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**Seychelles Fishing Authority**

**Republic of Seychelles**

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

**NOVEMBER 2000**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

**CRC OVERSEAS COOPERATION Inc.**

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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 Project for Coastal Fisheries Development and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Seychelles a study team from 23 of May to 19 of June, 2000.

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 from 21 of August to 3 of September, 2000 in order to discuss a draft basic design, and as this result, the present report was finalized.

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

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

November, 2000

Kunihiko Saito
President
Japan International Cooperation Agency

November, 2000

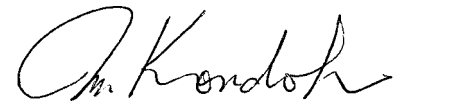
**Letter of Transmittal**

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

This study was conducted by CRC Overseas Cooperation Inc., under a contract to JICA, during the period from 17 of May, 2000 to 15 of December, 2000. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of the Republic of Seychelles and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

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

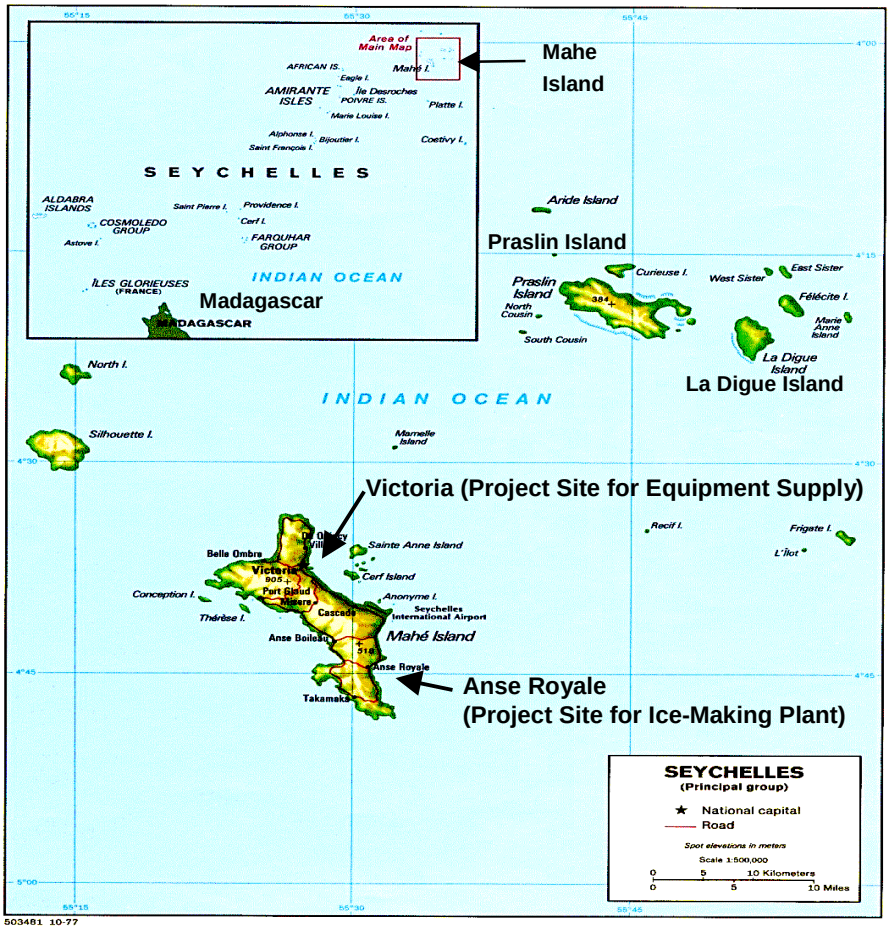
Very truly yours,



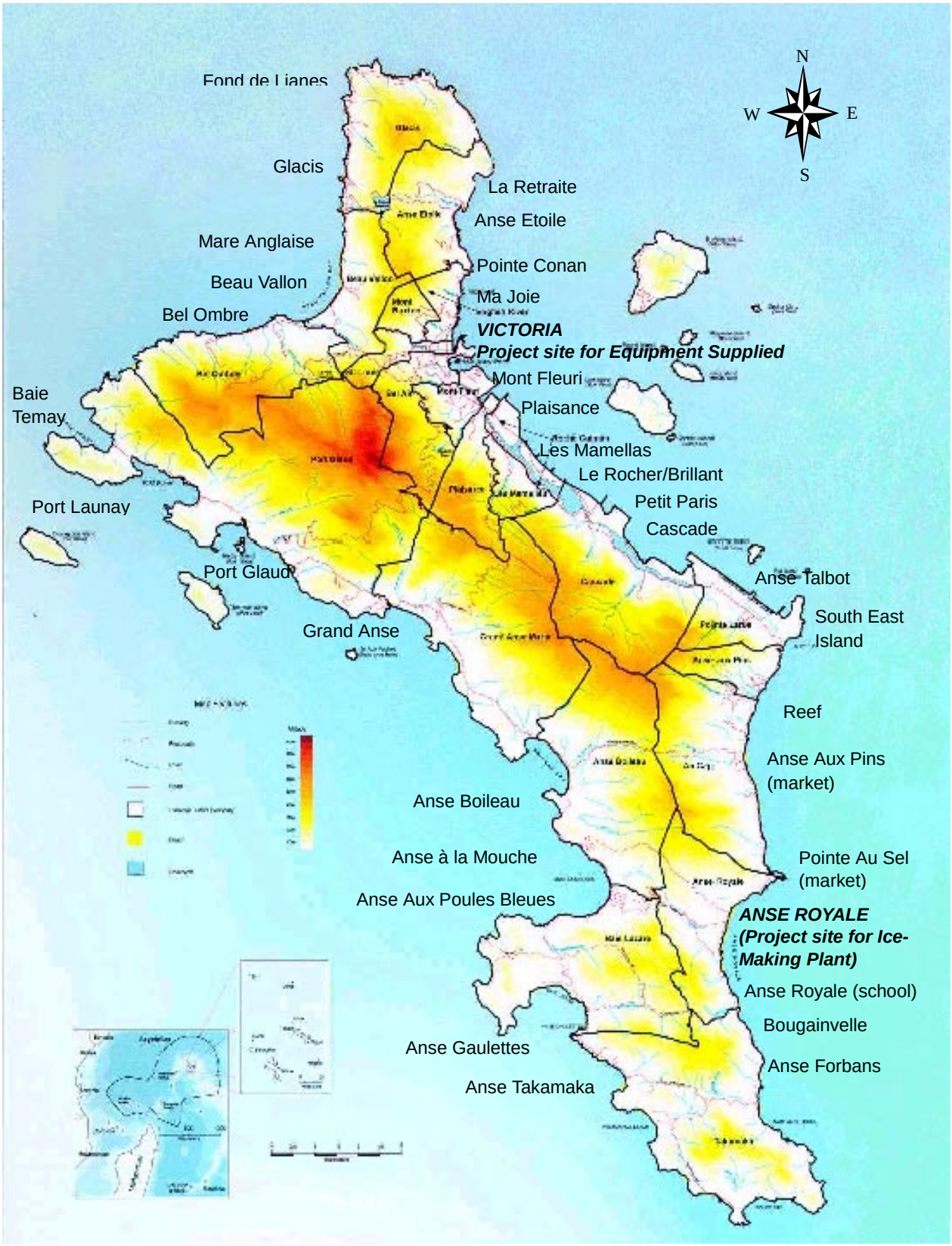
Mamoru Kondo
Project manager,
Basic design study team on
the Project for Coastal Fisheries Development
in the Republic of Seychelles
CRC Overseas Cooperation Inc.


The Republic of Seychelles

**Map of Africa**




**Map of Mahe Island and the Circumference**




**Fish Landing Point in Mahe Island**


**Anse Royale Project Site for Ice-Making Plant**


ICE PLANT

# Abbreviations

| | |
|---|---|
| **EEZ** | Exclusive Economic Zone |
| **SFA** | Seychelles Fishing Authority |
| **EU** | European Union |
| **FAO** | Food and Agriculture Organization of the United Nations |
| **ADB** | African Development Bank |
| **SSB** | Single Sideband |
| **VHF** | Very High Frequency |
| **GPS** | Global Positioning System |
| **OFC** | Oceana Fishing Company |
| **SMB** | Seychelles Marketing Board |
| **FRP** | Fiberglass Reinforced Plastic |
| **SCSA** | Seychelles Christian Seamen's Association |
| **SHL** | Sea Harvest Limited |
| **E/N** | Exchange of Notes |
| **IB** | Inboard engine |
| **OB** | Outboard engine |
| **CPUE** | Catches per Unit Effort |
| **LED** | Light Emitting Diode |
| **JCI** | Japan Craft Inspection |
| **EPIRB** | Emergency Position Indicating Radio Beacon |
| **CRT** | Cathode Ray Tube |
| **PVC** | Polyvinyl Chloride |
| **IOM** | Indian Ocean Marine Ltd. |
| **SEYCMI** | Seychelles Electronics Maritime Company Ltd. |
| **ADF** | Auto Direction Finder |

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# Chapter 1

# Background of the Project

# Chapter 1. Background of the Project

The Republic of Seychelles (hereinafter referred to as "Seychelles"), consisting of 115 islands, large and small, is a typical island country in the southwest portion of the Indian Ocean. The total land area is about 445km$^2$, the largest island is Mahe Island (155km$^2$) on which the metropolis of Victoria is located, followed by Praslin Island (38km$^2$) and La Digue Island (10km$^2$). The EEZ of Seychelles covers an area as vast as 1.37 million km$^2$ and has abundant fishing resources due to such plateaus of some 50m depth as Mahe Plateau and Amirantes Plateau forming good fishing grounds.

Seychelles became independent in 1976 June as a republic in the British Commonwealth of Nations and has a total population of some 78 thousand. The mainstay of the state economy is the tourism. The GDP is SR 2.754 billion and per capita GDP is SR 35.3 thousand in 1997. The contribution to GDP by sector is in the order of trade/transport (24%), manufacturing/construction (23%), tourism (17%), Government (13%), finance/services (6%), agriculture/fisheries (3%), and others (13%). Though the order of tourism seems to be not high, trade/transport, manufacturing/construction, and other industries as well as almost of all products of the primary industries such as agriculture/fisheries actually depend heavily upon tourists for revenue. The role of tourism in the national wealth is very important. On the other hand, the fisheries contribution stands at only 1.2%, but this figure represents the one of coastal/offshore fisheries employing the Seychellois nation, and when the contribution rates of other sectors such as tuna canning and processing which are classified into other sectors owing to statistical reasons are integrated, it is estimated that the figure rises to more than 10%. For such resource-poor nation as Seychelles the fishing industry is an important industry next to tourism.

Tourism earned SR 612.5 million in 1997, but in 1995 decreased drastically to SR 466.2 million. Given the fact that an average of tourism revenue for the past 5 years is SR 544 million, yearly range of fluctuation is as large as ±15%. Being affected greatly by the external factors, the Seychelles economy is continually unstable. The other major foreign exchange earners were canned tuna (SR 286 million), frozen shrimp (SR 22.6 million), frozen/fresh fish (SR 20.3 million), and shark fin (SR 0.7 million). The export of all of these fish and fish products accounted for 90% of total national export. Besides, there was a tuna-

related revenue of SR 236.2 million including access fee of SR 40.4 million, transshipment fee, and port charge, which contributed to improvement of the economic structure depending heavily upon mono-industry.

Comparing with these foreign exchange earning, import of foodstuff and other daily commodities was as large as SR 1.455 billion in 1977, resulting in a considerable trade deficit. Also Seychelles is suffering from perpetual external debt and in 1999 SR 843 million out of total national budget of SR 1.484 billion was allocated for debt servicing purposes. Under these situation, though no concrete national development plan is formulated yet after the 3rd one (1990-1994), in the Public Investment Program (1998-2000) the fishing industry is regarded as an important industry capable of earning some SR 100 million a year, accounting for about 96% of total national export.

The basic policy of the fisheries development is to develop and utilize the fishing resources on a sustainable basis and has the following 6 objectives definitely; (1) job creation, (2) foreign exchange earning, (3) improved linkage between industries, (4) establishment of a strong foundation to the fisheries, (5) development and management of resources, and (6) establishment of the hub fishing base in the Indian Ocean. At present an annual per capita consumption of fish is over 65kg, of which nearly 90% is supplied by the coastal fisheries, whose development objectives are (i) sustainable utilization of coastal/offshore resources, (ii) stable growth of national fishing fleet, and (iii) safety of fishing operation.

The Government of Seychelles, identifying the fishing industry as one of the most important sectors together with tourism and agriculture, has conducted various fisheries development projects with the assistance of Japan and other international organizations. As a result, the fishing industry has grown to become the most important sector next to tourism, contributing greatly to the development of the national welfare in such aspects as nutrition of people, domestic employment, and foreign exchange earning through export. However, as far as the coastal fishing industry concerned, it is still at only early stage of development to achieve the objectives, and numerous obstacles peculiar to the small island county are hampering the development. For example, delayed modernization of fish production measures such as fishing boat and fishing gear has resulted in stagnation of the conversion to offshore fisheries. The slow progress of the plan to reduce the fishing pressure on coastal fishing resources had led to a smaller size of fish caught and a general decline of the catch.

A short supply of ice at Mahe Island is causing problems of a decline of the freshness of fish and fish products in distribution in the island and increasing post-harvest loss. The policy to encourage offshore fishing has intensified the concern of fishermen and their families over increasing accidents at sea because of the slow development of appropriate type of fishing boat and inadequate improvement of many reef waterways around Mahe Island due to difficult national financial situation. Safety at sea is a critical issue to be urgently resolved towards the full-scale operation at offshore fishing grounds.

Under these background, the Government of Seychelles judged that it is necessary to resolve the problems concerning short-supply of ice, lack of fisheries input, and uneasiness of fishing operation in order to achieve the development objectives of the coastal fisheries, and formulated the Coastal Fisheries Development Project including the construction of ice making plant with a production capacity of 5 tons per day at Anse Royale, the center of fishing activities in the eastern waters of Mahe Island, and the procurement of fishing equipment and materials such as small fishing boats, marine engines, fishing gear, safety equipment for coastal fishermen, and requested the Government of Japan to offer a grant aid to implement this Project.

# Chapter 2

# Contents of the Project

# Chapter 2. Contents of the Project

## 2.1 Objectives of the Project

The Government of Seychelles has identified fisheries, which are endowed with rich resources in the country's vast EEZ of some 1.3 million $km^2$, as one of the most important sectors together with tourism and agriculture to support the economic development of the country. Accordingly, the Government of Seychelles established the Seychelles Fishing Authority (SFA) in the mid-1980's and has been implementing a series of fisheries development projects with the assistance of Japan, EU countries and such international aid organizations as the FAO and the ADB. As a result, fisheries have grown to become the most important sector after tourism industry, greatly contributing to the development of Seychelles' economy through the earning of foreign currency by exports and also to improvement of the level of nutrition of the public as well as domestic employment.

In the case of coastal fisheries, they are still at the early stage of development to achieve the targets, i.e. (i) sustainable utilization of fish resources, (ii) stable growth of the domestic fishing fleet and (iii) safety of fishermen at sea. There are many problems and obstacles for development which originate from the characteristics of Seychelles, which is an island country, making the continual provision of assistance by the Government.

For example, the delayed modernization of the means of fish production, such as fishing boats and fishing gear, has resulted in stagnation of the conversion to offshore fisheries. The slow progress of the plan to reduce the fishing pressure on coastal fisheries resources has led to a smaller size of the fish caught and a general decline of the catch, resulting in levelling off of the improvement of living standard of coastal fishermen.

At Mahe Island, the ice supply shortage for coastal fishermen is causing problems of a decline of the freshness of fish and shellfish marketed on the island and an increased loss of the catch. In addition, the policy of encouraging offshore fishing has intensified the concern of fishermen and their families in regard to an increase of the number of disasters at sea involving fishing boats because of the slow development and introduction of fishing boats of an appropriate size and the inadequate improvement of many reef waterways around Mahe Island. The facts that fishing boats are not yet fully equipped with life-saving equipment,

including life buoys, life jackets and signals, and that there is a supply shortage of such equipment because of the foreign reserves of Seychelles contribute to their concern.

Safety at sea is a critical problem faced by coastal fishermen in Seychelles and is considered an important issue to be urgently improved prior to the full-scale fleet operation of offshore fishing grounds.

The objective of the Project is to successfully achieve the targets for coastal fisheries proposed by the Government of Seychelles by constructing an ice-making plant with a daily production capacity of approximately 5 tons at Anse Royale, the central fishing base in the eastern part of Mahe Island, together with the procurement of small fishing boats, inboard engines, fishing equipment, fishing gear and safety equipment in order to solve the various problems faced by coastal fisheries, including the difficulty of obtaining ice, shortage of fishing gear, engines and other fishing equipment and concern in regard to safe operation.

## 2.2 Basic Concept of the Project

The fish consumption per capita in Seychelles is estimated to be approximately 65kg per year, indicating a strong taste for fish on the part of the people of Seychelles. With this background, coastal fisheries meet almost all of the domestic demand, including the tourist demand, contributing to improvement of the health and nutrition of the people and also playing an important role in domestic employment. However, the aging of the estimated 1,500 fishermen is progressing as coastal fisheries are failing to attract a sufficient number of young people. As a result, the number of skilled fishermen is declining. Coastal fisheries constitute an economic activity directly conducted by local people and are an extremely important type of fisheries.

Compared to tourism and other industries, however, the working conditions on fishing boats at sea are much more severe. Improvement of the fishing production technologies and techniques, including fishing boats and fishing gear, as well as improvement of the working conditions for fishermen are urgently required to encourage young people to take up this vocation and to increase the number of skilled fishermen.

Under these circumstances, the components of the first (1986) and second (1994/95) Coastal Fisheries Development Projects for which Japanese aid was provided included the construction of ice-making plants, the procurement of fishing equipment and fishing gear and the procurement of small fishing boats and a fishing training-research boat, etc. As these projects were continually implemented and contributed to a proper use of ice in the fishing, a reduction of post-harvest loss, a promotion of fish resource survey and an introduction of new fishing technics, etc. based on the same basic concept, there are high expectations of Japanese aid among coastal fishermen who were the direct beneficiaries. Despite the success of these projects, obstacles to fisheries development in Seychelles, which targets the sustainable use of fish resources in the Seychelles waters (conservation of coastal fish resources and effective use of offshore pelagic/ demersal fish resources) and the realization of responsible fisheries, still remain, including the slow growth of skilled successors, delayed building program of inboard engine fishing boats.

The Government of Seychelles has adopted development targets for the fisheries sector, i.e. (i) the sustainable utilization of fish resources, (ii) stable growth of the domestic fishing fleet and (iii) the safety of fishermen at sea, in view of the active structural improvement of coastal fisheries and the increased contribution of coastal fisheries to the development of the national economy. The achievement of these targets presumes the promotion of "the improved social status of coastal fishermen and the fostering of successors" which are the main features of as well as bottlenecks for the Coastal Fisheries Development Program in Seychelles.

The success of this Program depends on the establishment of a clear relationship between the components of the Project for Coastal Fisheries Development in the Republic of Seychelles (the Project) and the development targets described below to convert coastal fisheries to "an attractive industry" in an effective manner. As such, the planning of the construction of an ice-making plant and the procurement of equipment must incorporate all of the necessary items of an appropriate scale and specifications for the fisheries development in Seychelles, taking the present conditions of coastal fisheries into consideration. The resulting basic concept of the Project is shown in **Table 2-2-1**.

**Table 2-2-1 Basic Concept of the Project**

| Project Component / Development Target | Modernization of Coastal Fisheries | Improvement of Fishing Conditions | Development, Introduction and Wide use of Appropriate Fishing Boats | Promotion of Fisheries Resources Management |
|---|---|---|---|---|
| (1) Sustainable Utilization of Fisheries Resources | ○ | ○ | ◎ | ◎ |
| (2) Promotion of Stable Growth of Domestic Fishing Fleet | ○ | ○ | ◎ | ○ |
| (3) Safety of Fishermen at Sea | ◎ | ◎ | ◎ | ○ |
| Project Contents | Fishing boat engines, fishing gear, safety equipment, ice boxes | Ice-making plant, crane truck, navigational leading lights | 13.5m type longlines (development and introduction), 10m type small fishing boats (wider use) | Small fishing boat for survey use; underwater video camera; hydraulic bender |
| | Accumulation of counterparts funds (items subject to sale)* | -(managed by SFA) | Accumulation of counterpart fund (items subject to sale)** | -(managed by SFA) |
| | ← Management and operation of counterpart fund → | | | |

Notes:
* Including some of the equipment to be controlled by the SFA.
** These fishing boats (longliners) will be controlled by the SFA for the first one or two years after procurement for test operation and verification of their performance.
The marks in the table shows the scale of relation between development goal and project components.
◎ : Enormous, ○ : Big

### 2.2.1 Contents of the Request

The contents of the original request made by the Government of Seychelles and the agreed contents of the request following consultations as part of the Basic Design Study are shown in **Table 2-2-2**.

**Table 2-2-2 Contents of the Request**

| Original Request (April, 1999) | Finalised Request for Basic Design Study (June, 2000) | Reason for Change |
|---|---|---|
| Facilities | | |
| 1. Ice-making plant and storage (5t/day) | 1. Ice-making plant and storage (the management of which will be entrusted to fishermen or fishermen's group by the SFA) 5t/day; with a protective shed and emergency power generating unit: plate ice | - 2 machines of 2.5t/day each in view of the large seasonal fluctuation of the catch |
| Equipment | | |
| 1. Small fishing boats (7)<br>- 10m type fishing boats (5)<br>- 8m type fishing boats (2)<br>2. Marine engines<br>(1) Outboard engines<br>(2) Inboard diesel engines<br>(4 types; 85 in total)<br>3. Fishing gear for longlining and spares<br>4. Longlining maintenance tools<br>5. Fishing gear for trolling<br>6. Fishing gear for vertical longlining<br>7. Other fishing gear<br>8. Ice boxes<br>9. Handcarts<br>10. Safety equipment<br>11. SSB and VHF radio equipment<br>12. GPS<br>13. Fishfinders<br>14. Waterproof flush lights<br>15. Underwater camera<br>16. Crane truck<br>17. Hydraulic bender | 2. 1nboard diesel engines (to be sold) (Item 2-(2) of the original request)<br>(4 types: 70 in total) | - The required number has been revised based on the fishing boat construction and engine re-equipment plan. |
| | 3. Safety equipment (to be sold)<br>(1) Life saving appliances (Item 10 of the original request)<br>(2) SSB and VHF radio equipment (Item 11 of the original request)<br>(3) GPS (Item 12 of the original request)<br>(4) Fishfinder (Item 13 of the original request)<br>(5) Waterproof flush lights (Item 14 of the original request)<br>(6) Underwater video camera | - The equipment subject to the accumulation of the counterpart fund and equipment to be controlled by the SFA are clearly identified.<br>- The underwater video camera will be used for resources surveys. |
| | 4. Crane truck (managed by the SFA) (Item 16 of the original request) | - No change |
| | 5. Small fishing boats (Item 1 of the original request)<br>(3 types: 6 in total)<br>(1) 13.5m type longliners (2) (to be sold)<br>(2) 10m type small fishing boats (3) (to be sold)<br>(3) 8m type small fishing boat (1) (managed by the SFA) | - Longliners have been newly requested.<br>- The number has been reduced from 7 to 6.<br>- The 8m type small fishing boat will be used for surveys in shallow waters. |
| | 6. Fishing gear for longlining and spares (either sold or managed by the SFA) (Item 3 of the original request) | |
| | 7. Navigation leading lights (new request) (managed by the SFA)<br>8. Maintenance tools for longlining (managed by the SFA) (Item 4 of the original request)<br>9. Fishing gear (to be sold) (Item 5 of the original request) | - These lights have been newly requested. |

| | | |
|---|---|---|
| | 10. Fishing gear for vertical longlining (to be sold) (Item 6 of the original request)<br>11. Other fishing gear (to be sold) (Item 7 of the original request)<br>12. Ice boxes (to be sold) (Item 8 of the original request)<br>13. Handcarts and scales (managed by the SFA) (Item 9 of the original request) | - The scales will be used for statistical surveys on the catch. |
| | 14. Hydraulic bender (to be controlled by the SFA (Item 17 of the original request) | - To be used to manufacture fishing gear for fishing tests and anchors (made of bar steel) for fishing boats. |
| | 15. Outboard engines (managed by the SFA) (Item 2-(1) of the original request) | |

Notes:

Each requested item at the time of the Basic Design Study (June, 2000) in the middle column is accompanied by the classification category (to be sold, managed by the SFA or to be managed under the entrustment of the SFA). However, some of the equipment to be sold may be kept and used by the SFA for its own experimental survey purposes.

### 2.2.2 Examination of the Contents of the Request

The main components of the request are an ice-making plant, 13.5m type longliners, 10m type small fishing boats, marine engines, fishing gear, safety equipment, a vehicle (crane truck), an 8m type small fishing boat for shallow water resource surveys and navigational leading light buoys for reef waterways. As shown in **Table 2-2-2**, the number of fishing boats has been reduced from the originally requested 7 to 6 in the request at the time of the Basic Design Study. Similarly, the number of inboard diesel engines among the marine engines has been reduced from 85 to 70 as a result of the adjustment of the original request based on the demand situation of coastal fishermen for the construction of new fishing boats or main engine replacement (SFA's fishing boat building and rehabilitation program). In view of the urgency of securing the safety of life at sea in the offshore fishing by the coastal fishermen, the quantity of life-saving appliances has been increased. The results of the examination of each requested item are described below.

#### 2.2.2.1 Ice-Making Plant

The delayed development of fisheries infrastructure means that it is difficult to secure a stable supply of ice. At present, there are only two areas in Mahe Island which ice is supplied for coastal fishermen. Those are the capital city of Victoria, and Anse à La Mouche which is located on the west coast of the island.

**Table 2-2-3 Ice-Making Capacity and Available Supply for Coastal Fisheries in Mahe Island**

| Type of Ice | Production Site/Owner | Ice-Making Capacity (t/day) | Real Ice-Making Capacity (t/day) | Available Supply for Coastal Fisheries | Remarks |
|---|---|---|---|---|---|
| Flake Ice | Port Victoria: Oceana Fishing Company (OFC) | 24.0 | 16.0 | 8.0 | For own use by OFC but up to 50% can be supplied externally |
| | Port Victoria: Sea Harvest Ltd. (SHL) | 10.0 | 8.0 | 0.0 | For tuna export |
| Plate Ice | Port Victoria: Oceana Fishing Company (OFC) | 6.0 | 4.0** | 4.0** | Japanese aid (1986) |
| | Anse à la Mouche : Seychelles Fishing Authority (SFA) | 2.5 | 2.5 (*2.0) | 2.5 (*2.0) | Japanese aid (1994/95) |
| Total | | 42.5 | 30.5 (*30.0) | 14.5 (*14.0) | |

Notes:

* At the time of the field survey, the ice-making capacity of Anse à la Mouche declined by some 20% from the installed capacity. As the installed production level can be restored by ordinary maintenance work, an available ice supply for coastal fisheries of 2.5t/day is planned.

** The production capacity of the ice-making plant of OFC (established through the privatization of the former Fisheries Department of the SMB) at Port Victoria has declined by more than 30% after 15 years of operation, indicating that the plant has reached the time for replacement. Daily maintenance must be properly conducted to maintain the current ice production level for the time being.

Given the climate of Seychelles, there is a large demand for plate ice which is slower to melt than flake ice. The volume of ice carried by a fishing boat in terms of the weight ratio shows an increasing trend, from an average of 0.5 - 1.5 in the past to 1.0 - 2.0 today. The underlying factor for this increase is the increase of fishing boats engaged in offshore fisheries even though the ratio of such fishing boats in the total number of fishing boats is still small. This phenomenon reflects the noticeable decline of coastal fisheries due to the decreasing size of fish and the decline of the catch. As a result, the ice supply and demand situation has become significantly imbalanced and requires correction. The daily production capacity of the plate ice-making plant in Port Victoria, which is the largest ice supply base in Mahe Island, has declined from 6 tons to 4 tons as it is 15 years old. This plant requires replacement or thorough rehabilitation. The ice-making plant at Anse à la Mouche (five years old) supplies ice to surrounding area on the west coast of Mahe and villages (involving some 15 fishing boats) and is operating at almost full capacity. It is, therefore, difficult for fishermen from other areas to visit and obtain ice from this plant.

This ice supply situation has led to a critical need for a new ice-making plant at Anse Royale, which is a major fish landing port on the east coast of Mahe Island.

**Table 2-2-4 Daily Ice Demand in Mahe Island**

(Unit: tons/day)

| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ice Demand | 25.3* | 20.9 | 21.7* | 22.4* | 22.5* | 14.6 | 16.8 | 17.6 | 18.1 | 24.6* | 24.9* | 22.9* | 21.1 |

Note: An asterisk indicates those months in which the demand is above average.
Ice demand is largely beyond the supply capacity of ice in Mahe Island.

### 2.2.2.2 Examination of Requested Equipment

#### (1) Crane Truck

According to the request, a crane truck is essential to transport fishing boats, engines and other fishing equipment to Port Victoria which has a workshop for their repair as coastal

fishing villages on Mahe Island have hardly any infrastructure; Given the increased upper limit for equipment weight in recent years, the lifting capacity of the existing crane truck is insufficient and urgent improvement is required.

Examination of the existing crane truck found that it has been well maintained. As this vehicle is only five years old, it cannot be described as old. The field survey findings suggest that the subject items for transportation are small fishing boats, FRP fish holds (boxes), marine engines, fishing equipment and outboard engines, etc. and there has been no major change of these items since 1990 while a small fishing boat can weigh more than 2,000kg.

A crane truck is essential for fishing activities at coastal villages in Seychelles and there is a definite preference for a larger crane capacity (in terms of the lifting capacity and boom length). The existing crane truck is only 5 years old, can continue to be used. A crane truck has, therefore, been removed from the scope of the Project.

**(2) Small Fishing Boats**

1) Small Fishing Boats (13.5m Type Longliners×2 and 10.0m Type Small Fishing Boats×3)

Given the situation of a distinctive declining trend of resources for coastal fisheries, the dispersion of fishing activities from coastal fisheries to offshore fisheries is required to achieve responsible fisheries by means of the sustainable utilization of fisheries resources in the coming years. Many of the present fishing boats are old and the fishing methods are inefficient, resulting in a worsening of the working conditions. There is also a problem of a lower ratio of young people employed in fisheries compared to other industries. The increased employment of young people in the fisheries sector through improvement of the working conditions can only be achieved by the wide use of economical, highly productive and labour saving fishing methods and the development and introduction of fishing boats of appropriate design and sizes.

The introduction of 13.5m type small longliners and 10.0m type small fishing boats is based on the strong demand for these vessels by coastal fishermen and is essential for the effective promotion of fisheries to achieve the development targets adopted for coastal fisheries by the Government of Seychelles.

2) Small Fishing Boat for Surveys (8.0m Type Small Fishing Boat × 1)

According to the request, a small shallow draft boat is required to meet the increasing demand of the SFA for its own resources surveys in shallow waters. The small fishing boat requested is identical to the 2 boats provided under the previous Projects for Coastal Fisheries Development and, therefore, the procurement of this fishing boat under the current project is extremely difficult.

The SFA is engaged in the management and development of oceanic fisheries resources in collaboration with many related bodies of the Government of Seychelles and is expected to continue to play a pioneering role in the fields of the environment and resources conservation. As the continued and effective use of the existing small fishing boats in collaboration with many domestic bodies and organizations for resources surveys in shallow waters as well as deeper waters appears feasible, this small fishing boat for survey purposes has been removed from the scope of the Project.

**(3) Light Buoys for Reef Passages**

According to the request, there is an urgent need to secure safe navigation by setting up leading lights for reef-passes as there is strong concern in regard to a disaster at the reef-passes along the coast of Mahe Island due to the increase offshore activities of small coastal fishing boats. As 3 of the 9 reef-passes leading to major fishing villages or landing sites are already equipped with such light buoys, the installation of light buoys along the remaining 6 reef-passes is requested under the Project. So far, there is no record of a sea disaster involving a small coastal fishing boat along any reef-passes, indicating that local fishermen have a good understanding of the reef-passes and have been paying careful attention on their return from increasing offshore operation in recent years to port at night. As most of the landing sites on Mahe Island are protected by a reef, few disasters have occurred along the coast. The most dangerous prospect is grounding on the reef due to failure to properly recognize a reef-passes. Even though this has not actually happened, many fishermen have had kind of near misses experiences.

As the reef-passes are a dangerous water area for coastal fishermen, the improved safety provided by the installation of navigational leading light buoys is desirable. These lights are to be included in the scope of the Project.

**(4) Hydraulic Bender**

The seabed around the islands of Seychelles predominantly consists of reef and, therefore, small anchors made of bar steel are preferred to Danforth type anchors by fishermen due to their lighter weight, higher holding power and convenience of handling. This type of anchor is manufactured at the workshop of the SFA to assist the fishing activities of coastal fishermen. This workshop uses a hydraulic bender to manufacture the frames for its own towing fishing gear for survey and research purposes as well as other types of fishing gear and tools for testing purposes. However, this bender is suffering from oil leakage due to the breakage of the hydraulic cylinder which is beyond repair. As the SFA workshop is used for the practical training of students at the Maritime School, it is essential for the maintenance and repair of fishing equipment and fishing boat engines, etc. The provision of a replacement bender is, therefore, essential.

**(5) Marine Engines, Fishing Gear and Safety Equipment**

1) Marine Engines

a. Marine Diesel Engines (4 Types; 70 in Total)

The SFA is promoting a policy of encouraging the use of inboard engines for fishing boats in response to the increasing tendency towards offshore fishing by the coastal fishermen, i.e. increasing distance of fishing grounds from the coastline, and such requirements as the improved habitability of fishing boats, establishment of a safe operation system and increased economy of fishing. However, as the chronic deficit of foreign trade in the national economy has worsened the country's foreign reserve situation, it is extremely difficult for fishermen to obtain marine engines and other items to modernise their fishing boats in a timely manner. At present, three-quarters of small coastal fishing boats are equipped with an outboard engine. For the further development of coastal fisheries, expansion of the supply of marine diesel engines is necessary to further promote the policy of encouraging the use of fishing boats equipped with inboard engines. Requested quantity shall be carefully examined in accordance with the past record of sales, etc.

**Table 2-2-5 SFA's Fishing Boat Building and Rehabilitation Program**

| Type | HP | Number of New Boats | Number of Boats to be Rehabilitated | Total Number of Boats | Remarks |
|---|---|---|---|---|---|
| One Cylinder Type * | approx. 15 | 10 | 10 | 20 | * No new manufacturing of this type. To be of 2 cylinder type. |
| Two Cylinder Type | approx. 28 | 15 | -<br>(4) | 15<br>(19) | Figure in brackets shows the number in stock (four 28 PS type) |
| Three Cylinder Type | approx. 34 - 42 | 20 | 5 | 25 | Approx. 10 will have a larger HP |
| Four Cylinder Type | approx. 75 | 5 | 5 | 10 | |
| Total | | 50 | 20 (24) | 70 (74) | |

Note: The number of diesel engines procured in the project shall be carefully examined and appropriately determined within a limit of SFA's program and Japan's grant aid scheme.

b. Outboard Engines

As far as outboard engines are concerned, a system for their import, technical guidance and aftercare-services is being established by the private sector. It is believed that it is preferable for the 3 requested outboard engines to be procured in the domestic market in Seychelles. Accordingly, this item has been removed from the scope of the Project.

2) Fishing Gear

All fishing gear and fishing machinery are imported in Seychelles and it is difficult to quickly obtain even small items when really needed. As fishing gear is essential for the diffusion of new fishing methods and for the development of coastal fisheries, fishing gear should be procured under the Project. The fishing gear for longlining will be used by the small longline fishing boats to be used for the development and introduction of new fishing gear and fishing methods targeting highly migrating pelagic species. Following experimental operation by the SFA for 1 - 2 years, it will then be sold as accessories for longliners. As an assured supply of the bait fish is the most important issue for longlining, the relevant experiments will be conducted by the LAMITIE, a fisheries training and research boat of SFA. For this purpose, fishing gear for stick-held dip netting will be required (the fishing gear for stick-held dip netting will be controlled by the SFA).

The fishing gear materials for vertical droplining, trolling and gill netting will be sold to coastal fishermen. It is planned that the sale proceeds will be accumulated in the form of a counterpart fund which will then be used for the promotion of local fisheries development.

3) Safety Equipment

As already mentioned in the section on marine engines, there is concern in regard to a possible increase of marine disasters following the growing popularity of offshore and distant fishing grounds. Although organized protests by people working in the fisheries sector are very rare in Seychelles, a protest was held in February, 2000 when representatives of the Seychelles Christian Seamen's Association (SCSA) appealed their plight to the Government of Seychelles and requested the implementation of sufficient safety measures and assistance by the government to ensure safety at sea, to support the lives of the families in the case of a death of a fisherman at sea and also to solve the problem of the fishing gear and ice shortage. Although the Safety Equipment Standards for Fishing Boats introduced in 1996 make it compulsory for all domestic fishing boats to have certain safety equipment, the supply of such equipment in sufficient quantities has been impossible because of the foreign reserves situation. A wide range of safety equipment must be made available to urgently improve the situation in order to establish the required safety system.

4) Radio Equipment (SSB×10, VHF×20, Portable VHF Radio×2)

As already described, there is a growing risk of sea disasters for small fishing boats following expansion of the fishing grounds to the periphery of the plateau and their involvement in tuna longlining. The establishment of a system under which communication with a shore base is always possible is, therefore, necessary to enable a swift response to emergencies by means of introducing and encouraging the wide use of SSB radio equipment and/or VHF radio equipment. These two types of equipment will serve larger schooner type fishing boats which have a steering house. The remaining portable VHF radio equipment will be used by the SFA for the promotion of coastal fisheries.

5) Fishfinders (320m Type×20, Color 600m Type×5 and 2,000m Type×1)

Fishfinders are becoming essential items of equipment for coastal fishermen to find fishing grounds and the positioning. The 320m type fishfinder has a monochrome display and will be used by small coastal fishing boats. The 600m type fishfinder (with a colour display) will serve schooner type fishing boats which are engaged in the fishing of high quality demersal fish, etc. in the periphery of the plateau and other areas. The 2,000m type

fishfinder will be used by the SFA for survey activities, including the provision of fishing ground information for coastal fishermen.

6) GPS (4.5 Inch Liquid Display Type Units × 12)

The determination of the accurate geographical position of a boat is essential for the twin tasks of safe operation and improved fishing productivity. The use of GPS units has become essential and inevitable for those coastal fishing boats which are increasingly operating in distant offshore fishing grounds.

7) Navigation Tools (Dividers, Navigation Rulers and Vernier Calliper Gauges)

These tools will be used for the navigation training of students of the Maritime School to determine the position of vessels on a sea chart and to prepare fishing ground navigation plans. They will be controlled by the SFA and will be used for the extension of navigational techniques to fishermen in addition to the training of students.

8) Video Camera with Waterproof Case

According to the request, the reclamation of coastal areas is necessary due to the small land area of Seychelles and the destruction of the natural environment is unavoidable. Although the SFA has been attempting to intensify its spotting activities as part of its fisheries resources surveys, it has been hampered by the lack of suitable equipment, making the acquisition of an underwater video camera necessary. Coral reefs provide precious coastal fishing grounds and are important breeding grounds for fish and shellfish. As they are also important tourism resources, their protection is highly significant. However, the preparation of basic data is the most important issue.

While the SFA used to own an underwater video camera for survey purposes, the expected life of such a camera is short and the camera in question has not been used since it broke down, indicating a problem of the continued use of such camera. Although the water-tightness of an underwater video camera is no longer a problem because of its protection by a special housing, careless handling quickly leads to the entry of human hair, sand and other foreign matters into the sealing sector, often resulting in breakdowns and other problems.

Therefore, in view of objective of the Project (coastal fisheries development) even though a camera of this type is important for resources surveys, its low reliability makes

the procurement of such a camera under the grant aid scheme difficult. Consequently, an underwater video camera can not be justified to be appropriate to include in the scope of the Project.

9) General and Special Tools for Engine Overhaul (Two sets of each item)

The marine diesel engines described in 1) above will be sold to fishermen. As maintenance and repair tools will be required for these engines, sets of such tools will be kept at the workshop of the SFA to provide aftercare-services for the engines sold.

### 2.2.3 Basic Concept of the Project

The facilities and equipment to be included in the Project as its components are described here based on the examination results of the necessity of the requested items together with the basic concepts for the Project regarding each component.

#### 2.2.3.1 Basic Concept for Ice-Making Plant

The daily ice supply capacity on Mahe Island is some 24 tons of flake ice and some 6.5 tons of plate ice, totaling 30.5 tons, as shown in **Table 2-2-3**. Plate ice is made by ice-making plants constructed with previous Japanese aid projects and the entire amount is supplied to coastal fishermen. However, some 8 tons of flake ice is exclusively used by Sea Harvest Ltd. (SHL), a private company. The remaining some 16 tons are entirely controlled by Oceana Fishing Company (OFC) which is the former Fisheries Department of the SMB (Seychelles Marketing Board) and which was privatized last year. Therefore, the maximum quantity of flake ice purchased by coastal fishermen is 8 tons (based on a maximum ratio of 50%). Some 4 tons of plate ice from an ice-making plant owned by OFC is supplied to coastal fishermen as this plant was formerly owned by SMB and was constructed with Japanese aid to supply plate ice to coastal fishermen. This policy has been maintained even after privatization.

As described above, coastal fishermen on Mahe Island can obtain up to 14.5 tons of ice a day, some 100 tons a week, or some 5,200 tons a year. Meanwhile, the daily demand for ice is an average of 21 tons (average of the last 4 years; some 14.5 tons (69%) in the northern part of Mahe Island, some 3.5 tons (17%) in the eastern part and some 3.0 tons (14%) in the western

part). This daily demand can be translated to some 150 tons a week or some 7,800 tons a year, indicating an ice supply shortage of some 2,600 tons a year. In reality, as the amount of ice used per fishing boat and fishing operation has been increasing, the absolute supply shortage of ice is believed to create extremely difficult conditions for coastal fishermen, including the non-availability or insufficient availability of ice when it is needed.

The construction of a new ice-making plant to serve the Ance aux pins, Anse Royale and Takamaka district administratives on the east coast of Mahe Island will eliminate the excess demand for ice (approximately 17% of the total demand) and will ease the ice supply and demand situation at Port Victoria, making access to ice easier for fishermen operating along the north and west coasts (excluding the Anse à la Mouche in the southwestern part of Mahe Island). As a result, fishing activities throughout Mahe Island will be further stimulated. The scale and specifications of this new ice-making plant will be determined based on the required amount of ice, in turn decided by the number of fishing boats and the state of their activities in the target areas. The previous size of the catch will also be taken into consideration.

#### 2.2.3.2 Basic Concept for the Equipment

**(1) Small Fishing Boats (13.5m Type Longliners×2, 10m Type Small Fishing Boats×3)**

The original request was for 7 boats, consisting of five 10m type fishing boats and two 8m type fishing boats. However, this has been changed to 5 boats, consisting of two 13.5m type longliners and three 10m type small fishing boats (the 8m small fishing boats in the original request have been removed because the reason given earlier). While Seychelles has the boatyard facilities to build FRP boats, most of these are pleasure boats and the local technology has not yet reached the level of building full-scale as well as functioning fishing boats of more than 8 - 10m in length for longlining or vertical longlining.

Because handline fishing is the main form of fishing among coastal fishermen, there is extremely high pressure on coastal fisheries resources, causing concern in regard to the depletion of such resources. The SFA is promoting a policy of introducing and extending new fishing methods, such as longlining and vertical longlining, to alleviate such pressure on coastal fisheries resources, resulting in the latest request for 13.5m type small longliners and 10m type small fishing boats.

Among the requested fishing boats, longliners are related to the development and introduction of new fishing gear and fishing methods and will be used for the relevant

experiments by the SFA for the first 1 - 2 years to check the performance of the new fishing gear and methods with a view to fostering future longline fishermen and extending the relevant techniques.

In contrast, 10m type fishing boats were first introduced in 1995 under the second Project for Coastal Fisheries Development. As these can be used for various types of fishing, including handline fishing, trolling and vertical dropline fishing, they are highly evaluated by coastal fishermen. The request for these boats to be included in the Project is intended to extend their use among coastal fishermen and is deemed to be appropriate.

The sale of the 5 requested fishing boats (2 longliners and three 10m type small fishing boats) to coastal fishermen is planned. In principle, the Government of Seychelles has the obligation to accumulate a counterpart fund equivalent to 100% of the FOB price of these boats within 4 years of the signing of the E/N in association with the sale of the boats. It has been confirmed that this requirement will not cause any problems as the Government of Seychelles intends to establish a special budget for the development of coastal fisheries.

Behind the request for these fishing boats lies the policy to facilitate the change from coastal fisheries to offshore fisheries and the introduction of the requested fishing boats will be essential to achieve the development targets in the fisheries sector [(i) sustainable utilization of fisheries resources, (ii) promotion of the stable growth of the domestic fishing fleet and (iii) safety of fishermen at sea].

**(2) Light Buoys for Reef Passages**

In the island countries such as Seychelles, reef edges are the most dangerous point between land and sea for the fishing boat, when going to the sea through the reef passage. For the promotion of sustainable utilization of fish resources, it is essential to develop bigger size fishing boats and extend fishing grounds to offshore waters. Accordingly the fishing pattern is changing from one day trip to multi-day trip, i.e. returning to the port in the darkness at night and delivering catches to the markets in the early morning.

Under the circumstance, installation of navigational leading light-buoys and clearance of water passages must be implemented with top priority as a protective means for securing safety operation at sea as well as strict enforcement of safety rules for small fishing boats. Then, it is appropriate to include the light buoys for the reef passages, as the 6 sites are especially important fishing villages in Mahe Island, in the scope of the Project.

**(3) Hydraulic Bender**

Although an anchor is an essential item for each fishing boat, the marketed Danforth anchor is a difficult item for coastal fishermen to obtain because of its high price. This situation has led the SFA to manufacture anchors of its own design from bar steel. These anchors have a good anchoring performance and are supplied to coastal fishermen. They are popular among fishermen because of the fact that they are sold at cost. The SFA also uses a hydraulic bender to manufacture survey tools and fishing gear for experimental purposes, including metal frames for trawling nets. As the requested hydraulic bender is expected to be effectively used, same as the old one which was now out of order because of oil leakage, for the further development of new fishing gear, its inclusion in the scope of the Project is deemed to be appropriate.

**(4) Marine Engines, Fishing Gear and Safety Equipment**

1) Marine Diesel Engines

Marine diesel engines are essential to facilitate the upscaling and increased use of inboard engines by fishing boats. Of the 66 units procured under the previous grant aid project, the 2 cylinder type (25 units) accounted for the largest number at approximately 38% and four engines remain in stock in June 2000. The number of originally requested 2 cylinder type engines (30 out of a total of 85) was readjusted at the time of the Basic Design, taking these 4 units into consideration. As marine diesel engines constitute one of the most important issues for fishermen, a realistic quantity based on the past performance is included in the scope of the Project with some modifications in terms of their details. These marine diesel engines will be sold to fishermen and the proceeds will be accumulated in the form of a counterpart fund. Because of the similar provision and sale under previous projects, no technical or administrative problems are anticipated in regard to their sale.

2) Fishing Gear

The allowable catch for coastal fisheries in Seychelles is estimated to be approximately 7,000 tons. The present level of the catch is 4,000 - 5,000 tons, leaving room for further exploitation. In order to realize this potential, the development and introduction of new fishing gear and fishing methods are important to exploit new fisheries resources in the coastal offshore fishing grounds, making the procurement of

fishing gear and fishing materials suitable for offshore fisheries under the Project appropriate.

In general, the fishing gear specifications considerably vary from one region to another. There are also regional characteristics depending on the time of introduction of specific fishing gear and fishing methods. For example, longlining is a typical fishing method for pelagic fishing in Japan. In a country such as Seychelles, however, pelagic fishing grounds are part of the fishing grounds for coastal offshore fisheries. Accordingly, the required range of fishing gear, specifications and scale are determined based on the equivalent items for coastal offshore fisheries. For longlining in Seychelles, fishing gear and fishing techniques similar to those employed by archipelago countries in the Caribbean and South Pacific have been introduced. This situation must be taken into careful consideration to determine the response to the requested fishing gear and fishing methods. Thorough consultations will be held with government officials in Seychelles to finalize the fishing gear, etc. to be provided under the Project while rejecting both the one-sided introduction of Japanese fishing gear, etc. and the outright acceptance of the requested items by the Seychelles side on the grounds that they reflect the local situation.

As described earlier, the fishing gear for longlining will be used by the SFA as fishing gear for the experimental operation of longliners. Fishing gear for stick-held dip netting will be used to catch fish for use as bait for long-lining.

Other types of fishing gear for vertical droplining, trolling and gill netting will be sold to coastal fishermen as counterpart fund sources.

3) Safety Equipment

The safe operation of fishermen is one of the most important tasks facing the government and the SFA and must be urgently addressed. Because of the foreign exchange shortage in the Seychelles, the import of appropriate safety equipment and life-saving appliances is currently difficult. It is believed that the procurement and supply of such equipment under the Project will help to achieve safe fishing activities and will greatly benefit local fishermen.

The requested safety equipment quantities are based on the target number of fishing boats to be equipped and the safety equipment standards in force in Seychelles.

The supply of equipment quantities to stimulate private local suppliers would appear to be appropriate for the purpose of facilitating the establishment of a local supply system

based on local efforts instead of simply meeting the requested quantities in full. The actual quantities given in the request at the time of the Basic Design Study are, therefore, based on this principle.

4) Radio Equipment

The fishing activities of coastal fishermen are supported by their immediate family members as well as those working at radio stations, the Coast Guard and the SFA, all of which are involved in ensuring the safety of fishing activities. The provision and reception of not only information on the weather but also on fishing grounds and the catch, etc. constitute important elements of fishing operation.

In Seychelles, Cable and Wireless (Sey), Ltd. provides a maritime communication service from a station at Bon Espoir on the west coast of Mahe Island. The SFA, the implementation organization of the Project, also operates a SSB station to assist the monitoring of fishing activities and law enforcement work in the coastal waters around Mahe Island as well as other islands and the EEZ of Seychelles. The training and research boat owned by the SFA is equipped with SSB and VHF radio systems.

Except for the portable VHF radio equipment to be controlled by the SFA, all of the other radio equipment is planned to constitute counterpart fund sources.

5) Fishfinders

The finding of suitable fishing grounds is the most important factor for successful fishing operation and, therefore, fishfinders will be provided under the Project. The requested quantity appears appropriate in view of the number of target fishing boats and these fishfinders will be included in the scope of the Project as counterpart fund sources. The 2,000m color fish finder will be used for advance surveys, the collection of data on fishing grounds and other public purposes.

6) GPS

As already described earlier, safe operation and improved productivity are necessary while the demands for the performance of fishing boats (in terms of safety, productivity and comfort) show an escalating tendency. Among these demands, that for GPS is particularly important and the request for 12 sets of GPS equipment appears rather modest from such a point of view. As the Project is expected to play the role of assisting the

establishment of a self-reliant equipment supply system on the part of private companies, the requested GPS units are included in the scope of the Project for sale as counterpart fund sources.

7) Navigational Tools

The SFA has been implementing various types of assistance, including the acceptance of students of the Maritime School for training, the recruitment of graduates from the said Maritime School and the introduction of employment opportunities for graduates. The change of this system in 1999 transferred the jurisdiction for the Maritime School to the Ministry of Agriculture and Marine Resources and the SFA is now required to initiate different activities from the conventional training of and extension of skills and techniques to those working in the fisheries sector. For the effective implementation of such activities, there is a shortage of dividers and navigation rulers, etc. which are essential tools to work with sea charts. Although these items used to be purchased by students as basic personal items, the requested items are included in the scope of the Project on the grounds that support for the various activities of the SFA to develop domestic fisheries will certainly lead to the future development of coastal fisheries in Seychelles.

8) General and Special Tools for Engine Overhaul (Two of Each Item)

One set of tools required for the overhauling of the engines described in 1) above is included in the scope of the Project and these tools will be stored at the workshop of the SFA.

## 2.3 Basic Design

### 2.3.1 Design Concept

In order to ensure the optimal basic design for the planned facilities and equipment, etc., the following design principles are adopted for the Project, taking the characteristics of the local situation in Seychelles, including (i) the natural and social conditions, (ii) the conditions and problems regarding construction work and equipment procurement and (iii) the current situation of fisheries, into consideration.

(1) Seychelles belongs to the tropical oceanic climate zone and experiences high temperatures and high humidity throughout the year. Because it is located in the doldrums, it is seldom affected by cyclones. The fact that there is no record of an earthquake occurring in the past emphasizes the relatively favorable natural conditions. Nevertheless, these natural conditions will be taken into proper consideration when deciding the specifications for the planned facilities and equipment.

(2) The construction site for the ice-making plant will be Anse Royale, the second largest city in Seychelles, which is situated in the southeastern part of Mahe Island. Anse Royale is enclosed by a coastal reef of some 4km in length with a maximum distance from the coast of some 400m. The water inside this reef is calm and the area is hardly affected by currents or waves. The area is exposed to a southeasterly wind in the dry season from May to September. Given the opening of the waterway at the central part of the reef towards the southeast, the design and specifications for the ice-making plant building will integrate measures to prevent salt damage due to the splashing of waves and briny air.

(3) As the national economy of Seychelles relies on tourism, the Project will pay careful attention to environmental factors, including landscape and natural conservation, as tourism resources. The cutting of existing trees at the planned ice-making plant site requires a permit and the layout of the plant will be based on the layout plan prepared by the Government of Seychelles for the entire site.

(4) Even though the main procurement principle for the planned facilities and equipment is the use of local products as much as possible, most items are imported because the availability of such items in the local market is insufficient due to the severe foreign exchange situation. This will necessitate sufficient preparation time for the procurement of equipment, etc. and the recruitment of labour in Seychelles. Those items which are critical and which will significantly affect the construction schedule will not, in principle, be procured locally.

(5) The Ministry of Agriculture and Marine Resources and the SFA, the implementation bodies of the Project, fully understand the mechanism of the grant aid scheme of the Government of Japan based on experience with similar projects in the past and are capable

of operating and maintaining the planned facilities and equipment under the Project. The partial revision of Japan's grant aid scheme for the fisheries sector, commencing with the present Project, however, requires the Government of Seychelles (the recipient) to pay careful attention to the management of a counterpart fund which will be accumulated through the sale of equipment, etc. to be procured under the Project. This will necessitate clear identification of the equipment subject to the accumulation of the counterpart fund and both the obligation to accumulate the counterpart fund and the right to use this fund for the promotion of fisheries on the part of the recipient country under the new system will be confirmed by both sides to avoid any misunderstanding.

(6) A design and specifications which are easy to maintain will be adopted when determining the facility and equipment grades while referring to existing similar facilities and equipment. In particular, the design and specifications of the inner walls of the ice storage of the ice-making plant and the inner lining of fish holds onboard fishing boats, etc. will ensure their easy cleaning.

(7) The implementation schedule of the Project will be based on the grant aid scheme of the Government of Japan which requires the completion of a project within a single fiscal year. In regard to the construction of the planned ice-making plant, the Government of Seychelles will be required to conduct the preparatory work, including leveling of the ground, and the clearance of existing trees at the site and an exclusive access road to the site. As the cutting of trees requires an official government permit, this could affect the construction schedule. A construction method and specifications which allow the completion of the on-site construction work in as short a time as possible will be employed for the ice-making plant (including its protective building).

### 2.3.2 Design Conditions

The sizes and quantities of the planned equipment under the Project will be determined based on the fisheries statistics prepared by the SFA and the findings of the interview survey in Seychelles. The components of the Project are largely classified into equipment to be sold to fishermen and facilities and equipment to be directly controlled by the SFA. The

equipment to be sold will be determined based on the new guidelines introduced following the revision of Japan's grant aid scheme for the fisheries sector (in the case of the present Project, it will be necessary to accumulate an amount equivalent to 100% of the FOB prices of the equipment for sale within four years of the signing of the E/N). This means that the scope of cooperation for the Project will be determined based on the comparative evaluation of the expected economic effects of the assistance and the contents of the budgetary measures and fiscal assistance measures of the recipient government to achieve such economic effects. The sizes and specifications of the equipment for the Project will, therefore, be determined while confirming their conformity with the development targets of the Government of Seychelles for the fisheries sector [(i) sustainable utilization of fisheries resources, (ii) promotion of the stable growth of the domestic fishing fleet and (iii) safety of fishermen at sea].

**Table 2-3-1 Expected Effects and Required Measures**

| Expected Effects | Required Measures | Remarks |
|---|---|---|
| - Achievement of the target fisheries production quantity<br>- Promotion of the utilization of offshore resources (highly migratory fish)<br>- Vitalization of fishing activities (improvement of ice supply situation, etc.) (supply of fishing gear and safety equipment, etc.) | - Accumulation of the counterpart fund (subsidy for purchase of fishing boats) (pursuant to the new guidelines *)<br>- Management of the counterpart fund (utilization plan and the procedure) (consultation with Japan on utilization of the fund) | * New guidelines for Japan's grant aid scheme for the fisheries sector |

## (1) Current Conditions of Coastal Fisheries in Seychelles

1) Production Quantity of Coastal Fisheries by Region

The catch of coastal fisheries in Seychelles in the period from 1995 to 1998 is shown in **Table 2-3-2**.

**Table 2-3-2 Fish Production in Quantity by Region (1995 - 1998)**

(Unit: tons)

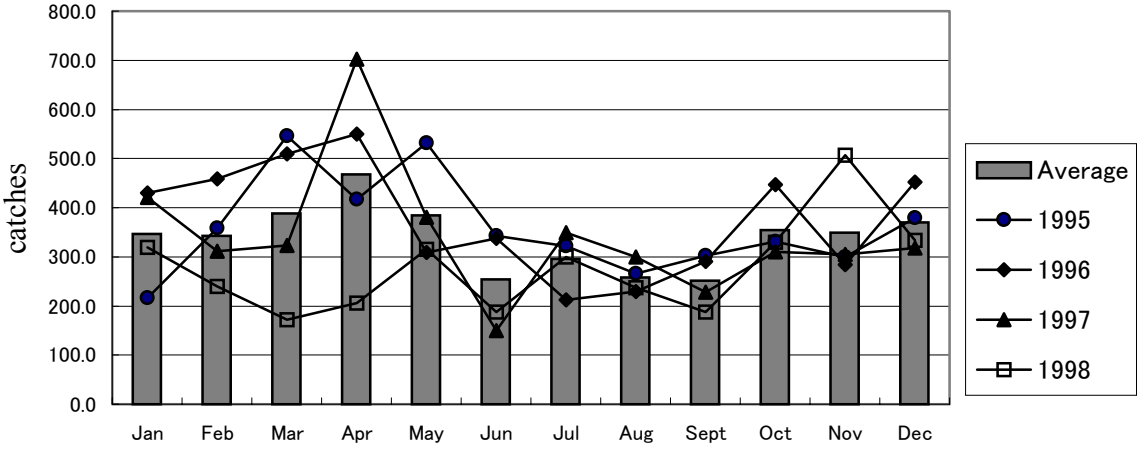
| Region | 1995 | 1996 | 1997 | 1998 | Average |
|---|---|---|---|---|---|
| Northwest, Mahe Island | 566.3 | 499.7 | 624.5 | 561.5 | 563.0 |
| Northeast, Mahe Island | 1,709.5 | 1,860.4 | 1,750.1 | 1,487.2 | 1,701.8 |
| East, Mahe Island | 818.4 | 768.3 | 564.5 | 344.4 | 623.9 |
| West, Mahe Island | 471.1 | 560.1 | 417.6 | 423.6 | 468.1 |
| Sub-Total for Mahe Island | 3,565.3 | 3,688.5 | 3,356.7 | 2,816.7 | 3,356.8 |
| Northeast, Praslin Island | 282.1 | 404.4 | 371.0 | 281.2 | 334.6 |
| Northwest, Praslin Island | 162.2 | 205.2 | 169.3 | 92.5 | 157.3 |
| Sub-Total for Praslin Island | 444.3 | 609.6 | 540.3 | 373.7 | 491.9 |
| La Digue Island | 142.1 | 133.6 | 133.1 | 96.0 | 126.2 |
| Total | 4,151.7 | 4,431.7 | 4,030.1 | 3,286.4 | 3,974.9 |

Source : SFA Seychelles Artisanal Statistics

The above table indicates that the annual production volume of coastal fisheries in seychelles is approximately an average of 4,000 tons. The large dip in the production in 1998 is said to have been caused by the adverse impacts of El Nino (so-called El Nino Southern Oscillation).

2) Monthly Catches of Coastal Fisheries

The monthly fluctuation of the catches of coastal fisheries in the same 4-year period is shown in **Fig. 2-3-1**.




Source: SFA Seychelles Artisanal Statistics

**Fig. 2-3-1 Monthly Catches of Coastal Fisheries**

As clearly indicated in **Fig. 2-3-1**, the dry season from June to September constitutes a relative off-season for fisheries as the strong southeasterly seasonal wind hampers fishing activities.

3) Number of Fishing Boats

SFA statistics basically classify fishing boats into 3 categories, i.e. pirogue, fishing boats with an outboard engine and fishing boats with an inboard engine.

| Type of Fishing Boat | Description |
|---|---|
| (i) Pirogue | : wooden boat without an engine or with an outboard engine of less than 15 HP |
| (ii) Fishing boat with an outboard engine | : FRP fishing boat equipped with an outboard engine of 15 HP or more |
| (iii) Fishing boat with an inboard engine | : fishing boat with an inboard engine regardless of the presence or non-presence of a deck |

**Table 2-3-3** shows the historical changes of the number of small fishing boats in Seychelles. Fishing boats with an outboard engine still account for almost three-quarters of all local fishing boats.

## Table 2-3-3 Number of Small Fishing Boats

| Region | 1995 326 Boats (Year-on-Year Change) | | | 1996 313 Boats (-13) | | | 1997 342 Boats (+29) | | | 1998 351 Boats (+9) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pirogue | With Outboard Engine | With Inboard Engine | Pirogue | With Outboard Engine | With Inboard Engine | Pirogue | With Outboard Engine | With Inboard Engine | Pirogue | With Outboard Engine | With Inboard Engine |
| Northwest, Mahe Island | 2 | 33 | 8 | 1 | 25 | 9 | 2 | 43 | 9 | 2 | 48 | 11 |
| Northeast, Mahe Island | 4 | 28 | 44 | 3 | 30 | 44 | 4 | 36 | 50 | 3 | 46 | 45 |
| East, Mahe Island | 5 | 33 | 18 | 6 | 35 | 12 | 6 | 35 | 14 | 8 | 30 | 10 |
| West, Mahe Island | 4 | 23 | 10 | 3 | 21 | 12 | 2 | 18 | 11 | 3 | 21 | 14 |
| Others | 29 | 73 | 12 | 26 | 74 | 12 | 28 | 73 | 11 | 28 | 72 | 10 |
| Total | 44 | 190 | 92 | 39 | 185 | 89 | 42 | 205 | 95 | 44 | 217 | 90 |
| (By Fishing Method) | | | | | | | | | | | | |
| Handline | 9 | 67 | 89 | 9 | 57 | 89 | 9 | 65 | 91 | 9 | 82 | 89 |
| Static Trap | 13 | 50 | 3 | 12 | 51 | (3) | 13 | 57 | 3 | 12 | 58 | 1 |
| Active Trap | 4 | 14 | - | 3 | 14 | - | 5 | 15 | - | 3 | 16 | - |
| Handline and Trap | 12 | 34 | - | 11 | 31 | - | 11 | 84 | - | 10 | 34 | - |
| Encircling Gillnet | 1 | 16 | - | 1 | 20 | - | 1 | 19 | - | 1 | 16 | - |
| Set Gillnet | 1 | 8 | - | 1 | 9 | - | 1 | 11 | - | 1 | 9 | - |
| Beach Seine | 2 | - | - | 1 | - | - | 2 | - | - | 2 | - | - |
| Harpoon | - | - | - | - | - | - | - | - | - | - | - | - |
| Others | 2 | 1 | - | 1 | 3 | - | 0 | 4 | 1 | 6 | 2 | - |
| Total | 44 | 190 | 92 | 39 | 185 | 89 | 42 | 205 | 95 | 44 | 217 | 90 |

Source: SFA Seychelles Artisanal Statistics

4) Number of Fishermen in Coastal Fisheries

The number of fishermen engaged in coastal fisheries is shown in **Table 2-3-4** based on estimation using the number of fishing boats by fishing method (see **Table 2-3-3**) and the number of crew members on board (interview survey conducted in Seychelles). The average number of crew members is set at 2.0 persons/boat for pirogues and fishing boats with an outboard engine and 3.5 persons/boat for fishing boats with an inboard engine according to the SFA statistics and the hearing survey.

**Table 2-3-4 Estimated Number of Fishermen by Fishing Method**

| Type of Fishing | 1995 | | 1996 | | 1997 | | 1998 | |
|---|---|---|---|---|---|---|---|---|
| Method (Average Size of Crew) | No. of Boats | No. of Fishermen | No. of Boats | No. of Fishermen | No. of Boats | No. of Fishermen | No. of Boats | No. of Fishermen |
| Handline | 165 | 464 | 155 | 444 | 165 | 467 | 180 | 494 |
| Static Trap | 63 (66) | 156 | 63 (63) | 158 | 70 (73) | 171 | 70 (71) | 169 |
| Active Trap | 18 | 36 | 17 | 34 | 20 | 40 | 19 | 38 |
| Handline and Trap | 46 | 92 | 42 | 84 | 45 | 90 | 44 | 88 |
| Encircling Gillnet | 17 | 34 | 21 | 42 | 20 | 40 | 17 | 34 |
| Set Gillnet | 9 | 18 | 10 | 20 | 12 | 24 | 10 | 20 |
| Beach Seine | 2 | 4 | 1 | 2 | 2 | 4 | 2 | 4 |
| Harpoon | 0 | 18 | 0 | 17 | 0 | 16 | 0 | 24 |
| (Adjustment) | (3) | | (4) | | (5) | | (8) | |
| Total | 320 (325) | 821 | 309 (313) | 801 | 334 (342) | 851 | 342 (351) | 870 |

Source: SFA Seychelles Artisanal Fisheries Statistics

Note: Although the figures for fishing boats are based on SFA statistics, they differ from those shown in **Table 2-3-3** in some cases. The figures in **Table 2-3-3** are given in brackets for reference purposes.

**(2) Ice Demand by Coastal Fishermen in Mahe Island**

Based on the actual catches in the period from 1995 to 1999 for each region of Mahe Island, the ice demand for fisheries on Mahe Island is estimated using the conditions and formula explained below.

1) Estimation of Ice Demand for Fisheries

Conditions

a. The classification of fishing boats is based on the system used for the "Seychelles Artisanal Fisheries Statistics".

b. As pirogues are used at fishing grounds immediately off the coastline, most fishermen using a pirogue do not use ice (interview survey findings). Pirogues are, therefore, excluded from the ice demand estimation.

c. The rate of ice consumption is generally set at 1kg for 1kg of catch (the fish to ice ratio is 1 to 1). In the case of fishing boats with an inboard engine (IB type), the ice loss is fairly large because of the average operating period of these boats of three days and the ice consumption is more than double the size of the catch (interview survey findings). Accordingly, the ice demand of fishing boats with an inboard engine is assumed to be double the size of the catch (the fish to ice ratio is 1 to 2).

d. In order to clearly establish the relationship between areas already served by an ice-making plant and areas for which the construction of an ice-making plant is planned, Mahe Island is divided into three regions, i.e. north (which may be further divided into the northeast and northwest), east and west.

e. The number of fishing boats and the catch per capita for each region are based on the Seychelles Artisanal Fisheries Statistics. The number of crew members and the number of monthly operating days per boat are based on the relevant findings of the interview survey conducted in Seychelles.

f. An ice-making plant is assumed to operate seven days a week and 52 weeks a year.

Calculation Formula

$$Q = \Sigma\ Ei = \Sigma (Ni \times ni \times Ci \times Di \times fi)$$

Where,

Q : required volume of ice (kg)

Ei : required volume of ice by fishing boat and fishing method (kg)

Ni : number of fishing boats

ni : number of crew members

Ci : catch per capita (kg)

Di : number of operating days

fi : fish to ice ratio for fishing boats with an outboard engine (OB type) (fi = 1.0)

fish to ice ratio for Whaler type fishing boats in the category of fishing boats with an inboard engine (IB type) (fi = 2.0)

Anse Royale, the site of the planned new ice-making plant under the Project, is located in the eastern part of Mahe Island.

i) Estimated Daily Ice Demand in North of Mahe Island (Unit: kg)

| Year | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 13,720 | 13,998 | 16,951 | 16,065 | 15,593 | 12,051 | 10,022 | 11,955 | 12,469 | 13,768 | 12,010 | 13,249 |
| 1996 | 13,133 | 15,714 | 11,123 | 21,094 | 13,601 | 6,042 | 7,672 | 6,892 | 9,716 | 19,748 | 12,886 | 21,321 |
| 1997 | 22,362 | 15,040 | 19,209 | 13,391 | 17,361 | 9,687 | 13,837 | 16,176 | 19,097 | 15,945 | 17,755 | 21,225 |
| 1998 | 17,303 | 12,884 | 12,567 | 11,104 | 15,519 | 11,876 | 15,017 | 13,902 | 9,328 | 18,691 | 26,657 | 8,033 |
| Av. | 17,893 | 14,409 | 14,963 | 15,414 | 15,519 | 9,914 | 11,637 | 12,231 | 12,653 | 17,038 | 17,327 | 15,957 |

ii) Estimated Daily Ice Demand in East of Mahe Island (Unit: kg)

| Year | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 5,028 | 5,075 | 6,126 | 5,729 | 5,609 | 4,636 | 3,798 | 4,262 | 4,342 | 4,744 | 4,533 | 4,533 |
| 1996 | 4,903 | 4,199 | 3,228 | 5,541 | 8,586 | 1,634 | 2,128 | 1,874 | 2,592 | 5,245 | 3,427 | 5,399 |
| 1997 | 4,632 | 3,119 | 3,900 | 2,730 | 3,439 | 2,094 | 2,905 | 3,239 | 3,902 | 3,399 | 3,673 | 4,329 |
| 1998 | 2,420 | 1,802 | 1,762 | 1,591 | 2,250 | 1,699 | 2,145 | 2,029 | 1,337 | 2,739 | 3,804 | 1,145 |
| Av. | 4,246 | 3,549 | 3,754 | 3,898 | 3,721 | 2,516 | 2,744 | 2,851 | 3,043 | 4,032 | 3,859 | 3,852 |

iii) Estimated Daily Ice Demand in West of Mahe Island (Unit: kg)

| Year | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 2,748 | 2,799 | 3,245 | 3,120 | 3,185 | 2,634 | 2,024 | 2,370 | 2,426 | 2,681 | 2,362 | 2,600 |
| 1996 | 4,004 | 3,559 | 2,664 | 4,640 | 3,317 | 1,655 | 1,857 | 1,705 | 2,298 | 4,554 | 2,900 | 4,619 |
| 1997 | 3,738 | 2,565 | 3,194 | 2,236 | 2,970 | 1,785 | 2,558 | 2,759 | 3,158 | 2,854 | 3,102 | 3,659 |
| 1998 | 4,299 | 2,969 | 2,932 | 2,659 | 3,697 | 2,724 | 3,492 | 3,257 | 2,124 | 4,356 | 6,648 | 1,843 |
| Av. | 3,697 | 2,973 | 3,009 | 3,164 | 3,292 | 2,200 | 2,482 | 2,523 | 2,300 | 3,606 | 3,753 | 3,180 |

iv) Estimated Daily Ice Demand on Mahe Island by Month (Unit: kg)

| Year | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Ice Demand on Mahe Island | 25,836 | 20,931 | 21,725 | 22,475 | 22,532 | 14,629 | 16,863 | 17,605 | 18,196 | 24,676 | 24,939 | 22,969 |

v) Ice-Making Capacity on Mahe Island (Unit: kg)

| Type of Ice | Location | Installed Capacity | Annual Capacity | Maximum Allocation for Fishermen | Remarks |
|---|---|---|---|---|---|
| Flake | Victoria (OFC) | 24,000 | 16,000 | 8,000 | As ice is made for the OFC's own use, only the surplus is sold to fishermen |
| | Victoria (SHL) | 10,000 | 8,000 | 0 | For tuna export |
| Plate | Victoria (OFC) | 6,000 | 4,000 | 4,000 | Provided by Japan (for coastal fishermen) |
| | Anse à la Mouche (SFA) | 2,500 | 2,500 | 2,500 | Provided by Japan (for coastal fishermen) |
| Total | | 42,500 | 30,500 | 14,500kg/day | |

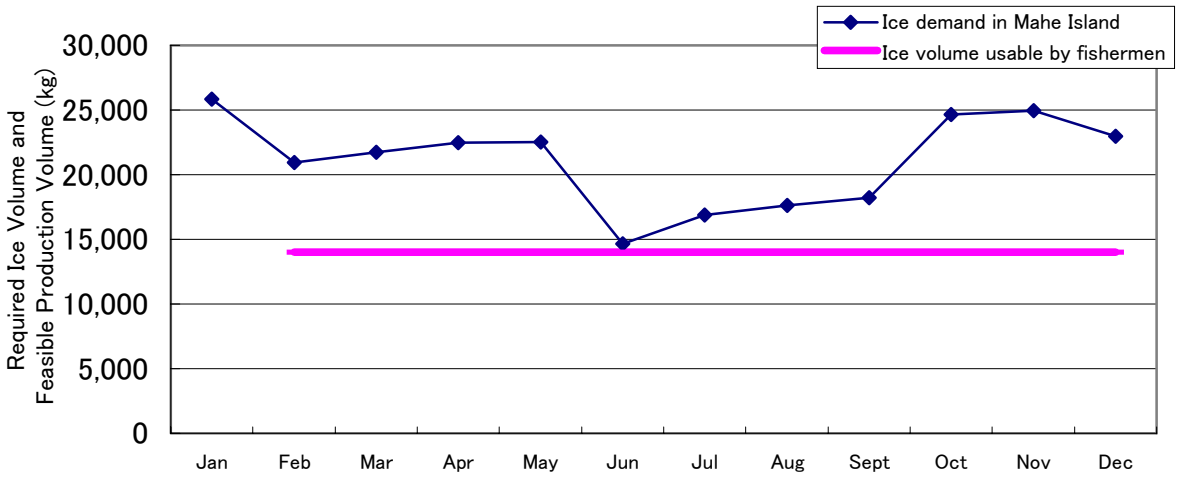
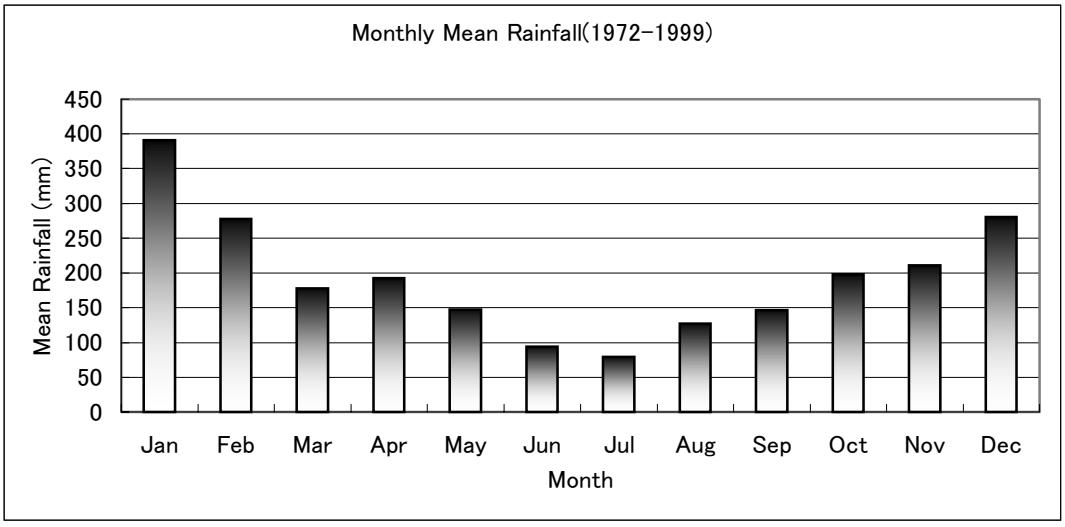



**Fig. 2-3-2 Ice Supply and Demand for Coastal Fisheries**

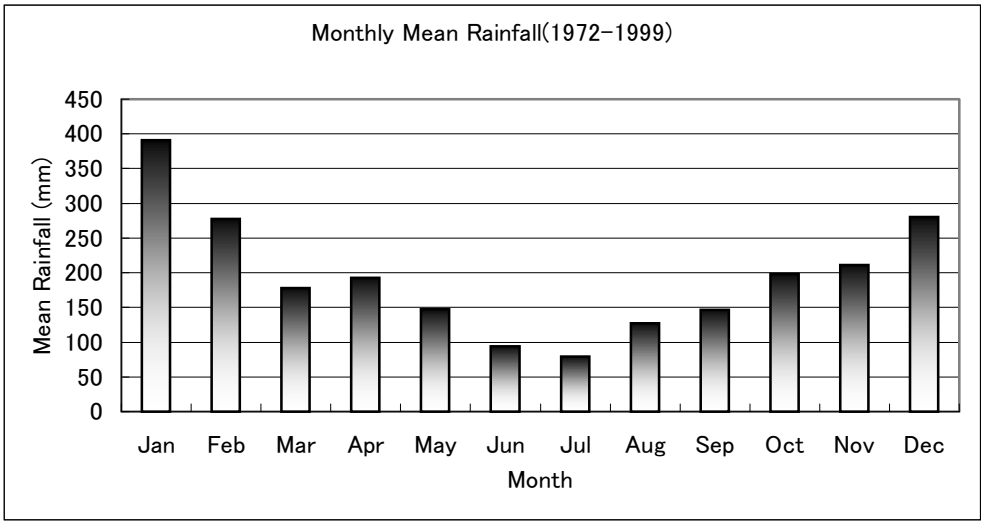
### (3) Climatic Conditions

The general climatic conditions in Seychelles in the period from 1972 to 1999 are shown in the following figures.



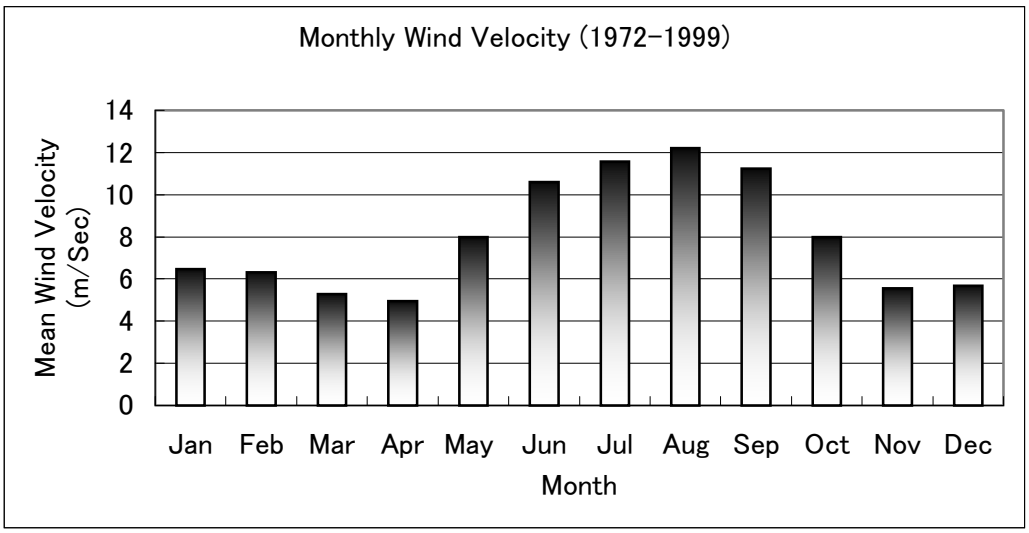

Source: Seychelles Airport

**Fig. 2-3-3 Mean Monthly Temperature (1972 - 1999)**




Source: Seychelles Airport

**Fig. 2-3-4 Mean Monthly Rainfall (1972 - 1999)**




Source: Seychelles Airport

Note: As Seychelles Airport is located in the central part of the eastern coast of Mahe Island, the impact of the southeasterly seasonal wind in the dry season can be clearly observed.

**Fig. 2-3-5 Mean Monthly Wind Velocity (1972 - 1999)**

**(4) Sea Conditions**

The Mahe Plateau and the Amirante Plateau sea areas of Seychelles locate between 3°30'S and 7°30'S and between 52°E and 58°E. (The sea area containing these two plateaus has a total area of some 0.3 million $km^2$. The EEZ of Seychelles is as large as some 1.3 million $km^2$ as the sea area around Aldabra Island, located southwest by west some 600 miles from Mahe Island is also included.) The areas above the Mahe Plateau and the Amirante Plateau and their peripheral areas provide fishing grounds for coastal offshore fisheries. The wave height distribution which is closely related to the sea weather and wind velocity in this sea area is shown in **Table 2-3-5**. According to this table, a wave height of 0 - 0.5m accounts for 21% and a wave height of 1.0 -1.5m accounts for 57%. A wave height of up to 1.5m which accounts for a total of 78% (285 days a year) suggests relatively calm sea weather conditions. Strong wind of a Beaufort wind scale of 5, causing a wave height of 2m or higher, is recorded on 80 days (some 22%). In regard to the ocean currents around Mahe Island, the current between Mahe Island and Praslin Island blows somewhere between northwest by west and southwest by west at a speed of 24 - 30 miles a day (1 - 1.5 knots) from early June to late September. The current direction changes from October to early December and settles down with an eastern flow from mid-December to mid-April. This direction begins to reverse around late April or May.

**Table 2-3-5 Wave Height Distribution in Seychelles Waters**

**(Unit: %)**

| Wave Height / Month | 0 - 0.5m | 1.0 - 1.5m | 2.0 - 2.5m | 3.0 - 3.5m | 4m or higher | Monthly Sub-Total |
|---|---|---|---|---|---|---|
| January | 27 | 60 | 11 | 1 | 1 | 100% |
| February | 28 | 65 | 7 | - | - | 100% |
| March | 53 | 43 | 4 | - | - | 100% |
| April | 37 | 56 | 5 | 2 | - | 100% |
| May | 23 | 49 | 25 | 3 | - | 100% |
| June | 11 | 55 | 23 | 9 | 2 | 100% |
| July | 9 | 48 | 38 | 5 | - | 100% |
| August | 4 | 57 | 37 | 2 | - | 100% |
| September | 3 | 71 | 25 | - | 1 | 100% |
| October | 28 | 56 | 10 | 5 | 1 | 100% |
| November | 25 | 65 | 10 | - | - | 100% |
| December | 23 | 64 | 13 | - | - | 100% |
| Annual Average | 21%<br>77 da | 57%<br>208 days | 19%<br>69 days | 2%<br>7 days | 1%<br>4 days | 100%<br>365 days |

Source: Sailing Direction

### 2.3.3 Examination of Project Components

#### 2.3.3.1 Scale of Ice-Making Plant

The tropical ocean climate in Seychelles means a high temperature of 24.5 - 29.8°C and high humidity of 80% throughout the year. This means that the construction of a building to envelop and protect the ice-making plant will be essential. The planned site of the new ice-making plant is Anse Royale, the second largest city in the country, which is located in the eastern part of Mahe Island. Coastal land of some 2,700m$^2$ in the central section of an urban area has been set aside as the site for the development of infrastructural facilities for fisheries. As this site is planned to accommodate various facilities, the layout plan for the ice-making plant must conform to the master layout plan of the Government of Seychelles for this site.

**(1) Number of Fishing Boats in Target Areas**

The number of fishing boats in 3 districts, i.e. Anse Aux Pins, Anse Royale and Takamaka, in the eastern part of Mahe Island where the planned ice-making plant under the Project will be installed in the period from 1995 to 1998, is shown in **Table 2-3-6** based on **Table 2-3-3** - Number of Small Fishing Boats.

As this table shows, the total number of fishing boats in these areas changed every year, ranging from 56 in 1995 to 48 in 1998. In 1998, both the fisheries production and number of fishing boats in operation considerably declined due to the adverse effects of the extraordinary weather. It is, therefore, necessary to ignore this year when determining the number of target fishing boats for ice supply. Accordingly, the average number of fishing boats in the 3-year period from 1995 to 1997 form the basis for determination of the scale of the planned ice-making plant.

**Table 2-3-6 Number of Fishing Boats in Eastern Part of Mahe Island**

(Unit: boats)

| Type of Fishing Boat | 1995 | 1996 | 1997 | 1998 | Average for 1995 - 1997 | Average for 1995 - 1998 |
|---|---|---|---|---|---|---|
| Pirogue | 5 | 6 | 6 | 8 | 5.6 | 6.3 |
| Outboard Engine Type | 33 | 35 | 35 | 30 | 34.3 | 33.2 |
| Inboard Engine Type | 18 | 12 | 14 | 10 | 14.7 | 13.5 |
| Total | 56 | 53 | 55 | 48 | 54.6 | 53.0 |

Source: SFA statistics

**Table 2-3-7 Number of Fishermen in Eastern Part of Mahe Island**

(Unit: persons)

| Type of Fishing Boat | 1995 | 1996 | 1997 | 1998 | Average for 1995 - 1997 | Average for 1995 - 1998 |
|---|---|---|---|---|---|---|
| Pirogue | 10 | 12 | 12 | 16 | 11.2 | 12.5 |
| Outboard Engine Type | 66 | 70 | 70 | 60 | 68.6 | 66.5 |
| Inboard Engine Type | 63 | 42 | 49 | 35 | 51.4 | 47.2 |
| Total | 139 | 124 | 131 | 111 | 131.2 | 126.2 |

Note: The number of fishermen is calculated on the basis of an average of two fishermen onboard either a pirogue or outboard engine type fishing boat and an average of 3.5 fishermen onboard an inboard engine type fishing boat.

As described earlier, pirogues do not use ice and, therefore, the types of fishing boats to be served by the planned ice-making plant are those with either an outboard engine or those with an inboard engine. The number of fishing boats with an outboard engine is not expected to substantially increase from the level of 30 boats in 1998 as there is a tendency for the use of these fishing boats to decline in accordance with the increasing popular use of fishing boats with an inboard engine.

| Type of Boat | No. of Boats | No. of Fishermen | Remarks |
|---|---|---|---|
| Pilogue Type | 5.6 → 6 | (11.2 → 12.0) | No use of ice |
| OB Engine Type | 34.3 → 30* | (68.6 → 60.0) | Fish to ice ratio = 1 to 1 |
| IB Engine Type | 14.7 → 15 | (51.4 → 52.5) | Fish to ice ratio = 1 to 2 |
| Total | 54.6 → 51 | (131.2 → 124.5) | |

Note: * The latest data is adopted because OB type boats will not be increased.

The target number of fishing boats to be served by the new ice-making plant is, therefore, some 30 outboard engine type fishing boats and some 15 inboard engine type fishing boats.

### (2) Catches per Unit Effort

**Table 2-3-8** shows the catches per unit effort (CPUE) by the target type of fishing boat and by the main fishing method. Coastal fishermen in Seychelles generally purchase an amount of ice corresponding to the expected maximum catch in the coming season based on past experience. Accordingly, the average CPUE (approximately 60kg/person-day) for the two highest months on the catch table is used as the catch by fishermen per day to calculate the required ice demand.

**Table 2-3-8 CPUE by Main Fishing Method (Catch/Person-Day)**

| Item | | Average (qu: kg/person-day) | | | |
|---|---|---|---|---|---|
| | | Top 2 Months | Top 4 Months | Top 8 Months | Whole Year |
| Onboard Engine Type Fishing Boat (OB type) | Handline | 43.4 | 41.3 | 37.4 | 34.3 |
| | Handline + Trap | 49.1 | 44.2 | 40.0 | 36.6 |
| | Encircling Gillnet | 82.5 | 80.2 | 75.3 | 73.7 |
| | Set Gillnet | 77.8 | 55.1 | 53.8 | 53.2 |
| Inboard Engine Type Fishing Boat (IB type) | Handline | 65.5 | 63.8 | 58.7 | 53.6 |
| Reference: CPUE by Boat Type and General Average (qm: kg/person-day) | | | | | |
| Average | Outboard Engine Type | 53.0 | 49.9 | 45.5 | 42.1 |
| | Inboard Engine Type | 65.5 | 63.8 | 58.7 | 52.2 |
| | Average for Entire Fleet | 60.1 | 57.7 | 52.9 | 47.8 |

Note:

$qm = \Sigma(qi \times Ni \times fi) / \Sigma(Ni \times ni)$

Where,

qm : CPUE by boat type and for whole fleet (kg/person-day)

qi : CPUE by main fishing method (kg/person-day)

Ni : number of fishing boats engaged in a specific fishing method (average for the period from 1995 to 1998)

Ni : number of fishermen by boat type (outboard engine type = 2; inboard engine type = 3.5)

| No. of Fishing Boats by Fishing Method | Average No. of Fishing Boats (Ni) | | Remarks |
|---|---|---|---|
| | Outboard Engine Type | Inboard Engine Type | |
| Handline | 67 | 89 | Fractional sums below the decimal point are ignored. |
| Handline + Trap | 54 | 1 | |
| Encircling Gillnet | 14 | - | |
| Set Gillnet | 25 | - | |
| Handline | 17 | - | |
| Set Gillnet | 9 | - | |

### (3) Capacity of Ice-Making Plant

The required volume of ice for coastal fisheries (Q) can be calculated as follows based on the conditions described in (1) and (2) above.

< Calculation Formula >

$Q = E(Ni \times ni \times Ci \times Di \times fi)$

Where,

Ni : number of fishing boats (30 outboard engine type and 15 inboard engine type)

ni : number of fishermen by boat type (two for outboard engine type and 3.5 for inboard engine type)

Ci : catch per fisherman (60 kg/day)

Di : operation duration - five days/week (outboard engine type); three days/week (inboard engine type)

fi : fish to ice ratio (in weight)

1:1 for outboard engine type (fi = 1.0)

1:2 for inboard engine type (fi = 2.0)

**Table 2-3-9 Required Volume of Ice**

| Type of Fishing Boat (i) | No. of Boats (Ni) | Average No. of Crew Members (Fishermen) (ni) | Required Volume of Ice (kg/week) [Q = E(Ni×ni×Ci×Di×fi)] | Remarks |
|---|---|---|---|---|
| Onboard Engine Type (OB type) | 30 | 2.0 | 18,000 [= (30×2×60×5)×1] | Fish to ice ratio = 1 to 1 (fi = 1.0) |
| Inboard Engine Type (IB type) | 15 | 3.5 | 18,900 [=(15×3.5×60×3)×2] | Fish to ice ratio = 1 to 2 (fi =2.0) |
| Total | | | 36,900 | |

The weekly ice requirement is estimated to be 36,900kg, making it necessary for the planned ice-making plant to have a production capacity of approximately five tons/day.

36,900 kg/week ÷ seven days/week = 5,271kg/day

(36,900 kg/week ÷ seven days/week/(0.90 - 0.95) = 5,857 - 5,548kg/day

Note: The actual ice utilization rate in a tropical area vis-a-vis the ice-making capacity is 0.9 - 0.95. Based on this figure, the required ice-making capacity of the planned plant is increased from 5,271kg/day to 5,857 - 5,548kg/day. Efforts should be made to reduce this requirement by means of the careful opening and closing of the ice storage door, shortening of the land transportation time of ice and the use of ice boxes, etc. As the ice-making capacity is set at five tons/day compared to the estimated ice demand of 5,271kg/day, the CPUE can be reduced from some 60kg/person-day to some 57kg/person-day provided that the fish to ice ratios used are maintained. The maximum ice demand is 6,126kg/day (March, 1995) based on analysis of data (1995 - 1998) on the catch in the subject areas. Data on the catch in 1998 is used for reference purposes only as the catch was severely affected by the extraordinary weather in that year, so-called ENSO.

### (4) Capacity of Ice Storage Bin

Coastal fisheries are affected by local customs, holidays and the weather and the weekly schedule changes from one week to another. The general practice is to set sail at the beginning of the week if the weather and sea conditions permit. Accordingly, the demand for ice is concentrated at the beginning of the week and the day following bad weather. This makes the storage of an amount of ice equivalent to 3 - 4 days' supply necessary to allow for the absence of fishing at weekends and during bad weather. Here, a storage capacity of 15 tons is planned, i.e. the equivalent of three days' production of ice, consisting of the volume of ice produced over the weekend (Saturday and Sunday) and one day's production volume as

stock, to allow for demand fluctuations. The typical weekly operation schedule of the ice storage is shown in **Table 2-3-10**.

**Table 2-3-10 Ice Storage Operation**

(Unit: tons)

| Item | Mon. | Tues. | Wed. | Thur. | Fri. | Sat. | Sun. | Weekly Total |
|---|---|---|---|---|---|---|---|---|
| A. Volume of Stored Ice (Start of Day) | 15.0 (1.00) | 10.6 (0.71) | 12.2 (0.81) | 7.8 (0.52) | 9.4 (0.63) | 5.0 (0.33) | 10.0 (0.67) | 70.0 (4.66) |
| B. Shipment Volume | -9.4 | -3.4 | -9.4 | -3.4 | -9.4 | -0.0 | -0.0 | -35.0 |
| For Outboard Engine Type | -3.4 | -3.4 | -3.4 | -3.4 | -3.4 | -0.0 | -0.0 | -17.0 |
| For Inboard Engine Type | -6.0 | -0.0 | -6.0 | -0.0 | -6.0 | -0.0 | -0.0 | -18.0 |
| C. Remaining Volume of Ice | 5.6 (0.37) | 7.2 (0.48) | 2.8 (0.19) | 4.4 (0.29) | 0.0 (0.00) | 5.0 (0.33) | 10.0 (0.67) | 35.0 (2.33) |
| D. Production Volume of Ice | +5.0 | +5.0 | +5.0 | +5.0 | +5.0 | +5.0 | +5.0 | +35.0 |
| E. Volume of Stored Ice (End of Day) | 10.6 (0.71) | 12.2 (0.81) | 7.8 (0.52) | 9.4 (0.63) | 5.0 (0.33) | 10.0 (0.67 | 15.0 (1.00) | 70.0 (4.66) |

Note: The figures in brackets indicate the ratio of ice to the storage capacity of the ice storage.
The above shows a typical case of three operations a week and two days fishing/operation. Other cases are also examined ; two operations a week and three days fishing/operation; two operations a week and two to three fishing/operation.

### (5) Other Function and the Facilities

The required types of work and facilities to ensure the effective use of the ice-making plant include ice sales, packing of ice into bags and toilet facilities. As the Project is mainly concerned with the procurement of equipment (the installation of an ice-making plant is included as it is regarded as special type of equipment), the construction of an approach road to the plant from the main road and a car park by the Seychelles side will be necessary. Other planned items relating to the ice-making plant are described in **2.3.4.1 - Basic Plan for Ice-Making Plant**.

### 2.3.3.2 Scale of Equipment

#### (1) Small Fishing Boats

The design specifications required for the building of the planned small fishing boats under the Project are determined to ensure the required operational as well as navigational performance (sea worthiness and safety of vessels), taking the natural conditions of the subject sea areas for fishing and navigation into consideration.

**[Natural Conditions of Sea Areas for Fishing and Navigation]**

The subject fishing grounds of coastal fisheries are the Mahe Plateau and the Amirante Plateau. According to the wave height distribution data, which is closely related to the sea weather and wind strength, for these areas, a wave height of less than 1.0m accounts for 21% while a wave height of 1.0 - 1.5m accounts for 57%, totalling 78% or 285 days a year. This suggests relatively calm conditions although a strong wind of a Beaufort's wind force scale of 5 or more occurs on 80 days a year (22%).

**Table 2-3-11 Wave Height Distribution in Seychelles Waters**

(Unit: %)

| Wave Height / Month | 0 - 0.5m | 1.0 - 1.5m | 2.0 - 2.5m | 3.0 - 3.5m | 4m or higher | Monthly Sub-Total |
|---|---|---|---|---|---|---|
| January | 27 | 60 | 11 | 1 | 1 | 100% |
| February | 28 | 65 | 7 | - | - | 100% |
| March | 53 | 43 | 4 | - | - | 100% |
| April | 37 | 56 | 5 | 2 | - | 100% |
| May | 23 | 49 | 25 | 3 | - | 100% |
| June | 11 | 55 | 23 | 9 | 2 | 100% |
| July | 9 | 48 | 38 | 5 | - | 100% |
| August | 4 | 57 | 37 | 2 | - | 100% |
| September | 3 | 71 | 25 | - | 1 | 100% |
| October | 28 | 56 | 10 | 5 | 1 | 100% |
| November | 25 | 65 | 10 | - | - | 100% |
| December | 23 | 64 | 13 | - | - | 100% |
| Annual Average | 21%<br>77 days | 57%<br>208 days | 19%<br>69 days | 2%<br>7 days | 1%<br>4 days | 100%<br>365 days |

Source: Sailing Direction

The worse impacts of waves on the vertical strength of a vessel occur when the wave length coincides with or is very similar to the length of a vessel. In the case of a wave length which is longer than the length of a vessel, the adverse impacts on the longitudinal strength of the vessel decrease but adversely affect the vessel's stability and other aspects.

The general length of oceanic waves corresponding to a wave height of 1.5m is approximately 30m. Small fishing boats of approximately 10m in length, such as those planned under the Project, do not face problems in the case of a wave height of 1.5m. However, the stability of such fishing boats is affected and fishing work on board can be hazardous.

For safe fishing activities at sea with a wave height of 2 - 2.5m or higher, larger fishing boats are necessary. Given the locations of the subject fishing grounds (within a range of some 160 - 200 miles from Mahe Island for longliners, some 100 - 130 miles for small fishing boats) and the scale of fishing gear and fishing methods (in terms of the types and layout of fishing machinery and fishermen involved), a fishing boat of more than 15m in length is unnecessary. Accordingly, fishing activities under the sea condition of a Beaufort's wind force scale of 4 (wave height of 1.0 - 1.5m and wind velocity of 5.5 - 8.0m/sec) is upheld as the design condition for the preparation of the basic plan for the Project.

1) 13.5m Longliners

The policy to change the fishing grounds from coastal fishing grounds to offshore fishing grounds and the strong determination of the Government of Seychelles to develop and introduce a domestic longliner fleet to achieve the development targets for the fisheries sector [(i) sustainable utilisation of fisheries resources, (ii) promotion of the stable growth of the domestic fishing fleet and (iii) safety of fishermen at sea] form the background of the Project.

At the planning stage of the previous project, the highest priority was the development of fishing boats corresponding to local Whaler type and Schooner type fishing boats. Five years later, it is now necessary to newly develop longliners. Experimental longlining activities involving the SFA research/training boat commenced in 1994 and have been fully integrated in the annual plan since May, 1995. In 1998, eight experimental voyages were made with a total of 52 casting and hauling operations taking place (6 - 7 longline fishing operations per voyage). However, there are still many problems. According to the available records, predation by large marine mammals is as high as 15%, making the introduction of measures to protect fishing gear from large marine mammals necessary. (In East Caribbean countries where small longliners are popularly used, it is reported that the use of a hookline wire is unnecessary because of the rarity of sharks being caught by

longlining. The high level of predation by large marine mammals is one of the main characteristics of longlining in Seychelles waters.)

At present, six fishing boats (five 17m type and one 38m type) are engaged in tuna longlining in Seychelles. These boats are classified in the category of semi-industrial type fisheries, a separate category from coastal fisheries, and three private companies are involved. In 1998, these longliners made a total of 112 voyages and caught approximately 302 tons of tuna. Predation by large marine mammals was reported to have been even higher at 30% or 90 tons a year.

The SFA has formulated a plan to encourage the participation of coastal fishermen and fishermen's groups in longlining and hopes to introduce new longliners of which the economic performance is superior to those currently used by the above-mentioned private companies. According to this plan, the number of longliners used for coastal fisheries will be increased to 15 - 20 in the future with the strong encouragement of the SFA as in the case of the policy of changing outboard engines to inboard engines.

Against this background, the development and introduction of two new longliners is planned to conduct experimental fishing activities to obtain data on the vessel performance, fishing performance and crew comfort, etc. The SFA also plans to provide continuous technical guidance even after the sale of these vessels to private fishermen. At least two boats of the same model are required to ensure the collection and analysis of reliable data and proper evaluation of the new longline fishing boats.

As it is necessary for the planned new longliners to be smaller and more economical than the existing longliners owned by private companies, their main specifications are determined based on the 10 - 13.5m type which has a proven track record, taking the sea conditions and other relevant conditions into consideration. While there are two types of fishing gear, i.e. US type and Japanese type, US type fishing gear is adopted because of its use by the existing longliners in Seychelles. A line throwing machine will be installed to facilitate adjustment of the main line depth as the findings of past experimental activities favor the use of such a machine.

**Table 2-3-12 Specifications of Small Longliners by Types**

| Type / Main Specifications | (a) 30ft type | (b) 36ft type (Grenada) | (c) Planned Boats Under Project | (d) 42ft type (St. Vincent) |
|---|---|---|---|---|
| Main Dimensions | | | | |
| - Total Length | 9.10m | 10.89m | 13 - 13.5m | 12.69m |
| - (Registered | (8.00m) | (9.34m) | (11 - 12m) | (11.25m) |
| Length) | 2.70m | 2.86m | 3.8 - 4.0m | 3.90m |
| - Total Width | 1.50m | 1.65m | 1.4 - 1.5m | 2.36m |
| - Depth | | | | |
| Engine | | | | |
| - Main Engine | 70 PS/2,300rpm | 70 PS/2,300rpm | 180 - 200 PS/2,300rpm | 330 PS/2,300rpm |
| - Speed (approx.) | 11 kt | 8 kt | 8 - 9 kt | 11 kt |
| Capacity (approx.) | | | | |
| - Fuel Tank | $0.4m^3$ | $1.0m^3$ | $2.0m^3$ | $1.5m^3$ |
| - Water Tank | $0.2m^3$ | $0.25m^3$ | $1.0m^3$ | $0.3m^3$ |
| - Fish Hold | $0.6m^3$ | $4.6m^3$ | $8 - 10m^3$ | $7.0m^3$ |
| Fishing Gear | | | | |
| - Method | hydraulic longlining reel | hydraulic longlining reel | hydraulic longlining reel | hydraulic longlining reel |
| - Length | 5 miles | 10 miles | 20 miles | 20 miles |
| Crew Capacity | 2 | 3 | 5 - 6 | 5 - 6 |
| - Number of Beds | none | 3 | 5 - 6 | 5 - 6 |

Based on the comparison of (a), (b) and (d) above, what is common among longliners for East Caribbean countries (Grenada and St. Vincent) is a small fuel tank capacity in view of the short sailing distance because of the relatively small sea area in which they operate due to the proximity of the sea area belonging to each country. In contrast, Seychelles has a vast EEZ and it is necessary for the longliners planned under the Project to have a fuel tank which corresponds to a sailing distance of some 400 - 450 miles so that a return trip between the Mahe Plateau and the Amirante Plateau can be comfortably made. Because of distance of the fishing grounds some 200 miles from the coast, a wider breadth is designed in view of better stability. In addition, the boat length is longer than that of those operating in the East Caribbean so that the sailing speed is not reduced by the wider breadth. The boat configuration is the fore-bridge type because of the layout above the deck [upper accommodation space, steering wheel house and fishing machinery (US type hydraulic longlining reel) from bow to stern] and below the deck (storage, accommodation space, engine room, fish/ice hold, stearing gearroom and water tank from bow to stern). By integrating the fishing work areas in the section from the central part of the hull to the stern, the line of flow for fishing work is simplified as much as possible to enhance the work efficiency.

2) 10m Type Small Fishing Boats

The 10m type small fishing boats requested under the Project are the same type of fishing boats which were first introduced by the second Project for Coastal Fisheries Development. The shape of these boats permits various types of fishing methods, including handlining, trawling and vertical longlining. Their size, main dimensions and equipment are comparable with those of the local Schooner type fishing boats (so named because they were originally sailing boats).

The field survey for the Project found that the existing boats procured under the previous project meet the intended performance. As no request has been made for major alterations, the same specifications are basically used for these three boats. The number of requested boats appears reasonable as their inclusion in the scope of the Project aims at extending their use by replacing some of the 60 strong Schooner type fishing boats (including small and large schooners). The interview survey conducted in Seychelles confirmed the local demand for such replacement.

**(2) Light Buoys for Reef Passages**

Now, following 6 fishing villages in Mahe island need light buoys for reef passages.

**Table 2-3-13 Site of Light Buoys**

| Site | Outline of region (Location, Population, etc) | Remarks (Administrative area) |
|---|---|---|
| 1. Pointe Au Sel | E. Mahe (Middle South), 3,518 persons | Anse Royale |
| 2. Anse Etoile | N. Mahe (East), 3,685 persons | Anse Etoile |
| 3. Anse Forbans | E. Mahe (South), 2,609 persons | Takamaka |
| 4. Anse à la Mouche | W. Mahe (Middle South), 3,476 persons | Anse Louis |
| 5. Anse Boileau | W. Mahe (Middle North), 3,882 persons | Anse Boileau |
| 6. Port Glaud | W. Mahe (North), 2,033 persons | Port Glaud |

Note: Seychelles is divided into 25 administrative districts. Total population in Seychelles is 75,876 persons in 1997 Census. Total population in this 6 administrative districts is 19,203 persons.

The diameter of light buoy's body is approximately 700-1,000mm equipped with a flashing light with solar battery. The depth around the site of reef passage is approximately 10-30m. Therefore anchoring chain should be about 50m length which is equivalent to the 1.5 times of depth. The anchor weight is of concrete or equivalent material and to be prepared locally by the SFA.

According to "Sailing Direction" (East Africa and North West Indian Ocean), sea area around Seychelles has less than 1.5m of wave height and less than 4 of Beaufort scale in 78% of a year or about 285 days. It is comparatively calm sea condition. But it also has more than 2m of wave height and more than 5 of Beaufort scale in 22% of a year or about 80 days. It is approximately 3% of a year to have more than 6 of Beaufort scale and it concentrate during southeast monsoon in Dry season.

The installation sites of light buoys are around the reef passage between reef and ocean. Therefore it is important to have enough intensity because of effect of wind, current and waves.

**(3) Hydraulic Benders**

Many types of the anchors for fishing boats with an outboard or inboard engine are manufactured at the SFA's workshop. The common materials used have a diameter of 8 - 16mm with a maximum diameter of 25mm. Stainless steel is predominantly used. The existing bender is used for the manufacture of not only anchors but also for towing type dredgers and frames for fishing nets, etc. The hydraulic bender which is now out of order and difficult to repair as mentioned earlier, has long been used by the SFA's workshop and such items as anchors for coastal fishing boats and fishing gear for resources surveys and experimental fishing activities have contributed to the promotion of coastal fisheries. As it is planned to use the requested benders for conventional manufacturing work and the practical training of students of the Maritime School, one for the cutting of steel bars and one for the exclusive bending of steel bars are required.

**(4) Marine Engines, Fishing Gear and Safety Equipment**

1) Marine Diesel Engines

The following numbers of marine diesel engines to be provided under the Project are determined based on the feasible number of sales within four years in accordance with the SFA's new fishing boat building and rehabilitation program.

| | New | Rehabilitated | Total | Remarks |
|---|---|---|---|---|
| Two Cylinder Type (15 HP) | 9 | 9 | 18 | |
| Two Cylinder Type (28 HP) | 13 | (4) * | 13 | * Unsold stock from the previous project |
| Three Cylinder Type (34 - 42 HP) | 17 | 4 | 21 | 10 with a larger HP |
| Four Cylinder Type (75 HP) | 4 | 4 | 8 | |
| Total | 43 | 17 | 60 | |

2) Fishing Gear

The required quantities of fishing gear are calculated based on the following conditions.

a. The contents of the set of fishing gear are determined based on the interview survey results.

b. The sale period is four years after the signing of the E/N (because of the obligation on the part of the Seychelles side to accumulate a counterpart fund). The fishing gear for a small longliner consists of two years' supply to cover the experimental operation period.

c. The number of operating days is based on the interview survey results.

d. The number of subject fishing boats is based on the Artisanal Fisheries Statistics published by the SFA.

e. The number of subject fishermen is calculated based on the same statistics.

The calculation formula is shown below.

$$Q = Gn \times N \times Od \times Co$$

Where,

Q : required quantity of fishing gear

Gn : quantity of fishing gear required for one set

N : number of subject fishing boats or fishermen

Od : number of operating days or years

Co : rate of wear

i) Fishing Gear for Sale

-Fishing Gear for Handlining

Handlining is the most popular fishing method for coastal fisheries in Seychelles. The number of fishermen engaged in handlining full-time was 582 in 1998 (88 were engaged in combined handlining and trapping full-time) and, therefore, the number of subject fishermen is set at 582. Following the change of the guidelines for Japan's grant aid cooperation scheme, a counterpart fund equivalent to 100% of the FOB prices of the equipment, etc. provided must be accumulated within four years of the signing of the E/N. Accordingly, the quantities of fishing gear to be provided under the Project must be quantities which can reasonably be sold during this period. Using the line configuration diagramme for handlining which is prepared based on the interview survey findings, the

quantities of the various items to complete one set are calculated to establish the required supply quantities for 582 fishermen and 960 operating days (in 4 years), taking the rate of wear (3 - 20% depending on the item) into consideration.

**Table 2-3-14 Handlining Fishing Gear Set**

| Item | Required Quantity per Set |
|---|---|
| Nylon braided rope | 200m |
| Trunk line No. 150, 100 | 10m |
| Lead line No. 70, 60 | 4m |
| Sinker line No. 30 | 2m |
| Sinker | 1 piece |
| Snell No. 50, 40 | 1m |
| Crane swivel (three types), barrel swivel | 1 piece |
| Three way swivel | 3 pieces |
| Curvey hook | 3 pieces |

-Fishing Gear for Gillnetting

According to SFA statistics, the number of fishing boats engaged in gillnetting and/or encircling gillnetting on a full-time basis was 27 in 1998. As in the case of the above fishing gear for handlining, the amount of sales four years after the signing of the E/N must be accumulated in the counterpart fund and, therefore, the quantities to be supplied under the Project must be those which can reasonably be sold during this period. Using the configuration diagramme for gillnetting prepared based on the interview survey findings, the quantities of the various items to complete one set are calculated to establish the required supply quantities for four years, taking the rate of wear (50%) into consideration.

**Table 2-3-15 Gillnet Fishing Gear Set**

| Item | Required Quantity per Set |
|---|---|
| Nylon multi-filament line, 210 d/12, mesh size: 2.5”, 200D×100m, green or white | 1 piece |
| Float: pvc | 150 pieces |
| Sinker: lead | 50 pieces |
| Rope: P.P. 5mm | 100m |

ii) Fishing Gear for SFA (for Fisheries Resources Surveys and Experimental Fishing Activities)

-Fishing Gear for Longlining

The required quantities of fishing gear for the two requested longliners will be supplied. Based on the request made by the SFA, one longlining set consists of 20 miles of main line, 600 of 14.5m branch lines and 100 of 45m float lines. As these new longliners

will be used for experimental fishing activities for a period of 1 - 2 years, the quantities of the items to be supplied will be equivalent to 2 years' supply in correspondence with the period during which they will be controlled by the SFA. As the rate of wear of fishing gear for longlining depends on the type of item (ranging from 30% to 100%), the spare part quantities are calculated for each item. The rate of wear used is that applied for Japanese longliners.

**Table 2-3-16 Longline Fishing Set**

| Item | Required Quantity per Set |
|---|---|
| < Main Line > | |
| - Nylon mono-filament line Ø3.2mm | 37,300m |
| - Silver lock A | 144 pieces |
| < Branch Line > | |
| - Nylon mono-filament line Ø2.1mm, 14.5m | 8,700m |
| - Snap Ø3.8 × 130mm | 600 pieces |
| - Vinyl tube | 1,200 pieces |
| - Lead swivel 60g or 80g | 600 pieces |
| - Silver lock D | 1,200 pieces |
| - Copper lock 2 | 600 pieces |
| < Hook Line > | |
| - Nylon mono-filament Ø1.8mm, 3.5m | 2,100m |
| - Vinyl tube | 1,200 pieces |
| - Copper lock 3 | 600 pieces |
| - Silver lock E | 1,200 pieces |
| - Aluminium course | 600 pieces |
| - Tuna hook (southern tuna) | 600 pieces |
| - Chemical light | 600 pieces |
| < Buoy Line > | |
| - Nylon mono-filament Ø2.1mm, 45m | 4,500m |
| - Snap Ø3.8mm×130mm | 100 pieces |
| - Snap Ø3.5mm×125mm GL | 100 pieces |
| - Vinyl tube | 200 pieces |
| - Silver lock D | 200 pieces |
| < Others > | |
| - Buoy | 100 pieces |
| - Flag Pole | 25 pieces |
| - Radio buoy (2,500 - 3,000 MHz) | 5 pieces |
| - Radar reflector with light | 2 pieces |

-Fishing Gear for Stick-Held Dip Netting

A stick-held dip net is used for tests to catch fish which can be used as bait for longlining.

-Fishing Gear for Vertical Droplining

Vertical droplining is one of the fishing methods promoted by the SFA. As such, fishing gear for experimental activities is required. The subject fishing gear for supply is, therefore, that to be used by the LAMITIE, a research/training boat of the SFA. The quantities of the items required to complete one set are calculated using the line configuration diagramme prepared based on the interview survey findings. These quantities will cater for four years' operation (800 days) and the four lines required per operation and also take the rate of wear (1 - 20% depending on the item) into consideration.

**Table 2-3-17 Vertical Longline Fishing Set**

| Item | Required Quantity per Set |
|---|---|
| - Pressure buoy (600m deep) 15cm | 1 pieces |
| - Pressure buoy (300m deep) 30cm | 3 pieces |
| - P.P. rope Ø12mm | 300 m |
| - Wire | 50 m |
| - Crane swivel (large) | 2 pieces |
| - Crane swivel (small) | 30 pieces |
| - Snell No. 40 | 6 m |
| - Aluminium sleeve | 30 pieces |
| - Silver lock | 30 pieces |
| - Tuna circle hook | 30 pieces |
| - Sinker | 1 piece |

-Fishing Gear for Handlining

Handlining is conducted in those sea areas of 50 - 100m in depth where the use of vertical longlining is unnecessary. As one set of lines is required per fisherman, the subject persons are the 15 fishermen onboard the fishing boats controlled by the SFA. The required items and quantities for one set are determined using the line configuration diagramme prepared based on the interview survey findings. The total quantities are then determined to cater for four years' operation (800 days) by 15 fishermen, taking the rate of wear (3 - 20% depending on the item) into consideration.

-Fishing Gear for Squid Fishing

Squid fishing is conducted as part of the SFA's experimental fishing activities with a view to establishing a self-supply of bait for longlining. The relevant fishing gear is supplied to the 15 fishermen onboard the fishing boats controlled by the SFA. The required items and quantities for one set are determined using the fishing device

configuration diagramme prepared based on the interview survey findings. The total quantities are then determined to cater for four years' operation (800 days) by 15 fishermen, taking the rate of wear (5 - 20% depending on the item) into consideration.

-Fishing Gear for Trolling

Trolling is necessary to catch fish used as bait for vertical droplining. As one fishing boat requires 2 sets of fishing devices, 6 sets are supplied for 3 boats (the LAMITIE of SAF and the two newly requested longliners). The required items and quantities for one set are determined using the fishing device configuration diagramme prepared based on the interview survey findings. The total quantities are then determined to cater for 4 years' operation (800 days) with six sets, taking the rate of wear (2 - 20% depending on the item) into consideration.

**Table 2-3-18 Trolling Fishing Set**

| Item | Required Quantity per Set |
|---|---|
| Nylon braided rope | 50m |
| Lead line No. 70 | 10m |
| Lure sinker | 1 piece |
| Snell No. 50 | 3m |
| Lure hook | 1 piece |
| Octopus lure | 1 piece |
| Plane or diving board | 1 piece |
| Shock absorber | 1 piece |

3) Safety Equipment

The Safety Equipment Standards in Seychelles enforced in 1996 lists the statutory life-saving appliances shown in **Table 2-3-19**.

**Table 2-3-19 Safety Equipment Standards in Seychelles**

| | Statutory Life-Saving Appliances | Statutory Required Quantity per Boat | | |
|---|---|---|---|---|
| | | Less than 6m Long | 6 - 12m Long | 12m or Longer |
| 1 | Life jacket (number of crew members + 10% equivalent) | 2 - 3 | 4 - 5 | 6 - 7 |
| 2 | Life buoy with automatic light and 20m long rope | 1 | 1 | 1 |
| 3 | Hand flare | - | 2 | 4 |
| 4 | Parachute signal | 2 | 2 | 4 |
| 5 | Buoyant smoke signal | 0 | 0 | 2 |
| 6 | Self-igniting smoke signal | 2 | 2 | 0 |
| 7 | Waterproof electric torch (with spare batteries and bulb) | 1 | 1 | 1 |
| 8 | Signalling mirror | 1 | 1 | 1 |
| 9 | Orange flag (1m×2m) | 1 | 1 | 1 |
| 10 | Radar reflector | 1 | 1 | 1 |
| 11 | SSB radio or EPIRB (Emergency Position Indicating Radio Beacon) | - | - | 1 |
| 12 | VHF radio or EPIRB (Emergency Position Indicating Radio Beacon) | - | 1 | - |
| 13 | Fishfinder or manual lead line | 1 | 1 | 1 |
| 14 | Compass | - | 1 | 1 |
| 15 | Spare compass | - | 1 | 1 |
| 16 | Sea chart | - | - | 1 |
| 17 | Log book | - | - | 1 |
| 18 | Fire extinguisher (1.5 kg or larger) | - | 1 | 2 |
| 19 | Manual bilge pump | 1 | 1 | 1 |
| 20 | Paddles or oars | 2 | 2 | 2 |
| 21 | Anchor, chain and sufficiently strong 200m or longer rope | 1 | 1 | 1 |
| 22 | Spare anchor, chain and rope | 1 | 1 | 1 |
| 23 | Sufficient quantity of emergency food and one liter of clean water per person to cover the number of crew members and days of operation | 1 | 1 | 1 |
| 24 | First aid set | - | 1 | 1 |
| 25 | Inflatable life raft for maximum number of crew members | - | - | 1 |

The number of target fishing boats for the supply of safety equipment under the Project is shown below (based on 1998 data).

| Boat Size | No. of Boats |
|---|---|
| Less than 6 m long (outboard engine type) | 261 |
| 6 - 12m long (inboard engine type) | 90 |
| 12m or longer (large inboard engine type) | 15 |
| Total | 366 |

As the requested safety equipment is expected to act as the prime mover of the law enforced in 1996 but which has not yet been implemented due to the supply shortage caused by the stringent foreign exchange situation, the supply quantity is determined at a level of approximately 50% of the total quantity required for the above number of fishing boats.

4) Radio Equipment

i) SSB Radio Equipment

The introduction of large fishing boats has made it possible to operate at distant fishing grounds and the demand for SSB radio equipment has been increasing as the VHF radio equipment cannot cover long distances. According to the Safety Equipment Standards enforced in 1996, fishing boats of 12m or longer are required by statute to have SSB radio equipment and the number of subject fishing boat currently totals 15. As most of these fishing boats do not have SSB radio equipment, the supply quantity is set at 10 to cover more than half of the subject boats. The output is 150W which is common for Japanese coastal fishing boats.

ii) VHF Radio Equipment

The same Safety Equipment Standards demand that fishing boats of 6 - 12m in length have a VHF radio equipment set. The number of subject fishing boats is, therefore, 90. As the 30 EPIRBs which the SFA plans to lease can substitute the VHF radio equipment, the supply quantity is set at 20 to cover some 30% of the remaining 60 boats. The output is 25W which can be used for communication over a distance of some 30 - 40 miles which is also the distance travelled by these fishing boats to their fishing grounds.

iii) Portable VHF Radio Equipment

This equipment is used for communication between the LAMITIE and a small survey boat, both of which are owned by the SFA. Because of the short distance involved, the output is 5W.

5) Fishfinders

i) Monochrome Display Fishfinder

ii) Color Display Fishfinder (2 Types)

The Safety Equipment Standards make it a compulsory requirement for all fishing boats to have either a fishfinder or a manual lead line. In view of the fact that a manual lead line acts as an alternative and also in view of the necessary installation work for a fishfinder, small boats are removed from the scope of the subject boats and 25 fishfinders are supplied to cover approximately 25% of the 105 inboard motor type fishing boats.

Among the colour fishfinders requested, one fishfinder under its own category is for the Ramite, a survey vessel owned by the SFA, and is not for sale.

6) GPS

There is an increasing demand for GPS as distress incidents have occurred due to the crew's loss of its own location, in turn caused by fishing at distance fishing grounds. The subject boats are 105 inboard engine type fishing boats which operate at distant fishing grounds and the supply quantity is 10 to cover some 10% of the subject boats.

7) Navigational Tools

The request for 20 dividers, 20 navigation rules and 12 calipers is based on the number of persons trained by the SFA. At present, the number of students at the Maritime School is 30 in each grade and 60 in total (2 year course). These tools will also be used for the training of fishermen when ever such training is deemed necessary.

### 2.3.3.3 Result of Basic Design Study

The result of Basic design study in this project is as follows.

**Table 2-3-20 Component list for this project**

| Items | Specifications | Amount | Sale | SFA use | Remark |
|---|---|---|---|---|---|
| 1. Ice Making Plant | Capacity 5 tons/day,<br>Ice storage bin, Emergency power generating unit,<br>Protective shed | 1 unit | — | 1 unit | |
| 2. Marine diesel engine | Total 4 type（2～4 cylinder）<br>Maintenance tool | 60 units<br>2 units | 60 units<br>— | —<br>2 units | Original request was 70 units. |
| 3. Safety equipment and Radio, etc<br><br>(1) Safety and navigation Equipments | <br><br>Life buoys , Life jackets,<br>Hand flare, Lifeline throwing appliance, EPIRB, Navigation equipment | <br><br>1 unit<br>2 sets<br>30 sets<br>1 unit | <br><br>1 unit<br>—<br>—<br>1 unit | <br><br>—<br>2 sets<br>30 sets<br>— | |
| (2) SSB and VHF Radio | SSB Radio 150W<br>VHF Radio 15W<br>Portable VHF radio 5W | 10 sets<br>20 sets<br>2 sets | 10 sets<br>20 sets<br>— | —<br>—<br>2 sets | |
| (3) GPS | Liquid crystal display, 12/24VDC | 12 sets | 12 sets | — | |

| | | | | | |
|---|---|---|---|---|---|
| (4) Fish finder | Liquid crystal display, range approx. 320m<br>CRT or Liquid crystal display, range approx. 600m<br>CRT or Liquid crystal display, range approx. 2,000m | 20 sets<br>5 sets<br>1 sets | 20 sets<br>5 sets<br>— | —<br>—<br>1 sets | |
| (5)Waterproof flashlights | 6 x size A (R20) | 220 sets | 215 sets | 5 sets | |
| 4. Small fishing boats<br>(1) 13.5m Tuna long line fishing boats | FRP, Total length 13～13.5m, Main engine 180～200PS, 5～6 persons, Long line hydraulic reel, Nylon monofilament 20 mile | 2 boats | 2 boats | — | |
| (2) 10m small fishing boats | FRP, Total length 10.5m, Main engine 75PS, 4 persons, Hydraulic reel | 3 boats | 3 borts | — | |
| 5. Tuna long line gear (including spare) | For long line hydraulic reel, For Tuna long line boats mentioned above | 2 sets | — | 2 sets | |
| 6. Light buoy | Diameter approx. 700～1,000 mm<br>Light 3W・LED, with solar battery, Anchor chain approx. 50m | 6 sets | — | 6 sets | SFA will conduct installing work including anchor. |
| 7. Tuna long line Maintenance tool | For SFA tuna long line gear maintenance | 1 units | — | 1 units | |
| 8. Trolling gear | Trolling gear | 1 units | 1 units | (Partially) | |
| 9. Drop line gear | Drop line gear | 1 units | 1 units | (Partially) | |
| 10. The other fishing equipment | Gill net, etc | 1 units | 1 units | (Partially) | |
| 11. Ice box | FRP 160 litre<br>FRP 400 litre | 45 sets<br>35 sets | 40 sets<br>30 sets | 5 sets<br>5 sets | |
| 12. Hand carts and Scales<br>(1)Hand carts | 2 wheel, max weight 200kg | 10 units | — | 10 units | |
| (2)Scales | Hanging type 1～100kg, 6 type | 22 sets | — | 22 sets | |
| 13. Hydraulic bender （for Iron bar） | Electrical hydraulic bender for 9～25 $\phi$ mm<br>Electrical hydraulic bar cutter | 1 units<br>1 units | —<br>— | 1 units<br>1 units | Box type<br>Handy type |

## 2.3.4 Basic Design

### 2.3.4.1 Basic Design for Ice-Making Plant

The planned ice-making plant will have a daily production capacity of 5 tons based on the earlier examination results of its suitable scale and will consist of an ice storage, a stand-by generator, a water tank for ice-making, a protective building and other facilities. In regard to the ice-making system, 2 alternatives have been examined and Plan - B, consisting of 2 units with a production capacity of 2.5 tons/day each, is selected over Plan - A, consisting of one unit with a production capacity of 5.0 tons/day, as a result of the comparative evaluation shown in **Table 2-3-20**.

**Table 2-3-20 Comparative Evaluation of Ice-Making Systems**

| Item for Comparison | (A) One Unit×5 Tons/Day | (B) Two Units×2.5 Tons/Day | Remarks |
|---|---|---|---|
| 1. Initial Investment Cost<br>(1) Ice-Making Machine<br>(2) Generator | ○ (0.98)<br>◎ (1.00)<br>△ (1.60) | △ (1.00)<br>△ (1.30)<br>◎ (1.00) | Figures in brackets are the comparative values for the two alternatives |
| 2. Maintenance Cost<br>(1) Ice-Making Machine<br>(2) Fuel Cost for Generator | △<br>△ (1.00)<br>△ (1.40) | ◎<br>◎ (0.80)<br>◎ (1.00) | As above |
| 3. Maintenance Work<br>(1) Maintenance Checks<br>(2) Breakdown Repair | △<br>△<br>×<br>(total stoppage) | ◎<br>◎<br>◎<br>(double safety) | |
| Overall Evaluation Result | △ | ◎ | |

Note: Evaluation symbols - ◎: excellent, ○: good, △: fair, ×: poor

**(1) Temperature Conditions and Refrigerant, etc.**

The temperature conditions and Refrigerant, etc. adopted for the operation of the planned ice-making plant under the Project are listed below. The use of such alternative cooling mediums (refrigerant) as R-134a, R-404A and ISCENON59, none of which are problematic in terms of fluorocarbon regulations vis-a-vis the zero ozone destruction factor, posing no problems in terms of global warming, were considered. However, as the use of such mediums would entail technical problems in regard to the refrigerator, auxiliary equipment and refrigerator oil corresponding to a new medium and problems concerning equipment sale and purchase as well as the maintenance of such medium, the conventional R-22 refrigerant will be used for the planned equipment under the Project. If any need to use a new type of cooling

medium for the planned ice-making plant arises, the refrigerating performance of the plant is expected to decline by some 8% on the basis of the present technical level. However, it should be possible to use either ISCENON59 or its equivalent among the above-mentioned new alternatives for the R-22-based ice-making plant without plant modification (depending on technical progress through the development of the practical application of such a new refrigerant).

- Ambient temperature : +35°C
- Relative humidity : 75%
- Temperature of water for ice-making : +30°C or lower
- Cooling medium : R-22
- Power supply : AC 415 V; 50 Hz; three phase

**(2) Basic Design**

1) Ice-Making Machine

The capacity of the ice-making machine is set at 5 tons/day based on the ice demand in the service area. Two alternatives are possible for the basic planning of the ice-making machine, i.e. (A) one 5 tons/day unit and (B) two 2.5 tons/day units.

The situation of local fisheries suggests that the ice demand declines in the dry season from May to October because of the declined catch, in turn caused by the reduced frequency of voyages by coastal fishermen from not only Mahe Island but also from Seychelles in general because of the prevailing strong southeasterly wind. The future progress of the use of inboard engines by coastal fishing boats and the smooth progress of the planned conversion from coastal fisheries to offshore fisheries are likely to reduce the ice demand fluctuations even though there will still be seasonable changes in terms of the fishing grounds and target fish. However, as such progress will not take place overnight, the basic design for the ice-making plant must ensure economical maintenance (in terms of a back-up emergency generator for power cuts and the need for double safety for the breaking down of the ice-making machine, etc.) Moreover, given the fact that the ice-making machine currently in use at Anse à La Mouche has a daily production capacity of 2.5 tons, Plan - B, i.e. two 2.5 tons/day plate ice-making machines, appears more advantageous in terms of economical management, parts replacement and everyday maintenance.

The design contents of these two alternatives are described below.

Plan - A: one 5t/day ice-making machine : △

| | |
|---|---|
| Ice-making capacity×number of machines | 5t/day×1 |
| Type of ice | crushed ice<br>(plate type automatic ice-making machine) |
| Refrigerating system | cooling medium direct expansion system |
| Condenser type | air condenser |
| Defrosting | hot gas; water |
| Ice-making water | Fresh water |
| Temperature of ice-making water | +30°C or lower |
| Operating system | Fully automatic |
| Refrigerator motor | approx. 30 kW |
| Refrigerator start-up system | unloading start-up |
| Refrigerator air condenser | approx. 1.5 kW (fan) |

Plan - B: two 2.5t/day ice-making machines : ◎

| | |
|---|---|
| Ice-making capacity×number of machines | 2.5t/day×2 |
| Type of ice | crushed ice<br>(plate type automatic ice-making machine) |
| Refrigerating system | cooling medium direct expansion system |
| Condenser type | air condenser |
| Defrosting | hot gas; water |
| Ice-making water | fresh water |
| Temperature of ice-making water | + 30°C or lower |
| Operating system | fully automatic |
| Refrigerator motor | approx. 15kW |
| Refrigerator start-up system | unloading start-up |
| Refrigerator air condenser | approx. 1.5kW (fan) |

2) Ice Storage

As described earlier, coastal fisheries are affected by local customs, holidays and the weather and the weekly schedule changes from one week to another. The general practice is to set sail at the beginning of the week if the weather and sea conditions permit. Accordingly, the demand for ice is concentrated at the beginning of the week and the day following bad weather. This makes the storage of an amount of ice equivalent to 3 - 4 days' supply necessary to allow for the absence of fishing at weekends and during bad weather. Here, a storage capacity of 15 tons is planned, i.e. the equivalent of 3 days' production of ice, consisting of the volume of ice produced over the weekend (Saturday and Sunday) and one day's production volume as stock, to allow for demand fluctuations.

The ice storage will be installed at the lower section of the frame incorporating the ice-making machines so that the ice made by these machines will drop to accumulate in the ice storage bin. The ice-making machines and the ice storage will be connected via a duct to drop the crushed plate ice. Consequently, the actual ice storage capacity is reduced to some 70% of the effective ice storage capacity (calculated on the basis of the effective height to the lower end of the duct; assumed to be 0.9 of the internal height). The storage density of an ice storage for crushed plate ice is usually 0.4t/$m^3$ and this value appears reasonable for the present purposes. Therefore, the internal ice storage capacity of the ice storage (Ve) will be approximately 60$m^3$ given the nominal capacity of 15 tons of crushed plate ice.

Ve = 15t/(0.4t/$m^3$ × 70% × 0.9) = 60 $m^3$

In accordance with the above, the specifications of the ice storage are as follows. There is no difference between the specifications for the 2 alternative ice-making machines. However, there is a slight structural modification because of the different duct layout.

Ice Storage Specifications

| | |
|---|---|
| Internal capacity | approx. 60$m^3$ |
| Ice storage volume | 15 tons |
| Building type | Prefabricated with heat insulation panels |
| External dimensions | 6,300mm in length × 4,500mm in width × 2,760mm in height |
| Internal temperature | -5°C ~ -10°C |
| Refrigerating system | Cooling medium direct expansion system; cold air circulation type |
| Defrosting | Electric heater |
| Condenser type | air condenser |
| Operating system | fully automatic |
| Insulated doors | 2 locations with ice stopper, thermometer and blind duckboard |
| Panel surface material | SUS plate |
| Refrigerator for ice storage | semi-sealed; 4.5kW |
| Indoor machinery | fan (0.2kW) × 3 units |

3) Generator

Anse Royale, the planned construction site for the new ice-making plant, is the second largest Administrative area in Seychelles and the voltage fluctuations and other problems are improving. Nevertheless, there are frequent power cuts at a rate of approximately twice a week (based on the interview survey findings), making the installation of an emergency

generator necessary as a back-up unit for short periods of time. The capacity of this generator will be restricted to the minimum but necessary capacity. In view of the installation of such a generator, an unloading start-up starter will be employed for the refrigerators for the ice-making machines and the ice storage.

As Alternative A and Alternative B for the ice-making machines result in different generator capacities, the examination results for these 2 cases are separately described below.

Plan - A: 5t/day ice-making machine×1 : △

Specifications for emergency generator

| | |
|---|---|
| Emergency generator | one 75 KVA unit |
| Rated output | 75KVA (50Hz) |
| Power | diesel engine; approx. 69.9kW/min (95 ps, 1,500 rpm) |
| Fuel tank | gas oil (A heavy oil), 185 liters (for 12 hours' operation) |
| Power supply | power - AC415V 50Hz three phase<br>light - AC240V 50Hz single phase |

Breakdown of 75 KVA

| Load Equipment | Start-Up Method | Capacity (kW) | Capacity (KVA) | Capacity at Start-Up (KVA) |
|---|---|---|---|---|
| Refrigerator for Ice-Making Machine | V start-up | 30.00 | 44.10 | 38.37 |
| Condenser Fan for Ice-Making Machine | Direct | 3.00 | 4.41 | 15.75 |
| Circulation Pump | Direct | 0.75 | 1.10 | 3.94 |
| Differential Pump | Direct | 0.75 | 1.10 | 3.94 |
| Crusher | Direct | 1.50 | 2.20 | 7.88 |
| Refrigerator for Ice Storage | V start-up | 4.50 | 6.60 | 6.60 |
| Condenser Fan for Ice Storage | Direct | 0.20 | 0.30 | 1.05 |
| Cooling Fan for Ice Storage | Direct | 0.60 | 0.90 | 4.72 |
| Water Supply Pump | Direct | 0.40 | 0.60 | 3.15 |
| Lighting | Direct | 1.50 | 2.20 | 2.20 |
| Total | | 43.20 | 63.50 | 88.60 |

The required minimum capacity of the generator for the operation of the ice-making machine during a power cut is calculated to be 75KVA in the following manner.

Required capacity = (total capacity in KVA) - (capacity of refrigerator for ice-making machine in KVA) + (capacity at start-up of refrigerator for ice-making machine)

= 63.5 - (44.1 + 4.41 + 1.1 + 1.1) + (39.37 + 15.75 + 3.94 + 3.94)

= 72.79 (KVA) → 75 KVA

Plan - B: 2.5 tons/day ice-making machines×2 : ◎

Specifications for emergency generator (for one 2.5t/day ice-making machine only; the required capacities for the ice storage are the same as those for Alternative A)

| | |
|---|---|
| Emergency generator | 50KVA unit×1 |
| Rated output | 50KVA (50Hz) |
| Power | diesel engine; approx. 4.7kW/min (64 ps, 1,500rpm) |
| Fuel tank | gas oil (A heavy oil), 125 liters (for 12 hours' operation) |
| Power supply | power - AC415V 50Hz three phase<br>light - AC240V 50Hz single phase |

Breakdown of 75 KVA

| Load Equipment | Start-Up Method | Capacity (kW) | Capacity (KVA) | Capacity at Start-Up (KVA) |
|---|---|---|---|---|
| Refrigerator for Ice-Making Machine | V start-up | 15.00 | 22.00 | 19.68 |
| Condenser Fan for Ice-Making Machine | Direct | 1.50 | 2.20 | 7.88 |
| Circulation Pump | Direct | 0.40 | 0.60 | 2.10 |
| Differential Pump | Direct | 0.40 | 0.60 | 2.10 |
| Crusher | Direct | 0.75 | 1.10 | 3.94 |
| Refrigerator for Ice Storage | V start-up | 4.50 | 6.60 | 6.60 |
| Condenser Fan for Ice Storage | Direct | 0.20 | 0.30 | 1.05 |
| Cooling Fan for Ice Storage | Direct | 0.60 | 0.90 | 3.15 |
| Water Supply Pump | Direct | 0.40 | 0.60 | 2.10 |
| Lighting | Direct | 1.50 | 2.20 | 2.20 |
| Total | | 25.25 | 37.10 | 50.80 |

The required minimum capacity of the generator for the operation of the ice-making machine during a power cut is calculated to be 50KVA in the following manner.

Required capacity = (total capacity in KVA) - (capacity of refrigerator for ice-making machine in KVA) + (capacity at start-up of refrigerator for ice-making machine)

= 37.1 - (22.0) _ 2.2 + 0.6 + 0.6) + (19.68 + 7.88 + 2.1 + 2.1)

= 43.46 (KVA) → 50KVA

4) Ice-Making Water Tank

Seychelles suffers from a severe water shortage in the dry season. As the islands are volcanic, there are few groundwater sources and public water supply relies on dam reservoirs constructed on small streams in mountain areas. The solution to this water shortage in the dry season lies with the rain clouds which pass over these reservoirs and, therefore, it appears that the problem cannot be quickly solved. Fundamental measures, including the introduction of a desalination plan, are, therefore, necessary. Although a

feasibility study has been conducted, there are as yet no concrete prospects for the realisation of such a plant. Accordingly, a water tank with a storage capacity of approximately 8 tons will be provided for the planned ice-making plant to secure ice-making water to produce a daily ice production volume of 5 tons.

Details of Water Tank

| | |
|---|---|
| Ice-making water | 6.25 tons (= 5 tons × 1.25) |
| Cleaning water | 0.75 tons |
| Toilet water | 0.25 tons |
| Hand-washing water | 0.25 tons |
| Total | 7.50 tons → 8 tons |

5) Protective Building and Auxiliary Facilities

At Anse Royale, the planned construction site of the new ice-making plant under the Project, the average temperature and humidity are high throughout the year as in the case of other coastal fishing villages in Seychelles. As the site is situated on the coast, briny air during the dry season when the southeasterly wind prevails can be anticipated. Even though some measures, including uncut trees on the coastal side to act as a windbreak forest, are employed to prevent salt damage, multiple access to the site from the sea-side must be available to serve for the planned introduction of a jetty for coastal fishing boats, a warehouse for fishermen, a fish market, a vegetable market, a slope to pull up fishing boats for repair and other repair-related facilities in the future. These openings will reduce the effect of the windbreak forest and, therefore, the construction of a building to protect the ice-making plant will be essential.

It can easily be imagined that the procurement of the necessary building materials in Seychelles is difficult because of the small absolute quantities available locally, particularly if the construction period of this building overlaps with other building work. As the purpose of this building is to protect the ice-making plant, a pre-fabricated building is planned in view of the easy adjustment of the construction schedule to coincide with the delivery, assembly and installation work of the ice-making plant.

The specifications, scale and required floor area of the protective building and other auxiliary facilities, including a car park, which are essential for the effective use of the ice-making plant, are described below.

a. Protective Building

Floor area: approx. 108m$^2$; prefabricated × 1

Water supply and drainage facilities (toilet, septic tank and washbasin, etc.)

Indoor lighting and outdoor lighting

Foundations for ice-making plant and protective building (RC continuous footings: approx. 130m$^2$)

i) Floor area of protective building for ice-making plant: approx. 9m × 12m = 108m$^2$

| | | | | | |
|---|---|---|---|---|---|
| Ice-making plant (including maintenance space) | approx. 9m | × | 5m | = | 45m$^2$ |
| Space for generator and water tank * | approx. 9m | × | 2.5m | = | 22.5m$^2$ |
| Ice sales counter space | approx.4.5m | × | 3.5m | = | 15.75m$^2$ |
| Ice packing and other work space | approx. 4.5m | × | 5.5m | = | 24.75m$^2$ |
| Total | | | | | 108m$^2$ |

* The air condenser and refrigerator for the ice storage will be installed above the generator. (The space requirement for these 2 items is 22.5m$^2$, i.e. approx. 9m × 2.5m).

ii) Water Tank

Approx. 8m$^3$ with a feed pump, plumbing, wiring, frame and distribution panel

iii) Others

Spare parts for main equipment and machinery, maintenance tools and other equipment and materials

### 2.3.4.2 Basic Design for Equipment

**(1) Small Fishing Boats (13.5m type long line fishing boats × 2 and 10m type small fishing boats × 3)**

1) 3.5m Type Long line fishing boats × 2

The Seychelles side has requested two 13.5m long fishing boats equipped with US type tuna longlining gear. It is relatively easy for fishermen to acquire the necessary skills to operate this type of long line fishing and the use of the direct winding system for the Nylon mono-filament main line (Ø3.2 - 3.5mm in diameter), which is popularly used in Seychelles and neighbouring countries as well as in Caribbean countries, is planned. The specifications of the planned long line boats under the Project include a line hauler. The planned main items and their specifications for the hull section and engine department of the long line boats are listed below.

**Table 2-3-21 Specifications for Long line Fishing Boat**

| Item | | Planned Specifications |
|---|---|---|
| 1. Hull Section | | |
| (1) Main Item | 1) Ship Category | Small FRP longliner |
| | 2) Qualification | Appraisal by Nippon Kaiji Kyokai (NK) pursuant to the Export Inspection Law of the Government of Japan and JC Standards |
| (2) Hull | 1) Construction Material<br>Ship Type | FRP (fibre reinforced plastic)<br>Bow bridge type single deck |
| | 2) Main Items<br>- Total Length<br>- Registered Length<br>- Total Breadth<br>- Moulded Depth<br>- Displacement<br>- Gross Tonnage<br>- Crew Strength<br>- Main Engine<br>- Speed<br>- Navigation Distance | <br>approx. 13.0 - 13.5m<br>approx. 11.0 - 11.5m<br>approx. 4.0m<br>approx. 1.40 - 1.50m<br>approx. 17t (with light load)<br>approx. 17 - 20t (international tonnage)<br>5 - 6 persons<br>approx. 180 - 200PS<br>approx. 8 - 9 knots<br>approx. 450 miles |
| | 3) Capacity<br>- Fish Hold<br>- Fuel Tank<br>- Fresh Water Tank | <br>approx. 9.0$m^3$<br>approx. 2.0$m^3$<br>approx. 1.0$m^3$ |
| | 4) Accommodation Quarters<br>- Steering House<br><br>- Crew Room<br><br>- Storage | <br>-Bow bridge×1 set (steering gear, sea chart table, locker and instrument table)<br>-5 - 6 beds; below bow section upper deck×1 room (kitchen to be located at the back of the steering house)<br>-Bow storage (for anchor and mooring lines)<br>Stern storage (inside steering gear room in the stern section) |
| (3) Legally Required Items | 1) Live-Saving Appliances | Based on the Safety Equipment Standards in Seychelles: inflammable life raft, life jackets, life buoys, various signals |
| | 2) Fire-Fighting Apparatus | - One each for steering house and crew room (dry powder extinguisher)<br>- One each for engine room (self-diffusion type fire extinguisher) |
| | 3) Mooring Devices | - Anchor ×1 (Danforth anchor: approx. 30kg)<br>- 1 set of anchor chain and anchor rope<br>- 1 set of mooring lines |
| | 4) Other Auxiliary Items | |
| (4) Navigational Instruments and Radio Equipment | 1) Steering Gear | - Manual hydraulic type: approx. 0.3kg-m<br>- Emergency steering direct (tiller directly linked to steering axle) |
| | 2) Navigational Instruments | - Compass<br>- Steering angle indicator<br>- VHF<br>- SSB<br>- ADF<br>- Fishfinder<br>- GPS<br>- Radar<br>- Navigation lights<br>- CVS |

| | | |
|---|---|---|
| (5) Fishing and Deck Equipment | 1) Deck Equipment | - Capstan for mooring (hydraulically operated) |
| | 2) Fishing Equipment | - Longlining equipment using mono-filament longline<br>- Direct winding reel for main line (hydraulically operated)<br>- Line hauler (hydraulically operated)<br>- Reel for buoy floated lines (manual)<br>- Others |
| 2. Engine Department and Electrical System | | |
| (1) Main Engine and Propulsion System | 1) Main Engine<br>- Type and Quantity<br>- Output<br>- Revolutions<br>- Fuel<br>- Number of Cylinders<br>- Cooling System<br>- Start-Up System<br>- Reduction/Reversing Gear | <br>Four stroke marine diesel engine×1<br>Maximum continuous: approx. not less than 180PS<br>Maximum: approx. 2,300rpm<br>Gas oil<br>6<br>Indirect fresh water cooling system with heat exchanger<br>Electric motor<br>- Hydraulic multiple disc clutch (engine attachment type)<br>- Reduction rate: approx. 2.6 or higher |
| | 2) Shafting Arrangement<br>- Propeller Shaft<br>- Type and Quantity<br>- Material | <br>Stainless steel or equivalent<br>Three blade fixed pitch propeller<br>Manganese bronze or equivalent |
| | 3) Various Equipment in Engine Department | Miscellaneous water pump, bilge pump, fresh water pump and others |
| (2) Generator | 1) Engine for Power Generation | 4 cycle high-speed diesel engine×1; approx. 20 PS×1,500rpm |
| | 2) Generators | DC 24V approx. 3kW×1<br>AC 220V 50 Hz 15KVA×1 |
| | 3) Inboard Power Source | DC 24V; AC 220V |
| (3) Others | | |

2) Three Small 10 m Type Fishing Boats

These small 10m type fishing boats were introduced under the previous Project for Coastal Fisheries Development to develop appropriate fishing boats for coastal fisheries in Seychelles. The planned main items and their specifications are listed below.

**Table 2-3-22 Specifications for Small Fishing Boats**

| Item | | Planned Specifications |
|---|---|---|
| 1. Hull Section | | |
| (1) Main Item | 1) Ship Category | Small FRP fishing boats |
| | 2) Qualification | Inspection by Japan Craft Inspection (JCI) pursuant to the Safety Regulations for Small Ships in Japan |
| (2) Hull | 1) Construction Material<br>Ship Type | FRP (fibre reinforced plastic)<br>Centre bridge type single deck |

| | | |
|---|---|---|
| | 2) Main Items<br>- Total Length<br>- Registered Length<br>- Total Width<br>- Moulded Depth<br>- Displacement<br>- Gross Tonnage<br>- Crew Strength<br>- Main Engine<br>- Speed | <br>approx. 10.5m<br>approx. 9.55m<br>approx. 2.8m<br>approx. 1.29m (0.83m to the deck)<br>approx. 17t (with light load)<br>approx. 4.9t (international tonnage)<br>4 persons<br>approx. 75 PS/2,400 rpm<br>approx. 9 knots |
| | 3) Capacity<br>- Fish Hold<br>- Fuel Tank | <br>approx. 2.0m$^3$<br>approx. 600 litres |
| | 4) Accommodation Quarters<br>- Steering House<br>- Crew Room<br>- Storage | <br>Centre bridge × one set<br>Four beds; 2 each at the front of the steering house and lower section<br>Bow storage |
| (3) Legally Required Items | 1) Live-Saving Appliances | Based on the Safety Equipment Standards in Seychelles: life jackets, life buoys, various signals |
| | 2) Fire-Fighting Apparatus | - One each for steering house and crew room (dry powder extinguisher)<br>- One each for engine room (self-diffusion type fire extinguisher) |
| | 3) Mooring Devices | - Anchor × 1 (Danforth anchor: approx. 15kg) |
| | 4) Other Auxiliary Items | |
| (4) Navigational Instruments and Radio Equipment | 1) Steering Gear<br>2) Navigational Instruments | - Manual hydraulic type<br>- Magnetic compass<br>- SSB, VHF<br>- Colour fishfinder<br>- GPS<br>- Navigation lights<br>- CVS |
| (5) Fishing and Deck Equipment | 1) Fishing Equipment | - Hydraulic line hauler<br>- Trolling line rod receptor |
| 2. Engine Department and Electrical System | | |
| (1) Main Engine and Propulsion System | 1) Main Engine<br>- Type and Quantity<br>- Output<br>- Revolutions<br>- Fuel<br>- Reduction/Reversing Gear | <br>4 stroke marine diesel engine × 1<br>Maximum continuous: approx. 75PS<br>Maximum: approx. 2,400rpm<br>Gas oil<br>Reduction ratio: approx. 3.12 |
| | 2) Shafting Arrangement<br>- Propeller Shaft<br>- Type and Quantity | <br>Stainless steel (SUS316) or equivalent<br>Three blade fixed pitch propeller |
| | 3) Various Equipment in Engine Department | Electric bilge pump, manual bilge pump, hydraulic pump/pressure tank and others |
| (2) Generator | 1) Generator | Main engine front drive |
| | 2) Inboard Power Source | DC 12 V × 1 set |
| (3) Others | | |

**(2) Light Buoys : 6 sets**

For minimizing maintenance, this light buoy will be equipped solar battery and Light – Emitting Diode bulb. The installation work will be conducted by SFA. Therefore length of mooring devices will be attached more than 1.5 times of depth in project site (50m).

The specification is as follows.

| | |
|---|---|
| Brightness | : Approximately 3W, LED bulb |
| Character of light | : 1 flash in 4 sec, Yellow |
| Diameter | : 70 - 100cm |
| Height | : Above 150cm of water level |
| Mooring Devices | : Short link Chain Ø16mm × 50m |
| The other Specification | : With Solar battery |

**(3) Hydraulic Benders**

The hydraulic benders will be used to bend steel bars (8 - 25mm in diameter) for the manufacture of anchors, etc. The specifications of the planned hydraulic benders are as follows.

1) Portable steel bar bender: 1 unit

| | |
|---|---|
| Motor | 240V, 1,080W, 50Hz |
| Bending capacity | 9 - 25mm diameter bar |
| Maximum/minimum bending radius | Ø9mm (R80 - R20)<br>Ø25mm (R46 - R40) |
| Range of bent angle | any between 0° - 180° |

2) Portable steel bar cutter: 1 unit

| | |
|---|---|
| Motor | 240V, 1080W, 50Hz |
| Cutting | Steel bar |

**(4) Marine Engines, Fishing Gear and Safety Equipment**

1) Marine Diesel Engines

4 types of marine diesel engines, i.e. 15 HP/2,400rpm, 28 HP, 3,000rpm, 34 HP/2,500rpm and 75 HP/2,400rpm, have been requested. As there have been many incidents where the engine cannot be started due to a flat battery. Therefore combined manual and electric start-up system is recommended. The specifications are as follows.

2 cylinder type engine: 18 units

| | |
|---|---|
| Type | water cooling four cycle diesel engine |
| Number of cylinders | Two |
| Output (continuous) | 12 - 15HP |
| Revolutions | 2,400 - 3,200rpm |
| Displacement | 580 - 1,400cc |
| Start-up system | manual and electric |
| Cooling system | fresh water cooling |

2 cylinder type engine: 13 units

| | |
|---|---|
| Type | water cooling four cycle diesel engine |
| Number of cylinders | Two |
| Output (continuous) | 24 - 28HP |
| Revolutions | 2,800 - 3,000rpm |
| Displacement | 1,300 - 1,500cc |
| Start-up system | manual and/or electric |
| Cooling system | fresh water cooling |

3 cylinder type engine: 21 units (10 with larger HP)

| | |
|---|---|
| Type | water cooling four cycle diesel engine |
| Number of cylinders | Three |
| Output (continuous) | 34 - 42HP |
| Revolutions | 2,500 - 3,400rpm |
| Displacement | 1,300 - 2,000cc |
| Start-up system | manual and/or electric |
| Cooling system | fresh water cooling |

4 cylinder type engine: 8 units

| | |
|---|---|
| Type | water cooling four cycle diesel engine |
| Number of cylinders | Four |
| Output (continuous) | 75 - 80HP |
| Revolutions | 2,400 - 2,600rpm |
| Displacement | 4,000 - 4,400cc |
| Start-up system | Electric |
| Cooling system | fresh water cooling |

Maintenance tools : 2 sets

2) Fishing Gear

The specifications of the planned range of fishing gear are as follows.

a. Requested Fishing Gear for Longlining

i) Fishing gear for longlining

| | | For Sale | SFA |
|---|---|---|---|
| - Fishing line | nylon mono-filament, 3.2mm, 500m | 300 | |
| - Fishing line | nylon mono-filament, 2.1mm, 1,000m | 45 | |
| - Fishing line | nylon mono-filament 1.8mm, 1,000m | 30 | |
| - Swivel | heavy duty swivel, 8mm | 80 | |
| - Silver lock | Type A | 300 | |

| | | | |
|---|---|---|---|
| - Silver lock | Type D | 1,200 | |
| - Silver lock | Type E | 1,200 | |
| - Snap | Ø3.8mm×130 mm | 2,700 | |
| - Snap | Ø3.5mm×125 mm with small BL | 250 | |
| - Vinyl tube | | 20,000 | |
| - Weight swivel | 80g | 1,200 | |
| - Weight swivel | 60g | 1,200 | |
| - Copper lock | No. 2 | 2,500 | |
| - Copper lock | No. 3 | 8,500 | |
| - Aluminium course | | 8,500 | |
| - Tuna hook | Southern tuna type, 9/0 | 8,500 | |
| - Chemical light | | 8,500 | |
| - Buoy | Ø 25cm | 300 | |
| - Flag pole | | 70 | |
| - Radar reflector | with light | 6 | |
| - Radio buoy | frequency in use: 2,500 - 3,000 KHz | 14 | |
| - Harpoon for sharks | | 4 | |

ii) Maintenance tools for longlining

| | | For Sale | SFA |
|---|---|---|---|
| - Lock presser | portable type | 20 | |
| - Lock presser | floor type | 5 | |
| - Silver lock | Type A | 10,000 | |
| - Silver lock | Type D | 22,000 | |
| - Silver lock | Type E | 19,000 | |
| - Chip for lock presser | for Type A lock | 20 | |
| - Chip for lock presser | For Type D lock | 20 | |
| - Chip for lock presser | for Type E lock | 20 | |
| - Cutting scissors | stainless steel, large | 25 | |
| - Cutting scissors | stainless steel, large | 25 | |
| - Kuikiri | | 10 | |

b. Fishing Gear for Trolling

| | | For sale | SFA |
|---|---|---|---|
| - Trawling rod | FRP, approx. 5m | | 6 sets |
| - Airplane type float | | | 40 |
| - Diving board | 195mm | | 20 |
| - Diving board | 150mm | | 20 |
| - Trawling line | nylon braided, 200m + 200m, 5mm | 100 rolls | 10 rolls |
| - Trawling line | nylon braided, 200m + 200m, 4mm | 500 rolls | 50 rolls |
| - Trawling line | nylon braided, 200m + 200m, 3.5mm | 500 rolls | 50 rolls |
| - Trawling line | nylon braided, 200m + 200m, 3mm | 500 rolls | 50 rolls |
| - Trawling line | nylon braided, 200m + 200m, 2.5mm | 500 rolls | 50 rolls |
| - Trawling line | nylon braided, 200m + 200m, 2mm | 500 rolls | 50 rolls |
| - Crane swivel | small | 2,500 | 250 |
| - Crane swivel | medium | 2,500 | 250 |
| - Crane swivel | large | 2,500 | 50 |
| - Tension absorber | approx. 2m, Ø5.0mm | | 20 |
| - Tension absorber | approx. 2m, Ø6.0mm | | 20 |

c. Fishing Gear for Vertical Longlining

| | | For sale | SFA |
|---|---|---|---|
| - Float | approx. 600m water pressure-proof, Ø 15cm | | 100 |
| - Float | approx. 300m water pressure-proof, Ø30cm | | 200 |
| - Fishing line | nylon mono-filament , No. 150, 100m | 200 rolls | |
| - Fishing line | nylon mono-filament, No. 100, 100m | 250 rolls | |
| - Fishing line | nylon mono-filament, No. 70, 100m | 100 rolls | |
| - Fishing line | nylon mono-filament, No. 60, 100m | 100 rolls | |
| - Fishing line | nylon mono-filament, No. 50, 100m | 200 rolls | |
| - Fishing line | nylon mono-filament, No. 40, 100m | 200 rolls | |

| | | | |
|---|---|---|---|
| - Fishing line | nylon mono-filament, No. 30, 100m | 200 rolls | |
| - Triangle combination swivel | 3×4 | 200 | |
| - Barrel swivel | 5/0 | 500 | |
| - Fish hook | Kirby type, Duratin, Size 3 | 5,000 | |
| - Fish hook | Kirby type, Duratin, Size 4 | 60,000 | - |
| - Fish hook | Kirby type, Duratin, Size 5 | 60,000 | - |
| - Fish hook | Kirby type, Duratin, Size 6 | 40,000 | - |
| - Fish hook | Kirby type, Duratin, Size 7 | 20,000 | - |
| - Fish hook | Kirby type, Duratin, Size 8 | 20,000 | - |
| - Fish hook | tuna circle hook, 12/0 | 5,000 | 500 |
| - Fish hook | tuna circle hook, 13/0 | 5,000 | 500 |
| - Fish hook | tuna circle hook, 14/0 | - | 2,000 |
| - Wire | stainless steel, nylon coated, 100m, No. 25 | - | 30 |
| - Wire | stainless steel, nylon coated, 100m, No. 39 | - | 30 |
| - Silver lock | aluminium, for No. 25 wire | - | 1,000 |
| - Silver lock | aluminium, for No. 39 wire | - | 1,000 |
| - Aluminium course | for No. 25 wire | - | 1,000 |
| - Aluminium course | for No. 39 wire | - | 1,000 |
| - Sinker | No. 150 or 400g | 500 | - |
| - Rope | P.P. 8mm×200m | 200 rolls | - |
| - Rope | P.P. 10mm×200m | 200 rolls | - |
| - Rope | P.P. 12mm×200m | 100 rolls | 25 rolls |
| - Rope | P.P. 14mm×200m | 100 rolls | - |
| - Rope | P.P. 16mm×200m | 100 rolls | - |
| - Rope | P.P. 20mm×200m | 20 rolls | - |
| - Rope | polyester 14mm×200m | 25 rolls | - |
| - Rope | polyester 16mm×200m | 25 rolls | - |
| - Rope | polyester 18mm×200m | 25 rolls | - |
| - Line hauler | roller revolution: 80 - 120 rpm<br>line winding speed: approx. 37 - 50m/min | 5 | - |
| - Line hauler | roller revolution: 80 - 120rpm<br>line winding speed: approx. 60 - 90m/min | 5 | - |

d. Fishing Gear for Gillnetting

| | | For sale | SFA |
|---|---|---|---|
| - Gillnet | nylon multi-filament, 210 d/12<br>mesh size: 2.5", 200 D×100m, green | 25 rolls | - |
| - Gillnet | nylon multi-filament, 210d/12<br>mesh size: 2.5", 200 D×100m, white | 25 rolls | - |
| - Float | PVC | 7,500 | - |
| - Net sinker | lead | 2,500 | - |
| - Rope | P.P. rope, 8mm, 100m | 50 | - |

e.Fishing Gear for Stick-Held Dip Netting

| | | For sale | SFA |
|---|---|---|---|
| - Stick-held dip net | net, rope, light bulbs | 2 sets | - |
| - Spares | net materials, net repair thread,<br>knitting needles, spare bulbs | 1 set | - |

f. Other Fishing Gear

| | | For sale | SFA |
|---|---|---|---|
| - Egi | Oita type, 3 pieces/set | - | 100 sets |
| - Scoop net | Ø60cm, 40cm deep, stick length of<br>not less than 3m | - | 20 |
| - Gaff | large | - | 12 |
| - Gaff | small | - | 5 |
| - Wooden hammer | to hit tuna | - | 5 |

| | | | |
|---|---|---|---|
| - Saw | stainless steel, for marlin bill cutting | - | 10 |
| - Tuna killer | for tuna | - | 10 |
| - Fishing gloves | | 1,000 | 100 |
| - Rainwear for fishing | Size LL | 150 | 30 |
| - Rainwear for fishing | Size L | 100 | 20 |
| - Anchor | Danforth type, 50kg | 6 | |
| - Anchor chain | Ø8mm, 6m, studless (with shackles and swivels on both sides) | 30 | 5 |
| - Anchor chain | Ø10mm, 6m, studless (with shackles and swivels on both sides) | 30 | 5 |
| - Anchor chain | Ø12mm, 6m, studless (with shackles and swivels on both sides) | 30 | 5 |
| - Fish knife | 210mm (Japanese carver) | - | 25 |
| - Fish knife | 180mm (Japanese carver) | - | 25 |
| - Wire mesh | for trap trials, 40×40mm | - | 3 rolls |
| - Bar | stainless steel, 4mm×45mm, 4m | - | 5 |
| - Ice box | 160 litres | 40 | 5 |
| - Ice box | 400 litres | 30 | 5 |
| - Two-wheel barrow | loading capacity of 200kg or more | - | 10 |
| - Scales | suspension type, 100kg | - | 3 |
| - Scales | suspension type, 50kg | - | 3 |
| - Scales | suspension type, 20kg | - | 4 |
| - Scales | suspension type, 10kg | - | 4 |
| - Scales | suspension type, 5kg | - | 4 |
| - Scales | suspension type, 1kg | - | 4 |

3) Safety Equipment

The specifications of the safety equipment are as follows.

a. Life-Saving Appliances

| Item | | Specifications/Description | For Sale | SFA |
|---|---|---|---|---|
| Life buoy | 1.Floating body<br>2. Lifeline<br>3. Type | : polyethylene foam<br>: not less than 20m<br>: type approved by Ministry of Transport | 120 | - |
| Life jacket | 1. Buoyancy | : 7.5kg for 24 hours<br>: type approved by Ministry of Transport | 500 | - |
| Inflatable life raft | 1. Capacity<br>2. Accessories | : 6 persons<br>: emergency food and safety equipment for 6 persons<br>: type approved by Ministry of Transport | 2 sets | - |
| Life raft throwing appliance | Type | : type approved by Ministry of Transport | - | 2 sets |
| Parachute signal | Type | : type approved by Ministry of Transport | 250 | - |
| Hand flare | Type | : type approved by Ministry of Transport | 100 | - |
| Rocket star signal | Type | : type approved by Ministry of Transport | 100 | - |
| Buoyant smoke signal | Type | : type approved by Ministry of Transport | 30 | - |
| Self-igniting smoke signal | Type | : type approved by Ministry of Transport | 100 | - |
| Self-igniting light | Type | : type approved by Ministry of Transport | 120 | - |
| EPIRB (Emergency Position Indicating Radio Beacon) | 1. Power source<br>2. Transmission frequency<br>3. Operating duration | : 11.2 V DC lithium battery<br>: 406.025MHz<br>: more than 24 hours | - | 30 |

b. Navigational Equipment

| Item | | Specifications/Description | For Sale | SFA |
|---|---|---|---|---|
| Compass (1) | 1. Power Source | : 12 V DC<br>: with light emitting diode<br>: built-in type | 35 | 1 |
| Compass (2) | 1. Card diameter | : 75mm or larger<br>: with wooden case | 35 | |
| Binoculars | 1. Magnification | : x8 - X20<br>: splash-proof type | 2 | 1 |
| Floodlight | 1. Power source | : 12V DC, 200W | 30 sets | - |
| Mast and stern lights | 1. Voltage<br>2. Output | : 12V DC<br>: 100W | 50 sets | - |
| Bilge pump | 1. Type | : hand operated | 50 | - |
| Fender | 1. Material | : PVC | 50 | - |
| Solar panel battery charger | 1. Voltage<br>2. Maximum output | : 12V DC<br>: 10W or higher | 30 | - |
| Waterproof flashlight | 1. Battery | : 6×Size A (R20) | 215 | 5 |

4) Radio Equipment

| Item | | Specifications/Description | For Sale | SFA |
|---|---|---|---|---|
| SSB radio | 1. Power source<br>2. Output | : 12/24 V DC<br>: 150 W | 10 | - |
| VHF radio | 1. Power source<br>2. Output | : 12/24 V DC<br>: 25 W | 20 | - |
| Portable VHF radio | 1. Power source<br>2. Output | : ni-cd battery<br>: 5W<br>: waterproof | - | 2 |

5) Fishfinders

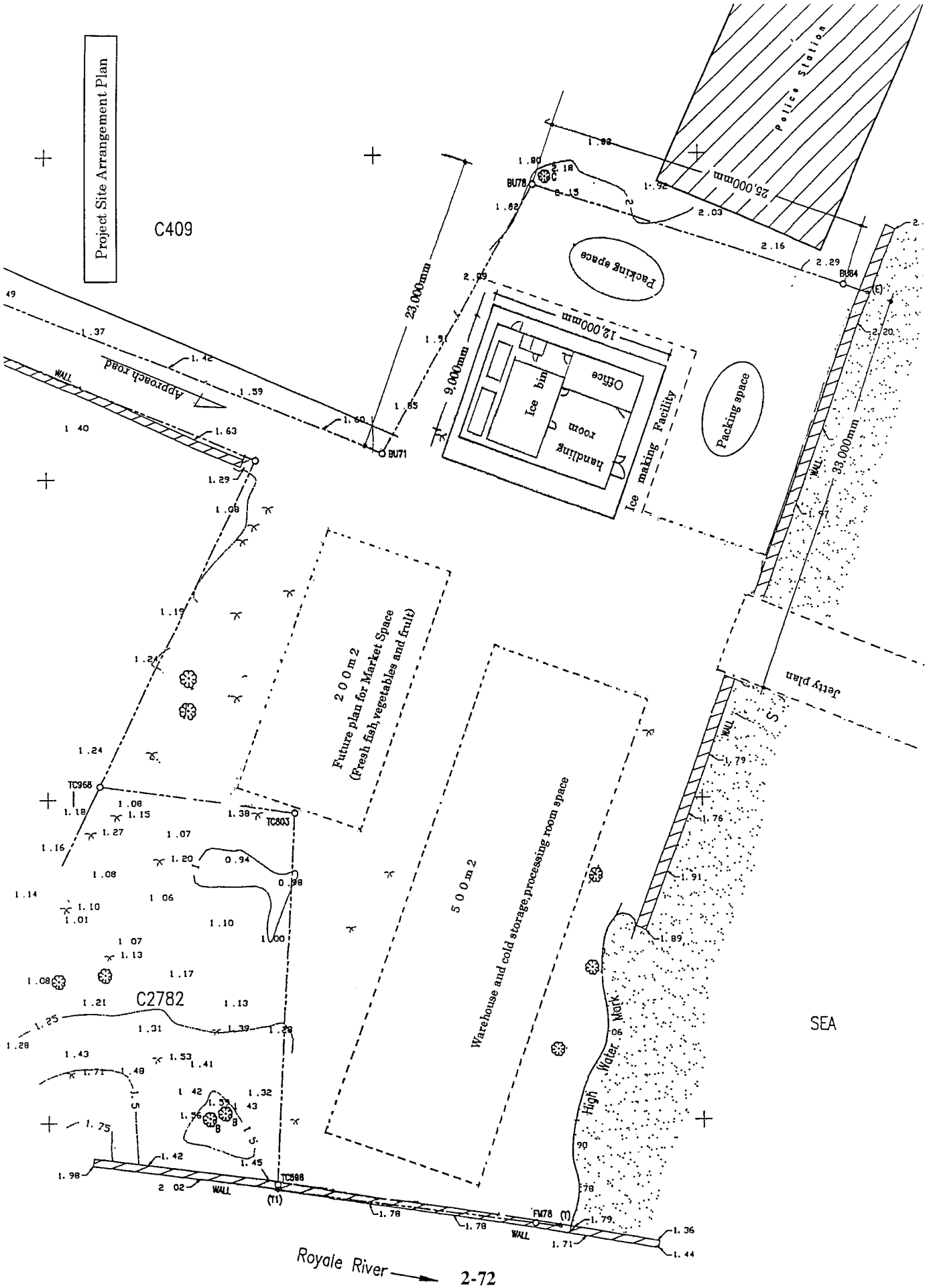
| Item | | Specifications/Description | For Sale | SFA |
|---|---|---|---|---|
| Fishfinder (1) | 1. Power source<br>2. Display<br>3. Frequency in use<br>4. Phase range | : 12/24V DC<br>: liquid crystal<br>: 50kHz<br>: 320m | 20 | - |
| Fishfinder (2) | 1. Power source<br>2. Display<br>3. Frequency in use<br>4. Phase range | : 12/24V DC<br>: CRT or liquid crystal, colour<br>: 50 and 200kHz<br>: 600m | 5 | - |
| Fishfinder (3) | 1. Power source<br>2. Display<br>3. Frequency in use<br>4. Phase range | : 12 – 32V DC<br>: CRT or liquid crystal, colour<br>: 28 and 200kHz<br>: 2,000m | - | 1 |

6) GPS

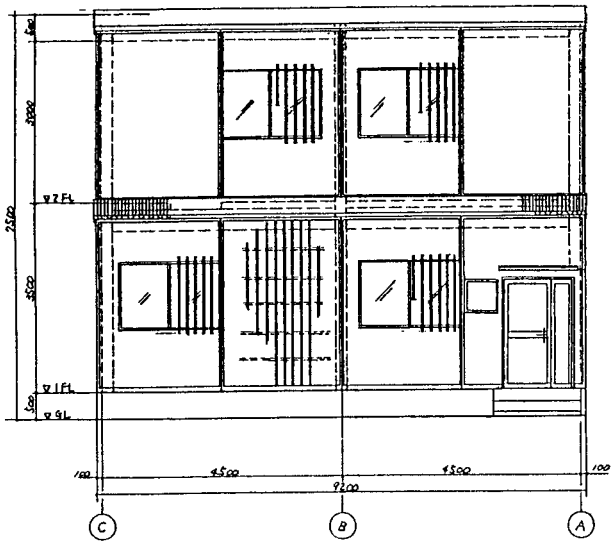
| Item | | Specifications/Description | For Sale | SFA |
|---|---|---|---|---|
| GPS | 1. Power source<br>2. Display | : 12/24 V DC<br>: liquid crystal | 12 | - |

7) Navigational Tools

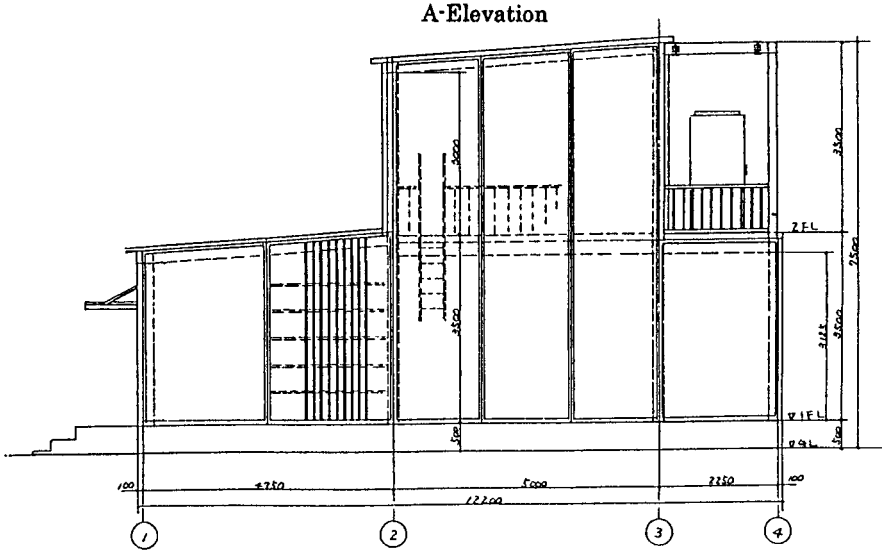
| Item | | Specifications/Description | For Sale | SFA |
|---|---|---|---|---|
| Dividers | | | - | 20 |
| Navigation ruler | French type | | - | 20 |
| Calipers | | | - | 12 |


Project Site Arrangement Plan
C409
Police Station
25,000mm
Packing space
BU78
BU84
BU71
23,000mm
12,000mm
9,000mm
Office
Ice bin
Handling room
Ice making Facility
Packing space
Approach road
WALL
33,000mm
Jetty plan
200m2
Future plan for Market Space
(Fresh fish,vegetables and fruit)
500m2
Warehouse and cold storage,processing room space
C2782
TC968
TC803
TC998
(T1)
FW78 (T)
High Water Mark
SEA
Royale River
2-72

1-Elevation

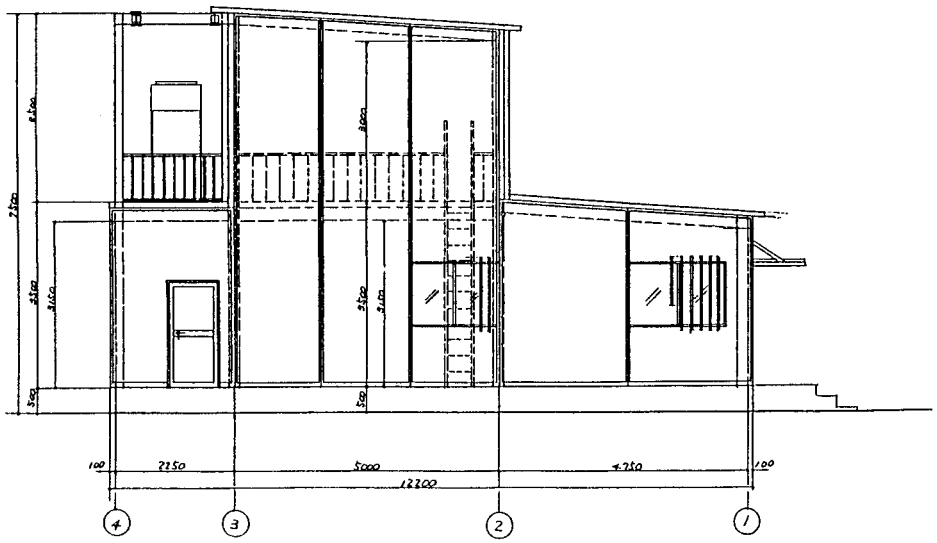


A-Elevation

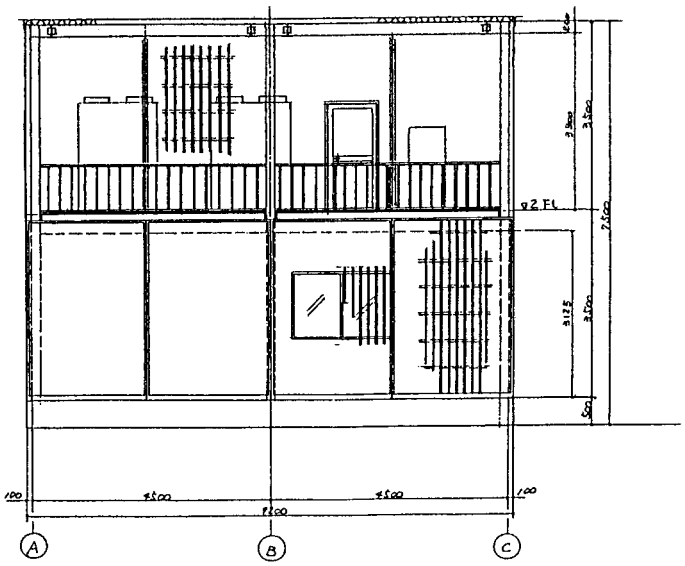


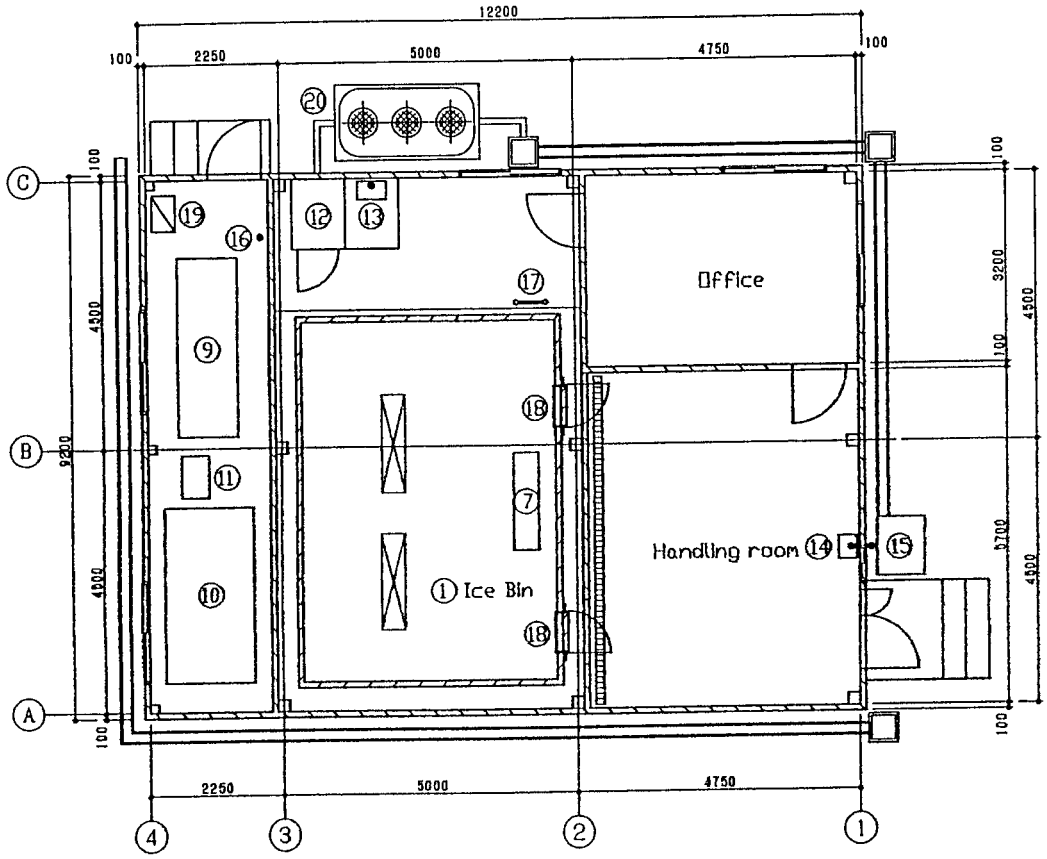
Ice-Making Machine 2.5ton/day×2 sets & Ice Bin Capacity of 15tons

C-Elevation

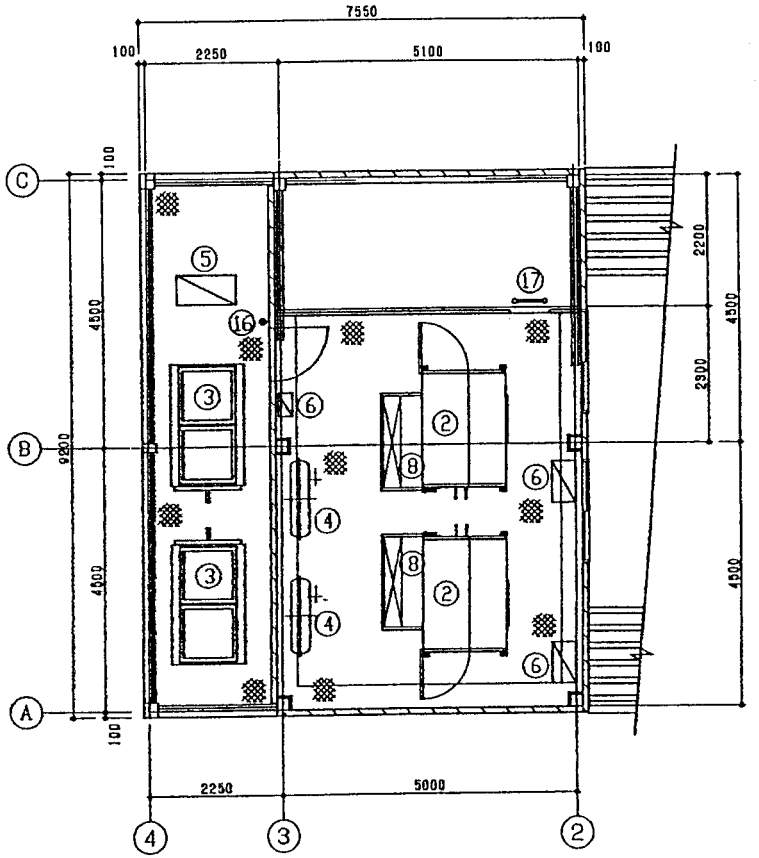


4-Elevation





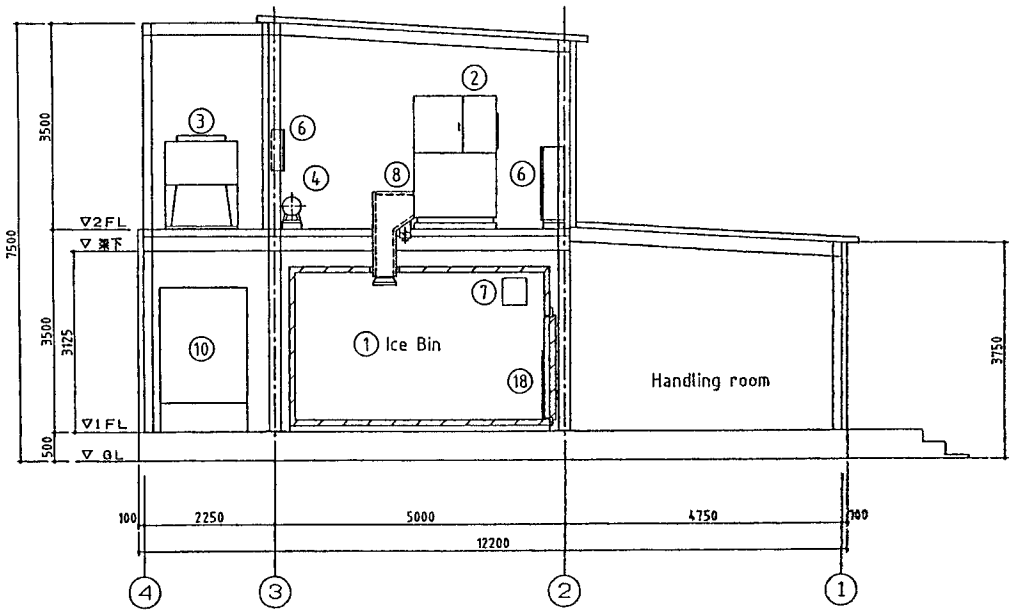

1st Floor plan for Ice Storage and Office

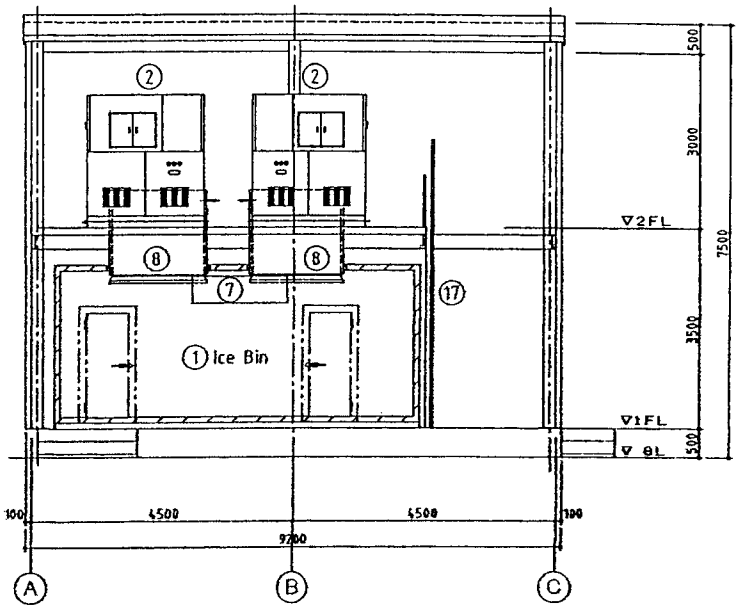



2nd Floor plan for Ice Making Room

① Ice Bin (Holding Capacity 15tons)
② Ice Making Machine 2.5ton/day x 2sets
③ Air-cooled condenser for Ice Maker
④ Receiver for Ice Maker
⑤ Cooling Unit for Ice Bin (4.5kw)
⑥ Starter for Ice makers
⑦ Unit cooler for Ice Bin
⑧ Ice shoot
⑨ Stand-by Diesel Generator
⑩ Water tank 8ton
⑪ Water Pump
⑫ W.C.
⑬ Wash bowl
⑭ Hand washer
⑮ Legs washer
⑯ Water cock
⑰ Ladder
⑱ Ice stopper
⑲ Distribution panel
⑳ Septic tank

Ice-Making Machine 2.5ton/day×2 sets & Ice Bin Capacity of 15tons




Ice-Making Machine 2.5ton/day × 2 sets & Ice Bin Capacity of 15tons

① Ice Bin (Holding Capacity 15tons)
② Ice Making Machine 2.5ton/day x 2sets
③ Air-cooled condenser for Ice Maker
④ Receiver for Ice Maker
⑤ Cooling Unit for Ice Bin (4.5kw)
⑥ Starter for Ice makers
⑦ Unit cooler for Ice Bin
⑧ Ice shoot
⑨ Stand-by Diesel Generator
⑩ Water tank 8ton
⑪ Water Pump
⑫ W.C.
⑬ Wash bowl
⑭ Hand washer
⑮ Legs washer
⑯ Water cock
⑰ Ladder
⑱ Ice stopper
⑲ Distribution panel

# Chapter 3

# Implementation Plan

# Chapter 3. Implementation Plan

## 3.1 Implementation Plan

### 3.1.1 Implementation Concept

The following principles will be adopted for the construction work under the Project in the case of the Project's implementation with grant aid cooperation provided by the Government of Japan.

(1) Thorough consultations must be held between the Government of Seychelles, the Ministry of Agriculture and Marine Resources, the SFA and other government bodies on the Seychelles side and the Japanese Consultant and Contractor so that both sides fully understand the intentions of each side to ensure the smooth implementation of the Project.

(2) Anse Royale, the planned construction site of the new ice-making plant, is located in the southeastern part of Mahe Island. As the population of Seychelles is as small as some 80,000, including those living on remote islands, there is a lack of engineers in virtually all technical fields. In addition, there is a shortage of goods caused by the stringent foreign exchange situation, making the procurement of construction materials in Seychelles extremely difficult. It will, therefore, be necessary to procure the main equipment and materials required for the construction of the planned ice-making plant, which incorporates ice-making machines, etc., in Japan. Such core staff members as engineers will also be dispatched from Japan to provide technical guidance for the local workforce. Careful attention should be paid to the preparation of an efficient operation plan for the construction machinery and skilled workers, etc. so that the facilities in question can be completed in accordance with the plan and with the required quality.

(3) In view of the fact that the road between Victoria, the capital, and the construction site has many curves and steep slopes, it will be necessary for the transportation plan for the construction equipment and materials to depend on 20-feet containers and trucks. Moreover, there is currently no secured storage yard for such equipment and materials at the site and the introduction of security measures will be necessary to prevent theft.

(4) An efficient operation plan must be prepared for the construction machinery and skilled workers to ensure the smooth progress of the construction work in view of the high costs of accommodation and food. Even though the planned construction work under the Project is not expected to produce excessive noise, the introduction of noise-reduction measures should be considered to keep any adverse impacts of noise in the neighboring area at a minimum level.

(5) Special attention should be paid to the following points to ensure proper quality control.

1) Prevention of Salt Damage

As the planned construction site is prone to salt damage, salt-resistant construction materials should be procured as much as possible. In addition to its careful selection, the main equipment should undergo full anti-rusting treatment. Careful attention should be paid to the storage and curing of the materials and equipment during the construction period, particularly to the prevention of salt damage.

2) Quality Control of Concrete for Foundations

In regard to the concrete to be used for the foundations, locally procured sand and gravel, etc. will be used and proper attention should be paid to the quality of the cement. Prior to the concrete placing work, sampling tests should be conducted at the construction materials inspection site in Seychelles.

3) Quality Control and Performance Testing of Equipment

Such equipment as the ice-making machines, refrigerator and generator should undergo strict inspection at the manufacturing stage as well as performance testing after their completion. In regard to the performance inspection of the ice-making machines, test operation should be conducted under the local temperature conditions to check that ice can be efficiently produced. The installation of the planned ice-making machines at the site should be witnessed by the on-site supervisor. The completion inspection as well as the performance test should be conducted by an expert engineer who will then hand the equipment over to the Seychelles side and convey the points to be noted for their operation to Seychelles engineers.

4) Procurement of Construction Materials and Main Equipment

The materials for the foundation work should be procured locally where possible and locally established construction methods should be used.

(6) The prospect of procuring the fishing boats, fishing gear and safety equipment, etc. in Japan or from a third country should be examined while making every effort to procure equipment of reliable quality, taking the ease of spare parts procurement and the availability of after-services into consideration.

### 3.1.2 Implementation Conditions

The important components of the ice-making plant construction work under the Project will be the construction of a protective building and the assembly as well as installation of the ice-making plant. Although ice-making facilities have been constructed in Seychelles in the past with Japanese aid, there is no local engineer who can single-handedly supervise the construction of such a facility, making the dispatch of a technical adviser from Japan or a neighbouring country necessary to cooperate with the subcontractor for the successful completion of the construction work.

Because of the stringent foreign currency situation, the materials available in the local market are limited. Materials which are available in Seychelles (sand, gravel, cement and form materials, etc.) will be procured at appropriate times in accordance with the construction schedule and particularly careful attention will be paid to those items which are critical vis-a-vis the construction schedule.

### 3.1.3 Scope of Works

The scope of works between the Japanese side and the Seychelles side for the Project is described in **Table 3-1-1**.

**Table 3-1-1 Scope of Works born by both Governments**

| Description of the Work | Japan | Seychelles |
|---|---|---|
| 1. Provision of land and ground clearance | | O |
| 2. Construction work (ice-making plant) | O | |
| 3. Customs clearance procedure<br>(1) Transportation to Seychelles and subsequent road transportation<br>(2) Tax exemption and customs clearance | O | <br><br>O |
| 4. Payment of commission for banking arrangements (B/A) to a foreign exchange bank in Japan | | O |
| 5. Provision of all conveniences for Japanese nationals working for the Project in Seychelles in terms of their entry to and stay therein | | O |
| 6. Appropriate and efficient management and operation of the facilities and equipment provided by the grant aid | | O |
| 7. Payment of the costs of the construction of facilities and transportation and installation of furniture and equipment not included in the scope of the grant aid | | O |
| 8. All necessary applications for permits and approval regarding the construction work | | O |
| 9. Exemption of the materials and services used by the Contractor for the Project from all domestic taxes, including local taxes | | O |

### 3.1.4 Consultant Supervision

The basic principles and points to note for the supervisory work under the Project are explained below.

(1) For the smooth progress of the construction work for the ice-making plant, the Consultant should closely liaise with the SFA in regard to the work progress. In particular, the provision of land and ground clearance are closely related to the work to be conducted by the Japanese side and their schedule and details should be discussed in advance by both sides.

(2) Prior to the commencement of the construction work, the construction plan and working drawings submitted by the Contractor should be checked in advance to confirm the appropriateness of the temporary work plan, schedule plan, quality control plan and planned construction method, etc.

(3) At the time of the handing over of the facilities after completion, inspection should be conducted to confirm that the completed work meets the design specifications. In the case of any modification being required, the Consultant will issue the appropriate instructions.

(4) The Consultant should dispatch a supervisor to the site to supervise the construction work and equipment installation.

### 3.1.5 Procurement Plan

The construction materials available locally are limited to such basic materials as sand, gravel and cement, etc. Because of the foreign exchange situation, a stable supply of reinforcing bars, construction steel, electrical materials and plumbing materials, etc. in Seychelles cannot be anticipated. Those items which cannot be locally procured due to inferior quality or shortage of stock will, therefore, be procured in Japan or a third country and will be transported to Seychelles by sea.

Except for special machinery, construction machinery can be procured in Seychelles. Procurement in Japan or from a third country will be considered in the case of fishing boats, fishing gear and safety equipment, etc., the procurement of which in Seychelles is difficult.

**Table 3-1-2 Procurement List**

| Item | Procurement Source |
|---|---|
| (1) Construction Machinery | |
| - General Construction Machinery | Seychelles, |
| (2) General Construction Materials | Seychelles, Japan or Third Country |
| (3) Machinery | |
| - Ice-Making Plant | Japan |
| - Refrigerator | Japan |
| - Generator | Japan |
| (4) Equipment | |
| - Small Fishing Boats | Japan |
| - Navigational Leading Lights | Japan |
| - Hydraulic Benders | Japan |
| - Outboard/Inboard Engines, Fishing Gear | Japan |

### 3.1.6 Implementation Schedule

If the decision is made to implement the Project under the grant aid cooperation scheme of the Government of Japan, the work will commence after the preparation of the tender documents by the Consultant following the signing of the E/N by the two governments for the implementation of the Project, tender for construction work and equipment installation work and the contract with the Contractor. The project implementation schedule will following the process described below.

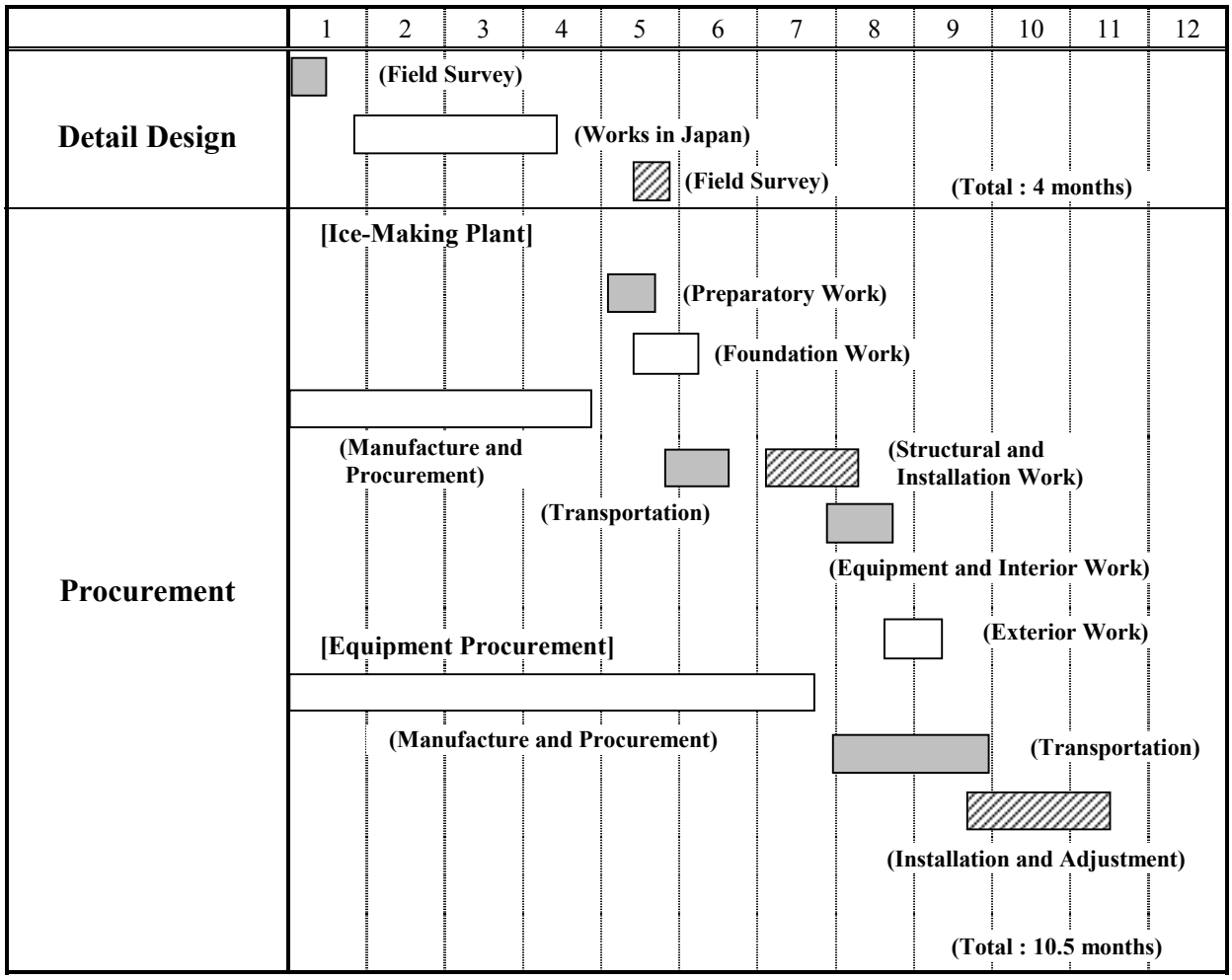
**(1) Detailed Design works**

Based on the present Basic Design Study Report, the Consultant will conduct the detailed design and prepare the tender documents for the selection of the Contractor. The required time for this work is expected to be approximately two months.

**(2) Bidding works**

Following the completion of the detailed design, a public invitation will be issued in regard to the tender for the planned construction work and equipment procurement under the Project and the eligible tenderers will be decided. The project implementation organization will then invite all tenderers to conduct the tender which shall be witnessed by representatives of the other organizations related to the Project. It is expected to take approximately two months from the public announcement to the signing of the contractor agreement.

**Table 3-1-3 Implementation Schedule**



### 3.1.7 Obligations of the Recipient Country

The Seychelles side will be required to undertake the following work as part of the planned construction work. The ground clearance must be completed prior to the commencement of the building work. The construction of the ice-making plant and equipment procurement will be conducted by the Japanese side.

(1) Securing of the necessary land (site)
(2) Cutting of palms and other trees on the site (obtaining of a cutting permit)
(3) Ground clearance
(4) Supply of power (including power for the construction work) to the site
(5) Laying of an incoming pipe to the site for ice-making water
(6) Securing of an access road to the site

## 3.2 Operation and Maintenance Plan

### 3.2.1 Operation Policy

The prospective utilization of the planned facilities and equipment under the Project can be classified into three categories, i.e. for sale, for entrusted operation and for the SFA's own operation.

**Table 3-2-1 Outline of Operation Plan**

| Operation Plan | Facility/Equipment | Maintenance |
|---|---|---|
| 1. Entrusted Operation | - Ice-making plant | While the SFA will retain ownership, operation of the plant will be entrusted to an outsider |
| 2. SFA's Own Operation | - Equipment and materials for fisheries promotion<br>- Hydraulic benders | These will be operated and controlled within the SFA |
| 3. Sale | - Fishing gear and auxiliary items for fishing activities<br>- Marine engines<br>- Safety equipment<br>- Radio equipment and navigational instruments, etc.<br>- 13.5m type longline fishing boats and 10m type small fishing boats | These will be sold to fishermen and other beneficiaries and the proceeds will be accumulated to build up the counterpart fund |

The management system for each of the above categories are described below.

**(1) Entrusted Operation**

The operation of the ice-making plant will be entrusted to a fisherman or a group of fishermen who makes the successful bid after trial operation for 2 - 3 months. The entrustment contract must specify such auxiliary conditions as the sales price of ice and the period of entrustment and these conditions must be strictly complied with. The entrusted manager of the plant will pay an agreed fee to the SFA, the plant owner, to run the plant. The contract period will be flexible and may be as short as 2 years to ensure a good service for coastal fishermen although the existing contract period for a similar facility at Anse a La Mouche is 5 years. The manager will be responsible for the maintenance of the plant. The tentatively estimated operation and maintenance cost of the plant (daily ice-making capacity of 5 tons using two 2.5 tons/day ice-making machines; only one machine will be operated during the off season) is as follows.

**Table 3-2-2 Estimated Operation and Maintenance Cost of Ice-Making Plant**

| Income (A) | | Expenses (B) | |
|---|---|---|---|
| Item | Amount | Item | Amount |
| Income from Ice Sales:<br>1,540 tons×1,000×0.9×SR 13/50kg | 360,260 | Personnel Cost:<br>2×SR 3,000×12 months | 72,000 |
| Breakdown:<br>2.5t×7×(52 + 36) =1,540 tons | | Electricity Cost:<br>(20kW × 20hrs × 7 days × 52 weeks) + (20kW×20hrs×7 days×36 weeks)×SR 0.95kW | 209,440 |
| | | Water Cost:<br>100 × SR 9.3 × 12 months + 105 × SR 13.16×12 months | 27,741 |
| | | Maintenance Cost:<br>SR 3,000×12 | 36,000 |
| Total | 360,360 | Total | 315,181 |

The profit from the annual operation of the ice-making plant will be SR 45,179/year (SR 360,360 - SR 315,181).

**(2) Management by SFA**

The equipment and materials for fisheries promotion and the hydraulic benders will be managed by the SFA.

### (3) Items for Sale

The management system for the items to be sold is shown in **Table 3-2-3**.

**Table 3-2-3 Sales Agents and Sales Methods**

| Subject Item for Sale | Sales Agent | Sales Method |
|---|---|---|
| 1. Fishing Gear and Auxiliary Items for Fishing Activities | IOM (Indian Ocean Marine) | Counter sales |
| 2. Marine Engines | " | " |
| 3. Safety Equipment | " | " |
| 4. Radio and Navigational Instruments, etc. | SEYCMI (Seychelles Electronic Maritime) | " |
| 5. 13.5m Type Long line fishing boats and 10m Type Small Fishing Boats | SFA | Tender |

1) Fishing Gear, Auxiliary Items for Fishing Activities, Marine Engines, Safety Equipment, Radios and Navigational Instruments

Among the various types of equipment to be sold, fishing gear, auxiliary items for fishing activities, marine engines, safety equipment, radios and navigational instruments will be sold by agents selected by the SFA as the SFA does not possess a suitable office to conduct such sale. These agents will be selected based on their capability of providing after-services, including equipment repair and the supply of spare parts.

2) 13.5m Type Longliners and 10m Type Small Fishing Boats

These 2 types of fishing boats will be sold by means of a tender organized by the SFA in a fair manner after their trial operation (experimental fishing) by the SFA for 1 - 2 years in the case of the 13.5m type longliners and 2 - 3 months in the case of the 10m type small fishing boats. The estimated operating income and expenses for the fishing boats during their trial operation period are shown in **Table 3-2-4**.

**Table 3-2-4 Estimated Operating Income and Expenses for Small Fishing Boats**

| Item | Unit | 10m Small Boat | 13.5m Longliner |
|---|---|---|---|
| A. Operating Expenses | | | |
| (1) Operating Cost (Annual) | | | |
| 1) Fuel cost (fuel cost × operating hours) | SR | 71,400 | 112,000 |
| 2) Lubricant oil (1) × 0.4% | SR | 2,856 | 4,480 |
| 3) Fishing gear (cost of fishing gear x operating days) | SR | 11,200 | 16,800 |
| 4) Ice (cost of ice × operating days) | SR | 15,040 | 18,200 |
| 5) Bait (cost of bait × operating days) | SR | 1,400 | 2,100 |
| **Operating Cost Total** | **SR** | **101,896** | **153,580** |
| (2) Fixed Cost | | | |
| 1) Depreciation cost (10 year depreciation) | SR | 109,000 | 300,000 |
| 2) Insurance premiums (rate: 0.035%) | SR | 4,000 | 10,500 |
| 3) General insurance premiums | SR | 3,500 | 3,500 |
| 4) Maintenance cost (HP × 100 SR/HP) | SR | 7,500 | 18,500 |
| **Fixed Cost Total** | **SR** | **124,000** | **332,500** |
| **Grand Total for Operating Cost** | **SR** | **225,896** | **486,080** |
| B. Turnover of Catch (Annual) | | | |
| Catch (Annual) | kg | 70,000 | 126,000 |
| Turnover (Annual) | SR | 420,000 | 756,000 |
| C. Turnover-Expenses (C = B - A) | SR | 194,104 | 269,000 |
| D. Personnel Cost of Crew (SR 3,000/month/person) | SR | 144,000 | 216,000 |
| E. Profit per Boat (Annual) (E = C - D) | SR | 50,104 | 53,920 |

(SR: US$ 1 = SR 5.58 = ¥107.91; SR1 = ¥19.34)

< Estimation Conditions >

- Fuel consumption per HP : 0.17kg/hour
- Operating days per year : 140 days (140 days - 200 days)
- Fuel cost : SR 5/litre
- Cost of bait : 2% (0.5 - 2%)
- Fish price : SR 6/kg (SR 6 - 12/kg)

* Although the catch and fish price may fluctuate, these conditions can compensate for any decline of the catch or fish price by increasing the number of operating days a year.

While the crew members during trial operation will be secured by the SFA, the provision of technical assistance by a Japanese expert should help to perfect the project management system.

In the case of the equipment to be sold, as the purchasers will be responsible for the maintenance of the equipment, the responsibility of the SFA will be fair control of the sales agents and the management and operation of the accumulated counterpart fund built up from the proceedings of equipment sales.

### 3.2.2 Counterpart Fund Utilization Plan

The counterpart fund will be accumulated in the Coastal Fisheries Development Fund of the Seychelles' Ministry of Finance and will be utilised for various sub-projects designed to promote coastal and offshore fisheries. The fund flow is outlined as follows.

1. Proposal of a specific purpose of use by the SFA
2. Ministry of Finance of the Government of Seychelles
3. Approval of the proposed purpose of use by the relevant Council of the Ministry of Finance
4. Consultation for the use of the counterpart fund for the approved purpose of use by the Government of Seychelles (via the SFA) to the Government of Japan
5. Approval of the purpose of use by the Government of Japan
6. Formulation of a sub-project implementation plan by the SFA
7. Tender for the sub-project
8. Implementation contract for the sub-project
9. Implementation of the sub-project
10. Auditing of the sub-project by the Seychelles' Ministry of Finance
11. Reporting of the implementation results to the Government of Japan

The main components of the counterpart fund utilisation plan at present are listed below.

(1) Implementation of sub-projects for fisheries extension

(2) Financial assistance for the Maritime School (student training, purchase of fishing gear and books and scholarships, etc.)

(3) Development and introduction of new fishing gear, new fishing methods and new fishing grounds (new businesses, including fish culture)

(4) Original fund for procurement and sale of fishing gear and equipment after the Project

(5) Consolidation of marine resources surveys and statistical surveys on fisheries

# Chapter 4

# Project Evaluation and Recommendation

# Chapter 4. Project Evaluation and Recommendations

## 4.1 Project Effects

The Government of Seychelles, identifying the fishing industry as one of the most important sectors together with tourism and agriculture, has implemented various fisheries development projects with the assistance of Japan and other international organizations. As a result, the fishing industry has grown to become the important industry next to tourism, contributing greatly to the development of the national welfare in such aspects as nutrition of the nation, domestic employment, and foreign exchange earning through export. The coastal fishery, providing nearly 90% of domestic fish demand which consumes fish of 65kg per capita a year, is playing an important role to meet the domestic fish requirements. Its development objectives are (i) sustainable utilization of resources, (ii) stable growth of national fishing fleet, and (iii) safety of fishing operation at sea. But the coastal fishery is now at an early stage of development and numerous obstacles peculiar to the small island country are hampering its further development. In particular, delayed modernization of production measures such as fishing boat and fishing gear has caused a stagnation of the conversion to offshore fisheries, and reduction of fishing pressure on coastal resources has not made progress as planned. As a result, the size of fish caught in coastal waters became smaller and the production was reduced. Also a short supply of ice at Mahe Island is causing problems of a decline of freshness of fish and fish products and increasing post-harvest loss. The policy to encourage offshore fishing has intensified the concern of fishermen and their families over increasing accidents at sea because of the slow development of appropriate type of fishing boat and inadequate improvement of many reef passages around Mahe Island due to difficult financial situation. Safety at sea is a critical issue to be urgently resolved towards the full-scale operation at offshore fishing grounds.

Under these conditions, the provision of an ice making plant, small fishing boats, fishing equipment and materials by the Project will produce the following effects, contributing greatly to the development of the coastal fishery.

**(1) Direct Effects**

1) Improvement of ice supply situation

Anse Royale, the second largest city in Seychelles, has no ice storage facility as well

as ice making plant despite of the center of fishing activities in the eastern region of Mahe Island. Fishermen here must to travel by truck to Victoria, 20km north, to buy ice every fishing day. The installation of an ice plant here makes it possible to save hours and fuel cost to travel to Victoria and to prevent melting loss of ice during transportation, resulting in a significant improvement of ice supply situation, which will benefit greatly local fishermen.

2) Contribution to sustainable utilization of resources

It became to be necessary to shift fishing activities to offshore fishing ground due to fears for a depletion of coastal resources around Mahe Island. The introduction of small longliners of the Project will allow coastal fishermen to catch highly migratory species offshore, to which fisheries they previously could not access systematically, and also will contribute to the development of fishing gear and fishing methods, fostering competent fishermen, diffusion of fishing technique, and sustainable utilization of fishing resources.

3) Improvement of fishermen's income

Similar to the introduction of longliners, the introduction of 10m type fishing boats, which have been introduced in 1995 with a view to developing an appropriate type of fishing vessel, and their diffusion will permit multi-purpose operation including hook and line fishing, trap fishing, vertical long lining, and trolling on offshore grounds, which will contribute to improve income of coastal fishermen through better utilization of offshore resources.

4) Secured safety operation and navigation

Some concern are expressed over an increase of accident at sea caused by misconception such as running aground or capsize around reef passages owing to increasing night operations and movements at night or early morning by shifting the policy to offshore fishing. The installation of light buoys will contribute to security of safe fishing operation and navigation.

5) Contribution to the development of fishing gear

The workshop of SFA has made anchors for coastal fishermen and metal frames for towing test, but its bending machine was broken down and not repairable. The provision of new machine of the Project makes resumption of function of the workshop possible and

will contribute to the development of fishing gear.

6) Promotion of inboard engine-driven fishing boat

The provision of marine diesel engines to coastal fishermen by the Project will promote the progress of the SFA program regarding building and rehabilitation of small coastal fishing boats, which will contribute to safety at sea with the number of boats equipped with inboard engine increasing.

7) Improvement of safety of fishing boat

The supply of safety equipment and radio equipment for small fishing boats will improve the situation of law enforcement after establishment of the Standard of Safety Equipment for fishing vessel. Also it will be useful for prevention of disaster at sea, improvement of inspection system conforming to the Standard of Safety Equipment, and initiation of a supplying system of safety equipment.

**(2) Indirect Effects**

1) Utilization of the Counterpart Fund System

The proceeds of sales of the fishing boats, fishing gear and other equipment and materials procured by the Project will be transferred to the Counterpart Fund System to be later used for the development of coastal fisheries and local communities including fishing villages.

2) Effective utilization of resources

The Project is ranked highly in the development programs of Seychelles as one of coastal fisheries development projects. It will contribute to keeping the present catch level, preservation of resources, and effective utilization of resources within a range of optimal catch based on environmental consideration, and also an increase of export of fish and fish products with high quality to Europe and neighboring countries.

3) Correction of regional differences

The installation of an ice plant at the eastern region of Mahe Island will not only provide the availability of ice in the region but also improve the ice supplying condition in the whole Island, and will be useful for correction of regional differences in fisheries supporting facilities.

4) Promotion of consumption of fresh fish and fish products

As for distribution, the Project will make it possible to supply fresh fish protein more and cheaper to consumers through improvement of quality of fish by increasing usage of ice and significant reduction of deterioration loss by securing low-temperature transportation.

5) Collection of data and promotion of training

SFA intends to operate small longliners and small fishing boats of the Project to collect and analyze data for fisheries development for one or two years before selling them to local fishermen. Thus SFA will be able to train students of the Maritime Training Center and coastal fishermen on board these vessels, taking advantage of this period.

In view of the expected effects above, it is judged that the Project to procure fishing equipment and materials including a ice plant, fishing boats, and fishing gear is appropriate and meaningful as a grant aid project.

## 4.2 Recommendation

In order to achieve the objectives of sustainable and effective utilization of fishing resources through the efficient utilization of the facility, equipment and materials after the Project was completed, the Government of Seychelles has to cope with the followings.

**(1) Preparation for renewal of equipment and materials**

Since its incorporation, SFA has formulated the fisheries development program aiming at the development of the country's fishing resources and implemented various projects to achieve the objectives. In this process, the coastal development projects financed by Japan have been conducted in 1986 as the first and in 1994/95 as the second, with success. The Project therefore is the 3rd one for the development of coastal fisheries in Seychelles. With the past two aid projects, a practical use of local resources including manpower, materials, and money through self-reliance effort is now under way, which is producing a result gradually. The Project has to intensify and extend more and more the fishing activities with on this spirit of self-reliance. For this purpose, the equipment and materials of the Project have to be delivered promptly to beneficiaries, that is, coastal fishermen, without delay, so

that they may use them effectively and efficiently, and then the profits have to be accumulated for the future renewal of equipment and materials.

**(2) Counterpart Fund**

In accordance with the grant aid scheme of Japan, the Government of Seychelles has to accumulate a counterpart fund equivalent to 100% of the FOB price of the equipment and materials to be sold to fishermen within four years after Exchange of Notes (E/N). Among them, since fishing gear and other materials are generally cheaper than market price and have a great demand, purchase by fishermen and accumulation of counterpart fund will have no trouble. However, rather expensive equipment and materials, that is, the small longliners and the 10 m type small fishing boats, are to be used by SFA for a certain period, one to two years or several months, before selling them to fishermen through tendering. Hence the selling price may be less than the FOB price and the Government has to make up for the balance by any special budget. In case of failure in recovery of proceeds of sales within 4 years after E/N owing to an unforeseen reason, the Government has to take the same step too. The development and diffusion of small fishing boats, which have a great economic effect, are very important for the future of coastal fisheries. The Government is required to have a full understanding of expected budget and take all necessary steps to cope with this matter.

**(3) Lease Agreement of the Ice Plant**

The ice making plant is to be leased to a fishermen or a group of fishermen through tendering after a test run for 2-3 months. The lease agreement has to be reviewed periodically about the price of ice, the period of lease, and so on to avoid disadvantage for fishermen.

**(4) Securing of Cost of Trial Operation**

All the small fishing boats are to be sold to coastal fishermen eventually, but the small longliners are to be used by SFA for one or two years before selling for developmental purposes. During this period, SFA intends to collect data on the performance of the vessel, fishing capacity, accommodation efficiency, and so on for the technical guidance and diffusion of longline fishing after delivery to the private sector, which is appreciated as a very effective measure. At present SFA is operating a research vessel for fisheries training and resources research, hence additional cost for this new vessels must be considered.

# Appendices

## Appendices-1 Member List of the Survey Team

**(1) Basic Design Study**

| | | |
|---|---|---|
| 1. Takeshi NARUSE | Leader | Deputy Resident Representative JICA Kenya Office, JICA |
| 2. Tatsushi MATSUO | Technical Advisor | Office of Overseas Fisheries Cooperation, Fisheries Agency, Japan |
| 3. Takashi TOYAMA | Project Coordinator | Follow-up Division, Department of Regional I, JICA |
| 4. Mamoru KONDO | Project Manager Fisheries Development Planning | CRC Overseas Cooperation Inc. |
| 5. Kunio YONEI | Fishery Facility and Equipment Planning | CRC Overseas Cooperation Inc. |
| 6. Shoji SHIZUKA | Fishery Management Planning | CRC Overseas Cooperation Inc. |
| 7. Satoshi NAGASHIMA | Construction Planning, Cost Estimation | CRC Overseas Cooperation Inc. |

**(2) Consultation on Draft Report**

| | | |
|---|---|---|
| 1. Takeshi NARUSE | Leader | Deputy Resident Representative JICA Kenya Office, JICA |
| 2. Tatsushi MATSUO | Technical Advisor | Office of Overseas Fisheries Cooperation, Fisheries Agency, Japan |
| 3. Mamoru KONDO | Project Manager Fisheries Development Planning | CRC Overseas Cooperation Inc. |
| 4. Kunio YONEI | Fishery Facility and Equipment Planning | CRC Overseas Cooperation Inc. |

# Appendices 2　Survey Schedule

## (1) Basic Design Study

| No. | Date | | Activities | Accommodation |
|---|---|---|---|---|
| 1 | 5/23 | Tue. | (*,A,B) Narita (NH201 11:20) → London (15:40) → (BA2069 22:15)<br>(A,B) Narita (JL401 12:00) → London (16:45) → (KQ101 20:00) | In Air |
| 2 | 24 | Wed. | (*,A,B) London → Nairobi (8:40)<br>(A,B) London → Nairobi (6:40)<br>(*,A,B) Courtesy call on the Embassy of Japan in Nairobi and JICA Kenya Office<br>(C,D) Narita (AF275 12:05)→ Paris (17:10) → (AF3862 19:30) | Nairobi / In Air |
| 3 | 25 | Thu. | (C,D) Paris → Seychelles (7:15)<br>(*,A,B) Nairobi (BA2069 10:30) → Seychelles (14:40) | Beau Vallon |
| 4 | 26 | Fri. | 14:00 Courtesy call on the Ministry of Agriculture and Marine Resources<br>15:30 Discussion with the Seychelles Fishing Authority | Beau Vallon |
| 5 | 27 | Sat. | 9:00-14:00 Inspection of the Fishery Survey of the Research Boat | Beau Vallon |
| 6 | 28 | Sun. | 9:00-16:00 Inland Survey (Anse Royale, Anse à La Mouche, Bel Ombre) | Beau Vallon |
| 7 | 29 | Mon. | 10:00 Courtesy call on the Ministry of Foreign Affairs<br>11:00 Discussion with the Seychelles Fishing Authority (on Inception Report, Explanation, Objective of the Survey, Schedule, Explanation of the System of the Japan's Grant Aid Scheme, Explanation of the Questionnaire and its Answer)<br>15:00 Discussion of the Agent | Beau Vallon |
| 8 | 30 | Tue. | 9:00 Inspection of the Ice-making Plant in Anse à la Mouche<br>10:00 Discussion at the Anse Royale Public Office<br>11:00 Site Survey of the Ice-making Plant<br>13:00 Discussion with the Seychelles Fishing Authority | Beau Vallon |
| 9 | 31 | Wed. | 9:00 Discussion with the Seychelles Fishing Authority | Beau Vallon |
| 10 | 6/1 | Thu. | 9:00 Courtesy call on the Minister of the Ministry of Agriculture and Marine Resources<br>10:00 Signing of Minutes of Discussion<br>(*) Seychelles (BA2068 18:55) → Nairobi (20:50) | Beau Vallon |
| 11 | 2 | Fri. | 10:30 Collection of Data<br>13:00 Confirmation of the Requested Equipments<br>(*) Report on the Survey to the Embassy of Japan in Nairobi<br>(*) Nairobi (BA2068 22:15) → | Anse Royale |
| 12 | 3 | Sat. | 5:00 Survey of the Catch<br>5:45 Inspection of the Market<br>13:00 Survey on the Infrastructure around the Site | Anse Royale |
| 13 | 4 | Sun. | 9:00 Inland Fishery Survey (Anse Royale, Takamaka, Grande Anse, Port Glaud)<br>13:30 Survey of Waterway in Anse aux Pins | Anse Royale |
| 14 | 5 | Mon. | 9:00 Inland Fishery Survey (Anse à la Mouche, Bel Ombre, Beau Vallon, Glacis)<br>13:00 Site Survey | Anse Royale |
| 15 | 6 | Tue. | 9:00 Discussion at Anse Royale Public Office<br>10:00 Natural Condition Survey (Topographical Survey I)<br>Collection of Data and Discussion on the Management and Maintenance Plan | Anse Royale |
| 16 | 7 | Wed. | 9:00 Natural Condition Survey (Topographical Survey II, Plate Loading Test I)<br>Collection of Data and Discussion on the Management and Maintenance Plan | Anse Royale |
| 17 | 8 | Thu. | 9:00 Distribute Questionnaire to the Construction Company<br>13:00 Collection of Data and Discussion on the Requested Contents<br>Request for Procurement Estimation | Anse Royale |
| 18 | 9 | Fri. | 9:00 Distribute Questionnaire to the Construction Company<br>13:00 Collection of Data and Discussion on the Requested Contents<br>Hearing from Fishermen<br>Request for Procurement Estimation | Anse Royale |

| No. | Date | | Activities | Accomodation |
|---|---|---|---|---|
| 19 | 10 | Sat. | 5:00 Survey of the Catch in Anse Royale<br>Hearing from Fishermen<br>13:00 Site Survey | Anse Royale |
| 20 | 11 | Sun. | 9:00 Inland Fishery Survey (Anse aux Pins, Bougainville, Anse Forbans)<br>13:00 Review of Data | Anse Royale |
| 21 | 12 | Mon. | 9:00 Distribute Questionnaire to the Ship Company<br>13:00 Discussion on Requested Contents | Anse Royale |
| 22 | 13 | Tue. | 9:00 Distribute Questionnaire to the Construction Company<br>11:00 Survey of the Infrastructure Condition (Electricity, Water Supply, etc.)<br>13:00 Discussion over Technical Specification | Anse Royale |
| 23 | 14 | Wed. | 9:00 Draft Discussion on Related Project<br>13:00 General Meeting | Anse Royale |
| 24 | 15 | Thu. | 9:00 Collect Questionnaire and Estimation<br>13:00 Collection of Data<br>(A, B) Seychelles (BA2068 18:55) → Nairobi (20:50) | Anse Royale |
| 25 | 16 | Fri. | (C, D) 9:00 Collect Questionnaire and Estimation<br>13:00 Collection of Data<br>(A, B) 11:00 Report the Result of the Survey to JICA Kenya Office<br>16:00 Report the Result of the Survey to Embassy of Japan in Nairobi | Anse Royale / Nairobi |
| 26 | 17 | Sat. | (C, D) Additional Survey<br>(A, B) Nairobi (KL4340 10:05) → Amsterdam (18:00) → (JL412 14:10) | Anse Royale / Nairobi |
| 27 | 18 | Sun. | (A, B) Narita (14:10)<br>(C, D) Seychelles (AF3863) → Paris (17:30) → (AF274 23:20) | |
| 28 | 19 | Mon. | (C, D) Narita (18:00) | |

* Official Team (A) Project Manager (B) Fishery Facility Planner (C) Management and Maintenance Planner
(D) Construction Planner/Cost Planner

## (2) Consultation on Draft Report

| No. | Date | | Activities | Accomodation |
|---|---|---|---|---|
| 1 | 8/21 | Mon. | Narita (BA008 13:05) → London (17:35) | London |
| 2 | 22 | Tue. | London (BA2069 22:15) → | In Air |
| 3 | 23 | Wed. | → Nairobi (8:40)<br>Courtesy Call to Embassy of Japan and JICA | Nairobi |
| 4 | 24 | Thu. | Nairobi (BA2069 10:30) → Seychelles (14:40)<br>Internal Meeting | Beau Vallon |
| 5 | 25 | Fri. | Courtesy Call to Government of Seychelles<br>Discussion with Seychelles Fishing Authority | Beau Vallon |
| 6 | 26 | Sat. | Site Survey | Beau Vallon |
| 7 | 27 | Sun. | Internal Meeting | Beau Vallon |
| 8 | 28 | Mon. | Discussion with Seychelles Fishing Authority<br>(*) Nairobi (BA2069 10:30) → Seychelles (14:40) | Beau Vallon |
| 9 | 29 | Tue. | Discussion with Seychelles Fishing Authority | Beau Vallon |
| 10 | 30 | Wed. | Discussion with Seychelles Fishing Authority | Beau Vallon |
| 11 | 31 | Thu. | Discussion and Signature on the Minutes<br>Seychelles (BA2068 18:55) → Nairobi (20:50) | Beau Vallon |
| 12 | 9/1 | Fri. | Report to Embassy of Japan an JICA<br>Nairobi (BA2068 22:15) | Nairobi |
| 13 | 2 | Sat. | → London (5:05) → (BA005 13:25) | |
| 14 | 3 | Sun. | → Narita (9:10) | |

**Appendices 3　List of Party Concerned in the Recipient Country**

| Organization and Title | Name |
|---|---|
| **Ministry of Agriculture and Marine Resources** | |
| Minister | Mr. Dolor S. Ernesta |
| Principal Secretary | Mr. Finley I. Racombo |
| **Ministry of Foreign Affairs** | |
| Director General International Relations | Mr. Terry Jones |
| **District Administration Anse Royale** | |
| Member of Parliament | Mr. Barry Faure |
| District Administrator | Mr. Benoit Julius |
| **Seychelles Fishing Authority** | |
| Managing Director | Mr. Philippe Michaud |
| Director Resource Management | Mr. Joel Nageon de Lestang |
| Fishing Port Manager | Mr. Clifford J. Toussaint |
| Assistant Fishing Port Manager | Mr. Jeff P.J. Lablache |
| Manager | Mr. Pierre Woodcock |
| Research Manager | M r. David Boulle |
| Research Section | Mr. Jerall Jelly |
| **The Seychelles Christian Seamen Association** | |
| Chairman | Mr. Philip Horeau |

## Appendices-4　Minutes of Discussion

# MINUTES OF DISCUSSIONS
# ON
# THE BASIC DESIGN STUDY
# ON
# THE PROJECT FOR COASTAL FISHERIES DEVELOPMENT
# IN
# THE REPUBLIC OF SEYCHELLES

In response to a request from the Government of the Republic of Seychelles(hereinafter referred to as "the Government of Seychelles"), the Government of Japan decided to conduct a Basic Design Study on the project for Coastal Fisheries Development (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to the Seychelles the basic design study team (hereinafter referred to as "the Team"), which is headed by Mr. Takeshi NARUSE, Deputy Resident Representative, JICA Kenya Office, and is scheduled to stay in the country from 25 May to 18 June, 2000.

The Team held discussions with the officials concerned of the Government of Seychelles and conducted a field survey at the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Victoria, 1 June, 2000

Mr. Takeshi NARUSE
Leader
Basic Design Study Team
JICA

Mr. Philippe MICHAUD
Managing Director
Seychelles Fishing Authority

Mr. Finley J. RACOMBO
Principal Secretary
Ministry of Agriculture and Marine Resources

ATTACHMENT

1. **Objective**

The objective of the Project is to supply appropriate equipment in order to achieve the following targets ;

(1) to improve, modernize and support the artisanal fishermen's activities in the field of coastal fishery

(2) to improve quality of the fish and to improve market value of the fish to be sold.

2. **Project Site**

The site of the Project is located at VICTORIA and ANSE ROYALE, Mahe Island shown in Annex-1.

3. **Responsible and Implementing Agency**

3-1. The Responsible Agency is the Ministry of Agriculture and Marine Resources.

3-2. The Implementing Agency is the Seychelles Fishing Authority (SFA).

4. **Items requested by the Government of Seychelles**

After discussions with the Team, the items described in Annex-2 were finally requested by Seychelles side. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. **Japan's Grant Aid System**

5-1. Seychelles side has understood the Japan's Grant Aid Scheme explained by the Team, as described in Annex-3.

5-2. Seychelles side will take the necessary measures, as described in Annex-4, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

6. **Counterpart Fund**

Seychelles side understood that in case of selling or lease-to-own arrangement for (procured components), the Government of Seychelles is obliged to open a bank account and deposit local currency equivalent to the FOB value of the procured equipment & materials within a period of 4 years from the date of the signing of the E/N (Exchange of Notes). The fund is called the "counterpart fund" and it is to be used for the purpose of fisheries development in the Republic of Seychelles.

7. **Schedule of the Study**

7-1. The consultants will proceed to further works in Seychelles until 17 June, 2000.

7-2. JICA will prepare the draft report in English and dispatch a mission in order to explain its contents around September, 2000.

7-3. In case of that the contents of the report is accepted in principle by the Government of Seychelles, JICA will complete the final report and send it to the Government of Seychelles by November, 2000.

8. **Other relevant issues**

8-1. The Seychelles side agrees to allocate the budget necessary to operate and properly maintain the equipment and facility provided under the Grant Aid for the Project.

8-2. The Seychelles side agrees that it will be responsible for the management, administration, financial and personnel matters, which are not covered by Japan's Grant Aid, for the Project. Moreover, the Seychelles side understands the system of "counterpart fund" and makes a definite promise to execute it by their own responsibility.

8-3. The Seychelles side explains the system of storing and selling the equipment procured under the Japan's Grant Aid as the following ways;

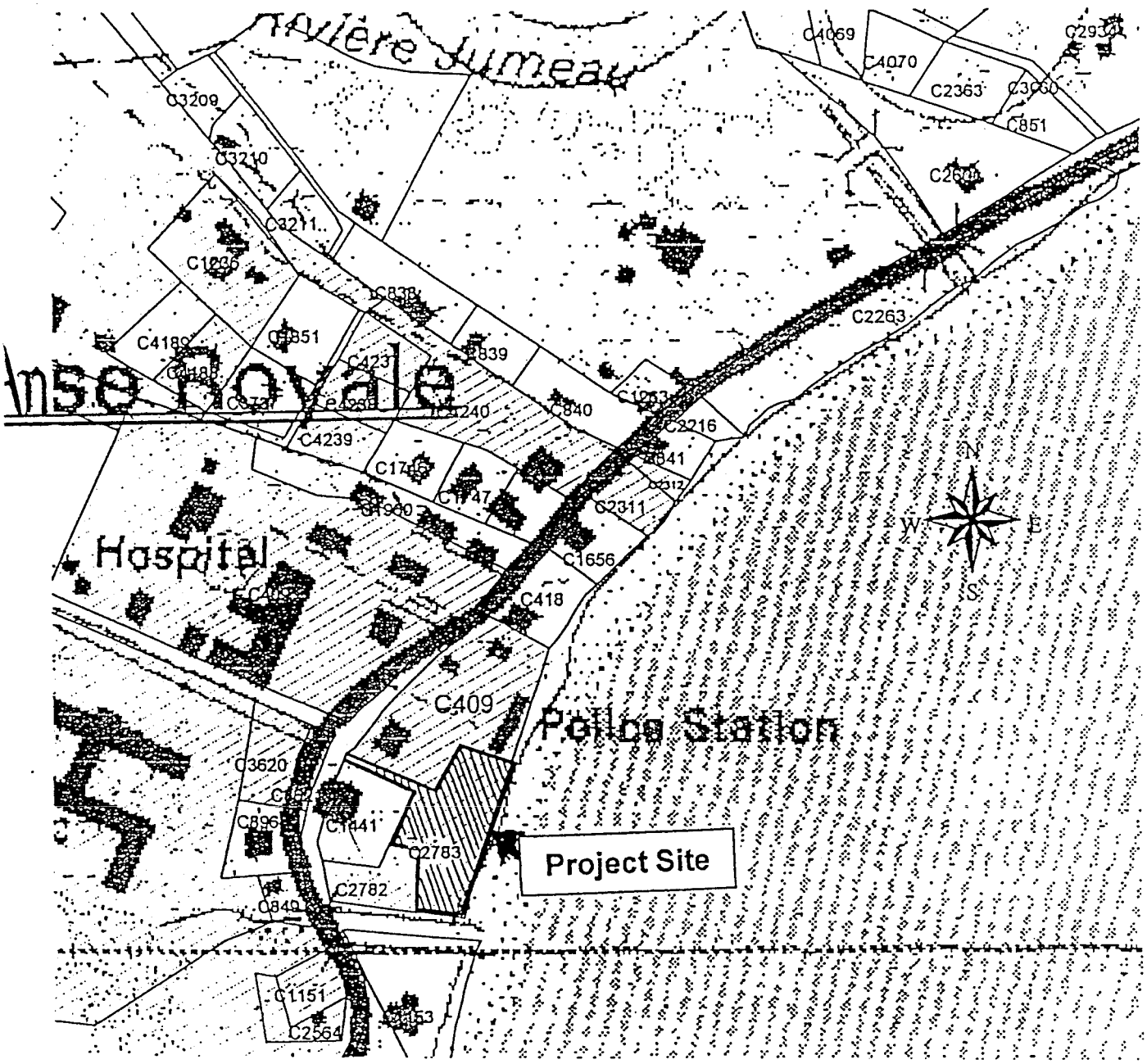
-Storing: SFA will undertake to store the equipment in SFA's warehouse.

-Selling: The equipment will be sold at the FOB price through the agents authorized by SFA

8-4. Both sides agree that the classification of the items to be sold, leased, or owned by SFA should be clarified during this Basic Design Study, and the consultant will bring its results to Japan.

8-5. SFA explains that it will own the ice plant. The day to day operation will be carried out by a private operator on condition set by SFA. These conditions would ensure that priority for ice will be given to artisanal fishermen.


MAHE ISLANDS MAP




ICE MAKING PLANT SITE

Annex-2

## Items requested by the Government of Seychelles

1. Ice making plant
2. Vehicle
3. Fishing boats
4. Navigational leading light
5. Hydraulic bender
6. Inboard & outboard engines, fishing equipment and fishing gear

# Japan's Grant Aid Program

## 1. Japan's Grant Aid Procedures

(1) The Japan's Grant Aid Program is executed by the following procedures.
**Application** (Request made by a recipient country)
**Study** (Preparatory Study / Basic Design Study conducted by JICA)
**Appraisal & Approval** (Appraisal by the Government of Japan and Approval by the Cabinet of Japan)
**Determination of Implementation** (Exchange of Notes between the both Governments)
**Implementation** (Implementation of the Project)

(2) Firstly, an application or a request for a project made by the recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to see whether or not it is suitable for Japan's Grand Aid. If the request is deemed suitable, the Government of Japan entrusts a study on the request to JICA (Japan International Cooperation Agency).

Secondly, JICA conducts the Study (Basic Design Study), using a Japanese consulting firm. If the background and objective of the requested project are not clear, a Preparatory Study is conducted prior to a Basic Design Study.

Thirdly, the Government of Japan appraises the Project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study Report prepared by JICA and the results are then submitted to the Cabinet for approval.

Fourthly, the Project approved by the Cabinet becomes official when pledged by the Exchange of Notes signed by the both Governments.

Finally, for the implementation of the Project, JICA assists the recipient country in preparing contracts and so on.

## 2. Contents of the Study

(1) Contents of the Study
The purpose of the Study (Preparatory Study/Basic Design Study) conducted on a project requested by JICA is to provide a basic document necessary for appraisal of the project by the Japanese Government. The contents of the Study are as follows:

a) to confirm background, objectives, benefits of the project and also institutional capacity of agencies concerned of the recipient country necessary for project implementation,
b) to evaluate appropriateness of the Project for the Grant Aid Scheme from a technical, social and economical point of view,
c) to confirm items agreed on by the both parties concerning a basic concept of the project,
d) to prepare a basic design of the project,
e) to estimate cost involved in the project.

Final project components are subject to approval by the Government of Japan and therefore may differ from an original request.

Implementing the project, the Government of Japan requests the recipient country to take necessary measures involved which are itemized on Exchange of Notes.

(2) Selecting (a) Consulting Firm(s)

For smooth implementation of the study, JICA uses (a) consulting firm(s) registered. JICA selects (a) firm(s) through proposals submitted by firms which are interested. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference made by JICA.

The consulting firm(s) used for the study is (are) recommended by JICA to a recipient country after Exchange of Notes, in order to maintain technical consistency.

(3) Status of a Preparatory Study in the Grant Aid Program

A Preparatory Study is conducted during the second step of a project formulation & preparation as mentioned above.

A result of the study will be utilized in Japan to decide if the Project is to be suitable for a Basic Design Study

Based on the result of the Basic Design Study, the Government would proceed to the stage of decision making process(appraisal and approval) .

It is important to notice that at the stage of Preparatory Study, no commitment is made by the Japanese side concerning the realization of the Project in the scheme of Grant Aid Program.

## 3. Japan's Grant Aid Scheme

(1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non reimbursable funds needed to procure facilities, equipment and services for economic and social development of the country under the following principles in accordance with relevant laws and regulations of Japan. The Grant Aid is not in a form of donation or such.

(2) Exchange of Notes (E/N)

The Japan's Grant Aid is extended in accordance with the Exchange of Notes by both Governments, in which the objectives of the Project, period of execution, conditions and amount of the Grant etc. are confirmed.

(3) "The period of the Grant Aid" means one Japanese fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedure such as Exchange of Notes, concluding a contract with (a) consulting firm(s) and (a) contractor(s) and a final payment to them must be completed.

(4) Under the Grant, in principle, products and services of origins of Japan or the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant may be used for the purchase of products or services of a third country origin.

However the prime contractors, namely, consulting, contractor and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means Japanese physical persons or Japanese juridical persons controlled by Japanese physical persons.)

(5) Necessity of the "Verification"

The Government of the recipient country or its designated authority will conclude into contracts in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. The "Verification" is deemed necessary to secure accountability to Japanese tax payers.

(6) Undertakings required to the Government of the recipient country

In the implementation of the Grant Aid, the recipient country is required to undertake necessary measures such as the following:

a) to secure land necessary for the sites of the project and to clear and level the land prior to commencement of the construction work,

b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,

c) to secure buildings prior to the installation work in case the Project is providing equipment,

d) to ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,

e) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,

f) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) Proper Use

The recipient country is required to maintain and use facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for their operation and maintenance as well as to bear all expenses other than those to be borne by the Grant Aid.

(8) Re-export

The products purchased under the Grant Aid shall not be re-exported from the recipient country.

(9) Banking Arrangement (B/A)

a) The Government of the recipient country or its designated authority shall open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by Government of the recipient country or its designated authority under the contracts verified.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay issued by the Government of the recipient country or its designated authority.

## Major Undertakings Required to the Government of Seychelles

1. To secure land,

2. To clear, level and reclaim the site when needed,

3. To construct gates and fences in and around the site,

4. To ensure access road to the site,

5. To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities in and around the site,

6. To bear the following commissions to a bank of Japan for the banking services based upon the B/A,
   1) Advising commission of A/P
   2) Payment commission

7. To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,

8. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the Government of Seychelles and stay therein for the performance of their work,

9. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Government of Seychelles with respect to the supply of the products and services under the verified contract,

10. To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid,

11. And to bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment.

# MINUTES OF DISCUSSIONS
# ON
# THE PROJECT
# FOR
# COASTAL FISHERIES DEVELOPMENT
# IN
# THE REPUBLIC OF SEYCHELLES

## (CONSULTATION ON DRAFT REPORT)

In May 2000, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study Team on the project for Coastal Fisheries Development (hereinafter referred to as "the Project") to the the Republic of Seychelles (hereinafter referred to as "Seychelles"), and through discussions, site surveys, and technical examination of the results in Japan, JICA prepared the draft report of the study.

In order to explain and to consult the Seychelles side on the components of the draft report, JICA sent to Seychelles the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Takeshi NARUSE, Deputy Resident Representative, JICA Kenya Office, from August 24 to August 31, 2000.

As a result of discussions, both sides have confirmed the main items described on the attached sheets.

Victoria, 30 August, 2000

Mr. Takeshi NARUSE
Leader
Draft Report Explanation Team
JICA

Mr. Philippe MICHAUD
Managing Director
Seychelles Fishing Authority
The Government of the Republic of Seychelles

## ATTACHMENT

1. Components of the Draft Report
The Government of Seychelles agrees and accepts in principal the components of the draft report explained by the Team.

2. Japan's Grant Aid System
Seychelles side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Seychelles as explained by the Team and described in Annex 3 and 4 of the Minutes of Discussions signed by both parties on June 1, 2000.

3. Schedule of the Study
JICA will complete the final report in accordance with the confirmed items and send it to the Government of Seychelles around November, 2000.

4. Other Relevant Issues

4-1. Seychelles side agreed to allocate enough budget to operate and maintain properly the Project.

4-2. Both sides agreed that Seychelles side was responsible for the management, administration, finance and personnel matters for the Project.

4-3. Seychelles side agreed that in case of selling or lease-to own arrangement for the procured equipment and materials, Seychelles side was obliged to open a bank account and deposit local currency equivalent to the FOB value of the procured equipment and materials within a period of 4 years from the date of the signing of the E/N (Exchange of Notes). Moreover, Seychelles side understood it is to be used for the purpose of social economic development including fisheries development in the Republic of Seychelles.

4-4. Seychelles side expressed the wish to sell the procured equipment and materials as described in ANNEX-1.

4-5. The Team required Seychelles side to utilize the procured equipment and materials for sale as described in ANNEX-1 for the purpose of fisheries development properly and effectively.

4-6. Both sides agreed that following matters are required to be executed by Seychelles side prior to the start of the building work on the Project site by Japanese side.

i) to carry out land clearance after removal of palms and other trees
ii) to supply of power and water,
iii) to secure an access road.



S

**ANNEX-1**
**PROJECT COMPONENTS FOR SALE**

Seychelles side expressed to sell the procured equipment and material as described in the list below.

**List of Project Components for Sale**

| Items | Specifications | Quantity for Sale |
|---|---|---|
| **Marine diesel engines** | Total 4 type (2～4 cylinder) | 60 units |
| **Safety equipment & Radios, etc** | | |
| (1) Safety & navigation equipment | L-buoys, L-jackets, Hand flare<br>Navigation equipment | 1 unit<br>1 unit |
| (2) SSB & VHF Radio sets | SSB Radio 150W<br>VHF Radio 15W | 10 sets<br>20 sets |
| (3) GPS | Liquid crystal display, 12/24VDC | 12 sets |
| (4) Fish finder | LCD, range approx. 320 m<br>CRT/LCD, range approx. 600 m | 20 sets<br>5 sets |
| (5) Waterproof flashlights | 6 batteries, Size A (R20) | 215 sets |
| **Small fishing boats** | | |
| (1) 13.5m Tuna long line fishing boats | FRP, Length 13～13.5m, Main engine 180～200PS, 5～6 persons,<br>Hydraulic reel for mono-filament 20 miles | 2 boats |
| (2) 10m small fishing boats | FRP, Total length 10.5m,<br>Main engine 75PS,<br>4 persons, Hydraulic reel | 3 boats |
| **Tuna long line fishing gear (including spare)** | For long line reel system with mono-filament mainline | 2 sets |
| **Trolling fishing gear** | Trolling gear | 1 set |
| **Drop line fishing gear** | Drop line gear | 1 set |
| **Other fishing gears** | Gill net, etc | 1 set |
| **Ice boxes** | FRP 160 litre<br>FRP 400 litre | 40 sets<br>30 sets |

## Appendices 5　Natural Condition Survey

### 5.1 Topographic Survey

The topographical survey was conducted to grasp the necessary land geographical features of the ice making plant in the project site in planning, designing and constructing.

| | |
|---|---|
| Survey site | : Expected ice making plant site (C2783). |
| Survey item. | : Height and form of the ground of the circumference area in which contains an ice making plant. |
| Way of surveying | : Plane table surveying and leveling (Contour interval 0.5m) |
| Scale | : 1/250 |
| Conducting company. | : CADD Survey |

**Client** : **CRC Overseas Cooperation Inc .**
**Survey Parcel No** : **C2783**
**Location** : **Anse Royale - Mahe**

## SURVEYOR'S REPORT

## 1.0 INTRODUCTION

Japan, under the Coastal Fisheries Development Project, has agreed to provide assistance to the Government of Seychelles for the construction of an ice plant at Anse Royale, Mahe .

Following discussions with the Government of Seychelles the latter agreed that the plant shall be located on parcel **C2783**, which has a beach front and is well situated to benefit the fishermen of that region .

The design process commenced with the signing of an Agreement between CRC Overseas Cooperation Inc. and Cadd Surveys on the 31st May 2000 .

A survey team was mobilised and plans and report were programmed to be completed by the 15th June '00 .

## 2.0) METHODOLOGY

The ice plant is to be located on parcel C2783 at Anse Royale . This parcel is defined by beacons and during a field verification four were located namely BU80, BU71 , BU78 and TC596 . The remaining beacons could not be located and are presumed to have been destroyed .

The survey datum adopted is as follows:

**Horizontal Datum** - Existing beacons demarcating property and which is based on the National Survey System (UTM Zone 40)

**Vertical Datum** - All elevations are relative to mean sea level and this was achieved by adopting National Survey Benchmark BM49 which has an elevation of 1.645m . This benchmark is located outside the project site, and it was necessary to transfer levels form the benchmark to the project site by levelling .

Contours have also been produced at an interval of 0.25m instead of 0.5m, due to the relative flatness of the site . As can be seen the land slopes towards the south with the northern portion being on average 1m higher .

## 3.0) SURVEY PLAN

Per requirements a survey plan of the project site has been drawn to a scale of **1/250,** with 5 copies attached for your records and reference .

Included with this report are the following :

- Extract cadastral lay-out at scale 1/2500 showing all the parcels in the Anse Royale region .
- Extract datum adopted f

A.Y.R. SAVY
Engineering Surveyor (BSc)

PRECISE LEVELLING PROJECT - BENCHMARK DESCRIPTION

Benchmark Reference Number

BM48

Situated

Anse Royale

1:10,000 Sheet No: 10

Approximate Coordinates

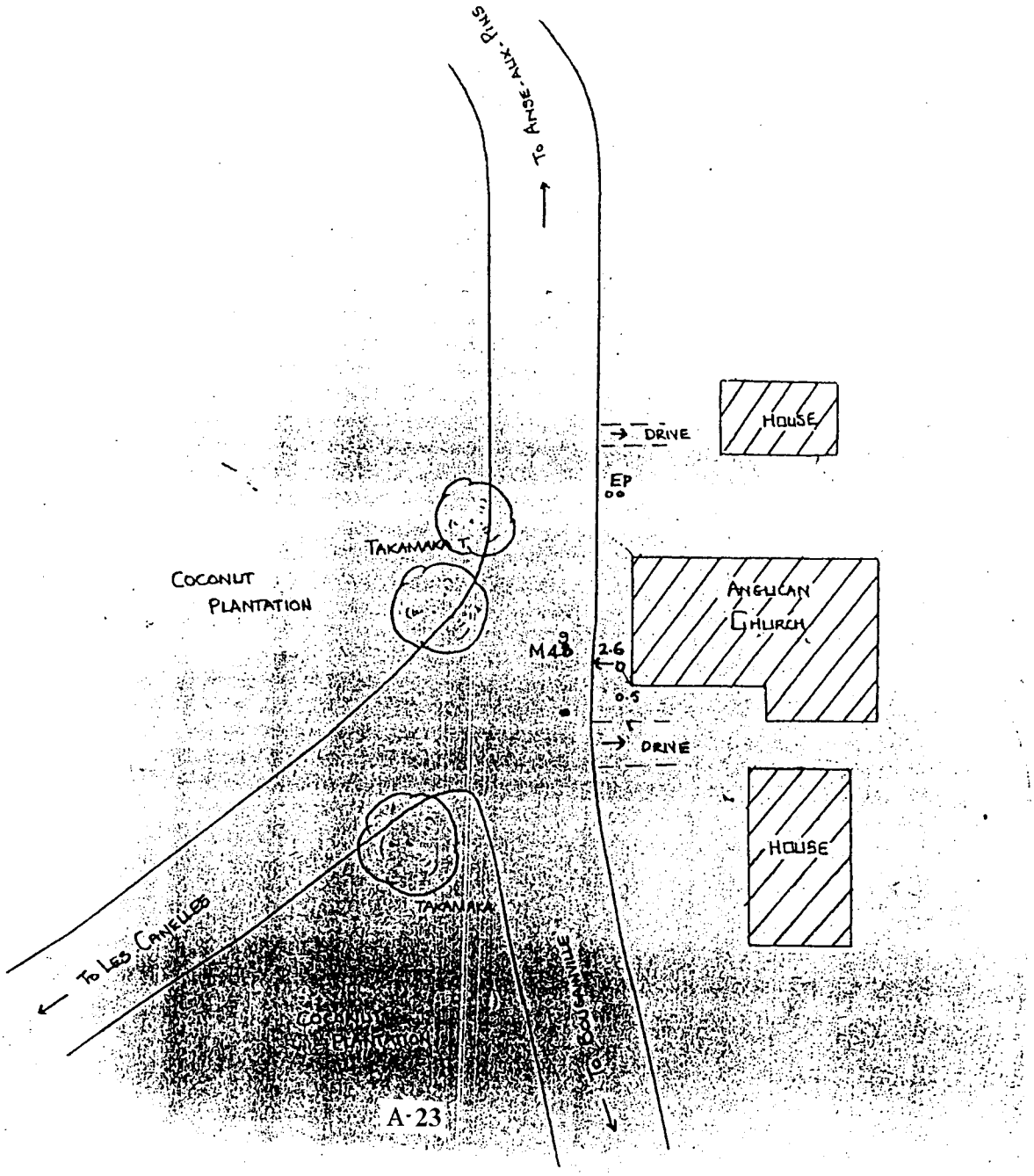
335540 E

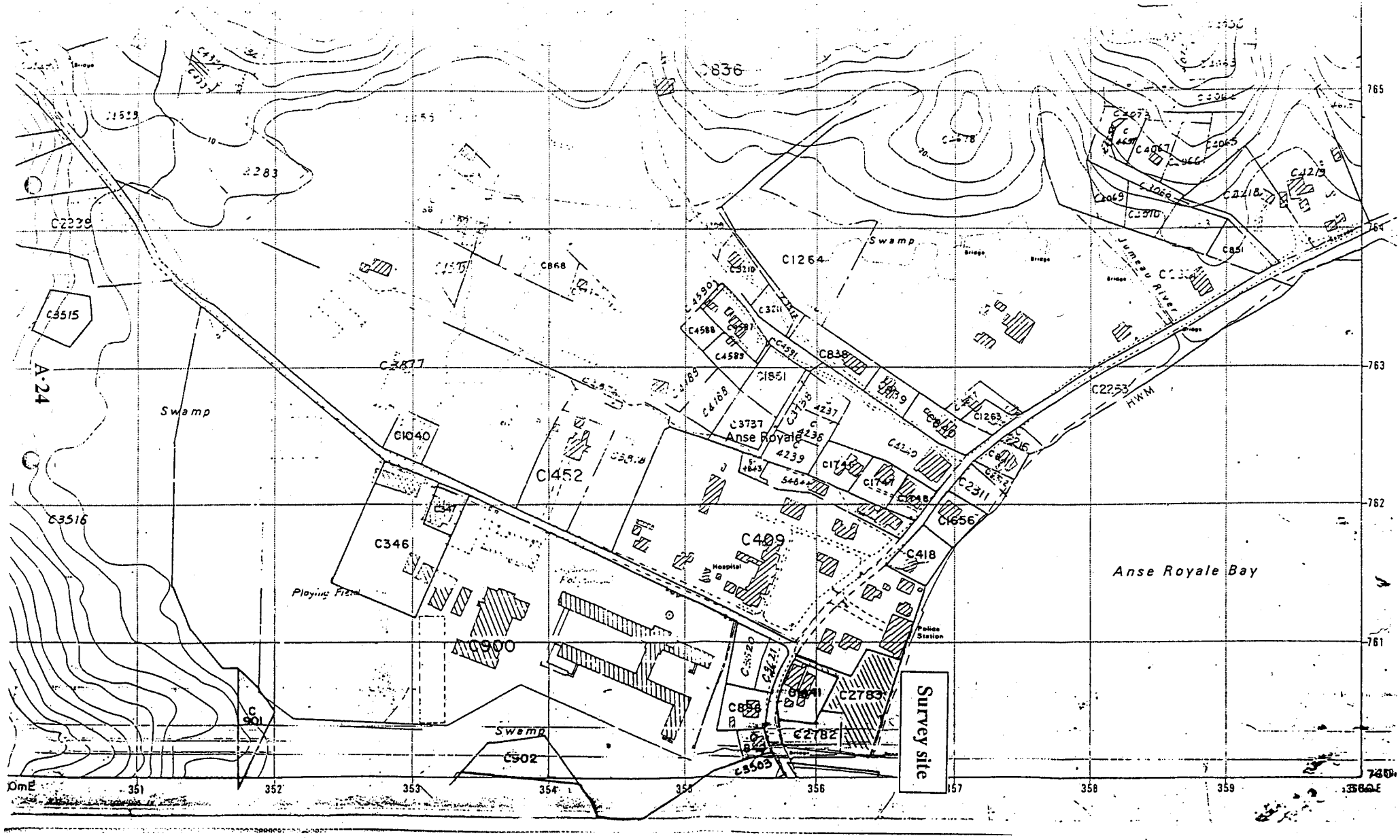
9475870 N

Date Sited

HEIGHT AMSL ..... 11.645

Sketch Plan - not to scale




C836
C1264
Swamp
Jumeau River
C1452
C1040
C346
C409
C900
C902
C901
C3515
C3516
C2339
C3737
Anse Royale
Anse Royale Bay
Survey site
Swamp
Playing Field
Hospital
Police Station
HWM
A·24
765
764
763
762
761
760
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352
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359

## Notes :

1. This survey is based on the National Survey System (UTM Zone 40 Grid)

2. All heights shown are in metres based on Mean Sea Level (Utilised BM49 with a value of 1.645m above Mean Sea Level)

3. Control Points

| Beacon Ref. | Easting | Northing | Height(m) (M.S.L.) |
|---|---|---|---|
| BU80 | 335566.98 | 9476092.78 | – |
| BU71 | 335625.54 | 9476078.88 | 1.649 |
| BU78A | 335637.40 | 9476097.52 | – |
| PEG1 | 335627.90 | 9476049.59 | 1.600 |
| BM49 | 335540.00 | 9475870.00 | 1.845 |

NOTE : BM49 coordinates are approximate.

4. Load Bearing Test Points 1–2

| Ref. | Easting | Northing | Height(m) (M.S.L.) |
|---|---|---|---|
| TP1 | 335632.60 | 9476062.47 | 1.810 |
| TP2 | 335641.83 | 9476083.93 | 1.960 |

## Legend :

- 2.20 ..... SPOT HEIGHT (M) (ELEVATION @ DECIMAL)
- PEG1 ..... SURVEY CONTROL POINT
- ..... COCONUT TREE
- C ..... TREE – Calice du pape
- B ..... TREE – Badamier
- ..... CADASTRAL BOUNDARY LINE
- TC3610 ..... CADASTRAL BOUNDARY BEACON
- C1441 ..... CADASTRAL PARCEL NUMBER
- 1.75 ..... CONTOUR LINE (CONTOUR INTERVAL @ 0.25m)

N

Scale 1/250

9476125mN
9476100mN
9476075mN
9476050mN
9476025mN

335575mE
335600mE
335625mE
335650mE
335675mE
335700mE

PUBLIC ROAD
to Mahé
from Anse Boileau
PUBLIC FACILITIES
C409
C1441
C2783
C2782
SEA
SAND
High Water Mark
Royale River
BU80
BU71
BU78A
BU84
PEG1
TP1
TP2
TC3610
TC3611
TC3612
TC3613
TC3614
TC3615
TC3616
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| Drawing | Client | Rev | Date | Description |
|---|---|---|---|---|
| Topographic Survey of Parcel C2783 – Anse Royale, Mahe, Seychelles | CRC Overseas Cooperation Inc. 2–7–5 Minamisuna, Koto–ku, Tokyo 136–0076 | | | |

Acad File : *layplan1.dwg* Checked By : *AS*
Survey Date : *JUN '00* Dwg. No : ——
Surveyed By : *MM* Scale : *1/250*
Drawn By : *SL* Contract No : ——

**CADD SURVEYS**
RM 40, KINGSGATE HOUSE, VICTORIA
P.O. BOX 114 TEL 225527 FAX 224666
E-MAIL : moaisec@seychelles.net

## 5.2 Ground Bearing Power Survey

Plate loading test was conducted to grasp the necessary ground bearing power of the ice-making plant in planning, designing and constructing.

| | |
|---|---|
| Survey site | : Two point of inside the expected ice making plant site (C2783) |
| Survey item | : The ground bearing power of the ice making plant |
| Way of survey | : Plate loading test (20KN&25KN). |
| Surveyor | : Mr. Marc A. d'Offay. |

Marc A. d'Offay BSc.
Civil Engineer

Room 40 Kingsgate House Victoria Mahe Seychelles Tel./ Fax 225527 E-mail : moas1sez@seychelles.net

15 June 2000
CRC00001.SiteRep.doc

**The Project Manager**
CRC Overseas Cooperation Inc.
c/o Seychelles Fishing Authority
Mahe Seychelles

Dear Sir,

## Coastal Fisheries Development

### Report on Bearing Tests

### 1. The Investigation

The tests were performed on the 7/6/2000 at Anse Royale Mahe Island Seychelles at 2 locations defined by CRC. These locations are indicated on the topographic Survey Plan attached.

The plate, jack, dial gauges and reference beam were all supplied by CRC and the tests were executed in accordance with ASTM D1194-94 & D1195-93. The soil is a medium grained dense coral sand.

### 2. The Tests and Results

For both tests the ground was loaded in at 20KN and 25KN with 6 repetitions done and deflections measured. Plate Size = 0.3m diameter.

20KN/ $\pi$ x 0.3 x 0.3 / 4 = 282.94KN/sq.m
25KN/ $\pi$ x 0.3 x 0.3 / 4 = 353.70KN/sq.m

These loads were felt to be loads where the ground would settle appreciably, however this did not prove to be the case as the ground proved to be quite competent. In both cases after the first 3 repetitions the deflections became quite minimal especially at TP2.

At Test Point 1 (TP1) the 2 increments of load were applied and the total settlement measured was 1.9mm. At Test Point 2 (TP2) the 2 increments of load were applied and the total settlement measured was 0.46mm. It was not possible to load the ground so as to induce failure or a total settlement of 30mm representing 10% of the Plate diameter as the truck used as kenteledge was not fully loaded.

The test results for TP1 and 2 are attached, only the first 2 repetitions are plotted due to the small deflections and rebound values recorded.

## 3. Foundations

Although failure of the ground was not achieved, based on the results obtained I am confident that the ground is suitably competent and will carry spread foundations with bearing pressures of up to **200KN/sq.m** quite safely with expected immediate settlements of 5-10 mm. I have been involved with numerous construction projects on similar sites and ground conditions and based on previous experience it is recommended that the foundation trenches be compacted by 8-10 passes of a 250-500 kg vibrating trench roller with wetting and that a blinding concrete be placed immediately following the compaction. The foundation concrete should be placed in the trenches without the use of formwork to the sides of foundations.

**Marc A. d'Offay**

Plate Bearing Tests-to ASTM D1195-93 & D1194-94 for **CRC Overseas Cooperation Inc.**
Site : **Anse Royale Ice Plant Site- Seychelles Fishing Authority**

| Test No.: TP1 | Truck No. | Temperature: 28°C |
|---|---|---|
| Date: 7/6/2000 | Time Start: 10 15 hrs | Time Finish: |
| Load: 20 KN & 25KN | Plate Size: Dia.300mm | |

| | | Deflection | | | | Rebound | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Repetn | | Zero | 1 min | 2 min | 3 min | 3 min | 2 min | 1 min | - |
| 1 | D1 | 1010 | 995 | 992 | 991 | 994 | | | |
| | D2 | 995 | 986 | 983 | 982 | 988 | | | |
| 2 | D1 | 212 | 204 | 201 | 199 | 204 | | | |
| | D2 | 282 | 278 | 276 | 274 | 284 | | | |
| 3 | D1 | 195 | 190 | 187 | 184 | 194 | | | |
| | D2 | 272 | 267 | 265 | 262 | 269 | | | |
| 4 | D1 | 182 | 178 | 176 | 175 | 180 | | | 20KN |
| | D2 | 260 | 257 | 255 | 254 | 262 | | | |
| 5 | D1 | 158 | 157 | 155 | 153 | 159 | | | |
| | D2 | 238 | 237 | 237 | 236 | 250 | | | |
| 6 | D1 | 152 | 150 | 148 | 148 | 152 | | | |
| | | 238 | 234 | 232 | 232 | 240 | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| 1 | D1 | 1041 | 1015 | 1000 | 984 | | | | |
| | D2 | 1122 | 1095 | 1079 | 1062 | 1058 | | | |
| 2 | D1 | 954 | 938 | 932 | 926 | 928 | | | |
| | D2 | 1028 | 1032 | 1023 | 1018 | 1018 | | | |
| 3 | D1 | 922 | 910 | 907 | 896 | 894 | | | |
| | D2 | 1010 | 998 | 990 | 988 | 984 | | | 25 KN |
| 4 | D1 | 888 | 882 | 878 | 876 | 874 | | | |
| | D2 | 979 | 971 | 968 | 965 | 964 | | | |
| 5 | D1 | 873 | 866 | 865 | 862 | 860 | | | |
| | D2 | 962 | 955 | 954 | 951 | 951 | | | |
| 6 | D1 | 859 | 854 | 855 | 853 | 853 | | | |
| | D2 | 947 | 946 | 943 | 942 | 942 | | | |

Plate Bearing Tests-to ASTM D1195-93 & D1194-94 for **CRC Overseas Cooperation Inc.**
Site : **Anse Royale Ice Plant Site- Seychelles Fishing Authority**

| | | |
|---|---|---|
| Test No.: TP1. | Truck No. | Temperature: 28°C |
| Date: 7/6/2000 | Time Start: | Time Finish: |
| Load: 20 KN & 25KN | Plate Size: Dia.300mm | |

| | | Mean Deflection (D1+D2)/2 | | | | Rebound | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Repetn | | Zero | 1 min | 2 min | 3 min | 3 min | 2 min | 1 min | TOTAL Δ |
| 1 | D1 | 0 | 0.15 | 0.03 | 0.07 | 0.13 | | | |
| | D2 | 0 | 0.09 | 0.03 | 0.07 | 0.07 | | | |
| | | | 0.12 | 0.03 | 0.07 | 0.10 | | | 0.16mm |
| 2 | D1 | 0 | 0.08 | 0.03 | 0.02 | 0.08 | | | |
| | D2 | 0 | 0.04 | 0.02 | 0.02 | | | | |
| | | | 0.06 | 0.025 | 0.02 | | | | 0.105 |
| 3 | D1 | 0 | 0.05 | 0.03 | 0.03 | | | | |
| | D2 | 0 | 0.05 | 0.02 | 0.03 | | | | |
| | | | 0.05 | 0.025 | 0.03 | | | | 0.105 |
| 4 | D1 | 0 | 0.04 | 0.02 | 0.01 | | | | |
| | D2 | 0 | 0.03 | 0.02 | 0.01 | | | | |
| | | | 0035 | 0.02 | 0.01 | | | | 0.065 |
| 5 | D1 | 0 | 0.09 | 0.02 | 0.02 | | | | |
| | D2 | 0 | 0.07 | 0.0 | 0.01 | | | | |
| | | | 0.09 | 0.07 | 0.015 | | | | 0.035 |
| 6 | D1 | 0 | 0.02 | 0.02 | 0.00 | | | | |
| | D2 | 0 | 0.04 | 0.02 | 0.00 | | | | |
| | | | 0.03 | 0.02 | 0.00 | | | | 0.05 |
| | | | | | | | TOTAL MEAN | Δ = | 0.52mm |
| | | LOAD = 20KN | | | | | | | |

Plate Bearing Tests-to ASTM D1195-93 & D1194-94 for **CRC Overseas Cooperation Inc.**
Site : **Anse Royale Ice Plant Site- Seychelles Fishing Authority**

| Test No.: TP1 | Truck No. | Temperature: 28°C |
|---|---|---|
| Date: 7/6/2000 | Time Start: | Time Finish: |
| Load: 20 KN & 25KN | Plate Size: Dia.300mm | |

| | | Mean Deflection (D1+D2)/2 | | | | Rebound | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Repetn | | Zero | 1 min | 2 min | 3 min | 3 min | 2 min | 1 min | - |
| 1 | D1 | 0 | 0.26 | 0.15 | 0.16 | | | | |
| | D2 | 0 | 0.27 | 0.16 | 0.17 | | | | |
| | | | 0.265 | 0.155 | 0.165 | | | | 0.585 |
| 2 | D1 | 0 | 0.16 | 0.08 | 0.06 | | | | |
| | D2 | 0 | 0.16 | 0.09 | 0.05 | | | | |
| | | | 0.16 | 0.075 | 0.055 | | | | 0.29 |
| 3 | D1 | 0 | 0.12 | 0.09 | 0.04 | | | | |
| | D2 | 0 | 0.12 | 0.08 | 0.02 | | | | |
| | | | 0.12 | 0.085 | 0.03. | | | | 0.235 |
| 4 | D1 | 0 | 0.06 | 0.06 | 0.02 | | | | |
| | D2 | 0 | 0.08 | 0.03 | 0.03 | | | | |
| | | | 0.07 | 0.045 | 0025 | | | | 0.14 |
| 5 | D1 | 0 | 0.07 | 0.07 | 0.03 | | | | |
| | D2 | 0 | 0.07 | 0.07 | 0.03 | | | | |
| | | | 0.07 | 0.07 | 0.03 | | | | 0.11 |
| 6 | D1 | 0 | 0.02 | 0.02 | 0.02 | | | | |
| | D2 | 0 | 0.01 | 0.03 | 0.01. | | | | |
| | | | 0.015 | 0.025 | 0.015. | | | | 0.055 |
| | | | | | | | TOTAL MEAN | Δ | 1.415mm |
| | | | | | | | | + | 0.52 |
| | | LOAD = 25KN. | | | | | TOTAL OVERALL Δ | | 1.935mm |

Plate Bearing Tests-to ASTM D1195-93 & D1194-94 for **CRC Overseas Cooperation Inc.**
Site : **Anse Royale Ice Plant Site- Seychelles Fishing Authority**

| Test No.: TP 2. | Truck No. | Temperature: 28°C |
|---|---|---|
| Date: 7/6/2000 | Time Start: | Time.Finish: 1400Hrs |
| Load: 20 KN & 25KN | Plate Size: Dia.300mm | |

| | | Deflection | | | | Rebound | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Repetn | | Zero | 1 min | 2 min | 3 min | 3 min | 2 min | 1 min | - |
| 1 | D1 | 1010 | 1002 | 1001 | 1000 | 1000 | | | |
| | D2 | 949 | 947 | 941 | 940 | 938 | | | |
| 2 | D1 | 998 | 997 | 997 | 997 | 997 | | | |
| | D2 | 938 | 934 | 934 | 934 | 934 | | | |
| 3 | D1 | 994 | 993 | 993 | 993 | 993 | | | |
| | D2 | 934 | 934 | 934 | 934 | 932 | | | 20KN. |
| 4 | D1 | 991 | 991 | 990 | 990 | 990 | | | |
| | D2 | 931 | 931 | 931 | 931 | 931 | | | |
| 5 | D1 | 988 | 987 | 987 | 987 | 988 | | | |
| | D2 | 929 | 929 | 929 | 929 | 929 | | | |
| 6 | D1 | 985 | 985 | 985 | 984 | 985 | | | |
| | D2 | 927 | 927 | 927 | 926 | 925 | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| 1 | D1 | 970 | 955 | 950 | 945 | 945 | | | |
| | D2 | 918 | 910 | 905 | 901 | 899 | | | |
| 2 | D1 | 943 | 942 | 941 | 938 | 936 | | | |
| | D2 | 899 | 898 | 897 | 894 | 892 | | | |
| 3 | D1 | 935 | 934 | 933 | 931 | 930 | | | |
| | D2 | 892 | 891 | 890 | 889 | 888 | | | 25KN. |
| 4 | D1 | 929 | 929 | 928 | 924 | 926 | | | |
| | D2 | 888 | 888 | 887 | 886 | 885 | | | |
| 5 | D1 | 925 | 925 | 924 | 924 | 924 | | | |
| | D2 | 885 | 885 | 884 | 884 | 883 | | | |
| 6 | D1 | 922 | 922 | 922 | 922 | 922 | | | |
| | D2 | 887 | 882 | 882 | 882 | 881 | | | |

Plate Bearing Tests-to ASTM D1195-93 & D1194-94 for **CRC Overseas Cooperation Inc.**
Site : **Anse Royale Ice Plant Site- Seychelles Fishing Authority**

| Test No.: TP2 | Truck No. | Temperature: 28°C |
|---|---|---|
| Date: 7/6/2000 | Time Start: | Time Finish: |
| Load: 20 KN & 25KN | Plate Size: Dia.300mm | |

| | | Mean Deflection (D1+D2)/2 | | | | Rebound | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Repetn | | Zero | 1 min | 2 min | 3 min | 3 min | 2 min | 1 min | - |
| 1 | D1 | 0 | 0.08 | 0.01 | 0.01 | | | | |
| | D2 | 0 | 0.07 | 0.01 | 0.01 | | | | |
| | | | 0.075 | 0.01 | 0.01 | | | | 0.095 |
| 2 | D1 | 0 | 0.01 | 0.00 | 0.00 | | | | |
| | D2 | 0 | 0.01 | 0.00 | 0.00 | | | | |
| | | | 0.01 | 0.00 | 0.00 | | | | 0.01 |
| 3 | D1 | 0 | 0.01 | 0.00 | 0.00 | | | | |
| | D2 | 0 | 0.00 | 0.00 | 0.00 | | | | |
| | | | 0.005 | 0.00 | 0.00 | | | | 0.005 |
| 4 | D1 | 0 | 0.00 | 0.01 | 0.00 | | | | |
| | D2 | 0 | 0.01 | 0.00 | 0.00 | | | | |
| | | | 0.005 | 0.00 | 0.00 | | | | 0.005 |
| 5 | D1 | 0 | 0.01 | 0.00 | 0.00 | | | | |
| | D2 | 0 | 0.00 | 0.00 | 0.00 | | | | |
| | | | 0.005 | 0.00 | 0.00 | | | | 0.005 |
| 6 | D1 | 0 | 0.00 | 0.00 | 0.01 | | | | |
| | D2 | 0 | 0.00 | 0.00 | 0.01 | | | | |
| | | | 0.00 | 0.00 | 0.01 | | | | 0.01 |
| | | | | | | | TOTAL Δ | | |
| | | | | | | | MEAN | | 0.13 mm |
| | | | LOAD = 20KN. | | | | | | |

Plate Bearing Tests-to ASTM D1195-93 & D1194-94 for **CRC Overseas Cooperation Inc.**
Site : **Anse Royale Ice Plant Site- Seychelles Fishing Authority**

| Test No.: TP2 | Truck No. | Temperature: 28°C |
|---|---|---|
| Date: 7/6/2000 | Time Start: | Time Finish: |
| Load: 20 KN & 25KN | Plate Size: Dia.300mm | |

| | | Mean Deflection (D1+D2)/2 | | | | Rebound | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Repetn | | Zero | 1 min | 2 min | 3 min | 3 min | 2 min | 1 min | - |
| 1 | D1 | 0 | 0.15 | 0.05 | 0.05 | | | | |
| | D2 | 0 | 0.08 | 0.05 | 0.04 | | | | |
| | | | 0.115 | 0.05 | 0.045 | | | | 0.21 |
| 2 | D1 | 0 | 0.01 | 0.01 | 0.03 | | | | |
| | D2 | 0 | 0.01 | 0.01 | 0.03 | | | | |
| | | | 0.01 | 0.01 | 0.03 | | | | 0.05 |
| 3 | D1 | 0 | 0.01 | 0.01 | 0.01 | | | | |
| | D2 | 0 | 0.01 | 0.01 | 0.01 | | | | |
| | | | 0.01 | 0.01 | 0.01 | | | | 0.03 |
| 4 | D1 | 0 | 0.00 | 0.01 | 0.01 | | | | |
| | D2 | 0 | 0.00 | 0.01 | 0.01 | | | | |
| | | | 0.00 | 0.01 | 0.01 | | | | 0.02 |
| 5 | D1 | 0 | 0.00 | 0.01 | 0.01 | | | | |
| | D2 | 0 | 0.00 | 0.01 | 0.01 | | | | |
| | | | 0.00 | 0.01 | 0.01 | | | | 0.02 |
| 6 | D1 | 0 | 0.00 | 0.00 | 0.00 | | | | |
| | D2 | 0 | 0.00 | 0.00 | 0.00 | | | | |
| | | | 0.00 | 0.00 | 0.00 | | | | 0.00 |
| | | | | | | | TOTAL Δ | | 0.33 |
| | | | | | | | MEAN | | |
| | | LOAD = 25KN. | | | | | | + | 0.13 |
| | | | | | | | | | 0.46mm |
| | | | | | | | TOTAL | | |
| | | | | | | | ALLOW Δ | | |

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