JAPAN INTERNATIONAL COOPERATION AGENCY

THE COMMONWEALTH OF DOMINICA
MINISTRY OF AGRICULTURE, LANDS, FISHERIES AND FORESTRY

BASIC DESIGN STUDY OF THE PROJECT FOR COASTAL FISHERIES DEVELOPMENT OF THE COMMONWEALTH OF DOMINICA

OCTOBER 1993

OVERSEAS AGRO-FISHERIES CONSULTANTS CO., LTD.

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PREFACE

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

JICA sent to Dominica a study team headed by Mr. Akihiro Mae, Assistant Director, Office of the Overseas Fisheries Cooperation, Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries from June 8 to July 2.

The team held discussions with the officials concerned of the Government of Dominica, 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 Dominica from September 6th to September 17th 1993 in order to discuss a draft report, and as this result, the present report was finalized.

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

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

October, 1993

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

October 1993

Mr. Kensuke Yanagiya
President,
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

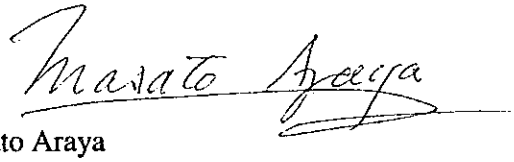
We are pleased to submit to you the basic design study report on The Project for Coastal Fisheries Development of the Commonwealth of Dominica.

This study was conducted by the Overseas Agro Fisheries Consultants Co., Ltd. under a contract to JICA during the period June 1 to October 29, 1993. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Dominica, and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, and Fisheries Agency, the Ministry of Agriculture, Forestry and Fisheries. We would also like to express our gratitude to the officials concerned of the Government of Dominica and the Embassy of Japan in Trinidad and Tobago for their cooperation and assistance throughout our field study.

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

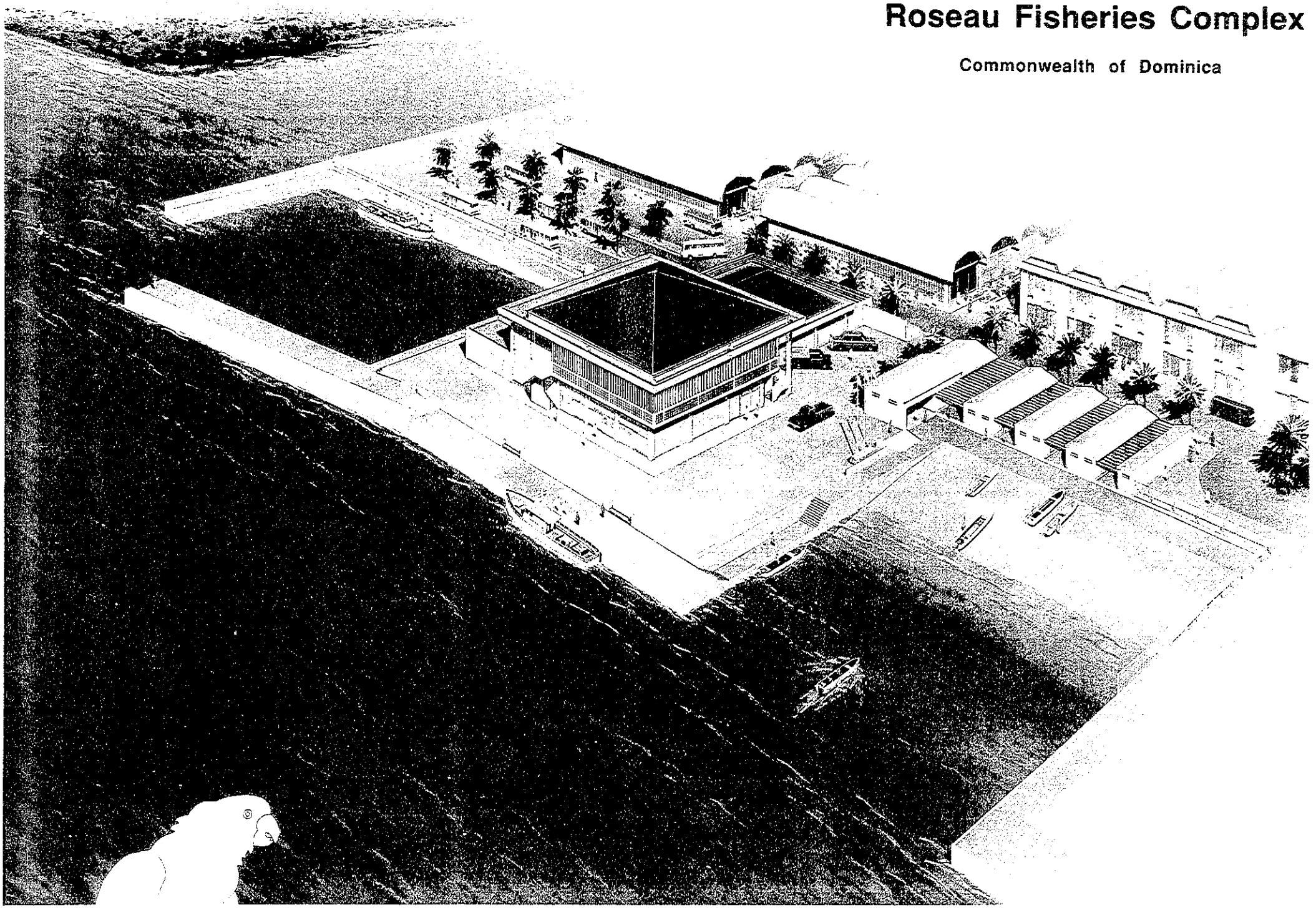
Very truly yours,

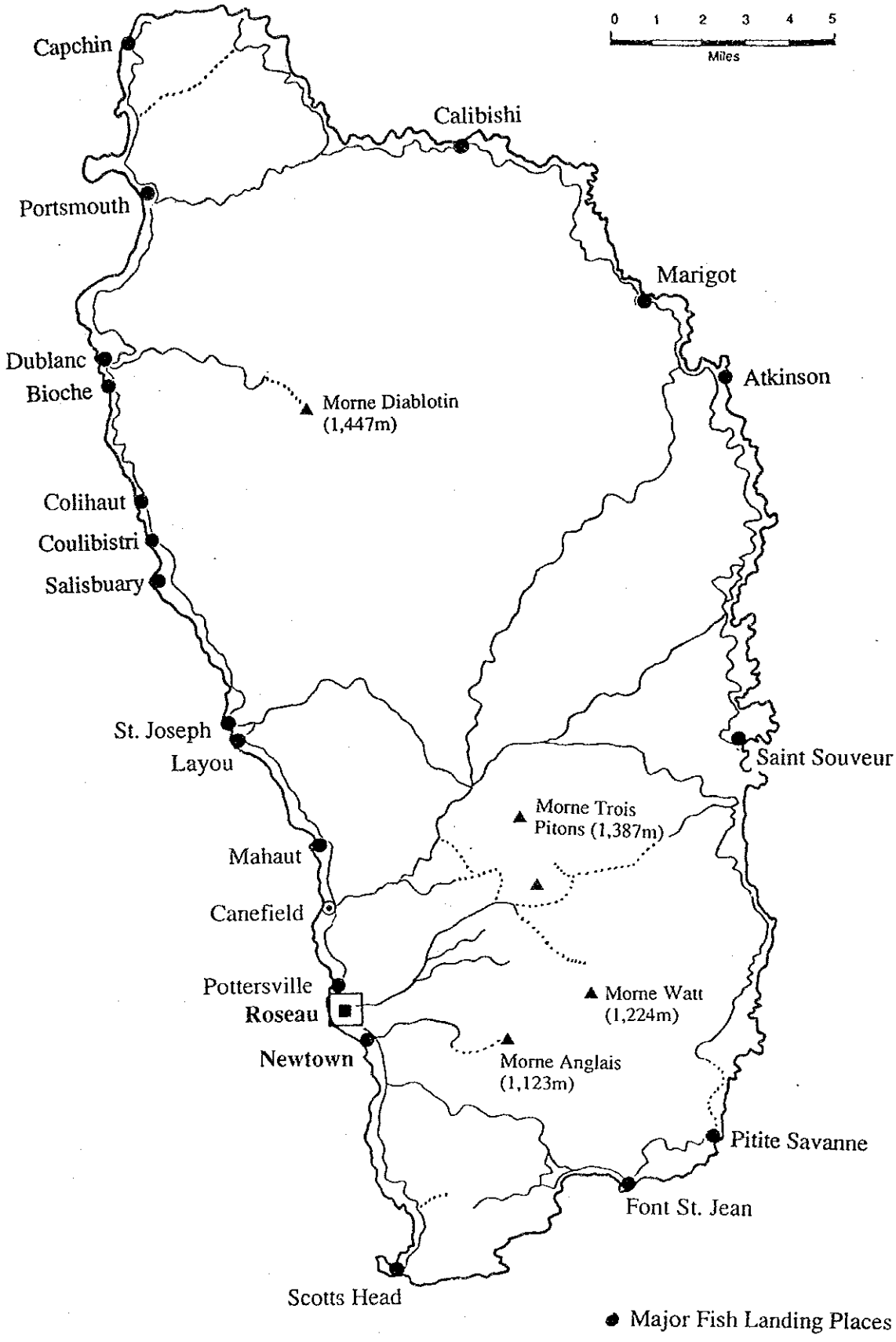


Masato Araya
Project manager,
Basic design study team on
The Project for the Coastal Fisheries Development of
the Commonwealth of Dominica.
Overseas Agro Fisheries Consultants Co., Ltd.

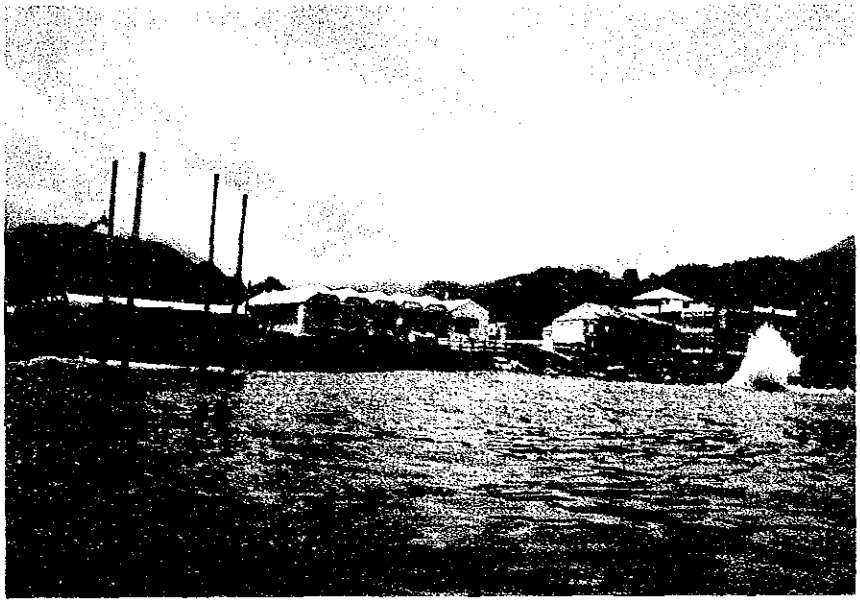
Roseau Fisheries Complex

Commonwealth of Dominica





Map of Dominica

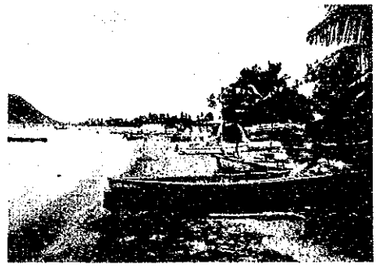


Project Site

Roseau Bayfront Project - Sea wall construction

Existing Roseau Market (Open market area)

Fish retail in the Roseau Market



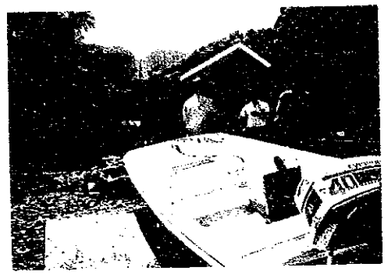
Portsmouth

Capucin

Vielle Case

Calibishi

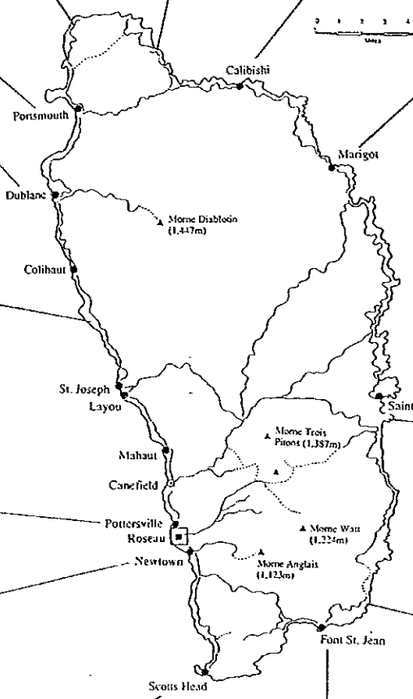
Marigot

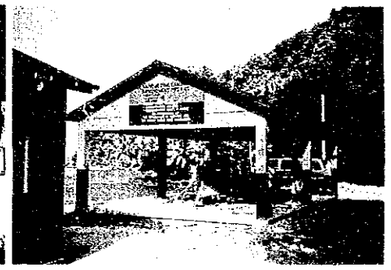


Bioche

Salisbury

Pottersville





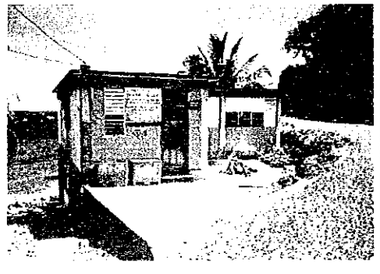
Saint Souveur

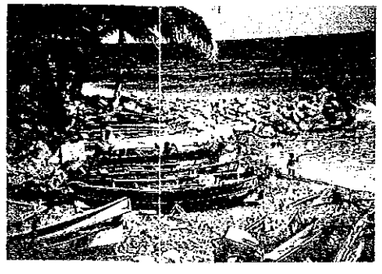
Fond Bananes

Newtown

Petite Savane

Scotts Head





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SUMMARY

The Commonwealth of Dominica is situated in the Windward Islands of the East Caribbean sea. Dominica is a volcanic island of about 60 km from south to north and 20 km from east to west. The island is basically mountainous with little flat land and is covered by tropical forests. The country's key industry is agriculture, mainly banana production, which accounts for about 40% of the gross domestic products.

There are 42 fishing villages along the coasts and about 2,500 fishermen are engaged in small scale coastal fishing with hand lines, gill nets, circle nets and cages. The people prefer a fish diet. The fisheries industry therefore, has an important role in supplying fish to the population and providing employment opportunities to the people living in coastal areas. The Government of Dominica and the Fisheries Development Division recognize this importance and have already begun fisheries development activities such as the modernization of fishing boats, the introduction of new fishing methods and the training of fishermen aiming at increasing food self-sufficiency, reducing food import bill and improving the standard of living for fishermen. However, Dominica's fisheries has many problems. For example, due to insufficient facilities such as fishing port and fish landing facilities, operation and maintenance of fishing boats are not easy; thus modernization of fishing boats is limited. Furthermore, since facilities and methods of fish distribution are poor, sales of catch is limited.

In view of the above conditions, the Government of Dominica planned a coastal fisheries development project aimed mainly at the establishment of fisheries facilities and fish marketing facilities in Roseau, the capital, to promote coastal fisheries, and made a request to the Government of Japan for the provision of grant aid for the implementation of the project. In response to this request, the Government of Japan decided to conduct a basic design survey for the Project and Japan International Cooperation Agency sent a study team from June 8, 1993 to July 2, 1993, to Dominica to conduct the survey. The team conducted investigations of the fisheries, distribution conditions and fisheries facilities conditions and discussed the Project contents and implementation system. Following the study and design work in Japan after the survey, JICA sent a team to Dominica for the period from September 6th to 17th, 1993 to explain the draft final report including the basic design of the facilities.

This Project aims at the construction of a fisheries complex in the metropolitan Roseau district as the first priority to improve fisheries facilities and fish distribution/ sales facilities and to establish a base for Fisheries Development Division. The Fish Market Complex has the following functions.

Landing of fish and mooring of fishing boats

Distribution/sales of the catches

Supporting of fishery activities

Strengthening of the Fisheries Development Division's activities

Organization of the Project is to be executed by the Fisheries Development Division, which will reorganize the system of the Fisheries Development Division itself and reinforce its staff using the Roseau Fisheries Complex of the Project as the base. The Division will execute management/guidance activities such as fisheries development, statistical data creation and education/ guidance of fishermen and propagation of technologies. Dominica Export Import Agency (DEXIA) which has experience in market operations will manage the fish distribution/sales section of the Fisheries Complex.

Major facilities and equipment required for Roseau Fisheries Complex are as follows:

Fishing Port:	Landing wharf	Sheet pile type	Approx. 40m long
	Service/mooring wharf	Sheet pile type	Approx. 85m long
Outer Facilities:	Breakwaters	Sheet pile type	Approx. 60m long
	Slipway/boat ramp	Concrete	Approx. 45m wide
	Bus terminal		Approx. 1,000m^2 in area
Buildings:	Roseau Fisheries Center	2-story reinforced concrete	Floor area Approx. 1,255m^2
	Workshop	1-story reinforced concrete	Floor area Approx. 50m^2
	Fishermen's lockers, Lavatory/shower		
Refrigeration Facilities:	Ice plant		Flake ice, capacity 4.5 tons/day x 2 units
	Blast freezer		Fish, frozen 2 tons/day
	Cold storage		Fish, 30 tons
	Chilled room		Fish, 10 tons

Facilities:	Water supply facility	Reservoir tank 30 tons, Elevated tank 3.5 tons
	Electricity	120 ~ 150kVA (AC230V/400V/50Hz)
	Water drainage	Purifying tank 4 tons/day, FRP
	Fish waste treatment plant	Processing capacity approx. 500 kg/time (4 hours)
Equipment:	Fish marketing equipment	Fish containers, balance, carts
	Vehicles for fish transportation and distribution	4 insulated trucks and 1 vehicle
	Fish processing equipment	Work table, bandsaw, vacuum packaging machine
	Quality inspection equipment	Physical and chemical examination instruments
	Data processing equipment	Copying machine, data processors
	Workshop equipment	Various tools

With the implementation of the project, it is expected to promote efficient fishing, to expand fish distribution and to improve guidance system using Roseau Fisheries Complex as a base of operations. The establishment of fisheries facilities in each area is desired. However, by establishing fisheries and distribution/sales facilities in Roseau area which has the largest population and is a center of consumption, the Fisheries Complex will become a center for fisheries development activities and fish distribution/sales. Not only that, it will also encourage fishermen to increase fish catches and activate their activities by means of collection and sales of catch.

To create such favorable effects, sound management and operation of the Fisheries Complex is essential. Another necessary factor is comprehensive support and cooperation extended to the executing agencies by the Government of Dominica. We would suggest the following items for smooth implementation of the Project and creation of the desired effects.

1) Although the Government of Dominica is considering establishment of a new agency as the management and operation organization of the Fisheries Complex, it seems a more reasonable and practical course to select DEXIA to operate and manage the Complex since it has experience in market management and operation. DEXIA should increase the size of its management and operation staff before the opening of the Fisheries Complex.

2) In the distribution/sales section of the Project, how to collect fish from local fish landing sites is an important element, thus establishment of the fish collecting

marketing system in local areas is essential. Because this fish collecting system would not be established or functioned by the market operating organization (DEXIA) only, a local fish-collecting system tied in with the Fisheries Market is indispensable. It is important to guide and foster fisheries cooperatives and fishermen's groups in each area to form a core group to establish the local fish-collecting system. The Fisheries Development Division and the market operating organization must provide guidance to cooperatives and fishermen's groups through instructions and on-the-job training using the Fisheries Complex. They should further ensure a good supply of fish from the Fisheries Complex by the fish-collecting system, it is also necessary to establish a sales route. Fish retailers and other large consumers must be instructed to obtain fish through the Complex and systemization to a certain extent may be necessary to implement this.

In the first stage of the operation of the Fisheries Complex, it is necessary for the market operating organization (DEXIA) to purchase fish from local areas for a certain period until the local fish collecting bodies have management and financial abilities. However, distribution/sales of fish must be promoted by encouraging fisheries cooperatives and private sectors. In the future, the fish market of the Complex will introduce a sales system or consignment base, receiving fish from local villages and selling to fish dealers and retailers. It is, therefore, essential to support and develop the collection of fish to be conducted by local fishies cooperatives and to establish a firm marketing channel from the Complex to fish dealers/retailers.

CONTENTS

CHAPTER 1 INTRODUCTION

1-1 Objective of the Study

In the Commonwealth of Dominica, the poor state of fish landing and fundamental distribution facilities combine to create a bottleneck in the development of coastal fisheries, thus people's demand for fish is not satisfied. Under these circumstances, in a three-year fisheries development plan (1990–1993) the Government of Dominica has placed a special emphasis on the improvement of fish landing and distribution facilities at each fish landing places, and intends to transform the structure of their fishery from the traditional small scale fishery to an industrial scale fishery. With this plan, it is expected that the amount of marine products supplied in the country will increase, reducing imports of marine products and insuring effective use of fishery resources. It is particularly important that Roseau, the capital of the country, be developed immediately. Therefore, the Government of Dominica drafted the "Coastal Fisheries Development Project" which includes the improvement of fish landing handling and distribution facilities and other facilities and equipment which support fishery activities, and made a request to the Government of Japan for Grant Aid for project implementation.

The objective of the study is to facilitate understanding of the specific contents and background of the request concerning "The Project for Coastal Fisheries Development in the Commonwealth of Dominica" submitted by the Government of Dominica, in order to analyze the social and economic effects of the Project and the feasibility of the project as a subject for Grant Aid and to produce a basic design for facilities and equipment required for the Project.

1-2 Dispatch of Study Team

The Japan International Cooperation Agency (JICA) sent to the Commonwealth of Dominica a basic design study team headed by Mr. Akihiro Mae, Assistant Director, the Office of the Overseas Fisheries Cooperation, Fisheries Agency, from June 8 to July 2, 1993 and conducted the necessary investigations, collected data and held discussions with government officers (the period of official base field survey was from June 8 to June 19, a total of 12 days). During the stay, the team exchanged the minutes of discussion with officers representing the Government of Dominica (see Appendix 4).

1-3 Contents of the Study

The basic design study team conducted the following activities to study the possibility of Grant Aid.

(1) Study of the feasibility of the background and the contents of the request.

(2) Investigation and study of the government development plan.

(3) Investigation of current conditions and problems with the Dominican fishery and distribution of marine products.

(4) Discussion and study of the contents and scale of the Project.

(5) Confirmation of a system to provide for project implementation, operation and management system, and construction borne by the Dominican side.

(6) A survey of the project site.

(7) A survey of relevant facilities.

(8) Collection of data related to the project .

The results of the above activities are summarized in this study report.

CHAPTER 2 BACKGROUND OF THE PROJECT

2-1 General Information

The Commonwealth of Dominica belongs to the Windward Islands of the Eastern Caribbean Sea, with Guadeloupe and Antigua to the north and Martinique and Saint Lucia to the south. The eastern shores are washed by surf of the Atlantic Ocean, while the western shores lie on the Caribbean Sea.

The country gained its independence in 1978, becoming a member of the Commonwealth of Nations. The country is 790km^2 in area, about 40% of which is comprised of mountains and forests. A 1991 census indicated a population of 71,800. Topographically, the Commonwealth of Dominica is mountainous, belonging to the volcanic arch of the Lesser Antilles. There are many high mountains such as Morne Diablotin (1,447m), Morne Trois Pitons (1,387m) and Morne Watt (1,224m). There are roads running along the coast and across the island but they are narrow and twisted and the threat of falling rocks poses considerable danger.

Dominica lies within the tropics, but the hot climate of this zone is tempered by the Northeast Trade Winds. This zone is included in the hurricane belt and recently the country was extensively damaged by Hurricanes David and Frederick (1979), Allen (1980) and Gabriel and Hugo (1989).

The gross national product (GNP) of Dominica in 1991 was EC$398 million, 6.3% higher than the previous year. Between 1985 ~ 1991, the economy grew 10% annually. This is because the production of agricultural products such as bananas, grapefruit, etc. have increased, as well as the tourist industry. Based on this increased profit, a rush of construction is continuing and the expansion of domestic demand is being achieved gradually.

The export of bananas and soap (made of coconuts) has increased solidly, from EC$70.9 million in 1985 to EC$142.4 million in 1991. However, 70% of the banana crop was damaged by hurricanes Gabriel and Hugo in 1989, resulting in a substantial effect on Dominica's ability to obtain foreign exchange.

On the other hand, 90% of imports are manufactured goods: machines, cars, foodstuffs and chemical products. The total value of imports increased from EC$149.4 million in

1985 to EC$ 149.4 million in 1991. The increase in garnering foreign exchange seems to have activated capital investment.

The major counterpart export countries are England, accounting for 50% of total exports, and the Caribbean Sea Allied Countries (CARICOM), which accounts for about 25%. Counterpart import countries are the U.S.A. (about 27%), CARICOM (about 21%) and England (15%), these countries accounting together for about 63% of total imports.

Dominica is a poor country which lags behind most of the Caribbean Sea region in development. The economy is based primarily on agricultural products including banana and coconuts. However, since 40% of its land is mountains and forests, it is difficult to increase the production of those agricultural products. Because of the above, the amount of calorie intake in the country is the lowest among the Caribbean Sea countries; thus, improving the nutritional conditions of Dominican is an important subject.

The country's demand for marine products is estimated at 40kg/person/year. However, though it is an island appropriate for fishing, only half of the demand (a total of 30kg/person/year) is supplied by domestic marine products (about 17kg/person/year) and imported fish (about 13kg/person/year).

In order to improve the nutritional conditions of Dominicans, it is necessary to promote fisheries to increase the supply of animal protein. The amount of calorie intake of each Latin American country is shown in the table below.

Table 2-1 Amount of Calorie Intake Per Person in Latin American Countries and Caribbean Sea Countries

(unit : kcal/person/day)

Amount of Calorie Intake	Country and Area
2,000 ~ 2,400	Dominica, Haiti, Antigua
2,400 ~ 2,800	Grenada, St. Vincent, Barbados, Belize, Costa Rica, Venezuela, Brazil
2,800 ~ 3,300	Cuba, Mexico

(Fisheries Development Division)

2-2 Condition of Marine Products Industry

2-2-1 Current Condition of Coastal Fisheries

Dominica's fisheries industry is a small scale coastal fisheries that people (fishermen) living in coastal areas operate using small-sized boats. The number of fishermen including part-time fishermen is about 2,500, accounting for about 8% of the total number of the country's employed (30,600). As shown in Table 2-2, fishermen operate using such fishing methods as hand lining, haul nets, gillnets, beach seines, pound cages and bottom long lines. Recently, longline fishing aiming at tuna was introduced and developed through technical guidance from the Fisheries Development Division (FDD). The number of fishing boats is about 900, most of them 4–6m long small sized boats such as wooden canoes and keel boats. Their navigation power is small, thus they can only operate in coastal areas near fishing village. Recently, modified boats and large-sized fishing boats have been introduced. However, due to insufficient facilities in fish landing places, the number of those kinds of boats is not yet all that large.

Dominica has about 80 miles of coastline but is different from St. Vincent or Grenada, as the continental shelf around the island is narrow and the shelf drops off suddenly in the most areas. For this reason, bottom fish resources are not so rich; however, when in season, large-sized migrating pelagic fish (tuna, marlin, etc.) or small-sized fish (sardine, flying fish, mackerel, etc.) are found in the area. The Macuba Bank located about 10 ~ 12 miles to the southeast is 107 square miles and is a good fishing ground. Since this ground is far away from the mainland and it is difficult to fish with the small-sized boats in the country, only a small number of the fishermen of Dominica go there and in fact the area is populated primarily by foreign fishing boats.

Table 2-2 Fishing Season of Major Fish Species and Fishing gear/Method

Fishing Season	Fishing Gear and Method	Target Fish
Jan. ~ Dec.	Gillnet, Beach seine	Sardine, Mackerel, Skip Jack
Jan. ~ Jun.	Hand lining, Haul net	Dolphin
Feb. ~ Apr.		
Jun. ~ Jul.	Gillnet	Flying Fish
Sep. ~ Nov.		
Jun. ~ Dec.	Floating long line	Yellow Fin, Marlin
Aug. ~ Dec.	Bottom longline, Trap	Bottom Fish

(Fisheries Development Division)

The number of fishermen in the country used to be 2,500 but it decreased to about 1,200 after destructive damage caused by hurricanes David and Frederick in 1979 and Allen in 1980. Then, it again gradually increased to 1,950 by 1986. The details include 375 full-time fishermen and the rest are part time fishermen having other jobs. According to a 1989 census, the number of fishermen is 2,200; 1,300 operating on the Atlantic coast and 900 on the Caribbean coast side. Those fishermen are from 42 fishing villages dispersed along the coastline.

The number of fishing boats decreased due to frequent attack of hurricanes but currently it has increased to 890 boats. 390 boats have a keel frame structure, plywood or FRP and 500 boats are canoes in which a log is hollowed out and a wooden board is added to the bottom of the boat to obtain the freeboard. The boats are 12 ~ 23 feet in length and about 700 boats have an outboard engine. Small-sized longliners (38 ~ 45 feet) introduced in 1987 under the technical cooperation from the Government of Taiwan are operated as a fishery training boat of FDD and 7 boats of the same type are used by private fishermen.

Even though the haul sharply decreased due to the 1979 hurricanes, it gradually recovered after that. The reason the 1986 catch decreased to 1/3 of the previous year is the poor catch of large-sized migrating fish such as tuna and marlin; however, the catch has been increasing since 1987 because of the introduction of the tuna surface longline fishing method.

Dominica did not have a system to collect statistics on the amount of fish landed but a collection system program has been developed jointly with OECS (Organization of East Caribbean States). Currently, the FDD assigns 12 investigators to local landing places to investigate the amount of catch. However, there are still villages where investigation is not conducted, thus the system has not matured sufficiently to conduct investigation satisfactory.

Table 2-3 shows the amount of catch in Dominica as compiled from those reports available and the most recent catch was about 700 ~ 800 tons. However, this figure was calculated with the understanding that the catch statistics investigation system is not fully established, thus the figure does not represent the entire catch in the country. The FDD believes that there is a considerable amount caught which was not investigated; for example, the catch of fishing villages which were not investigated, catch consumed by fishermen themselves or catch consumed in local areas. Therefore, it predicts the total amount of catch by local fishing villages with small sized boats is 1,243 tons (1992) as shown in Chapter 3, 3-2-5 (1) Projection of amount of catch. According to this figure,

the amount of fish consumption per person from the domestic fisheries production is about 17 kg/year.

The Government of Dominica aims at 3,000 tons of marine products supplied yearly, or 40kg/year per capita. However, the amount of domestic fisheries production is quite low. In order to supplement the lack of domestic production, a large amount of marine products are imported by spending precious foreign currency. Currently, import levels have reached about 900 tons (equivalent to original fish weight) consisting mainly of salted codfish from Norway and Canada. Even adding this imported fish, the amount of marine products supplied is about 2,100 tons, only 30kg per capita per year.

Table 2-3 Annual fish catch and the Amount of Fish Import to Dominica

(unit : ton)

Year	Fish catch	Fish import	Comments
1979	*	*	Hurricanes David & Frederick
1980	*	*	
1981	*	*	
1982	184	271	
1983	210	387	
1984	300	360	
1985	479	*	
1986	161	*	Poor catch of large sized migrating fish
1987	421	*	
1988	476	*	
1989	804	*	Hurricanes Gabriel & Hugo
1990	800	900	
1991	*	*	
1992	704	900	

(Fisheries Development Division)

Note: The catch volume shows the actually weighed volume, not total amount.

* : Data not available

The Government of Dominica encourages the establishment and promotion of fisheries cooperatives by local fishermen. A Cooperative Division has been established in the Ministry of Agriculture Lands, Fisheries and Forestry. Currently, cooperatives have been established in 8 fishing villages (Roseau, Newtown, St. Mark, (Foufriere/Scotts

Head), Font St. Jean, Saint Sauveur, Marigot, Vielle Case, Coulibistri) and groups of fishermen are being forged in other fishing villages.

2-2-2 Current condition of Distribution of Marine Products

Since there is no fishing port in Dominica where fishing boats can anchor, most of the fishing boats are pulled up on the beach and put to sea by hand. Small boats are always in danger of being washed away because of strong waves. When Hurricane David struck in 1979, most of the fishing boats were damaged because there is no port protected from wind and waves and there is no appropriate landing facilities. Despite such examples, even now fishing ports and landing facilities have not been prepared and fishing boats are destroyed or damaged by the constant occurrence of relatively small-sized tropical depressions.

Because of the above, large-sized improved fishing boats cannot be pulled up to the narrow rocky beach, thus the development and introduction of those boats has been hindered. Also, since the pulling up of boats is usually delayed in emergency conditions, fishermen along part of the east coast facing the Atlantic Ocean do not go sea if the weather is little stormy and many of them leave off fishing earlier if the conditions are windy. Because of these conditions, the number of days fishermen stay at fishing grounds (operation dates) is short.

Unless there is a huge catch, most of catch is sold to ordinary customers at fish landing places or neighboring areas. There is no broker in those villages but there are some peddlers. The remaining fish which is not consumed at landing places is sent to Roseau, the capital and is also sold along the street.

Large catches which cannot be consumed solely in local areas occur mainly during the seasons for small sized migrating fish (sardine, flying fish, mackerel, etc.) and they are caught on the east coast where small number of people live. A lot of the flying fish caught on the west coast deteriorates quickly and is not popular among consumers, thus is over-supplied.

2-2-3 Current condition and Problems of Roseau Market

The Roseau market is located in an area which faces the south end of the river mouth of the Roseau River flowing through the city. The current market facilities started its construction in 1971 with the cooperation of England and the market was opened in May 1972.

(1) Major Facilities

Major facilities comprising the market are as follows.

Market building :	Reinforced concrete structure, Block wall	
	30m x 20m	1 building
	60m x 20m	1 building
Sales stalls :	Inside sales stall : (fixed type concrete stall) (about 1m²/stall)	90 stalls (for general)
		20 stalls (for vegetables)
		14 stalls (for hand-crafted articles)
	Permanent sales stalls :	14 stalls
	Outdoor sales stall : (mobil wooden stall)	98 stalls

Refrigeration facilities :	Chilled room :	5.8m x 4.0m x 2.0m (H)	2 rooms
	Chilled room :	4.0m x 3.7m x 2.0m (H)	2 rooms
	Refrigerator :	4.0m x 3.7m x 2.0m (H)	1 room
Lavatory :			
Management office :			

(2) Management and Operation of the Market

Management and operation of the Roseau market is executed by DEXIA (Dominica Export and Import Agency) as a part of its activities.

DEXIA has a market office which functions as the Roseau market management division and the Market Superintendent and five staff persons (1 clerk, 1 supervisor and 3 workers) execute management work under the General Manager. Also, the Market Support Service Department supports the technical end of the market facilities and takes care of long-term maintenance and repair plans.

The basic principle of market management and operation is a self-supporting accounting system with management costs being covered by income including rental fees for sales stalls and refrigerators. The most recent budget available for management of the market includes the following.

Budget of Roseau Market Management

(unit : EC$)

Year	1991/92	1992/93	1993/94
Income	141,880	164,892	194,476
Expenses	158,818	164,785	173,920

(source : DEXIA)

Detailed Statement Of Income And Expenses in 1992/1993

(unit : EC$)

Income		Expenses	
Rental fee for sales stall permanent stall and warehouse	85, 228.-	Personnel expense	107,043.-
Electricity fee for permanent stall	10,596.-	Electricity fee.	17,640.-
Rental fee for refrigerator	31,212.-	Water fee	20,866.-
Outdoor sales stall charge	30,856.-	Garbage handling expense	8,736.-
Rental fee for Lavatory	7,000.-	Communication expense	3,150.-
		Refrigeration facility Maintenance expense	7,350.-
Total	164,892.-	Total	164,785.-

(Source : DEXIA)

(3) Conditions surrounding market use

The selling of agricultural products in the market does not require permission or a license thus far and anybody can bring in products and sell them as long as they pay the fixed amount of rental fee for a sales place.

Ten to fourteen permanent small shops opens every day except Sunday. The weekend, especially Saturday, is the busiest time.

Number of retailers by day :	Monday :	About 20 people
	Wednesday :	About 20 people
	Friday :	About 90 people
	Saturday :	About 300 people

(4) Problems

The Roseau market was established for sales of mainly agricultural products such as vegetables and is not equipped with facilities appropriate for sales of meat and fish. Particularly, facilities for fish sales are poor as there are only two fish sales stalls. Retailers who cannot use these stalls have to place fish in a narrow passage and sell them there. No ice is supplied and the supply and drainage facilities in the market are not appropriate for handling marine products, thus the market is in extremely unsanitary condition. For the above reasons, the amount of fish brought into the market is limited, thus consumers have difficulty in obtaining fresh fish when they like.

2-2-4 Condition of local fishing villages

Fourty-two fishing villages are distributed along the 80 miles of Dominican coastline. Most of the coastline of the island is rugged coast except for part on the west side. Steep mountains approach the coast and the steep slope extends down to the bottom of the ocean. There is almost no defoliated area and in many places it is difficult to pull up fishing boats or build fish landing facilities. In particular, the condition of the east side of the island where directly receives winds and waves of the northeast trade winds blowing from the Atlantic Ocean is extremely bad and fishermen fish as if somehow stuck to the rugged coast.

The Fisheries Development Division (FDD) is trying to install fishing facilities in local fishing villages using financial support from World Food Program (WFP), but the implementation of such facilities is not all that easy due to the severe natural conditions prevalent in the area. Major achievements (including ongoing construction) are as follows.

Marigot	:	Fisheries center, ice making machine 200kg/day x 3 units (EDF)
Font St. Jean	:	Fisheries center, ice making machine 200kg/day x 3 units (EDF)
Vielle Case	:	Fisheries center, warehouse, fishermen's lockers

Installation of facilities by WFP (1990–1993)

Salisbury	:	Landing pier, net loft (net repairing place), fishermen's lockers (20 rooms)
Bioche	:	Slipway, fishermen's lockers (12 rooms)
Capucin	:	Slipway, fishermen's locker (10 rooms)
Vielle Case	:	Seawall, landing place, breakwater
Calibishie	:	Seawall, slipway, fishermen's lockers
San Sauveur	:	Seawall, slipway, fishermen's lockers, cooperative's warehouse
Petite Savane	:	Road

2-2-5 Problems in the marine products industry

Problems in the marine products industry of Dominica are summarized as follows.

i. Facilities and equipment which support fisheries activities of the country are poor, thus safe and efficient production activities cannot be performed.

ii. The distribution system of marine products at landing places and from landing areas to consumption areas has not been established, thus the catch is not used effectively.

iii. There is little basic data because an investigation of marine products resources has not been conducted, thus appropriate administrative fisheries management cannot be done and efficient fishing activities of fishermen are limited.

iv. Fishermen are generally poor and they don't have sufficient fishing boats, tools and equipment, thus it is difficult to increase their income and their lives cannot be improved.

Table 2-4 Outline of Fishing Village

Fishing Village	No. of Fishermen (full-time + part time)	No. of Fishing Boats	Fish landing volume (tons)	Facilities
West side				
Scotts Head/Soufriere	429 (109 + 320)	136	54.7	—
Pointe Michel	30 (16 + 14)	—	—	—
Newtown	184 (59 + 125)	69	99.2	Slipway, cooperative's office / warehouse, ice making unit
Pottersville	182 (52 + 130)	66	53.6	—
Canefield	15 (5 + 10)	—	—	—
Fond Cole	57 (22 + 35)	27	—	—
Mahaut / Massacre	98 (46 + 52)	40	21.0	—
Layou / Tarou	62 (22 + 40)	22	54.4	—
St. Joseph	30 (10 + 20)	20	22.6	—
Salisbury	34 (17 + 17)	27	—	Landing pier, net loft, fishermen's lockers (WFP)
Coulibistrie/Morne Rachette	40 (23 + 17)	35	—	—
Colihaut	37 (20 +17)	32	80.6	—
Dublanc/Bioche	87 (33 + 54)	54	42.2	Slipway and fishermen's lockers (WFP) in Bioche
Portsmouth / Glanvilla	277 (88 + 189)	77	102.0	—
Capucin / Clifton	44 (9 + 35)	22	—	Slipway and fishermen's lockers (WFP) in Capucin,
East side				
Calibishie	68 (12 + 56)	24	—	Seawall, slipway, fishermen's lockers (WFP)
Vielle Case / Penville / Thibaud	91 (30 + 61)	43	—	Seawall, landing place, breakwater, fisheries center and fishermen's lockers (CIDA) in Vielle Case
Anse de Mai/Wesley	67 (17 + 50)	22	—	—
Atkinson / Salibia / Castle Bruce	133 (37 + 96)	53	—	—
San Sauveur / Good Hope / Pitite Soufriere / Rosalie	113 (35 + 78)	35	45.4	Seawall, slipway, fishermen's lockers , cooperatives' warehouse (CIDA) in San Sauveur
Marigot	104 (27 + 77)	32	64.9	Fishermen's warehouse, ice making unit (EDF)
Petite Savane	25 (5 + 20)	9	—	Road (WFP)
Fond St. Jean	94 (30 + 64)	31	63.6	Fisheries center/warehouse, ice making unit (EDF)
Stowe	37 (12 + 25)	22	—	—
Total		893	704.2	—

(Fisheries Development Division)

* Fish landing volume shows the amount actually surveyed and not the actual total.

2-3 Outline of Related Projects

2-3-1 National Development Project

The Government of Dominica is preparing a new National Development Project and each Ministry is proceeding with a development plan for each sector. The following items are supposed to be development targets.

(1) Promotion of food self-sufficiency.

(2) Creation of employment opportunities.

(3) Elimination of poverty and improvement of social and economic conditions.

(4) Promotion of industrialization.

For the development of the agriculture, forestry and fisheries sectors, considering the influence of the abolition of the preferential tariff of England planned in 1993 due to the unification of the European market, the country intends to extract itself from industry which depends on agriculture, mainly banana production, and to then diversify its products and industry. Since Dominica is surrounded by the sea, it is pointed out that the country should place special attention on the development of marine resources and use them effectively in order to reduce the imports of food staff and contribute to improving the rate of food self-sufficiency.

2-3-2 Fisheries Development Project

Along with the policy of the national development of diversification and modernization of the industry, the development of marine products field is thought to be one of the most important subjects and the Ministry of Agriculture, Lands, Fisheries and Forestry is raising the following targets to try to develop and activate the fisheries industry field.

(1) Increasing of the fishery production and the supply to the local population.

(2) Improvement of social and economic conditions of fishermen.

(3) Promotion of effective use of marine resources.

(4) Increasing of employment opportunities in the fisheries sector.

The following measures will be taken to achieve the above targets.

(1) Increase in the catch by means of modernization of fishing boats and introduction and spreading of effective fishing tools and methods.

(2) Improvement of fisheries infrastructure such as fish landing facilities.

(3) Establishment of the catch distribution system.

(4) Reinforcement of the fisheries administration and fishery guidance system.

2-4 Outline of Request

2-4-1 Progress of Request

The Government of Dominica is putting its efforts in developing the country's coastal fishery in order to meet its own demand for fish. It is proceeding with the training of fishermen and constructing local landing places with support from Taiwan, Canada, WFP and the European Development Fund (EDF). However, the achievements so far have not been satisfactory due to the fact that a domestic distribution system as not been prepared and also because of the poor state of the fish market in Roseau, the capital where a large population is concentrated. Against this background, the Government of Dominica planned a Project to establish fish landing and market facilities in the capital zone, and made a request to the Government of Japan for the provision of Grant Aid for the implementation of the Project.

The initial request included:

① Construction of a Fish Market Complex in Roseau, and

② Improvement of fishing village environment (Roseau and Newtown).

However, Newtown construction is excluded from the Project because, for one thing, the Dominican side needs to reclaim the land for construction of the facility.

2-4-2 Description of request

(1) Roseau Fish Market Complex

A. Facilities

i. Fish marketing facilities

• Fish market (for retail and trader)	300m^2
• Fish handling area	200m^2
• Freezer, refrigeration and ice making facilities	50m^2
• Lockers for retailers	25m^2
• Fish market management office	30m^2
• Stand	100m^2 (10m^2 x 10 stands)

ii. Fisheries Division facility

• Office	150m^2
• Training /meeting room	100m^2
• Quality control laboratory	30m^2
• Work shop	100m^2

iii. Fishing port facilities

• Pier	L80m x W5m x 2 units
• Seawall	About 100m
• Soil backfill	About 2,100m^2

B. Material and equipment

i. For market

• Blast freezer (10m^3)	1 unit
• Refrigerator (-20°C, 40m^3)	1 unit
• Refrigerator (0°C, 10m^3)	1 unit
• Ice making unit (flake)	1 unit
• Ice storage (0°C, 10m^3)	1 unit
• Insulated truck(2 tons)	2 units
• Plastic fish containers (150L)	24 pcs.
• Insulated fish containers (150L)	12 pcs.
• Spring balance (0 ~ 10kg)	12 pcs.
• Platform scale (0 ~ 100kg)	2 pcs.
• Hydraulic hand cart (1.2m ~ 0.9m)	2 units

ii. For Fisheries Division

- Tools for outboard engine repairing — 1 set
- Audio visual devices for training — 1 set
- Equipment for equality control/processing development — 1 set
- Office equipment — 1 set
- Data processing apparatus — 3 units
- Radio equipment — 8 units (including 5 units for vehicles)
- 4WD vehicle (for extension services) — 3 cars

(2) Improvement of Fishing Village Environment

Fishermen's lockers (for 60 fishermen), slipway with boat ramp, cooperative's office, net loft.

2-5 Assistance of Foreign Countries for Fisheries-Related Projects

(1) UN/FAO/WFP

From 1990 to 1993, grants of EC$ 2.5 million was given to improve the environment in eleven fishing villages (Bioche, Calibishie, Capucin, Salisbury, Vielle Case, etc.), and covered construction of landing piers, slipways, seawalls, and fishermen's lockers.

(2) ROC (Government of Taiwan)

A. Fisheries Development (Training and Relief) Project

A loan of US$ 1,000,000 (2% interest/year) was made to Dominica in 1986. The Government of Dominica used this fund to make loans of from EC$ 1,000 to EC$ 300,000 to fishermen through the Agriculture and Industry Developing Bank (AIDB) of Dominica with 5% interest and a repayment term of 3 ~ 5 years. The Government of Dominica also used this fund to introduce six small sized longliners (38 ~ 45 feet); one of them was named Silver Dolphin and is used as the investigation/training boat of the Fisheries Development Division (FDD). At this point, one out of 5 boats distributed to fishermen was stranded but the rest are in operation. A technician (chief fisherman) who is Taiwanese has been in Dominica for 7 years for provision of technical assistance.

B. Culturing of Prawn

A prawn hatchery and small ponds on experimental basis were constructed near Layou, in western Dominica, with a total of EC$1.5 million . Currently, one Taiwanese technician is providing with a technical guidance.

(3) OECS

A Fisheries Unit of the Organization for Eastern Caribbean States (OECS) was established in November 1985 using financial and technological support from the International Center for Ocean Development (ICOD) in Canada. This unit is intended to foster the development and management of fisheries resources in sea areas of eastern Caribbean counties. Countries belonging to this organization are Antigua & Barbuda, British Virgin Island, Dominica, Grenada, Montserrat, St. Christopher & Nevis, St. Vincent & the Grenadines, a total of 8 counties. The headquarters of Fisheries Division of OECS located in Kingstown of St. Vincent. Its major activities are the drafting of a fishery development plan, education and training and financing of small projects (EC$ 5,000–$15,000).

(4) CIDA

The Canadian International Development Agency (CIDA) investigated the fisheries industry of Dominica as a part of fishery related cooperation activities and a report was drafted in 1986.

(5) IFAD

International Fund for Agriculture Development (IFAD) financed Dominica to repair damages inflicted by hurricanes in 1979 and 1980.

(6) EDF

Europen Development Fund (EDF) constructed a fisheries center including a cooperative's office, meeting room, warehouse, stand, small-sized ice making machine (200kg/day x 3 units), refrigeration stocker, and fish bay, etc. at Font St. Jean which is in the southern part of Dominica.

CHAPTER 3 OUTLINE OF PROJECT

3-1 Objectives

The Commonwealth of Dominica is an island originally formed of volcanic rock, having a population of 72,000 and an area of 750km^2. The country's economy is based on agriculture, mainly banana cultivation. The fishing industry of the country is small scale mainly consisting of small sized boats and canoes with outboard engines. The recent annual production is approximately 1,250 tons, which meets only about 35% of the demand and 900 tons of fish (mainly salt-dried fish) is imported every year.

It would seem desirable to promote the fisheries sector to gain greater self-sufficiency in supplying food to the population. This would reduce the amount of imports of food and improve the living standard of fishermen. For this reason, modernization of fishing gears and methods would be advantageous, such as the introduction of the new longliner. However, the following problems restrict the promotion of the country's fishing industry:

1) Safe and efficient production activities are lacking due to poor facilities, equipment and materials that support the fishing industry.
2) The catch is not effectively used because a distribution system has not been established at the landing areas and from the landing areas to the consumption areas.
3) Fishermen are generally poor without sufficient fishing boats, equipment and materials; thus it is difficult to increase their income and their lives cannot be improved.
4) Supporting facilities necessary for promotion, guiding and administration of fisheries are poor. Therefore, activities such as appropriate fisheries management, guidance, technical extension and maintenance of equipment cannot be performed.

The Project is focused to construct a fisheries complex in the Roseau area thereby developing the environment as the base of production, distribution and guidance of fisheries. This should result in an increase in production of small scale fisheries, improve the safety and the living standard of fishermen and increase the amount of marine products to the consuming areas. The Project includes the following functions.

1) Landing of catch
2) Safe moorings of fishing boats
3) Storing and distribution of catch
4) Training of fishermen and propagation activities
5) Development of fish processing and quality control
6) Control and support of fishing activities
7) Improvement of the of fishing village environment

3-2 Study and Examination on the Request

The scope of the Project requested by the Government of Dominica are as explained in 2-4-2 of this report. However, during discussion with the Dominican government officials covered the basic design study, details and scale of facilities, equipment and materials have been modified and corrected. Results of study on these contents are as follows.

3-2-1 Justification of the Project

Dominica's key industry is agriculture with 60% of its exports in this mono-economic structure focusing on bananas. Since 1980, the Government of Dominica has attempted to stabilize its economy by promoting ① industrialization ② diversification of the primary industry and self-sufficiency of food. The fisheries is a logical area for development because Dominica is surrounded by seas with a traditional population that prefers a fish diet. The present fishery sector produces only 1,250 tons a year making it necessary for the country to import another 900 tons of fish to meet consumer demand. Although the country has steep geographical characteristics with few continental shelf and is often subjected to severe hurricanes, its surrounding sea areas are blessed with migrating fish, such as tuna, dolphin, flying fish, etc.

In order to reduce the amount of imported marine products while meeting the demand for fish, it is essential to increase the volume of the domestic catch. To do so, first of all, it is necessary to construct facilities for the landing and mooring of large sized fishing boats (approximately 40 feet or more in length) This concept was introduced by the Dominica's Fisheries Development Division in 1986 as a part of its expansion and modernization plan for the fishery sector. Roseau, the capital, is the center of a large market for marine products. Locating the Project in Roseau should improve the distribution and market facilities there. If accomplished, this should meet the demands

of the fish eating people living around Roseau. Also, fishermen in local villages can sell surplus fish using a sales route; thus the enthusiasm of local fishermen to raise production levels may be increased. Currently, the UN/FAO/WFP projects are proceeding to improve the environment of several local fishing villages. Construction of a fisheries complex in Roseau can be expected to activate those local fishing villages. Moreover, the complex can be used, not only by fishermen, but also by existing distributors (wholesalers, venders) to collect and market fish as scheduled; thus the volume of distributed fish can be increased.

Also, certain government support activities such as ① quality inspection and fish processing development, ② spreading of technologies to fishermen and strengthening of training, and ③ analysis and distribution of relevant information may be effectively implemented; thus we believe that fisheries development may be achieved comprehensively.

Because of the rationale stated above, and because the Project establishes a central fundamental fisheries industry in the country, it is believed that the Project can provide benefits directly to all of the people in Dominica.

3-2-2 Executing agency

Plans have been made for the Dominica Export Import Agency (DEXIA) to manage and operate the fish distribution facilities requested (fish processing, sales place, insulated truck, fish containers, etc.) including ice making and refrigeration facilities. DEXIA is currently in charge of the management of the existing Roseau market facilities. DEXIA handles the importing/exporting of products other than bananas (especially imports and sales of rice and sugar), thus the agency has knowledge and experience in distribution and market operation. According to the Government of Dominica, it intends to establish "Dominica Fish Marketing Agency", transferring the operation of the facility after it is completely functional with a target date of several years.

Workshop, training/education facility, office, and laboratory, including equipment and materials, will be under the control of the Fisheries Development Division (FDD).

Fisheries facilities (slipway with boat landing, fishermen's rockers, lavatory/shower for fishermen), which will be constructed as components of the Roseau Fisheries Complex, will be operated by concerned fishermen's cooperatives under the control of the Fisheries Development Division. The mini bus terminal will be operated under the control and guidance of the Traffic Department, Prime Minster's Office..

3-2-3 Relation to Similar Projects

Projects similar to the Project are described below.

(1) Roseau Bayfront Project – Sea Wall Construction

The sea wall construction began in April 1992 with a completion date September 1993 with a grant aid totaling EC$ 18 million (about ¥740,000,000). This project site is adjacent to the Roseau Fisheries Complex construction site including sea wall (320m), rehabilitation of the pier for ferry (L shape 47.4m long x 13m width, 45m length x 18 width), esplanade inside the sea wall, parking lot and roadway (3-lane). Completion of this sea wall is expected to provide the base for the development of tourism in Dominica and to contribute to relieving the traffic congestion in Roseau City. Since the Roseau Fisheries Complex will be constructed on the extension of this sea wall, comprehensive water front development will be implemented.

(2) Local Landing Facility Improvement Project

From 1990 to 1993, UN/FAO/WFP improved the environment in 11 fishing village locations. This project includes facilities such as a jetty, slipway, mooring, sea wall, fishermen's rockers. These facilities are to support fisheries activities of local small scale fishermen. This support is expected to encourage the fishermen in their fishing activities and lead to an increase in production. When the requested Roseau Fisheries Complex is constructed and the system to collect fish from local fishing villages is prepared, the amount of fish from those villages should increase and villages defined by the Project may be encouraged further.

3-2-4 Study of Project Components

Functions of facilities, equipment and materials included in the Project are ① landing of catch and safe mooring of fishing boats, ② storage and distribution of catch, ③ training of fishermen and technical extension activities, ④ development of processing and quality control of marine products, ⑤ supporting of fisheries activities, ⑥ improvement of fishing facilities in fishing villages, and ⑦ improvement of access to the market. Those functions are indispensable to the promotion of the coastal fisheries of the country and when each function is demonstrated the comprehensive development of fisheries becomes possible. Especially, Roseau Fisheries Complex will be a core facility of the development of the country's fisheries and has a great role to provide stable supply of high quality marine products to the people. For those meanings, the components of the Project is determined appropriate.

3-2-5 Study of The Scope of Facilities and Equipment

(1) Projection of the Amount Of Catch

The amount of catch shown in Table 2-4 of the previous chapter is only the amount of landed fish recorded by the investigators at fish-landing sites. There are many landing places where investigations have not been conducted. The Fisheries Development Division (FDD) thinks this recorded amount is 50 ~ 60% of the total fish landings. As shown in Table 3-1, the FDD estimated the catch in 1992 at 1,243 tons, stating it can accurately estimate the actual volume of catch based on the number of fishing boats, net working rate and average catch per boat obtained through the investigations at the landing sites.

Table 3-1 Projection for Each Local Village

First group: Net working ratio : 60%

Number of fishing trips : 20 trips/month/ 60% x 12 = 144 times/year

Average amount of catch : 13.5 kg/time/boat

Fishing village	Number of boats	Yearly amount of catch (ton)
Scotts Head	109	211.9
Fond St. Jean	31	60.3
Marigot	32	62.2
San Souveur	35	68.0
Portsmouth	77	68.0
Bioche	54	149.7
Mahaut	40	77.8
Colihaut	32	62.2
Newtown	68	154.2

Second group: Net working ratio : 50%

Number of fishing trips : 20 trips/month/ 50% x 12 = 120 trips/year

Average amount of catch : 9.0 kg/time/boat

Vieille Case	27	29.2
Anse de Mai	22	23.8
Stowe	22	23.8
Calibishie	12	13.0
Salisbury	17	18.4
Atkinson	22	23.8
Pottersville	66	71.3

Third group: Net working ratio : 33%

Number of fishing trips : 20 trips/month/ 33% x 12 = 79 trips/year

Average amount of catch : 6.8 kg/time/boat

Capucin	22	11.8
St. Joseph	20	10.7
Layou	22	11.8
Coulibistrie	35	18.8
Castle Bruce	20	10.7
Penville	16	8.6
Petite Soufiere	30	16.1
Total amount of catch (ton)		1,243.1

As explained previously, the FDD is proceeding with the improvement project of local fishing villages, with the introduction of new fishing boats (FRP boat) to substitute for conventional small sized boats as well as the introduction of large sized fishing boats. With guidance to fishermen and the preparation of a financing system, projection of the number of fishing boats is:

1) Increase in number of small sized fishing boats

	1989	1990	1991	1992	1993	1994	1995	1996
Number of modified type boats increased	27	22	28	23	25	25	25	25
Number of FRP new type boats increased	—	7	14	8	10	10	10	10

2) Number of large sized boats introduced

	1990	1991	1992	1993	1994	1995	1996
Number of boats introduced	1	1	2	3	3	2	3
Total (boats)	1	2	4	7	10	12	15

The Fisheries Development Division (FDD) predicts the amount of catch based on the increased number of fishing boats as follows:

1) Amount of catch by small sized fishing boats

Modified fishing boats and FRP new type fishing boats are larger and have more seaworthiness than the conventional boats, are more navigable and have more thrusting power. For these reasons, the range of the fishing area can be expanded and they can go fishing during sea conditions when conventional boats are not seaworthy. Thus operation times can increase. Regarding fishing methods, in addition to the bottom fish hand lining and bottom longlining, purse seining methods aiming at horse mackerel, flying fish, etc. in offshore and gillnetting aiming at skipjack, king fish, dolphin, etc. can be used. In addition to these methods, with FRP new type fishing boats, it is possible to operate tuna longline fishing. In fact, fishermen who received technical guidance from the FDD have used this method. The conventional fishing boats cannot go to an excellent bank 10' ~ 12' south east offshore Dominica, but new fishing boats can. Thus the

capability of catch of the new fishing boats is significantly greater than the conventional boats. Operation records of the new type fishing boats is shown in Appendix 5. Assuming the amount of average catch of new fishing boats are about 70 ~ 80% these records, the increase of catch provided by the increased number of new boats can be projected as follows:

Increase by modified boats	25 boats x 18 kg x 160 days/year =	72.0 tons
Increase by FRP new type boats	10 boats x 37.8 kg x 180 days/year =	68.0 tons
	Total increase	140 tons/year

Year	1992	1993	1994	1995	1996
Catch (ton)	1,243	1,383	1,523	1,663	1,803

2) Amount of catch by large sized fishing boats

Large sized fishing boats can operate offshore and also can operate a whole year following the movement of schools of fish (tuna). The amount of catch is predicted based on the records kept during training operations on FDD's training boat and the catch sampling investigation of private fishing boats.

Number of hooks	:	400 pieces/set
Catch rate	:	2%
Average fish weight	:	40 kg/fish
Number of operation	:	3 times/trip
Catch per trips	:	about 900 kg
Number of trips	:	6 times/month (72 times per year)

Year	1994	1995	1996
Number of Boats	10	12	15
Amount of Catch	648	778	972

(Note) However, the above projection is based on the condition that the facilities of the Project operate and operation support services such as fish landing, supply of fuel and ice are provided to the large sized fishing boats.

According to the above, it is predicted that the total catch will reach 2,775 tons in 1996. Given the total population 72,000 (as of 1991), this gives a figure of about 38.5 kg consumed per person per year. It is about 1.3 times the current amount of fish

consumption per person, which stands at 30 kg. With this increase of catch, the previously mentioned government target value, 40kg/person/year will be almost achieved and it is a marketable amount considering the traditional fish intaking habits of the people of Dominica and current shortages of domestically supplied fish.

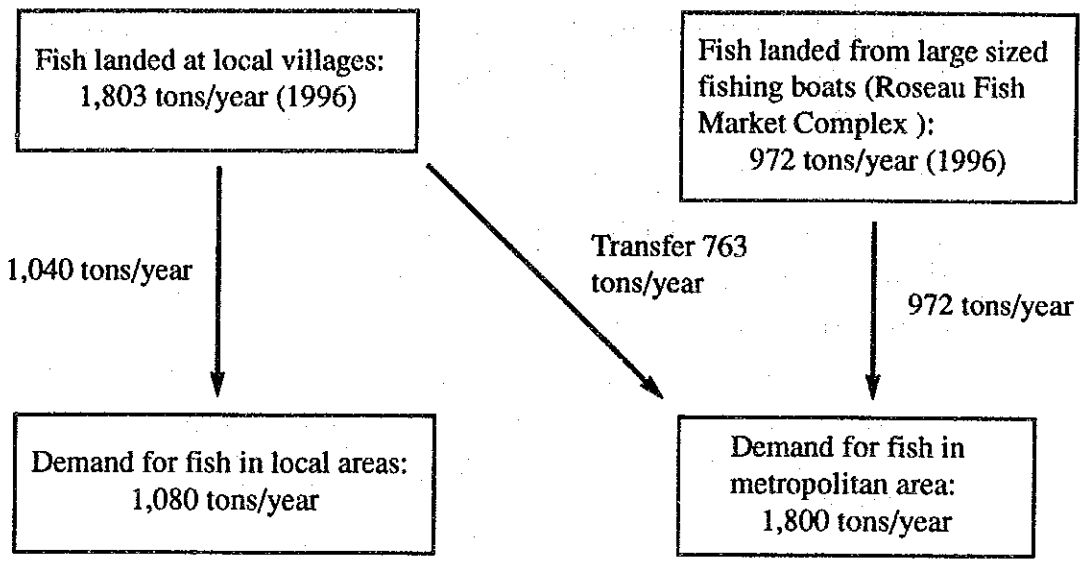
(2) Prediction of Demand

The Government of Dominica sets the target amount of fish consumption to 40 kg/person/year. Based on this, when calculating the current demand for fish in the Roseau area and local areas, the following figures result:

Roseau area	:	Population 45,000 x 40 kg/person/year =	1,800 tons/year
Local area	:	Population 27,000 x 40 kg/person/year =	1,080 tons/year
		Total	2,880 tons/year

Generally, the purchasing power of people is stronger in Roseau areas than those in local area; however, the price of fish in local areas is cheaper than that in Roseau areas. Thus the assumption can be made that there is not much difference in the amount of fish consumption in the Roseau area and local areas. Although, the consumption pattern of beef/chicken meat/fish can be different depending on whether the area is coastal or a inland, when averaging, people in both areas seem to consume fish at almost the same ratio. Therefore, to estimate the amount of demand for fish was assumed to be 40 kg/person/year in both Roseau and local areas.

When the planned amount of catch is compared to the above amount of demand, the planned catch in 1996 is 2,775 tons against the demand 2,880 tons/year. This means that the domestic demand estimated is almost satisfied. Based on the above figures, in order to satisfy all demands of Roseau and local areas after Foes Fisheries Complex is completed, the following distribution of catch seems most likely:



(3) Landing/Mooring Facility

In Dominica, catch is landed at fishing villages dispersed over the island but due to steep geographical characteristics and only a few beaches, landing of fish from small sized boats and mooring of boats cannot be performed satisfactorily. Small jetties, slipways, and fishermen's rockers have been installed in several villages by the previously mentioned UN/FAO/WFP projects; however, those facilities cannot be used for large sized fishing boats (approximately 40 feet with inboard engine) which the Government of Dominica promotes to introduce. Currently, Dominica has eight large sized fishing boats of approximately 40 feet (one of them belongs to the Fisheries Development Division) and there is a plan to introduce 2 ~ 3 more of the same type of boat every year to increase the number of fishing boats. (Refer to "(1) Projection of the amount of catch "in this chapter.)

To implement the policy to increase the number of these large sized fishing boats, the Fisheries Development Division trained 64 fishermen. In order to provide financial assistance for the fishermen to construct boats, a low interest credit system (5% per year, repayment term is 3 ~ 5 years) was established by the Agriculture, Industry Development Bank of the country, using repayment of loans for boat construction as a revolving fund; thus the planned number of boats to be increased in the above table seems to be realized without difficulty.

Since there are no landing/mooring facilities in the country for the existing large sized fishing boats, these boats anchor off Portsmouth in the north west region of the country and they are enforced difficulty to land fish and get supplies. Furthermore, during stormy weather, it is difficult to ensure the safety of those boats; in fact, already one of these boat was stranded and crashed due to stormy weather.

Because of the above circumstances, constructing landing/mooring facilities for fishing boats is extremely necessary in order to encourage fishermen to invest in large sized boats and increase the volume of catch. The Project is to be formulated with the projected number of the large sized fishing boats in 1996, that is , 15 boats.

(4) Storage and Distribution of Catch

Currently, Dominica has few ice-making facilities for fisheries. Several small sized ice making machines (200 kg/day x 2 ~3 units) are in Font. St. Jean, Marigot, and Newtown but they are mostly broken down, thus the amount of ice available is very lacking. The above mentioned large sized fishing boats (approximately 40 feet long) are used mainly for tuna longline fishing. Since ice cannot be supplied in the country, they have to sail to Martinique or Montserrat to obtain ice. Some advanced cooperatives use chest type freezers to make ice with pails, but they are too small and costly to supply ice for the fishing boats. Therefore, it is necessary to install ice-making facilities in order to provide a stable supply of the necessary amount of ice to fishing boats and also maintain the freshness of fish.

Since there are no storage facilities for fish in Roseau City, even if catches are brought into the market from local fishing villages, they often cannot be treated appropriately when the market is closed.

In addition to supply of ice, it will be necessary for the Roseau Fisheries Complex to secure temporary fish storage until the fish market is opened and also to provide a stable supply of fish to fish-market when the large sized fishing boats call the complex to land their catches mainly tuna. Also, it may promote private investment to processing and wholesaling of fish, as well as possibly activating distribution to hotels and supermarkets. In this context, freezers and cold storage are essential to freeze and stock fish.

According to the aforementioned demand for fish in Roseau and local areas, the planned amount of fish (1996) to be handled in the requested Roseau Fisheries Complex is as follows.

① Landing of fish from large sized boats

All of the catch from large sized boats is landed at Roseau Fisheries Complex.

Yearly amount of fish landing	972 tons/year
Daily amount of fish landing	4,050 tons/day

② Amount of fish to be collected from local fishing villages

Total catch of local villages	1,803 tons/year
Amount of fish to be transported to Roseau	763 tons/year
Daily amount of fish transported	3,180 kg/day
Total	7,230 tons/day (1,735 tons per year)

(Market yearly business days 240 days/year)

Sales destinations of catch landed and collected at the Complex are roughly divided into two areas: ① for large demand such as existing wholesalers and ② for a fish retail market, a part of the Complex.

① Large demand of wholesalers

Major sales destination for large demand are hotels, guest houses, restaurants, supermarkets and general retail stores in Dominica. Their potential demand are currently predicted as follows.

Table 3-2 Potential Demand for Fish by Large Supply Destination

(Original fish base)

Sales Destination	Number of Businesses		Demand (kg/day)		Estimation Grounds
	Roseau area	Local Area	Roseau Area	Local Area	
Hotel	8	7	84	74	0.7 kg/person x 15 persons/hotel/day
Guest house	8	11	56	77	0.7 kg/person x 10 persons/hotel/day
Restaurant	23	8	483	168	0.7 kg/person x 30 persons/store/day
Supermarket	8	6	1,200	450	Roseau : 150 kg/store/day Local area : 75 kg/store/day
General retail stores	15	13	1,500	650	Roseau : 100 kg/store/day Local area : 50 kg/store/day
Total	62	45	3,323	1,419	
Ratio	58%	42%	57%	43%	
Yearly demand (ton)			1,212	518	Demand per day x 365 days/year

In the above table, it is supposed that the fish for sales is to local areas (518 tons/year) is not redistributed from the fish landed and collected at Roseau Fisheries Complex but directly supplied from local fishing villages by fishermen or fish dealers. On the other hand, the large demand around the Roseau area is 1,212 tons per year and most of fish is supposed to be frozen fish or processed fish, considering of the current sales style.

② Demand of the fish market in the Complex

As explained before, all catch landed and collected at Foes Fisheries Complex is used to satisfy the demand of the people around Roseau area. Therefore, the amount of fish distributed to the fish retail market of the Complex can be found by subtracting the large demand explained above from the total landed/collected fish at Roseau Fisheries Complex.

Roseau area total demand	:	1,800 tons/year
Roseau area large demand	:	1,212 tons/year (3,323 kg/day)
Demand of fish	:	588 tons/year
Market yearly business days	:	240 days
Demand of fish retail market per day	:	2,450 kg/day

The above can be summarized as follows.

	Roseau Area		Local Area	
Fish demand	1,800 tons/year	(100%)	1,080 tons/year	(100%)
• Large demand	1,212 tons/year	(67%)	518 tons/year	(48%)
• Local consumption or retail market demand	588 tons/year	(33%)	562 tons/year	(52%)
Amount of supply	1,735 tons/year	(100%)	1,040 tons/year	(100%)
• Fish landing at local villages	763 tons/year	(44%)	1,040 tons/year	(100%)
• Fish landing from large sized fishing boats	972 tons/year	(56%)	—	(0%)

According to the above table, the amount of fish landing planned matches the amount of demand for fish by the country, and the amount of fish distributed to each sales destination can be appropriate, reflecting the circumstances of the country's fish distribution.

(5) Education and Training Facilities for Fishing Techniques

Dominica introduced the tuna longliner SILVER DOLPHIN in 1986 with the cooperation of the Government of Taiwan. The Fisheries Development Division (FDD) owns the boat and uses it for training of fishermen. Already 64 fishermen acquired the tuna longline operation technique through on-the-job training on the boat of FDD. Contents of the training conducted by the FDD are as follows.

On-land training	7 days
At sea training (I)	7 days (45 feet type boat)
At sea training (II)	3 days (25 feet Martinique type boat)
Total	17 days

8 fishermen/session x 8 training sessions = 64 fishermen received training

The Government of Dominica is making efforts to train and educate fishermen. Two engineers of the FDD and seven young fishermen are currently receiving short-term training in Canada. With these people as key personnel, Dominica is planning to expand and improve the training of fishermen. By installing a training facility in the Foes Fisheries Complex, the plan is to conduct more effective education and training for about 30 fishermen or fisheries extension staff through combing training together with conventional on-the-job training.

Specifically, the facility will be used to educate and train local fishermen. The key personnel will be assigned to each fishing village, being responsible for introducing and teaching fishing techniques, engine maintenance, and management of cooperatives and they will be called to Roseau to receive more advanced technologies. The facility will be used for that purpose. Those key personnel will train and guide fishermen at each area and also collect data to report to the headquarters. Those data will be appropriately analyzed and used to draft future plans.

Using the above method, local fishermen do not have to take the day off to come to Roseau for the training and also this method may contribute to fostering leaders in each fishing village, even possibly leading to the development of whole technologies from the bottom up.

(6) Supporting Fishing Activities

The planned facilities shall provide the following activities and services to fishermen in order to facilitate fishing activities and improve the efficiency of the operation of fishing boats.

1) Maintenance and Repair of Fishing Boat Engines Such as Outboard Engines

Most of the fishing boats (small sized boats including canoes and keel boats) use an outboard engine and its operational conditions surrounding its operation determines the working rate of the fishing boat. In the current state that an engine maintenance and repair system has not been prepared, when an engine breaks down, it takes a

long time to arrange repairs and the fisherman must take an extended period of time off until the repair is finished.

With the Project, a maintenance/repair facility (workshop) for fishing boat engines such as outboard engines will be installed with the necessary tools in order to provide engine maintenance service and prompt repair so that the net working ratio of fishing boats can be increased. The workshop will be also used to conduct training for engine maintenance and repairing techniques to foster mechanic in local villages.

2) Supply of Fuel, Ice and Water

Fuel, ice and water will be quickly supplied to fishing boats to facilitate fishing operations. Ice is just as indispensable to the operation of large sized fishing boats as fuel. It is, however, impossible to supply sufficient quantity of ice in Dominica in the current circumstances. The large sized fishing boats have been enforced to call other islands such as Montserrat to buy ice or go fishing without ice to operate for only a short time and then return. The difficulty in obtaining ice makes fishing activities inconvenient. The general pier at Portsmouth is the only place where large sized fishing boats make alongside to obtain fuel and water carried by trucks. This situation hinders the operation of fishing boats.

The planned facilities will secure the supply of necessary items to fishing boats, smooth the operation of fishing boats, consequently increasing the net working ratio. Together with the landing facilities, these facilities and services the enthusiasm of fishermen and contribute to modernization of fishing boats will be promoted.

(7) Quality control And Processing Development Of Marine Products

Currently, organoleptic testing is currently the only method of quality examination for fish conducted in Dominica and almost no scientific analysis has been carried out. The occurrence of cigarette poison cases has already been reported in the Caribbean countries and it is possible it may occur in Dominica. Cases of allergic reactions caused by eating rotten fish have also been seen. It is therefore necessary to take measures to prevent food poisoning beforehand along with the introduction of sanitary fish treatment/sales facility and ice. Furthermore, when a new international airport construction plan is materialized, the possibility of exporting fish such as tuna will increase. If so, a system could important in order to monitor the amount of mercury accumulated in fish bodies from early stages—an international issue. For the above

reasons, equipment and materials required to conduct physical and chemical inspections (K value, volatile basic nitrogen, pH value, mercury, etc.), bacteriological inspection (number of live bacteria, parasitic worms, colon bacillus, etc.) and physical inspection (temperature in fish body) for fresh fish and frozen fish.

Because of an increase in the amount of fish landing and diversification of distribution channels it will also be required to introduce technologies such as small fish fillet processing and block processing of frozen tuna in addition to fish preservation. Those processed products are already in demand in Dominican supermarkets and is expected that their demand will grow in the future as the products become popular. For this reason, equipment such as band saw, vacuum packaging machines, tables for processing, etc. will be installed in the Fisheries Complex so that private traders can use them.

(8) Improving the Fishing Villages Environment

Sixty fishermen are supposed to move into the Foes Fisheries Complex from Pottersville to the north side of the project site. Also, it is planned that 75 fishermen from Newtown will land fish at the Complex for the time being until the facilities at Newtown are improved. Since the area the fishermen of Pottersville now use for fish landing is designated as a part of anchorage area at the Roseau commercial port, it has been decided that they will be moved in order to eliminate any inconvenience in regard to boat navigation. They used to land fish at the project site but had been forced to move to another location because of city development and promotion of the waterfront project. When relevant facilities are established at the project site, a comfortable environment will be provided for fishing activities. The fishermen of Newtown will use the Complex for fish landing only and they go back to their place after that.

(9) Improving Access to the Market

Currently, the Roseau market (adjacent to the Project Site) is open every day except Sunday and national holidays. Only the weekends (Fridays and Saturdays) are crowded and on weekdays just 10 ~ 14 stores are open and a small number of venders sell mainly agricultural products outside the market building. This is because access to the market is not convenient for one thing. Since mini bus terminals are dispersed across the city (about 10 locations, see Fig. 3-1), people feel it is inconvenient to go to the market everyday by public transportation. With this traffic situation, people tend not to go to the market on weekdays, instead going there on the weekend to buy many things at once. For another thing, many of the venders are farmer's wives who work as farmers on weekdays and then go to the Roseau market on Friday or Saturday to sell

their products. Therefore, during the two days, Friday and Saturday, the number of the venders exceeds the capacity of the market and they crowd outside the market buildings. The number of cars parked on the road reaches saturation. To solve this weekend concentration, it is important to make mini bus terminals at a place adjacent to the market so that people can easily get to the market after work on weekdays. A week's worth of agricultural products can be stored but fish and meat can't as long as each family has no refrigerator, therefore, they have to buy them everyday.

For the above reasons, constructing a mini bus terminal close to the Foes Fisheries Complex will not only increase the number of people coming to the fish market but also contribute to effective use of the existing Roseau market. Furthermore, it is supposed that it will ease congestion in Roseau city. Construction of a parking lot for ordinary cars has been proceeding as a part of the construction of the sea wall which is about 320m along the coastline next to the project site; thus, a kind of multiplier effect can be expected.

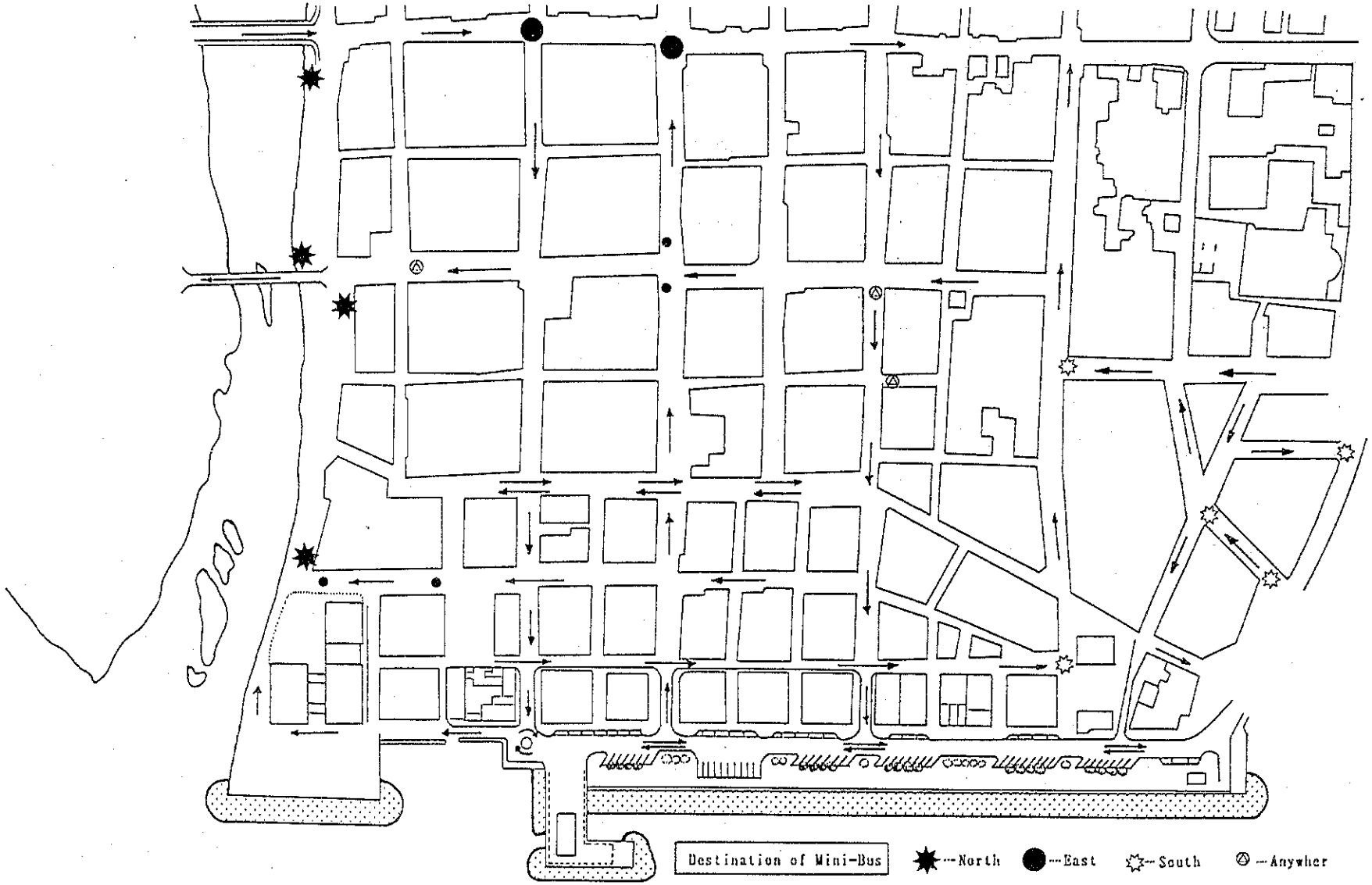


Fig. 3-1 Rosean City Mini Bus Terminals Locations (Current)

3-2-6 Necessity for Technical Cooperation

Among the Project facilities, it is planned that fish marketing/processing related facilities will be controlled and managed by DEXIA. However, as it will be the first experience for DEXIA to handle fish, they will have to handle it with technical advice from the Fisheries Development Division. The project facilities includes freezing, storing and processing functions, and management of DEXIA must be profitable as a whole business. In this context, the long-term cooperation of Japanese fish marketing expert is supposed to be necessary. Also, regarding operation and maintenance technologies for refrigeration equipment, it is the first time for them to handle the anything on the scale to be introduced in this Project. Therefore, it would be desirable for Japan to dispatch an refrigerator engineer for a short period of time (6 months) to guide and train the local technicians in the operation and maintenance of the facility. In addition, it is important to invite middle class technicians of Dominica to Japan for training to foster the growth of core personnel involved in facility operation.

3-2-7 Basic Policy of Implementation of Cooperation

According to the above study, implementation of the Project is determined to be appropriate because its effects, feasibility and implementation ability of the recipient country were confirmed and the effects of the Project meet the criteria of Japan's Grant Aid program. Therefore, taking Japan's Grant Aid program as precondition, the outline of the Project is discussed and the basic design is determined as follows.

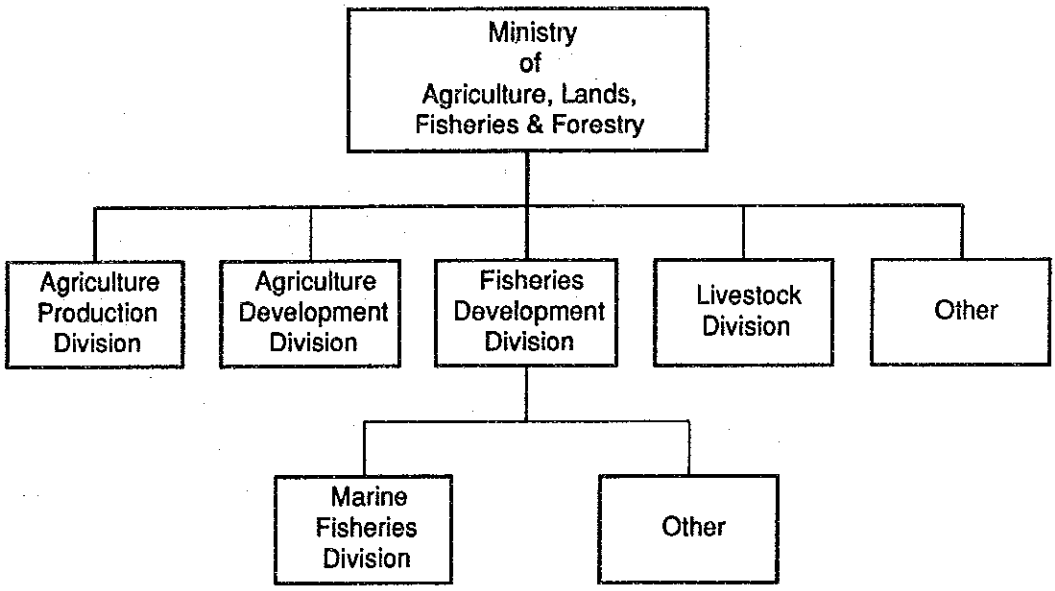
3-3 Project Description

3-3-1 Executing Organization

(1) The FDD of Ministry of Agriculture, Lands, Fisheries and Forestry

The Fisheries Development Division established in 1986 in the Ministry of Agriculture, Lands, Fisheries and Forestry is in charge of the administration of fisheries in Dominica and the number of staff persons has increased from 3 at the beginning to 16 staff persons as of June 1993. Among them, 11 staff persons have been assigned to Roseau headquarters and 5 staff persons are engaged in extension and data collection activities.

According to the Government of Dominica, at the time of implementation of the Project, it is planned for the number of staff to be increased to 32 (among them, 22 staff in Roseau). The yearly budget of the division was about ¥35 million (1990/1991). The system of the division is as follows.



(2) Dominica Export Import Agency (DEXIA)

As the management and operation agency, the DEXIA will manage the facilities and operate fish market and distribution businesses which are the main part of the Project.

DEXIA is already engaged in import/export businesses and management of the Roseau market; therefore, as the operating agency it has ability to manage fish market/distribution sectors of the Project. Details of DEXIA are as follows:

DEXIA was established in 1986 to engage in the promotion of import/export and it is under the control of Ministry of Trade, Industry and Tourism. Its activities include the collection of export marketing information, technical guidance for commercialization of products and training, installation of equipment for collection and packaging of products, trial shipment to develop markets and export promotion businesses such as establishment of credit and export insurance for traders. Also it imports rice and sugar and sells them on a monopoly basis and improves the domestic market in order to stabilize domestic prices.

The business budget of DEXIA is as follows.

(Unit : EC$)

Year	1991/92	1992/93	1993/94
Income	7,358,680.–	6,635,789.–	6,709,686.–
Expenses	7,621,013.–	6,629,949.–	6,685,293.–

Major facilities owned, managed and operated by DEXIA are as follows.

Headquarters office and rice/sugar warehouse in Roseau city

Roseau market

Agricultural products packaging place, cold storage (7.5m x 2.5m) 2 rooms (Melville Hall)

Fresh agricultural products collection center (Castle Bruce, Melville Hall and Portsmouth)

Citrus fruits packaging place, sorting place (22.5m x 30m) and shipment warehouse (45m x 7.5m)
(Currently under remodeling to change it to a multi-purpose agricultural products packaging place)

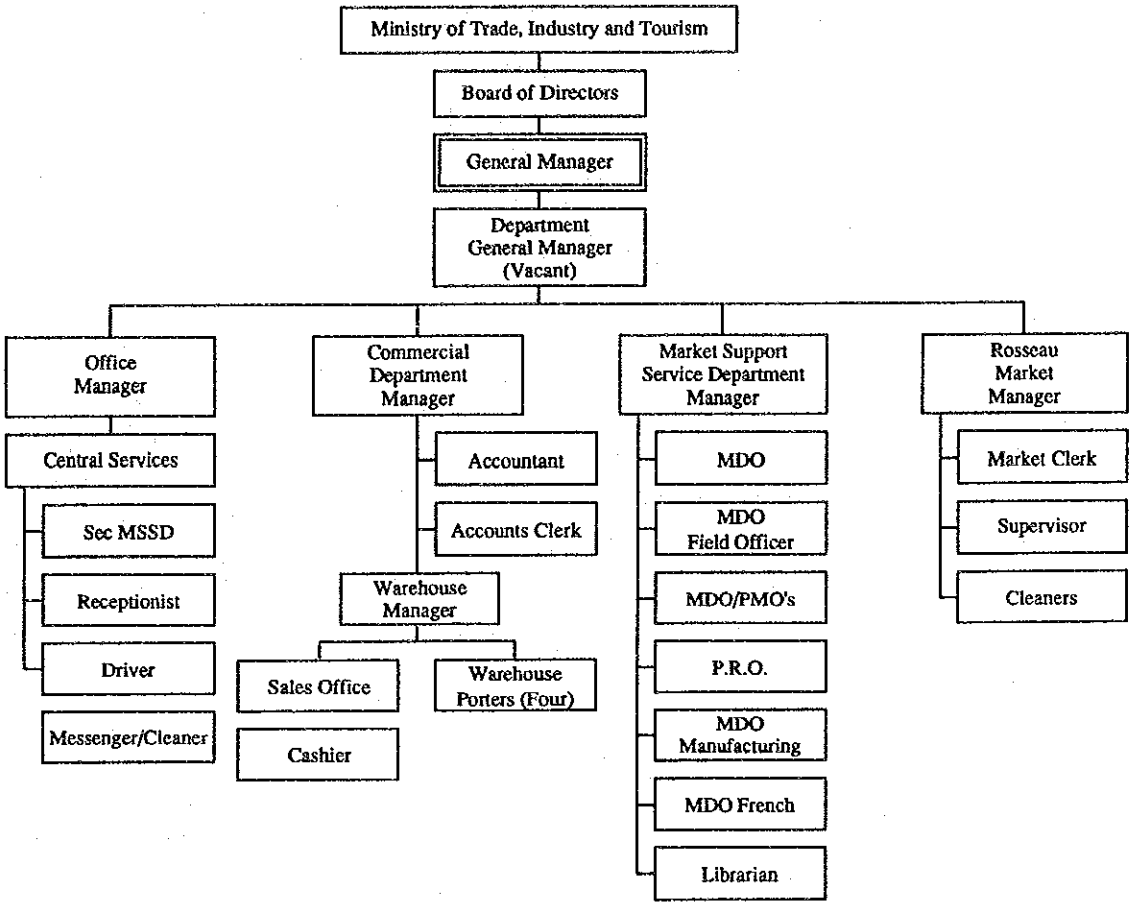
Cold storage in Antigua airport (6m x 4.8m)

Items, amount and value of imports by DEXIA

Year	1991/92		1992/93		1993/94 *	
—	Amount	Value	Amount	Value	Amount	Value
Sugar	3,000	4,470,638	2,875	3,308,478	2,900	3,331,182
Rice	1,000	1,323,983	875	1,268,011	875	1,268,011

(Unit : Amount ton, Value EC%)
(* 1993/94 are predicted values)

As of 1993, DEXIA has 38 staff persons. An analysis of the system includes the following information:



3-3-2 Location and Condition of the Project Site

(1) Location

Roseau City developed on the left bank of the river mouth, which is a natural levee alluvial fan which has been accumulating for several centuries at the mouth of the Roseau River and now the city has been extended to the right bank (north side) of the mouth of the river and to the Newtown side to the south. Concerning the coastline, the right bank of the river mouth faces south-north and the left bank faces northwest/southeast and as it flows toward Newtown it changes direction to the south-southeast.

The project site is located on the coastline of the left bank of the mouth of the Roseau River. It is a narrow beach 30m deep and 150m long surrounded by the newly-built ferry terminal on the southeast side (completion is planned for September 1993) and the Bay Street has an effective width of 5m on the back (2-lane). The water depth reaches

180m at 1 km offshore from the coast and the average gradient of the sea bottom to this distance is 1/3.3 at the right bank of the river mouth, 1/5 in front of the site and 1/5.4 in front of Newtown, which is very steep. This topographical feature is similar to that of the mountainous areas inland. For this reason, including the commercial port at the north side of the project site, anchorage for boats with about 10m draft is limited in the narrow area sandwiching the coastline (see Fig. 3-2 Area surrounding the Project site).

(2) Landform

Dominica is a part of the volcanic arch of the Lesser Antilles. The portion of mountains against the area of the island and the complicated land form of peaks and valleys overwhelms other countries and the country is said to be steeper than Switzerland. It is similar to Japan's Hakone. At the northernmost side, Morne au Diable (860m above sea level) towers above the island and the second city, Portsmouth is on the foot of the mountain facing southwest. The flat part of this area is also narrow except for a portion on the sea side.

The central part of the island is an old volcanic plateau 450m above sea level which was formed by the erosion since the Eocene era, thus accounting for the relatively young nature of the soil. Peaks and ridges can be seen here and there about 600m above sea level. This central plateau is divided to the east and west by ravines and rivers of relatively wide width. The rivers flowing to west side are Layou and Roseau and to the east side are Melville Hall, Pagua, Bell Fille, and Rosarie. Several new Pleistocene volcanoes tower over this old volcanic plateau. Morne Diablotin (1,420m above sea level) projects up to the north and Morne Trois Piton (1,424m above sea level), Morne Macaque (1,220m above sea level) and Watt Mountain (1,225m above sea level) all range to the south side. Roseau, the capital is developed on the alluvial fan of the mouth of the Roseau River on the west side of this south side mountain range. These particular mountains are not very high, in fact, half of the island is less than 300m above sea level. However, Dominica is not characterized by the height of its mountains but instead by its steep inclines. For this reason, though the distance is not that great, roads running in the east-west direction are twisted with steep slopes constructed through the severely sloped base of the mountains. From Canefield airport at the southwest side to Melville airport on the northeast side is actually only about 30 km as the crow flies but it takes about one hour to get there by car.

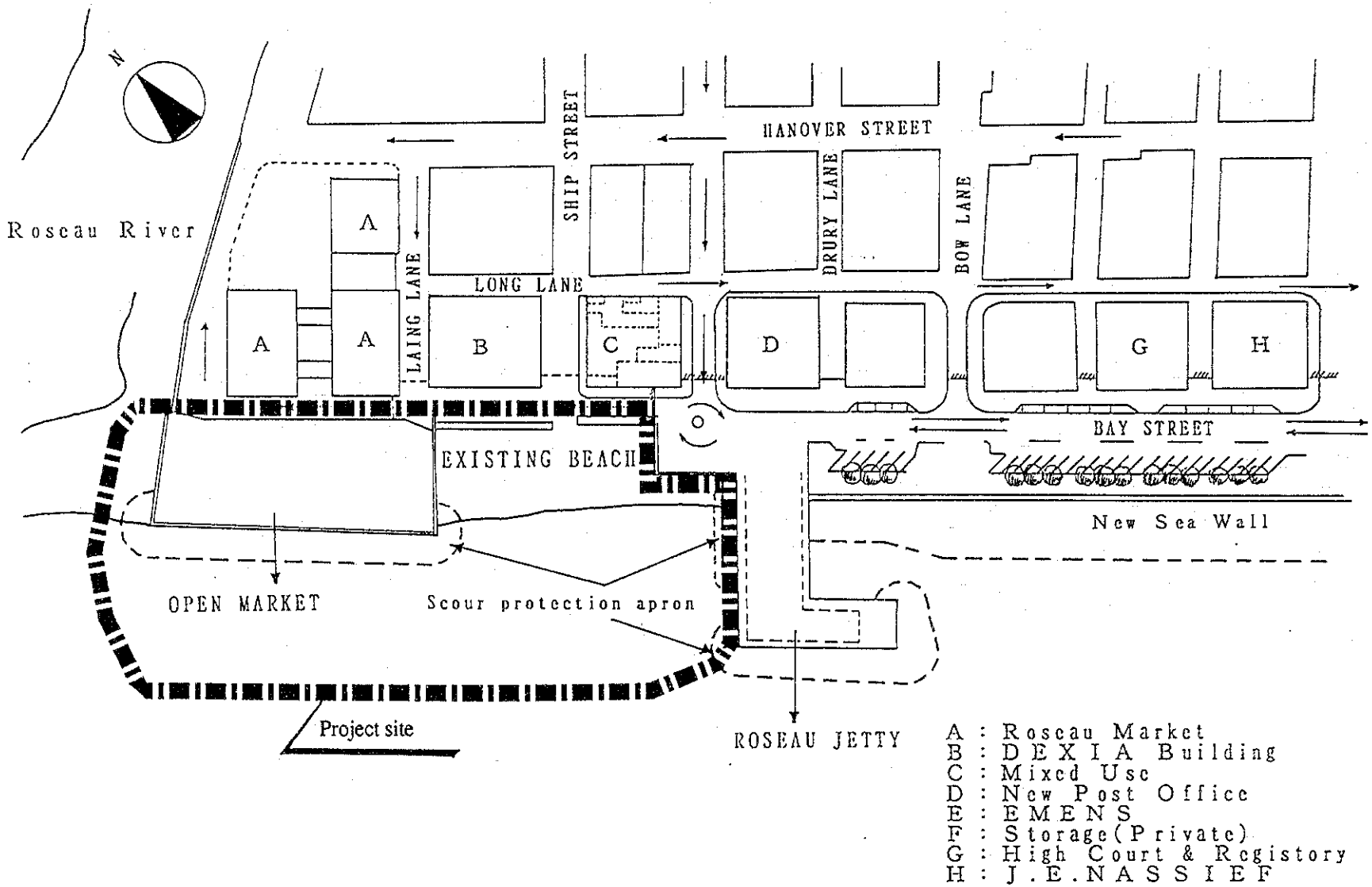


Fig. 3-2 Area Surrounding The Project Site

Agricultural products (bananas, palms, sugarcane, etc.) have to be grown on the steep slopes. However, most of the forests in the mountains at higher elevations to the north and south have been designated as forest preserve and natural parklands. Geologically, old volcanic rocks consisting of breccia and basalt lava are exposed to the east and northeast and those rocks are hard. This condition is seen in small fishing ports such as Vielle Case. On the west side, a Pleistocene-era sedimentary rock layer, thick limestone and pumice stones have accumulated non-consecutively along the coastline from north to south on the basalt of old volcanic plateaus and it is seen on the cutting face of roads and quarries in Colihaut. The surface layer is formed of beccia, mega rocks, lava, tephra of basalt decaying from young volcanic eruptions are accumulating on top of this sedimentary rock layer. Also, hot springs gush out in the south area of Dominica and there is also a geysering hot spring lake (Valley of Desolation). This indicates that the deep layer of the volcano is still active.

On the cliff under Fort Young Hotel on the southeast side of the project site, cobbles 10 ~ 30 cm in diameter and groups of rocks of about 1m in diameter are consolidated with soft sandstone. Roseau River is the result of slow accumulation of sand and gravel following the deep erosion of this layer of rock groups, and the river bed consists of many cobbles and rocks of about 1m in diameter. North to south of the beaches on the west side, the beaches can be characterized by one of two types of beach: areas of stone beach (Scotts Head in the south) and sand beach (Portsmouth in the north), the particular composition depending on the distance from the supply source for soil and stone (rivers), the gradient of the seabed and the surrounding land form. Though the area at the front of the project site is close to the mouth of the Roseau River, cobbles/rocks are seen in the shallow waters, and the surface of the seabed (extending down to 4m) is sand. Below that level at 5m and below, a sand layer mixed with cobbles can be seen and rocks protrude here and there. Except for part of the mountainous area, the west side coastal road runs less than 3m above sea level along the coastline and as it goes south from Roseau, many parts of the road were made by cutting into steep cliffs and the road passes under groups of rocks, thus there is the danger of falling stones. There are few shelving bottom beaches on the east side of the island. Some fishing villages use small steep inlets and site/lava cliffs, and boats are always exposed to wild waves of Atlantic Ocean, with the result that the anchoring/beaching of small sized fishing boats is extremely difficult.

(3) Weather and Sea Weather

[Temperature]

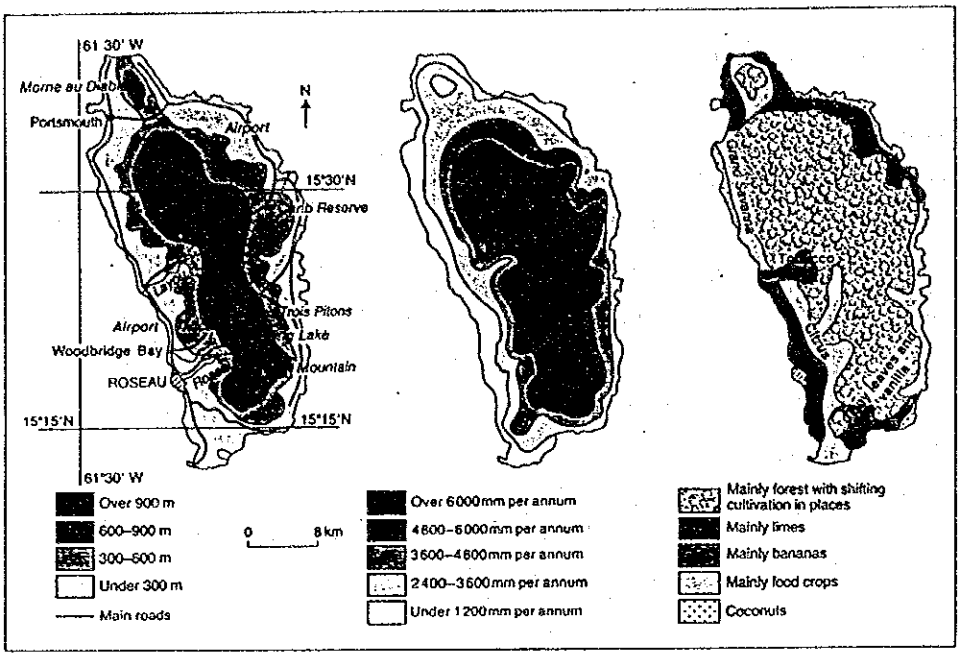
The average yearly temperature is 28°C and temperature is low during 4 months, from December ~ March (average monthly temperature is 26 ~ 27°C). Temperatures swings of 10 ~ 12°C are common throughout the year. Despite what data recorded on the flatlands of the beach indicates, the weather is characteristic of a mountainous country, that is, it is cool in the morning and evening if the wind blows. Temperatures can reach as high as 34°C in May and as low as 18.6°C in December.

[Humidity]

The average yearly humidity is 69% and the average monthly humidity is within a range of 65 ~ 75% throughout the year and there are not much difference during the dry and rainy seasons.

[Rainfall]

The rainy season is said to be from June to November, however, since Roseau is in a dry lowland area, accumulated rainfall can fluctuate greatly from month to month, thus the total yearly rainfall also exhibits considerable fluctuation (1,812mm in 1990, 1,309mm in 1991, 1,938mm in 1992). Rain falls intermittently. Total daily rainfall exceeds 10mm between 11 ~ 17% of the time and 20mm only 5 ~ 8% of the time. Therefore, with the exception of typhoons accompanied with gusty winds, rain hinders construction (50mm or more/day) less than 10 days each year. When looking at the whole Dominica island, except for some of the beach areas, the highlands of the mountain area are tropical rain forest where yearly precipitation exceeds 3,000mm. However, with the exception of certain types of wood (cedar, balata, mahogany), the production of south-sea wood is quite limited.



(Above Sea Level) (Rainfall) (Land Use)

Fig. 3-3 Land Form, Rain Fall And Land Use of Dominica

[Wind]

Regardless of the season, trade winds blow east-northeast in the sea around Dominica. Except for hurricanes conditions, wind speed falls mostly within Beaufort scale 4 (9m/second) or less, and winds of Beaufort scale 5 (about 10m/second) or more do not occur even 10% of the time, even in summer (West Indies Pilot Vol. II). This trade wind is disturbed before reaching the west side as it must traverse the mountains/plateau of the central area of the island. On the other hand, during the daylight hours the wind conditions on the west side of the Roseau area show local characteristics, as they are influenced by the ascending sea wind currents on the surface of the sea. At the Canefield airport near Roseau, the instantaneous wind velocity (gusting) and wind direction are recorded by calculating average wind velocity for 10 minutes. According to a summary of records for the 5 years from 1988 ~ 1992, average wind velocity exceeded 5m/second in the Roseau area less than 2.2% of the time, meaning that winds in this area are much gentler overall than on the east side/mountainous areas. Regardless of the season, southeastern winds blow parallel to the beach. The frequency of gusts exceeding 5m/second of instantaneous wind velocity is 9 ~ 30%. Of these, winds with 10m/second or less instantaneous wind velocity account for 20 ~ 50% and winds with 15m/second or more wind velocity occur only when hurricanes approach.

[Waves]

With respect to waves in the area offshore of Roseau, there are observation records (for 489 days except June ~ August) by a British consulting firm (Scotts & Bertlin/1988 ~ 1989). According to this record, waves traveling south are dominant and northeastern (14%) and southeastern waves (4.3%) follow. The wave cycle averages 7.5 sec. Waves in the dominant direction (south) have a short period of 8 seconds or less and waves from the northwest direction have a long period of 10 ~ 15 seconds. Wave heights (maximum wave height by visual observation) is less than 23cm 60% of the time and less than 75cm 96% of the time, and wave height exceeding 90cm occurs only 4% of the time. This figure includes abnormal weather conditions (19 days out of a total of 489).

[Tide]

Water level fluctuation of astronomical sea level is the highest level + 0.7m/lowest level - 0.1m (C.D.L. = Chart Datum Level = L.L.W. - 0.3m). However, according to the chart, the highest level (H.H.W.L.) + 0.6m/lowest level (L.L.W.L.) + 0.2m, the difference in sea level is 40cm—a small amount even during the spring tide.

[Current]

In the whole Caribbean sea, the surface current of trade winds accelerates the westward equatorial current and around areas where islands are close to each other, the current velocity exceeds 75cm/second. But the current velocity does not exceed 50cm/second in Dominica. However, in the Roseau area, attention must be paid to the influence of the vortex moving southward from the Atlantic Ocean side. According to the current velocity actual measurement record (England/Scotts & Bertlin) in front of Roseau market, the current changes its direction to north west or south east periodically depending on tide but the current velocity is 30cm/second which is small. Influence of the river current near the mouth of the Roseau river cannot be ignored.

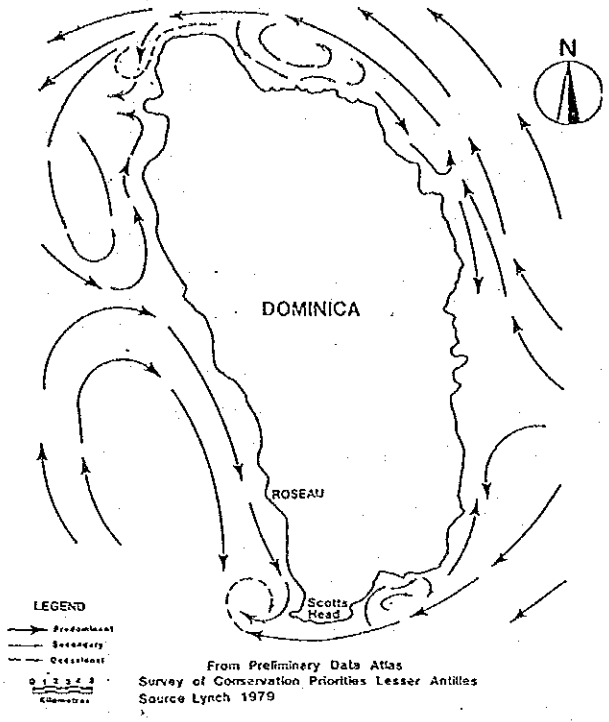


Fig. 3-4 Currents Around Dominica

(4) Conditions Around the Project Site

The project site is situated at the north end of beach in the Roseau district and the left bank of the Roseau river mouth and has Roseau market (mainly vegetable and meat) on its hinterland. A part of the project site is planned as a DEXIA's parking lot and is currently in use as a construction site. There is a DEXIA building next to the Roseau market on the other side of the Bay Street which is 5m in width. The city area is expanding behind this area. Roads in the city are 5m or less in width causing crowded conditions even though traffic is one way only.

On the south side of the project site, an ferry terminal/pedestrian and parking lot space, a bayfront road/esplanade/sea wall of 20m in width is under construction. Completion date is estimated for the end of August. The height of the old road on the back of the project site is C.D.L. + 2.2 ~ 2.5m and currently a +3.0m concrete block breakwater is located at the sea side of the road. At the old reclaimed area on the left bank of the Roseau river mouth extending 30m to the sea side, there is a +3.0m sea wall supposedly constructed around 1980 . A part of it has been damaged and corrosion is effecting the front sheet pile for anti-scouring. Currently, the project site and its surrounding area is under construction. There is a building, discarded materials, and soil and sand in the project site and water areas of the project site as well as a dump site

and a temporary building. These will be removed after completion of this seawall construction project.

A 2,000m^2 temporary yard is necessary for use as a construction block fabrication yard, working place and a place for equipment and materials. Obtaining all of this area near the project site is difficult. Therefore, a request has been made to Dominica to secure places in the government controlled land near Canefield and on the opposite bank of the project site.

Except in the city area, 2-lane roads of 3m ~ 4m in width have been constructed on the island. They have been paved with asphalt with the exception of a part of the roads on the eastern portion of the south side which are under construction and rehabilitation following damage from a natural disaster. Therefore, in terms of traffic, there is no problem in collecting catch from local fishing villages as long as cars are secured.

Mini buses coming from the north/east/central/south area are concentrated in Roseau city. Especially, during early Saturday morning, the market area is crowded with people and cars. Therefore, to afford access to the market, it seems necessary to build a bus terminal inside the project site as well as on the beach road which is currently under construction.

3-3-3 Outline of Facilities And Equipment

To implement the Project, the following facilities and equipment are required:

	Facility/equipment	Type	Specifications
Fishing	Landing wharf	Sheet pile type	For large boat: 40m long,-2.5m deep 2.0m high
			For small boat: 17.5m long, -1.5 ~ -2.5m deep, 1.5m high
Port	Service wharf	Sheet pile type	For large boat: 35m long, -2.5m deep, 1.5m high
	Mooring wharf	Sheet pile type	For large boat: 40m long, -2.5m deep, 1.5m high
Outer	Breakwaters	Sheet pile type	35m long, (+3.0m high) + 25m long (+2.5m high)
	Slipway/boat ramp	Concrete	45m long, 19.5m wide
Facilities	Bus terminal		Area about 1,000m^2
Buildings	Roseau Fisheries Center	2-story reinforced concrete	Building area 820m^2, total floor area 1,255m^2
	Workshop	1-story reinforced concrete	Building floor area 50m^2, total floor area 50m^2
	Lavatory/shower	1-story reinforced concrete	Building floor area 30m^2, total floor area 30m^2
	Fishermen's lockers	1-story concrete block	Building floor area 140m^2, total floor are 140m^2
Incidental	Water supply facility		Reservoir tank 30 tons, Elevated tank 3.5 tons
	Fuel supply	TEXAXO specification	For gasoline 2,000IG, with fuel supply device
			For diesel, 3,000IG, with fuel supple device
	Electricity		120 ~ 125KVA (AC230V/400V/50Hz)
			Stand-by generator, 30KVA
Facilities	Water drainage	Contact aeration type	Purifying tank 4 tons/day, FRP, BOD 20ppm or less
	Fish waste treatment plant		Process 500 kg/time (4 hours)
	Ice plant	Flake ice	Capacity 4.5 tons/day x 2 units
Refrigeration	Blast freezer	For freezing fish	Fish 2 tons/day, 7.2 x 4.5 x 3.6 (m)
Facilities	Cold storage	For storage of frozen fish	Fish 30 tons, 7.2 x 4.5 x 3.6 (m)
	Chilled room	For storage of frozen fish	Fish 10 tons, 3.6 x 3.6 x 2.5 cm)
	Workshop equipment		Various tools for repair and maintenance of engines
Equipment	Fish marketing equipment		Fish containers, balance, cart
	Fish processing equipment		Bandsaw, vacuum packaging machine, table
and	Quality inspection equipment		Physical and chemical and bacteriological examination instruments
	Extension activities equipment		VHF radio 6 units (5 for loading on car)
Materials	Data processing equipment		5 Data processors 1 copying machine, 1 facsimile machine
	Vehicles		Two 2- ton insulated trucks and one extension service car

3-3-4 Operation Plan (fish marketing plan)

(1) Planned Handling Volume

Methods used to transport the catch into the Roseau Fisheries Complex are mainly divided into two categories: ① direct landing from large sized boats (40 feet or more) and ② land transportation from local fishing villages (Fishermen of Pottersville and Newtown directly land fish to the Complex). Planned handling volumes of each case are as follows:

① Direct landing from large sized boats

Year	1992	1994	1996
Number of boats	4 (boats)	10 (boats)	15 (boats)
Catch per trip	900 (kg)	900 (kg)	900 (kg)
Number of trips per year	72 (times)	72 (times)	72 (times)
Landing of fish per year	25 (tons)	648 (tons)	972 (tons)
Landing of fish per day	1,080 (kg)	(kg)	4,050 (kg)

② Land transportation from local fishing villages

Year	1992	1994	1996
Yearly fish landing volume	1,243 (tons)	1,523 (tons)	1,803 (tons)
(from Newtown/Pottersville)	(223)	(321)	(419)
(from others)	(1,020)	(1,202)	(1,384)
Amount transported by land to Roseau	N.A.	645	763
(from Newtown/Pottersvile)		(321)	(419)
(from others)		(324)	(344)
Amount transported by land per day		2,690 (kg)	3,180 (kg)

Note) Amount of land transportation to Roseau : 100% of catch of Newtown/Pottersville is landed at Roseau

60% of catch from other fishing villages is land transported.

Yearly market open days : 240 days

The scale of the Complex has been designed based on the projection of the amount of fish landing in 1996 and in that case, about 7,230 kg fish are brought into the Complex per day. Method and amount of handling fish in the Complex are as shown in the flowchart of Fig. 3-5. Also, its distribution channel is shown in Fig. 3-6.

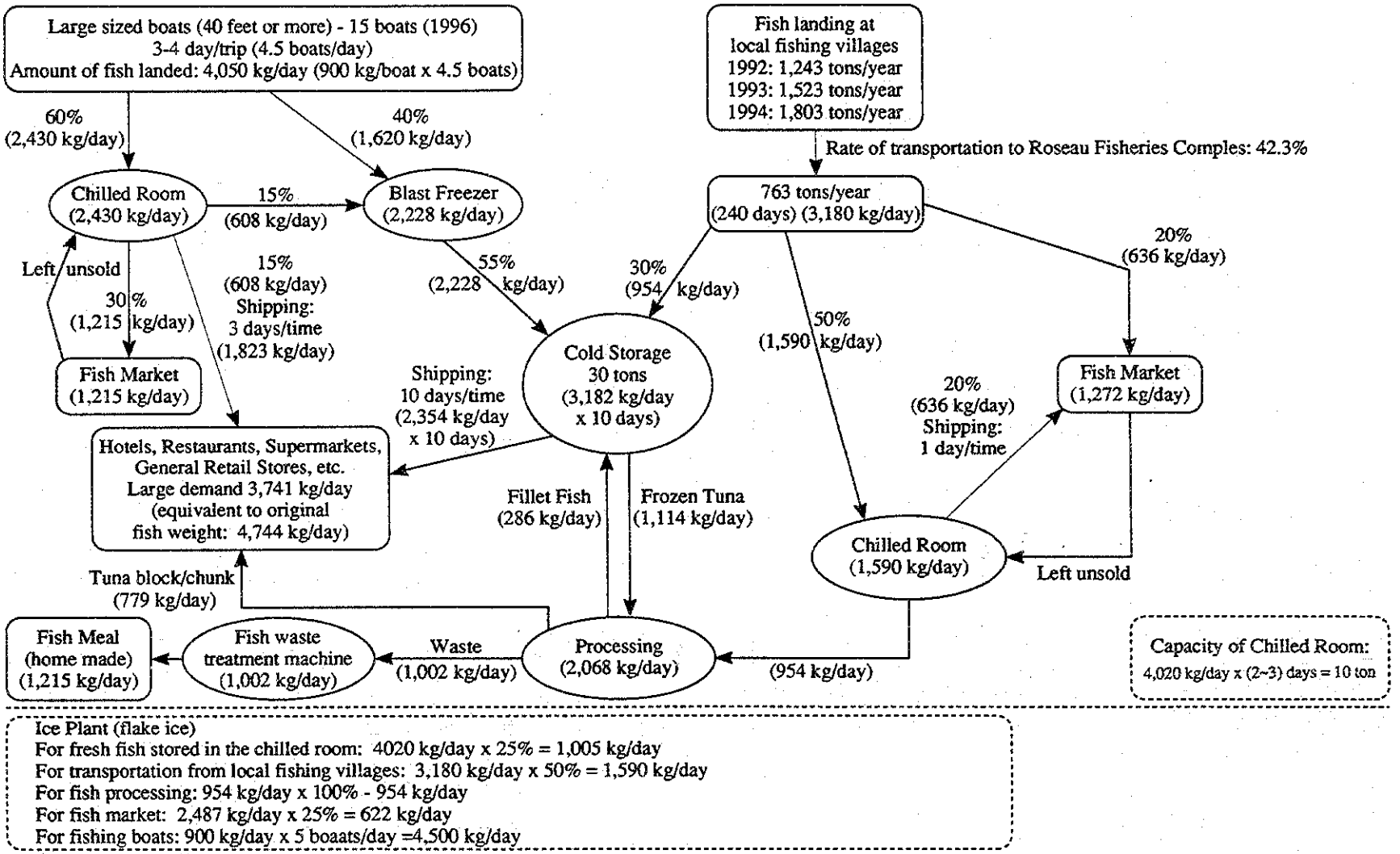
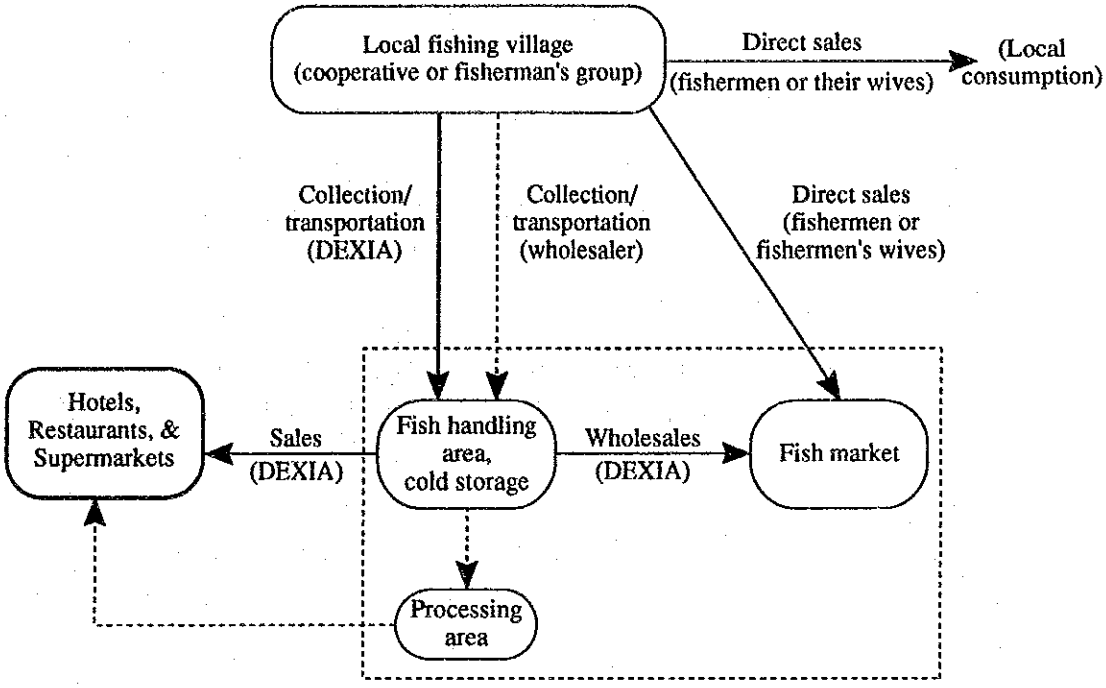


Fig. 3-5 Expected Flow of Fish Landed/Transported to Roseau Fisheries

(1) Fish Landed at Local Villages



(2) Fish Landed from Large Sized Boats (40 feet or more)

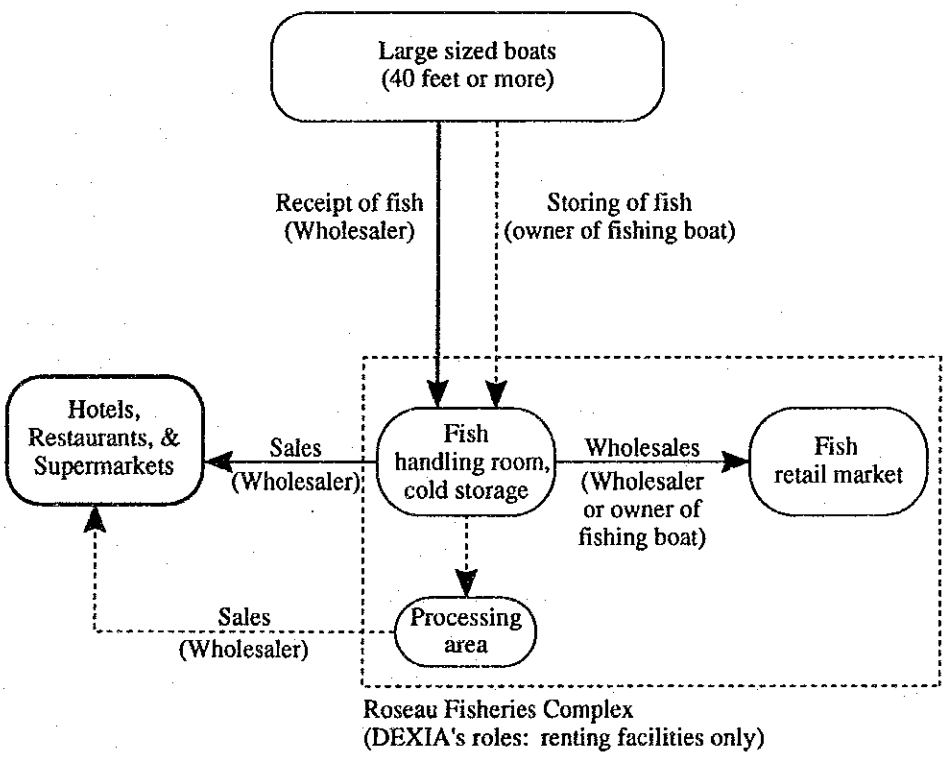


Fig. 3-6 Catch Distribution Cnannel

(2) Distribution Channel and Fish Handling Method

Fish landed from large sized boats are mainly migrating tuna. Fifty five percent of them will be frozen using a blast freezer and stored in a cold storage. The remaining 45% are supposed to be wholesale traded to the fish retail market in the form of fresh fish (iced) or shipped to hotels and restaurants through local wholesalers' channels. Half of the frozen tuna will be cut with the processing machine to be installed in the Complex, packed, then shipped to supermarkets.

Since the existing wholesalers do business with fishing boats, fish landed from large fishing boats are supposed to be stored, processed and distributed by those existing traders as a consignee using the facilities of the Complex continuously after the number of fishing boats are increased. In case a boat does not have a consignee, the owner of the boat shall store the catch in the facility by himself and try to sell it to wholesalers. Therefore, in this case, DEXIA shall simply lend the facility to those people and charge rental fees.

On the other hand, concerning fish landed at local villages, about 58% of the fish landed at each village and fish from Pottersville and Newtown, for which the plan calls for the catch to be directly landed at Roseau, will be tailored to suit the tastes of local consumers. The remaining 42% will be land transported to Roseau. Insulated fish containers will be installed at each fishing village to temporarily store fish left unconsumed at each local area. Since cooperatives and fishermen's groups have been formed in many villages, fish will be consigned by fishermen and store catch. Currently, wholesalers directly buy fish from some of local villages and Font St. Jean, which has an advanced cooperative, transports catch to Roseau and sell them by themselves, however, its amount is limited. Also, on Friday and Saturday while Roseau market is clouded, fishermen's wives from villages in the west coast come to Roseau and other towns in order to directly sell fish. However, due to insufficient ice making and storage facilities, transportation and sales from those local villages is limited in terms of quantity, and risk is great when fish is left unsold. Opening of the Complex will dramatically reduce those risks and collection of fish by wholesalers and cooperatives and direct sales activities by fishermen's wives can expect to be activated at a certain extent. However, despite that catch by fishermen in local villages has been increasing favorably because of improvement in fishing techniques and modernization of fishing boats, the scale of distribution by those existing traders and individual fisherman is still small and also transportation medium is limited. Therefore, it seems difficult for them to transport to Roseau and distribute the planned handling amount of fish by themselves. Therefore, in the Project, the operation body of the market

facilities, i.e. DEXIA shall regularly go to each fishing village (including remote and small villages) to collect catch. However, needless to say, this activities must not be done monopoly and have to be done for the benefit of local fishermen without disturbing private distributors.

About 40% of the land transportation fish including catch directly landed at Roseau by Pottersville/Newtown fishermen will be wholesale traded to the retail market in the Complex. Remaining 60% will be wholesale traded mainly to hotels/restaurants/ supermarkets in the form of fresh fish (iced) and frozen fish. Also, small pelagic fish which are caught in large quantity will be frozen and used as bait for longline fishing and DEXIA will develop processing such as fillet processing. Leavings due to cutting of frozen tuna or small fish fillet processing will be processed to fish meal using the fish waste processing machine to be installed, then used as feed for livestock.

3-3-5 Personnel Plan

Personnel required to operate Roseau Fisheries Complex is planned as follows.

(1) Fisheries Development Division (FDD) of Ministry of Agriculture, Lands, Fisheries and Forestry

Currently headquarters of the FDD are dispersed to 3 locations in the city because a limited space of the office in the joint government office building. Any of them is small even a meeting room cannot be secured, thus lack of understanding between staff easy to occur. Therefore, the Government of Dominica is planning to move and consolidate the FDD headquarters to the 2nd floor of the planned Fisheries Complex and expand, activate and smooth fisheries related activities. For this reason, the number of staff is planned to be increased from the current number of 11 to 23 by 1995. The details are as follows.

Fisheries Development Advisor	1
Senior Fisheries Officer	1
Fisheries Officer	2
Fisheries Extension Officer	5
Statistician	3
Laboratory Staff	3
Mechanics	3
Accountant/General Affairs	2
Handyman chores	3

(2) Dominica Export Import Agency (DEXIA)

In Foes Fisheries Complex, the fish landing and market facilities will be operated by DEXIA. The existing Roseau market is next to the project site and it is managed and operated by DEXIA. Currently, six DEXIA staff operate the existing Roseau market. In addition to it, 21 new employees (except part-time employees) are necessary to operate the new fish market facilities. The details are as follows.

Person in Charge	No. of Personnel	Work
Market Manager	1	Manage overall market businesses
Accountant	1	Totaling of fish handling amount, collecting of facility rental charge.
Mechanics	3	Maintenance and repairing of ice plant, cold storage and other machines, etc.
Fish Handling Staff	8	Weighting, washing and handling of fish
Fish Collecting Staff	8	Collecting and transporting fish from local fishing villages by insulated truck.
Part-time Workers	8	Fish fillet processing by DEXIA.

3-3-6 Management Balance Plan

The major objective of the Project is to increase the amount of catch by means of improving the distribution and quality of fish and making fish landing and mooring convenient and safe. Basically, it is not profit-pursue type project. However, in order to operate the market and distribution facilities, operation expenses will be piled up. Therefore, to provide healthy operation and services, at least the profit equivalent to the expenses must be expected. For the time being, DEXIA which has knowledge and experiences in market management and distribution businesses will take care of the operation, but since DEXIA is already operated based on self-supporting accounting system, subsidy from the government cannot be expected. Therefore, each facility rental charge shall be set so that a certain profit can be gained from the beginning of the operation. Furthermore, DEXIA will take initiative to collect and sell catch until the existing collector or cooperatives actively transport and distribute fish landed at local fishing villages by themselves.

The management balance of DEXIA concerning the Project has been planned as shown on the separate page based on the following preconditions.

① The rental fee for each facility has been set almost equivalent to the actual unit price of Kingstown (St. Vincent) and Dominica.

② The unit price fluctuates depending on conditions such as type of fish, landing place and season. Here, the major collected fish was assumed to be small migrating fish to set up the average fish price as follows.

Purchase price (beach value)	:	EC$6.50/ kg		
Wholesale price (Roseau)	:	Fresh fish/frozen fish	:	EC$7.50/kg
		Fish fillet	:	EC$25/kg

③ Concerning the collection of landed fish from local fishing villages, since the amount of handling by private traders or cooperatives is currently small, DEXIA is supposed to collect and transport 100% of the fish for the time being.

④ Assuming catch landed from large sized boats is 100% handled by private traders, it has been a subject for collecting rental fees for related facilities . A rental fee is not expected for the amount of catch directly handled by DEXIA.

⑤ Since fish meal is a by-product of fish waste processing, the material cost is free and the sales price has been set equivalent to the international price (EC$1.50/kg).

⑥ Personnel expenses, electricity and water required for the operation of the facilities have been calculated based on the actual value in Dominica.

A. Income

	Business Item	Sales Details			
①	Facility rental fee				
	Ice sales (fishermen)	For fishing boats	:	900 kg/boat x 15 boats x 72 trip/year x EC$0.50/kg	= EC$486,000
		For market	:	622 kg/day x 240 days x EC$0.50/kg	= EC$74,640
		For storage	:	608 kg/day x 240 days x EC$0.50/kg	= EC$72,960
		For transportation	:	Free (DEXIA directly collect catch)	
	Blast freezer rental fee			2,228 kg/day x 240 days/year x EC$0.60/kg	= EC$320,832
	Cold storage rental fee (-20°C)			2,228kg/day x 240 days/year x 10 days/time x EC$0.2/kg/day	= EC$1,069,440
	Chilled room rental fee (0°C)			2,430 kg/day x 240 days/year x EC$0.02/kg/day	= EC$11,664
	Retail space rental fee			15 persons x 240 days/year x EC$8.00 x person/day	= EC$28,800
	Process machine rental fee			1,114 kg/day x 240 days/year x EC$0.05/ kg	= EC$13,368
	Fish handling place rental fee	Fishing boat	:	900 kg/boat x 15 boats x 72 sailing/year x EC$0.02/kg	= EC$19,440
				Subtotal	: EC$2,097,144
②	Collection and wholesales of catch				
		Fresh fish	:	1,272 kg/day x 240 days x EC$7.50/kg	= EC$2,289,660
		Frozen fish	:	954 kg/day x 240 days x EC$7.50/kg	= EC$1,717,200
		Fillet	:	286 kg/day x 240 days x EC$25/kg	= EC$1,716,000
		Fish powder	:	200 kg/day x 240 days x EC$1.50/kg	= EC$72,000
				Subtotal	: EC$5,722,800
				Total Sales	: EC$7,819,944

B. Expenses

Item			Expenses details	
Purchase cost			EC$6.50/ kg x 3,180 kg/day x 240 days	= EC$4,960,800
			Sub Total :	EC$4,960,800
Personnel expense	Market manager	:	1 x EC$2,500/month x 12 months	= EC$30,000
	Accountant	:	1 x EC$2,000/month x 12 months	= EC$24,000
	Mechanics	:	3 x EC$2,000/month x 12 months	= EC$72,000
	Labors	:	16 x EC$1,500/month x 12 months	= EC$288,000
	Part-time workers	:	8 x EC$5/hour x 4 hours/day x 240 days	= EC$38,400
			Subtotal :	EC$452,400
Electricity/water expense	Electricity	:	EC$0.52/kw x 120kwh x 24 hours x 240 days	= EC$359,424
	Water	:	EC$2.80/$m^3$ x 60m^3 x 240 days	= EC$40,320
	Gasoline	:	EC$1.50/L x 200 L/day x 240 days	= EC$72,000
			Subtotal :	EC$471,744
Other	Maintenance/repairing	:	EC$7,500,000 x 5%	= EC$375,000
	Cleaning Miscellaneous:			= EC$20,000
				= EC$30,000
			Subtotal :	EC$425,000
			Total Expenses :	EC$6,309,944

C. Profit

EC$7,819,944 - EC$6,309,944 = EC$1,510,000

As shown in the above estimation, if fish is distributed as planned, the balance of DEXIA, operation body, is expected to be very well.

However, it must be noted that the planned amount of fish landing (1996 prediction) may not be obtained from the beginning of opening of facilities and it is expected that the amount of catch is not so great due to weather and sea weather. Furthermore, fishermen, wholesalers may change storage, transportation methods and amount depending on then market conditions. Therefore, when assuming the rate of use of the facilities is 50%, the following balance can be estimated.

A. Income

① Facilities rental fee	EC$5,722,800 x 50%		= EC$1,048,572
② Collection/wholesales of catch	EC$2,097,144 x 50%		= EC$2,861,400
	Total	:	EC$3,909,972

B. Expenses

Purchasing cost	EC$4,960,800 x 50%		= EC$2,480,400
Personnel expense	100%		EC$452,400
Electricity/water	100%		EC$471,744
Other	100%		EC$425,000
	Total	:	EC$3,829,544

C Profit EC$3,909,972 - EC$3,829,544 = EC$80,428

According to the above, even if the facilities use ratio is 50% of that planned, the management balance of the market/distribution facilities will nudge slightly into the black, thus financial problems will not occur.

Other risk considered in the fish marketing business is that of the sliding of the price for fish while it is being stored after the purchasing of the catch. If the sales value drops under the purchase price, the fish collection/wholesale business will suppress the management of DEXIA. Like this Project, when the fluctuated expense (purchasing price) accounts for a large portion of total expenses, care must be exercised because the trend of the fluctuated expense decides the balance conditions.

Assuming that DEXIA does not perform collection/wholesaling of the catch and only engages in facility rental businesses, a yearly profit of EC$748,000 (EC$2,097,144 - 1,349,144) can be expected if the facilities use ratio is 100%. However, while income fluctuates depending on the use ratio, the operation expenses (personnel, water, electricity, and others) are supposed to be fixed costs. Therefore, the smallest use ratio needs to be 65% or more as shown below in order to keep the facilities operating.

Facilities use ratio (%) = Fixed cost (personnel, electricity/water, others) ÷ Income (facilities rental fee)

= EC$1,349,144 ÷ EC$2,097,144

= 65%

CHAPTER 4 BASIC DESIGN

4-1 Basic Design

4-1-1 Design policy

For preparing a basic design amply founded upon the current situations in the Commonwealth of Dominica and, within the scope of the Grant Aid Program administered by the Japanese Government, in order to establish the optimum project scale, the following preconditions will be kept in mind.

1) A design shall provides appropriate project scale.
   - ① Based on surveys of current conditions, formulate the demand forecasts, and establish the appropriate scale of the facilities.
   - ② Ascertain that all elements constituting the project facility are implementable within the scope of the Grant Aid Program.
   - ③ Strive to minimize maintenance costs after construction completion.

2) A design shall be taken into consideration to natural environmental conditions.
   - ① Create a design in which sufficient consideration is taken into local meteorological, topological, geological, hydrological and hydrodynamic conditions.
   - ② Take care not given an impact or otherwise affect the surrounding environment, either during construction or after completion of construction.

3) A design shall provide the structures and construction methods appropriate to conditions at the local site.
   - ① Select simple structures and construction methods, and simplify maintenance.
   - ② To the extent possible, use local products that are either domestically produced or can be obtained from nearby countries.
   - ③ Take care to preserve the surrounding scenery.

4-1-2 Environmental Conditions

Table 4-1 on the following page compiles the design condition related to environmental conditions selected for drafting the basic design of this plan.

Table 4-1 Design Requirements

Item			Selected Value	Remarks
Ambient Conditions				
	Maximum wind speed		60m/sec	
	Maximum wave height		2.5m (breakwater)	During hurricane conditions (once in 20 years): 5m
	Sea Level	Tide levels	+0.2m~+0.6m	C.D.L. base/normal level (flood tide)
		Surge	Max: +0.6m	Crest sea level during hurricane (once in 20 years)
	Maximum current velocity		0.5m/sec	
	Seismic intensity		0.10	Recommended value (0.20)
	Rainfall		1309~1938mm/year	Total yearly rainfall (1990~1992)
			430mm/month (Oct.)	Maximum daily rainfall (1990~1992)
			Frequency of 10mm or greater (days) = 10.7~16.8% (1988~92)	
	Temperature		26.2~29.7°C	Yearly variation of average monthly temperature (1990~1992)
			18.6~34.0°C	Daily high/low temperatures (1990~1992)
			11.6°C	Daily maximum fluctuation
Soil Conditions				
	Thickness of stratum		Surface layer	Substratum (B-1, B-2, B-3)
			3m(B-1) ~ 5m(B-2)	
	Specific gravity		1.75 ~ 1.90 ton/m^3	
	Water absorption capacity		19% wt	11 ~ 14%
	Particle size		Sand 80% (0.07 ~ 2.0mm)	Sand 45~65%, others : gravel
	N values		3m(B-2) ~ 26m (B-1)	Not less than 26

For the design of the marine structures, although meteorological and oceanological data at time of extreme conditions (hurricane/earthquake) are required. However, no reliable record of such data exists, basic values for a rational design, both economical and technical, have been estimated by addressing inquiries on past observations (ocean winds and waves, earthquakes, observations, etc.)

(1) Wind Speed

Hurricanes are categorized by wind speed as tropical depressions (average wind speed: up to 17m/sec), tropical storms (wind speed: 17~32m/sec), and hurricanes (wind

speed: 32m/sec or greater). Accordingly, a maximum wind speed of 60m/sec shall be employed for the design value at time of extreme weather conditions, identical to that employed in Japan.

(2) Wave Height

There are numerous examples of open sea wave estimates both during times of normal weather conditions (remotely-originating winds/waves) and during times of extreme weather conditions (hurricanes), which are compiled in Table 4-2.

Table 4-2 Surf Conditions in the Waters off Roseau

(1) During normal weather

Survey Nation/Organization	Britain (Bertlin); 1989	Netherlands (DHL); 1972	Germany (Kocks); 1990
Information Source	Ship/other 1) B.M.T. (Entire Caribbean sea)	Ship/20,000 Examples/1949~70 4) R.N.M.I.	Ship/18,678 Examples/21 years Offshore (10~15° N/60~65° W) 5) D.W.S.
Open Sea Wave Estimates (Ho')	Ho' = 17m (Once per 20 years) Ho' = 21m (Once per 100 years)	Ho' = 6.2m (Once per 20 years) SE/Martinique, NW/Guadeloupe) $\alpha = 0.1\alpha = 0.5$	Ho' = 5.5m (Once per 20 years) Ho' = 5.2m (NE)
Sea of Roseau (Ho)	Diffraction factor (15sec/NW) α (= 335°) = 0.58 Ho = 16.5m (once per 100 years)	(S)Ho = 2.0m (SW)Ho = 1.3m (W)Ho = 0.8m (NW)Ho = 1.5m	

(2) During Hurricane

Survey Nation/Organization	England (Bertlin); 1989	Netherlands (DHL); 1972	Germany (Kocks); 1990
Frequency	18 times/1754~1989 (18 times/236 years = 1 time/13 years) Actual example when hit by hurricane)	67 times/1877~1963 (67 times/76 years = 1 time/1.13 years (Dominica 250' and lower)	15 times/100 years = 1 time/6.7 years (Region stated in Table 4.2)
DataSource-Estimation Method Hurricane Surf Conditions (Ho') Sea of Roseau (Ho)	2) E.C.C.I. 3) SPM./84	R.N.M.1 Ho' = 7m (SE~NE) (1 time in 25 years)	D.W.S./U.S. Naval Weather Service/1974 Hurricane Allen (1980) Ho' = 9.6m
Sea of Roseau (Ho)	Hs = 7.6m (1 time/20 years) Tmax = 15 sec. Hs → Hmax = 11.2 Ho = Hmax x 1.3 → 17m (1 time/100 years)	(S)/3.2m (SW)/4.2m (W)/3.5m (NW)/1.8m	0.7 at 30' → 6.7m 0.55 at 45' → 5.3m

Notes:

1) British Marine Technology; *Global Wave Statistics*; 1986
2) Eastern Caribbean Coastal Investigation
3) Shore Protection Manual
4) Royal Netherlands Meteorological Institute
5) Deutcher; Wetterdienst, Seewetter Amt.

In Table 4-2 above, the open sea wave statistics of the waters off Roseau obtained by the British consulting firm for use in determining the design requirements of the current Roseau Seawall/Ferry terminal work are overvalued, both during normal weather conditions and hurricane conditions. To elaborate, although the observation data used as the basis for statistics of normal weather conditions are unclear, there were unexpectedly few points plotted on the statistical diagram utilizing wave observation data from the entire Caribbean sea, and, thus, the results are judged to be of poor

reliability. Although the statistics from times of hurricane conditions do consider the increase in wave height (1.3 times) due to the shoaring in the waters off Roseau, it is thought that converting the significant wave height (Hs = 7.6m) to the maximum wave height of Hmax = 14.6m seems a misunderstanding (the significant wave height [Hs] during hurricanes actually corresponds the maximum wave height [Hmax]). In contrast, the open sea wave estimates for both normal and extreme weather conditions by Netherlands and Germany are reasonable, although, in the Netherlands' case, the coastal sea wave estimates on the waters off Roseau for both normal and extreme weather conditions are undervalued. In consideration of the above points, Germany's statistical estimates will be used for open sea waves during normal weather conditions. For times of extreme weather conditions, when a hurricane of the largest class approaching to within 45 nautical miles (= 83.3km) of the Dominica, a maximum open sea wave height of Ho' = 5.3m will be employed. Even though the shoaring generated wave height increases the height of a open sea wave where the sea floor is steep in places (1:2 ~ 1:4), the incoming waves will break upon being subject to the restrictions imposed by the water depth (waves break where the wave height exceeds one-half the water depth), and one may safely assume that, even during hurricanes, the maximum wave height on the front side of the project site will be Ho = h/2 = 2.5m. Because marine structure within the project site of Roseau are planned to be built upon areas in which the water depth is 5m or less. To wit, even though the floors of older structures and the surfaces of roads near the shoreline are approximately 2.5m above sea level, they exhibit little damage. In addition, the apex of the sea wall currently under construction (3.6m) is being built to allow for a wave of height slightly higher than the wave height predicted during times of hurricane conditions. This is thought to have been determined, as indicated earlier, based on the prediction performed by the British consultants in which the wave statistics were overvalued.

Table 4-3 Height of Open Sea Waves Recurring Once Every X years-

Frequency of Appearance	NE	E	SE	S	SW	W	NW	N
1 year	3.8	4.1	2.8	1.6	0.8	0.7	1.0	2.4
10 years	4.9	5.2	3.5	2.8	3.3	1.8	2.6	3.8
20 years	5.2	5.5	3.8	3.2	3.8	2.2	3.1	4.2
50 years	5.6	6.0	4.0	3.8	4.5	2.5	3.7	4.8