


No.

**BASIC DESIGN STUDY REPORT
ON
THE COASTAL FISHERIES
DEVELOPMENT PROJECT
IN
GRENADA**

MARCH 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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国際協力事業団

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Preface

In response to the request of the Government of Grenada, the Government of Japan has decided to conduct a Basic Design study on the Coastal Fisheries Development Project and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Grenada a survey team headed by Mr. Soichiro Shirahata, Fisheries Expert, Overseas Fishery Cooperation Foundation (OFCF) from December 11, 1988 to January 4, 1989.

The team exchanged views on the Project with the officials concerned of the Government of Grenada and conducted a field survey. After the team returned to Japan, further studies were made and the present report has been prepared.

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

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

March 1989

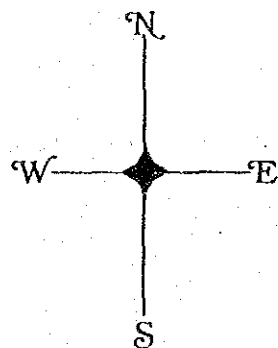
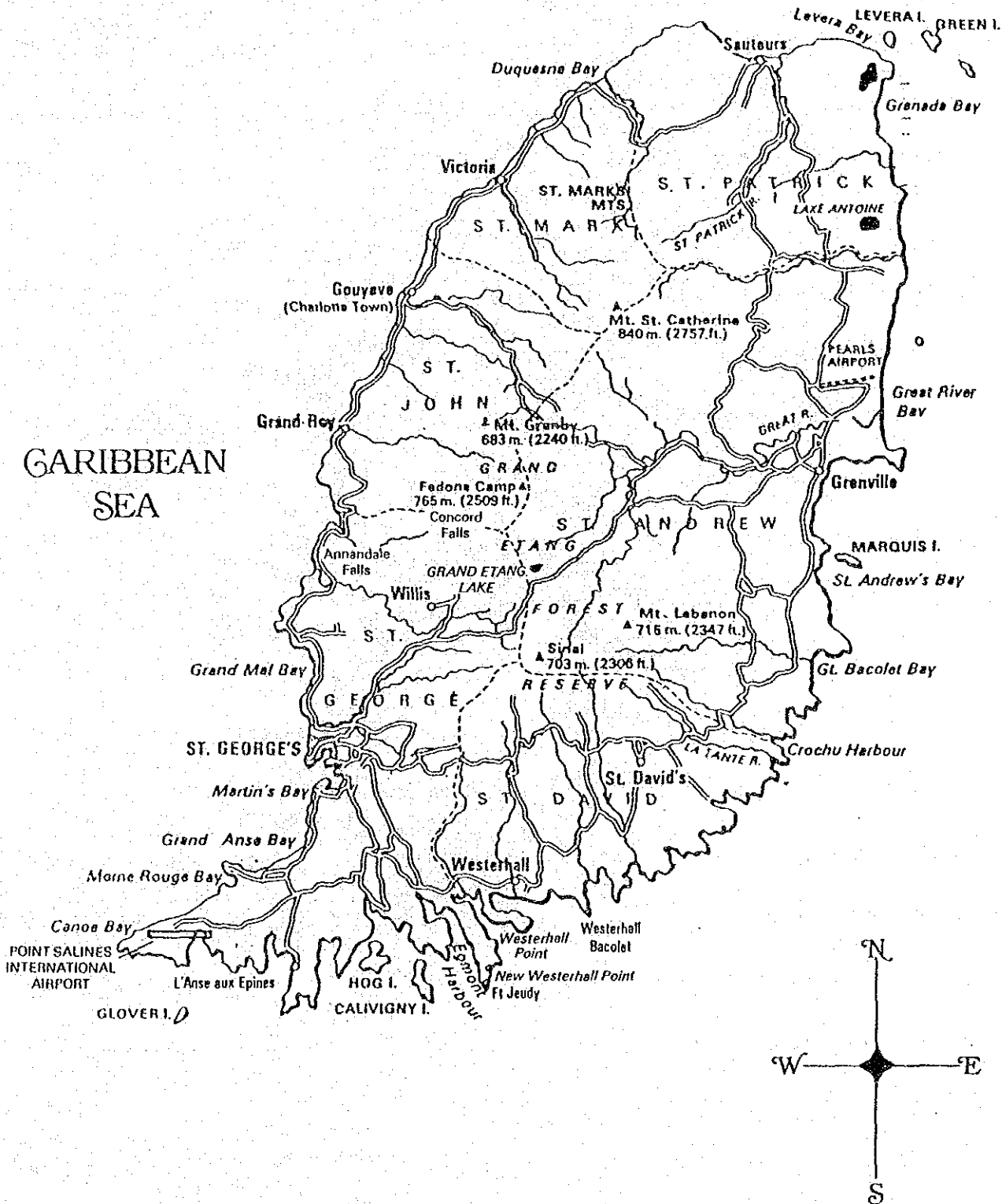
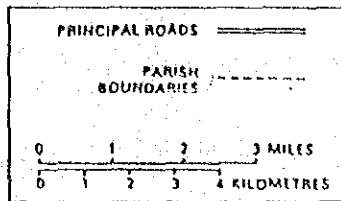


Kensuke Yanagiya

President

Japan International Cooperation Agency

Grenada



SUMMARY

Although Grenada has striven for economic development centering around agriculture, it has not been successful in promoting the export of spices, its principal specialty, which are influenced by the trend of its price on the international market. It therefore hopes to develop various industries in order to improve the living conditions of its people. In this respect, the development of fisheries resources in Grenada, which are known to exist in abundance in offshore areas, has only just begun and the industry is still small.

As this island country, which is only about 300km² in land area, is limited in its resources, the Government of Grenada will promote economic development by effectively exploiting the abundant fisheries resources within its territorial waters.

The only fisheries promotion program on a national level is the "Artisanal Fisheries Development Project" which was commenced in 1982. The results of this project has been contributed the Government of Grenada to recognize the potential of fisheries development and its importance for the country.

Fishery in Grenada is basically small in scale, but the fishing technologies employed within the scope of their fishermen's fishing modes is already of a fairly high level. They are performing long line fishing using of wooden fishing boats with outboard engines, but with this fishing mode it would be difficult to increase the fishing intensity and expand fishing grounds beyond the present level.

In view of this, the Government of Grenada formulated the "Coastal Fisheries Development Project", which aims at the exploitation of offshore fisheries resources by introducing larger sized fishing boats and consolidating support facilities. However, because the country lacks the technologies required for fisheries development and the funds for developing the various necessary facilities, it has approached the Government of Japan for grant aid cooperation in implementing the Project.

Based on the above request, the Government of Japan, through the Japan International Cooperation Agency (JICA), JICA sent to Grenada a

Basic Design Study Team headed by Dr. Soichiro Shirahata, Fisheries Expert, Overseas Fisheries Cooperation Foundation, from December 11, 1988 to January 4, 1989. The Team conducted a field survey in Grenada to confirm the background and objectives for implementing the Project, the propriety of cooperation from Japan, and to discuss the contents of the request and the scope of the Project with concerned officials of the Government of Grenada. The results of discussions were summarized in Minutes of Discussions, which were signed and exchanged by and between both parties.

The objective of this Project is to foster and reinforce Grenada's fisheries industry with exploitation of offshore fisheries resources, to improve on the environment of the fishing industry and fish marketing system and for coastal fishermen by promoting the activities of fishermen's cooperatives. As a result of the field survey and analysis in Japan of data obtained thereby, it was decided that provision of the following facilities and equipment would be most appropriate for realizing the aforesaid objectives.

- 1) Promotion of coastal fisheries
 - A. Establishment of a Fishermen's Center at Gouyave
Construction of a Fishermen's Center (365m²) and a small jetty (approx. 57m in length),
Provision and installation of block ice and plate ice-making machines, cold storage facilities and other equipment.
 - B. Establishment of a Fishermen's Center at Grenville
Construction of a Fishermen's Center (355m²) and a small jetty (approx. 52m in length),
Provision and installation of block ice and plate ice making machines, cold storage facilities and other equipment.
 - C. Provision of eight inboard engine fishing boats.

- 2) Improvement of the fishing industry environment,
 - A. Construction of a slipway (for 15 boats) for hauling ashore small fishing boats at Victoria,
 - B. Provision of safety equipment and fishing materials necessary for development of pelagic and demersal fisheries,
 - C. Installation of fishermen's lockers (for 80 fishermen) for storing fishing gear,
 - D. Provision of materials for laying a water supply system for fisheries at Calliste,
 - E. Provision of tools for maintenance and repair of equipment and provision of vehicles for repair services,
- 3) Improvement of distribution facilities,
 - A. Provision and installation of a insulated fish box manufacturing machine for retaining freshness of catches,
 - B. Provision of cars with insulated boxes.

The executing agency for this Project is the Fisheries Division of the Ministry of Education, Culture and Fisheries. Basic design of facilities, equipment, etc. which will be necessary for implementing the Project was formulated with due consideration to the personnel and budgeting plans of the executing agency so that the facilities and equipment may be smoothly operated with its current technical level and personnel.

The establishment and operation of the Fishermen's Centers account for a greater portion of this Project, which requires that the Fishermen's Centers and the small jetties be juxtaposed on the project sites in constructing them. When the time necessary to stabilize the ground due to reclamation work for preparation of sites for the Fishermen's Centers

is taken into consideration, it has been judged desirable to divide the work into two phases, namely construction of the jetties and construction of the Fishermen's Centers. According to the project schedule, five and six months will be required from the Exchange of Notes to contract and tender, and seven and eight months for the first and second phases of the construction work, respectively.

The establishment of Fishermen's Centers at the two locations of Gouyave and Grenville, which are the centers of the fisheries industry in Grenada, constitutes the core of this Project. It is, in other words, a project which aims to promote the activities of the fishermen's cooperatives already established at these two locations in order to promote fisheries development by effectively operating the inboard engine fishing boats to be provided under this Project under the control and supervision of the Fisheries Division.

The following effects can be anticipated by implementing this Project.

- 1) Promotion of the activities of fishermen's cooperatives,
- 2) Integration and enhanced efficiency of training for fishermen,
- 3) Effective implementation of repair services for fishing equipment,
- 4) Repercussive impact of effectively utilizing a revolving fund consisting of proceeds recovered from sales of equipment and materials provided under this Project on future fisheries development projects,
- 5) Exploitation of offshore fisheries resources,
- 6) Development and improvement of the fishing industry environment,
- 7) Improvement of the fish marketing system,
- 8) Promotion of fish exports.

The most important effect that the Project will have, if implemented, is that it will be the first step forward in promoting fisheries as an industry capable of contributing to the economic activities of Grenada by promoting the activities of the fishermen's cooperatives and exploiting the fisheries resources which are known to exist in the off-shore areas.

From the foregoing, it is judged to be both significant and timely to implement this Project for modernizing the fisheries industry of Grenada under Japan's grant aid cooperation.

In order to assure that the facilities and equipment to be provided under this Project will be effectively utilized and the anticipated effects will be realized with greater certainty, this Report not only makes recommendations to the Government of Grenada on matters concerning the promotion of the activities of the fishermen's cooperatives and the marketing systems but also confirms the necessity of extending Japan's technical cooperation such as dispatching experts from Japan, as proposed by the Government of Grenada, in order to effectively utilize the facilities and equipment provided by the grant aid cooperation and thus further amplify the operation of this Project.

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CHAPTER 1 PROJECT BACKGROUND

CHAPTER 1 PROJECT BACKGROUND

1-1 General Condition of Fishery

1-1-1 Geographical Condition of Grenada

Grenada is an island country consisting mainly of three islands, namely, Grenada, Carriacou and Petite Martinique in the East Caribbean Sea. Its combined land area is about 344km², and it administers 1,200km² of sea area exploitable by fishery within its territorial waters extending 12 nautical miles from the coast as established in 1978. The country is situated at the northern tip of the South American Continent, and at the northern and southern tips of each of its island prevail highly productive ocean currents which flow in from the Atlantic Ocean to the Caribbean Sea and form good fishing grounds for pelagic fish resources.

Grenada's coastal areas (Grenada Island is the object of this Project) have the following geographical characteristics when viewed from the standpoint of the fisheries industry.

1) Western coastal area, including St. George's, Gouyave and Victoria

The area has a monotonous coastline and the oceanographic conditions are mild as it is on the lee side of where the northeastern monsoon which prevails in the country is interrupted by the mountainous land that comprises the backbone of Grenada Island. The protrusion of the continental shelf is narrow, however, which a few miles from the coast topographically precipitates into the abyssal part of the ocean.

2) Northern and eastern coastal areas, including Sauteurs and Grenville

Although the areas have a monotonous coastline they are affected by northeasterly winds due to the northeastern monsoon which causes the waters to undulate constantly. The continental shelf protrudes and the neritic area extends far and wide.

3) Southern coastal area, including Calliste

The coastal area has a complex configuration with many bays, but as it is hard to reach from the land side it has only a few fishing colonies.

1-1-2 Condition of Fisheries Resources in Grenada and Its Surroundings

The catch of large size pelagic fish resources (tuna-like fish including bonito and marlin) in the west central Atlantic sea area exceeds 70 thousand tons. Coupled with the catch of 30 thousand tons of medium size pelagic fish resources such as wahoo, barracuda and dolphin, a total of 100 thousand tons of pelagic fish are caught in the seas surrounding Grenada (FAO: 1985). Although these fishes widely migrate in this sea area, the catch by the fishermen of Grenada is only around 1% of the total catch in the area. Accordingly, although it would be necessary to conduct survey and research on fisheries resources management in cooperation with neighboring countries which are along the migrating routes of the fish in order to manage the fisheries resources so that the largest possible catch might be landed without damaging these resources, in actuality, even if Grenada were to double or triple its present catch it would hardly have any effect on the resources. The annual catch of small sized pelagic fish migrating to coastal areas such as flying fish and small horse mackerel in the West Central Atlantic area is estimated to be another 60 to 70 thousand tons in addition to the above.

Besides pelagic fish resources, considerable demersal fish resources exist on the continental shelf around Grenada. These resources have been confirmed by the U.S.S.R. and WECAFC in the past, and the fact that fishing efforts made in Grenada's waters (demersal fish catch per unit area: ton/km²/year; as the continental shelf adjacent to other countries seems to be contiguous to that of Grenada, the magnitude of the following numerical values indicate the degree of exploitation based on the assumption that the quantity of unexploited resources is the same everywhere) are less in degree compared to the efforts made in the seas of other countries indicates that Grenada's sea area has higher potential.

Demersal fish catch per unit area: ton/km²/year
(WECAFC: 1983)

Burmuda : 0.4	Cuba : 0.4-0.5	Puerto Rico: 0.8
Bahama : 2.4	Jamaica : 4.1	Pedro Atoll: 0.4
Dominica: 1.8	Virgin Islands: 0.3	Grenada : 0.08

Also the sea area on the outer peripheral slope of the continental shelf is known for its abundance of demersal stock, so, as hardly any demersal fishery is performed on Grenada's continental slope, it has a large development potential. Fig. 1 shows the relationship between the continental shelf of Grenada and fisheries resources. According to this figure, it is seen that pelagic fish stock occurs in the offshore areas in the east and west of the country while demersal fish stock occurs on the continental shelf off Carriacou Island and in the offshore area southeast of Grenada Island. Grenada's fisheries industry can hardly claim to be effectively utilizing the pelagic and demersal fish stocks within its territorial sea but it has the potential to grow into a greater industry if it introduces appropriate fisheries technologies.

1-1-3 Condition of Fisheries in Grenada

A. Classification of fisheries

Fisheries in Grenada, when classified by scale and form, can be largely grouped into the following three categories.

Artisanal fishery : Majority of fishing industry in Grenada falls within this category. Fishermen have formed colonies at various places along the coastal areas from where they make daily fishing trips using 6 to 7.5m long wooden boats with outboard engines. Pelagic fish are their main target. Catches are supplied to local markets on Grenada Island.

Commercial fishery: Three or four licensed American small-sized long liners (ship's length 15 to 18m) are engaged in Marlin fishing in Grenada's territorial waters using St. George's Port as their base. With the promotion of these offshore fisheries, three local enterprises (joint ventures with foreign enterprises) have used three new vessels of the same type to carry out long-line Marlin fishing and are exporting their catches mainly to the United States.

Carriacou's fishery

: The fisheries of Carriacou and Petite Martinique Islands are basically of artisanal scale as on Grenada Island but the difference is that these islands are surrounded by large fishing grounds for demersal fish on the continental shelf so 80% of their catch is demersal fish. Fishing methods are beach seining, trolling, angling, trapping, bottom gillnetting and bottom long lining. As they have no other industry than fishery, all of fishermen, who number approximately 150, are full-time fishermen. Some 20% of them are female. The fishing fleet consist of 40 to 50 sailing ships with auxiliary engines called "sloops" (with several crew) and 6 to 9m long wooden boats with outboard engines, of which the larger ones engage in voyages of several days. About 90% of their catch (grouper, snapper and other demersal fish, lobster and lambi) are exported to French Martinique. The French Martinique trading merchants periodically collect these fish with their fish carriers (iced storage vessels) and bring them back to Martinique and other overseas markets (export price EC\$2.3/lb). The fact that the fishermen on Carriacou Island have access to an overseas market strikes a contrast with the fishermen on Grenada Island, who are suffering from sluggish growth of the domestic market. The fact that an overseas market is ensured is an incentive for the fishermen on this

island as manifested by the high productivity of fisheries on this island. The following shows the efficiency of the fishing on these islands calculated on the basis of 1987 data.

Efficiency of fishing on Grenada Island:

1,359tons ÷ 1,541 fishermen = 0.88 ton/fisherman

Efficiency of fishing on Carriacou Island, etc:

837tons ÷ 241 fishermen = 3.51 tons/fisherman

(Data: 1987)

On the other hand, symptoms of overcatching are beginning to show up as a result of having continued highly productive demersal fishery in the area.

As the objective of implementing this Project, which has been requested by the government of Grenada, lies in the development of Grenada Island, which is lagging in fisheries development, the report hereafter will focus on Grenada's artisanal fishery.

B. Conditions of artisanal fishery

Grenada's fisheries industry consists primarily of small scale coastal artisanal fishing. In Grenada Island, mainly pelagic fishing is performed with the use of long line, beach seine, encircling gillnet, gillnet, trammel net, angling, trap and diving apparatus by about 1,400 full-time fishermen (full-time fishermen: 1,440 persons; part-time fishermen: 309 persons; total: 1,749 persons). Table 1 shows the number of fishermen and fishing boats at various places on Grenada Island and on Carriacou and Petite Martinique Islands.

Table 1 Numbers of Fishermen and Fishing Boats (1987)

Area	No. of fishermen		No. of fishing boats
	Full-time	Part-time	
St. George's (includes St. George's and Calliste, which are the sites of this Project)	348	100	176
St. John's (includes Gouyave, which is the site of this Project)	291	78	109
St. Mark's (includes Victoria, which is the site of this Project)	128	78	37
St. Patrick's (includes Sauteurs, which is the site of this Project)	152	8	53
St. Andrew's (includes Grenville, which is the site of this Project)	216	18	96
St. David's	107	17	57
Carriacou Island	171	0	81
Petite Martinique Island	70	0	26
Total	1,483 persons	299 persons	635 boats

Grenada Island's fishing mode is to make daily fishing trips using small boats (635 fishing boats are registered with the Government of Grenada, of which 23 (6%) are inboard engine boats of 7.5m or more in length but the rest are for the most part wooden boats with outboard engines (451 boats)), which start fishing early in the morning and return early in the afternoon. Basically, it is not a mode of fishing that is centered around the fishing port but a small scale mode of fishing by fishermen who sail out from the beaches of their respective fishing colonies. The amount of time spent on going to and from the fishing ground is generally large compared to the actual fishing time and the catch per unit fishing effort or unit expense is not economical (revenue is small compared to operating expenses). Also, the fishermen of Grenada Island who go after pelagic fish must inevitably suffer fluctuations in fish catch by season and by year (July - November: peak season; December

- May: for dolphin, flying fish, etc.; January - June: for tunalike fish). The living of these artisanal fishermen is unstable as they are chronically affected by fluctuations in fish catch according to the fishing season. Their income for the year (EC\$4,800/year) is less than that of farmers (EC\$7,200/year).

Grenada's fish catch in the past ten years has fluctuated between 2,000 tons and 650 tons per year as shown in the following table, but since 1981, it has been steadily growing due to the popularization of the long line method for catching pelagic fish. The fisheries industry is gaining importance in Grenada also because of its increasing contribution to GDP in recent years.

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987
Catch (tons)	1,317	1,248	646	864	1,327	1,356	1,427	2,095	2,196

Given in the order of their quantities caught, the fish specie with the largest catch is jacks, followed by yellow fin tuna, black fin tuna, grouper, ocean gar, etc. Particularly in the case of pelagic fish, the catch of each fish species fluctuates wildly by year. For instance, the catch of flying fish, which used to be large in the past, has sharply decreased lately (792 tons in 1978, 55 tons in 1986). Also, as the total quantity of fisheries products which can be sold within the framework of the existing distribution system is limited, the situation is that the distribution of fisheries products may be affecting the fish species composition of the catch as witnessed by the recent popularization of fishing gear such as the long line for catching high priced large-sized fish among fishermen.

Although there seems to be much room for improvement in the fishing boats and fishing gear now being used by fishermen when one considers the huge fisheries resources with which Grenada is endowed, fishermen are fishing quite effectively with the fishing methods now employed and the

level of their technique is also high. Accordingly, for fishermen who must engage in fishing within the limitations of the present fishing environment, a maintenance and management system for equipment and materials necessary for operating fishery, including the maintenance of fishing boats and outboard engines, fabrication and maintenance of fishing gear and methods of handling fish catches with emphasis on preservation of freshness at all times, is considered appropriate. The interest of the fishermen and their willingness to introduce new technologies are also high.

Fishing rights and fishing licenses are clearly stipulated by Grenada's existing Fisheries Act, but in actuality, rights and licenses are applied only to foreign vessels and commercial fisheries, while fishermen engaged in coastal fishing are in no way protected by any fishing rights or licensing rules.

C. Conditions of fisheries products distribution

The form in which fish catches are distributed in Grenada is quite simple. The fish are retailed by the fishermen themselves or through fish vendors. Grenada has about 25 fishermen's communities of various sizes, and in places near these communities the fish may be supplied to consumers by the said method. They cannot effectively supply fish to inhabitants of distant places or in the back regions. Consumption of frozen fish is becoming popular in Grenada but consumer preference is still definitely for fresh fish.

For fisheries product distribution in Grenada, the "Artisanal Fisheries Development Project (AFDP)" being implemented (commenced in 1982 and still being carried out) by the financial assistance of IFAD and the Venezuela Development Fund is playing an important role such as in developing the distribution facilities of Fisheries Centers at various places and improving the distribution system. The basic forms of fisheries product distribution on Grenada Island are as follows.

- 1) The fishermen sell to vendors who make direct calls on consumers sell the fish,
- 2) The fishermen sell to vendors who utilize the distribution and marketing facilities within the fisheries centers for sales to consumers,
- 3) The fishermen or vendors sell directly to bulk consumers (such as hotels and restaurants),
- 4) AFDP collects the fish by refrigerated or insulated vehicles and
 - a) Sells fresh fish and processed fish at AFDP's direct sales stores,
 - b) Supplies and consigns the sale of fresh fish and processed fish to 110 stores under contract in St. George's, St. David's and St. Andrew's parishes,
- 5) Exports to the United States and other neighboring countries.

The Government establishes official guarantee prices on fresh fish distributed in Grenada. The fishermen's selling prices and the consumers' purchase prices are regulated by official prices according to the grade of fish. The commission for distribution is set at EC\$0.5/lb.

D. Conditions of infrastructure facilities for fisheries

In the past, fisheries development had not been an important theme for the Government of Grenada but lately, particularly since the commencement of the "Artisanal Fisheries Development Project", the Government has been putting much effort into fisheries development. Although the condition of the infrastructure supporting fisheries is very poor, it is being developed recently with progress in the "Artisanal Fisheries Development Project". The following lists the conditions of the infrastructure for supporting fisheries in Grenada.

St. George's

Burns Point

AFDP Fisheries Product Processing Center

Cold Storage (280m³, -20°C), Frozen Facility (30 tons/day, -30°C), Chilling Room (17.5m³, +5°C), Flake Ice Making Machine (2 tons/day), Processing Yard, Fisheries Product Direct Sales Store

Carenage	<p>Carenage Fishing Center</p> <p>Cold Storage (17.5m³, -20°C), Sales Compartments (Stalls) for Fresh Fish Vendors</p> <p>AFDP Repair Center</p> <p>Repair Shop, Fishing Gear Sales Store</p>
Melville Street	<p>Melville Street Fishing Center</p> <p>Cold Storage (17.5m³, -20°C), Sales Compartments (Stalls) for Fresh Fish Vendors, Landing Jetty (30m)</p>
<u>St. John's</u>	
Gouyave	<p>Gouyave Fishing Center</p> <p>Cold Storage (17.5m³, -20°C), Sales Compartments (Stalls) for Fresh Fish Vendors, Flake Ice Making Machine (3 tons/day), 4 units of Fishermen's lockers</p>
<u>St. Mark's</u>	
Victoria	<p>Victoria Fishing Center</p> <p>Cold Storage (20m³, -20°C), Sales Compartments (Stalls) for Fresh Fish Vendors</p> <p>St. Mark's Fishermen Cooperative Society</p> <p>Office of the Cooperative Society, Fishing Gear Store, Fuel Oil Sales Store</p>
Duquesne	<p>Duquesne Fishing Center</p> <p>Cold Storage (15m³, -20°C), Sales Compartments (Stalls) for Fresh Fish Vendors</p>
<u>St. Patrick's</u>	
Sauteurs	<p>Sauteurs Fishing Center</p> <p>Cold Storage (17.5m³, -20°C), Sales Compartments (Stalls) for Fresh Fish Vendors, Flake Ice Making Machine (3 tons/day), 6 units of Fishermen's lockers</p>

St. Andrew's

Grenville

Grenville Fishing Center

Sales Compartments (Stalls) for Fresh Fish Vendors

Soubise Fishermen Cooperative Society

Cold Storage (17.5m³, -20°C), Sales Compartments

(Stalls) for Fresh Fish Vendors, Cooperative

Society's Office, Fishing Gear Sales Store

E. Fisheries-related organizations

Fisheries in Grenada are administered under the jurisdiction of the Ministry of Education, Culture and Fisheries. The Fisheries Division of the Ministry is responsible for fisheries development, fishing licensing, drafting and administration of the Fisheries Act (the Fisheries Act now in force was enacted in 1986. It includes stipulations on a Fisheries Advisory Committee, fishing rights, fishing licenses, prohibited fishing methods, etc.), administration of fisheries product distribution, including import and export of fisheries products, operation and management of Fishing Centers at various locations, training of fishermen, administration and management of the "Artisanal Fisheries Development Project", promotion of fishermen's cooperative society activities, etc. In recognition of the diversification of the works involved in the field of fisheries and the importance of fisheries development for the country, both the budget and manpower allocated to the Fisheries Division has been augmented since 1988. (Budget: EC\$158,265 (1987), EC\$562,253 (1988), Manpower: 36 (1987), 49 (1988)). The personnel of the Fisheries Division, which is under the supervision of the Assistant Secretary of the Ministry of Education, Culture and Fisheries, consists of a headquarters' staff and personnel at Fisheries Centers located at various places. It is not large enough, however, to cope with the growing workload. In order to meet growing manpower requirements, the Division has adopted a system of securing necessary manpower by selecting skilled fishermen and having them undergo training at home and abroad. Also, a Fisheries Advisory Committee has been established within the Ministry of Education, Culture and Fisheries and this body renders policy decisions on important matters.

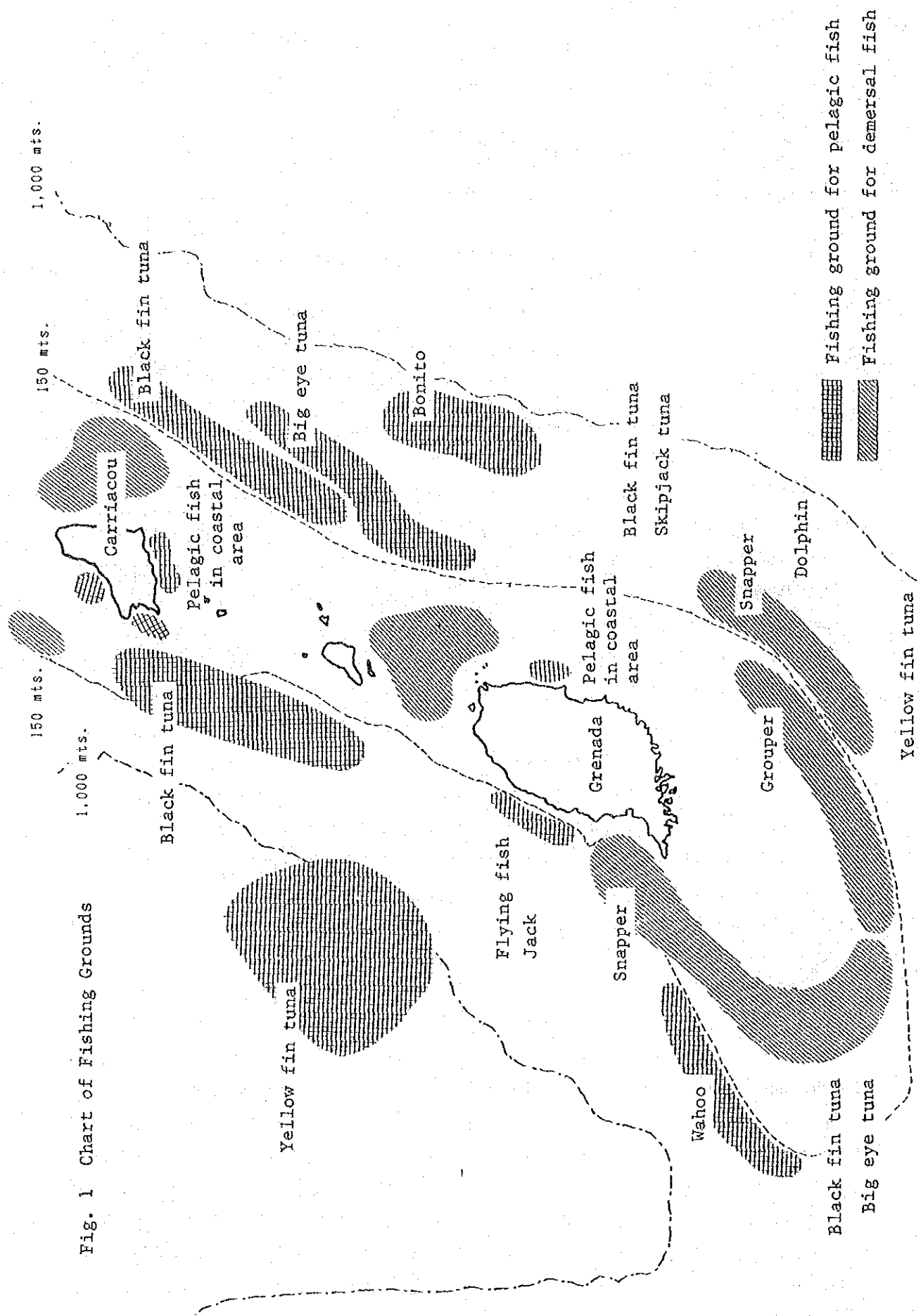


Fig. 1 Chart of Fishing Grounds

Fisheries cooperative associations organized with the cooperation of the Ministry of Education, Culture and Fisheries, the Cooperative Department of the Ministry of Public Works are located at various places on Grenada. The Cooperative Societies Ordinance (enacted in 1958: it pertains to such matters as the associations' obligation to keep accounting books and supporting documents, requirements for becoming a member of a cooperative, dividends, bonuses, loan facilities accommodation system, general meetings, election of presidents, etc.) provides preferential measures for these cooperatives such as treating them as public service corporations and granting them financial assistance in order to promote the activities of the cooperative societies. As shown below, three fisheries cooperatives have already been established, registered and commenced work, while three others have been established and are now waiting to be legally registered.

Gouyave	: St. John's Fishermen's Association Registered, 140 members
Grenville	: Soubise Fishermen's Cooperative Society Registered, 40 members
Victoria	: St. Mark's Fishermen's Cooperative Society Registered, 30 members
Sauteurs	: St. Patrick's Fishermen's Cooperative Society Registration pending, 25 members
Mahaut	: Mahaut Fishermen's Group Registration pending, 20 members
Grand Mal	: Grand Mal/Cherry Hill Fishermen's Group Registration pending, 20 members

1-2 Fisheries Development

The only fisheries development project being implemented by Grenada at present is the "Artisanal Fisheries Development Project" financed by the International Fund for Agricultural Development (IFAD) and the Venezuela Investment Fund (VIF). It was started in 1982 as a four-year project but due to having been partially amended, the project fund has not been used up yet.

The project in progress aims to increase the quantity of fish supply as of 1982 by 40%. For this purpose it has planned the following contents which are centered on consolidation and improvement of the distribution system.

1. Consolidation of fisheries infrastructure
 - a. Establishment of a Project Administration Office at St. George's (Burns Point)
 - b. Improvements to or new construction of fishing centers at seven locations; Carenage, Melville Street, Gouyave, Victoria, Sauteurs, Hills Borough (change in plan at the start of implementation, and construction was stopped), Windward (on Carriacou Island).
 - c. Construction of fish collecting centers at two locations on Carriacou Island
2. Development of support systems
 - a. Sale of ice,
 - b. Sale of fishing gear using a revolving fund,
 - c. Improvement of the distribution system by utilizing fishing centers,
 - d. Inducement of a fishing vessel registration system.
3. Technical cooperation
4. Loan accommodation system for fishermen for the purchase of fishing equipment and materials such as fishing boats, outboard engines, etc.

While this project has been amended with regard to construction of facilities at Burns Point and elsewhere, it has been implemented almost according to the original plan and is now being operated. The Ministry of Education, Culture and Fisheries has established the Office of Artisanal Fisheries Development Project as a self-supporting organization within the Ministry and has entrusted it with administration and operation of the Project. The Office has a staff of 21 and its duties consist of distribution transport, processing and sale of catches, maintenance and management of fishing equipment and supplies as well as repairs, and sale of fishing gear. It was able to generate a surplus (EC\$80,000) at the end of 1987 but not enough to be able to make up for the deficits accumulated during the initial period of operations. Such is the situation in Grenada: its fisheries development has only just been launched, but with progress in the AFDP project, improvements are being made in the distribution system which have enhanced recognition that fisheries development is important.

1-3 Contents and Circumstances Leading to Request

The promotion of agriculture based on production and export of spices has so far been Grenada's central policy for economic development. Tourism has also contributed significantly to the economy since 1983. However, despite the fact that the ocean environment surrounding the country has a large development potential for the fisheries industry of Grenada, its development has lagged behind because of a failure to fully recognize the importance of the fisheries industry.

Grenada is now aware of the huge fisheries resources with which it is endowed and hopes to effectively utilize them. It is also aware of the fact that if it is to foster the fisheries industry as a pivotal center for economic development, it must upgrade the level of its coastal fisheries, which operate in the form of small scale artisanal fishery. In order to upgrade the existing level, however, it is necessary to introduce appropriate technologies and funding from outside in addition to endogenous promotion measures. Under the circumstances, the Government of Grenada formulated the "Coastal Fisheries Development

Project" and requested the Government of Japan to extend grant aid for the installation and procurement of the following facilities and equipment necessary for implementing the Project.

1. Provision of fishing vessels and fishing gear
 - a. Fishing boat of approx. 15m length 5 ea.
 - b. Fishing boat of approx. 10m length 5 ea.
 - c. Long line and gillnet As appropriate
 - d. Winch (5-10 ton capacity) 10 units
 - e. Fish processing equipment 1 set
2. Construction of landing facilities (small jetties) at the five locations of Gouyave, Victoria, Sauteurs, Grand Mal and Beausejour
3. Installation of flake ice making machine (5 tons/day) and block ice making machine (5 tons/day)

CHAPTER 2 PROJECT CONTENTS

CHAPTER 2 PROJECT CONTENTS

2-1 Problem Areas in Fisheries Development and Objectives for Implementing the Project

In fostering and developing fisheries as one of the pivots for achieving economic development, the development potential and problems of fisheries must be studied from the following three aspects: 1) increase in fisheries production, 2) improvement in distribution of fisheries products and 3) training of fishermen, and maintenance of equipment.

2-1-1 Increase in Fisheries Production

A. Problem areas

As pointed out in the preceding chapter, the ocean environment surrounding Grenada holds great promise for fisheries development but a number of problems exist which are preventing development of artisanal fisheries. Firstly, regarding exploitation of large-sized pelagic fish resources, the following problems may be cited.

- a) Although oceanographic conditions are basically mild throughout the year, it is difficult to operate in the open seas even during the usual monsoon with existing wooden boats of 6 to 7.5m equipped with outboard engines but no decks.
- b) At present, the fish caught in Grenada are distributed as fresh fish. The fishermen, therefore, are particularly sensitive about the freshness of their fish, and the need to keep the fish fresh is greatly restricting their operating time. The present mode of operation is to sail out early in the morning and return early in the afternoon, but as the ratio of time spent going to and from the fishing ground to the total fishing time is high, it is quite uneconomical. Yet, with existing boats which have no facilities for keeping the fish fresh with ice, it is not possible to extend the fishing time to operate more economically. If the fish are not very

fresh as a result of having extended the fishing time, vendors do not buy them. As a result, fishermen sometimes have to go out fishing twice a day during the peak fishing seasons.

- c) Pelagic species fishing is influenced by the migration season and migration routes of each school of fish. The annual catch, as a result, fluctuates wildly. Fishing is therefore an occupation that lacks stability.
- d) Even if attempts were to be made to enlarge the size of fishing boats to accommodate facilities for preserving the freshness of fish (insulated fish hold) and to be capable of coping with meteorological conditions on the open seas near Grenada, Grenada has no facilities for mooring and supplying such fishing boats, i.e., jetties, except at St. George's Port.

Also, the following problems exist with respect to development of other resources.

- a) On Carriacou and other islands, exploitation of demersal fish is progressing steadily, being supported by stable export markets in French Martinique and elsewhere in addition to being blessed with favorable sea and meteorological conditions and as well as fishing grounds on the continental shelf. Although the western coast of Grenada is not blessed with any continental shelf fishing grounds, the eastern coast near Grenville faces large continental shelf fishing grounds just like Carriacou Island. However, as this area is affected by the northeasterly monsoon, it is difficult to carry out demersal fisheries development effectively with the present small boats with outboard engines. Also, it is necessary to thoroughly enforce demersal fish resource management, including various regulatory measures prior to promoting demersal fisheries development.
- b) The annual quantity of migrating schools of small pelagic fish in the coastal area such as horse mackerel and flying fish fluctuates wildly. Neither is the condition of the domestic market such that

it can accommodate increased production. Also, 57 sets of beach seines for catching these fish schools are already in operation, mainly on the western coast, and it is neither economical nor desirable to further expand the scale of operation as it would result in mixed catches of the juveniles of useful fish species which normally stay in the littoral zone.

- c) Fisheries products such as lobster, lambi and sea urchin are constantly in demand with the promotion of tourism. These resources, however, also need to be carefully managed as in the case of demersal fish stocks.

B. Objectives for implementing the Project

With an understanding of the problems related to fisheries development noted above, the following possibilities as objectives for implementing the Project were conceived in order to increase fisheries production.

- (1) Increase fish catches by extending the operating time and improving the freshness of fish by equipping existing outboard powered boats with insulated fish boxes as a first step;
- (2) Improve fishing efficiency by providing superior fishermen with fishing boats of a size that can be operated throughout the year under existing meteorological conditions. These fishing boats would explore the pelagic and demersal fish fishing grounds that cannot be reached by existing outboard powered boats;
- (3) Experimental laying of FADs (Fish Aggregating Devices) to obtain more stable catches of pelagic fish is considered effective for future pelagic fisheries development.
Furthermore;
- (4) As Carriacou Island proves, demersal fisheries have the potential of growing into an industry that can earn foreign exchange for Grenada, and

- (5) Accompanying the change of fishing boats to large sized inboard engine types, it would be necessary to develop landing facilities such as jetties for mooring such boats and for supplying necessary gear at main fishing villages.

2-1-2 Improvement in Marketing of Fisheries Products

A. Problem areas

The area of fisheries development which needs to be improved just as improvement is needed to increase fisheries production is the distribution system for fisheries products. Grenada's distribution system for fisheries products has been dramatically improved with progress in the "Artisanal Fisheries Development Project". Especially, the official guarantee price system under which producers' prices and consumers' prices have been determined has more or less functioned as anticipated and been effective in building up a stable market. However, adverse effects of the official price system have begun to show up. The following shows the retail price of protein foods at supermarkets in St. George's. The price of frozen fish (processed food is not subject to official price controls) is not much different from the price of meat. When seen from a long range perspective, it would be difficult to increase per capita consumption of fish (23.7 kg/year as of 1983) significantly with the price of fish as high as it is now.

Local beef	: EC\$5.0/lb	Local pork	: EC\$3.5/lb
Local chicken	: EC\$3.2/lb	Chicken wings	: EC\$3.0/lb
Beef liver	: EC\$2.9/lb	Turkey	: EC\$1.5/lb
Frozen fish	: EC\$4.3/lb	Fresh fish	: EC\$3.3/lb

In the short range, however, improvement of the distribution system with emphasis on enlarging the scale of distribution facilities is necessary in order to cope with increased fish catch. The fisheries product prevailing in Grenada is basically fresh fish, but the equipment and facilities available for handling and transporting them, such as ice-making machines, apparatus for cooling (cold storage warehouses and

insulated trucks), insulated fish boxes, etc. are still limited in availability.

B. Objectives for implementing the Project

If fisheries development is to be further advanced under these circumstances, it will be necessary, in the longer term, to reexamine the official guarantee pricing fish system. Any drastic change in the system is not desirable as it is closely related to fisheries and other industries. The way to develop a large domestic market is to orient the distribution system for fish toward the free market system step by step. At present, fish prices are stabilized at a high level, but it is often the case that the market cannot accept all of the fish catch, which happens during the peak fishing season but not during the poor fishing season. This means that fish remain unsold and the fishermen, as a result, are compelled to remain idle. Although some confusion might be unavoidable at the outset of a switch to a free market, the fishermen would be able to cope with price movements in the free market by reducing their production cost through introduction of insulated fish boxes and extending operating time, and improve their annual income by being assured of a market throughout the year. In the existing fish pricing system under government control, only the vendors who are individual, small-scale distributors can intervene. In a free market, the emergence of private dealers specializing in the distribution of fisheries products, including the export of fish, would be encouraged, enable a more effective and modern distribution system to be built and allow fresh fish to be supplied to consumers throughout the year. For consumers, too, it would have the advantage of allowing them to obtain low priced fresh fish, especially during the peak fishing season, and increase the inclusion of more fish in their diets. At the recommendation of the Study Team, the program for making the transition to a free market is now under review by the Fisheries Advisory Committee upon.

If fisheries production is to be increased, the provision and improvement of distribution facilities such as ice-making machines, cold storage facilities, insulated trucks, etc. (which are in short supply even for the present production quantity) are necessary. Especially, the

provision of insulated fish boxes for fishermen will play an important role not only in increasing fisheries production but in improving the distribution system in that fish will retain their freshness during distribution. The provision of insulated fish boxes would also accelerate the export of fresh fish accompanying the development of demersal fisheries.

2-1-3 Training of Fishermen and Maintenance of Equipment

A. Problem areas

The Fisheries Division of the Ministry of Education, Culture and Fisheries has been offering practical training in 1) navigation safety, 2) marine distress procedures, 3) basic navigation in coastal waters, 4) bottom long lining, 5) long lining, 6) use of echo fish finders, etc. periodically at each Fishing Center. The Government of Grenada also has a plan to establish within the National College a training facility where more sophisticated training can be offered with due consideration to future offshore fisheries development but the contents of the plan require further study.

At present, the Office of the Artisanal Fisheries Development Project of the Ministry has a repair shop at St. George's where it performs maintenance and repairs on outboard engines and refrigerating machines necessary for fisheries development. Most villages are capable of repairing outboard engines and the like. Repairs of inboard engines are taken care of by automobile repair shops located at various places. Shipyards in many fishing villages have the capacity to build wooden fishing vessels of up to 12m in length and the arrangements which the fishermen have for maintaining their fishing equipment and supplies are appropriate.

B. Objectives for implementing the Project

It is necessary, however, to decentralize the maintenance functions for equipment which are currently concentrated in St. George's to local areas in order to develop a more effective maintenance system.

As for the training of fishermen for future fisheries development, it would seem more effective to strengthen training at current training venues rather than gathering trainees at St. George's. The fishermen's attitude toward acquiring new technology is positive, therefore, if field training which is conducted fairly frequently, though sporadically, at various places is given intensively at one place each on the west and east coasts, it can be conducted much more efficiently even with the present setup of the Fisheries Division.

2-2 Study of the Contents Requested

The Government of Grenada, after examining the aforementioned problems and development potential of fisheries, formulated a coastal fisheries development project of which the central theme is development of equipment and facilities for five model fishing villages which are to be provided with modern fishing boats, as noted in Chapter 1, Paragraph 1-3. They requested the Government of Japan for grant aid. In response to this request, the Study Team investigated in detail the present condition of fisheries in Grenada, the activities of fisheries-related organizations and the operating plans for implementing the Project. Through discussions with the Fisheries Division of the Ministry of Education, Culture and Fisheries, it studied the contents of the request as described below.

The Fisheries Division of the Ministry of Education, Culture and Fisheries, which is planning to develop infrastructure at various places on the west coast of Grenada Island in order to promote fisheries as one form of regional development in the area, has been unable to make adequate analysis of the current conditions of the proposed sites on the north and west coasts and on their development potential. The Study Team therefore conducted field surveys of the project sites at Gouyave,

Victoria, Sauteurs, Grand Mal and Beausejour. For Grand Mal and Beausejour, however, when the Study Team had arrived Grenada the candidate sites had been revised and increased to include three other sites at Grenville, Melville Street and Calliste. Field surveys were made for these new candidate sites as well, the results of which are as follows.

At Sauteurs, it was found that a jetty, even if provided, would not be functional unless a new breakwater were to be constructed as the site is located at the northern tip of Grenada Island where the waves are always high due to swells from the oceanic current flowing in from the Atlantic Ocean to the Caribbean Sea and the northeasterly monsoon tant prevails in the area. As the scale of the necessary breakwater and the effects of drifting sand were impossible to determine within the short survey period, the Study Team judged that, although it recognizes the need for a facility like jetty, it would be difficult to cope with this request within the framework of grant aid cooperation. For Calliste, the Team's conclusion was that the installation of a jetty there should not be included in the Project because the fishermen there, unlike the fishermen in other areas, catch lobster, lambi, sea moss and sea urchin by diving and have little need for a jetty to expand their fishery. For the site on Melville Street, which has a 20m concrete block bridge type jetty for supplying fish to St. George's, judging from current use, there seems to be little need to expand the scale. Accordingly, it was judged that studies should be made for the installation of fish landing facilities such as jetties at the three sites of Gouyave, Grenville and Victoria only under this Project. A fisheries development plan was therefore drafted aiming primarily at these three areas.

2-2-1 Study of Project Contents

The Government of Grenada hopes to explore more efficiently the fisheries resources that are present in huge quantities in the surrounding seas and thereby foster fishery into an industry capable of contributing to economic development. The main theme of this Project, therefore, is the upgrading of the level of Grenada's artisanal fishery by improving its fishing technology and fishing environment.

In order to attain the foregoing objectives, integrated development is necessary in all of the following areas.

1. Effective utilization of fisheries resources

Offshore pelagic fish and demersal fish resources which the fishing industry of Grenada currently makes only little use of should be developed. In developing them it will be necessary to assume a development policy that considers both economy and safety. The country shows stronger inclination toward the attainment of modern development and this posture has the effect of attracting the younger generation to the fishing industry as in the case of the tourist industry, which has achieved spectacular development, so that in this respect, too, modernization of fisheries is necessary. An industry that fails to attract the younger generation has little chance of development.

2. Promotion of the activities of fishermen's cooperatives

Although fishermen's cooperatives have been established in Grenada, one must admit that their activities are still limited in scope. However, in a country where the government system supporting fisheries is still inadequate, the functions performed by the cooperative organizations are significant and, in this context, the promotion of activities of the cooperatives is extremely important for the government in its management of fisheries.

3. Consolidation of training for fishermen and dissemination activities for the necessary technologies

With the modernization of fishing technologies, the training of fishermen and dissemination activities for technologies must be consolidated.

4. Improvement of fishing environment

A project such as this which implements fisheries development by inducing foreign capital has two aspects. One aspect is that it will have an impact on the fisheries of the country which induces foreign technology because it does not have that technology for

carrying out development itself even though the development potential is high. The other is that the country must look for foreign capital because it does not have the financial resources to improve the fishing environment even though it is necessary from the standpoint of basic human needs or as an approach to regional development. In other words, a fisheries development project contains a portion that is pioneering as well as a portion that clings to the basic infrastructure. Likewise, it is impossible to separate the one aspect of this Project which is to induce technology in order to upgrade the level of existing fisheries from the other which is to provide official support for the fishermen who are having difficulty in pursuing their trade and to improve the fishing environment for them. Accordingly, if the part of this Project which aims at developing offshore fisheries is deemed to be the pioneering part of the plan, then the plan for improving the environment so that the many and unspecified fishermen can engage in coastal fishing under better conditions is just as important as the former.

5. Improvement of distribution facilities

With respect to the distribution system for fisheries products in Grenada, there exists the problem of making a transition to a free market in the long term. In the short term, however, it is necessary to provide and improve various distribution facilities and equipment the supply of which may become short in order to cope with increased fish catches.

This Project aims to make the aforementioned five improvements in order to modernize fisheries comprehensively and develop the under utilized fisheries resources of Grenada.

2-2-2 Examination of Facilities and Equipment Requested

Based on the contents of the Project requested by the Government of Grenada and on the field surveys, the Team has judged a Project containing the following items to be most appropriate for the promotion of coastal fisheries in Grenada. The following table shows the relationships between facilities and equipment to be installed or provided under the Project and the areas in which improvements are necessary for coastal fisheries development as explained previously.

	Effective utilization of fisheries resources	Promotion of cooperative association activities	Consolidation of training & dissemination activities	Improvement of fishing environment	Improvement of distribution facilities
Promotion of coastal fisheries:					
Fishermen's Center	⊙	⊙	⊙	○	⊙
Small fishing boats	⊙	⊙	⊙		
Small jetties	⊙	⊙		○	
Improvement of fishing environment:					
Slipways for small boat	○	⊙		⊙	
Fishing gear, etc.	⊙	○		○	
Fishermen's lockers		○		⊙	
Water supply materials for fishermen		○		⊙	
Equipment for maintenance		○	○		
Improvement of distribution facilities:					
Insulated fish box manufacturing equipment	⊙	○		○	⊙
Stocker for retail					⊙
Insulated vehicles		○			⊙

⊙: Especially closely related ○: Related

The following examines the propriety of each aspect of the Project.

1. Promotion of coastal fisheries

A. Establishment of Fishermen's Center

Fisheries-related facilities, called "Fishing Centers" are located at various places on Grenada, but all are small in scale. They are positioned as distribution bases primarily for the activities of vendors and are not organized with any consideration for future fisheries development. Therefore, Fishermen's Centers which are necessary for comprehensively promoting more extensive (including offshore) and effective fishing activities centered on inboard engine fishing boats will be established contiguous to small jetties which will be described later. Each said Center will function as the "office of overall coastal fisheries base" and can be used for supporting operation of inboard engine boats requested under this Project, training of fishermen, maintenance of simple equipment and instruments and as a base for distribution of the fish catch with the cooperation of the Fisheries Division of the Ministry of Education, Culture and Fisheries and the Fishermen's Cooperatives. Duplication of the distribution equipment and apparatus existing will result, but as the existing ones are small in size and continue to pose problems, it is indispensable that they be reinforced.

As candidate sites for the Fishermen's Centers, Gouyave and Grenville, the two largest fishing areas on Grenada Island and where the fishermen's cooperatives are active, are considered appropriate. Gouyave's proximity to fishing grounds would allow it to function as an extensive and effective base for the development of pelagic fish resources, while Grenville, which is close to demersal fishing grounds, would function not only as a base for the development of pelagic fish resources but also demersal fish resources and as a base from which as many fisheries products as Carriacou Island may be exported.

The Fishermen's Centers will not only be positioned as fishing bases for modern coastal fisheries but as organizations that will render considerable benefit to promotion of community activities in the area.

At present, the fishermen's cooperatives in Grenada do not even have proper offices of their own. As they must use the classrooms of primary schools and the like for general meetings and when gathering for training, the role of the Fishermen's Centers in promoting the activities of the cooperative associations in at least these two areas from now on would indeed be significant. As for training and extension activities being implemented by the Ministry of Education, Culture and Fisheries, these can be integrated and effectively performed by gathering all of the fishermen on the west coast and those on the east coast at their respective Fishermen's Centers in Grenville and Gouyave.

B. Inboard engine fishing boat

The present artisanal fishermen in Grenada have already attained a high level of ability in fishing and in maintaining and managing their equipment with the use of their own fishing methods and their respective fishing boats (small wooden craft with outboard engines) and fishing gear within the scope of their own resources. In order to upgrade their capabilities as fishermen, it is judged that the time has come to introduce modern technologies from outside. When Grenada's fishing industry introduced the long-line fishing method from Cuba in the early 1980s, the technology was smoothly transferred and it had a great influence in increasing fish catches in Grenada. Factors which are preventing coastal fisheries now from being carried out more efficiently are the following.

1. The existing outboard engine boats have no decks and so are incapable of coping with changes in sea conditions and cannot be used for operating throughout the year.
2. The existing boats cannot be economically operated as outboard engines consume much fuel and are not easy to maintain and manage.
3. As the boats have no insulated fish holds for preserving the freshness of the catch, fishing time cannot be extended.

4. As the boats have neither bunks nor lighting, they cannot be operated during the night or for several days at a time.
5. Fishing intensity cannot be raised any further with the present manual operation of long lines.
6. The boats do not carry proper safety devices for emergencies and as a result of the distance to the fishing grounds becoming longer recently, marine accidents have been increasing.

	No. of accidents reported	Death toll
1987	21	5
1988	7	1

Accordingly, it is considered important to include in this Project the smallest type of inboard engine fishing boats necessary in order to eliminate the aforementioned negative factors preventing development and improve the efficiency of coastal fisheries. At present, specialized lone-liners of 16 to 20m are being economically operated by local enterprises but they are considered too large to be diffused among coastal fishermen. The fishing boats to be included under this Project will be assigned to the Fishermen's Centers at two places as belonging to them and used for the dissemination of economical ways of offshore fishing.

C. Installation of small jetties

Installation of a small jetty as an incidental facility at each Fishermen's Center is considered necessary. The jetties will be used for mooring, loading, unloading and resupplying small inboard engine fishing boats which are to be included under this Project. They will be the first jetties that Grenada will have for coastal fisheries.

2. Improvement of fishing environment

A. Installation of slipways for hauling fishing boats ashore

In addition to Gouyave and Grenville, which are the centers of coastal fisheries and where the Fishermen's Centers are to be constructed, Victoria is where the last of the three registered Fishermen's Cooperatives in the country is located and where fishing activities are brisk. Topographically, however, the coastal area is the worst for boats to beach as its shores are covered with large cobblestones. The fishermen sail out from a slipway used for hauling fishing boats ashore (as it is a slipway made by merely laying cobble stones many of which have been washed away by the waves it can hardly be called a slipway) which is provided between houses but the fishermen have an extremely difficult time in pulling up and pulling down their fishing boats. If, therefore, a slipway were to be installed on the unused government-owned land at the edge of town, the benefit bestowed on fishermen of the area would be substantial.

B. Fishing gear

It is difficult for the present artisanal fishermen to acquire fishing gear. In areas where the promotion of fisheries has become active only recently such as Grenada, the support systems of private enterprise (for the sale or maintenance of fishing equipment and materials such as outboard engines and the sale of fishing gear) have not been established yet. The Project Office uses the revolving fund established for the purchase of fishing gear and fishing materials included in the "Artisanal Fisheries Development Project" and handles the sale and maintenance of fishing gear.

This fund, however, has shrunk due to irrecoverable accounts receivable which ought to be recovered during its turnover. The fund for the purchase of fishing gear and the like which are indispensable for future fisheries development is inadequate. It will be necessary,

therefore, to support the fishing activities of coastal fishermen by including the fishing gear they are now using under this Project.

However, even if expendable fishing gear were to be included in this Project, it would be difficult to determine the quantities and types that would be used by the many and unspecified fishermen. For fishing gear, therefore, it would be better to utilize funds for the purchase of fishing gear out of the operating profits of the Fishermen's Centers which will be described later and the revolving fund to be set up by the Ministry of Education, Culture and Fisheries for this Project out of the sales proceeds of materials and equipment. In this way not only will the actual requirements of the fishermen be met but the right items will be effectively procured. From this viewpoint, it was judged appropriate to exclude fishing gear for sale to the many and unspecified fishermen from this Project and instead to include only fishing gear for the inboard engine fishing boats included under the Project.

As even outboard engine fishing boats have lately begun to operate at fishing grounds some 25 nautical miles from shore during the fishing season, accidents are increasing. The Fisheries Division is therefore considering institution of a compulsory requirement that boats carry specified safety equipment. However, as there are no rescue boats and it is difficult to have the existing fishing boats equipped with wireless for emergency contact considering the size of the boats and the financial capabilities of the fishermen, it would be more realistic, as a first step, to consider equipping them with gunpowder type signal cylinders and similar inexpensive and simple emergency devices.

The introduction of inboard engine boats under this Project will promote demersal fishery development. The demersal fish stock, however, is sensitive to fishing intensity, and its weakness is that without proper resource management there is a danger of it perishing. Under current conditions where resource management cannot be enforced effectively, therefore, demersal fisheries development must be sought on the continental slope where demersal fish stocks are abundant. The sea there, however, is far too deep (150 to 200m) to be coped with by hand lining. It would therefore be appropriate to include electrically

operated reels among the fishing gear on an experimental basis with an eye to future demersal fisheries development. For exploring pelagic fish stocks which have no fixed migration routes, it is desirable to lay FADs (fish aggregating devices) on an experimental basis as they have the effect of stopping the movement of pelagic fish schools temporarily and are therefore effective in improving the probability of catches as well as stabilizing catch sizes. The effectiveness of FADs on pelagic fisheries development has been proven in many instances.

C. Fishermen's lockers

Fishermen have requested the government for improvements to facilitate their daily work, that is, to provide them with lockers in order to prevent burglary, manage their fishing gear and materials and alleviate the heavy labor involved in bringing them home. In this Project, therefore, lockers for fishermen are to be provided at the Fishermen's Centers at two locations and also adjacent to the slipway for hauling fishing boats ashore at Victoria. It has been judged necessary to also provide lockers for fishermen at Sauteurs. Sauteurs, being located at the northern tip of Grenada, is far away from St. George's so government support for the fishermen is limited. It is, however, an active fishing area where the number of fishermen is as large as 150 making it next in size only to Gouyave and Grenville.

D. Materials for laying fishery waterworks

Installation of facilities capable of supplying clean water will be planned for Calliste, which presently has no facilities for supplying water for washing outboard engines (the life of an outboard engine is shortened if not washed after use in salt water) or potable water. This is where the village and the fishing settlement were separated by a runway when Grenada constructed the Point Salines Airport, severely hampering fishing activities in the area. It is necessary, therefore, to induce basic materials, such as those for the waterworks system for fisheries in such areas from the viewpoint of improving socio-economic conditions and to satisfy basic human needs. It is judged appropriate to

include the materials for laying water supply piping from the water source within the dormitory of the medical college about 400m away (the local government will negotiate with the college and bear the expenses for pipe laying work) under this Project.

E. Maintenance equipment

Repair, maintenance and management of fishing equipment and apparatus in Grenada are performed, depending on the seriousness of the problem, by the fishing village or fishermen (maintenance of outboard engines and fishing boats, simple repairs on electric systems), by AFDP's repair shop (maintenance and repair of refrigerating equipment at the Fishing Centers, repair of outboard engines) and by automotive repair shops at various places on the island (repairs of inboard engines). Repairs sometimes take a long time at these places due to lack of spare parts. Repairs on the small inboard engine fishing boats which are to be introduced can be adequately coped with by the Grenada Yard Service and Lance Euphine boatyard (each has a synchronized lift of around 250 tons capacity which can be used for repair work on vessels up to 200 tons) which are performing maintenance and repair of commercial fishing boats and other large vessels.

Wooden ships are maintained, managed and repaired at the small shipyards of each fishing village. The Mt. Moritz FRP Shipyard (which builds new FRP vessels of about 8m length) can repair the hulls of FRP boats to be provided under this Project. A maintenance and management system for equipment necessary for fishing activities has been more or less established but when the equipment and materials included under this Project and future fisheries development are considered, it is felt necessary to organize a more effective maintenance and management service network as described below.

1. How can the equipment repair services concentrated in St. George's be extended to the local areas? → Transport and repair of broken equipment and apparatus.
2. Mobile repair service by engineers.

3. Offering of practical training in simple repair techniques and repairs of equipment at Fishermen's Centers.

In order to organize a more efficient service network for repairs of equipment and apparatus, it is appropriate to include provision of the following equipment under this Project.

1. Basic tools to be distributed to workshops of Fishermen's Center workshops

Simple repairs can be made with these tools. Their availability will also enable engineers dispatched from St. George's to repair equipment and to train fishermen.

2. Tools to be distributed to AFDP's Carenage Repair Shop

At present, this shop has some electrically driven tools. Fishing equipment and apparatus are being repaired by its four repair engineers. The engineers, however, are distressed over the shortage of tools. Therefore, tools which are in short supply and special tools such as an injector tester and a small welder for their mobile repair car, which will be described later, are necessary.

Also, vehicles for providing mobile repair work and offering training in maintenance of equipment and apparatus are indispensable. To begin with, small trucks to transport outboard and inboard engines for repairs, fuel oil, fishing gear and materials, insulated fish boxes, etc. are necessary for improving smoothness of work. Also, mobile repair vehicles for carrying tools are necessary for refrigerating engineers and repair engineers stationed at St. George's.

3. Improvement of distribution facilities

A. Insulated fish box manufacturing equipment

A major obstacle to fisheries development in Grenada is the lack of insulated fish boxes for the fishermen. The Fisheries Division has been looking around for cheap insulated fish boxes which the fishermen can easily buy. The cheapest type, made in Canada, was of waterproof corrugated card board, but these still cost US\$90 a piece, making them too expensive for the fishermen to buy. This situation can be greatly improved by including a minimum sized foamed polystyrene fish box manufacturing machine in this Project. The foamed polystyrene fish box of 50kg capacity, if manufactured locally, will cost around US\$10-12 a piece. If fishermen reinforce it with a wooden box, it should adequately withstand extended use. Vendors, in the distribution of fish, carry the fresh fish without any ice at present but if foamed polystyrene fish boxes were available they would have a major effect in retaining freshness. Also, as there are export markets for fresh demersal fish in neighboring countries, polystyrene fish boxes would be an indispensable material for promoting fish exports. The foamed polystyrene fish box manufacturing machine is a small plant and the Government of Grenada has expressed its desire to install one at the food processing factory at Calliste (government-owned but not in used at present. If repaired, it would be adequate) if this plant can be included in this Project.

B. Stockers for retail

The distribution system has been consolidated under the "Artisanal Fisheries Development Project", as a result of which the consignment sales system for fresh fish has been steadily diffused and the number of retail stores now under contract has expanded to 110. However, as they have no special facilities for fresh fish, the consignment quantity per shop is inevitably small and it is hard for them to keep up with demand, especially in remote settlements where the number of consumers is large. If stockers were to be installed at consignee stores, it would become

possible to increase the quantity consigned each time and greatly improve distribution to areas far from the coast.

C. Insulated trucks

In response to increased fish catches expected under this Project, it is necessary to include insulated trucks for transporting the fish to St. George's, the major consumption center. The insulated trucks will belong to the Fishermen's Centers and be utilized as distribution equipment.

2-3 Project Contents

2-3-1 Executing Agency

If this project should be implemented, the executing agency will be the Ministry of Education, Culture and Fisheries and actual administration will be handled by the Fisheries Division within the Ministry. Cooperating agencies and organizations are the Ministry of Finance, the Ministry of Foreign Affairs, the Land Planning Department, which is under the jurisdiction of the Ministry of Health, the Ministry of Works and the Fisheries Cooperatives, which are under the jurisdiction of the Cooperatives Department of the Ministry of Works.

2-3-2 Budgeting Plan

As already shown, the Government of Grenada has been putting much effort into fisheries development and the budget appropriated for the Ministry of Education, Culture and Fisheries has been increased since 1988. If this Project should be implemented, a problem regarding the burden of the Government of Grenada will arise, as will be described later. In this respect, it has been confirmed that while banking arrangements and arrangements for construction work can be undertaken by the executing agency, the required expenses will be defrayed from the

supplementary appropriation in the budget of the Government of Grenada as soon as implementation has been given the go-ahead.

2-3-3 Personnel Assignment Plan

As for necessary personnel required during implementation of this Project, the existing personnel are considered adequate. The personnel assignment plan at the start of operation will be shown in the Management and Maintenance Plan described later.

2-3-4 Operating Plan

As for the operating system of this Project, details will be shown in the paragraph on "management and maintenance plan" as the operating body will differ for each item in the Project. However, the operating body of the major project will be the Fishermen's Cooperatives and the direct beneficiaries are the many and unspecified artisanal coastal fishermen.

2-3-5 Conditions of Proposed Sites for Establishment of Facilities

The climate in Grenada is a tropical oceanographic climate with high temperatures (26°C average throughout the year, annual temperature difference $\pm 6^\circ\text{C}$), high humidity, and high precipitation (within the range of 4,000mm of annual rainfall in the mountain areas to 1,500mm on the southern plateau) but with very little seasonal climatic change. It is exposed to the northeasterly trade winds throughout the year (strongly affected by the trade winds particularly during the winter months) and the period between June and October, especially, is the hurricane season, although Grenada hardly ever suffers any damage because it is slightly south of the hurricane track. Accordingly, although its eastern coastal area is affected by the trade winds, its western coast, which lies leeward of where the trade winds are interrupted by the mountain range which runs in the north-south direction, is hardly affected. As the country consists of islands of volcanic origin, earthquakes have been

recorded from time to time but as all have been of minor scale, no damages have been recorded.

The proposed sites where the facilities are to be established under this Project are the following three.

1. Gouyave

The proposed project site is located at the northern tip of urban Gouyave in the parish of St. John. The site is also the northern tip of the fishing settlement along the Gouyave Bay of urban Gouyave and is relatively less affected by the winds and waves, being protected by a cape which projects to the north. The fishing settlement consists of the Fishery Center and a sand beach of about 1km which stretches along the urban area of Gouyave and where the outboard fishing boats are hauled ashore. The principal fishing methods employed here are beach seining for small pelagic fish on the sand beach and long-line fishing for large pelagic fish. As the site for building the facilities of the Project, the northernmost area, which does not interfere with beach seine fishing and which is also desirable for reasons of wind and wave protection and other natural conditions, is most suitable.

The proposed construction site for the Fishermen's Center and small jetty is government-owned land (under the control of the Land Planning Department of the Ministry of Health) but is currently occupied by three families (three houses) who built their homes without permission of the Government (the Government has been planning for some time to relocate these families and demolish the houses). The site is about 28m in length and 20m in width, and covers an area of about 300m² with a slope of maximum difference in elevation of 3m. It is located seaward of the area where the west coast circumferential road leading from the urban district of Gouyave starts to ascend the cape at the northern tip. It is also about 10m seaward of the 6m-wide west coast circumferential road and can be reached by a simple 4m wide access road. Along the boundary of the site is a 2m wide concrete ditch for draining rain

water. A slight flooding is anticipated to occur around the side ditch after a large rainfall. The land survey map, levels and results of sounding along the coastal area of the proposed site are attached at the end of this report.

The ground on the west coast of Grenada Island generally consists of volcanic soils (lateritic clay and silty sand), volcanic boulders and limestone of a low degree of consolidation, with thick vegetation covering the soil. Differences in types of soil are also recognized within the site, e.g., sandy soil in the area near the sand beach and lateritic clay ground on the upper slope. As boring tests could not be conducted during this study there is no analysis data on the subsoil, but as boulders are seen exposed on the upper slope facing the sea, the possibility of more boulders and rock bed underground cannot be denied.

The coastal zone comprises a shoal, and as the northeasterly trade winds are interrupted by the mountain to the back (on the eastern side) and a cape extends to the north, the waves are small throughout the year. The beach is scattered with cobblestones but the sea bottom is inferred to be sandy. As an extension of the onshore area, the possibility of rock beds occurring beneath the surface layer of this site cannot be denied, but even if they do occur, their position is thought to be deeper than those of the onshore area.

The surrounding residential area is complete with water supply facilities consisting of a 6" water main and 1 3/4" branch pipelines laid along the circumferential road. As for power supply, a high tension aerial cable (11kv, 400v) has been laid about 500m to the east of the circumferential road from where electricity can be easily supplied via a transformer. The power source in Grenada is a four-wire three-phase system which can be used for household service and motor power. As electricity is not supplied with a wattmeter, the electricity charges are not based on actual consumption but on the number of electrical apparatus used and the sum of their nominal electric energy consumption. For drainage, rain water sewage is

drained by the side ditch or river, while sanitary sewage is disposed of by septic tanks.

2. Grenville

The project site is located at approximately the center of urban Grenville in the parish of St. Andrew. It faces an anchorage (Grenville Port) surrounded by coral reefs. Approximately at the center of the anchorage is a jetty (projecting offshore about 30m, width about 3m) for shipping agricultural products but one side of it where a wrecked ship has been abandoned is unusable. This jetty is badly damaged and repair is being planned under the Agricultural Products Export Promotion Project of the World Bank. The office of the Fishermen's Cooperative of the area and the Fishing Center have been constructed at a point about 100m north of this jetty.

Fishermen haul their fishing boats ashore another 200-300m to the north of these buildings. The principal fishing methods employed here are demersal fishing, mainly by angling, and long-line fishing for large pelagic fish as at Gouyave.

The proposed construction site for the Fishermen's Center and small jetty is on the onshore side of the existing site for hauling fishing boats ashore. It extends over a regulated area (Government-owned land under the jurisdiction of the Land Planning Department of the Ministry of Health) where construction of ordinary homes is not permitted for conservation of scenic beauty and is an extension of the sand beach and land owned by the Anglican Church. The Land Planning Department of the Ministry of Health is planning to purchase the land owned by the church. A public latrine stands on the church-owned land but is so badly damaged that it is no longer used. This site is about 300m² in area and can be approached via a 6m wide road (city road) which cuts seaward from where it branches off from the east coast circumferential road passing through urban Grenville. The northern boundary of the site comprises a side ditch. The ground within the site is volcanic soil (silty sand) with a somewhat high proportion of sand and the surface is covered by beach plants. The ground bearing capacity seems to be low. The

land survey map, levels and results of sounding in the coastal zone are attached at the end of this report. The coastal zone is a shoal, and coral reefs encircle the anchorage approx. 500m from shore. At the approx. center of the surrounding coral reefs is a waterway (20m wide, 10m deep) which opens into the ocean. The waves, when they are high, occasionally go over the coral reef but these waves, which are caused by the northeasterly trade winds, are usually broken by the natural coral reef breakwater. Accordingly, the sea here is generally calm and suitable for anchorage. The soil of the seabed is inferred to be homogeneous silty soil or clayey soil.

The environment of the surrounding residential area is far better in all respects compared to Gouyave than as it is in Grenville, which is the second largest city in Grenada. The condition of the waterworks, sewage, electricity, etc. are about the same as at Gouyave, each of which are installed along the adjacent city road.

3. Victoria

The project site is situated contiguous to the rivermouth at the southern tip of urban Victoria in the parish of St. Mark. The coast of Victoria is covered by cobblestones of 30 to 50cm diameter which make hauling of small fishing boats onto the beach extremely difficult. The project site is government-owned land at the seaward side of a basketball court located at the southern end of Victoria where the streets end. It is presently being used as a quarry to supply stone for construction work. Local fishermen are using a narrow yard of approximately 6m width and a slipway located at the approx. center of the town to haul out their boats. The slipway was once of rubblework, but the stones have washed away so that it no longer functions as a slipway. As at Gouyave, the principal fishing method here is long-lining for large pelagic fish.

The rock quarry which is the proposed construction site for the slipway for hauling small fishing boats ashore is government-owned land (under the control of the Land Planning Department of the

Ministry of Health). The land survey map, levels and results of soundings close inshore are attached at the end of this report. The site, which covers an area of 300m², is located about 10m seaward of the west coast circumferential road that passes through urban Victoria. The southern boundary line of the site comprises a river.

The ground within the site consists of volcanic soil (silty sand), and the coast side is covered with cobblestones. The coastal zone is a shoaling beach and the seabed is covered with cobblestones.

2-3-6 Outline of the Project

As a result of having investigated the economic conditions, fisheries situation and the condition of activities performed by fisheries-related organizations on Grenada, the Team has judged the inclusion of the following items in the Coastal Fisheries Development Project in Grenada to be quite appropriate.

Objective	Facility or equipment	Place installed	Quantity
1. Coastal fisheries promotion	1. Fishermen's Center		
	a. RC Two-Storeyed Building (300m ²) Training & Meeting Room, Ice Making and Cold Storage Facilities, Small Workshop, Sales Stall, Office, Machine Room, Toilet, Storage, Shower	Gouyave	1 bldg.
	b. Block Ice Making Machine	Gouyave	1 set
	c. Plate Ice Making Machine	Gouyave	1 set
	d. Cold Storage	Gouyave	2 sets
	e. Emergency Generator	Gouyave	1 set
	f. Tools	Gouyave	1 assorted set

	g. Training equipment	Gouyave	1 assorted set
	h. Insulated truck	Gouyave	1 ea.
	i. Weight Scales	Gouyave	1 assorted set
	j. Small Jetty (approx. 40m long), Small Fueling Facility, Fishermen's Lockers	Gouyave	1 set 1 set 20 ea.
	2. Fishermen's Center		
	a. RC One-Storeyed Building (300m ²) Training & Meeting Room, Ice Making and Cold Storage Facilities, Small Workshop, Sales Stall, Office, Machine Room, Toilet, Storage, Shower	Grenville	1 bldg.
	b. Block Ice Making Machine	Grenville	1 set
	c. Plate Ice Making Machine	Grenville	1 set
	d. Cold Storage	Grenville	2 sets
	e. Emergency Generator	Grenville	1 set
	f. Tools	Grenville	1 assorted set
	g. Training equipment	Grenville	1 assorted set
	h. Insulated truck	Grenville	1 ea.
	i. Weight Scales	Grenville	1 assorted set
	j. Small Jetty (approx. 50m long), Small Fueling Facility, Fishermen's Lockers	Grenville	1 set 1 set 20 ea.
	3. Inboard Engine Fishing Boat, Length approx. 11m	Gouyave Grenville	4 ea. 4 ea.

2. Consolidation & development of fisheries environment	1. Slipway for Hauling Small Fishing Boats	Victoria	1 set
	Winch for Hauling Fishermen's Lockers	Victoria Victoria	2 sets 15 ea.
	2. Fishing Gear	Each place	1 assorted set
	3. Fishermen's Lockers	Sauteurs	25 ea.
	4. Materials for Laying Water Supply System for Fisheries	Calliste	1 assorted set
5. Equipment for Maintenance & Management of Equipment & Apparatus	Truck for Transporting Equipment	AFDP	1 ea.
	Mobile Repair Car	AFDP	1 ea.
	Tools	AFDP	1 assorted set
3. Distribution facilities improvement	1. Insulated Fish Box Manufacturing Machine	AFDP	1 set
	2. Stocker for Retail Sales	AFDP	10 sets

2-4 Technical Cooperation

The Project shown above can basically be operated by the manpower (in terms of both quantity and quality) currently available to the operating bodies such as the Ministry of Education, Culture and Fisheries and the Fishermen's Cooperatives. If technical cooperation were to be extended by Japan in such areas of software as operation of the Fishermen's Centers, drafting of the operating plan for inboard engine fishing boats and improvement of the distribution system, however, this Project could be operated more smoothly and effectively. From this viewpoint, the Government of Grenada made a request to the Study Team for technical cooperation from the Government of Japan in implementation of the Project. In response to the request, the Study Team explained to the Government of Grenada the Grant Aid System and the Technical Cooperation System of the Government of Japan. The areas in which the Government of Grenada wishes technical cooperation are as follows.

1) Dispatch of experts	Fishing technology expert (operational control of small coastal vessels and operation and management of Fishermen's Centers)	One person
	Fisheries product distribution expert (consolidation and improvement of organizations accompanying improvements in distribution)	One person
2) Acceptance of trainees	Coastal fisheries, marine engine technology	Several persons

CHAPTER 3 BASIC DESIGN

CHAPTER 3 BASIC DESIGN

3-1 Basic Policy

The basic design takes into consideration such local conditions as weather, climate, the status quo of fisheries, state of the construction industry, etc., of Grenada with the object of securing harmony with them. Such being the case, special attention is paid to the following points in formulating the basic design.

- 1) Construction materials and other articles available in Grenada and in neighboring countries will be used as much as possible taking into consideration the physical distance between Japan and Grenada.
- 2) Local construction methods will be adopted as much as possible. The design will be properly formulated so as to realize the project as economically as possible in conformity with the construction techniques and construction capacity available at the project site, and measures will be taken to reduce as much as possible the required cost while securing the required functions and environment. With these considerations, implementation of this project will contribute to increased employment opportunities and the transfer of modern technology to construction workers in Grenada.
- 3) Special attention to the organization in charge of the various facilities and equipment as well as to the technical and financial resources of the users, for the sake of smooth operation of the equipment supplied under the auspices of this project. Moreover, this project is planned in such a way as to teach the required technical skills through effective use of the supplied equipment and materials.

3-2 Definition of Scale of Facilities and Equipment

This section examines, from the technical standpoint, the scale of the required facilities and equipment to be supplied under Project. The contents of this section are basically arranged in conformity with the items outlined in section 2-3-6 but different facilities and equipment are arranged in the form of lots comprising many items when they are similar to each other.

3-2-1 Fishermen's Center

This project is planning the construction of two Fishermen's Centers. These Fishermen's Centers have the object of: 1) Promoting coastal fishery, including the development of offshore fishing grounds; 2) Promoting fisheries cooperative activities; 3) Implementing effective training programs for fishermen; 4) Equipping distribution facilities. The two Fishermen's Centers will be located at Gouyave and Grenville. Gouyave is far larger in terms of members of the Fishermen's Cooperatives (Gouyave: 140 members, Grenville: 40 members) but there is no major difference in terms of fishermen in the respective areas (Gouyave: 291 fishermen, Grenville: 216 fishermen) so it may safely be said that the two sites are even in terms of potential regarding future development of fisheries when promotion of demersal fisheries being planned at the offings of Grenville is taken into consideration. Such being the case, it was decided to design the two Fishermen's Centers with the same functions and scale.

1. Block ice making machine and cold storage room

Block ice will be used mainly for fisheries and the cold storage room will be used mainly for temporary storage of catches. The room will be constructed taking into consideration access from the landing facilities including the jetty. No separate machine house will be constructed because the as compressors, condensers and the like required for the facilities are small in size. Equipment of various kinds of the scale mentioned later will be housed in the room and the minimum necessary work space will be provided around the equipment.

Scale of block ice making machine:

Block ice will be crushed and used for fisheries. From the standpoint of keeping the freshness of the catch it goes without saying that ice which readily melts is the most appropriate. It must be borne in mind, however, that no ice has been used so far for the fisheries in Grenada. On the other hand, it is necessary to keep ice from melting for relatively long periods of time to securing the freshness of the catch during each fishing voyage. Moreover, it must be remembered that in countries such as Grenada where large-sized pelagic fish are caught, future introduction of freshness-keeping methods making use of water with ice will be possible using block ice. Such being the case, the quantity of ice required for the four inboard engine fishing boats belonging to the Fishermen's Centers included in this project is used as a base to determine the capacity and scale of the block ice making machines.

Operating plan for peak fishing season (6 months) for inboard engine fishing boats

- Duration of each fishing voyage = {2 days (preparation period) + 3 days (fishing period) + 2 days (rest)} / Week
= 7 days/trip

- Monthly quantity of ice required by inboard engine fishing boats at each site during peak fishing season
= 1 ton (ice loading capacity of the inboard engine fishing boat) x 4 times/month (number of fishing voyages per month) x 4 boats
= 16 tons

Ice making capacity required to secure the required quantity of ice

- Daily production capacity = 16 tons ÷ 20 days (operating days/month)
= 0.8 ton/day

As can be seen, in this project it is regarded as appropriate to supply block ice making machines of 1 ton/day capacity, the minimum scale available in equipment of this kind.

Scale of cold storage

No freezing facilities are required in Grenada because distribution in the country consists basically of the fresh fish market. It must be borne in mind, however, that inasmuch as the catch consists of large-sized fish it is necessary to lower the temperature at the core of the fish body for storing it for a time and keeping its freshness in view of the distribution system (cold store facilities of this kind are classified as freezing storage in Japan because the internal temperature of the fish is adjustable down to -18°C). Moreover, it must be remembered that the quantity of catch in the cold storage is variable from the peak fishing season to the off season. Economical operation of the cold storage would become impracticable if the capacity of the cold store were designed based on the quantity of catch to be housed during the peak fishing season only. Under the circumstances, the cold storage facilities are designed assuming that the quantity of catch during the off season to be stored therein is half the quantity of the peak fishing season. Operation of one of the cold storages can be stopped depending on the quantity of catch to be stored, and the two cold storages both operated during the peak fishing season to cope with fluctuations in the catch.

Grenada is a market of fresh fish but operation of cold storages is regarded as indispensable for running the Fishermen's Centers. In this connection, problems are found in the distribution system of Grenada. In particular, the insufficient capacity of the transportation system from production centers to consumption markets is a bottleneck and there is congestion of catch even during the off season. The transportation capacity from the production centers to the consumption market is presumed to be of the order of 1.5 tons/day. On the other hand, there are currently approximately 100 fishing boats registered in Gouyave and in Grenville, respectively, and their daily catch is presumed to be of the order of:

$$0.054 \text{ ton/boat} \left(\begin{array}{l} \text{catch per fishing} \\ \text{voyage of each boat} \end{array} \right) \times 100 \text{ boats} = 5.4 \text{ tons/day}$$

Inasmuch as the annual average number of operating days is presumed to be of the order of 100 days, fishermen are working barely one out of every 3 days. The current state of fisheries and transportation being practiced in Grenada is summarized in the following table.

Peak fishing season	1 day	2 days	3 days	4 days	5 days	6 days
Catch (tons)	5.4	-	-	5.4	-	-
Transportation (tons)	1.5	1.5	1.5	1.5	1.5	1.5
Freight congestion (tons)	3.9	2.4	0.9	4.8	3.3	1.8
Off season period						
Catch (tons)	2.7	-	-	2.7	-	-
Transportation (tons)	1.5	1.5	-	1.5	1.5	-
Freight congestion (tons)	1.2	0	0	1.2	0	0

If this project should be implemented, the catches and transportation at Gouyave and Grenville would be changed as shown in the following table, particularly during the peak fishing season.

Peak fishing season	1 day	2 days	3 days	4 days	5 days	6 days	7 days
Catch (tons)							
Inboard engine fishing boat	3.6	-	-	-	-	-	3.6
Existing fishing boat	5.4	-	-	5.4	-	-	5.4
Transportation (tons)							
Existing transportation capacity	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Insulated truck	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Freight congestion (tons)	6.5	4.0	1.5	4.4	1.9	0	6.5

The Transportation problem caused by freight congestion which is occurring at present can be solved by introducing an insulated truck of 1.0 ton transport capacity, as mentioned later in this report, to reinforce the current catch transportation capacity and by erecting cold storages of 6.5 ton capacity at Gouyave and at Grenville, respectively, to cope with the catch expected as a result of the implementation of this project. There are cold storages with 17.5m^3 internal volume each at each of these places. Fishermen of Gouyave and Grenville are fishing mainly Marlin and the catch is kept in the cold storages by hanging from the ceiling. Since Marlin are presumed to have a specific gravity 0.55 and the volumetric efficiency of the cold store is of the order of 0.2 when this storage method is adopted, the storage capacity of the existing facility is presumed to be of the order of $17.5\text{m}^3 \times 0.2 \times 0.55 = 2$ tons. Inasmuch as cold storage capacity of the order of 4.5 tons will be additionally required as a result of implementation of this project, the cold storage to be erected must have an inner volume as determined by the following calculation.

$$4.5 \text{ tons} \div 0.2 \div 0.55 = 40\text{m}^3$$

Moreover, a minimum stock of the order of 4 tons of ice (quantity of ice required for one operating day for inboard engine fishing boats) in the cold storage will be required for effective usage of block ice making machine. This means 8m^3 if the volumetric efficiency of ice inside the cold store is regarded as 0.5. Therefore the internal volume of the required cold storage facility must be 48m^3 in total.

2. Plate ice making machine room

Plate ice will be used for two purposes, fishing and transportation of the catch. The plate ice making machine room will be designed attaching importance to access from the road side as well, in order to facilitate its use by insulated trucks and the like. Moreover, the plate ice making machine will be designed in for two stories in view of its construction and will be properly arranged within the context of the design of the facilities as a whole (relation with

the function and layout of the second storey portion). The scale of the plate ice machine room will be designed with the minimum space required to install a plate ice machine with the capacity mentioned later in this report.

Scale of plate ice machine

Fine grain ice is regarded as desirable for fish distribution. Such being the case, flake ice has been used so far in Grenada. It is presumed, by applying the same line of reasoning used for the design of the block ice making machine, that plate ice of larger grain size can be used more effectively in Grenada because the country is located in the tropical zone and, moreover, freezing facilities are not available throughout the whole distribution network. The scale of the plate ice machine is designed taking into consideration the quantity of catch to be transported from the Fishermen's Centers to the consumption markets during the peak fishing season and the quantity of ice required when fishing making use of the insulated fish boxes.

- Quantity of catch to be transported to the consumption market during the peak fishing season : 2.5 tons/day
- Quantity of ice required for insulated fish boxes:
50kg x 100 boats x 10 trips/month ÷ 20 days
ice machine operating days per month) = 2.5 tons/day

Total 5.0 tons/day

There are machines with 3 ton/day capacity at Gouyave and Grenville respectively. Accordingly, the required ice making capacity will be 2 tons/day.

3. Training and meeting room

Training of fishermen has been carried out so far at Gouyave and at Grenville by the Fisheries Division of the Ministry of Education, Culture and Fisheries. Each training course (implemented 3 times/month on average) has been attended by approximately 30 persons on average. Moreover, it must be remembered that properly equipped space is required for meetings and other events held within the

context of the activities of the fishermen's cooperatives. Classrooms of local elementary schools are being used for these purposes because there are no other appropriate facilities. These Fishermen's Centers will be built on the east and west coasts of Grenada Island and are expected to function as bases for future development of fisheries in the country. Such being the case the training and extension activities that have been carried out by the Fisheries Division will be further centralized and the service area will cover not only the Fishermen's Centers but also fishermen of adjacent areas. Moreover, training will be required also in connection with new equipment such as inboard engine fishing boats and the like as well as new techniques to be introduced under the project. On the other hand, training of young fishermen is a matter of top importance when the future of the fisheries of Grenada is taken into consideration. It must be borne in mind, however, that training courses and meetings are not held permanently and therefore it is presumed that the space required to cope with the needs of the training courses and the like being implemented currently is regarded as sufficient to cope with the increased training demand mentioned above by simply speeding up the cycle of use of these facilities. The training and meeting rooms of the Fishermen's Centers will be designed in such a way to meet the scale of the training courses being implemented at the present time. Space to cope with training courses for 30 persons per class is regarded as appropriate. Moreover, a storeroom to house such educational equipment as video cassette recorders, slide projectors and the like, as well as, fishing gear and spare parts of inboard engine fishing boats, safety equipment, etc. will be provided adjacent to the training and meeting room.

4. Fishermen's Center administrative office

The Ministry of Education, Culture and Fisheries is planning to post one staff member at each Fishermen's Center to take charge of operation and administration. The staff members will act as project managers mainly in charge of accounting duties at the center, planning of fishing boat operations, control of the purchase and sales of

materials of various kinds, and maintenance and control of equipment. An administrative office, with the minimum equipment needed for the project manager to perform his duties, will be required at the Fishermen's Center.

5. Sales shop

Administration such as selling ice and other items to the fishermen, selling plate ice to fish vendors, controlling use of the cold storage, insulated trucks, and other facilities by fish vendors, etc., will be required at the Fishermen's Centers. A small office will be required within each Fishermen's Center to control such sales activities.

6. Small-scale repair shop

A small-scale repair shop will be required for minor repairs including the maintenance of outboard engines. Major repair services beyond the technical level of fishermen will be carried out by repair technicians dispatched from St. George's. They will make use of each occasion to provide fishermen with technical training as well. Repair tools and educational materials required in this connection will be brought to the Fishermen's Centers by the mobile repair car.

7. Emergency generator

The supply of electricity is interrupted from time to time in the areas in which the Fishermen's Centers will be built. Power stoppage is troublesome particularly when ice is being made and when the cold storage contains fish. Space is therefore required for an emergency generator with a capacity sufficient to operate the cold storage.

8. Lavatory

Lavatory facilities are required for staff working at the Fishermen's Centers and fishermen gathering at the center for training and other activities.