulated a coastal fisheries development project aiming at modernization of the coastal fishery, improvement of fishing environment, and transformation of the coastal fishery into an attractive industry. To achieve these aims, it is necessary to resolve such several problems as short supply of fishing equipment and materials, lack of shore facilities, an lack of supporting services to fishermen. The Government of Seychelles therefore has requested the Government of Japan to offer a grant aid on the procurement of the equipment and materials necessary for the said project.

Responding to the request, the Government of Japan decided to conduct a basic design study on the project, and Japan International Cooperation Agency (JICA) sent a basic design study team to the Seychelles for a period between September 9 and September 30, 1993. The team carried out a field survey and data collection, and after returning home, prepared a draft final report, which was discussed again between the Seychelles officials concerned and a draft report explanation team, which was sent from November 26 to December 1, 1993.

The surveys revealed that foreign assistance in the coastal fishery sector was in success with an increasing production, average 5,600 tons for last three years, and an increasing export of fish products. Consequently the fishing industry has grown into an important industry next to the tourism. On the other hand, the coastal fishermen remain at a rather low social position, and

also the coastal fishery itself is facing several problems such as aging of the fishery population due to a small population, a small scale of the national economy, and difficult working conditions. The project requested consists of four components of modernization of the coastal fishery, improvement of fishery environment, development of suitable fishing boat, and promotion of stock management, and its details based on the basic design are as follows;

(1)	Fishing equipment for fishermen	
	1) Fishing gear and fishing instruments	1 lot
	① Dropline	
	② Echo sounder (fish finder)	
	③ Hydraulic line-hauler	
	2) Safety equipment	1 lot
	3) Marine diesel engines and spare parts	66 units
	4) Marine chandlery	1 lot
(2)	Ice plant and its shed	
	1) Ice plant: 2.5 tons/day, ice bin 7.5 tons	1 lot
	2) Shed for the above: about 35㎡	1 unit
(3)	Vehicle and workshop equipment	
	1) Truck with crane	1 unit
	2) Submersible pump	2 units
	3) High pressure washer	1 unit
(4)	Small fishing boats	
	1) Type-A: 8 m , 25 HP	2 units
	2) Type-B: 10 m , 65 HP	2 units
	3) Fishing gear	4 lots
(5)	Fishing research vessel and fishing gear	
	1) Fishing research vessel: FRP, 20 m	1 unit
	2) Fishing gear	1 lot

The cost of the project borne by the Government of Seychelles is estimated at about Rp 44,000 (¥900,000) for the site preparation of the ice plant.
The project will require approximately 12 months; 3 months for the detail design, 7.5 months for the preparation, manufacturing, and procurement plus 1.5 months for marine transport and customs clearance. Regarding the ice plant, the

procurement in Japan will take about 4.5 months and the installation at the site will require about 2 months, and hence the required working period will stay within the proposed project schedule.

The Ministry of Agriculture and Marine Resources and the Seychelles Fishing Authority (SFA) are responsible for the implementation of the project, and SFA will be in charge of the equipment and materials of the project. The fishing equipment for fishermen will be sold to the selected fishermen on the subsidy basis, and the proceeds of sales will be deposited in "Counterpart Account," which will be used to execute coastal fishery development projects with a consent of the Government of Japan. The ice plant will be managed by SFA in cooperation with Seychelles Marketing Board (SMB). The fishing research vessel will be controlled by SFA to perform necessary fishery surveys and training of fishermen. Also sea training will be given to the students of Maritime School on board the research vessel in close cooperation with the Maritime School.
On the implementation of the project, the transformation rate of outboard engine into inboard engine will increase from 35% to 54%, and an increased production will reach 320 tons, or 5% of the present production, and thus an increase of fishermen's income is expected; a remarkable economic effect. The supply of the fishing research vessel will make it possible to develop new species and new fishing grounds, which will produce the sustainable exploitation of fishery resources, and also, sea training on board the vessel will make it possible to activate fishing activities as well as to rejuvenate the fishery population through much entry of young people to the fishing industry.
These will contribute greatly to development of the Seychelles fishing industry and thus stable development of the national economy, helping to achieve the aims of the National Development Plan 1990-1994 as well as the Environmental Management Plan 1990-2000.

From the above, it is concluded that the coastal fisheries development project deserves to be implemented under Japan's grant aid and its prompt implementation is advisable as well.

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CHAPTER 1

INTRODUCTION

Chapter 1 Introduction

The fisheries sector of Seychelles is basically divided into two categories; the coastal fishery and industrial fishery. Recent annual catch of the latter is approximately 220,000 tons, of which some 86% are transhipped at Port Victoria and 10,000 to 15,000 tons are consumed for the cannery for export. The coastal fishery accounts for only 2.5% of total fishery production but supplies about 80% of national fish consumption. Also it accounts for only 1.6% of GDP but contributes to as much as almost 90 % of total export value, the second greatest source of the foreign exchange earnings next to the tourism in Seychelles. In the Third National Development Plan 1990-1994, the Government has determined to make the fishery play more important role in the national economy and to further consolidate the Seychelles' position as a fishing nation. In regard to the coastal fishery, the development strategy emphasizes to restructure progressively, and efforts have been made to improve the basis of it and thus to transform it to an attractive industry.

Under these situations, the Government of Seychelles formulated a coastal fishery development project to support the coastal fishing activities, and requested the Government of Japan to offer a grant aid on the procurement of the equipment and materials necessary for the project.

The Government of Japan, responding to the request, decided to conduct a basic design study on the project, and Japan International Cooperation Agency (JICA) sent a basic design study team headed by Mr. Ryouzo Kaminokado, Director, Office of the Overseas Fisheries Cooperation, Fisheries Agency, to Seychelles for a period between September 7 and October 3, 1993. The team discussed the details of the request with the Seychelles officials concerned, examined the urgency and appropriateness of the project, previous foreign assistance, implementation arrangements of the project and so forth, collected data and materials available, and carried out a field survey including fishery situations and related conditions.

Major points of the mutual agreement resulted from discussions were confirmed on the "Minutes of Discussions; Basic Design Study on the Coastal Fisheries Development Project in the Republic of Seychelles" signed mutually. And then, based on the analysis and review of the results of the field survey, the team assessed the effect of the project in developing the Seychelles fisheries,

conducted a basic design on the equipment and materials most suitable for the project.

The present report covers the basic design, implementation schedule, and recommendations that are judged the most suitable for the implementation of the project.

The List of Members of the Study Team, Study Itinerary, List of Persons concerned, and the Minutes of Discussions are shown in Appendix.

CHAPTER 2

BACKGROUND OF THE PROJECT

Chapter 2 Background of the Project

2-1 Overview of Seychelles

The Republic of Seychelles is a typical island nation, consisting of more than 110 small islands, in the southwest portion (4 ° 5'S, 55 ° 30'E) of the Indian Ocean, about 1,580 km east of Kenya. Its total land area is approximately 445㎢, including of about 153㎢ of Mahe Island, about 38 ㎢ of Praslin Island, and about 10㎢ of La Digue Island. Its EEZ covering more than 1,000,000㎢ is a good fishing ground. The climate belongs to the hot and humid tropical marine climate with annual average temperatures of 29.8 ℃ at the highest and 24.5℃ at the lowest, and the humidity of 80%. The year has two seasons; the dry season with a prevailing SE wind from May to September and the rainy season with a NW wind from October to April. The annual rainfall reaches 2,200 mm. No cyclone attacks the country due to its path turning aside.

The 1992 population of Seychelles is estimated at 70,763 with a growth rate of about 0.65% annually. Almost of the people are living at Mahe Island (89%), Praslin Island (7%), and La Digue Island (3%). The density of population is about 350/ ㎢. The capital city, Victoria of Mahe Island, has a population of about 24,000, 35% of the national total population. The average life expectancy is 67.3 years for male and 74.2 years for female. The population less than 20 years old is about 50% (the one less than 15 years old is about 34%), while the population more than 65 years old is about 7% of the total population.

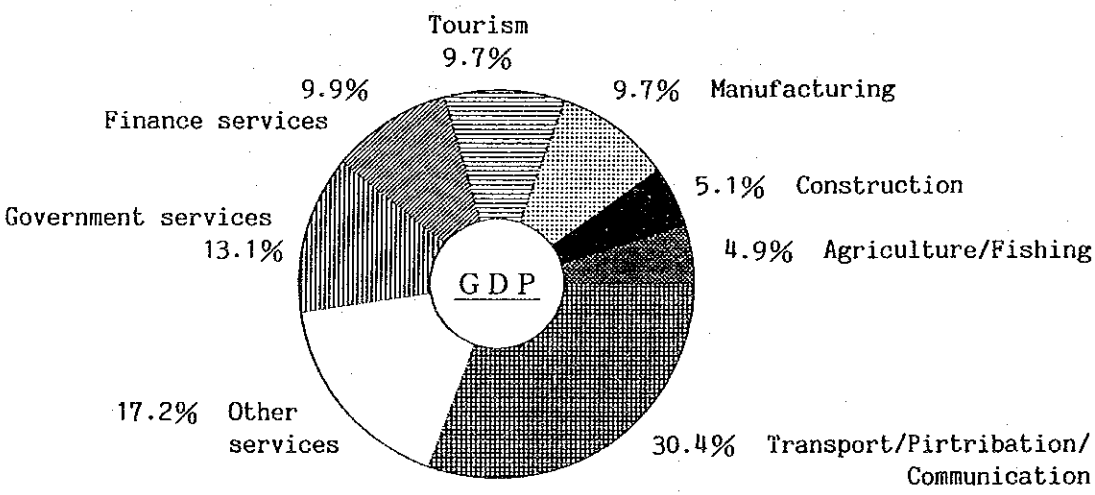
The 1991 GNP is Rp 1,890.0 million (US$ 380 million), and GNP per capita stands at Rp 26,900 (US$ 5,330), growing at a rate of 9% for last 4 years. The 1991 GDP is Rp 1,980.0 million (US$ 390 million) with a per capita GDP of Rp 28,100 (USS$ 5,550). The contribution to GDP by origin is shown in Fig. 1. Not only tranportation/disribution/communication and finance/service but also the products of the primary industries are mainly offered to tourists; that is, the tourism is the most important sector in Seychelles.

The fishing industry output accounts for only 1.6% of GDP, but the figure represents the production of coastal fishery being carried out by Seychelles nationals only. When such the production as tuna fishery by the industrial fishery, which falls into other sectors, is added, the contribution of fishery to GDP seems to exceed 10%. The fishing industry is one of the most important

industries only next to the tourism.

Tourism earned Rp 638 million in 1990 compared with 433 million in 1988, and in 1991 decrease drastically to Rp 518 million (80% of 1991) due to worldwide depression. Although the year of 1992 saw a recovery of tourism to Rp 592 million, the Seychelles tourism is affected greatly by the international factors, resulting in a fluctuating revenue. The other major foreign exchange earners are the export of canned tuna amounting to Rp 66 million and the export of frozen/fresh fish amounting to Rp 18 million. Export of these fish and fish products accounts for around 90% of the total export value. The revenue derived from the tuna fishery is Rp 199 million in 1992, of which Rp 50 million is from fishing licensing, Rp 122 million from shipment, and Rp 27 million from harbor charges and others. On the other hand, the 1992 import of foodstuffs and other living necessaries reached Rp 984 million, and hence both the foreign trade balance and invisible trade in the same year showed a considerable deficits, and the current account after adjusting by transfers also went into the red (see Table-1 and 2).

Seychelles is suffering from perpetual external debt and Rp 420 million out of Rp 1,320.0 million of 1993 national budget is allocated for debt servicing purpose.



(Source:; Seychelles Statisics Bureau, 1991)

Fig. 1 GDP by origin in 1991

Table-1 National Budget in 1993

Allocation of Authorized Expenditure	Rp 1,000
President's Office	5,944
Ministry of Agriculture and Marine Resources	20,309
Ministry of Tourism and Transport	75,115
Ministry of Finance and Information	27,340
Department of Defence	67,065
Department of Legal Affairs	2,658
Ministry of Local Government, Culture and Sports	53,473
Judiciary	6,568
Department of Audit	1,486
Ministry of Education	143,584
Ministry of Environment, Economic Planning and External Relations	21,235
Ministry of Employment and Social Affairs	18,146
Ministry of Health	94,625
Ministry of Community Development	7,797
Department of Industry	3,924
Ministry of Administration and Manpower	14,267
Department of Internal Affairs	37,086
Pensions and Gratuities	17,286
Centralized Payments	293,735
Public Debt Servicing	417,159
Interest and Service Cost	(199,897)
Principal Repayments	(217,262)
Total	1,328,802

(Source: Official Gazette)

Table-2 Balance of Payments (Rp million)

	1988	1989	1990	1991	1992*
Net Current Account	-150.7	-152.2	24.1	14.4	-9.8
Goods, services & income, net	-281.5	-278.9	-145.5	-101.9	-117.7
of which:					
Tourism income	433.1	515.0	638.5	518.8	592.5
Exports f.o.b.	92.8	81.7	149.2**	98.9	100.3
Re-exports f.o.b.	78.7	112.6	150.8	157.6	121.6
Marine & port charges	20.7	25.4	27.3	26,7	27.0
Imports f.o.b.	-726.1	-788.7	-842.7	-771.8	-834.7
Freight & insurance	-128.5	-139.5	-149.1	-136.6	-147.6
Foreign travel	-70.6	-96.5	-106.4	-66.0	-83.9
Interest					
Receipt	12.6	14.8	15.6	18.6	18.6
Payments	-47.3	-45.4	-49.4	-44.1	-40.3
Transfers, net	130.8	126.7	169.6	116.3	107.9
of which:					
Official grants	127.1	114.1	137.1	84.1	64.9
Fishing licence fees	26.8	37.8	43.4	39.8	50.3
Net Capital Account	106.9	185.4	63.9	138.7	50.2
Official loans, net***	18.0	75.4	-24.3	71.2	-39.2
Commercial bank's assets	-5.0	26.0	-14.0	-21.5	5.8
Private capital, net	93.9	84.0	102.2	89.0	83.6
Net Current & Capital Account	-43.8	33.2	88.0	153.1	40.4
Errors & omissions	20.1	-14.0	-69.4	-98.3	-21.4
Change in reserves****	23.7	-19.2	-18.6	-54.8	-19.0
(Minus sign indicates increased)					

(Source: Central Bank Annual Report, 1992)

*: Provisional.

**: This includes the re-export of two aircraft valued at Rp 70 million.

***: This comprises drawings net of repayments by the Central Government, Central Bank and other public sector organizations.

****: Comprises of external reserves of Central Bank and other public sector.

2-2 Seychelles Fishery

The agriculture/fisheries sector contributed to 1991 GDP for 4.9%, employing 2,181, about 9% of the labor force of 23,957. The contribution of the fishing industry alone to GDP of the same year was only 1.6% and the number of fishermen is some 1,100, but the export of canned products and frozen/fresh products in the fishing industry accounted for about 90% of the total export value, which fact made the fishing industry an important foreign exchange earner. The 3rd National Development Plan 1990-1994 emphasized that the fishing indusdtry is one of the most important sectors for the national economy. The fishing industry of Seychelles is divided into the coastal fishery operated by artisanal local fishermen and the industrial fishery for tuna within the 100㎢ EEZ; each fishery is playing an important role, in a different sense, for the national economy respectively. The industrial fishery employs a fishing fleet of some 50 purse seiners from EC (France and Spain), Russia, Japan (10 purse seiners), and local enterprises plus a tuna long-liner fishing fleet from Japan, Taiwan and Korea. The fishing license fees were approximately Rp 50.3 million (US$ 9.9 million) in 1992.

Table-3 Fishery Production (M/T)

	1990	1991	1992	Average	%
Industrial fishery					
Production (A)	193,000	210,000	246,000	216,333	100
Transhipment (B)	165,703	177,000	214,511	185,738	86
A - B	27,297	33,000	31,489	30,595	14
Coastal fishery					
Production (C)	5,359	5,745	5,733	5,612	100
Transhipment (D)	554	813	1,042	803	14
C - D	4,805	4,932	4,691	4,809	86
Total production					
A + C	198,358	215,745	251,733	221,946	100
Transhipment & export					
B + D	166,257	177,813	215,553	186,541	84
Local consumption & cannery	32,102	37,932	36,180	35,405	16

(Source: SFA)

As shown in Table-3, about 86% of catch of the industrial fishery are transhipped at Port Victoria. Similarly minimum 9,000 tons of tuna are to be landed annually as canning materials for export. The industrial fishery is contributing greatly to the promotion of harbor related industries through transhipment, employment through cannery, and obtaining of foreign money by export.

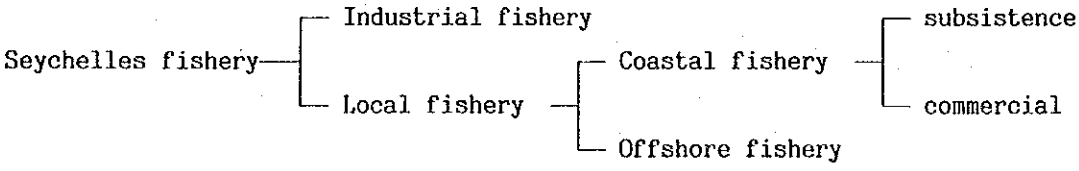
Catch of the coastal fishery accounts for only 2.5% of the total catch in the Seychelles waters but it meets almost all the nation's fish requirements (more than 80%). Furthermore it is contributing greatly to the national economy through employment, export of quality fish, and stabilization of incomes of fishermen. Subsistence fishing activities are also one of the important aspects of the national economy, though invisible in the statistics.

Recognizing the role of these two fishery sectors, the Government of Seychelles intends to develop the fishery more as a fishing nation but is compelled partly to rely on foreign assistance due to its nature of a small country and the rather small scale fishery-related budget. Efforts now is being made to improve the foundation of the coastal artisanal fishery and thus to transform it to an attractive industry so that young people may positively participate in it.

2-2-1 Fishing activities

(1) Type of fishery

According to the scale and the fishing pattern, the Seychelles fishing industry is broadly divided into the local fishing industry and industrial fishery; the local fishery is subdivided into the coastal fishery and offshore fishery and the former consists of the subsistence fishery and commercial fishery.



- Coastal fishery use small wooden/FRP outboard-engined boats (5 to 8 m long) and open whalers with inboard engines (7 to 9 m long), fishing red snapper, green jobfish, snapper, streamlined, spangled, Indian mackerel, etc. by

using mainly hand lines and traps, occasionally purse seines and beach nets, on the Mahe Plateau within 10 to 30 miles of Mahe Island. Its catch accounts for about two thirds of the local catch.

- Offshore fishery employs decked whalers with inboard engines (8 to 10 m long) and schooners (9 to 10 m long), fishing demersal fishes such as red snappers by using mainly hand lines on the edges of Mahe and Amirante plateaux on trips of 6 to 8 days. They are manned by 4 to 6 crewmembers and have a fish hold capacity of about 2 tons.
- The Industrial fishery employs the purse seiners from EC, Japan, and Russia and the tune long liners from Japan, Taiwan and Korea. They are operating in accordance with fishing agreements, paying fishing license fees. Since 1992, the Seychelles purse seiner "Spirit Of Koxe" has participated in the industrial fishery, harvesting 345 tons in the year. The Government of Seychelles places them under an obligation of transhipment at Port Victoria and supply of canning materials (9,000 tons of tuna a year).

(2) Problems of the coastal fishery

The artisanal fishery sector provides enough fish for local consumption. About 1,100 full time fishermen with more than 400 fishing boats are using mainly hand lines and fish traps. Although there is difference between the fishing patterns, e.g. one day trip against 6 to 8 days trip, the coastal fishery and offshore fishery have common problems as follows;

① Aging of the fishermen population: few recruitment of young people into the fishery due to the difficult working condition of the industry.

② Out-of-date production methods: insufficient supply of modern and effective fishing boats and fishing equipment.

③ Fluctuation of catches: the SE monsoon makes the operation of existing small fishing boats impossible, resulting in a fluctuating catch.

④ Lack of supports: port and shore facilities are limited: in particular, fishermen are not able to obtain ice except Port Victoria.

These problems are not independent and make an impression that a fishery is an unattractive industry. To improve the situation and to activate the coastal fishing activities, it is of urgent necessity to stabilize coastal fishermen's living and thus to place them on social standing appropriate to their social and economic role. The incentive measures of the Government and previous aid

projects helped to improve the situation but the current situation is far behind satisfaction, but more assistance by world fishery developed countries including Japan is needed.

Fig. 2 and Fig. 3 show the progress of catch of the coastal fishery.

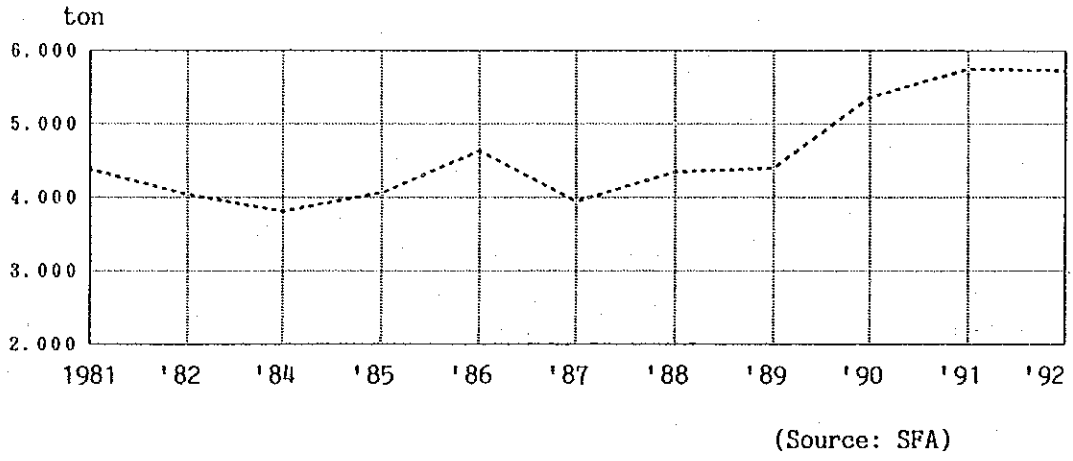


Fig. 2 Progress of catch of the coastal fishery (1978-92)

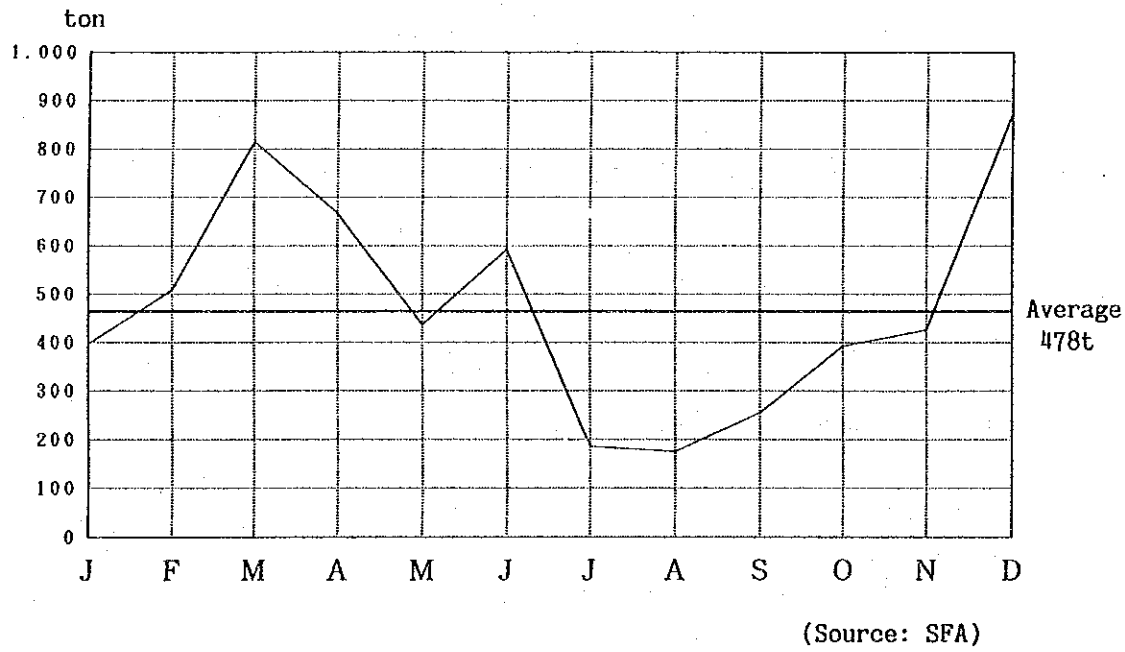


Fig. 3 Monthly change of catch of the coastal fishery (1992)

(3) Distribution

The Government established the Fishery Division in Seychelles Marketing Board (SMB) in 1984 to improve the distribution of fish products. The Division is in charge of marketing fish products of Mahe Island, Praslin Islands, and La Digue Island. Recent opening of fish marketing to private organizations decreased the volume of business of SMB to some 20% of the total catches.

The distribution route of fish products, as shown in the below, are 3 ways; firstly a way from fishermen to SMB, secondly a way from fishermen to collectors and then to market, and finally a way from fishermen to market directly.

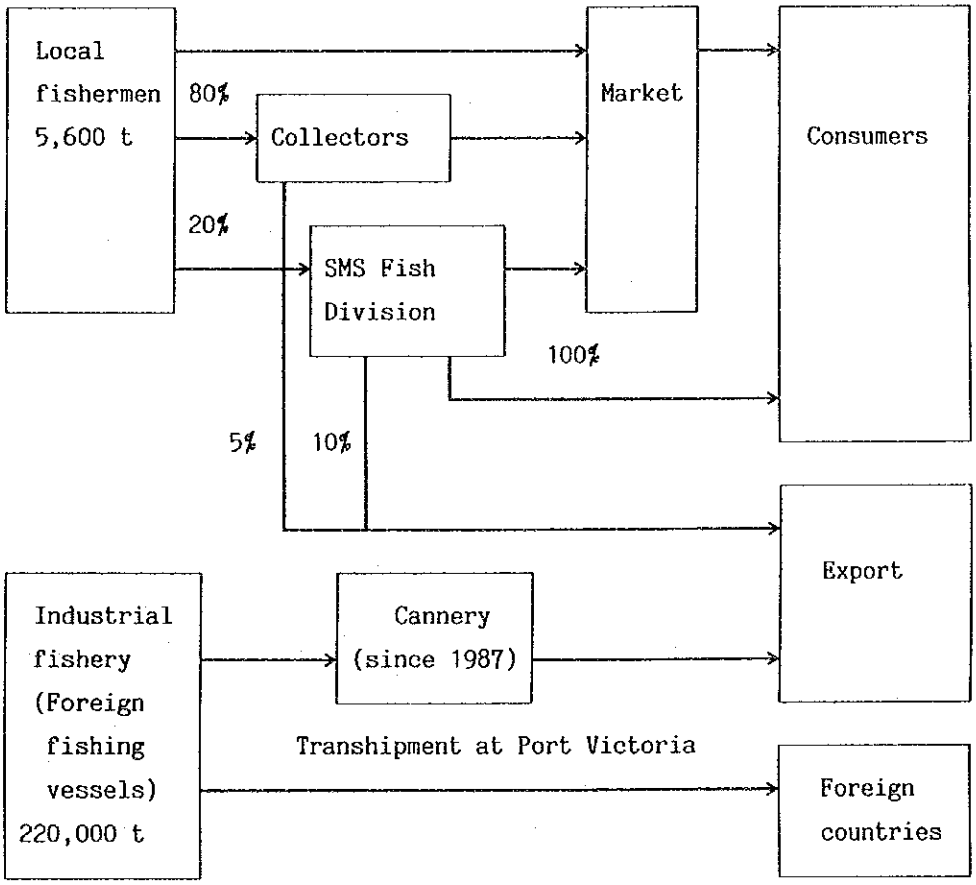


Fig. 4 Distribution of fish products

(4) Consumption

The Seychelles people traditionally have a strong preference for fresh fish. Fresh fish are sold at rather high price, while other fish products such as dried/salted are also popular. Frozen fish begin to be accepted with major consumers of schools and hotels.

The annual per capita consumption of fish is in proportion to fish production, peaking at 85 kg in 1978, and decreasing recently to 65 to 70 kg due to an increase of export.

(5) Fishery-related infrastructure

The fishery-related facilities at Mahe and Parslin Islands are as below.

Table-4 Fishery-related facilities

	Slipway	Jetty	Gear store	Market	Ice plant (t/day)	Cold store (ton)
Mahe Id.						
Anse Aux Pins	□	×	●	●	×	5
Anse Royale	●	×	□	●	×	5
Anse La Mouche	×	×	-	●	□	5
Port Glaud	×	×	-	□	×	×
Bel Ombre	●	●	□	□	×	5
Glacis	×	-	-	●	-	3
Cascade	×	●	-	●	-	3
Anse Boileam	×	-	●	●	-	-
Praslin Id.						
Grand Anse	●	●	□	●	1(flake ice)	5
Baie St. Anne	●	●	□	●	4(plate ice)	5

(Source: SFA)

● : Exist.

× : No exist.

□ : No exist but local fishermen demand strongly.

In general the fishery-related infrastructure is very poor except Port Victoria, only at which ice can be obtained at Mahe Island. The Government planned to construct these facilities at various landing sites. As shown in Table-5 below, there is generally a strong demand for a market facility and slipway for maintenance.

Table-5 Fishery-related infrastructure improvement projects

	Jetty	Market	Rest house	Passage	Slipway	Store	Break-water
Mahe Id.							
Cascade	①	②	③	-	-	-	-
Anse Aux Pins	-	③	-	①	②	-	-
Anse Royale	②	③	⑤	-	①	④	-
Anse La Mouche	-	②	-	-	①	-	-
Port Glaud	-	③	-	①	②	-	-
Bel Ombre	-	-	-	①	③	④	②
Glacis	-	②	-	-	④	③	①
Parslin Id.							
Grand Anse	①	-	③	-	②	④	-
Baie St. Anne	①	-	④	-	③	②	-
La Digue Id.							
La Passe	①	-	④	-	③	②	-

(Source: SFA)

①, ②, ・・・ represent the order of priority.

2-2-2 Administration

(1) Ministry of Agriculture and Marine Resources

The fishery is administered by the Ministry of Agriculture and Marine Resources in Seychelles. The Ministry, however, is mainly controlling agriculture, while the fishery of Seychelles is placed under the control of Seychelles Fishing Authority (SFA) which receives directives from the Ministry as shown in the organization chart on the following page.

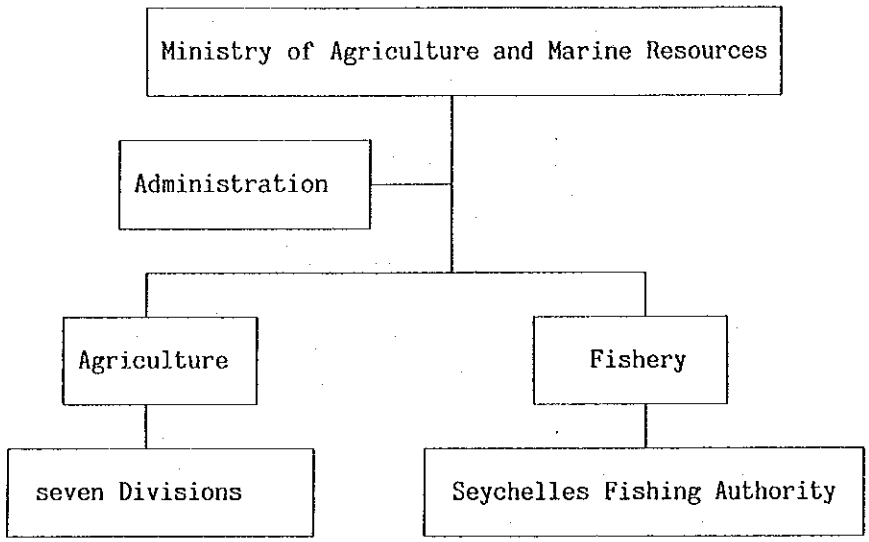


Fig. 5 Organization chart of the Ministry of Agriculture and Marine Resources

(2) Seychelles Fishing Authority (SFA)

The Seychelles Fishing Authority (SFA) was created in 1984 with a view to develop the fishing industry and is run by the Board of Directors appointed by the President. It is the executive arm of the Ministry of Agriculture and Marine Resources and employs 129 persons at present compared to 50 persons in 1986 with an increasing budget despite a constant heavy external debt of the Government. Its outline is shown below.

Outline of Seychelles Fishing Authority (SFA)

Title: Seychelles Fishing Authority (SFA)

Establishment: August 1984 by the Seychelles Fishing Authority Act

Purpose: Executive arm of the Ministry of Agriculture and Fishery to develop the fishery industry.

Organization: Board of Directors, Managing Director, and 4 divisions consisting of Administration & Service Division, Fishing Port Division, Resources Management Division, and Research Division.
Fishing research vessels and small fishing boats are operated by the Resources Management Division.

Functions: To collect statistical and other relevant information.

To issue foreign fishing licences and monitor payments.
To monitor the activities of the foreign fishing vessels.
To develop the fishing gear and fishing ground for the coastal fishery.
To research fishing resources.
To formulate fishery related regulations.
To conduct extention services and training.
To market fishing equipment and materials and to give maintenance.

(3) Seychelles Marketing Board (SMB)

The Fish Division of Seychelles Marketing Board (SMB) is in charge of marketing and distribution of fish products. The Division has a share of about 20% to 30% of the coastal fishery production, of which a half is processed to fillets to export to France, Reunion, U.K. and so on.

2-2-3 Fishery resources and fishing grounds

The catch within Seychelles EEZ accounts for 20% to 30% of the total catch in FAO Division No. 51 (30 ° E ～80° E, north of 45° S, including Sri Lanka waters) of western Indian Ocean. The major fishing ground lies in the west of the country, between 55 ° E to 65 ° E and 0 ° S to 10 ° S. In 1985 a new fishing ground was found at the water area from Somalia to the Mozambique Strait, which situation made Seychelles favorable fishing base.

Major fishing grounds for the coastal fishery are the Mahe Plateau and the Amirantes Plateau, ranging from Sector I (around three major islands) to Secor X I (the Amirantes Plateau) shown in Fig. 6 on the following page. In 1978 a joint research of NORAD and Seychelles was conducted by the "R/V Fridjof Nansen." The results of its survey are shown in Fig. 7.

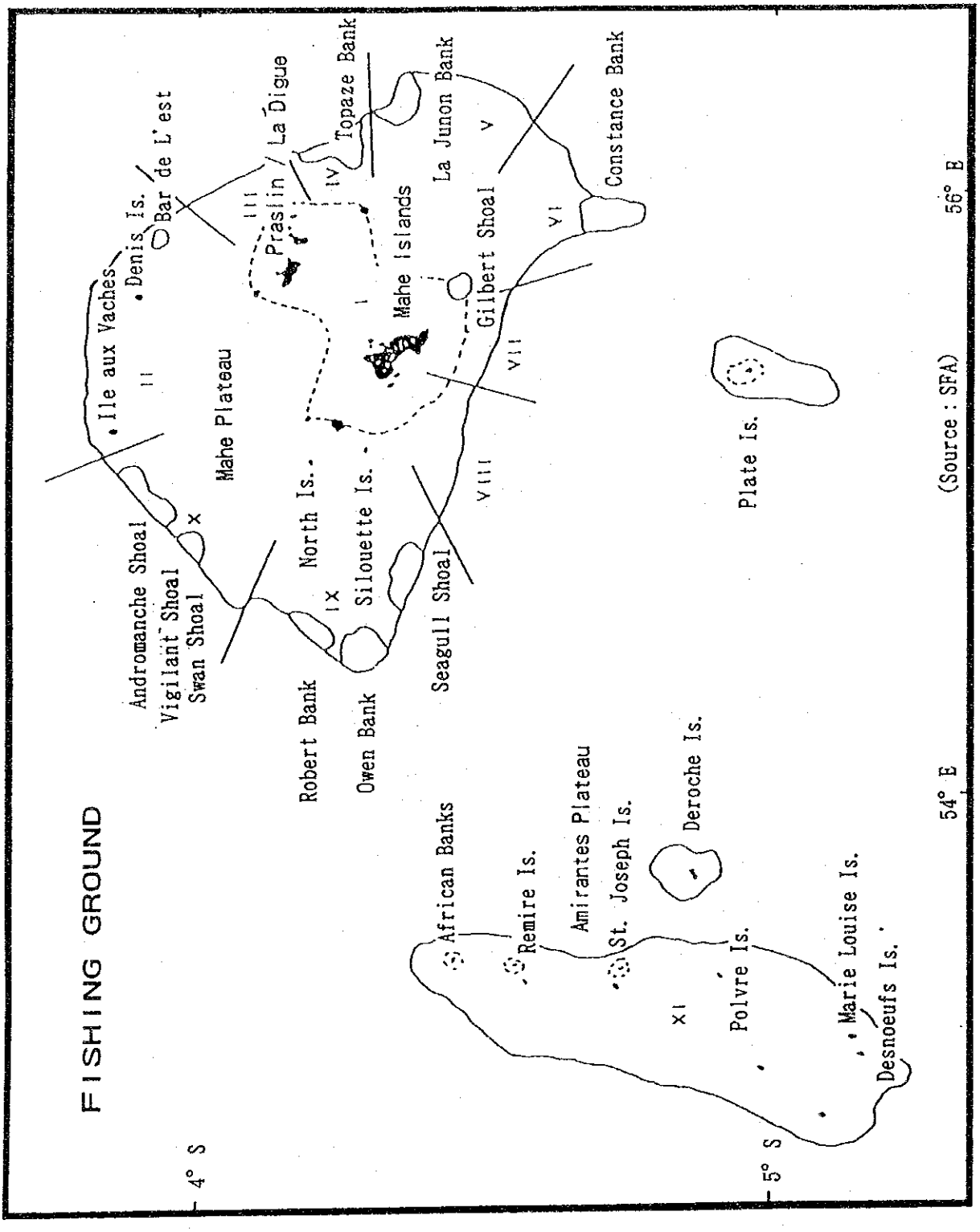
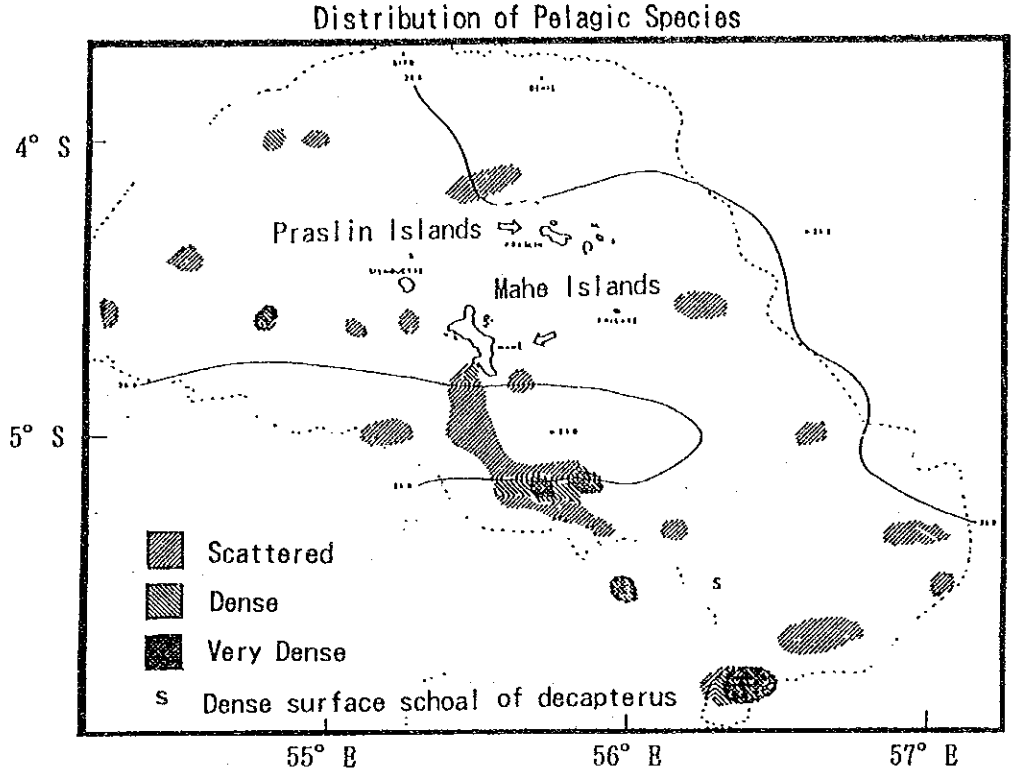
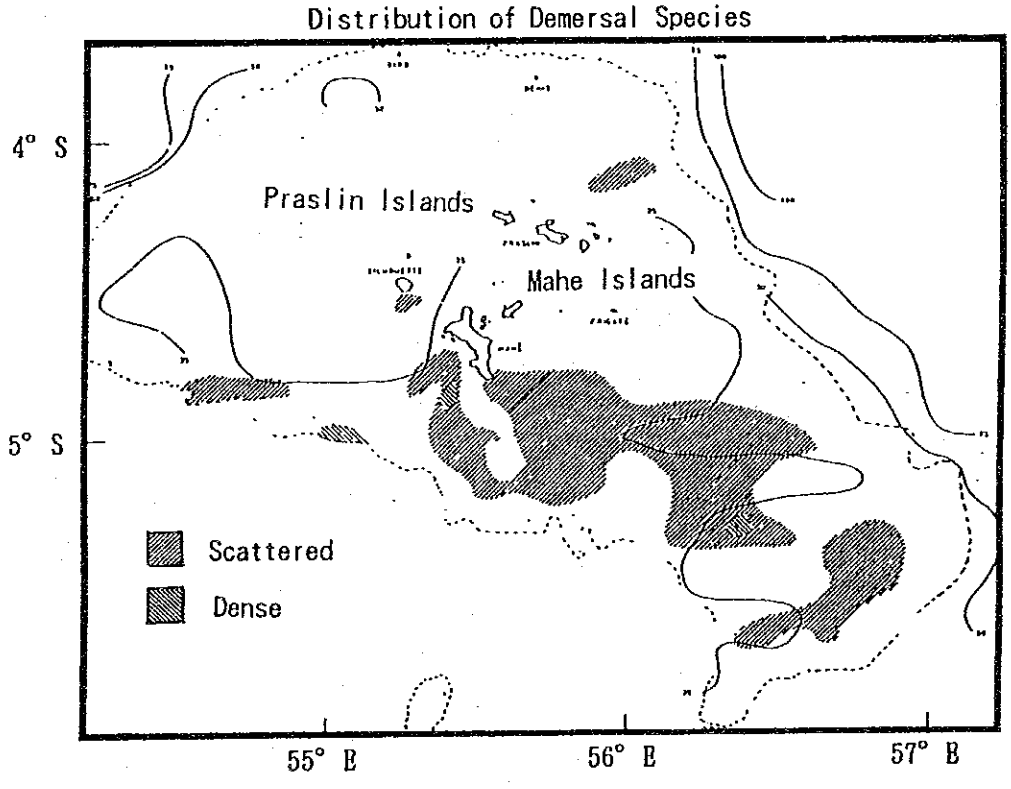


Fig. 6 Fishing Grounds





(Source: Joint NORAD/Seychelles project to investigate the fish resources in Seychelles waters, Survey results of R/V "Dr. Fridjof Nansen" in July 1978)

Fig. 7 Distribution of Species

2-3 Fishery Development Plan

2-3-1 Basic policy of fishery development

The general strategic objectives of the 3rd National Development Plan (1990-94) of Seychelles are the improvement of living standard of the nation, the achievement of sustainable development, and the reinforcement of self-supply and self-dependence. In line with this policy the development objectives of the fishery, aiming at the consolidation of the Seychelles position as a fishing nation and the promotion of the contribution to the national economy, are as follows;

1. Creation of employment opportunities.
2. Obtaining of foreign money by the promotion of export.
3. Reinforcement of activities in concert with other industries.
4. Establishment of the basis of stable development of the fishery.
5. Reservation and more effective utilization of the marine resources in view of the long-term prospect.
6. Development to an important base in the Indian Ocean fishery.

In regard of the coastal fishery, the following objectives are set to facilitate promotion and transformation of the artisanal fishery.

① to provide fishing equipment for the fishermen.
② to facilitate recruitment of young people into the fishery.
③ to promote stock management.
④ to reinforce the basis of the coastal fishery and to promote the transformation into an attractive industry.

This "Coastal Fisheries Development Project" aims at the development of the coastal fishery through supporting fishing activities of artisanal fishermen, solving problems, in line with the above-mentioned policy and strategy of the Government of Seychelles.

2-3-2 Fishery development projects

In the 3rd National Development Plan (1990-1994), there are 33 development projects in sub-sectors, amounting to Rp 318.7 million (US$ 63 million) for five years, as shown on Table-6. These projects, however, are almost financed by foreign assistance (grant is 40% and loan 60%) due to the tight economic situation of the country.

Table-6 Fishery development projects

Sub-sector	No. of project	Project cost (Rp million)
Industrial fishery	6	136.0
Coastal fishery	15	65.0
Aquiculture	3	62.0
Processing	1	2.0
Stock management	3	7.5
Man-power development	4	42.2
Local project	1	4.0
Total	33	318.7

(Source: The 3rd National Development Plan; 1990-1994)

In view of the tight economic situation, a project for acquisition of 4 purse seiners has presently been shelved with only one 46 m type purse seiner "Spirit of Koxe." Joint ventures with foreign partners are in the planning stage. Among other projects, the construction of the new tuna quay by Japan's aid has been completed as scheduled.

The coastal fishery sub-sector has as most as 15 projects, of which 6 projects were joined as a general development project, reducing to Rp 78 million in total. But, because of strong needs of fishermen, the ice plant projects at Port Victoria and Praslin Island by Japan's aid were completed in 1992. Also a jetty project respectively at two sites on Praslin Island and were implemented by a counterpart fund derived from Japan's 1986 aid. As this, several projects were executed but there are many project suspended for financial reasons. The inboard engine project aims at the improvement of the safety at sea, more economical operation, and preservation and optimum utilization of coastal fishery resources by dispersion of fishing ground. It planned originally to introduce 155 units of inboard engine in all, and until today only the rehabilitation of 10 fishing boats and the building of 3 units of 11.6 m type fishing boat and 2 units of 22 m type fishing boat were completed.

Besides, other new 5 projects were added, and the fishermen's store project at Glacis and the project for the research store for SFA were implemented by the aforesaid counterpart fund derived from Japan's aid in 1986.
In total the projects numbered 38 including additional 5 and almost of all the projects except a fishery training school project (Rp 48 million, planned to start in 1992 or 1993) were implemented as scheduled. There still remains, however, various obstacles to the development of the coastal fishery. This is the reason why grant assistance of Japan, who has a lot of successful results, is expected.

2-4 Contents of the Request

Seychelles has developed as a tourist nation, taking advantage of the most beautiful view in the world and its nature of a small island country as well at the maximum. As a result, as a outstanding exception among similar countries in the world, GNP per capita in Seychelles exceeds US$ 5,000 annually.

On the other hand, tourism is greatly depending on the international economy and agriculture with very small arable land has little prospect of further development. Investment in developing new flight routes to attract tourists and in maintenance of air facilities and the related facilities resulted in a huge external debt, falling heavily on the national economy. Because of Seychelles small population, a burden of external debt per capita is very high singular in the world.
The Government of Seychelles with abundant marine resources within its EEZ, emphasizing the importance of the fishery as one of the most important sectors in the national economy, has made efforts to develop the fishery as a key industry in the country. With this basic strategy, the Government has received three fishery grant aid projects from Japan as follows;

- 1982: Procurement Plan for Materials & Equipment for the Implementation of the Praslin Treated Water Supply Project (¥ 350 million)
- 1986: Coastal Fisheries Development Project (¥ 350 million)
- 1990: Project for Reinforcement of Fishing Port and its Facilities (¥ 640 million)

These aid projects have been successful in the modernization of the coastal

fishery, improvement of fishery environment, development of suitable fishing boats, and promotion of fishery resources management, but various obstacles still remains. Hence the Government of Seychelles formulated this "Coastal Fisheries Development Project" and requested the Government of Japan to offer a grant aid on the procurement of the equipment and materials necessary for the Project. The contents of the request are as follows;

(1) Fishing equipment for fishermen — 1 lot
   ① Fishing gear, echo sounder, etc.
   ② Safety equipment, radio telephone, etc.
   ③ Marine diesel engine
   ④ Marine chandlery

(2) Ice making plant — 1 unit
   Capacity: 2 tons/day

(3) Vehicle — 1 unit
   Truck with 2 ton crane

(4) Fishing boats — 4 units
   ① Type-A FRP 8 m type, 25 HP 2 units
   ② Type-B FRP 10 m type, 65 HP 2 units

(5) Boat for research and extension service — 1 unit

CHAPTER 3

CONTENTS OF THE PROJECT

Chapter 3 Contents of the Project

3-1 Objectives of the Project

Efforts have been made to develop the fishery by the Government of Seychelles, which established the Seychelles Fishing Authority (SFA) and have implemented various fishery development projects. As the result, the fishery has contributed greatly to the national economy in the improvement of nutrition of people, increase of employment opportunities, obtaining of foreign currency by exporting fish products, and revenue of fishing license fees, resulting in growing to the most important industry next to tourism. In regard to the coastal fishery, however, it has several problems peculiar to an island country as follows, which situation is arresting the development of itself.

① Insufficient supply of modern and effective fishing equipment
The majority of artisanal fishermen are forced to operate with superannuated fishing boats and inefficient fishing gear due to a short supply of modern and effective fishing equipment and materials. The existing boats and fishing equipment restrict fishing grounds, resulting in concentration of fishing efforts in a certain area and thus a decline of coastal fishing resources.

② Lack of port and shore facilities
Various fishery development projects based on the governmental strategy and recent opening (1992) of exporting fish products to private corporations caused dispersion and expansion of fishing grounds offshore. Consequently, the fishing days at sea became longer and keeping the catches fresh became more necessary. Nevertheless port and shore facilities to support the coastal fishing activity are very poor. Fishermen of Mahe Island, for example, are able to get ice at Port Victoria only.

③ Lack of supports for fishermen
Lack of supports including extention service, technique of processing, management and so on makes it difficult for fishermen to manage their fishery business.

④ Aging of the fishermen population
The hard and difficult working condition prevent young people's participation in the fishery. The fishermen using small fishing boats are

forced to curtail their fishing during the SE monsoon season, and hence their income is Oubject to heavy fluctuation. Despite strong wishes for training, the Maritime School has no training vessel. These are part of reasons why the recruitment of young people into the fishery is difficult.

The project aims at resolution of these problems through the activation of the coastal fishery by supplying new fishing gear, marine engines, safety equipment and so on, the improvement of supporting facilities by the installation of an ice-making plant in the South Mahe, and the reinforcement of extention services and the development of most suitable type of fishing boat by the supply of new fishing boats and research vessel. By the implementation of the project the following effects are expected.

① Increase of catches and incomes of fishermen, and then improvement of their living standard through supplying fishing equipment and materials.

② Optimal utilization of fishery resources through the dispersion of fishing efforts.

③ Improvement of fishery environment through the installation of fishery supporting facilities at fishing communities.

④ Development of new stocks and new fishing grounds by the activities of the new research vessel.

⑤ Promotion of participation of young people in the fishery through training fishermen and the students from the Maritime School.

3-2 Study and Examination on Contents of the Request

3-2-1 Appropriateness and necessity of the request

In regard to the "Coastal Fisheries Development Project" requested by the Government of Seychelles, the basic design study team had a series of discussions with Seychelles officials concerned about the background and contents of the request and their implementation arrangements, and also carried out a necessary field survey. From the results of the field survey, the team concluded the appropriateness and necessity of the request to be as follows;

① Necessity of the request and the position of the coastal fishery.

Seychelles has a rather high GNP per capita, while having as much as the

almost world-highest external debt per capita. Though the tourism is the mainstay of the Seychelles economy and the greatest foreign money earner, it must depend on the international situation, and the Seychelles agriculture is not favored by natural conditions such as topography and climate. For the development of the country, a comprehensive development of an industry next to the tourism is essential. In particular, despite a fishery carried out by Seychelles nationals only, the coastal fishery is not very well developed. From the viewpoint of supplying protein, employment, export and so on, the coastal fishery is an essential part of the Seychelles fishery sector.

② Current situation of the coastal fishery and a social status of fishermen

Several obstacles common to the small island country such as small population, meager fishery-related budget for wide EEZ, tourism-dependence, etc. are preventing the full development. In particular, the coastal fishery, originally a subsistence fishery, is still at the early stage of development as an industry, and a great deal of support is required to overcome such impediments as inefficient fishing methods, heavy dependence on natural conditions, poor organization of fishermen, lack of credit, poor financial support, difficult working conditions and so on. Its fluctuation of incomes and difficult working conditions particularly restrict recruitment of young people.

③ Environmental consideration

Furthermore, a concentration of fishing efforts to a certain fishing ground and a certain species is one of impediments. Any dispersion of fishing efforts cannot be achieved by fishermen alone due to obsolete fishing boats and equipment and their comparatively weak socioeconomic power. As a result, there is a sign of a decline of a certain stock. It is essential that various project be implemented to achieve the major objective of "sustainable development" in the National Development Plan and Environmental Management Plan (1990-2000) and to develop the fishery with the coastal fishery resources preserved. From this, this project is important.

④ Appropriateness of the request to Japan

The fishing industry is an important sector for the Seychelles economy, and the Government, under foreign assistance has, implemented various fishery development projects with success despite the tight national economy. However, after many test fishing projects to establish the foundation of the coastal fishery, being backed by sound finance and economic effects of implemented projects, it is essential that further promotion of the sustainable coastal fishery supporting projects be carried out with a long-term view on the preservation of resources and environment, training for fishermen, improvement of related industries and facilities, and activation of distribution. In this respect, Japan's experience in the fishing industry plus its wealth can give highly appreciated assistance to developing Seychelles. The past three projects provided by Japan have been fully utilized. In particular, in the "Coastal Fisheries Development Project" in 1986, similar to the concept of the project, deposited counterpart funds on the proceeds of provided equipment and materials have been effectively employed as a part of fund for implementation of the projects for improvement of port/shore facilities in local fishing communities. The requested project is based on the results of the previous Japan's grant aid project for the development of the coastal fishery, and its equipment and materials are the most suitable ones, matching with the actual fishery condition and the technical level of the coastal artisanal fishermen. The proposed measures to resolve the problems as well as the proposed target of the requested project are realistic. The team concluded that the requested project deserved to be implemented as a Japan's grant aid project.

3-2-2 Study and examination on requested equipment and materials

The coastal fishery of Seychelles is facing serious problems such as development difficulties resulted from small national economy due to a small island country, a low social position of fishermen, and aging of the fishery population. To resolve the problems step by step and to develop the coastal fishery to a future main industry, the requested equipment and materials including the fishing equipment for fishermen, ice plant, vehicle, fishing research vessel, and small fishing boats are very suitable.

After full discussions with the Seychelles side, the team concluded that the items of the requested equipment and materials have the appropriateness, and, on the basis on the examination of components of the requested project, its 5 components are all to be included in the grant aid project. However, normal fish hooks and fishing lines in the request were deleted because shortage of fishing materials at present was caused by new fishing methods and fishing gear for the modernization of the coastal fishery.
The following are the original request and agreed contents after discussions and examination of the components of the request.

(1) Original request and results of discussions

Request		Decided contents
① Fishing equipment for fishermen	1 lot	
(a) Fishing gear	1 lot	Agreed as request
(b) Safety equipment	1 lot	Agreed as request
(c) Marine diesel engines	75 units	66 units in total 10-18 HP 15 units 21-27 HP 20 units 34-42 HP 25 units 52-70 HP 6 units
(d) Marine chandlery	1 lot	Agreed as request
② Ice making plant Capacity: 2 tons/day	1 unit	Agreed as request. More capacity was requested but it will be dealt with the type of plant. Installation and shed construction shall be included.
③ Vehicle Truck: 2 tons load Crane: 2 ton capacity	1 unit	Agreed as request. More crane capacity was requested.
④ Fishing boats	4 units	Agreed as request.
(a) Type-A FRP 8 m type, 25 HP	2 units	
(b) Type-B FRP10 m type, 65 HP	2 units	
⑤ Fishing research vessel FRP, 20 m long, 12 berths main engine of 240 HP	1 unit	Agreed as request. Additional equipment was requested. More fish hold capacity was requested instead of 10 berths.

(2) Examination of components of the request

The request, consisting of various equipment and materials, is divided into four components as follow;

Components	Contents
① Modernization of the coastal fishery	• Supply of fishing equipment for fishermen (fishing gear, echo sounder, safety equipment, marine diesel engine)
② Improvement of fishing environment	• Supply of an ice plant • Implementation of infrastructure improvement projects funded by proceeds of sales of fishing materials.
③ Development of suitable fishing boat	• Supply of small fishing boats
④ Promotion of stock management	• Supply of a fishing research vessel

The development of the Seychelles coastal fishery cannot be achieved in one step effort. Following priority, many obstacles must be eliminated step by step. From this point of view, a relation between the components above and their effects is estimated as follows;

Table-7 Request components and problems of the coastal fishery

	Problems of coastal fishery			
	Lack of equipment	Lack of facilities	Lack of services	Aging of fishermen
Modernization of the coastal fishery	Supply of equipment	-	-	-
Improvement of fishing environment	Supply of equipment	Supply of ice plant & CP/F projects	Supply of truck	CP/F projects
Development of suitable fishing boat	-	-	Supply of fishing boat	-
Promotion of stock management	-	-	Supply of r/v	Supply of r/v

Note: CP/F project - Counterpart fund project
r/v: Fishing research vessel

And the expected effects of each components are as follows;

① Modernization of the coastal fishery
- Increase of catch by activation of the coastal fishery.
- Saving of labor, promotion of efficiency and safety by installation of inboard engines.

② Improvement of fishing environment
- Promotion of quality control, decrease of post-harvest loss, increase of incomes of fishermen by easy obtaining of ice.
- Promotion of fishing efficiency and improvement of working condition by improvement of port/shore facilities in local fishing communities.

③ Development of suitable fishing boat
- Systematic fishing activity and stable fishery management on marketing situation by the introduction of the most suitable fishing boat.
- Improvement of working condition by the rationalization of the operation

pattern.

④ Promotion of stock management

- Improvement of data collection.
- Introduction of new fishing gear and new fishing methods.
- Effective utilization of fishing resources by the development of new species and new fishing grounds.
- Improvement of fishing technique through the training of fishermen and students on board the research vessel.
- Increase of recruitment of young people into the fishery.

Furthermore, it should be noted that for the achievement of coastal fishery development objective of the Government, the improvement of the credit and socioeconomic status of fishermen is also essential, in line with the modernization of coastal fishery and the improvement of fishery environment. Among the fishing equipment for fishermen, basic fishing gear such as fishhooks and fishing lines should be bought by fishermen themselves even if these materials are temporarily in short supply due to foreign currency situation.

3-2-3 Project area and proposed project site

(1) Overview of the project area

The project covers the main islands of the Seychelles Group including three major islands of Mahe Island, Praslin Island, and La Digue Island and also coastal artisanal fishermen of these islands.

The Republic of Seychelles consists of 115 islands with a population of 68,598 according to the 1987 census (the 1992 estimation is 70,438) and an land area of 455 ㎢.

The data of three major islands are as follows;

- Mahe Island has Victoria, the capital of Seychelles.

  Population: 61,183, of which 24,325 is a population of Victoria.

  Land area: 152㎢

- Praslin Island

  Geographical position: 15 minutes flight, or 3 hours trip by boat, from Victoria.

  Population: 5,002 (1987 census)

  Land area: 41 ㎢

Distance from the capital: about 50 km.

• La Digue Island

Geographical position: Half an hour trip by boat from Praslin Id.

Population: 1,926 (1987 census)

Land area: 15 km²

Distance from the capital: about 50 km. (about 8 km from Praslin Id.)

Full-time fishermen are estimated at about 1,100, but, like other island nations, Seychelles coastal fishery has many part-time fishermen, who are earning partly from other resources and are indistinguishable from full-time fishermen. Admittedly, skipper-cum-owners are about 600 and other crew members are always fluctuating. According to the 1987 census, the fishery employs 849 persons, of which fishermen are 573. On the basis of information from SFA and the field survey, the number of fishermen was estimated at 1,000 to 1,260 (see Table-9). The distribution of fishing boats except the schooners based on Mahe Island is about 60% for Mahe Island, about 32% for Praslin Island, and about 8% for La Digue Island. Motorization rate is high at Mahe Island and low at Praslin and La Digue Islands (see Table-8).

Open boats powered by outboard motors account for about a half of total fishing boats throughout the country. From the viewpoint of improving working condition, transformation to inboard engine is highly expected, and the marine diesel engines to be supplied by the project are in line with a fishing boat construction plan of SFA (see Table-10).

Table-8 Average monthly fishing fleet (1992)

	Pirogue	Outboard	Inboard	On foot	Total	% by area
Mahe Id.*						
NW	2.9	25.4	10.7	1.6	40.6	(9.7)
NE	4.8	30.7	40.9	0	76.4	(18.2)
SE	12.5	35.3	18.6	3.0	69.4	(16.5)
SW	8.4	24.0	11.4	19.8	63.6	(15.2)
Sub-total	28.6	115.4	81.6	24.4	250.0	(59.6)
%	[11.4]	[46.2]	[32.6]	[9.8]	[100.0]	
Praslin Id.						
NE	28.4	36.6	7.2	5.2	77.4	(18.5)
NW	22.6	30.4	2.4	1.9	57.3	(13.6)
Sub-total	51.0	67.0	9.6	7.1	134.7	(32.1)
%	[37.9]	[49.7]	[7.1]	[5.3]	[100.0]	
La Digue Id.	6.9	14.0	4.5	9.4	34.8	(8.3)
%	[20.6]	[46.8]	[22.8]	[9.7]	[100.0]	
Grand total	86.5	196.4	95.7	40.9	419.5	(100.0)
%	[20.6]	[46.8]	[22.8]	[9.7]	[100.0]	

*: plus 60 schooners. (Source: SFA)

Table-9 Fishing fleet and fishermen (1987-1992)

A. Number of fishing boat

Type	1987	1988	1989	1990	1991	1992
pirogue	148	135	117	102	82	87
[1987=100]	[100]	[91]	[79]	[69]	[55]	[59]
Outboard	182	180	171	192	203	198
	[100]	[99]	[94]	[105]	[111]	[109]
sub-total	330	315	288	294	285	285
	[100]	[95]	[87]	[89]	[86]	[86]
Inboard	60	70	81	84	84	95
[1987=100]	[100]	[117]	[135	[140]	[140]	[158]
Schooner	24	21	16	16	21	60
	[100]	[88]	[67]	[67]	[88]	[250]
sub-total	84	91	97	100	105	155
(Motovization)	(20)	(24)	(25)	(25)	(27)	(35)
	[100]	[108]	[115]	[119]	[125]	[184]
Total	414	406	385	394	390	440
(100%)	(100)	(100)	(100)	(100)	(100)	(100)
[1987=100]	[100]	[98]	[93]	[95]	[94]	[106]

(Source:SFA)

B. Number of fishermen(Estimation based on No. of fishing boats)

Fisherman $N = \Sigma (Nb \times n)$

Fishermen=No. of fishing boats×average crew members

Average crew members

Pirogue	1.9
Outboard	2.1
Inboard	3.5
Schooner	5.8

Type	1987	1988	1989	1990	1991	1992
pirogue	281	256	222	194	156	165
Outboard	382	378	359	403	426	416
sub-total	663	634	581	597	582	581
Inboard	210	245	284	294	294	333
Schooner	139	122	93	93	122	348
sub-total	349	367	377	387	416	681
	(34)	(37)	(39)	(39)	(41)	(54)
Total	1012	1001	958	984	998	1262
(100%)	(100)	(100)	(100)	(100)	(100)	(100)
[1987=100]	[100]	[99]	[95]	[97]	[98]	[125]

(Source:SFA)

Table-10 Fishing boat construction plan of SFA (1994-97)

Type	1994		1995		1996		1997		Total	
	N	R	N	R	N	R	N	R	N	R
Inboard										
Lekonomi	6	2	6	1	6	2	8	2	26	7
Whaler	10	3	10	2	10	3	11	3	41	11
Schooner										
small schooner	8	2	8	2	8	3	9	3	33	10
large schooner	2	1	2	1	2	1	2	1	8	4
Sub-total	26	8	26	6	26	9	30	9	108	32
Grand-total	34		32		35		32		140	

Note: N represents the number of newly building fishing vessels and R the number of fishing vessels under rehabilitation.

(2) Proposed project site

The proposed project site where an ice making plant is to be installed is located at Anse La Mouche in the Southwest Mahe, one of seven landing sites at the area. The car journey to Victoria, about 25 km away, takes about 30 minutes. The site owned by the Government covers a space of about 100㎡ along the trunk road encircling Island. Permission to utilize the site was given. Also leveling of ground, electricity, water supply, and telephone, which are in charge of the Seychelles side, are prepared. The sea is shallow for some distance from the shore at Anse La Mouche, and fishermen are using the beach in the inlet for maintenance of their fishing boats during the SE monsoon season. They are also exchanging information here. On the neighboring land is the former fish collecting center of SMB, which was transferred to a private company in January 1993.

(3) Mooring site of the fishing research vessel

Part of the schooner quay west of the SFA headquarters at Port Victoria is to be

used for mooring the fishing research vessel. At present a warehouse for researching equipment and materials of SFA is being build on the neighboring plot, which will be completed the end of 1993. Since the warehouse and the quay is within easy access, this site is ideal for mooring the fishing research vessel.

3-2-4 Implementation arrangements

(1) Implementation

The Ministry of Environment, Economic Planning and External Relations acts as the contact Ministry, and the authority responsible for the project is the Ministry of Agriculture and Marine Resources and Seychelles Fishing Authority (SFA). SFA was established in 1984 with a view to develop the fishery and run by the Board of Directors appointed by the President. The number of its staffs was 50 in 1986 but increased to 129 in 1992. From the viewpoint of importance of development of the fishery, the budget also increased to Rp 7.18 million from Rp 4 million in 1988 with annual rate of 12.4% despite the tight national economy. On the implementation of the project, SFA should obtain cooperation from Development Bank of Seychelles (DBS), Maritime School, Seychelles Marketing Board (SMB), and the Ministry of Environment, Economic Planning and External Relations.

(2) Management

The Resource Management Division of SFA takes charge of the implementation of the project. The Division at present has a staff of 26 persons for its activities of extension service, monitoring the fishing activities, management of the research vessel and so on. It has successfully carried out various surveys in cooperation with the Research Division. Since the Division transfered recently its 2 fishing boats to the private sector, its capacity including financing and manpower was judged to be sufficient to manage the proposed fishery research vessel. The following are the method of operation and maintenance of the proposed equipment and materials.

① Fishing equipment for fishermen

The fishing equipment for fishermen to be provided by the project will be sold to fishermen through a 100% Government-owned company, Indian Ocean Marine (IOM; the Government purchased it in 1983; capital is Rp 350,000). Selected fishermen will buy necessary fishing equipment with a loan from DBS through a

financing system organized by SFA. The price marked by SFA corresponds to domestic market. As a rule there is very little subsidy on all the goods in Seychelles, but some subsidies depending on the kind of articles, 10% to 15% corresponding to money rates, will be applied from the viewpoint of the project purpose of the diffusion of new fishing gear and safety equipment for the development of the coastal fishery.

The reinforcement of the spirit of self-help of fishermen is one of major objectives of the project. In Seychelles without organization of fishermen, free distribution of fishing equipment may only broaden earning differentials among fishermen. To establish a sound management of the fishery business through the buildup of self-help of fishermen, the selling of fishing equipment to fishermen is a suitable method.

② Counterpart fund

The receipts from the fishermen as payment of the fishing equipment will be deposited in "Counterpart Account," which will be used to execute infrastructure improvement projects. The utilization of the fund is strictly controlled through a procedure; that is, to begin with, SFA proposes a plan to the the Ministry of Finance and Information, and after the approval of the said Ministry, the plan is given back to SFA and then implemented subject to consent of Japan's Government. It is needless to say that the plan is audited by the Department of Audit.

- Procedure of use of counterpart fund

SFA's proposal → Ministry of Finance and Information → SFA → consent of the Government of Japan → SFA → Execution → Department of Audit

This procedure was applied to the previous Japan's grant aid project with success. From this, the team judged that the application of this system to the project has no problem.

③ Other equipment and materials and the fishing research vessel and small fishing boats

The management of the proposed ice-making plant, originally planned to be done by Seychelles Marketing Board (SMB), will be done directly by SFA due to the transfer of the fish collecting center to a private firm in line with a government policy of opening of the fish distribution and exporting business to

the private sector. A periodic inspection and maintenance of the facility, however, will be done by SMB on the contract basis after the completion of the project.

The management of the fishing research vessel, like the "Etelis," will be done directly by the Fishery Management Division of SFA. Its major task is fishery research, training of fishermen, and on board training of Maritime School students. Training of fishermen will be conducted during the fishery research trips and on board training of students will be performed under the close cooperation with the Maritime School. Training of Maritime School students has been conducted at the workshop of SFA, and hence, there seems to be no problem on the cooperation between SFA and Maritime School. This will contribute greatly towards recruitment of younger fishermen in the industry.

Four small fishing boats will belong to SFA and be used to collect fishing data and conduct extension services. The small truck will also belong to SFA and have a multipurpose usage such as pulling up outboard motors, marine engines, small boats, etc. and transport of removable FRP fish holds. The supply of small fishing boats will help coastal fishermen to improve their social standing through establishment of sound fishery business and improvement of incomes. Besides, these boats will be also effective for assisting fishermen with boats equipped with outboard engines who cannot afford to own a whaler or a schooner. The small truck is used in place of the worn-out truck of SFA to refresh supporting services to fishermen. All of these equipment and materials, the team considers, are necessary for the proposed project.

(3) Budget

Besides the government-alloted budget, the Government of Seychelles receives annually ECU 300,000 (Rp 1.75 million) from EC, as one condition of fishing agreement. Such money that is used to preserve the fishery stock or to protect the environment is treated with priority. Based on a balance estimation of each equipment, the team concluded that management of all the equipment is financially viable. Recently SFA has planned an increase of the research budget with a view of the need for a better assessment of marine resources and environment research.

3-2-5 Relation with foreign assistance

The Government of Seychelles depends on foreign assistance for almost all the fishery development projects, large or small, due to the national financial situation. The coastal fishery sector for which the project is implemented has the most important development plan in the fishery sector, consisting of six projects including the construction of fishing boats and improvement of channels, and the supply of marine diesel engines of the project is linked closely with the plan. Similarly, the fishing research vessel is to be used for the stock survey and fishery research in the said plan. However, the nature of supplying equipment and materials, the project does not compete with or overlap the said projects, but complements the said plan toward the development of the Seychelles coastal fishery.

The following are major foreign assistance in the fishery sector

(1) General fishery development project (Project No. FIS/011/007)

Six projects including a fishing boats construction project and a channel improvement project were integrated to the project. The major financing source is ADB.

① Objective and task

Export of fishery products, full supply to domestic demand, improvement of international payments through import substitutes.

The task ranges from the improvement of fishery-related facilities to reinforcement of fishery production methods. The stock management project of SFA is included in this project.

② Period 1992 to 1995

③ Project area Coastal fishery

④ Project cost Rp 78 million

⑤ Responsible agency SFA

(2) Stock management project (Project No. FIS/011/027)

The project is to be funded by World Bank. The Terms of Reference was decided in March 1993.

① Objective and task

Sustainable utilization of fishery stock. The project is also connected with the protection of environment.

② Period 1990 to 1994
③ Project area Assessment of fishery stock
④ Project cost Rp 3 million
⑤ Responsible agency SFA

(3) Bel Ombre breakwater improvement project (Project No. FIS/011/034)

The project funded by ADB aims to repair the destroyed breakwater at Bel Ombre.

① Objective and task

One of the infrastructure improvement projects.

② Period 1993 to 1994
③ Project area Bel Ombre (northwest part of Mahe Island)
④ Project cost Rp 0.6 million
⑤ Responsible agency SFA

(4) Tuna Quay improvement project (Project No. FIS/011/001)

The project funded by EC aims to improve the tuna quay in Port Victoria.

① Objective and task

Improvement of fender equipment of the tuna quay to meet the transhipment requirements.

② Period Completed in September 1993.
③ Project area Port Victoria
④ Project cost Rp 7.4 million
⑤ Responsible agency SFA

3-3 Estimation of the Balance

Among the equipment and materials of the project, the fishing research vessel, small fishing boat, and ice plant are to produce costs for operation. Each balance is estimated as follows;

(1) Fishing research vessel

Four crew members plus six researchers or trainees will be on board the vessel. The researching work is to involve training, and, in that case, teachers are to be involved in the number of the trainees. In a very short trip more persons will be able to participate, which case is excluded in the estimation.

(A) The operation plan is as follows;

- Trip days a year: Research 160 days + training 48 days = 208 days
- Trips a year: Research 16 trips + training 12 trips= 28 trips
- Mean trip days: Research trip 10 days
  Training trip 4 days mean 7.4 days

• Preparation for trip:	1.5 days × 28 trips	=	42 days
• Maintenance just after trip:	1.5 days × 28 trips	=	42 days
• Docking:	once a year		15 days
• Maintenance:	once a year	=	10 days
• Holidays:	60 days × 208/365	=	34 days
• Repairing fishing gear:	2 times × 5 days	=	10 days
• Reserve:			4 days
		Total	365 days

(B) Assuming that a cruising speed of 8 knots and the operation area within a 160-miles radius from Mahe Island are applied, the number of actual researching days and hours is as follows;

• Turnaround to and from fishing ground:	16 trips(32 days) × 40 hrs	=640 hours
• Long lining:	32 days × 8 hours	=256 hours
• Gillnetting	16 days × 8 hours	=128 hours
• Droplining	32 days × 8 hours	=256 hours
• Reel fishing	32 days × 8 hours	=256 hours
• Trolling	8 days × 8 hours	= 64 hours
• Trap fishing	8 days × 8 hours	= 64 hours
Total	128 days	1,664 hours

(C) Assuming that each one of 40 students of Maritime School is given training for a 4-day trip once a year on the edge of Mahe plateau 50 miles away from Mahe Island, the actual training hours are calculated as follows;

• Turnaround to and from fishing ground:	12 trips(12 days)	× 12.5 hrs	=150 hours
• Long lining:			
• Gillnetting:	24 days	× 8 hours	=192 hours
• Droplining:			
• Other fishing:	12 days	× 8 hours	= 96 hours
Total	36 days		438 hours

(D) The crew organization and their wages as as follows;

		Wages	Sea allowance
• Skipper	1	Rp 3,000/month	Rp 50/day at sea
• Engineer	1	Rp 2,500/month	Rp 40/day at sea
• Deckhand A	1	Rp 1,800/month	Rp 30/day at sea
• Deckhand B	1	Rp 1,500/month	Rp 25/day at sea
Total	4	Rp 8,800/month	Rp145/day at sea

(E) The operation cost based on the above factors is as follows;

• Wages for crew:	Rp 8,800×12 months		=Rp 105,600
• Sea allowance:	Rp 145×208 days		=Rp 30,160
• Provisions for crew:	Rp 50×365 days×4 persons		=Rp 73,000
• Provisions for researchers:	Rp 50×160 days×6 persons		=Rp 48,000
• Provisions for trainees;	Rp 50× 48 days×6 persons		=Rp 14,400
• Ice:	Rp 260/ton×3 tons×16 trips		=Rp 12,480
	Rp 260/ton×1 ton ×12 trips		=Rp 3,120
• Fuel oil:	240 HP×0.9 ×185 g/hr/HP		
	2,102 (1,664+438)hrs	×0.92ℓ/g×Rp4.27/ ℓ	=Rp 329,970
• Lubricating oil:	240 HP×0.9 × 5 g/hr/HP		
	2,102 (1,664+438)hrs	×0.92ℓ/g×Rp11.6/ ℓ	=Rp 24,227
• Expendables:	Rp 310/HP		=Rp 74,400
• Port charges, communications:			=Rp 10,000
Total			Rp 725,357

(F) Catch and its proceeds of sales are expected as follows;

- Research trip: 128 days ×50 kg/person/day×10 persons×0.8 = 51,200 kg
- Training trip: 36 days ×50 kg/person/day×10 persons×0.8 = 7,200 kg

Total 58,400 kg

A unit price of Rp 6.0/kg is applied; Rp 6.0/kg ×58,400 kg =Rp 350,400

(G) From the above the balance is calculated as follows;

Operation budget appropriated by the Government
ECU 300,000 ×25% × Rp 5.9/ECU = Rp 450,000

Proceeds of sales = Rp 350,400

Operation cost = Rp 725,357 (-

Balance (net profit) Rp 75,043

In short, SFA can operate financially the proposed research vessel by spending some 25% of ECU 300,000 which the Government receives annually from the EC Fishing Agreement. The "Etelis" is also given 21% of ECU 300,000, that is Rp 375,000. When SFA employs the "Etelis" and new research vessel, Rp 825,000 in total will be required. The amount is within the EC assistance money, accounting for 61% of it. Furthermore, with researching tasks expanding, SFA may be permitted to use the ADB loan for the integrated coastal fishery development project (project No. FIS/11/07). The "Etelis" was given part of the ADB loan according to her task. The same step is to be taken to the proposed research vessel.

(2) Small fishing vessels

Cost estimation of two types of small fishing vessel of the project was made. To examine the capability of depreciation by Seychelles fishermen themselves when Seychelles come to produce suitable fishing boats locally, Rp 300,000 and Rp 500,000 of purchase cost for each 8 m type boat and 10 m type boat were added to factors to be considered, though these cost is originally nil from the viewpoint of grant aid. The balance was estimated to be in black as below even if the depreciation was added, i.e. Seychelles fishermen will be able to operate the small fishing vessels to be provided by the project with financial viability.

	① 8 m type	② 10 m type
Income (Proceeds of sales)	Rp 185,625	Rp 285,000
Expenditure	Rp 147,937	Rp 229,061
Balance (net profit)	Rp 37,688	Rp 55,939

The following are major factors in calculation and a breakdown of the estimation.

(a) Major factors

	① 8 m type	② 10 m type
• Performance of boat		
Fish hold	3 m³	4 m³
Main engine	25 HP	65 HP
Speed	10 kn	10 kn
Operation range	30 miles	50 miles
Fishing days	2 days	5 days
Crew	3 persons	4 persons
Useful life	10 years	10 years
Trips a year	100 trips	40 trips
Mean catch	6.25 kg/person/hr	6.25 kg/person/hr
• Investment		
Purchase cost	Rp 300,000	Rp 500,000
Loan	0	0
Capital	0	0
• Repayment		
Loan term	5 years	5 years
Interest	0.1	0.1
• Depreciation term	10 years	10 years
• Insurance		
Insurance rate of ships insurance	0.035	0.035
Third party insurance	Rp 3,000	Rp 3,000
• Maintenance cost	Rp 100/HP	Rp 100/HP
• Prices		
Diesel oil	Rp 4.27/ℓ	Rp 4.27/ℓ
Lubricating oil	4% of fuel oil	4% of fuel oil

Ice	Rp 0.26/kg	Rp 0.26/kg
Bait	Rp 2.5/person/day	Rp 2.5/person/day
Provisions	Rp 25/person/day	Rp 25/person/day
Fishing gear	Rp 20/person/trip	Rp 20/person/trip
Fish	Rp 6.0 /kg	Rp 6.0 /kg
• Profit sharing		
Owner	33%	33%
Crew	67%	67%

(b) Balance estimation

• Cost	① 8 m type	② 10 m type
(1) Operation cost		
① Fuel oil	Rp 11,049	Rp 19,151
② Lubricating oil	Rp 442	Rp 766
③ Fishing gear	Rp 12,000	Rp 16,000
④ Ice	Rp 429	Rp 572
⑤ Bait	Rp 1,500	Rp 2,000
①~⑤	25,420	38,489
⑥ Wages	Rp 76,518	Rp 113,572
Sub-total (1)	Rp 101,938	Rp 152,061
(2) Fixed cost		
① Depreciation	Rp 30,000	Rp 30,000
② Insurance	Rp 10,500	Rp 17,500
③ Third party insurance	Rp 3,000	Rp 3,000
④ Maintenance	Rp 2,500	Rp 6,500
⑤ Repayment	Rp 0	Rp 0
⑥ Interest	Rp 0	Rp 0
Sub-total (2)	Rp 46,000	Rp 77,000
①~⑤+(2)	Rp 71,420	Rp 115,489
(1) +(2)	Rp 147,937	Rp 229,061

• Income		
Catch (year)	kg 30,938	kg 47,500
Catch (month)	kg 2,578	kg 3,958
Proceeds (year)	Rp 185,625	Rp 285,000

Proceeds (month)	Rp 15,469	Rp 23,750
• Income-Cost(excluding wages)	Rp 114,205	Rp 169,511
• Earnings of fishermen	Rp 76,518	Rp 113,572
Yearly earnings per person	Rp 25,506	Rp 28,393
Monthly earnings per person	Rp 2,125	Rp 2,366
• Earings of owner (SFA)		
Yearly earnings	Rp 37,688	Rp 55,939
Monthly earnings	Rp 3,141	Rp 4,662

(3) Ice plant

Assuming that the supply of ice is 806 tons (15.5 tons/week ×52 weeks/year) a year, the balance estimation of the ice plant to be installed at Anse La Mouche was calculated as follows;

• Proceeds of sales of ice: 806 tons/year ×Rp 260/ton = Rp 209,560/year

• Operation cost:

Wages	2 persons×Rp 2,500/month×12 months/year	= Rp 60,000/year
Electricity	7.5KWH×24 hr/day ×365 days×Rp 1.5/KWH	= Rp 98,550/year
Water	3.0 m³/day× 365 days ×Rp 15/m³	= Rp 16,425/year
Maintenance	Rp 1,000/month×12 months/year	= Rp 12,000/year
Total		Rp186,975/year

As shown above, the proceeds of sales of ice can meet the operational requirements.

Income	Rp 209,560/year
Expenditure	Rp 186,975/year
Balance	Rp 22,585/year

3-4 Technical Cooperation

The equipment and materials supplied by the project are all within SFA staff's capability. However, introduction of new fishing gear usually necessitates a knowledge based on various experiences. In Seychelles particularly a reinforcement of a planning capacity on stock research and management of the research vessel is very important. Also a cooperation in an educational aspect

such as training of Maritime School students and fishermen is useful.
In the previous aid project (1986) Japan sent one fishery expert successfully for a period of 2 years from November 1988.
The Seychelles Government requested one expert of the fishery sector and acceptance of two trainees (fishery and engine maintenance) in the original request. A cooperation in such sector will heighten the effect of the project.

3-5 Outline of the Project

The outline of the project is as follows;

(1) Contents of the project

a. Modernization of the coastal fishery

① Supply of fishing equipment for fishermen.
(fishing gear, safety equipment, marine diesel engine, etc.)

b. Improvement of fishing environment

② Supply of an ice plant including a shed

③ Supply of a small truck

c. Development of suitable fishing boat

④ Supply of small fishing boats to make a study of the most suitable type of fishing boat.

d. Promotion of stock management

⑤ Supply of a fishing research vessel.

(2) Implementation agency

The implementation agency of the project is the Seychelles Fishing Authority (SFA), and SFA should obtain cooperation from the Ministry of Environment, Economic Planning and External Relations, Development Bank of Seychelles (DBS), Maritime School, and Seychelles Marketing Board (SMB) to carry out the project successfully.

(3) Budget

In addition to the budget from the Government, the Government of Seychelles is given annually ECU 300,000 (Rp 1.75 million) on the basis of a fishery agreement with EC. The money will use to operate the fishing research vessel of the project.

(4) Staffing plan

At present SFA employs 129 persons. When the project is implemented, SFA will run two research vessels, the existing "Etelis" plus a new vessel provided by the project, and SFA is well experienced in the management of research vessels and its capacity is sufficient since its 2 fishing boats were transferred to the private sector. A cooperation of SMB is desirable for the maintenance of the ice plant.

(5) Site condition of the ice plant and the mooring site of the fishing research vessel

The site is a government-owned plot with an area of about 100 ㎡ at Anse La Mouche in the Southwest Mahe. The installation of a shed housed the ice-making machine is included in the project. Leveling of ground, electricity, water supply, drainage and other facilities were prepared by the Seychelles side. The mooring site of the research vessel is part of the schooner quay west of the SFA head office at Port Victoria. There stands a warehouse for the research equipment and materials near the quay.

(6) Management

All the equipment and materials except the fishing equipment for fishermen (the component of the modernization of the coastal fishery) are managed by SFA.

The fishing equipment for fishermen are to be sold to the selected fishermen on the subsidy basis. The receipts from the fishermen as payment of fishing equipment will be deposited in "Counterpart Account" to be used various projects for development of the coastal fishery. The use of the Account is strictly controlled through a procedure as follows;

SFA's proposal ⇨ Ministry of Finance and Information ⇨ SFA ⇨ consent of the Government of Japan⇨ SFA ⇨ Execution ⇨ Department of Audit.

The management of the proposed ice plant will be done directly by SFA. The periodic inspection and maintenance of the facility, however, will be under contract with SMB.

Like the "Etelis," the fishing research vessel is managed by SFA and used for fishing survey and training purpose. Four small fishing boats will also belong to SFA and used for data collecting and fishery business teaching purpose. The small truck of the workshop of SFA will be multipurposefully used.

CHAPTER 4

BASIC DESIGN

Chapter 4 Basic Design

4-1 Design Policy

The selection and determination of the equipment and materials were conducted based on the results of the field survey and on the natural condition, current situation of the fishery and fishery-related industries, the technical level and traditional fishing practice of Seychelles, so that they could contribute to the achievement of the objective of development of the fishery. The criteria are as follows;

(1) Tourism is the mainstay of the Seychelles economy, and hence the natural beauty of the island must be preserved. Also Seychelles has a tropical marine climate, and hence the equipment and materials must be endurable to the hot and humid natural condition.

(2) The coastal fishery of Seychelles is considerably behind in the development compared to the tourism, and the project is to play a significant role to improve this situation. It is essential to assist the promotion of the spirit of free enterprise of Seychelles nationals.

(3) Taking the current activities and the equipment and materials being used by Seychelles fishermen into consideration, the specifications are not to be too far beyond the technical capability of local people.

(4) To facilitate easy maintenance and operation, the equipment and materials requiring expensive management cost must be avoided.

(5) The quantities of equipment and materials must be decided on the staffing plan of the Seychelles side.

(6) Based on the current situation of maintenance capability and import of spare parts, it is necessary to provide adequate maintenance tools and spare parts.

(7) The equipment and materials to be sold to fishermen must be selected carefully based on the technical level and purchasing power of fishermen.

4-2 Examination of Contents of Requested Equipment and Materials

4-2-1 Fishing equipment for fishermen (Modernization of the coastal fishery)

The scale of fishing equipment except marine diesel engines is to be established on a SFA's fishing boat construction plan, which aims to reduce the number of pirogues and out-board engined boats to whalers or schoolers equipped with inboard engines for the modernization of the coastal fishery. The effects of the plan are① increase of the safety at sea, ② decrease of fuel/maintenance costs, and③ promotion of laborsaving and fishing efficiency. The following Table-11 shows the SFA's boat construction plan and the number of fishermen affected by the plan, and Table-12 shows the estimate of fishing fleet and fishermen in 1992.

Table-11 Fishing boat construction plan of SFA (1994-95)

Type	New building	Rehabili-tation	Total	@ crew member/boat	Fishermen affected	Total
Inboard engine						
Lekonomi	12	3	15	2.7	40.5	150.5
Whaler	20	5	25	4.4	110.0	
Schooner						
small	16	4	20	5.8	116.0	150.8
large	4	2	6	5.8	34.8	
Total	52	14	66			301.3

Table-12 Estimated fishing fleet and fishermen in 1992

Type	No. of boats	@ crew member/boat	No. of fishermen
Outboard			
Pirogue	87	1.9	165.3
Outboard	198	2.1	415.1
Inboard			
Inboard	95	3.5	332.5
Schooner	60	5.8	348.0
Total	440		1,261.6

① Fishing gear and instruments

The transformation of outboard-engined boats to boats with inboard engines is under way with a rate of 35%, as shown in Table-13.

Table-13 Transformation of engine (1987-92)

	1987	1992	1992/1987
No. of outboard boats (a)	330	285	0.86
No. of inboard boats (b)	84	155	1.84
Total (c)=(a) +(b)	414	440	1.06
Transformation rate (r)			
(r)=(b) ÷(c)	0.20	0.35	-

Fishing boats with inboard engines can operate at offshore fishing grounds where important demersal species are more abundant, and these quality species are being exported mostly fresh and occasionaly frozen. Hence the most suitable type of fishing gear to be provided by the project will be dropline fishing gear capable of harvesting quality demersal species. According to SFA's strong wishes, the fishing gear, except one assembly set as an exhibition, shall be supplied as materials so that SFA can sell them at reasonable cost as cheaply as possible and fishermen also can assemble fishing gear at their discretion.

(a) Dropline

SFA is striving to spread the technique of droplining to develop new species, but materials to make this type of fishing gear are not sufficiently available in Seychelles. When the useful life of this type of fishing gear is established to be 6 months and they are supplied to a half of 66 boats in the SFA's boat construction plan (see Table-11), considering the number of boats which are exclusively fishing with hand lines, their necessary qualities will be 150 sets including 18 sets in reserve, shown as below.

Unit/boat	Useful life	Necessary Q'ty a year	No. of boats	Q'ty for 2 years	Reserve	Total
(u)	(m)	(n)=u/m		(q1)	(q2)	(q1)+ (q2)
1 set/boat	6 months	2 sets/boat	66/2	132 sets	18 sets(14%)	150 sets

And the composition of one set of dropline fishing gear is as follows;

Float	ϕ 300 mm, 200 m deep submersible	1 piece
Trunk line	ϕ 2.0 mm, 200 m/coil	4 coils
Leading line	Nylon monofilament #60- #70, 100 m/coil	4 coils
Hook line	Nylon monofilament #40- #50, 200 m/coil	2 coils
Swivel	Two-way swivel 3×4	10 pieces
Swivel	With lead, barrel type	4 pieces
Lead line	Nylon #35	4 coils
Hook	Kirby type, 100 hooks/box	4 boxes
Sinker	250 g	4 pieces

(b) Echo sounder (Fish finder)

• Type-1 Small fish finder

With fishing grounds extended further offshore, the time period should be reduced to locate a good fishing ground. In that case a fish finder is a necessity. Until today few open boats were equipped due to no protective deck, and hence the portable type of this device is to be provided for smaller boats (20 boats in Table-11). When the demand rate of 0.25 is applied, necessary quantities are 10 sets.

• Type-2 Two wave type fish finder

At present large schooners are operating on the edge of plateaux and in need of a modern fish finder capable of sounding more wide range. When the demand rate of 0.1 is applied, necessary quantities are 3 sets on the basis of the number of schooners (small and large) of 26 in Table-11

(c) Hydraulic line hauler

Large schooners operating on the edge of plateaux are equipped with electric line haulers, which often breakdown due to mechanical problems resulted from poor availability of maintenance services. The project will supply the hydraulic line hauler in place a electric line hauler. The quantities are 3 sets on the basis of the demand rate of o.1 and the number of schooners (small and large) of 26 in Table-11.

② Safety equipment

With fishing grounds extended further offshore, the risk of distress of small boats is increasing. The supply of the safety equipment is essential, but unfortunately the provision of such equipment on board small boats is

neglected in spite of SFA's guidance due to fishermen's financial situation. To improve situation the following safety equipment will be provided.

(a) Life buoys 25 sets

Life buoys are to be supplied to schooners.

(b) Life jackets 200 sets

Life jackets are to be provided to the fishermen covered the component of modernization of the coastal fishery of the project.

(c) VHF radio telephones 10 sets

VHF radio telephones will make it possible for fishing boats to contact the shore station on the 24 hour basis. The instrument will be supplied to the schooner with a wheelhouse.

(d) VHF handy type marine band radios 5 sets

VHF handy type marine band radios will be supplied to small open fishing boats.

And the quantities are established as follows

Article	Unit/boat	No. of boats (Table-11)	Rate of demand	Q'ty to be supplied
(a) Life buoy	1 set/boat	26	0.95	25 sets
(b) Life jacket	1 set/boat	300 fishermen	0.67	200 sets
(c) VHF Radio telephone	1 set/boat	26	0.40	10 sets
(d) VHF marine band	1 set/boat	40	0.13	5 sets

③ Marine diesel engine and spare parts

The previous Japan's aid project (1987) supplied 78 units, all of which were sold to fishermen by 1991, and hence the inboard engined boats increased to 184 boats compared to 84 boats in 1987. SFA wants more engines to promote efficient operation of fishing boats and made the said fishing boat construction plan. The supply is to be made in accordance with the plan. Their spare parts will be 2 year supply due to the difficult situation for procurement in Seychelles. Also it is necessary that a domestic supply system be established. The quantities of marine diesel engines to be supplied are as follows;

Output	Type	For new boat	Rehabilitation	Total
10～18 HP	Lekonomi	12 units	3 units	15 units

21～27 HP	Whaler	20 units	5 units	25 units
34～42 HP	Small schooner	16 units	4 units	20 units
52～70 HP	Large schooner	4 units	2 units	6 units

④ Marine chandlery

The marine chandleries are to be supplied for about 300 fishermen with 66 fishing boats with inboard engines. The quantities are as follows;

Article	Unit/boat	No. of boats (Table-11)	Rate of demand	Q'ty to be supplied
(a) Magnet compass	1 set/boat	66	0.75	50 sets
(b) Ice box	1 set/boat	66	0.75	50 sets
(c) Working light	1 set/boat	25	0.80	20 sets
(d) Raincoat	1 set/boat	300 fishermen	0.67	200 sets
(e) Navigation lights	1 set/boat	15	0.67	10 sets
(f) Waterproof flashlight	2 sets/boat	25	1.00	50 sets
(g) Solar panels	1 set/boat	26	0.20	5 sets
(h) Rope				
ϕ 12 mm	2 coils/boat	66	0.75	100 coils
ϕ 15 mm	1 coil/boat	20	0.50	10 coils
ϕ 20 mm	2 coils/boat	6	0.85	10 coils
ϕ 24 mm	1 coil/boat	66	0.75	50 coils
(i) Anchor	1 set/boat	6	1.00	6 sets
(j) Gloves	1 pair/man	300 fishermen	0.83	250 pairs

Major functions of above marine chandleries are as follows;

(a) Magnet compasses are supplied for three-quarters of 66 fishing boats with inboard engines

(b) The Ice box will be used as a supplement of the fish hold.

(c) Working lights are supplied for the whalers which are fishing at night.

(d) Suitable raincoats are not available in Seychelles. These are supplied for 200 fishermen, two thirds of 300 fishermen covered the project.

(e) Lekonomi type fishing boats cannot physically be equipped with locally-made wooden navigation lights. Instead, new navigation lights will be supplied.

(f) Good waterproof flashlights are not avaliable in Seychelles. These are supplied for whalers which are fishing at night.

(g) Solar battery charger will be supplied for schooners as a test of energy saving.

(h) Each rope's usage is as follows;

- ϕ 12 mm for general services
- ϕ 15 mm for mooring of small schooner
- ϕ 20 mm for mooring of large schooner
- ϕ 24 mm for anchoring

(i) Only small anchors are available locally. As anchors for schooners, Danforth type anchors with a high holding capacity, 40 kg type and 50 kg type, are supplied.

(j) Two hundred and fifty pairs of gloves are to be supplied for five-sixth of 300 fishermen covered by the component of modernization of the project.

4-2-2 Ice making plant (Improvement of fishing environment)

It is essential to build a shed housed the ice plant due to a hot and humid Seychelles climate. Also a compact type ice plant combined an ice-making machine with an ice bin is necessary due to a comparatively narrow site space.

The kind of ice is to be plate ice from the viewpoint of easy handling and usage. The fishermen at and around the site, Anse La Mouche, are now fully depending on Port Victoria for ice. The fishing boats to obtain ice from the proposed ice plant are 15, 12 existing boats plus 3 new boats which will participate by the time the project begins, dividing into the following types, and their necessary quantity of ice is estimated as below.

Assumption

Catch per fisherman: 50 kg/day

fishing days: 5 days/week

Ratio of ice to fish in weight: 1 : 1

Type	No. of boats	@ crew	Quantity of ice (kg/week)
Whaler	8+3 = 11	4.4	12,100
Lavenir	1	3.5	875
Lekonomi	3	2.7	2,025
Total	15		15,000 kg/week

In addition, 500 kg of ice per week will be necessary for transporting and marketing. When the utility rate of 90% is applied in due consideration of melting under the tropical natural condition, the capacity of the proposed ice plant is about 2.5 ton/day.

(15,000 kg+500 kg) ÷ 7 days ÷0.9 = 2,460 kg/day≒ 2.5 t/day.

Since the demand of ice has usually a tendency to become greater at the opening of a week or on the day succeeding a storm, it seems to be necessary to keep 3 to 4 days production. Hence, the capacity of the ice bin is established to be 7.5 tons corresponding to 3 days production. Consequently the area of the shed is as follows;

Ice-making machine (including a space for maintenance)	5×5 m =	25㎡
Working space for packing	2×3 m =	6㎡
Sales counter		4㎡
Total		35㎡

The specifications of the ice plant are as follows;

Ice making machine: 2.5 tons/day (24 hrs), plate ice
Cooling machine for ice-making: semi-closed compressor, about 15 KW
Air cooling condenser: about 0.6 KW
Ice bin: 3.6×3.6 ×2.6 m, about 7.5 tons,
Cooling machine for ice-storage: Air cooling closed type, about 2.2 KW.
Unit cooler inside the ice bin

Electricity:	Power	415 V, 50 Hz, 3 phase
	Lighting	240 V, 50 Hz, 1 phase
Others:	Water tank (about 6 ㎥), major spare parts	
	Shed	about 35㎡ , prefabricated, with toilet

4-2-3 Vehicle (Improvement of fishing environment)

The vehicle (small truck with crane) belongs to the workshop of SFA and is mainly used for removing and replacing marine engines as well as beaching and transporting small boats. Major articles to be transported are outboard engines, marine engines, pirogues, and FRP fish boxes, and 2 or 3 cargoes, weighing 500 kg to 900 kg each, will be carried simultaneously. Hence a load capacity of 2 tons is necessary. Besides being used for loading and unloading, the crane will be used for pulling up small boats on the beach. Its requested

capacity of 2 tons is suitable. Seychelles with a flourishing tourism has a good road network, but there are many curves and steep slopes. The vehicle therefore must be of powerful type with sufficient gradeability.

Besides, two units of submersible water pump and one unit of high pressure washer are to be supplied to the workshop. These equipments are used for emptying of flooded fishing boats and so forth.

As mentioned above, the equipment and materials for the workshop of SFA are as follows;

①	Vehicle (small truck with crane) Truck: 2 tons load Crane; 2 tons capacity	1 unit
②	Submersible pump	2 units
③	High pressure washer Movable type, with engine	1 unit

4-2-4 Small fishing boats (Development of suitable fishing boat)

Whalers and schooners are now fishing on the edge of plateaux, but whalers have no deck and accommodation despite 3 to 4 day fishing and so fishermen are forced to take a rest or sleep in exposure. In addition, no fishing machinery and instruments are on board, which situation makes an efficient operation impossible. This poor working condition is one of causes for few recruitment of young people into the fishery and thus hampering the development of the fishery. SFA is now testing various types of fishing boat to overcome these impediments. Fishing boat yards in Seychelles are growing as fishery supporting facilities, but their capacity cannot meet the technical requirements for the development of suitable fishing boat yet. Hence the small fishing boat for the development of suitable fishing boat is to be supplied for the test purpose. The boat will collect fishing data, marketing data, cost data, and data on the improvement of working environment including accommodation, laborsaving, and fishing efficiency.

To process and compare data two units of the same type boat are necessary. SFA divided Seychelles fishing boat into four categories; pirogue (less than 15 HP, outboard engine), outboard (more than 15 HP, outboard engine), whaler (open boat with inboard engine), and schooner (decked boat with inboard engine). Hence ① one after the prototype of whaler and ② the other after

the prototype of schooner, each two units, are to be supplied. These boats equipped with tuna long-line, trolling line, and dropline will be controlled by SFA and leased to fishermen groups on the one or a few months basis, depending on the fishing season. Extension officers of the Fishery Management Division will give fishermen guidance in new fishing technique. Their specifications are as follows;

① Type-A FRP 8 m type, 25 HP

Accommodation:	3 persons
Fish hold capacity:	Insulated, about 3 ㎥
Major equipment:	VHF, GPS, line-hauler, fish finder
Major fishing methods:	Hand line, dropline

② Type-B FRP 10m type, 65 HP

Accommodation:	4 persons
Fish hold capacity:	Insulated, about 4 ㎥
Major equipment:	SSB, GPS, line-hauler, fish finder
Major fishing methods:	long line, dropline

③ Fishing gear

(a) Tuna long-line complete set 40 sets

Float, trunk line, branch line, hook, etc. 5 branch lines a set

(b) Materials for tuna long-line

Trunk line	Nylon monofilament, #200	100 m/coil	500 coils
Trunk line	Nylon monofilament, #150	100 m/coil	500 coils
Branch line	Nylon monofilament, #100	100 m/coil	500 coils
Swivel	tuna swivel, small		2,000 pieces
Swivel with lead	38 g		1,000 pieces
Fishhook	Japanese type tuna hook #32		800 pieces
Fishhook	French type tuna hook #32		800 pieces
Float	300 mm		100 pieces
Radio buoy	10 W type		1 set
Wire	Nylon-coated 7×7 #39 stainless steel, 10 m/coil		300 coils

(c) Processing equipment

Lock press	Table type for nylon mono #100, 150, 200 wire	4 units
	Handy type	10 units
Spare tips for nylon mono #100, 150, 200 wire		5 sets
Locks for nylon mono #100, 150, 200 wire		6,000 pieces

(d) Trolling gear

Splashing board	12 cm	8 pieces
Diving board	150 mm	8 pieces
	195 mm	8 pieces
Fishhook	Double-hook 70 mm 500 pcs/bag	4 bags
	Double-hook 80mm 500 pcs/bag	4 bags
Lure hook (A)	135 mm 10 pcs/bag	80 bags
Lure hook (B)	175 mm 10 pcs/bag	80 bags

(e) Materials for dropline

Float	ϕ 300 mm, 200 m deep submersible	50 pieces
Trunk line	resin-coated thread 200 m/coil	125 coils
Leading line	Nylon monofilament # 60, # 70, 100 m/coil	125 coils
Hook line	Nylon monofilament # 40, # 50, 200 m/coil	125 coils
Swivel	Two-way type 3 ×4 100 pcs/bag	5 bags
Swivel	barrel type 200 pcs/bag	15 bags
Sinker line	#35 100 m/coil	125 coils
Fishhook	Kirby type	200 bags
Sinker	250 g	150 pieces

(f) Other materials

Branch line basket	Polyethylene	24 pieces
Gaff head	Stainless steel	8 pieces
Gaff stick	Wooden, 1.5 m	16 pieces
Scoop net	ϕ 60 cm, 40 cm deep, 3 m stick	8 pieces
Tuna killer	Device to kill instantly by taking out the spinal cord	16 pieces

4-2-6 Fishing research vessel(Promotion of stock assessment and management)

Efforts have been made by SFA to develop new fishing grounds, to survey new species, to test and teach new fishing techniques, and to give training to fishermen, through the operation of the research vessel "Etelis" which was granted by Japan in 1987. For this purpose the "Etelis" has undertaken some 47 trips, each trip lasting 2 to 5 days, during the year, but recently one trip have become longer, 8.3 days in 1991 and 9.5 days in 1992 on an average, due to the following reasons;

(a) The survey area became larger.

(b) Diversity of fishing methods due to the diversity of target species.
(c) Increase of concentration of effort to promising species.
(d) Increase of necessity of training fishermen in new fishing techniques.
(e) Increase of necessity of training students of Maritime school which has no training vessel of its own.

This situation made it impossible for the "Etelis" to meet the development requirements, and SFA came to stand in need of one more research vessel and formulated a new operation plan with two vessels as follows;

Table-14 SFA research boat operation plan

Operation	Trips		
	Etelis	New vessel	Total
(a) Fishing research Development of fishing grounds & fishing gear	21	16	37
(b) Training Fishing technique & extension services			
(c) On-board training of students	-	12	12
Total	21	28	49

The contents of each operation are as follows;

(a) Fishing research

The fishing research will be performed on the whole offshore area within the EEZ as well as on the Mahe and Amirante plateaux to develop new fishing grounds and fishing gear. The "Etelis" will mainly concentrate on the Mahe and Amirante plateaux within 100 miles radius on average (180 miles at maximum) from Mahe Island, while the new vessel will operate within 160 miles (240 miles at maximum) from Mahe Island.

(b) Training

Training will be given to some 150 fishermen during the fishing research trips. Thirty-seven trips in all will permit each fisherman to receive training in droplining, gillnetting, reel fishing, and trolling on board either of two vessels during one trip for 2 years. That is;

Two fishermen/trip× 37 trips/year×2 years =		148 fishermen
New vessel	(16)	(64)
"Etelis"	(21)	(84)

(c) On-board training of students

A plan concerning a fishing training school (Project No. FIS/11/30, Rp 40 million) in the Third National Development Plan (1990/94) was suspended due to financial difficulties and arrangement of relation with the existing Maritime School. It is very important and indispensable to give training to young people for future development of the fishing industry of Seychelles. It is SFA's intention to give training on board the new research vessel provided by the project to the students of Maritime School which has no training vessel. The course of the School consists of four courses; 2 year course and 3 year course of "Coxswain and Fisheries Technician" and "Marine Diesel Mechanic" respectively, and the students as of 1992 are 87 in total. The on-board training will be given to senior 40 students once a year. That is;

Four students/trip× 12 trips/year×1 year = 48 (40) students

Since Maritime School belongs to the Ministry of Eduction, two teachers (one from "Coxswain and Fisheries Technician" and "Marine Diesel Mechanic" each) will cooperate with the SFA staff of the vessel. Maritime School will carry accident insurance during on-board training.

・Major factors of designing the research vessel

① Natural condition

The survey areas of the proposed research vessel are on the Mahe and Amirante plateaux and their fringe areas. The natural condition represented by a wave-height of these water area are shown in Table-14.

As shown in Table-14, the proportion of the wave-height less than 1 m is 21% a year (some 77 days), 1.0 m ～1.5 m is 57% (some 208 days), and the proportion of the wave-height less than 1.5 m is 78%, 284 days, in total reflects a comparatively gentle sea condition throughout the year of Seychelles, while the proportion of the wave-height more than 2 m, i.e. the fresh breeze of Beaufort's wind scale 5 and more, is 22%, 80 days.

Table-15 Wave-height in Seychelles waters (%)

Month	0～0.5m	1.0 ～1.5m	2 ～2.5m	3 ～2.5m	4m above
January	27	60	11	1	1
February	28	65	7	-	-
March	53	43	4	-	-
April	37	56	5	2	-
May	23	49	25	3	-
June	11	55	23	9	2
July	9	48	38	5	-
August	4	57	37	2	-
September	3	71	25	-	1
October	28	56	10	5	1
November	25	65	10	-	-
December	23	64	13	-	-
Average	21	57	19	2	1

(Source: Sailing Direction:1988)

The impact of the wave on the longitudinal strength of the hull is strongest when the wave-length equals or is nearly equal to the hull-length. When the wave-length is longer than the hull-length, the effect of the wave on the longitudinal strength of the hull rather decrease, though the stability is affected adversely. The wave-length corresponding to 1.5 m wave-height is generally about 30 m in an ocean, and hence a boat 10 m long, under this condition, has no problem in terms of strength, though the stability may be somewhat lost and thus men working on the deck may be in danger. To secure a safe work on the deck, a larger boat is required under the sea condition of the wave more than 2 ～2.5m high, but, since the proposed research vessel does not necessitate more than 20 m in length from the operational point of view, the design condition of the wave-height was established to be less than 1.5 m.

② Major tasks of the research vessel

The new research vessel will survey quality demersal species on the edges of the plateaux as well as migrating pelagic tuna, skipjack, and marlin within a 160-mile radius (240-mile max.) from Mahe Island. The vessel therefore have a type capable of droplining, long-lining, trap fishing, gillnetting, and trolling. In the case of FRP construction, the single decked vessel with a midship wheelhouse is thought to be the best to meet all these operational requirements. The fishing machinery will be installed on the fore deck and the fishing gear storage space on the stern, and then, taking the fuel tank, water tank, hold, engine room, accommodation based on the trip days, main engine, catch, and necessary crew members into consideration, the length between perpendiculars of some 18 m is required. Finally the overall length of 20 m was decided, considering the hull strength, arrangement of each part, major tasks of the vessel and so on.

③ Local technical level

The technical level in all fields both on the sea and the shore of Seychelles is an important factor of designing the research vessel. It seems to reach a certain level from the previous performance of the "Etelis," but further improvement will be necessary.

④ Fishing gear

The fishing gear used on board the research vessel for survey or training will be restricted to 3 kinds of line fishing gear, i.e. long-line, trolling line, and dropline. Although the research vessel can conduct net fishing operations, no net fishing gear is provided by the project. The same would apply to fish traps which are broadly used in Seychelles.

Based of the above-mentioned conditions, the specifications of the proposed research vessel are established as follows. Compare them with the "Etelis."

Items	Proposed research vessel	"Etelis"
Material	FRP	FRP
Dimensions		
Length	approx. 20 m	18.40 m
Breadth	approx. 4.7 m	4.50 m
Depth (to bulwark top)	approx. 2.5 m	2.40 m
Main engine	approx. 240 HP	165 HP

Cruising radius	approx. 1,000 miles	600 miles
Fish hold	approx. 8 m³ (fish)	5.5 m³ (fish)
	approx. 3.5 m³ (ice)	1.8 m³ (ice)
Berth	10 persons	6 persons
Major equipment	Radar, VHF, SSB, GPS, direction finder, windvane & anemovane line hauler, fish finder	Radar, NNSS, SSB, fish finder, radio buoy, electric thermo-meter
Major fishing methods	Long-line, dropline, trolling, fishing net, fishing trap	Hand-line, long-line, gillnet, trolling, trap

Also the fishing gear to be supplied are as follows;

Tuna long-line set, complete	40 sets
Materials for the above	1 lot
Fishing gear processing equipment	1 lot
Trolling line set, complete	10 sets
Dropline set, complete	50 sets
Other necessities	1 lot

4-3 Project Schedule

4-3-1 Project schedule

Following the conclusion of the Exchange of Notes concerning the project between the Governments of Seychelles and Japan, a consulting firm of Japan will conclude an agreement regarding consulting services with the Government of Seychelles, on the basis of the contents of the Exchange of Notes.

The consulting firm will prepare necessary tendering documents, which are to be authorized by the Seychelles Government, and render help to hold the tender of the project after a necessary pre-qualification investigation. Based on the result of the tender evaluation, the consulting firm will recommend a successful tenderer to the Seychelles Government.

The successful tenderer will conclude an agreement on supply of the equipment and materials for the project on the basis of the content of the tender, and

procure and manufacture the necessary equipment and materials in accordance with the plans and drawings approved by the consulting firm. Meanwhile the consulting firm will perform required inspections including testing work and also report the progress of the project to the Governments of Seychelles and Japan. Also the refrigerating engineers and construction engineers will be sent to construct the ice plant, and the fishery engineers will give Seychelles people concerned guidance in trial fishing and operation after the delivery of the fishing research vessel.

On the completion of controlling business, the consulting firm will receive a completion certificate of the project issued by the Seychelles Government, when the project will be finished.

The project will require approximately 12 months; 3 months for the detail design, 7.5 months for the preparation, manufacturing, and procurement plus 1.5 months for marine transport. Regarding the ice plant, the procurement in Japan will require about 4.5 months and the installation at the site will take about 2 months, and hence the required working period will stay within the proposed project schedule.

4-3-2 Work to be borne by the Japanese side

The contents of the work to be borne by the Japanese side are as follows;

- The detail design and implementation of the project.
- Procurement, manufacturing, transport, installation, and delivery of the equipment and materials of the project.

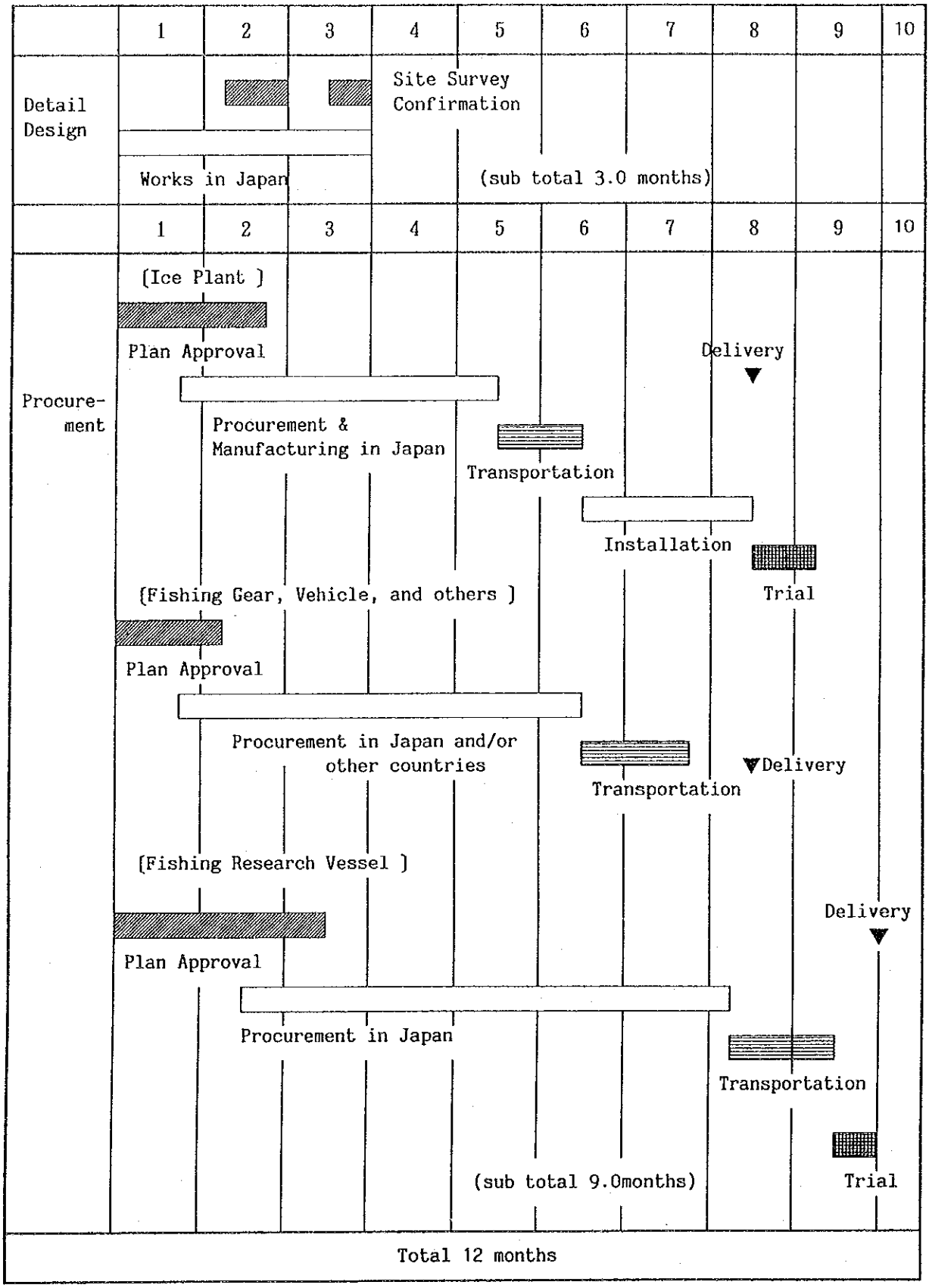
4-3-3 Work and cost to be borne by the Seychelles Side

Major work to be borne by the Seychelles side, mainly SFA, are as follows;

- To ensure prompt unloading, tax exemption and customs clearance of the goods for the Project at port of disembarkation in Seychelles.
- Leveling of ground and preparation of the water supply, electricity, telephone, and drainage at the site for the ice plant. Its expenses are estimated to be ¥900,000 (US$ 8,500) at the exchange rate of ¥106.00.

Fig. 5 on the following page shows the project schedule.

Fig. 5 Project Schedule



CHAPTER 5

EFFECTS AND RECOMMENDATIONS

Chapter 5 Effects and Recommendations

The Chapter covers an estimate of effects of the project on the basis of the aim of the fishery development in the Seychelles development plan, the objective of the "Coastal Fishery Development Project," and the indices on the achievement of the aim and objective. The estimation was made as quantitatively as possible, but some unavoidable qualitatively estimation was made due to a short of statistics and unreliable data.

Problems to be resolved in the Seychelles coastal fishery and the countermeasures of the project to meet the situation and their effects are put together as the following Table-16.

Table-16 Problems, countermeasures, and effects

Problems	Countermeasurs	Effects
1. Short of equipment. • Unefficient fishing due to lack of modern equipment. • Worsening working condition of worn-out fishing boat.	• Supply of equipment.	• Increase of catch through activation of fishing. • Laborsaving, promotion of efficiency and safety at sea
2. Lack of fishery related facilities. • As ice is available at only Port Victoria, both quality control and utilization of resources are poor.	• Supply of ice plant. • Projects through counterpart fund.	• Easy access to ice makes it possible for fishermen to keep fish in good quality, decrease waste, increase income. • Improvement of operation efficiency and working condition by improvement shore facilities.
3. Lack of supporting services. • Repair and maintenance spend time and difficult. • No opportunities of learning new fishing technique.	• Supply of vehicle. • Supply of fishing research vessel. • Supply of small fishing boats.	• SFA workshop will improve repair capability used by vehicle. • Possibility of development of suitable boat through trials with small fishing boats. • Improvement of working condition by rationalization of fishing. • Development of new fishing grounds and new species.

(continued)

4. Aging of fishermen population. • Few recruitment of young people due to hard working condition • Unstable income due to fluctuating catch. • As fishing grounds become remote purchase cost of equipment is increasing. • Fishing is losing appeal.	• Supply of fishing research vessel. • Projects through counterpart fund.	• Improvement of fishing technique by training. • Raising of talent through training of Maritime School students.

5-1 Benefits to Coastal Fishermen

The Seychelles coastal artisanal fishermen will enjoy benefits from the project as follows;

- Easy access to fishing equipment and materials (fishing equipment for fishermen).
- Improvement of fishing jetties and stores (counterpart fund).
- Availability of ice in the South Mahe (ice plant).
- Easy and prompt access to repair and maintenance at the improved SFA workshop (vehicle)
- Availability of data and information concerning new fishing grounds and new species (fishing research vessel)
- Availability of training in new fishing technique (fishing research vessel).
- Promotion of participation of young people to the fishery through the on board training of students of Maritime School (fishing research vessel).
- Availability of concrete data concerning the management of fishery business. Fishermen not owned any fishing boat will be able to experience the fishery business by leasing the small fishing boat subject to the presentation of fishing data (small fishing boat).

5-2 Effects to Coastal Fishery

Through the above-mentioned benefits the effects of the project for each component will be expected as follows.

(1) Modernization of the coastal fishery

The supply of fishing gear, fish finders, line-haulers, safety equipment, and marine diesel engines will activate fishing activities of the coastal fishery as well as accelerate modernization of coastal fishery which is comparatively behind other industries in Seychelles. Also the supply of an ice plant, small truck, small fishing boats, fishing research vessel will contribute to transformation of the coastal fishery into an attractive industry as well as to resolve problems of the Seychelles coastal fishery.

It is needless to say that all the fishing equipment and materials of the project increase their effectivenes and the overall output of the fishing industry in connection with one another, and in this section the effects of the fishing equipment for fishermen on the modernization of the coastal fishery are exclusively examined.

① Fishing gear and instruments

The supply of 150 sets of dropline, 13 sets of fish finder, and 3 sets of hydraulic line-hauler conduces to efficiency and laborsaving of fishing operation, resulting in an increase of catch and fisherman's annual income.

- Dropline

  When being used jointly with hand-line, dropline will increase fishing efficiency.

- Fish finder

  Fish finder facilitates the locating a good fishing ground, resulting in economy of time and thus an increase in the catch.

- Hydraulic line-hauler

  It is expected that a hydraulic line-hauler can increase a catch and thus fishermen's income by lavorsaving and increased efficiency.

② Marine diesel engines

According to the SFA fishing boat construction plan, 66 units of marine diesel

inboard engine are supplied, of which 40 units are installed on board new boats and 26 units are for rehabilitation of vessels. This supply will cover about 300 fishermen and accelerate the modernization of the coastal fishery, activating fishing activities, with an increase of catch and income expected. The transformation rate of engine into inboard engine will finally be 54% as compared with 35% in 1992 as below Table.

Table-17 Transformation of engine

Type	1992	After project	Remarks
Outboard boats (A)	285	285-114=171*	*: Whaler's crew of 112 and schooner's crew of 116, 228 in total will be on board inboard engine boat, i.e. 32 boats×3.5 persons= 112 20 boats×5.8 persons= 116 Instead, 114 outboard boats will be decreased, i.e. 228 ÷2 person/boat=114
Inboard boats (B)	155	155+52=207	
Total(C)=(A)+(B)	440	378	
Transformation rate r=(B)÷(C)	0.35	0.54	

Secondly, the total fish production after the completion of the project will be 6,037 tons as compared to 5,717 tons in 1992, an increase of 320 tons or about 5.5%, as shown in Table-18. An increase of annual income of the fisherman whose engine is changed into an inboard engine will be 36%, assuming that the operation cost equals to 40% of the proceed of sales and that average catch per boat in 1992 is applied, as shown in Table-19. On-foot fishing, sports fishing, and others are counted for no change in future.

Table-18 Change of catch

Type	Rate of catch composition (1992) (%)	Catch (1992) (ton)	Fishing boats (1992)	Catch a boat (ton)	Boats after project	Catch after project (ton)
On-foot	0.3	17	-	-	-	17
Pirogue	3.8	211	87	2.4		
Outboard	28.6	1,629	198	8.2		
Sub-total	32.4	1,840	285	6.4	171	1,094
Whaler	49.2	2,813	95	29.6		
Schooner	7.6	429	60	7.1		
Sub-total	56.8	3,242	155	20.9	207	4,326
Sport fishing	0.1	6	6	-	6	6
Others	10.4	594	1	-	1	594
Grand total	100.0	5,717	447	-	385	6,037

Table-19 Increase of fisherman's income

	Q	p	I=Q ×p	E	B=I-E	N	b= B×0.67÷N
Outboard (present)	6,400	6.0	38,400	15,360	23,040	2	7,718
Inboard (after project)	20,900	6.0	125,400	50,160	75,240	4.8	10,502

Where

B:Benefit (Rp) B = I - E

I:Income (Rp) I = Q× p

E:Expenditure (Rp) b = B×0.67÷N

Q:Quantity of catch (kg) per boat (Outboard Q =6.4 tons and inboard Q = 20.9

tons from Table-18).

b:Annual income per fisherman

q:Catch per unit effort (CPUE)

p:Price of fish (Rp/kg)

t:Fishing hours (hrs/day)

d Annual fishing days (days/year)

N:Number of crew members a boat (person/boat)

(2) Improvement of fishing environment

Aging of the fishermen population and few recruitment of young people into the fishery are major impediments to the development of the Seychelles fishery, reflecting the difficult fishing environment including the hard working condition and comparatively less income. The fishing industry is becoming unattractive in Seychelles.

As mentioned the previous section, the supply of the fishing equipment and materials will produce an increase of catch and income, and also the counterpart fund generated from selling of them will enable SFA to execute projects for improvement of port/shore facilities in local communities, and through the improvement laborsaving, timesaving, and rationalization of fishing activities will be achieved, which situation will contribute greatly to improvement of fishing environment.

The supply of the ice plant will make it easy for fishermen in the South Mahe to obtain ice, resulting in helping to abolish local differentials of fishery supporting facilities.

The supply of the truck with crane will make transporting heavy equipment and materials such as marine engines, small pirogue type fishing boats, and removable fish holds, possible, and hence, the SFA workshop will enable to meet the repair and maintenance requirements from fishermen. Good repair and maintenance in consequence will contribute to timesaving in inspection and arrangement and heighten the safety and reliability of the fishery and finally conduce to an efficient operation with an increase of fishing hours and to an increase of catch and fisherman's income.

(3) Development of suitable fishing boat

For the Seychelles coastal fishery it is most important to stabilize artisanal

fishermen's living and place them at the position suitable their social and economic role. To do so, it is essential for SFA to gives them a proper guidance in fishing business as well as to take supporting measures. In view of this point, the supply of small fishing boats is very useful.

At present, for a fishermen of Seychelles the initial investment to acquire a small fishing boat necessary for the coastal fishing is rather difficult. The bank rate as of December 1992 is 14% to 17% according to the Seychelles Central Bank, while the deposit rate stands at 9%, and hence, an IRR of some 20% must be maintained for the initial investment. The Seychelles fishermen, with a few exceptions, have no economic means to meet such requirements.

One of the steps to settle the problem may be as follows; SFA first collects and analyses all the fishing data of the small fishing boats of the project to analyse the operation pattern and performance of these vessels, comparing with the whaler and schooner, and secondly, determines the prototype, capable of fulfilling required performance, of each whaler and schooner. Finally SFA will examine the possibility of building such a prototype with reduced building cost at the practical and reasonable level that a fisherman can meet the initial investment requirements.

The IRR calculated at the same factors applied at the balance estimation of small fishing boats, substituting the repayment of initial investment for the depreciation, is 7% for the 8 m type boat and 2.1% for the 10 m type boat. When the initial investment is 0.5 times, 0.75 times, and 1.25 times, the IRR of the 8 m type boat changes as 34%, 15%, and 1.5% respectively. In case of the 10 m type boat, an IRR of 24% corresponds to 0.5 times initial investment, while an IRR of 9.7% corresponds to 0.75 times initial investment. In the sensitivity analysis based on the change of fish price, when the price is 1.25 times and 1.5 times, the IRR of the 8 m type boat stands at 38% and 78% respectively, while each 30% and 64% for the 10 m type boat.

Thus it seems theoretically to be necessary for a viable management of the small fishing boat to reduce the initial investment by 15% and to increase the profit by 10% to 15% by raising price. In practice, the development of suitable fishing boat must depend on many other factors including the natural condition of Seychelles, and this is why the collection, analysis, and assessment of operation data is essential for the development of suitable fishing boat.

From this, the supply of small fishing boats will be much useful for the

development of the coastal fishery of Seychelles. Besides, these boats will be also useful for guidance of fishermen of outboard engine boats who cannot afford to own a whaler or schooner.

(4) Promotion of stock management

In Seychelles, the concentration of fishing efforts to a certain fishing ground and species is one of obstacles to development of the coastal fishery. The supply of the fishing research vessel will be much useful for promotion of stock management and rational development of the coastal toward the achievement of the major objective of "sustainable development" in the National Development Plan and Environmental Management Plan through collection of operation data, introduction and modification of new fishing technique and fishing gear, development of new fishing ground and new species, training of students and fishermen.

Effects of the previous coastal development project funded by Japan's grant aid in 1986 are remarkable. The average annual catch of coastal fishery reached 5,612 tons in the past three years. To increase an annual catch up to 7,000 tons which is estimated to be somewhat affordable sustainable yield, it is essential to grasp the number of fishermen, the number of fishing boats, the condition of fishing grounds and domestic/international marketing, and also the mutual relation of each factor. This is why confirmation of stock situation and improvement of the quality of fishermen by training are important. An increase of a 25% from 5,612 tons to 7,000 tons, the increase in the last part within the limit, and an increase of a 25% from 50% to 75% are different in significance despite the same figure of 25%. Therefore, more strict stock assessment is required as the effect on the Seychelles fishery is greater.

5-3 Economic Effects of the Project

The projects involving development of the coastal fishery in the National Development Plan are the most numerous in the fishery sector. There are 15 out of 33 projects related to the development of the costal fishery, costing Rp 65 million and accounting for 20% of total project cost. This expenditure is all used for more effective utilization of coastal fishery resources through supplying fishing equipment, fishing materials, shore facilities, and

supporting services to fishermen.

The project is also in line with the strategy of development of the coastal fishery and expected to play an important role on the development of the national economy through exploitation and conservation of fishery stock within the sustainable yield and an increase of export of fish products by some 19%, as shown in Table-20.

Table-20 Catch and export of coastal fishery

Period	Catch (ton)	Domestic consumption (ton)	Export (ton)
Average for last 3 years (1992=1.0)	5,612	4,809	803
Prospect after the project (1996)	6,037 (1.08)	5,083 (1.06)	954 (1.19)
Development target (2000)	7,000 (1.25)	5,216 (1.08)	1,784 (2.22)

Note:

(1) Expected catch after the project was calculated based on Table-18 "Change of catch." Increases generated from each fishing gear and instrument, varying markedly according to its usage and management, seem to not affect the catch of the whole county, and thus, these were neglected.

(2) An annual per capita consumption of fish is 68 kg in 1992. Estimates placed an annual per capita consumption of fish after 1996 at 70 kg, considering the annual population growth of 0.65%.

5-4 Conclusion and Recommendations

Since 1984, Seychelles Fishing Authority (SFA) has been successful in development of the Seychelles fishery, but the coastal fishery originated in a subsistence fishery is at the early stage of development as industry, requiring many supporting steps. The coastal fishery is being carried out by Seychelles nationals only and playing an important role in both social and economic fields

through the supply of protein, employment, and export. In Seychelles, the fishery is the most important industry just next to tourism, and the Government's enthusiasm and expectation of development of the fishery are great. However, several obstacles peculiar to the small island country such as thin population, meager fishery-related budget, and tourism-dependence, and, in particular the coastal fishery has such difficult problems as inefficient fishing methods, dependency on natural conditions, poor organization of fishermen, lack of credit scheme, lack of financial support, difficult working conditions. Moreover, few participation of young people in the fishery and consequent aging of fishermen population are reflecting rather low social status of coastal artisanal fishermen. Adequate assistance to such the fishermen, therefore, who are supporting the coastal fishery under these difficult conditions, will be sure to activate their fishing activities and utilize fishing resources within the Seychelles EEZ of 1 million km^2.

The effect of the project will directly affect some 300 fishermen, who will benefit from the acquisition of inboard engines, plus about 800 people engaging in the fishery on the full-time or part-time basis. Indirectly some 200 people in fishery-related industries and some 4,400 people engaged in tourism which is served with fresh seafood, totalling some 4,600 people, will benefit from the project; when adding their families (average 4.5 persons a family) the number will reach 25,000.

The executing agencies of the project are the Ministry of Agriculture and Marine Resources and SFA. The fishing equipment for fishermen are to be sold to fishermen at a reasonable price which will benefit fishermen through Indian Ocean Marine (100% Government owned company) which is controlled by SFA. The proceeds of sales will be deposited as counterpart fund in the "account of the coastal fishery development," and employed as part of the funds for implementation of projects for further development of the coastal fishery. This counterpart fund is strictly controlled by the Government, and was applied to the 1987 Japan's grant aid project with success. It is needless to say that the counterpart fund derived from this project will be used only for the projects that meet the real needs of fishermen. The ice plant, small truck, small fishing boats, and fishing research vessel are to be directly controlled by SFA.

From the viewpoint of the expected profound effects and contribution to the improvement of the living standard of the Seychelles people, the project deserves to be implemented as a grant aid project.

On the implementation of the project, the following recommendations are made.

(1) It is recommended that the Government of Seychelles take prompt budgetary step on levelling of ground of the project site, electricity, and water, and conclude an agreement with Seychelles Marketing Board (SMB) concerning maintenance of the ice plant.

(2) It is recommended that the Government of Seychelles organize the management of two fishing research vessels, including the budget and staffing, on the basis of the project schedule, and also conclude an agreement with Maritime School concerning training of the students.

(3) It is recommended that the Government of Seychelles organize the project team, including marine engineers and economists, of small fishing boats to collect, analysis, and assess the data.

APPENDIX

Ⅰ. BASIC DESIGN STUDY

Members List of
Basic Design Study Team

Ryouzo, KAMINOKADO	Leader Director, Office of the Overseas Fisheries Cooperation, Fishery Agency
Shigeo, WATANABE	Project Co-ordination Fisheries Technical Cooperation Division Japan International Cooperation Agency(JICA)
Mamoru, KONDO	Fisheries Promotion planner D & A Engineering Co.,Ltd.
Masakazu, ISHII	Fishing Boat/equipment planner D & A Engineering Co.,Ltd.

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Basic Design Study Itinerary 1/2

			Governmental Officials	Consultants	Accomo-dation
1	9/7	Tue		Tokyo 12:45 (AF 275) → Paris 18:15	Paris
2		Wed		Paris 19:40 (AF 437) →	
3	9	Thu		07:35 Arrive at Mahe Explanation of Inception Report at SFA (Seychelles Fishing Authority) Survey of the related projects by Japan's Grant in Victoria fishing port area. SMB(Seychelles Marketing Board), SFA Workshop, Tuna Quay	Mahe
4	10	Fri		Discussion about Study Schedule at SFA Courtesy call to Ministry of Agriculture & Marine Resources Data collection at Ministry of Finance	Mahe
5	11	Sat		Mahe→Praslin Survey of the related projects by Japan's Grant. Fishery activity survey at the Project areas in Praslin Island (Grand Anse, Baie St Anne, etc)	Praslin
6	12	Sun		Praslin →La Digue Survey related facilities ans fishery activity SMB Fish collecting center, La Digue Boat Builder's Co., etc La Digue→Mahe	Mahe
7	13	Mon		Survey of Research boat "ETELIS" Survey of the related facility and fishery activity in Mahe Island Southern area (Petit Paris, Anse Royale, Anse La Mouch, Anse Aux Pins)	Mahe
8	14	Tue		Survey of fishery related school, Environment policy, fishermen's Finance etc. Maritime School, Department of Environment, Development Bank of Seychelles (DBS) Meeting with SFA and Data collection	Mahe
9	15	Wed		Discussion with SFA Fishery activity survey at Anse Aux Pins Hearing survey to IOM (Indian Ocean Marine Co.)	Mahe
10	16	Thu		Meeting with SFA. Hearing survey on the fishing gears/engines IOM, Schooner Quay Discussion with SFA	Mahe

			Governmental Officials	Consultants			Accomo-dation
	17	Fri		Data collection at SFA Hearing survey on the fishing boats IOM, Schooner Quay Survey of the related facility and fishing activity in Mahe Northern areas. (Bel Ombre, Beau Vallon, Glacis) Hearing survey on the condition of spare parts supply and related specification of engines			Mahe
12	18	Sat		Summary of the fishery activity study			Mahe
13	19	Sun		Team meeting/Summary			Mahe
14	20	Mon		Meeting with SFA Collection of materials, Meeting with DBS			Mahe
15	21	Tue	Tokyo 12:45 Paris 18:15	Meeting with SFA Site survey.			Mahe
16	22	Wed	Paris 19:40	Meeting with SFA.			Mahe
17	23	Thu	Mahe 07:35 Team meeting Courtesy call to SFA, Department of Environment, Ministry of Foreign Affairs, Economic Planning & Environment				Mahe
18	24	Fri	Meeting with SFA Courtesy call to Ministry of Agriculture & Marine Resources Survey Victoria fishing port area, (Tuna Quay, Schooner Quay) and Project area.				
19	25	Sat	Mahe→Praslin Survey Project area. Praslin→Mahe				Mahe
20	26	Sun	Team meeting				Mahe
21	27	Mon	Discussion with SFA, General meeting Minutes of Discussion (draft), Signing of Minutes of Discussion				Mahe
22	28	Tue	Survey fishery related school	Mahe	Mahe 22:30 AF 426		Mahe
23	29	Wed	Survey Research boat "ETELIS"	Mahe	≫≫≫		Mahe
24	30	Thu	Mahe 15:00 KQ 451 →Nairobi 17:00	Nairobi	Tokyo 11:15 AF 276		Nairoboi
25	10/1	Fri	Courtesy call to Japanese Embassy Nairobi 22:25 (AF 479) →				
26	2	Sat	→ Paris 04:35 Paris 15:00 (AF 276)→				
27	3	Sun	→ Tokyo 10:45				

List of Persons Concerned

Ministry of Agriculture & Marine Resources

Mr. Jacquelin Dugasse	:Minister

Ministry of Foreign Affairs, Economic Planning & Environment

Mr. George Troain	:Director, Department of Environment
Mr. François de Backer	:Technical Advisor, Department of Environment
Mr. Claud Morel	:Director General for Foreign Affairs
Ms. M.Robert	:Director for Foreign Affairs

Seychelles Fishing Authority (SFA)

Mr. Philippe Michaud	:Managing Director
Mr. Joel Nageon de Lestang	:Director, Resources Management
Mr. Pierre Woodcock	:Assistant Director, Resources Manageme
Ms. Confait	:Document Center
Mr. Antoine Polite	:Chief Technician
Mr. Basil Louis Marie	:Chief Engineer
Mr. Maxell Agathevi	:Skipper (ETELIS)
Ms. P. Carosin	:Accountant,
Mr. M. Marguerite	:Economist

Development Bank of Seychelles (DBS)

Mr. E. Faure	:Managing Director
Ms. L.Monthy	:Director
Mr. R.Curtiss	:Deputy Director

Seychelles Marketing Board (SMB), Fish Division

Mr. Peter L. Larose	:General Manager,
Mr. Joseph Tirant	:Deputy Managing Director
Mr. Robert Rose	:Industrial Refrigeration Engineer

Ms. Marie Helen Pointe	:Supervisor, (Praslin) SMB Fish Collection Centre
Mr. George Laduceau	:Supervisor, (La Digue) SMB Fish Collection Centre

Maritime School

Mr. S. Daka	:Head of School
Mr. A. I. Orloff	:Senior Instructor

Public Utility Corporation (PUC)

Mr. Jean Louise Dugasse	:Manager

Delpech Fish Co., Ltd.

Mr. Denis Delpech	:(Schooner fishing boat Owner)

Indian Ocean Marine Co., Ltd.

Mr. George Verghese	:Managing Director

Praslin Trading Co., Ltd.

Mr. C. G. Dunienvile	:Owner

Praslin Boatyards Co., Ltd

Mr. Rodney Pouponneau	:Owner

Souris Glass Co., Ltd.

Mr. Robert Souris	:Owner

Anse La Mouche Fish Collecting Center

Mr. Gilbert Rassol	:Owner

Embassy of Japan in Kenya

Mr. M.Horie	:Councilor
Mr. S.Takahara	:Second Secretary

JICA Kenya Office

Mr. T. Nagashima	:Resident Representative
Mr. S. Aoki	:Deputy Resident Representative
Mr. T. Ito	:Assistant Resident Representative
Mr. K. Makino	:Assistant Resident Representative

ORGANIZATION CHART OF IMPLEMENTATION AGENCIES