

Ministry of Agriculture and Labour
St. Vincent and the Grenadines

**BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
CONSTRUCTION OF FISHERY CENTRES
IN
ST. VINCENT AND THE GRENADINES**

MARCH 1998

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**JAPAN INTERNATIONAL COOPERATION AGENCY
CRC OVERSEAS COOPERATION Inc.**

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PREFACE

In response to a request from the Government of St. Vincent and the Grenadines the Government of Japan decided to conduct a basic design study on The Project for Construction of Fishery Centres and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to St. Vincent a study team from October 25, 1997 to December 1, 1997.

The team held discussions with the officials concerned of the Government of St. Vincent, and conducted a field study at the study area.

After the team returned to Japan, further studies were made. Then, a mission was sent to St. Vincent in order to discuss a draft basic design, and as this result, the present report was finalized.

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

I wish to express my sincere appreciation to the officials concerned of the Government of St. Vincent and the Grenadines for their close cooperation extended to the teams.

March, 1998

A handwritten signature in black ink, reading "Kimio Fujita", written in a cursive style.

Kimio Fujita
President
Japan International Cooperation Agency

March, 1998

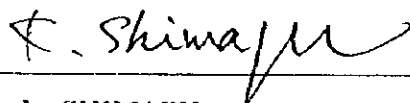
LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on The Project for Construction of Fishery Centres in St. Vincent and the Grenadines

This study was conducted by CRC Overseas Cooperation Inc., under a contract to JICA, during the period from October 6, 1997 to March 27, 1998. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of St. Vincent and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

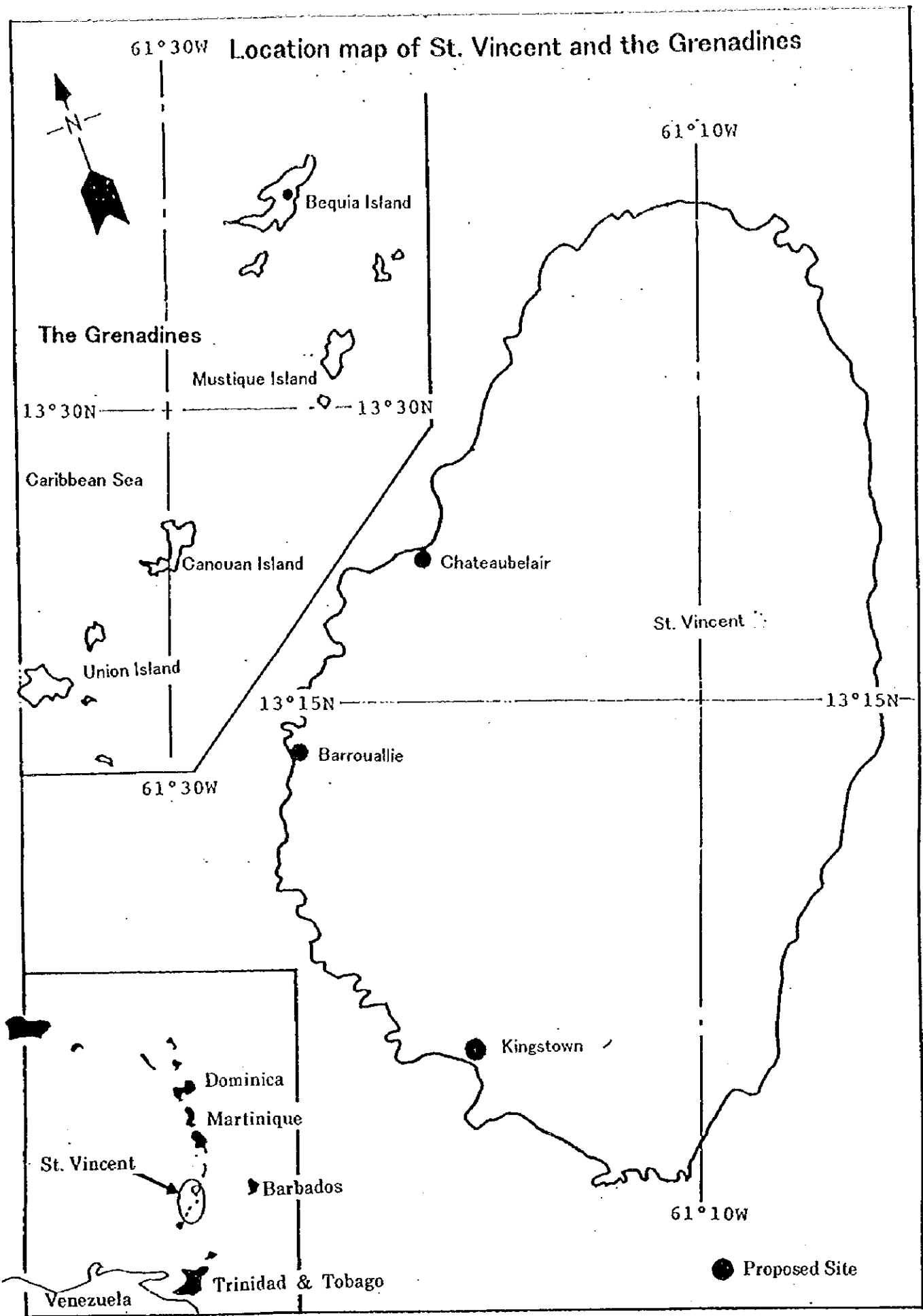
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,



Kohsuke SHIMAZU
Project manager,
Basic design study team on
The Project for Construction of Fishery Centres
in St. Vincent and the Grenadines

CRC Overseas Cooperation Inc.



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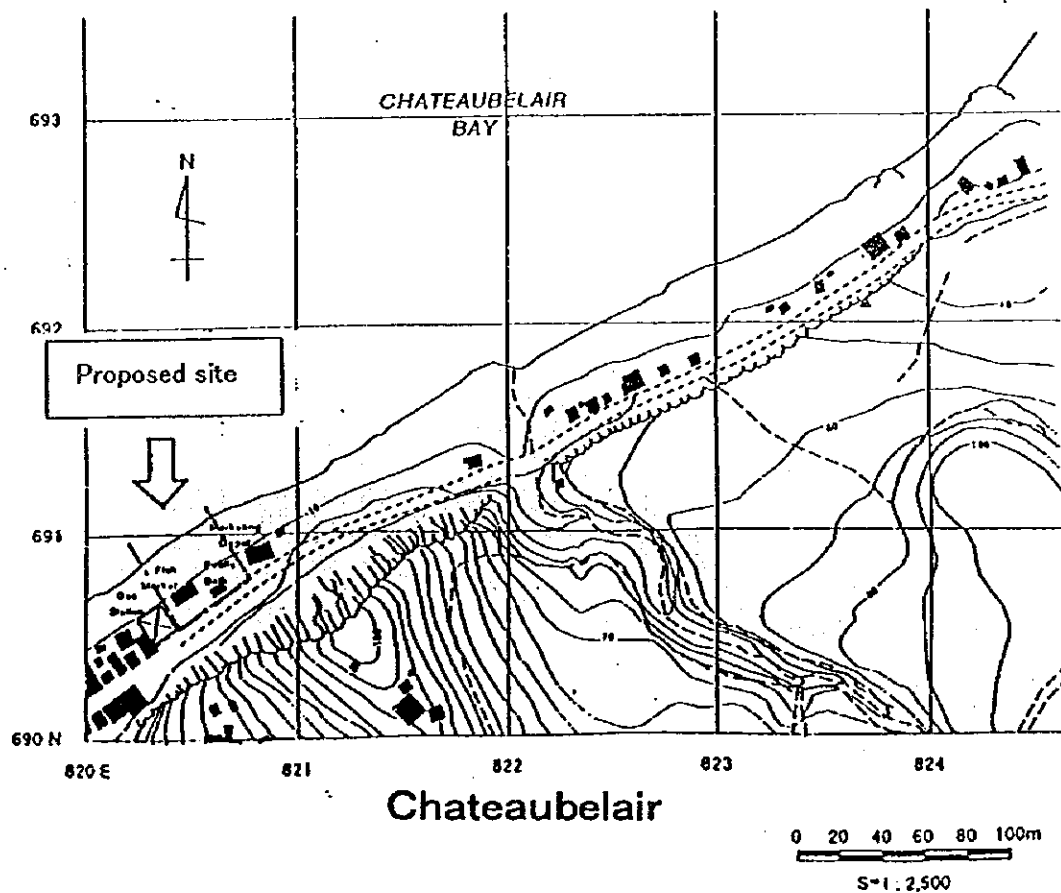
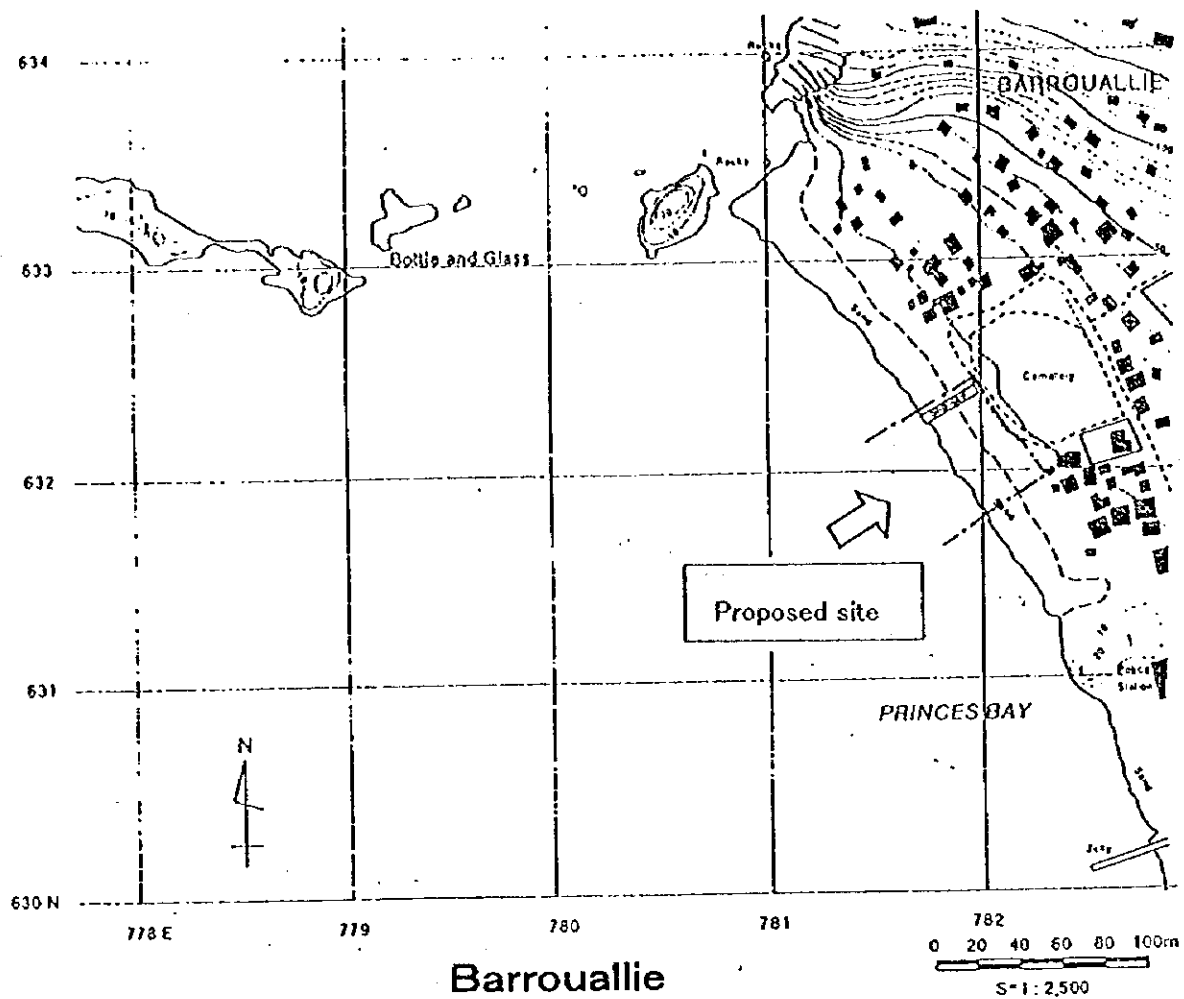
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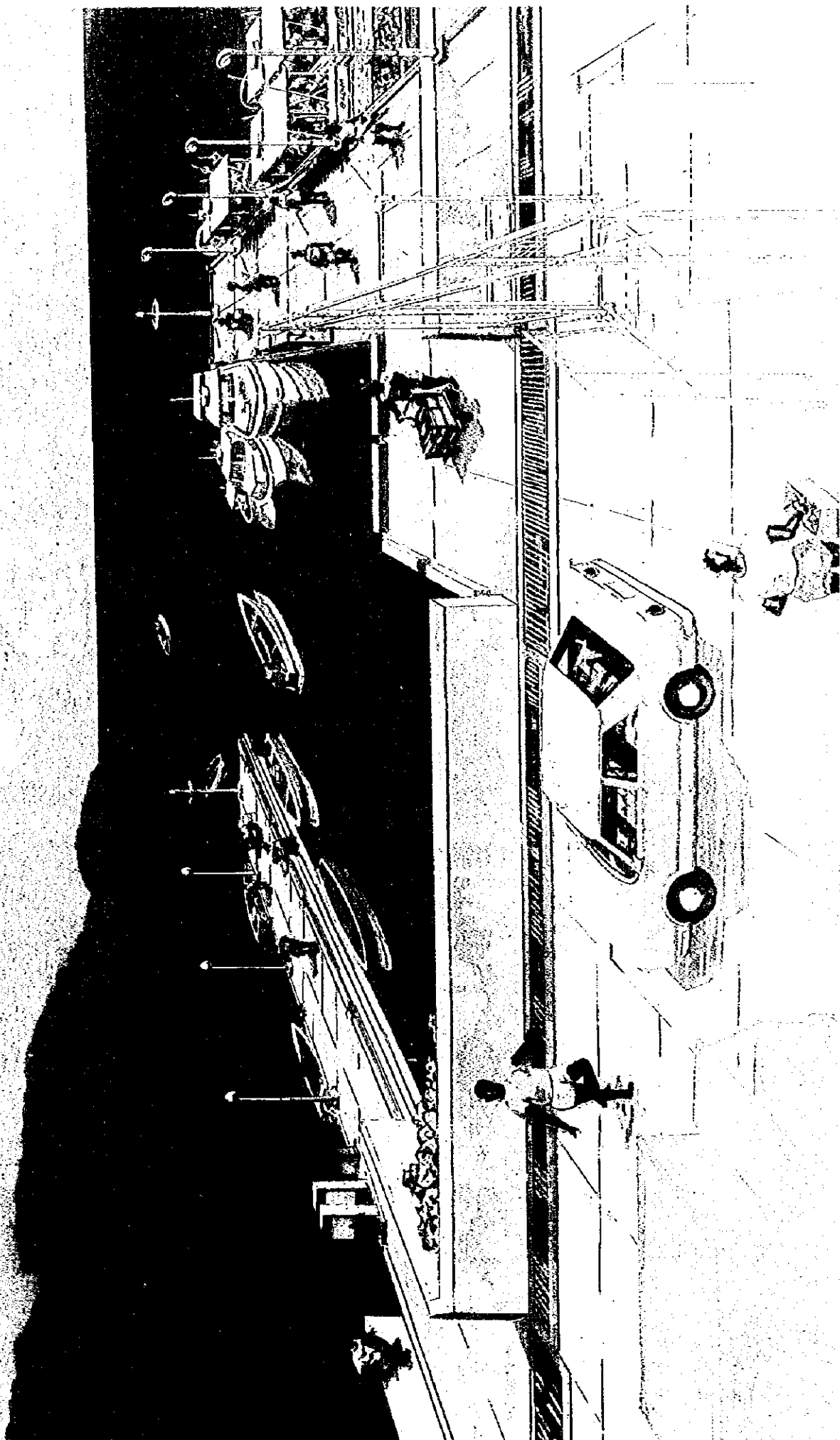
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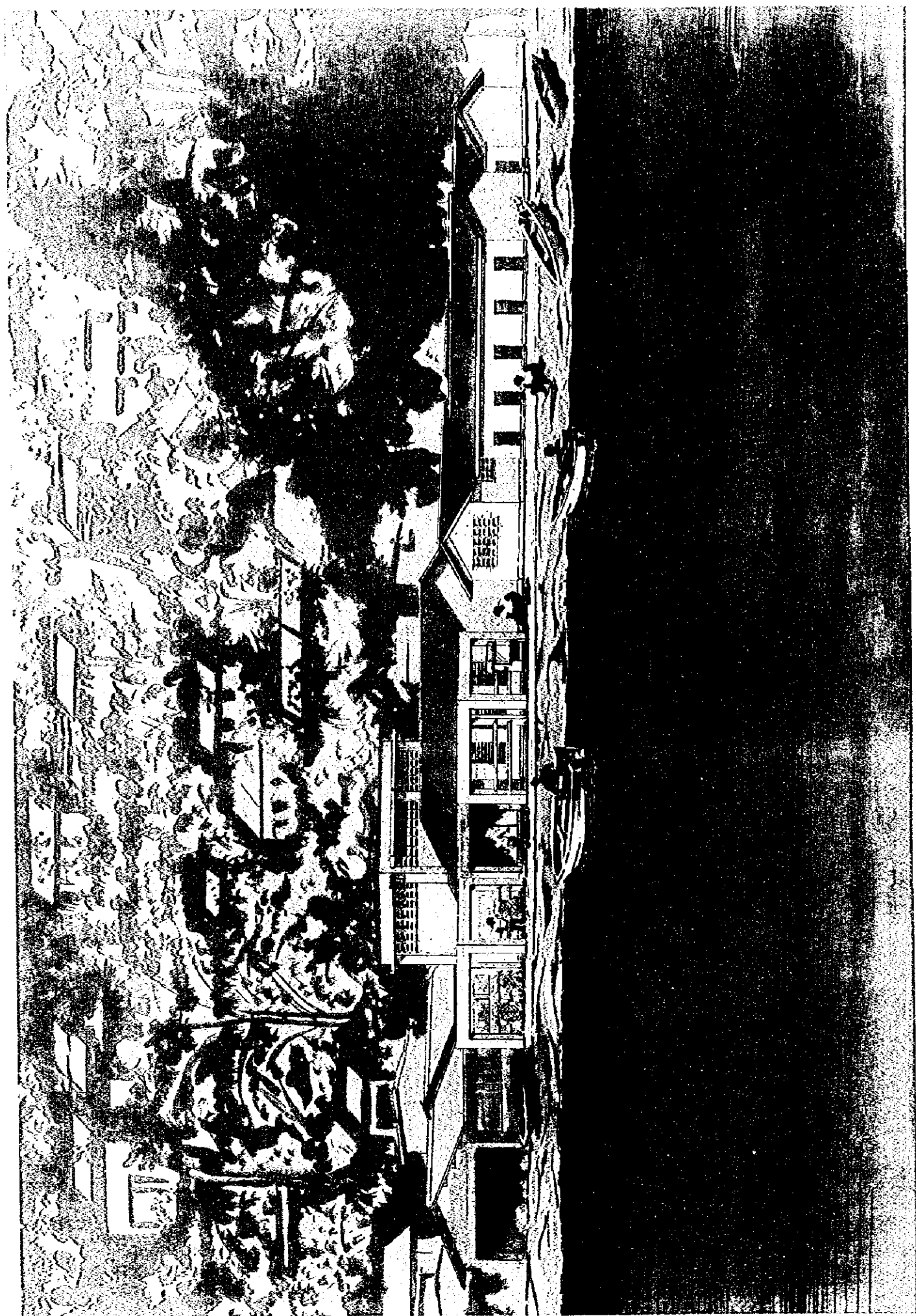
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Proposed Site (2) at Barrouallie and Chateaublair







ABBREVIATIONS

CARICOM : Caribbean Community

CDB : Caribbean Development Bank

CFRAMP : CARICOM Fisheries Resources Assessment and Management Program

CIDA : Canadian International Development Agency

DANIDA : Danish International Development Agency

FAO : Food and Agriculture Organization

GDP : Gross National Product

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Chapter 1

Background of the Project

Chapter 1 BACKGROUND OF THE PROJECT

1.1 Background

The economy of St. Vincent and the Grenadines depends heavily upon agriculture and tourism. The major agricultural products are banana, arrowroot, and copra in the island of St. Vincent. Agriculture including fisheries and forestry contributes 16% to 18% to GDP (1990 - 1993), and employs one third of the national labor force. The Grenadines, remote islands with tropical white sand beaches, have a lot of visitors throughout the year as a resort area in the Caribbean Sea, some 100 thousand tourists spending more than 50 million US\$ a year, and a progressive development including construction of large resort hotels is now under way.

While the tourism revenue is steadily increasing, the export of the biggest agricultural product, banana, is now stagnant, and under these conditions the Government of St. Vincent is reconstructing the state economy through diversification of the primary industries in the 5 year national development program with a motto of "well-balanced growth and sustainable development."

St. Vincent's yearly fisheries production is about 1,300 tons (1994), contributing 1.7% to 1.9% to GDP (1990-1994), accounting for 10% of agricultural sector's production. For St. Vincent less abundant natural resources, the fishing industry is given an important status as an industry having high potential.

Fishermen of the country is estimated at some 5,000, and, except those engaging in tuna long-line fishing, almost of them are operating artisanal fisheries using small fishing boats, and the type of fishing industry is divided into 2 categories, the fisheries of the Grenadines, and the fishing activity at the Island of St. Vincent.

The Grenadines consist of scattering small islands with only fisheries and tourism, and at some islands more than 80% of manhood are engaging in fishing industry, which is the largest industry in term of employment. Inshore gill netting, angling, trap, and diving are their activities, harvesting sea bream, grouper, lobster, conch,

etc. Catches, except for consumption at local resort hotels, are exported to Martinique by collecting boats.

At the Island of St. Vincent, purse seining for small pelagic fish such as jacks and robin, hand-lining for demersal fish, and trolling for tuna and skipjack are being operated by small boats, and recently long-line fishing for tuna by middle-sized fishing boats was introduced. About more than 50% of catch caught in the coastal waters around the island are landed and marketed at the New Kingstown Fish Market, also delivered to the interior of the island. Tuna catch by long-liners is exported to Miami by air, contributing toward the obtaining of foreign money.

The 1994 fisheries export is about 250 tons worth one million US\$, but, on the other hand, St. Vincent is traditionally importing fish products, mainly salted cod, from Canada and Europe, same quantity and value as export, due to large fluctuation of monthly catch, preservation, and preference.

In this way, the fishing activities of St. Vincent and the Grenadines are obviously composed of the traditional inshore artisanal fisheries with fishing ground being limited to coastal waters and one day fishing trip. Recently, resources of lobster and conch in remote islands and demersal fish in around the Island are decreasing as a result of increasing fishing effort, and the management of fishery resources and research and development of offshore demersal species became thus a major theme of future fisheries development. Furthermore, at the Island of St. Vincent, preservation of catch without ice except tuna long-liners, and lack of cold storage facility in all fishing villages other than Kingstown produce a problem of post-harvest loss, seriously in such mass catch as jacks and robin.

To cope with these problems, the St. Vincent Government expressed the intention to develop fisheries with support by developed countries, aiming at

- (a) increasing production and sustainable development,
- (b) increasing export and domestic supply,
- (c) construction of fisheries center for improving fisheries infrastructure necessary for increasing production at local fishing villages, and

(d) formulation of sustainable fisheries resources management plan.

The main objective of the Project is to improve a distribution system in the Island of St. Vincent by improving facilities and their functions in both local fishing villages, fish production areas, and the New Kingstown Fish Market, the only inlet of fish.

The Fish Market, one of the proposed Project sites, and its annexed bus terminal are the center of fisheries activities, a hub of traffic in the metropolitan area, and the only marketing district in the country, showing activity in din and bustle. However, at the jetty, the receiving spot of fish, confusion and complication of landing work are taking place due to shortage of mooring berths resulting from increasing fishing boats, which situation is producing a serious problem of quality deterioration of catch because of prolonged landing hours.

On the other hand, both Barrouallie and Chateaubelair, other proposed Project sites, are leading fishing villages in the Island, and since the biggest consuming center of fish in St. Vincent is Kingstown, fishermen of both fishing villages are striving to maximize their shipment of catch to Kingstown, in particular of quality fish, to turn catch into money. However, unavailability of ice in both villages is restricting their shipment and also offers a serious problem of post-harvest loss of jacks and robin caught in great quantities in purse seining.

In order to resolve these problems as well as to improve the distribution system of fish product and activate local fishing communities, the Government of St. Vincent formulated "The Project for Construction of Fisheries Centers" (construction of jetty, ice-making/preservation facilities and provision of equipment and materials for distribution), and requested the Government of Japan to extend a Grant Aid for its implementation.

On the request, the Government of Japan confirmed that the Project is of high necessity and its implementation under a Grant Aid is appropriate, and decided to carry out a basic design study.

1-2 Outline of the Project and its main components

1-2-1 Outline of the Project

The contents of the Project are mainly the improvement and extension of the existing New Kingstown Fish Market jetty in confusion and the construction of the fisheries centers containing ice-making/preservation facilities in Barrouallie and Chateaubelair. By this, it is expected that the distribution system of the Island of St. Vincent is improved, the implementation of fisheries development policies is promoted, the post-harvest loss is decreased, and the supply of fresh fish products is stabilized.

1-2-2 Main components of the Project

The followings are requested in the Project.

Table 1-1 Requested Facilities and Equipment

Contents of requested facilities and equipment	Scale or capacity	Quantity
A. Kingstown Fish Market		
1. Facility		
1-1 Landing facility (jetty)	30 m extension of the existing jetty	
B. Fisheries center		
B-1 Barrouallie		
1. Facility		complete
a. Ice-making machine	2 ton/day	one set
b. Ice bin		complete
c. Office	75 m ²	complete
d. Toilet/shower room	75 m ²	complete
e. Fisherman's locker	4 m ² each	30 lots
f. Ramp way		complete
g. Oil terminal		complete
2. Equipment and materials		
a. Fish box	For fish distribution	

b. Insulated box		
c. Scale		
d. Cart		
e. Shovel		
f. Fish processing table		
g. Fish selling counter		
h. Winch		
B-2 Chateaubelair		
1. Facility		complete
a. Ice-making machine	2 ton/day	
b. Ice bin		
c. Office	25 m ²	complete
d. Toilet/shower room	75 m ²	complete
e. Fisherman's locker	4 m ² each	20 lots
f. Ramp way		complete
g. Oil terminal		complete
2. Equipment and materials		
a. Fish box	For fish distribution	
b. Insulated box		
c. Scale		
d. Cart		
e. Shovel		
f. Fish processing table		
g. Fish selling counter		

Chapter 2

Contents of the Project

Chapter 2 CONTENTS OF THE PROJECT

2-1 Objectives of the Project

The main objective of the Project is to improve the distribution system in the island of St. Vincent through strengthening organic linkage between communities by improving facilities and by upgrading their functions in fish producing areas as well as its major receiving center

For this purpose, at the New Kingstown Fish Market a new jetty is to be constructed with improving partly its existing jetty, and in two fishing villages, Barrouallie and Chateaubelair, a landing/distribution facility is to be constructed respectively along with the supply of equipment and materials necessary for supporting fishery facilities in the villages.

The New Kingstown Fish Market, locating on the center of the capital, forming part of the central market including a vegetable market and a meat market, attaching a bus terminal, is always presenting brisk appearance with crowded people. However, the jetty became so crowded by increasing number of fishing boats that they were forced to wait long for landing, the direct trade between fishermen and middlemen were more and more delayed.

And, in St. Vincent, since the fish business and fisheries-related facilities are concentrated at only Kingstown, the production sites of fish of the Project, Barrouallie and Chateaubelair, have no ice-making/storage facilities, which result in a great deal of post-harvest loss due to quality deterioration in poor handling of fish.

The Project is to be implemented to settle these problems and thus improve the distribution system of fish and to activate rural fishing villages in the island.

The short-term objectives of the Project are as follows;

- (1) To increase artisanal fishermen's revenue through providing better working circumstance, improving fish distribution situation and decreasing post-harvest loss by quality preservation.

- (2) To maintain stable supply of fresh fish products to both the town people and the inland people of the island.

Also the medium-term objectives are,

- 1) to protect fishery resources through decreasing post-harvest loss, effective utilization of catch and avoiding excessive fishing.
- 2) to earn hard currencies through an increase of export by quality reservation and upgrading.
- 3) to promote appropriate utilization of fish caught in quantities by processing development and distribution development.
- 4) to enhance cooperation of fisherfolk and to promote organization of the their cooperatives.

2-2 Basic concept of the Project

(1) Appropriateness and necessity of the Project

Concerning the requested "Project for Construction of Fisheries Centers in St. Vincent and the Grenadines" , discussions with St. Vincent Government officials concerned were conducted on the background, content, scale, implementation arrangements, etc. of the request, and the field survey was carried out. The results of the examination of the appropriateness and necessity of the request as a grant aid project are as follows.

1) Necessity of the fisheries development plan and its status

The mainstay of the economy of the St. Vincent and the Grenadines is agriculture and tourism. Because of the recent stagnation of the export of bananas, the single most valuable export crop, however, the Government intends to restructure the state economy through diversification of the primary industry, with a slogan

"balanced growth and sustainable development" in the five year national development plan 1991-1995. The emphasis was in particular placed on the fishery sector with abundant resources, which is one of the most promising sectors and a major industry in the remote islands as well, but its development is on the way.

Agriculture including the fishing industry which contributes 1.7-1.9% to GDP accounts for constantly more than 10% in the state economy, i.e. 16-18% in 1990-1994, and remains the most important sector of the state economy.

Under these circumstances, it is recognized that the development of the fishery sector with potential resources is useful for not only the development of one of the most important industries but also has possibilities to promote national supply of protein, to obtain foreign currencies and to create employment opportunities, and so is given an important status in the national industry development.

2) The fisheries development plan and the significance of the implementation of the Project

The fisheries development of the St. Vincent was initiated with the "Formulation survey of fisheries development program" of FAO in 1980s. In this survey FAO identified

- ① the preparation of a fish terminal for Kingstown,
- ② the preparation of local fisheries centers and
- ③ the establishment of fisheries education as the major projects to be implemented for the fisheries development of the country, and in 1987/88 a construction project of fish terminal for Kingstown was conducted under a grant aid of Japan

Furthermore in the end of 1980s the St. Vincent Government adopted a fisheries development plan supported by CIDA. Its major objective was to support activation and organization of four fishery communities in the Grenadines, and in this context a fisheries center construction project was carried out under the Japan's grant aid program.

Now that the preparation of fisheries center in the Grenadines was completed, fisherfolk as well as local people in neglected rural areas of St. Vincent Island are expecting eagerly to be improved the infrastructure of their communities. Also

the alleviation of congestion at the fishery jetty at Kingstown, the single inlet of fish products, is a common demand of both producers and market users.

It is judged that benefits generated by the Project are expected to cover not only the project sites but also the neighboring areas and thus the implementation of the Project is of deep significance.

3) Effects of the Project

The Project aims at the improvement of distribution system in St. Vincent through the improvement of facilities and their function in two fishing villages and the New Kingstown Fish Market and thus expanding an effective linkage between producers and consumers in the island.

The Fish Market and its annexed bus terminal in Kingstown, one of the proposed Project sites, is the center of fishery activities and traffic in the metropolitan area as well as the sole market in the state, and so now is presenting animated appearance in bustle. In this circumstances, the jetty that is the only inlet of fish products has become insufficient for berthing space due to increasing number of fishing boats. This resulted in complication and congestion of landing work and thus prolonged landing hours and consequent quality deterioration of catches.

The appropriate extension of the jetty and landing/handling spaces and the improvement of the flow line of activity by the Project will bring benefit to both producers and market users through improved working efficiency and upgrading fish quality.

Barrouallie and Chateaubelair, other proposed Project sites, are major fishing bases along the west coast of the island. Kingstown is the most important market for high-value species harvested by fishermen of Barrouallie and Chateaubelair as well as the largest consuming center in St. Vincent, and to where fishermen of both fishing bases want to maximize marketing their catch. However, they are prevented their shipment due to unavailability of ice for preservation. Also a problem of post-harvest loss of such species as jacks and robin caught in large quantities in purse seining must be considered.

The settlement of these difficulties in fishing operation, along with strengthening cooperation of fishermen and establishing their cooperatives, through the

construction of a fisheries center at each Project site will greatly contribute to the local economy as well as achieve the objectives of the fisheries development.

4) Relation with the development of small-scale fishery

The St. Vincent Government regards the Project as a strategy for improvement of the fish distribution system in the island. No preservation facilities in the whole island except Kingstown result in the poor distribution of fish without even ice into the interior of the island and a great deal of post-harvest loss of small pelagic species. These are the major constraints of fish distribution, and an effective support for the settlement of them is essential to the fisheries development in the island.

In scrutinizing the request, taking all the points above into consideration, the study team judged that the Project is necessary as well as is feasible.

(2) Basic policy of the Project

1) Basic concept of the Project

The concept of the Project is based on decreasing post-harvest loss and increasing shipment at production bases along with improving market conditions at consuming area.

The function of the jetty of the New Kingstown Fish Market, then, must be recovered through the improvement of the flow line of activity by the extension of spaces for fishing boats to land their catch or to go in and out the Fish Market.

Also, in rural fishing bases, the solution of difficulties in fishing operation, full utilization of fish products and supply of fresh protein to the people must be achieved through the preparation of fishery-related infrastructure.

2) Basic policy in implementation of the Project

It is judged that the Project is appropriate as a Japan's grant aid project due to its necessity, priority, implementing capability of the recipient, excepting public benefit and so forth. The basic design, then, will be properly made on the basic policy of the Project in conformity of the conditions of the Japan's grant aid program.

The content of the Project will be determined on the results of discussions in the field survey, considering full utilization of existing facilities, improvement of their functions, cooperation with the private sector, increasing efficiency of management and securing benefit for local people.

2-3 Basic Design

2-3-1 Design concept

The basic design concept of the proposed facilities consists of five components; that is, Management Plan, Layout Plan, Facility Plan, Implementation Plan, and Local Conditions.

(1) Management Plan

The jetty to be newly constructed under the Project will be managed by the Marketing Corporation responsible for the existing jetty.

The management of the fisheries center at Barrouallie and Chateaubelair is to be conducted by managing staff and extension officers dispatched from the Fisheries Division for some time just after the completion while aiming at self-management by a local fishermen's cooperative in the future. The basic policy of the center management is to manage and maintain the center facility including toilet/shower room with the proceeds of ice/fuel oil and the rental fee for fisherman's locker and retail shop, contributing to fisheries development and improvement of distribution system.

(2) Layout Plan

1) Jetty of the New Kingstown Fish Market

In order to meet the extension requirements of berth for small boats and to alleviate the present congesting 4 mooring rows of tuna long-liners and research vessels to 2 rows so that the landing and sailing preparation work may be conducted easier, a new jetty shall be constructed and the existing jetty shall be extended. The new jetty shall be used for middle-sized boats only and the extended existing jetty for small boats only to establish order in outgoing and

incoming boats. The distance between the new and existing jetties shall be decided on the water space and sizes of boats. Almost of all construction works will be carried out in a favorable situation for the continuation of landing on the existing jetty due to possible full independent construction works.

2) Fisheries center at Barrouallie and Chateaubelair

Each of the Project sites is a long strip area along a sandy beach in front of the fishing village. Making the best use of this shape of site, every building of the center shall be arranged in accordance with a flow line of activity convenient for all of works including landing at seaside, sailing out, and shipment of catch as well as to minimize influence of waves caused by hurricane. Also the distance between buildings is to be adequate to allow easy access to the seashore by the village people.

(3) Facility Plan

1) Jetty of the New Kingstown Fish Market

The new jetty is for the extension requirements of berth for middle-sized boat and increasing function, and the shape of it will be similar to the existing jetty. The access of the new jetty shall be of reinforced concrete, and the jetty proper be of a reinforced concrete floor supported by steel piles. Marking lights, lighting posts, mooring bitts and fenders are to be installed. Structural calculation is to be made on the basis of wave conditions with 30-year probability from the standpoint of hurricane damage.

The step to be added to the existing jetty is for the extension requirements of berth for small boat, and shall have two stairs of reinforced concrete floor supported by steel piles. Structural calculation shall be made on the same basis as the case of the existing jetty.

2) Fisheries center at Barrouallie and Chateaubelair

As fisheries-related infrastructure in line with the objective of modernization of fisheries and improvement of distribution in each village, a center with such function is to be constructed in each fishing village. The ice plant to be installed first in each village shall be of particularly stout and maintenance-easy, having

an appropriate capacity. It is the basic policy to design buildings well-matching with surroundings as well as to maximize procurement of locally available construction materials.

(4) Implementation Plan

Preparation of the implementation plan of the Project requires total cooperation of the St. Vincent side. In the construction of the new jetty a space for temporary works is essential, and also to secure a flow line of construction activity in the site it is necessary to obtain cooperation from the Fish Market staff.

In order to construct the fisheries center at Barrouallie and Chateaubelair, cooperation from authorities concerned necessary in leveling of ground, removal of existing buildings, and relocation of the existing fish drying site.

Procurement of almost of all equipment and materials and heavy machinery necessary for the construction of centers will made in Kingstown, but their transportation to the Project sites will be carried out by sea due to poor road conditions.

The implementation plan is to be prepared on the basis of a proper construction period in due consideration of hurricane and a careful supervision plan.

(5) Local Conditions

1) Natural conditions

a) All the three Project sites are located at the west coast of St. Vincent Island. Generally the ESEly winds prevail, but, when a hurricane is attacking the western coast of the island, the sites are exposed to the westerly winds and waves which may bring damage. The Facility Plan, then, must be prepared with special attention to be paid to wind force, wave, and subsequent erosion.

b) All the sites, facing the sea, are subject to a salt sea breeze. Salt-resistant equipment and materials, then, shall be used.

c) The ground level must have a height to allow easy drainage when the site is temporary submerged by hurricane. Special care shall be taken to prevent scouring while draining.

- d) Special care shall be taken in lighting and ventilation from the weather standpoint of high temperature and humidity.
- e) Materials, color, and shape of building shall be selected so that the appearance of building may match with surroundings.

2) Environmental care

In the construction of new jetty of the New Kingstown Fish Market, appropriate care shall be taken to prevent mud pollution by marine engineering works, noise by construction machinery including pile driver, and natural disaster by hurricane.

As for the construction of the fisheries center at Barrouallie and Chateaubelair, the following environmental care shall be exercised.

- In the Project site, a wall is to be constructed between the sandy beach and the back of landward side. Enough space shall be placed between the buildings not to prevent the movement of people and goods toward the sea.
- Living trees in the site shall be left intact as possible.
- Sewage shall be treated in a septic tank before leading to a seepage basin. Drainage from the handling space shall be treated in a settling tank after screening trash and waste.

3) Construction situation

a) Regulations and standards concerning construction and designing of structures in St. Vincent are of Britain and the U.S. in origin. Also the Caribbean Code established by Caribbean states is applied. With reference to them, the building standards/civil engineering standards of Japan are to be applied in construction works of the Project.

b) Construction firms in St. Vincent have only a few skilled engineers. They are inviting engineers from abroad, as occasion calls, even in the present construction situation in the country. It is essential to grasp the local construction situation before beginning construction works.

- c) At present St. Vincent has no marine engineering firm, and thus, it must be introduced from neighboring countries. Due consideration is necessary to employ a proper firm without delay at the commencement of the work.

- d) Sand, steel piping, soil, etc. are available in St. Vincent, but since construction materials such as steel, sheet pile, and steel frame rely upon import from foreign countries, their stock is not always sufficient. Although locally available materials shall be used as much as possible, materials which are difficult to obtain within the country will be brought from Japan or the third countries, comparing costs of the two.

2-3-2 Investigation of design conditions

A. Jetty site of the New Kingstown Fish Market

(1) Present site conditions

	Present conditions
Status of site	The key landing site of the Island, about 50% of total catch of the state are being landed, supplying fish to the metropolitan people.
Activity	The jetty, a attaching facility of Fish Market, is the landing base for small fishing boats and the base for tuna long-liners to land bycatch, make sailing preparation, and mooring.
Fluctuation of landing	Total landing of 1996 was 275 tons. High fishing season is January through July, while November and December are poor season.
Change in the week	Small boats have a holiday every Sunday. Market is also closed on Sunday. No difference in fishing activities between weekdays. Boats return to their home village after landing. Tuna boats sail out usually on Thursday, return on Sunday, land their catch on Monday, and take a rest and make sailing preparation on Tuesday and Wednesday.
Daily change	The ESEly winds prevail in January through July with rough sea conditions, which situation restricts fishing operation only during daytime, resulting in concentration of landing from 4 to 5 p.m. August through December is a hurricane season, but, when no hurricane attacks it is so calm that even small boats can operate bottom fishing at night, and their landing works take place from morning to evening.

Mooring hour	Bottom fishing boat and trolling boat acting independently take average 20 minutes for landing. Purse seining group consisting of 3 boats require about 1 hour mooring at the jetty for unloading, mending fishing net and reloading it
Constraints	For small boats 3 berths are provided. Mooring of more than 6 boats causes congestion in landing, some boats use the berth for tuna boat. The day which more than 20 boats are entering sees heavy congestion, resulting in longer waiting hour. Alongside the tuna boat berth 4 boats must moor in a row. The 3 rd and 4 th boats are in trouble for landing of bycatch and sailing preparation.

(2) Conditions on which the scale of existing jetty was established

The existing jetty connecting with the Market site has the berth for small boat on the left side and for middle-sized boat on the right side, facing to the sea. It is the only fish inlet of the Market, which cannot fulfill the function without it.

1) Condition on which the small boat berth was designed.

The berth for small boat is 31 m long. It was designed to give 3 berths for landing, 7 berths for mooring, totaling 10 berths for small boat mooring fore and aft (stern mooring). Stern mooring was the way for small boat to moor at the jetty when the basic calculation for construction was made.

Actual number of fishing boats to land in 1989 when the jetty was designed is estimated at 11 boats/day on the basis of average catch at present, and the jetty was designed to permit 34 incoming boats a day, 10 boats/hour at peak.

2) Condition on which the middle-sized boat berth was designed

On the supposition that a boat carrying export cargo for Martinique will enter harbor, one berth for a 20 m middle-sized boat was designed.

(3) Fishing activities and utilization of existing jetty at present

1) Small fishing boats

In high season in January through July small boats are operating in daytime only, avoiding dangerous night fishing, due to rough waves caused by the prevailing ESEly winds. They sail out in morning and return in evening all together, and thus landing on the existing jetty concentrates in evening.

September through November is a hurricane season, but when no hurricane attacks it is so calm on the sea that even small boats can operate in night. Night fishing boats sail out for high-priced demersal species and then landing is carried out from morning to evening.

The fishing fleet consists of hand-line fishing boats, trolling boats, and purse seiners. Hook fishing boats and trolling boats, fishing independently, finish their landing and cleaning works in 20 minutes. Its landing is usually about 50 kg but in high season may be more than 200 kg. Purse seining are operated by a group of 3 to 4 boats, usually some 200kg are being caught, more than 500 kg in high season. Exchanging, reloading, or mending its fishing nest, the group requires mooring for nearly one hour.

2) Middle-sized fishing boat

Having been granted by Japan in 1990 after the completion of the existing jetty, these 5 middle-sized fishing boats have not existed when the jetty was designed. At present no cargo vessel carrying export goods for Martinique calls at harbor, and the berth for middle-sized boat is exclusively occupied by these 5 boats.

Out of 5 boats 4 boats are tuna long-liners. They sail out on Thursday and return on Saturday, spending days between Saturday and the next Thursday in mooring, relaxation, and sailing preparation, due to landing and exporting by air limited to Monday, once a week. Although tuna for export is landed at a working site 5 km away due to no landing space on the existing jetty, such byproducts other than yellowfin tunas as dolphins, sharks, marlines, etc. are handled on the jetty for the Fish Market.

Another middle-sized fishing boat used as research vessel by the Fisheries Division sails out irregularly, mooring at the middle-sized boat berth while staying in harbor. The Fisheries Division has one more small research boat

surveying demersal resources once a week, mooring at the middle-sized boat berth while staying in harbor as well.

(4) Quantitative data

As one of basic materials for establishing the scale of a newly constructing jetty, the data concerning the number and landing of small fishing boats by time zone was collected through the 14 hours actual condition survey at the existing jetty site.

1) Results of actual condition survey.

The 14 hours survey was conducted on November 5 (Wednesday) and 6 (Thursday). Although the number of boats was almost same on both days, landing of Thursday was nearer average than Wednesday, and hence it was applied as basic value. Table2-1 shows the results.

Table 2-1 Landing, arrival, and mooring of small boats by time zone

Berth for small boat on the jetty of Kingstown

Nov. 6 (Wed.), 1997

Arrival time	No. of boats arriving	Landing (lbs)	Type of boat	No. of boats not landing	No. of boats mooring at middle time
06:00-07:00 a.m.	-			9	9
07:00-08:00	2 (2)	1,540	carrier, trolling		11
08:00-09:00	-			2	3
09:00-10:00	-				3
10:00-11:00	-			1	3
11:00-12:00	3 (1)	300	one purse seining group	3	9
00:00-01:00 p.m.	3 (1)	250	one purse seining group		9
01:00-02:00	-				9
02:00-03:00	-				9
03:00-04:00	2 (2)	220	bottom fishing	3	6
04:00-05:00	-			1	3
05:00-06:00	2 (2)	126	bottom fishing	1	3
06:00-07:00	-			1	1
07:00-08:00	-				
Total	12 (8)	2,436		21	

Number in brackets shows number of groups.

Table 2-2 Comparison between actual number and recorded number

November 6 (Wed.) 1997

	Actual number of landing boats used the jetty	Number of boats recorded on Market's book.	Recorded /actual number
Number of groups	8	5	1.6
Number of boats	12	5	2.4
Landing (<i>lbs</i>)	2,436	1,956	1.2

Table 2-3 Recorded number of boats and landing for the week including the days of survey

(weight in *lbs*)

	Nov. 2 (Sun)	Nov. 3 (Mon.)	Nov. 4 (Tues.)	Nov. 5 (Wed)	Nov. 6 (Thurs.)	Nov. 7 (Fri.)	Nov. 8 (Sat)	Average
No. of boats.	5	5	11	5	5	2	10	6.1
Landing	718	1,973	3,490	418	1,956	440	1,355	1,479

Note:

- All of the daily landing are not always handled at the Market. The Market deals with only marketable amount, and out of catch amount of such species as jacks and robin caught in large quantities the amount being apt to remain unsold is rejected by the Market or bought by venders taking a risk for himself. For this reason difference occurs between recorded and actual values.
- Hand-line and trolling fishing boat is operating singly, while purse seining is being operated with a group consisting of 3 to 4 boats. In case of seining group, then, even if landing is recorded as one time, actual number of boats is 3 or 4. Furthermore, many of hook fishing boats having as poor catch as less than 5 kg, do not land their catch and use their catch for home consumption without recording on the Market's book.
- Some boats for carrying personnel or various works can moor alongside the jetty regardless of landing. This also produces difference between recorded number of boats landed their catch and actual number of boats moored to the

jetty.

- Shortage of berth is estimated on a comparison between an estimated actual number of landing boats induced from the yearly Market's book concerning recorded number of boats and the utilization rate of berth on the survey on November 6 above mentioned. On the said survey showed the actual number 2.4 times of recorded number, but on estimation a factor of 2.0 is applied for safety's sake.
- These are all for small boat. As for middle-sized boat, five boats are using the jetty as mother port, and the number of 5 is unchanged.

The utilization rate of the day when the recorded number of incoming boats on the Market's book is 5 (actual number of boats landing their catch is 12) is shown on Table 2-1. Even in case of this number of incoming boats, a time zone with the utilization rate of 33%, that is, the boats being moored in 3 rows, a limit to allow landing, was observed.

Table 2-6 shows the estimation of actual landing boats, the product of the incoming boat record of 1995 (Table 2-5) multiplied by the above mentioned factor of 2.0.

Even on the day which the actual number of boats landing catch is 12, landing using the berth for small boat is approaching the limit. Some boats removing to the berth for middle-sized boat after getting tired of waiting for landing were observed, and, in high season, fishing operation is restricted on daytime due to rough sea conditions, resulting in concentration of boats returning to harbor at evening. Given these conditions, it is estimated that the day which the number of entering boats is more than 18 will have a delaying landing work due to congesting berth condition. According to the hearing from fishermen and vendors, a waiting hour more than half an hour is not uncommon.

According to the estimated degree of congestion by month, one third of fishing days shows congestion due to actual number of landing boat more than 18 as below Table.

Table2-4 Estimated day of congesting utilization of jetty
(the day of actual number of landing boats more than 18)
(On estimated number of entering boats in 1995)

Month	1	2	3	4	5	6	7	8	9	10	11	12	total
Day of more than 18 boats	11	8	17	6	6	6	2	5	12	8	8	11	100
Fishing day	30	28	24	19	22	27	23	23	24	26	26	27	299
% of day of more than 18 boats	37	29	71	32	27	22	9	22	50	31	31	31	33

2) Size of fishing boat

The size of fishing boat utilizing the jetty is as follows;

a) Small fishing boat

The dominating size of hand-line fishing boat and trolling boat is 25 ft (7.5 m) long, 2.0 m wide, and 0.9 m deep. Of purse seining group usually consisting of 3 boat, net boat is of 30 ft type, powered boat of 25 ft type, and net casting boat of 20 ft type.

In designing the berth for small boat, a 25 ft type boat, accounting for about 70% of landing boats, shall be adopted as model boat.

b. Middle-sized boat

The size of middle-sized boat is 42 ft (13.2 m) long, 4.0 m wide, and 1.4 m deep. Required depth of water shall be more than 2.3 m; the maximum draft of 1.0 m plus maximum range of tide plus allowance of 0.5 m.

Number of Entering Boats

Table2-5 Recorded entering boats

1995, Market's landing record

date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	17	0	0	0	7	0	2	9	0	11	8
2	1	13	4	0	0	9	0	12	12	7	7	6
3	7	13	9	18	0	2	0	9	0	6	14	4
4	9	12	9	16	0	1	0	2	15	2	10	9
5	17	1	0	16	9	1	0	4	3	6	1	22
6	13	7	18	9	7	11	0	0	1	5	6	8
7	5	8	9	3	0	7	6	0	0	5	7	8
8	4	16	17	0	14	7	6	4	8	0	1	15
9	10	9	11	0	11	7	0	11	3	9	7	10
10	10	5	17	0	8	4	0	7	0	8	12	1
11	12	2	12	0	8	0	1	12	11	4	10	7
12	7	1	2	0	8	4	1	7	7	11	0	12
13	5	14	15	0	6	6	7	0	6	10	14	13
14	12	11	5	0	3	12	8	2	0	6	6	18
15	3	2	0	6	6	7	4	6	2	0	13	6
16	3	5	9	0	6	9	0	1	3	16	5	6
17	8	3	13	3	3	8	9	2	0	12	4	0
18	6	5	16	2	8	1	10	4	9	8	0	10
19	4	5	0	2	7	8	2	6	14	4	0	20
20	4	11	17	8	10	10	2	0	13	10	4	6
21	3	7	17	6	6	8	6	8	7	3	7	8
22	2	5	5	8	6	6	4	4	9	0	4	4
23	0	2	8	0	14	6	1	4	2	8	4	3
24	18	6	14	7	14	7	3	4	0	7	11	0
25	4	7	4	5	5	0	4	4	9	1	5	2
26	15	4	0	9	0	8	5	0	13	9	0	0
27	2	11	11	6	1	9	7	0	7	0	5	8
28	11	7	9	15	1	4	4	0	5	3	3	5
29	4		4	5	0	0	4	0	14	0	4	9
30	7		0	0	0	0	0	4	10	5	2	9
31	19		0		0		5	9		10		0

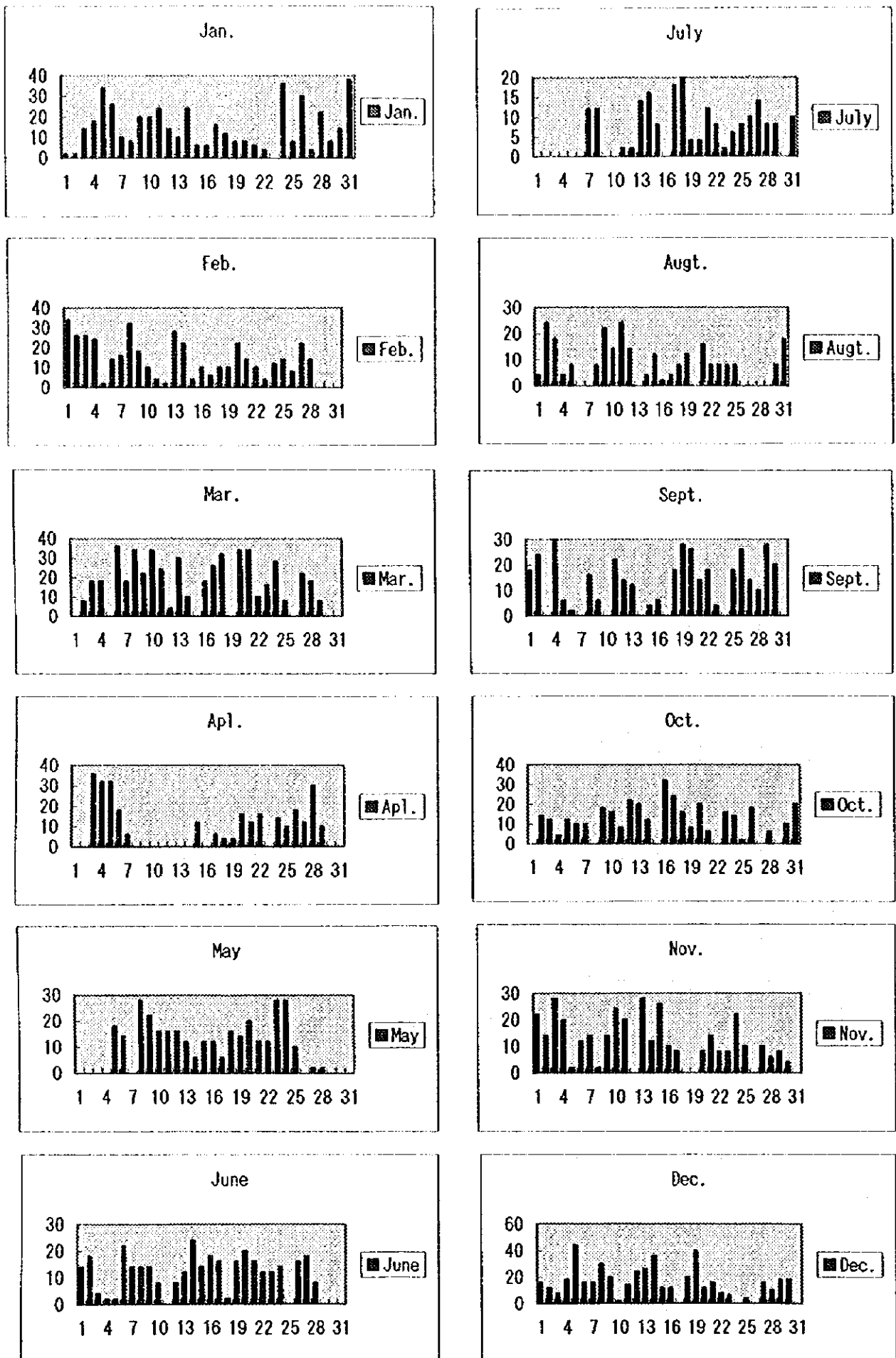
Table 2-6 Estimation of actual number of landing boats

(1995 Market's record x 2.0)

date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2	34	0	0	0	14	0	4	18	0	22	16
2	2	26	8	0	0	18	0	24	24	14	14	12
3	14	26	18	36	0	4	0	18	0	12	28	8
4	18	24	18	32	0	2	0	4	30	4	20	18
5	34	2	0	32	18	2	0	8	6	12	2	44
6	26	14	36	18	14	22	0	0	2	10	12	16
7	10	16	18	6	0	14	12	0	0	10	14	16
8	8	32	34	0	28	14	12	8	16	0	2	30
9	20	18	22	0	22	14	0	22	6	18	14	20
10	20	10	34	0	16	8	0	14	0	16	24	2
11	24	4	24	0	16	0	2	24	22	8	20	14
12	14	2	4	0	16	8	2	14	14	22	0	24
13	10	28	30	0	12	12	14	0	12	20	28	26
14	24	22	10	0	6	24	16	4	0	12	12	36
15	6	4	0	12	12	14	8	12	4	0	26	12
16	6	10	18	0	12	18	0	2	6	32	10	12
17	16	6	26	6	6	16	18	4	0	24	8	0
18	12	10	32	4	16	2	20	8	18	16	0	20
19	8	10	0	4	14	16	4	12	28	8	0	40
20	8	22	34	16	20	20	4	0	26	20	8	12
21	6	14	34	12	12	16	12	16	14	6	14	16
22	4	10	10	16	12	12	8	8	18	0	8	8
23	0	4	16	0	28	12	2	8	4	16	8	6
24	36	12	28	14	28	14	6	8	0	14	22	0
25	8	14	8	10	10	0	8	8	18	2	10	4
26	30	8	0	18	0	16	10	0	26	18	0	0
27	4	22	22	12	2	18	14	0	14	0	10	16
28	22	14	18	30	2	8	8	0	10	6	6	10
29	8	0	8	10	0	0	8	0	28	0	8	18
30	14	0	0	0	0	0	0	8	20	10	4	18
31	38	0	0	0	0	0	10	18	0	20	0	0

Note: At the survey on November 6, 1997, the number of actual landing boats 2.4 times of the one Market's record was observed, but for safety's sake, a coefficient of 2.0 is adopted.

Figure 2-1 Estimation of actual number of landing boats



B. Fisheries Center site

(I) Present site conditions

(I)-1 Fisheries Center site at Barrouallie

	Present conditions
Status of site	This is a local fishing base on the west of Island, having landing next to Kingstown, about 50 fishing boats, and some 200 fishermen, supplying fish to Kingstown and inland area.
Activity	Major activity is purse seining, employing 70% of fishing boats. Remaining boats are engaging in bottom fishing or trolling.
Change in season	Yearly landing was 87 tons in 1996. More is in June through September, while less in March through May.
Distribution of fish	Fisheries Division's statistics say that 25% of catch go to Kingstown, 50% to inland, and 5% to St. Lucia, and 20% are consumed locally. Delivery to Kingstown is conducted by fishermen directly by boat, and to inland by trader by truck.
Constraints	Absence of ice plant and impracticable transport of ice from Kingstown make it impossible to regular shipment to Kingstown Fish Market due to deteriorating fish quality. Poor availability of fuel oil is restricting fishing activity. About 90% of fishermen's homes have no shower/toilet.

(I)-2 Six fishing villages in Chateaubelair Fisheries Center site area

	Present conditions
Status of site	Chateaubelair, a fishing base locating on the NW of Island, is central to the site area. Containing 6 fishing villages within a 2.5 km radius of Chateaubelair, the site area is wholly regarded as one community. The Project, therefore, shall be planned on this area as a whole. The area has some 50 fishing boats and 200 fishermen, supplying fish to Kingstown and inland area.

Activity	Major activity is purse seining, employing 90% of fishing boats. Remaining boats are engaging in bottom fishing or trolling.
Change in season	Yearly landing was 69 tons in 1996. More is in January through August except April, while less in September through December.
Distribution of fish	Fisheries Division's statistics say that 25% of catch go to Kingstown, 50% to inland, and 5% to St. Lucia, and 20% are consumed locally. Delivery to Kingstown is conducted by fishermen directly by boat, and to inland by trader by truck.
Constraints	Absence of ice plant and impracticable transport of ice from Kingstown make it impossible to regular shipment to the New Kingstown Fish Market due to deteriorating fish quality. There is a gasoline station, but its limited business hours and poor availability of fuel oil due to increasing automobiles are restricting fishing activity. About 90% of fishermen's homes have no shower/toilet.

(2) Existing facility, fishing activity, and distribution of catch

Both sites, Barrouallie and Chateaubelair, are badly behind in fisheries infrastructure, having only a few facilities by constructed with local budget more than 10 years ago.

1) Barrouallie fishing village

1)-1 Existing facility

A concrete jetty and a working site of concrete block structure are fisheries related facilities. Height of the jetty makes it difficult for small boat to moor alongside the jetty due to a difference of more than 1 m between the sea surface and the top of jetty, resulting in use by only a few boats. The working site is used for repairing small boats. There is no other facility for fishermen.

1)-2 Fishing activity and distribution of fish

Main fishing is purse seining operated by group consisting of 3 or 4 small fishing boats. Target fish is small pelagic species such as horse mackerel, and some 70% of fishing boats are engaging in this fishery. The rest of fishing boats is fishing medium-sized species in bottom fishing and trolling.

According to the statistics of Fisheries Division, 50% of catch are marketed to inland area, 25% to Kingstown, 5% to St. Lucia, and the remaining 20% are consumed locally. Shipment to Kingstown and St. Lucia is conducted by fishermen directly by boat, while delivery to inland area by retail traders by truck. No use of ice is observed in distribution.

2) Chateaubelair area

There are 6 fishing villages in the area. As shown in Figure 2-3-2, all of these villages are located within a 2.5 km radius of Chateaubelair, at which catches are landed, and hence, the scale of fisheries center shall be established on 6 villages as one fishing community.

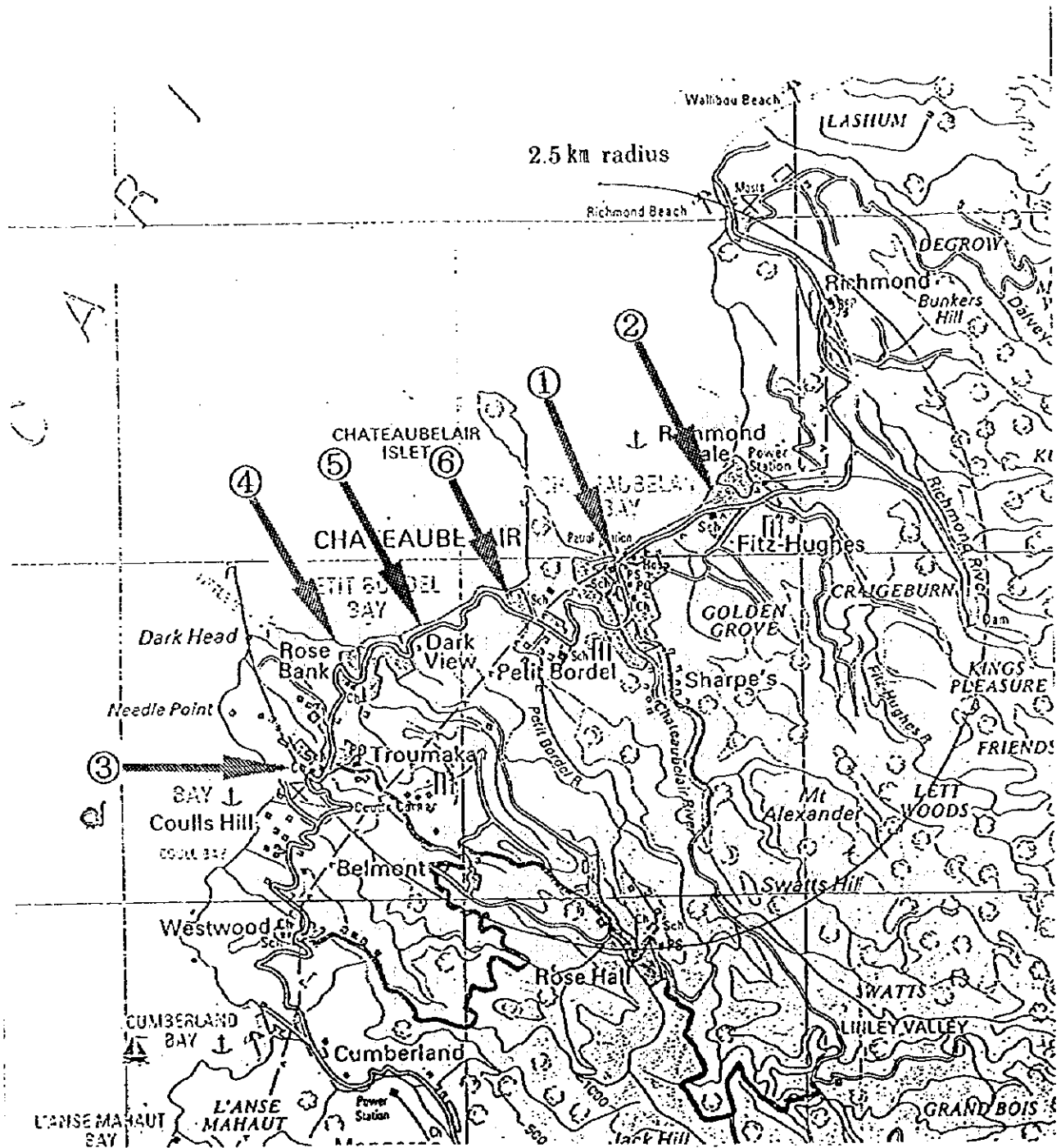
2)-1 Existing facility

There is a concrete jetty as fishery-related facility. The height of the jetty is not apt to small boats, and like Barrouallie, a difference of more than 1 m between the surfaces of sea and jetty top restricts usage by small boat, permitting to be used by a few boats. Other facilities, a selling shop and a toilet for fishermen, constructed by local funds more than 20 years before, became obsolete to be deserted. There is no other facility for fishermen.

2)-2 Fishing activity and distribution of fish

Purse seining is also the main fishing in the area, engaging 90% of fishing boats. Other fishing boats are operating bottom fishery and trolling for medium-sized species. The distribution of fish is similar to Barrouallie.

Figure 2-2 Six fishing villages in Chateaubelair area



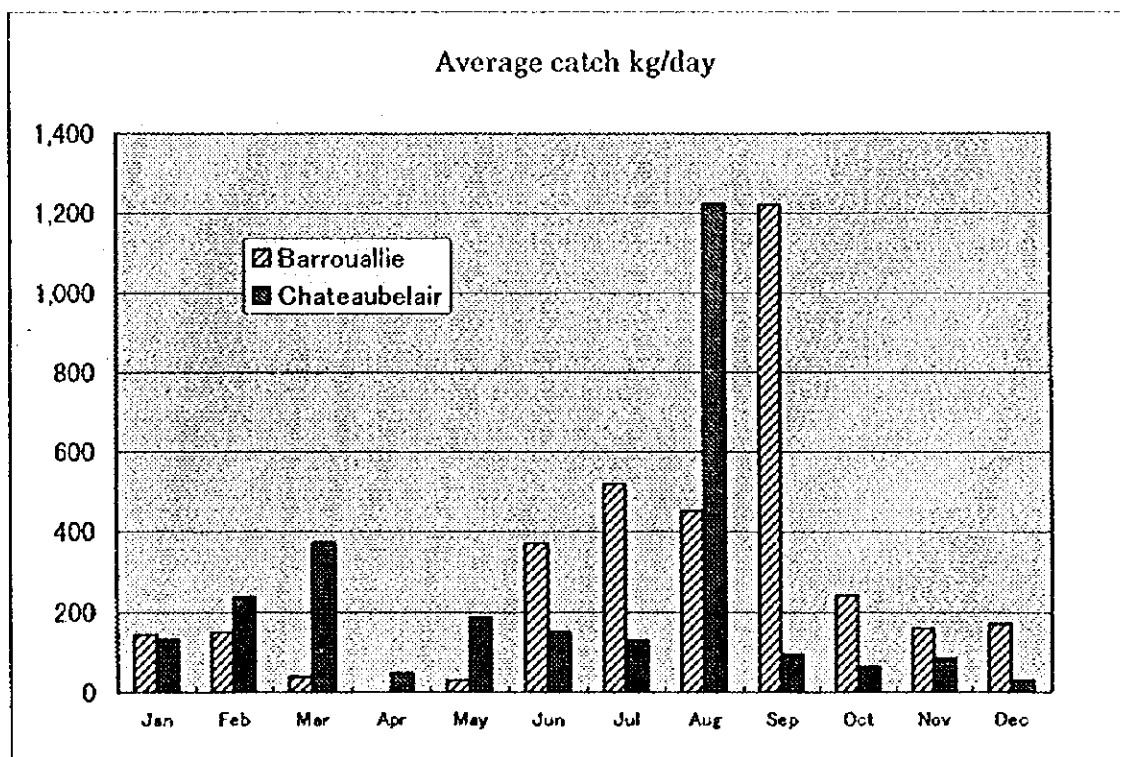
(3) Quantitative data

The Fisheries Division of St. Vincent is entrusting the work of data collection to 5 persons, who are going round fishing villages to collect data such as landings, and the Statistics Section gathers and compiling them for the fisheries statistics. Catch data at the proposed Project sites are reliable due to recent well-organized system, and then, the 1996 data below shall be used as basic value for the Project.

Table 2-7 Catch data of Project site

(Source: Statistics of Fisheries Division)

(Unit: kg)		
site	Barrouallie	Chateaubelair
Jan	142	132
Feb	149	236
Mar	38	375
Apr	0	48
May	30	185
Jun	372	150
Jul	520	130
Aug	452	1,223
Sep	1,221	95
Oct	242	63
Nov	160	83
Dec	170	29
Total	3,496	2,749



2) Basic amount of catch

As seen on the previous Table, catches of Barrouallie and Chateaubelair vary fairly by month, but, in the establishment of ice required in distribution and catch reservation, as the general way, an average catch per day throughout the year shall be adopted, and any fluctuation in catch between an actual catch and average, which will take place as a matter of course, shall be dealt with through an adjustment of ice storage.

The handling space of each Fisheries Center shall be established to allow to deal with the most bustling evening hour when almost of the catch will be landed after the completion of the day's fishing operation.

The scale of a chilled room shall be determined to allow 2 days preservation due to the arrangement of transport equipment and one day delay of shipment.

Table 2-8 Basic value for establishing the scale

Item	Basic value		Ground of calculation
	Barrouallie	Chateaubelair	
Ice plant: Average catch	291 kg/day	229 kg/day	yearly catch/300 (fishing days)
Required ice: Preservation of catch	290 kg	230 kg	required ice: weight of fish = 1:1
Handling space	290 kg	230 kg	to cope with the bustling evening hour when landing concentrates.
Chilled room	580 kg	460 kg	to allow to preserve 2 days catch.

2-3-3 Establishment of scale of facility, equipment and materials

A. Jetty

(1) Scale of new jetty of Kingstown Fish Market

Item of Request	Why is it necessary	Established scale (draft)
1. Construction of a jetty and extension of existing jetty	To recover falling landing function caused by congestion on jetty, and also to separate jetty functions for small and middle-sized boats.	New jetty is to be constructed alongside existing jetty, and an additional step for small boats shall be constructed on the existing jetty.
a. Extension of berth for small boat on the existing jetty	To improve jetty function by doubling berth for small boats.	Westside of existing jetty shall be used for small boats by constructing step; hence 6 berths can be provided for small boats along with existing 3 berths. 28m(L) × 1.2m(B)
b. Construction of a new jetty	To relieve constraints in sailing preparation of tuna long-liners due to multi-mooring by doubling berth.	The new jetty shall be used for middle-sized boats only; 2 berths for 4 tuna long-liners and 2 berths for research vessels; 45.5 m long and 7.0 m wide (floor area).
c. Oil terminal and water supply	To supply diesel oil and water to tuna boats at the new jetty.	A diesel oil meter shall be provided. Existing oil/water piping shall be connected to new pipe lines.

(2) Constraints in utilization of the existing jetty

1) Berth for small fishing boat

All of the fishing boats must be moored alongside the jetty from the standpoint of safety of boat and efficiency of landing work. The existing jetty can

accommodate 3 boats on one side; that is, it has 3 berths for small boat. Assuming that the utilization rate of the jetty is the percentage value of the number of berths divided by the number of boats moored there, it stands 100% when the berths (3) are utilized by fishing boats (3) being moored in single row, and it is 50% in the case of fishing boats being moored in double rows. The survey at the existing jetty shows that the utilization rate of 50% offers no problem in landing work because the catch on board the outside boat is allowed to be carried to the jetty across the inside boat by using fish boxes. When the rate goes down to less than 30%, that is, fishing boats are moored in more than 3 rows, however, the boats outside of the 3rd row have to wait to land their catch until the inside boats sail out, landing works are congested, and which situation results in quality deterioration of catch on board waiting boats without cold storage system due to high temperature. In the site survey, even on the day which only 12 boats landed their catch actually, such a time zone of congestion as less than 50% of the utilization rate, as shown in Table 2-10, was observed, and fishermen are desirous of speed-up of landing works.

2) Berth for middle-sized boat

Since the berth for middle-sized boat of the existing jetty is designed for one 20m long boat, it can provide only one berth even for a 14m long boat. The tuna long-liners must be moored in four rows as a result, and the tuna boat to do sailing preparation works in 3rd or 4th rows is forced to load some 1,500kg of ice, bait fish, etc. across the deck of other boats inside on the row, which situation is restricting works each other.

Of the two research vessels belong to the Fisheries Division, the middle-sized one is operating irregularly, while the small vessel sails out a day a week, but on days when they have no operation they are forced to lie at anchor due to no mooring space on the jetty, resulting in delay of works in coming in and out harbor.

(3) Necessity of extension of jetty and its scale

1) Berth for small boat

In order to alleviate the congestion at the jetty and thereby to make landing work

smooth, it is necessary to keep the utilization rate at more than 50% according to the site survey. As shown in Table 2-11, in the case where more than 18 boats are going to land their catch in a day the rate is 20% level and congestion is anticipated. When 6 berths can be prepared the utilization rate will be satisfied. Even the year of 1995, when the landing was the least for past 3 years, as shown in Table 2-4, one third of fishing days of the year saw more than 18 boats to enter harbor. Taking these conditions into consideration, 6 berths, twice capacity of the existing jetty, shall be provided.

To be concrete, the existing jetty shall be used exclusively for small boats to systematize respective mooring and landing works of small and middle-sized fishing boats as well as to minimize the flow line of traders between the jetty and the weighing place. For this purpose, a step for small boats, providing 3 berths, shall be constructed on the western side of the existing jetty which is now used for middle-sized boats. By this, alleviation of the current congestion and improved efficiency of landing can be expected.

Although the existing jetty is now aging, construction work of the step will offer no problem when no load falls on it.

2) Berth for middle-sized boat

In order to improve inefficiency works of middle-sized tuna boats mooring in 4 rows, two berths to permit 2 rows mooring shall be newly provided. The method is that a new jetty is to be construct in parallel with the existing jetty.

The western side of the newly constructed jetty shall be for tuna long-liners only, providing 2 berths for middle-sized boats, and also other 2 berths for middle-sized boats shall be provided on the eastern side; one for research vessels of the Fisheries Division and one for carrying vessels and yachts which are entering port at times.

Table 2-9 Utilization of berth for small boat
(Length of berth of existing jetty is equal to
length of 3 small boats altogether)

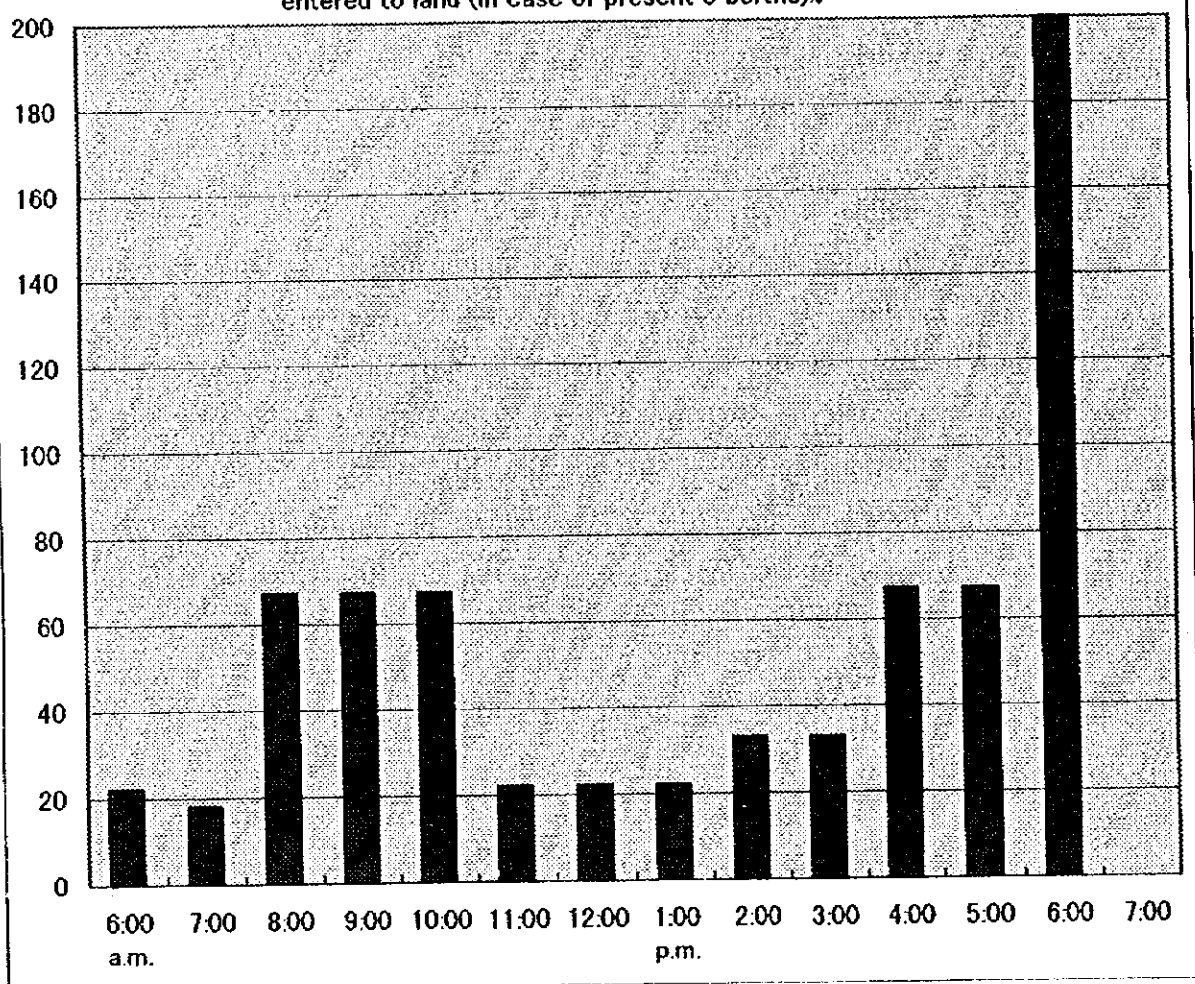
Based on the survey of November 6, 1997

time	boats	Utilization rate of berth
6:00 a.m.	9	33
7:00	11	27
8:00	3	100
9:00	3	100
10:00	3	100
11:00	9	33
12:00	9	33
1:00 p.m.	9	33
2:00	6	50
3:00	6	50
4:00	3	100
5:00	3	100
6:00	1	300
7:00	0	

**Table 2-10 Utilization rate of berth for
small boat by number of berth**

Utilization rate of berth %		
12 boats 3 berth	18 boats 3 berth	18 boats 6 berth
33	22	44
27	18	36
100	67	133
100	67	133
100	67	133
33	22	44
33	22	44
33	22	44
50	33	67
50	33	67
100	67	133
100	67	133
300	200	400

**Table 2-11 Estimation of utilization rate on the day when more than 18 boats
entered to land (in case of present 3 berths)%**



B. Fisheries Center

(1) List of facility, equipment and materials

(1)-1 Fisheries Center at Barrouallie

Item of Request	Why is it necessary	Established scale (draft)
1. Facility		
a. Handling space	This is a core space of Center for collecting, washing, and sorting fish.	Space to meet requirements of concentrating landing of some 290 kg in the evening, $5.0\text{m} \times 8.0\text{m} = 40.0 \text{ m}^2$, shall be allotted.
b. Ice plant and ice bin	To product and store ice necessary for preservation of catch	Storage capacity of the ice bin is to be 600kg, 2 days production, from the standpoint of demand fluctuation, emergency requirements, increasing catch in high season, etc. $1.8 \text{ m} \times 1.8 \text{ m} = 3.2 \text{ m}^2$.
c. Chilled room	For storage of catches to enable them to sell on the following day or two days after.	Capacity to accommodate designed 580 kg fish packed in fish boxes shall be provided. $3.6\text{m} \times 2.7\text{m} = 9.7 \text{ m}^2$
d. Office	For 2 persons.	15 m^2
e. Store	To keep fish boxes, insulated boxes, scales, etc.	15 m^2
f. Retail shop	To sell fish to local people.	18 m^2
g. Shower room and toilet	For fishermen to use after they returned from fishing or worked at shore.	3 booths for men 2 booths for women..
h. Fishermen's locker	To store fishing gear, gasoline, etc.	20 booths, each $2\text{m} \times 2\text{m}$, are to be provided for 20 fishermen living more than 200m away from seaside.

i. Oil terminal	To supply fuel oil to small fishing boats to meet fishermen's time requirements.	One 3 ton tank is to be installed.
2. Equipment and materials		
a. Ice-making machine	To produce required ice	Production capacity shall be 300 kg/day based on the basic designed value.
b. Fish box	To keep catch in chilled room.	Number to meet designed storing requirements of 580 kg plus for use when landing is provided. 25kg capacity × 24 boxes +6 boxes=30
c. Insulated box	To encourage fishers to keep catch with ice, and to promote to market fish using ice in villages and inland.	Insulated boxes belong to the Center. To popularize their use, they are to be lent to half of 14 demersal fishermen plus 6 traders in turn for a few months. Ten boxes, $(14+6)/2=10$, 100 /each, are provided.
d. Scale	For landing and retail selling.	For landing: one 200lbs scale. For retail selling: two 20lbs scales.
e. Cart	For landing	300 kg capacity ×2 carts
f. Shovel	For selling of ice	2 units
g. Processing table	For processing and sorting fish.	1.5m × 2m: 3 tables
h. Selling table	For retail selling	0.5m × 1.5m: 2 tables
i. Winch	For hauling up fishing boat.	3000kg capacity winch: 1 unit
j. Spare parts	For repair and maintenance of equipment	Spare parts for ice-making machine, ice bin, and chilled room shall be provided.

(1)-2 Fisheries Center at Chateaubelair

Item of Request	Why is it necessary	Established scale (draft)
1. Facility		
a. Handling space	This is a core space of Center for collecting, washing, and sorting fish.	Space to meet requirements of concentrating landing of some 230 kg in the evening is to be allotted, but, in actual designing, similar to one of Barrouallie due to little difference. $5.0\text{m} \times 8.0\text{m} = 40.0 \text{ m}^2$.
b. Ice plant and ice bin	To product and store ice necessary for preservation of catch	Storage capacity of the ice bin is to be 600kg, 2 days production, from the standpoint of demand fluctuation, emergency requirements, increasing catch in high season, etc. $1.8 \text{ m} \times 1.8 \text{ m} = 3.2 \text{ m}^2$
c. Chilled room	For storage of catches to enable them to sell on the following day	Capacity to accommodate designed 460kg of fish packed in fish boxes is to be provided. Its space is to be similar to one of Barrouallie due to little difference, that is; $3.6\text{m} \times 2.7\text{m} = 9.7 \text{ m}^2$
d. Office	For 2 persons.	15 m^2
e. Store	To keep fish boxes, insulated boxes, scales, etc.	15 m^2
f. Retail shop	To sell fish to local people.	18 m^2
g. Shower room and toilet	For fishermen to use after they returned from fishing or worked at shore.	3 booths for men 2 booths for women..
h. Fisherman's locker	To store fishing gear, gasoline, etc.	10 booths, each $2\text{m} \times 2\text{m}$, are to be provided for 10 fishermen living more than 200m away from seaside.

i. Oil terminal	To supply fuel oil to small fishing boats to meet fishermen's time requirements.	One 3 ton tank is to be installed.
2. Equipment and materials		
a. Ice-making machine.	To produce required ice.	Although the designed basic value is 230kg, 300kg/day capacity same as Barronallie shall be determined in view of production cost and reserve.
b. Fish box	To keep catch in chilled room.	Number to meet designed storing requirements of 460kg plus for use when landing is provided. 25kg capacity \times 19 boxes+6 boxes=25
c. Insulated box	To encourage fishers to keep catch with ice, and to promote to market fish using ice in villages and inland.	Insulated boxes belong to the Center. To popularize their use, they are to be lent to half of 7 demersal fishermen plus 6 sellers in turn for a few months. Seven boxes, $(7+6)/2=7$, 100 /each, are provided.
d. Scale	For landing and retail selling.	For landing: one 200lbs scale. For retail selling: two 20lbs scales.
e. Cart	For landing	300kg capacity \times 2 carts
f. Shovel	For selling of ice	2 units
g. Processing table	For processing and sorting fish.	1.5m \times 2m: 3 tables
h. Selling table	For retail selling	0.5m \times 1.5m: 2 tables
i. Spare parts	For repair and maintenance of equipment	Spare parts for ice-making machine, ice bin, and chilled room shall be provided.

(2) Constraints in fishing activity in Barrouallie and Chateaubelair

At both Barrouallie and Chateaubelair the major constraint is unavailability of ice and cold storage facility for preservation. As a result, catches lose their quality easily under high temperature, and shipment to the largest market, Kingstown, is heavily restricted. Furthermore, in case of abundant harvest a lot of post-harvest loss may occur due to excess of handling capacity.

Having no gas station, Barrouallie's fishermen must go to Kingstown to buy gasoline, taking half an hour by boat, and keep it at their own home using plastic tank. As a result they may be restricted in fishing activity due to shortage of fuel oil, and storage of gasoline at private home is very dangerous. Although there is a gasoline station at Chateaubelair, its limited business hours makes it impossible for fishermen sailing out in early morning to buy gasoline. Also shortage of gasoline is often seen due to increasing automobiles.

Lack of toilet/shower facility at more than 90% of fishermen's houses, in both Barrouallie and Chateaubelair, presents sanitary problem in handling fish.

(3) Necessity of Fisheries Center

Construction of the fisheries center containing ice plant/ice storage facility, fuel oil supplying system, and toilet/shower facility is highly necessary to improve, modernize, and support fishing activity of artisanal fishermen.

Provision of ice making/storage facility will make it possible to maintain quality of fish, market more catches to Kingstown, and decrease post-harvest loss.

Provision of oil terminal will make it possible for fishermen to obtain fuel oil whenever they want, avoid a danger in home storage of oil.

Also preparation of toilet/shower facility will improve fishermen's life level in sanitation.

(4) Establishment of scale of Fisheries Center

Fisheries Center at Barrouallie

1) Main building and related-facility

From the viewpoint of management efficiency, one building integrated the following facilities of (a) through (f), that is, handling space, ice plant and ice bin, chilled room, office, store, and retail shop, due to electricity and drainage, is to be constructed. Each facility and its function is as follows.

(a) Handling space

The space is the core of activities in the center, at which catches are landed, sorted, weighed, washed, packed in fish boxes, and prepared for shipment on the following day.

The catch at Barrouallie is some 290 kg/day at average throughout the year. This basic value shall be adopted in establishing the scale of the handling space. Since the landing is concentrated in the evening, the handling space shall be provided to allow to cope with the concentrating landing of this value.

The day's catch will be brought into the main building of center with fish boxes of 25kg capacity each, and then, sorted, weighed, washed, and stored in the chilled room with ice-packed fish boxes for selling on the following day. The area of handling space shall occupy 40 m², consisting of a space of 1.5 m × 4.0 m for working at the center, 2 spaces of 1.0 m × 1.5 m each for washing, and a passage of 1.5 m wide around, and be also used for preparation of shipment, selling of ice, filling compressed air for divers, etc.

Working space (for 5 persons)	20 m ²
Space for fish boxes	6 m ²
Space for washing	3 m ²
Passage and others	11 m ²
Total	40 m ²

The floor shall be of concrete brushing finish for antislipping and washing, having adequate gradient for drainage. Wastewater containing trash shall be let to a

settling tank after screening trash with stainless steel mesh on a catch basin. Wainscot around the space shall be of porcelain tile for splashing and cleaning (see Figure-1.).

(b) Ice plant and ice bin

The basic catch required for designing necessary volume of ice shall be an average catch throughout the year, 290 kg/day.

In St. Vincent Island ice is produced at Kingstown only at present, and although Barrouallie and Chateaubelair are two leading fishing villages, any ice making business in Kingstown is unconcerned with transporting and selling ice to both villages due to poor road conditions taking more than 1 hour drive and heavy loss of ice because of hot climate.

On the other hand, there are the following demands in Barrouallie and Chateaubelair, and fisherfolk in both villages are eager for ice production.

- a. Quality preservation in shipment to the New Kingstown Fish Market.
- b. Quality control in export to St. Lucia and quality preservation in transport to inland villages
- c. Catch preservation and quality control popularization for fisherfolk.

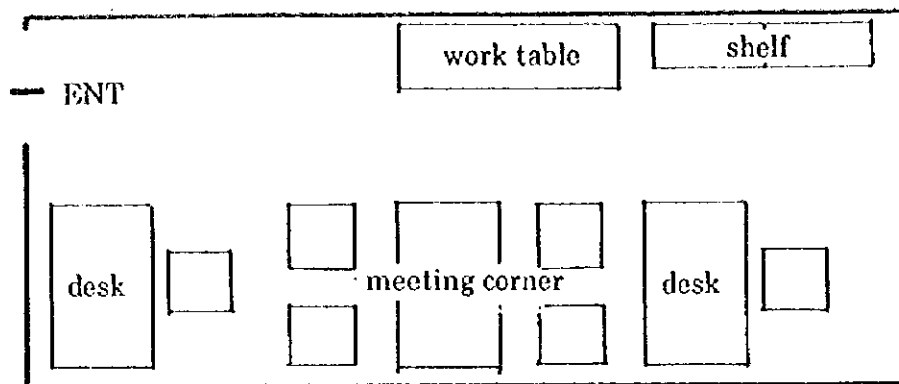
When the required quantity of ice equals a weight of fish to be distributed, necessary quantity of ice is to be 290 kg/day. To meet this requirement an ice plant with 300 kg production capacity shall be installed.

The kind of ice shall be palate ice having a longer melting hour than flake ice, but a mobile ice crusher shall be equipped to meet a demand for flake-like ice familiar to fish body.

The capacity of the ice bin shall be 600 kg, that is, 2 days production, $1.8 \text{ m} \times 1.8 \text{ m} = 3.2 \text{ m}^2$ (ice storage unit 250 kg/m^2), considering demand fluctuation, increasing catch in high season, and so on.

(c) Chilled room

The catch landed in the evening is generally marketed on the following day, and thus the catch shall be packed in fish boxes covering with ice and stored in the chilled room. There will be some cases where storage of catch takes two days due to reasons of traders, fishermen's operation, or business days of the Fish Market.



OFFICE LAYOUT PLAN

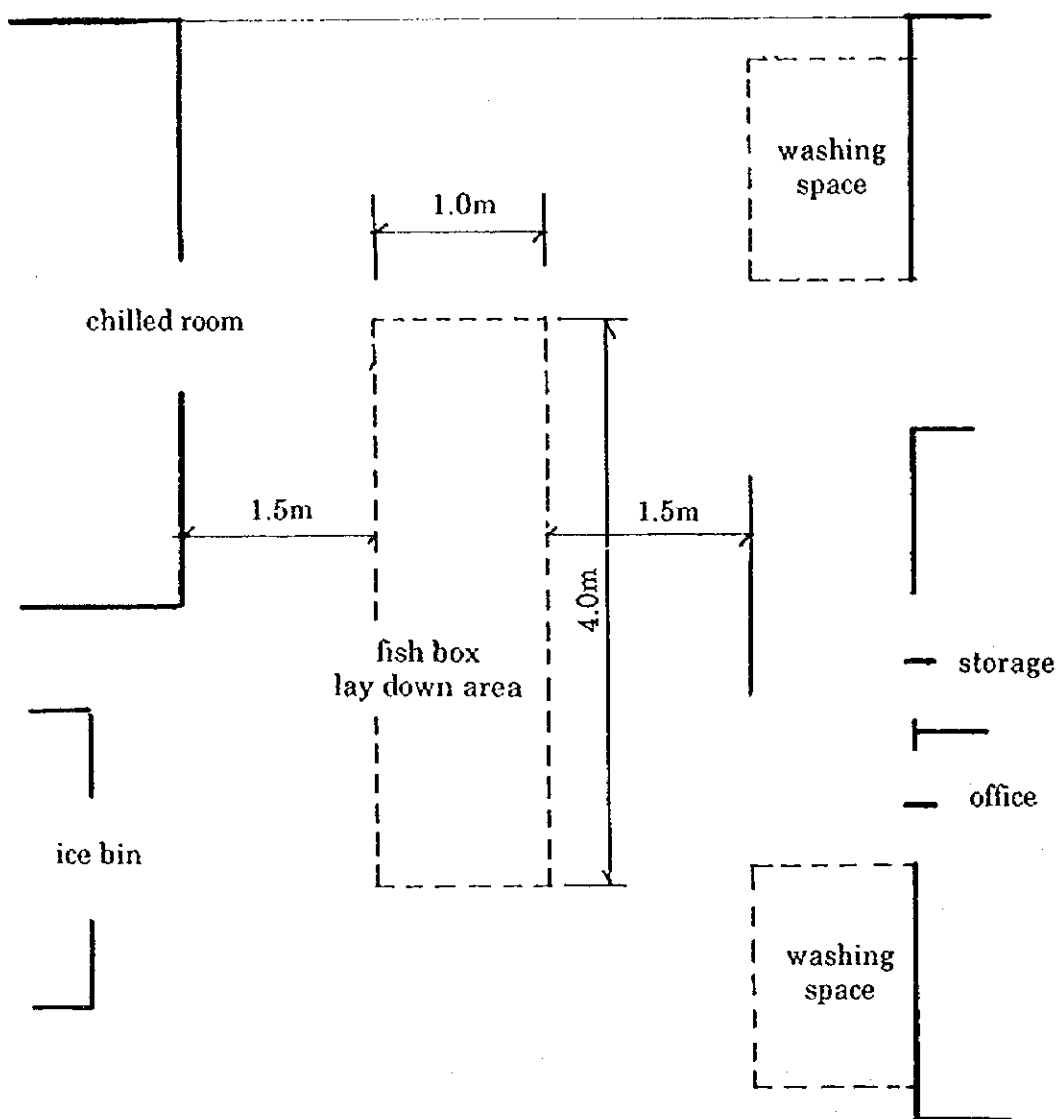


Figure-1 HANDLING YARD LAYOUT PLAN

Hence a storage capacity of some 580 kg, two days catch, shall be provided.

Fish of 580 kg are to be packed in 24 fish boxes, 25 kg capacity each. Boxes are stacked in 4 columns on a shelf on each side of the passage, and hence, a floor area of $3.6 \text{ m} \times 2.7 \text{ m} = 9.7 \text{ m}^2$ is planned.

A cooling system capable of maintaining the indoor temperature at $0^\circ\text{C} \sim -5^\circ\text{C}$ shall be equipped, and on the floor wooden grating is installed. Under this temperature it is possible to keep fish for more than one week.

(d) Office

A manager and workers will work here for managing the facilities, selling ice/fuel oil, collecting rental fee, etc. Also the meeting with extension officers will be held. A space of about 15 m^2 shall be provided to accommodate two desks, one bookshelf, one filing cabinet, spare chairs, etc. (see Figure-1).

Desk	$2.7 \text{ m}^2 \times 2$	5.4 m^2
Meeting corner	$1.5 \text{ m} \times 2.4 \text{ m}$	3.6 m^2
Bookshelf		0.7 m^2
Filing cabinet		0.7 m^2
<u>Passage and others</u>		<u>4.6 m^2</u>
Total		15.0 m^2

(e) Store

A store of 15 m^2 is to be installed for storing fish boxes, insulated boxes, carts, shovels, mobile ice crusher, etc.

Storage space for fish boxes and insulated boxes	5 m^2
Platform scales	2 m^2
Carts	4 m^2
<u>Storage space for others</u>	<u>4 m^2</u>
Total	15 m^2

(f) Retail shop

At present Barrouallie has some 6 fish traders, who buy fishes directly from fishermen at the shore and sell them at home. Since the village people are desirous of buying fish at the Center, a retail shop shall be installed on the road side of the main building. The shop will be equipped with display counters, processing tables, fish boxes, etc., and be leased to fish traders jointly (see Figure-2).

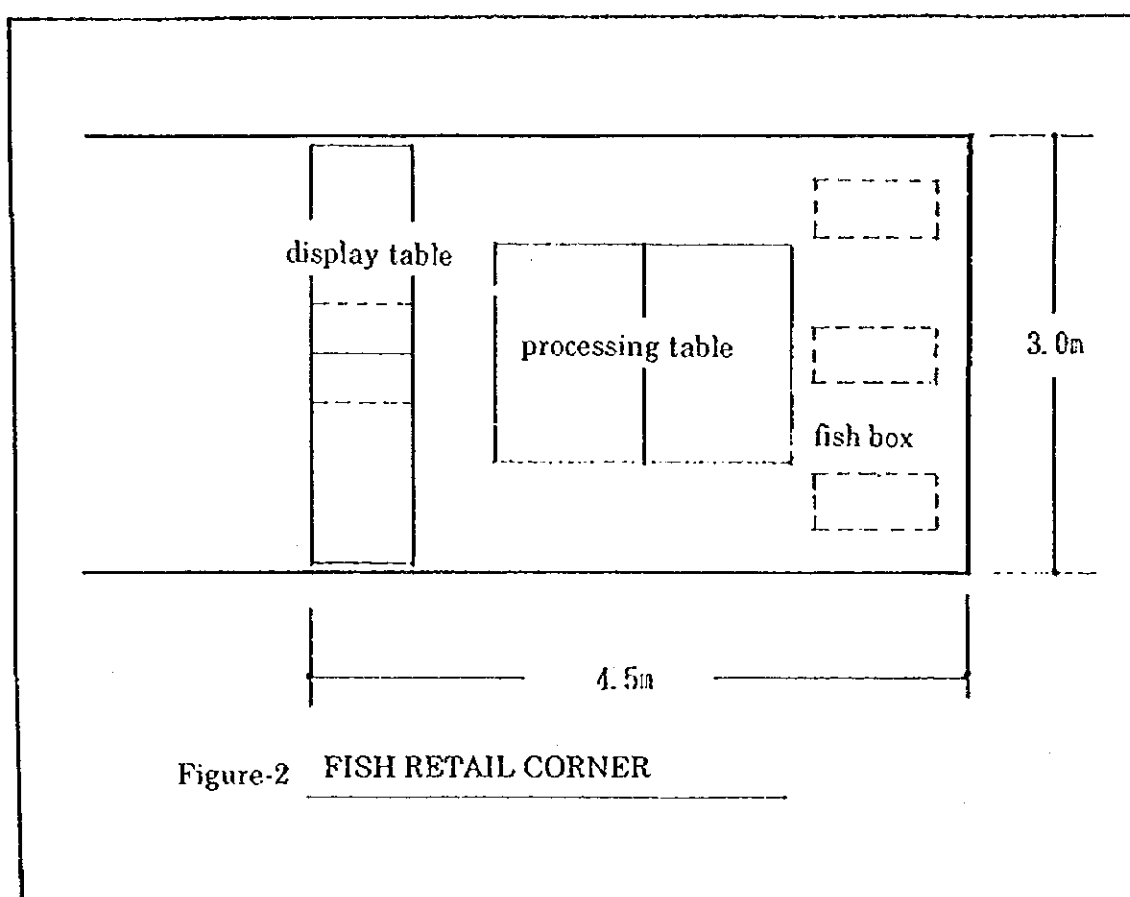


Figure-2 FISH RETAIL CORNER

Display counter	0.6 m × 1.5 m × 2	1.8 m ³
Processing table		3.0 m ³
Space for fish boxes		4.5 m ³
Passage and others		8.7 m ³
Total		18.0 m ³

2) Toilet/shower room

Toilet/shower room for fishermen sailing out, returning from fishing, or working on the shore shall be constructed. The facility will be used by employees of the center too.

Since there is no local standards, the Japan's standards in office building, one booth per 40 persons, will be applied, and hence five booths for some 200 fishermen of Barrouallie shall be installed.

In landing work on the shore 4 out of 10 persons, 40%, are female, and thus 3 booths will be allotted to male, 2 booths to female. The number of shower rooms shall be similar. The area in conformity to a standard will be applied.

The building structure shall be of concrete block structure due to size appropriateness, easy maintenance, and easy washing. Sewage shall be treated in a septic tank to be installed in the main building.

3) Fisherman's locker

The registered fishing boats in Barrouallie are 50 in number, and almost of the boatowners are living within one-mile radius from the landing site on the seashore. Owners living within a 200 m radius that carry their fishing gear, outboard motor, etc. is humanly possible are about 60%. The remaining 40% are living more than 200 m far away, and for them carrying their fishing gear, boat's fittings, and fuel oil to their boat on the shore is heavy physical burden according to the site survey and hearing survey at a meeting of fishermen. For these 20 boatowners, lockers of 20 units shall be installed.

The locker will accommodate outboard motor, fishing gear, fishing net, spare fuel tank, spare clothes, oxygen bottle for diving, etc. In Barrouallie some 75% of landing come from purse seining groups, one of which consists of one powered

boat plus 3 to 4 non-powered boats. Although equipment and materials which each boatowner is going to store in his locker are accordingly varied, a space of 2 m × 2 m each is judged to be proper according to the site survey and discussions. Concrete block structure is suitable to a locker in such scale, and 20 units shall be constructed, connecting back to back. Each locker shall have a structure with proper ventilation and security, and a tools shelf which also serves as an engine rack is equipped inside.

4) Oil terminal

Gasoline is not available in Barrouallie, and fishermen must go to Kingstown to buy it, taking one hour by car or half an hour by boat. That gasoline is not always obtainable whenever necessary is restricting their fishing activity. Since storage of gasoline at home is very dangerous, installation of oil terminal is in immediate need and given top priority in fishermen's request.

As shown on the Table below, Barrouallie have 50 fishing boats of which 24 boats are outboard powered. Fisheries are the major economy activity at Barrouallie and fishing boats are fully operating.

Table 2-12 Fishing fleet of Barrouallie

Fishing boat	No powered	Powered	Total
Registered	16	14	30
Unregistered	10		20
Total	26	24	50

Fishing days are 300 days in the year, and supposing that a 25 HP boat travels for less than 2 hours a day, its fuel oil consumption is about 25 l. Assuming that transport of oil by tank lorry is conducted once a week, the required volume to be stored is

$$25 \text{ l/day/boat} \times 24 \text{ boats} \times 300 \text{ days} / 365 \text{ days} \times 7 \text{ days} = 3,450 \text{ l}$$

Hence, a 3 ton tank will be constructed.

Based on the regulations concerning the handling of dangerous articles the gasoline tank shall be constructed under ground, and gasoline will be sold

through dispenser. Lubricating oil, requiring about 2% of volume of gasoline, will be stored by drum placed on the ground and is sold directly. The whole oil terminal shall be surrounded by fence with adequate attention paid to security.

2) Related equipment and materials

The contents of related equipment and materials shall be determined on the same basic value as used to establish the scale of facility, that is yearly average catch. At Barrouallie, the average catch is 290 kg/day.

All the related equipment and materials shall belong to the fisheries center.

a. Ice-making machine

As mentioned above, one ice-making machine with production capacity of 300 kg/day shall be provided.

b. Fish box

Fish box will be used for storing catch in the chilled room. The required number of boxes are 30 to meet the requirements of 2 days catch plus the ones for landing.

$$580 \text{ kg (2 days average catch)} / 25 \text{ kg (box capacity)} + 6 \text{ boxes} = 30 \text{ boxes.}$$

c. Insulated box

Insulated box is used for education and extension of quality control. Demersal fishermen and fish traders will be encouraged to use the freely leased insulated box with ice to preserve fish quality during fishing or carrying fish in village and inland. When an increase of incomes by using insulated box is realized, they will be instructed to buy it for private use.

To lease box to half of 14 demersal fishing boats and 6 traders in turn for a few months, 10 boxes, 100 l/capacity each, will be provided.

d. Scale

Scale will be used for weighing at landing and retail selling. One 200 lb capacity platform scale for landing and two 20 lb capacity spring scales are to be provided.

e. Cart

Cart will be used for carrying catch, fishing gear, outboard motor, etc. from the shore to the center. Maximum load is estimated at 300 kg, and a cart with stoutness and durability is necessary due to rough road condition. Because catch and fishing gear must be carried separately, two carts are provided.

f. Shovel

From the viewpoint of handling ice and small fishes, two anticorrosive stainless steel shovels are supplied.

g. Fish processing table

Fish processing table is used for sorting and handling fishes in the handling space. Stainless steel tables of 1.5 m×2.0 m, two for sorting and one for handling, will be provided to permit dealing with one landing of 200 kg. The table may be removed to the retail shop for further using if necessary.

h. Selling table

Selling table is used for retail selling to local people at the retail shop. Two stainless steel tables, 0.5 m×1.5 m each, will be provided, being used by 2 or 3 persons if necessary.

i. Winch

Winch is used for hauling up or pulling down fishing boat at the repair shop neighboring to the center. One system with 3 ton capacity shall be provided due to the weight of a wooden purse seiner. Being subject to inspection once a year, all the 50 fishing boats will use this system. The system shall be of maintenance-easy, stout, and hand-operated type, and be installed in the joint workshop contiguous to the Fisheries Center. Also necessary spare parts and tools will be provided.

j. Spare parts

Spare parts for the ice-making machine, ice bin, and chilled room shall be provided for emergency use including repair and maintenance.

Fisheries Center at Chateaubelair

Apart from principal values with a little difference, the basic concept to be applied to establish the scale of Chateaubelair Fisheries Center is similar to Barrouallie Fisheries Center.

Since there is little difference on the scale between two facilities, the same scale shall be planned from the standpoint of cost-saving and higher efficiency in preparation of drawings, construction materials, cooling system, etc.

1) Main building and related facility

The same facilities as Barrouallie shall be constructed.

(a) Handling space

The average catch throughout the year at Chateaubelair is 230 kg/day. In establishing the scale of the handling space, this value is applied. Usually landing is concentrated in the afternoon and the space to allow to handle the concentrating landing shall be allocated.

Working space (5 persons)	20 m ²
Space for fish boxes	6 m ²
Washing space	3 m ²
Passage and others	11 m ²
Total	40 m ²

(b) Ice plant and ice bin

The basic value to be applied to determine the necessary volume of ice is 230 kg, the yearly average catch at Chateaubelair.

In order to meet the requirement of daily supply of ice of 230 kg, a 300 kg/day production ice-making machine shall be established. Also an ice crusher same as the one of Barrouallie is to be provided.

The capacity of the ice bin shall be 600 kg, 2 days production, $1.8 \text{ m} \times 1.8 \text{ m} = 3.2 \text{ m}^2$ (storing unit 250 kg/m²).

(c) Chilled room

Similarly, the basic value of 230 kg catch per day shall be applied to determine the scale of the chilled room. Usually the catch landed in the afternoon is, like Barrouallie, marketed on the following day. Since there are some cases where the stored catch is marketed 2 days after, a storage capacity for 2 days catch shall be provided. Fish of 460 kg shall be packed in 19 fish boxes, 25 kg capacity each, with ice. Boxes are stacked in 4 columns on a shelf on each side of passage, and thus a floor area of $3.6 \text{ m} \times 2.7 \text{ m} = 9.72 \text{ m}^2$ is planned.

(d) Office

As same as Barrouallie, an office of some 15 m^2 area is provided.

(e) Store

As same as Barrouallie, a store of 15 m^2 area is provided.

(f) Retail shop

Chateaubelair has 6 fish traders same as Barrouallie. The space of 18.0 m^2 same as Barrouallie is planned.

(g) Toilet and shower room

Chateaubelair has some 200 fishermen. Since the facility is installed for all the fishermen, 5 booths same as Barrouallie are provided.

(h) Fisherman's locker

Lockers are to be installed for Chateaubelair fishing village only. At present the village has 20 registered fishing boats, and half of boatowners are living beyond a 200 m radius from the landing site on the seaside that carrying the fishing gear is humanly very difficult. For them 10 units of locker are provided.

(i) Oil terminal

There is a gas station in Chateaubelair, but fishermen are experiencing difficulty in obtaining fuel oil for fishing due to increasing automobiles. Furthermore business hours of the station are from 08:00 to 16:00, which situation restricts fishermen's

activity due to unavailability of fuel in early morning. Installation of oil terminal is in urgent need and given top priority in fishermen's request.

Chateaubelair has about 60 fishing boats as shown on Table 2-13 below, of which 16 boats are outboard propelled. Fisheries are the major economy at Chateaubelair, and almost of the fishing boats are operating.

Table 2-13 Fishing fleet of Chateaubelair

Number	No powered	Powered	Total
Registered	34	16	50
Not registered	7	-	7
Total	41	16	57

Fishing days are 300 days/year, and when a fishing boat with 25 HP outboard motor travels for less than 2 hours a day, the fuel oil consumption will be about 25 l. Assuming that a tank lorry carries fuel oil each 10 days due to worse road condition than Barrouallie, the required storing amount is

$$25 \text{ l/day/boat} \times 16 \text{ boats} \times 300 \text{ days}/365 \text{ days} \times 10 \text{ days} = 3,280 \text{ l}$$

Hence, a 3 ton tank will be installed.

2) Related equipment and materials

The contents of related equipment and materials shall be established on the same basic value as used to determine the scale of the facility. At Chateaubelair the basic value, the yearly average catch, is estimated at 230 kg/day.

All the related equipment and materials shall belong to the fisheries center.

a. Ice-making machine

As mentioned above, one 300 kg/day production capacity machine is to be provided.

b. Fish box

Fish box will be used for storing catch in the chilled room for selling on the following day. The required number of boxes is 25 to store 2 days catch plus the ones for landing.

$460 \text{ kg (2 days average catch)}/25 \text{ kg (box capacity)} + 6 \text{ boxes} = 25 \text{ boxes.}$

c. Insulated box

Insulated box of 100 l capacity shall be lent freely to lent of 7 demersal fishermen and 6 fish traders in turn for a few months. Required boxes are 7 in number.

d. Scale

Scale will be used for weighing in landing or retail selling. One 200 lb capacity platform scale for landing and two 20 lb capacity spring scales are to be supplied.

e. Cart

Two carts, about 300 kg capacity each, are provided same as Barrouallie.

f. Shovel

From the viewpoint of handling ice and small fishes, 2 anticorrosive stainless steel shovels are provided.

g. Fish processing table

Fish processing table are used for sorting and handling fish in the handling space. Stainless steel table of 1.5 m×2.0 m, two for sorting and one for handling, will be provided to permit dealing with one landing of 150 kg. The tables may be removed to the retail shop for further using if necessary.

h. Selling table

Two stainless steel tables, 0.5 m×1.5 m each, will be provided same as Barrouallie.

i. Spare parts

Spare parts for the ice-making machine, ice bin, and chilled room shall be supplied for emergency use including repair and maintenance.