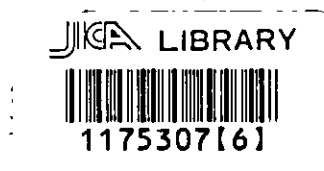


**BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
CONSTRUCTION OF FISHERIES DEVELOPMENT CENTER
IN
ANTIGUA AND BARBUDA**

MARCH, 2004



**JAPAN INTERNATIONAL COOPERATION AGENCY
THE JOINT VENTURE BETWEEN
ECOH CORPORATION
AND
KYOKUYO CO.,LTD**

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PREFACE

In response to a request from the Government of Antigua and Barbuda, the Government of the Japan decided to conduct a basic design study on the Project for Construction of Fisheries Development Center and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Antigua and Barbuda a study team from July 1 to August 6, 2003.

The team held discussions with the officials concerned of the Government of Antigua and Barbuda, 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 Antigua and Barbuda 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 Antigua and Barbuda for their close cooperation extended to the teams.

March 2004

Kunimitsu Yoshinaga
Vice-President
Japan International Cooperation Agency

March, 2004

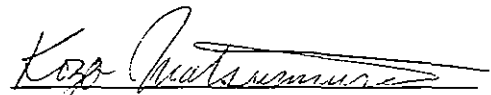
LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on the Project for Construction of Fisheries Development Center in Antigua and Barbuda.

This study was conducted by the joint venture between ECOH CORPORATION and KYOKUYO CO., LTD., under a contract to JICA, during the period from June, 2003 to March, 2004. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Antigua and Barbuda 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,



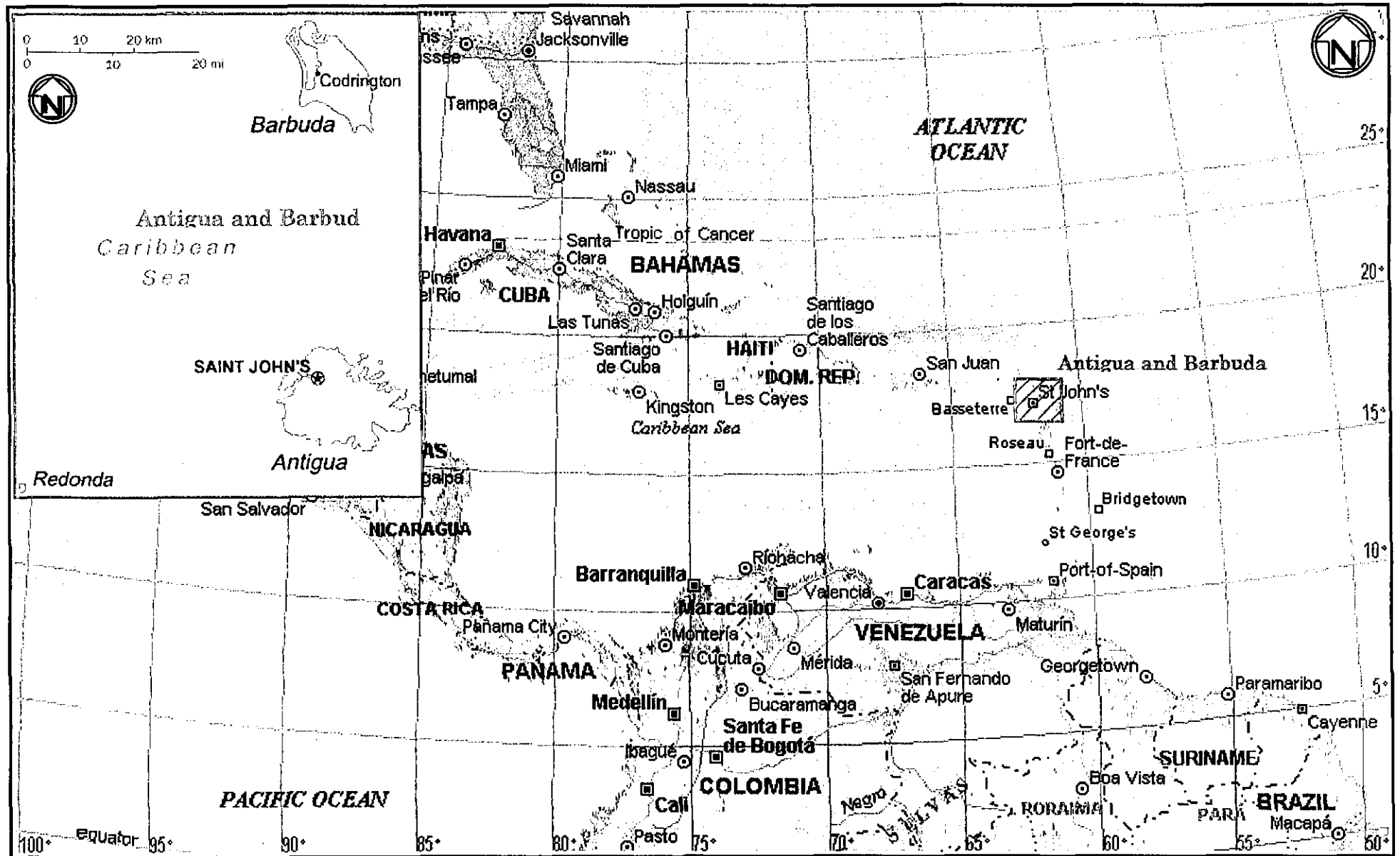
Kezo Matsumura

Chief Consultant,

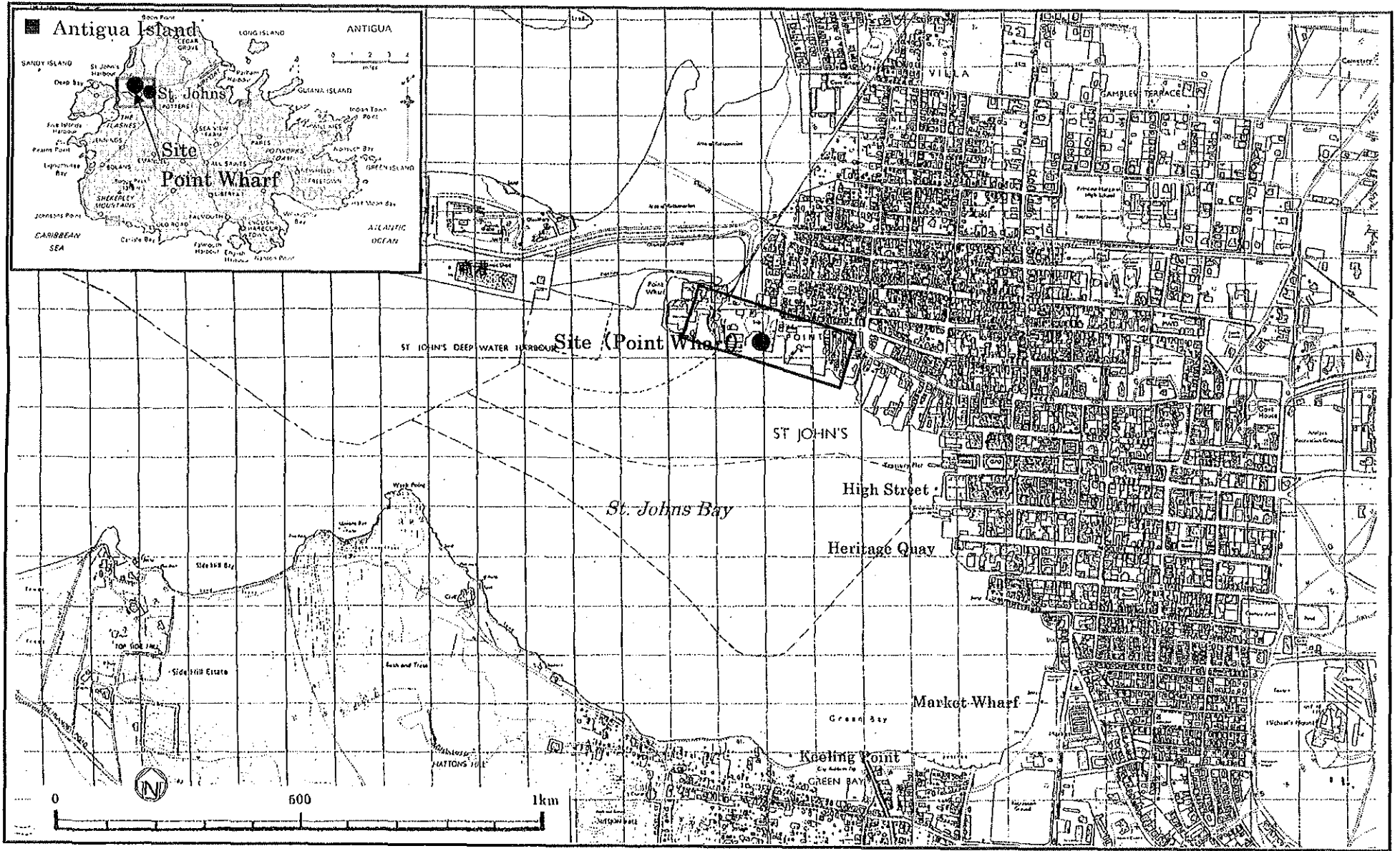
Basic design study team on

the Project for Construction of
Fisheries Development Center

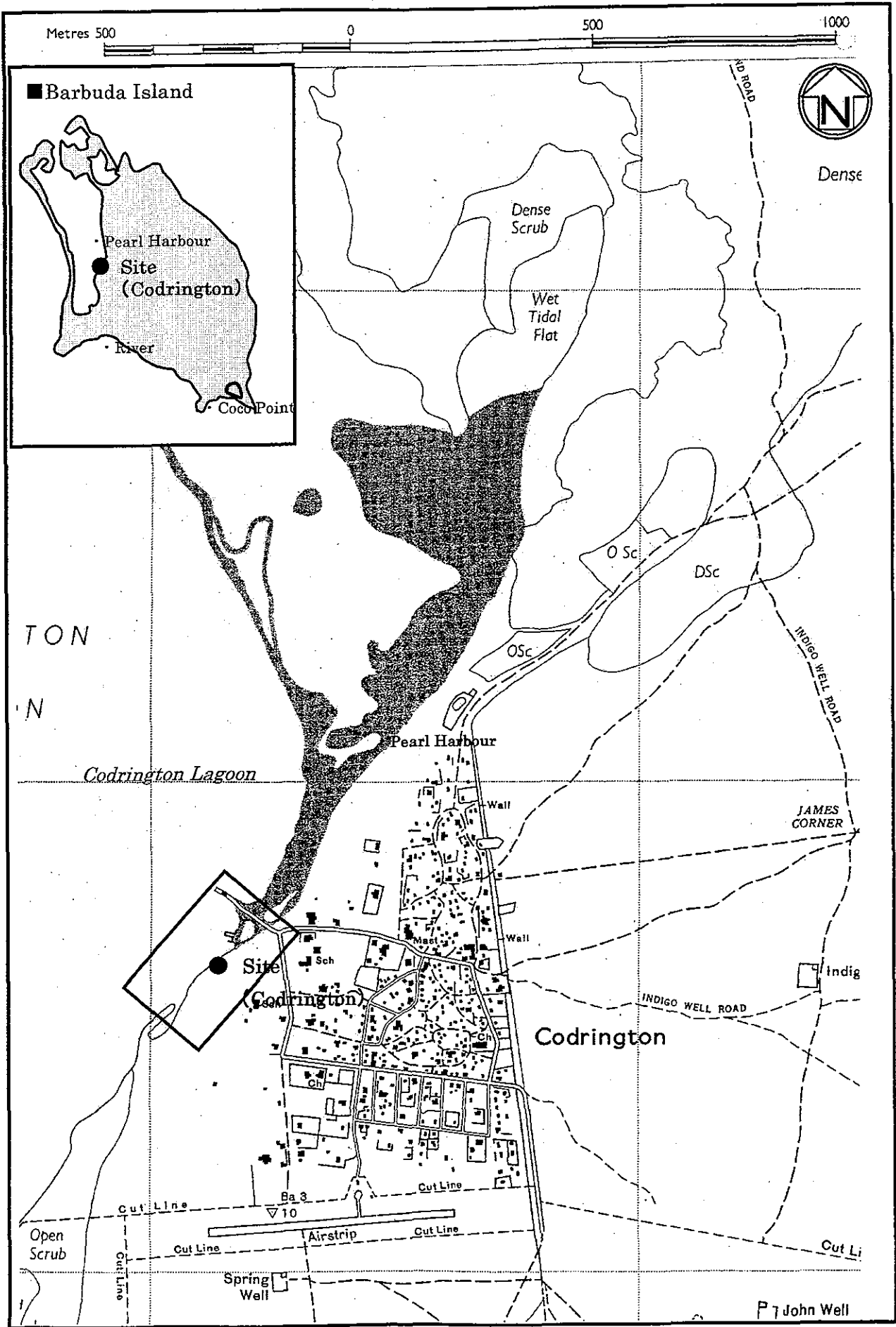
The joint venture between
ECOH CORPORATION and
KYOKUYO CO., LTD.



Location Map of Antigua and Barbuda



Project Site (Point Wharf)



Project Site (Codrington)



Perspective (Point Wharf)

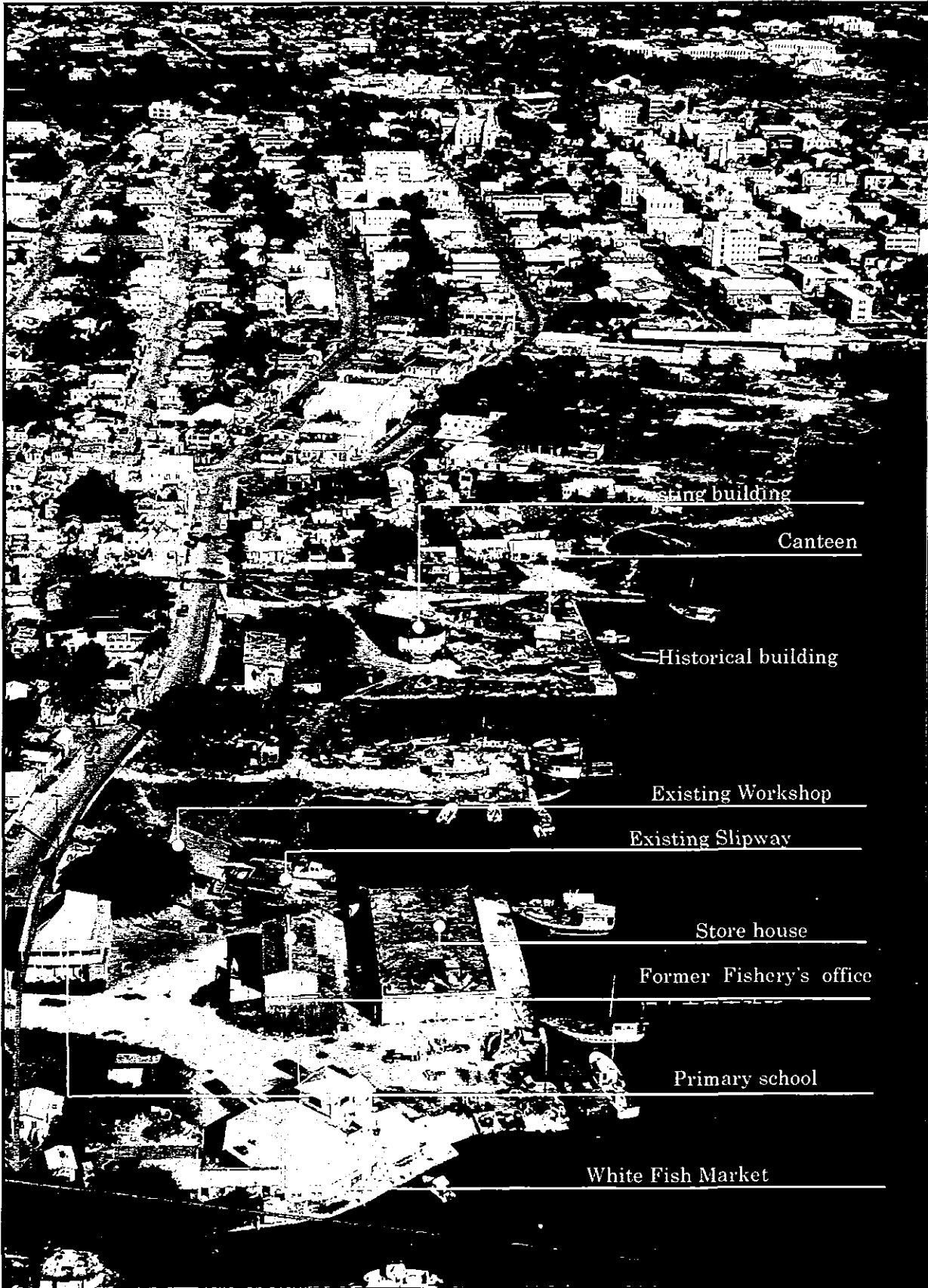


Photo-1 Overall view of Point Wharf

Photo of Point Wharf Site No.2



Photo-2 West side view of Point Wharf



Photo-3 Damaged wharf



Photo-4 Former Fishery's office



Photo-5 Workshop and Slipway

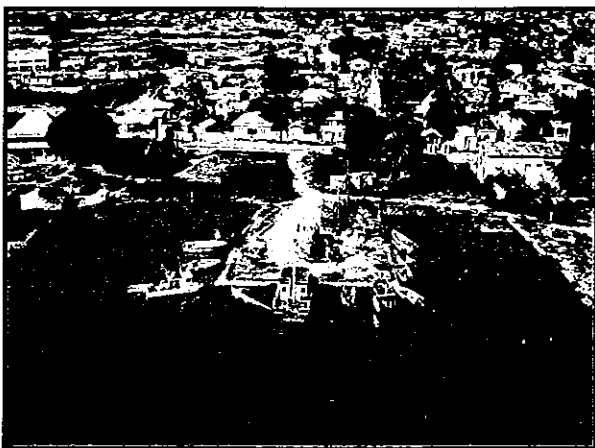


Photo-6 Center view of Point Wharf

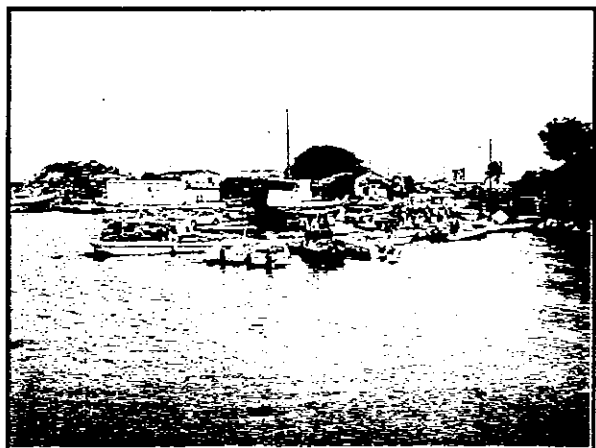


Photo-7 Fishing boats at center mooring place

Photo of Point Wharf Site No.3



Photo-8 East side view



Photo-9 East side mooring place



Photo-10 East side wharf



Photo-11 Behind of east side wharf



Photo-12 Historical building



Photo-13 Fish trap

Photo of Point Wharf Site No.4



Photo-14 Scenery of unloading



Photo-15 Scenery of going fishing



Photo-16 Landed catch

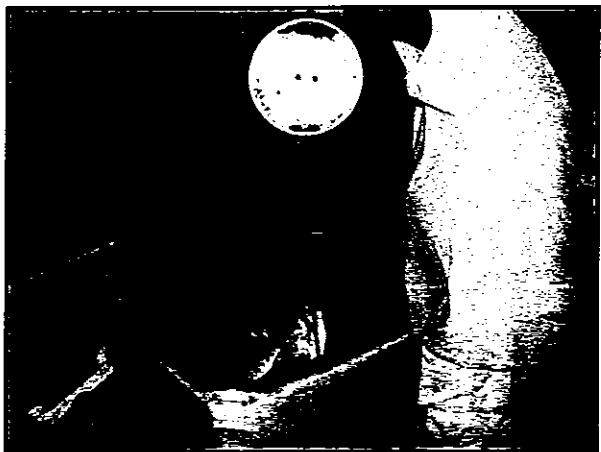


Photo-17 Scenery of selling fish (1)



Photo-18 Scenery of selling fish (2)

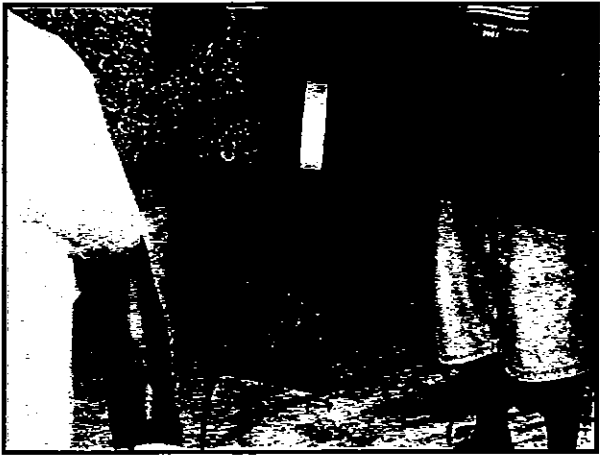


Photo-19 Scenery of selling fish (3)

Photo of Point Wharf Site No.5

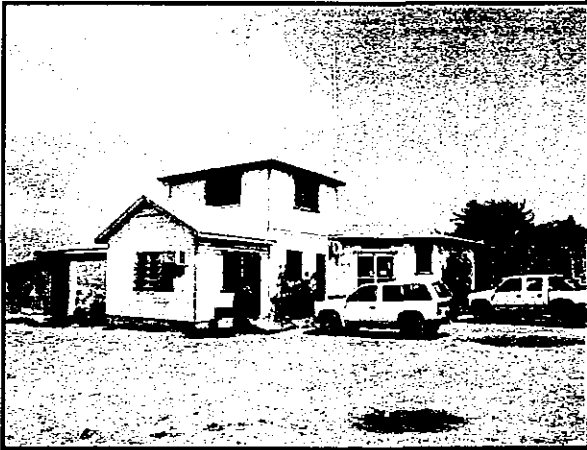


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Photo-21 Scenery of buying fish at WFM



Photo-22 Inside of WFM

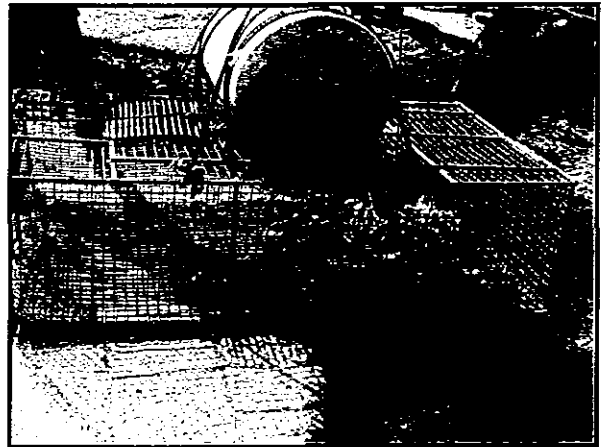


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Photo-25 Scenery of sorting fish on boat

Photo of Point Wharf Site No.6



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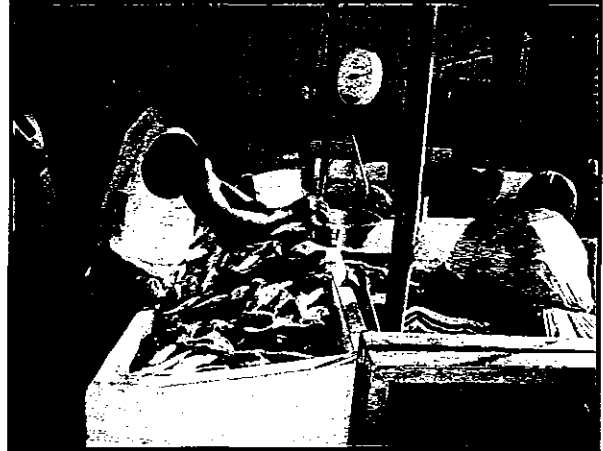


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Photo-30 Fish retail shop at AFL



Photo-31 Examining room of Agriculture Department

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Photo-39 High Street (2)

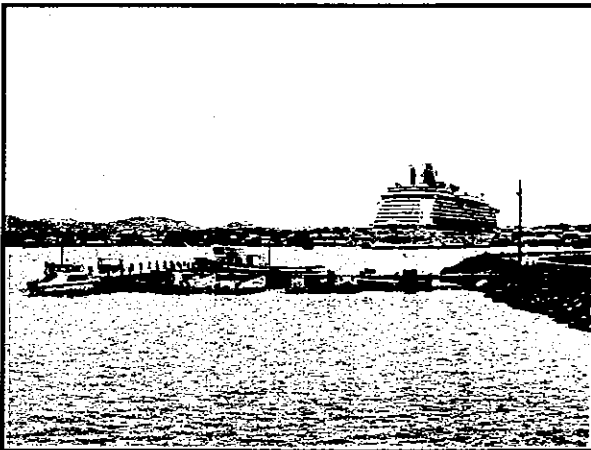


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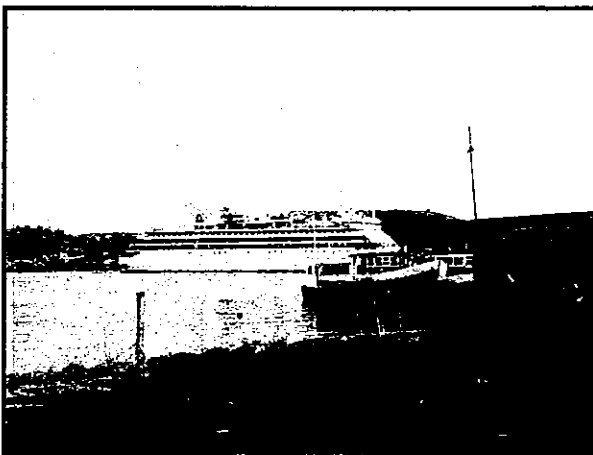


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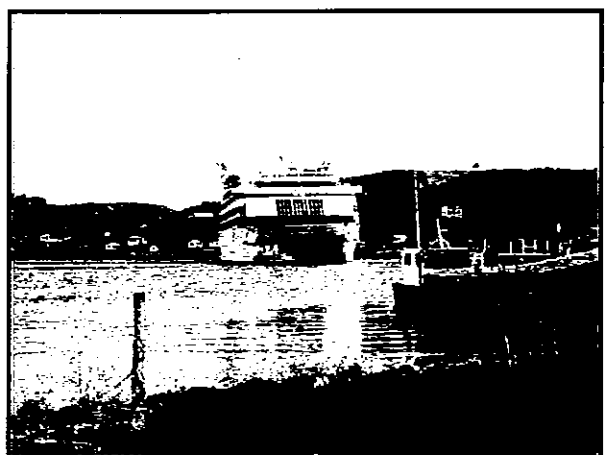


Photo-43 In front of view of Keeling Point

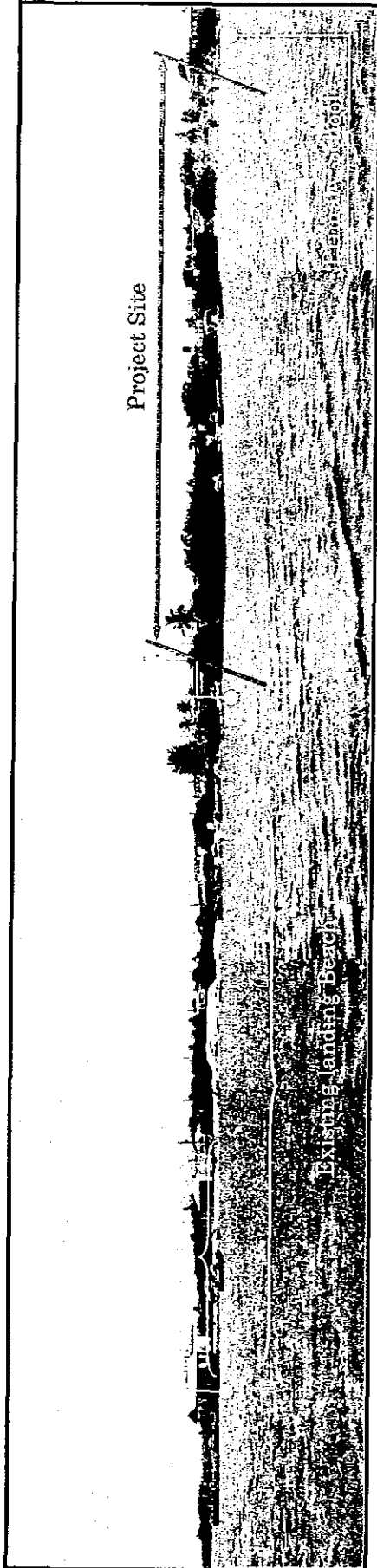


Photo-1 Requested Project Site (Codrington Site)



Photo-2 Codrington Site

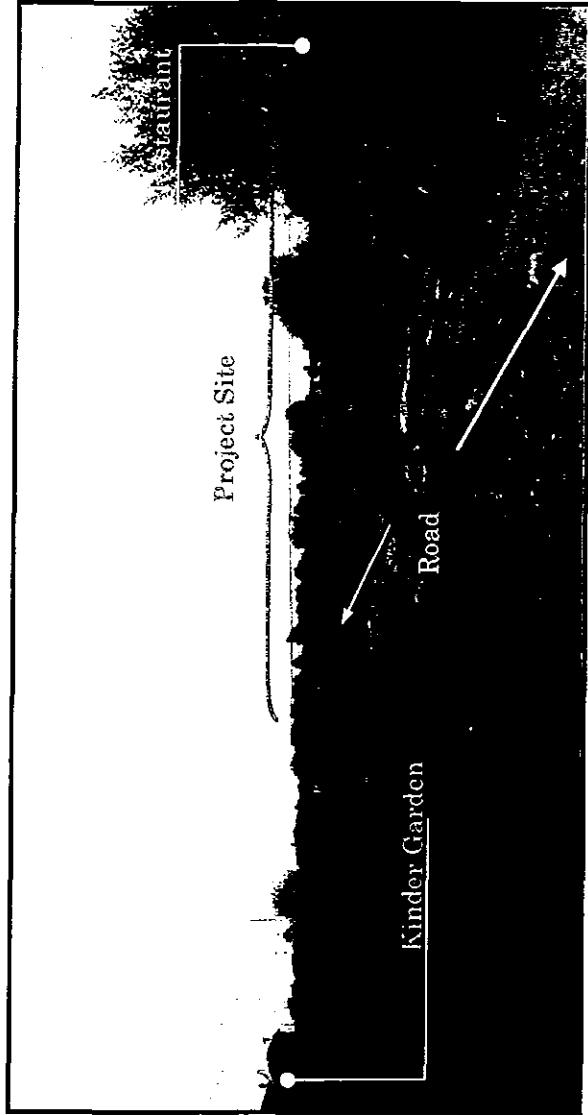


Photo-2 Codrington Site

Photo of Codrington Site No.2

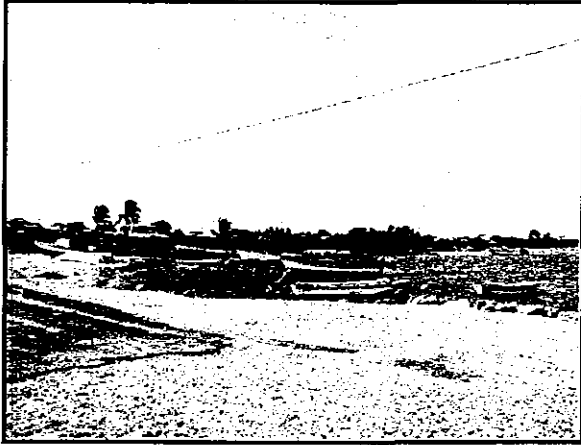


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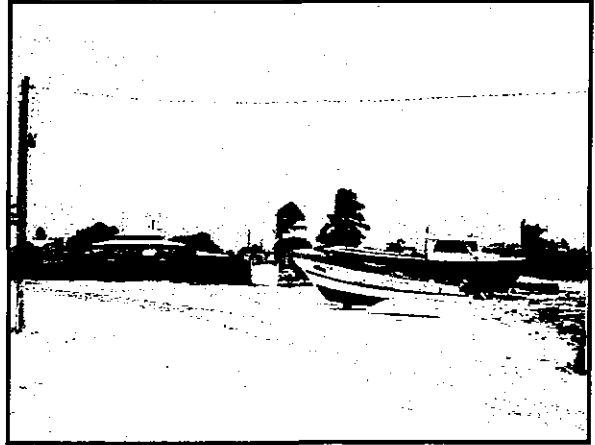


Photo-5 Landing Beach



Photo-6 Preparation work

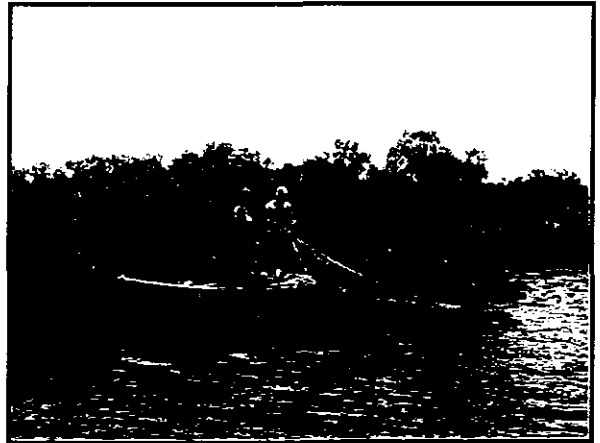


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Photo-8 Making fish trap



Photo-9 Preparation work of fish trap



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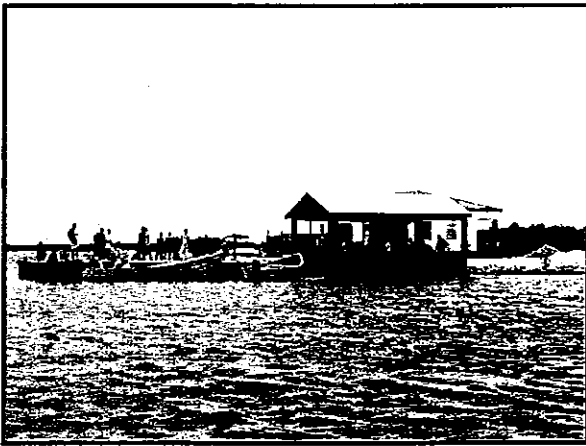


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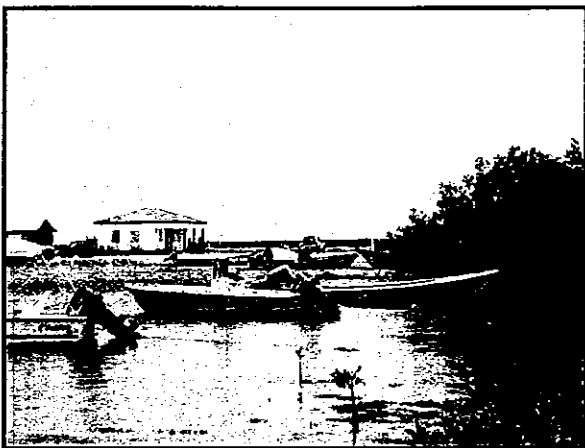


Photo-14 Mooring situation in front of the Site

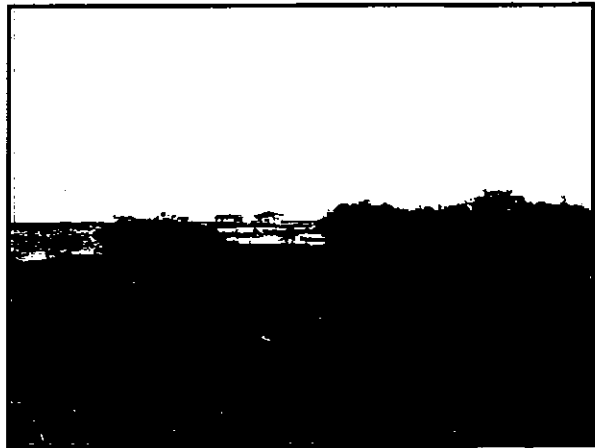


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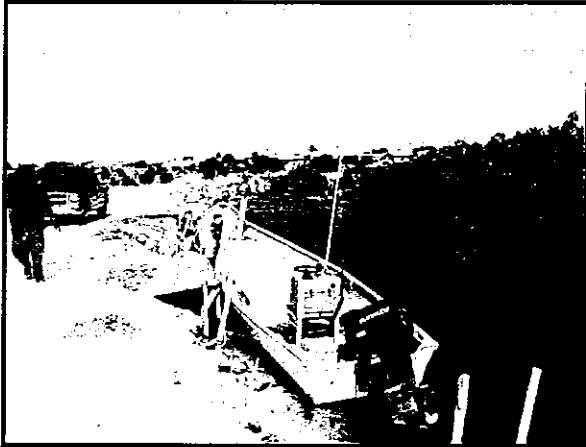


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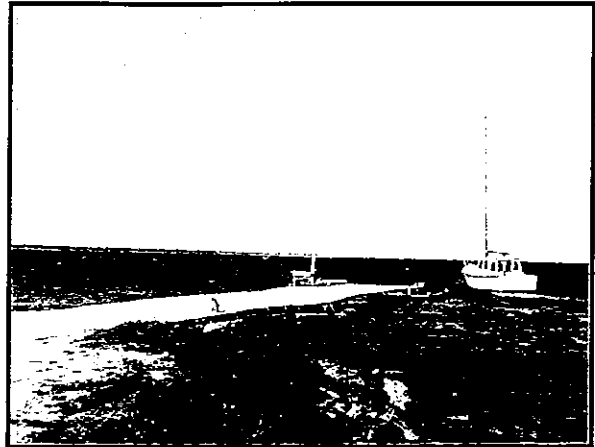


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Photo-20 Cargo vessel between Barbuda
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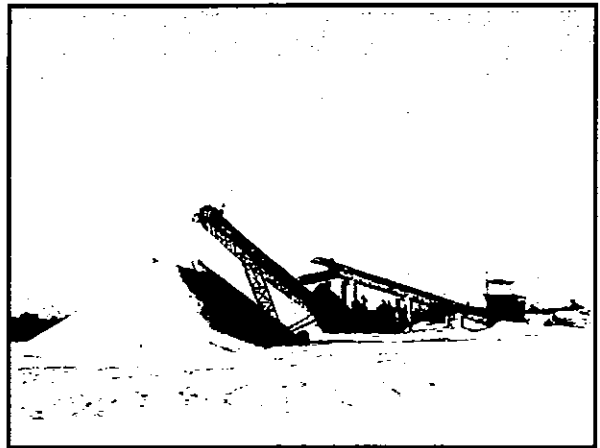


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ABBREVIATIONS

AEP	Acryl Emulsion Paint
AFL	Antigua Fisheries Ltd.
APUA	Antigua Public Utilities Authority
BOD	Biochemical Oxygen Demand
CIDA	Canadian International Development Agency
CARICOM	Caribbean Community
CSF	Caribbean Sea Food
CSME	Caribbean Single Market and Economy
CUBIC	Caribbean Uniform Building Code
CB	Concrete Block
DCA	Development Control Authority
D.L.	Datum Level
E/N	Exchange of Note
EP	(Synthetic Resin) Emulsion Paint
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FRP	Fiver Reinforced Plastic
GDP	Gross Domestic Product
HACCP	Hazard Analysis and Critical Control Point
H.W.L	High Water Level
JICA	Japan International Cooperation Agency
JIS	Japan Industry Standard
KVA	Kilovolt Ampere
Loa	Length overall
L.W.L	Low Water Level
M.W.L	Mean Water Level
OECS	Organization of Eastern Caribbean States
pH	Potential of Hydrogen
PVC	Poly Vinyl Chloride
WFM	White Fish Market
USGS	United States Geological Survey
VP	Vinyl Paint

Summary

Summary

Antigua and Barbuda is a small island nation with a national land area of 442 km² located in the Leeward Islands on the north of the Lesser Antilles in the Eastern Caribbean. It is a country established through tourism belonging to a hot dry subtropical climate that is relatively mild despite its average yearly temperature of approximately 27°C. However, the country is also located in the usual path of hurricanes that develop in the vicinity of the equator in the Atlantic Ocean, and routinely suffers damage to its social infrastructure including fisheries infrastructure.

The country's economic activities are largely dependent on the service industry, centered on the key industry of tourism, which represents approximately 78% of the GDP of US\$7,970 (2002) per capita. After the country gained its independence in 1981, the economy of Antigua and Barbuda continued to progress smoothly throughout the 1990s. Despite this, the economy remains very sensitive to the economic trends of developed countries and effects of natural damage caused by events such as hurricanes.

Therefore, Antigua and Barbuda has formulated a ten-year national development plan with emphasis on improving the nature of the economy that is now dependent on tourism, achieving sustainable economic development, industrial diversification, and redistribution of socioeconomic benefits. The development plan recognizes the importance of the fishing industry, representing approximately 3.8% of the GDP, as a sector that is an important means for promoting economic development and encouraging independence in the people of the country and one that will contribute to industrial diversification in the context of the plan.

The four issues that are particularly important in the fisheries sector are: 1) improvements to fishery infrastructure, 2) utilization of untapped resources, 3) improvements in fish processing technology, and 4) strengthening of the distribution network. Based on the country's needs, the Fisheries Agency of the Ministry of Agriculture, Forestry and Fisheries of Antigua and Barbuda has formulated a five-year Fishery Development Plan with the basic principle of contribution of the fisheries sector to the national economy, and aims to further promote advancement of the fishing industry by maximizing the sustainable use of marine resources. The basic outline of that plan includes: 1) enhancement of unloading and distribution facilities in order to improve the handling of marine products, 2) reduction in imports through the appropriate development of marine resources, 3) strengthening of artisanal fishermen activities through improvements in fishing work, 4) quality improvement of marine products, 5) provision of protein by increasing catches of fish, and 6) increase in

fishery-related employment opportunities and increase in income.

The fishing industry of Antigua and Barbuda is a small-scale artisanal fishing industry and its activities are carried out using small- and medium-sized fishing boats by 1,040 fishermen (659 fishing boats) who mainly fish with nets and baskets to catch such marine products as lobster and bottom fish in the 3,500 km² shallow water continental shelf that is located in the vicinity of the islands of Antigua and Barbuda. The annual catch volume has been increasing at an average rate of 2.2% annually since 1995 and reached 1,824 tons/year in 2001, and the country has a high average annual consumption per capita of approximately 31.8 kg/year, or 2.2 times the world average. Furthermore, according to forecasts by FAO, the domestic demand for marine products will increase from 2,422 tons in 2001 to reach 3,390 tons in 2016. The domestic demand also includes the volume of imports and exports with other countries, and therefore while the country mainly exports live lobsters (412 tons in 2001) to the French Caribbean (islands including Martinique and Guadalupe) it is currently forced to rely on the import of approximately 48% of the marine products it consumes or 1,251 tons, including cured products (2001), in order to meet the domestic demand for marine products. On the other hand, in fish exports, the EU and the U.S. have pointed out management issues in terms of product quality and health and sanitation, the country is currently unable to export marine products.

For unloading areas, there are 35 naturally good ports in the country utilizing tranquil areas that have complicated capes and bays. However, there are a few unloading areas that have developed fishing facilities in Antigua and Barbuda

Meanwhile, it is vital to improve the catches of fish and distribution in Antigua and Barbuda in order to meet the numerous safety, sanitary and quality demands of the tourists from the EU and the U.S. In addition, with the shift to CARICOM Single Market and Economy (CSME: a single market created to liberalize trade, investment, and financial transactions among 12 Caribbean countries, including Antigua and Barbuda) starting in 2005, there is a demand for improving quality standards and the safety of marine products in order to strengthen the competitive power of exports among Caribbean countries.

Given the above context, Antigua and Barbuda has called on Japan for Grant Aid Cooperation in order to formulate a plan for the construction of a marine product development center where advanced processing, fishery training, and studies can be carried out in order to increase the production of healthy and sanitary marine products that are of a high value, while continuing to safeguard against over fishing through effective fishery management, and to develop the

two planned sites of Point Wharf Landing Site and Codrington Landing Site that are the largest bases for fishing activity on both islands.

With this request, the Japanese government conducted a preliminary study in February 2002 to clarify the items in the request that were the most important and to define the scope of possible cooperation from Japan. As a result of the study it became clear that the item of highest priority was improving the distribution of the artisanal fishermen's marine products, and a decision was made at the preliminary study stage to suspend request components including the marine product development center, the community center for the fishermen, and the retail area. At the same time, since there is no control on basic data showing the actual conditions of fishing activities and marine product distribution at the two sites, it was determined that it was necessary to gain an understanding of those actual conditions by conducting a baseline study as well as to reconfirm the necessity, urgency, and relevance of the request details.

Through this process, the Japanese government decided to conduct a basic design study and dispatched study teams to the project sites as follows:

Basic Design Study: June 29 – August 8, 2003

Explanation of Draft Basic Design: December 13 – 24, 2003

Through the local study of the basic design study, the following actual conditions were confirmed at the two project sites.

The Point Wharf Landing Site on Antigua is at the center of waterfront tourism and is the largest fishing base (76 registered fishing boats, 127 registered fishermen) in the country, located in a central area of the capital of St. John's. Approximately 300 tons of fish are landed annually to supply not only local consumers, but also meet the demands of hotels, restaurant, and other areas of the tourism industry. There used to be an office of Fisheries Agency here and had long been recognized as the base for distribution of marine products as well as for fishery administration. However, the area has lost its function as a base due to repeated hurricane damage to and aging of the fishery facilities including the pier and the buildings of Fisheries Agency. Moreover, the damage to the fishery facilities has become a major obstacle to the distribution of catches as it has greatly reduced the function of the fishing port. Also, since there are no health, sanitary inspection facilities at Point Wharf, it is unable to correspond with the strict demands of consumers who place a great deal of value on product quality.

Meanwhile, the Codrington Landing Site on Barbuda is a natural landing site located in a tranquil tideland in a closed-off section of the bay and the largest fishing base (76 registered fishing boats, 127 registered fishermen) on the

country (the third largest in the country). With the exception of government employees and tourist agents, nearly all of the 1,500 residents of the island are people working in the fishing industry or relatives of those people, and live in the Codrington area. Since most of the development investment in Antigua and Barbuda has been concentrated on Antigua thus far, distribution facilities such as ice-making and ice-storage facilities have not been developed. As a result, despite the fact that the area is surrounded by good fishing areas, there is a chronic shortage of fresh fish on the island and there are major constraints on the distribution of marine products to Antigua and the St. John's area where there is a great demand from the tourism industry.

Based on the results of the study described above, the plan aims to provide healthy, sanitary and high value marine products by improving the distribution system for marine products and developing marine product infrastructure and facilities in order to not only resolve problems at the project sites but also to help cope with the problems faced by the development plan and the marine product sector. To do so, it will improve distribution inside and outside of Barbuda through the development of marine product distribution facilities at the Codrington Landing Site and at the same time it will develop facilities to improve marine product distribution on Antigua through the construction of marine product processing facilities at the Point Wharf Landing Site that restore the fishing port function that has been lost, improve the health and sanitary product quality of catches.

However, due to constraints in project costs and in efficiency of carrying out the work (procuring equipment and materials, construction timeframe, etc.), it has been decided that it would be advisable to carry out the work in stages, and rather than carry out the work at both sites simultaneously. Project at Codrington is examined whether implement or not according to the operating situation of distribution facilities at Point Wharf.

Given the above, the basic design study concluded that Point Wharf Landing Site will be developed as a base for the distribution of marine products, giving priority to the development of facilities with a focus on the seven items below.

- 1) Develop a distribution base to receive catches from outlying residents and Barbuda
- 2) Develop facilities to supply a healthy, sanitary and safe catch to meet the needs of the tourism industry and consumers
- 3) Establish a mooring facility for fishing boats in order to improve the safety of fishing boats in St. John's port

- 4) Refurbish and repair lost fishing infrastructure (pier and revetment)
- 5) Clarify the use of land for fishing activities and establish areas for various operations
- 6) Develop an area for repairing fishing boats and engines and establish an evacuation route for fishing boats to use during emergencies (hurricanes)
- 7) Reestablish management functions and create a space for communication

Following is an outline of the facilities and equipment to be provided at the Point Wharf Landing Site under the plan study, to be provided by two stages. The overall timeframe required for the project will be one year and four months (16 months) including the detailed design. Project costs are estimated at 972 million Japanese Yen for Japan side and 3 million Japanese Yen for the recipient country side.

Details of Planned Facilities and Equipment

(1) Civil engineering facilities

Stage	Facility name	Scale	Details of plan
First construction stage	Wharf	Extension: 30m Construction: gravity type (concrete block type)	Crown height: D.L.+1.1m
	West Revetment	Extension: 48m Construction: rubble-mound type (with landing)	Crown height: D.L.+1.1m
	Revetment (West side of slipway)	Extension: 22m Construction: Concrete block type	Crown height: D.L.+1.1m
	Land reclamation	2,400m ³	Ground height: D.L.+1.1m
	Removal of obstructions	160m ³	Removal of existing revetment
Second construction stage	Wharf	Extension: 38m Construction: gravity type (concrete block type)	Crown height: D.L.+1.1m
	East Revetment	Extension: 72m Construction: rubble-mound type (with landing)	Crown height: D.L.+1.1m
	Revetment (east side of slipway)	Extension: 38m Construction: Concrete block type	Crown height: D.L.+1.1m
	Slipway	Without rails: 10m×17m≒ 170 m ² With rails: 10 m ×45 m ≒450 m ² Slope: 1:8	Crown height: +1.1m Front wall Crown height: Without rails:-1.0m With rails:-2.5m

(2) Constructed Facilities

Stage	Facility name	Scale	Details of plan
Second construction stage	Processing Plant Building	Area: 360 m ² Reinforced concrete structure (one story, independent footing)	Exterior walls: Sprayed acrylic emulsion stucco coating Roof: Trapezoid type colored metal sheet roof Floor height: 0.5m Building height: 7.0m
	Administration office building (Hygienic laboratory and meeting hall annex)	Area: 1 st floor 316 m ² 2 nd floor 311 m ² Total: 627 m ² Reinforced concrete structure (one story, independent footing)	Exterior walls: Splayed acrylic emulsion stucco coating Roof: Trapezoid type colored metal sheet roof Floor height: 0.5m Building height: 7.9m
	Work shop and fishing gear locker building	Fishing gear locker portion: Area 243 m ² Reinforced concrete structure Work shop area portion: Area 81 m ² Reinforced concrete structure	Exterior walls: Splayed acrylic emulsion stucco coating Roof: Trapezoid type colored metal sheet roof Floor height: 0.2m Building height: 5.7m
	Boatyard	Area: 380 m ²	Concrete pavement
	Other, exterior	Area: 11000 m ²	Compound roads: asphalt pavement Fishermen parking lot: bulldozing only Fishing gear repair yard: grass

(3) Provided Equipment and Materials

Stage	Facility name	Scale	Details of plan
Second construction stage	Equipment and materials for hygienic laboratory	See equipment and materials list	See Laboratory Unit list (A, B, C, D, E, F)
	Equipment and materials for processing plant	See equipment and materials list	See Processing Unit list (G, H, I)
	Equipment and materials for meeting hall	See equipment and materials list	See Administration Unit (J)

The following impacts are anticipated as a result of implementing the plan, and it is therefore considered to be relevant and meaningful as a Grant Aid Cooperation project.

【Direct Impacts】

- (i) Repairs and improvements to the landing pier will improve the efficiency of work such as landing catches and will reduce the workload of the fishermen. This will also improve the efficiency of loading and unloading everyday goods to and from Barbuda.
- (ii) Repairs and improvements to the landing pier will improve the

distribution system for receiving from Barbuda where there are good fishing grounds.

- (iii) Repairs and improvements to the revetment will enable safe mooring and efficient preparations for going out to fishing, will improve the efficiency of fishing activities, and will reduce the workload of the fishermen.
- (iv) Providing a hygienic laboratory will establish a function for sanitary management.
- (v) Providing a processing plant that complies with international standards (HACCP) will make it possible to supply healthy, sanitary and good quality catches. In particular, it will become possible to offer healthy and sanitary catches to meet the high demands of the tourism industry (hotels, restaurants, cruise ships).
- (vi) Through provision of (iv) and (v) above will meet the conditions required to resume exports to the U.S. and the French Caribbean (including islands such as Martinique and Guadalupe) areas to which it has not been possible to export marine products until now.
- (vii) Providing of a slipway and an area for repairing boats and engines will make it easier to repair fishing boats and engines, the assets of the fishermen, greatly improving the fishermen's convenience. It will also make it possible to lift up fishing boats for repair at a low cost and will reduce the financial burden on the fishermen.
Provision of these facilities will also establish a safe evacuation route for fishing boats during hurricanes, which will safeguard the fishermen's assets (the fishing boats).
- (viii) Providing a meeting hall will increase the opportunities for courses taught by the Fisheries Agency staff on resource management, fishing gear and methods, and engine repair, and will modernize the fishing industry.
- (ix) Providing fishing gear lockers for fishermen will enable fishermen to safeguard their assets such as fishing gear. Moreover, it won't be necessary to take their gear home and this will reduce the workload of the fishermen.

【Indirect Impacts】

- (i) The work environment of the fishermen and other people working in the fishing industry will be greatly improved.
- (ii) The work environment in the Point Wharf Site will be improved and it will be possible to then cultivate a fisherman's wharf and other parts of the tourism industry, as well as other industries linked with the marine product sector and the related employment opportunities will be increased.
- (iii) By achieving smooth communication between fishermen and the Fisheries

Agency, it will become possible to smoothly carry out fishery administration, and will promote the marine product sector. In addition, this will encourage organization of the fishermen and will help to secure benefits for the fishermen.

Following the completion of construction under the plan in order to ensure the efficient use of the landing facility, the fishing port management facility, and the processing plant facility and in order to resolve any problems related to the fishing port facilities at Point Wharf in terms of management and operation of the facilities, it is recommended that the implementing organization, the Ministry of Agriculture, Lands and Fisheries, and the organizations that directly carry out the management and operation of the facilities, the Fisheries Agency and the AFL (Antigua Fisheries Limited) take into careful consideration the following points: 1) establishment of a operational framework and the securing of needed staff and an operating budget, 2) education and training for the fishermen, 3) operation of the hygienic laboratory, 4) cooperative activities between the inspection laboratory at the Agriculture Agency and the inspection laboratory at the Fisheries Agency, 5) operation of the processing plant, 6) conservation of marine product resources and sustainable use, and 7) maintenance of the fishing port facilities.

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Chapter 1

Background of the Project

Chapter 1 Background of the Project

1-1 Background of the Project

The GDP per capita of Antigua and Barbuda has reached nearly US\$7,970 (2002), with the services and the agriculture industry representing 78% and 3.8% of the GDP respectively. The economy of the country is centered on the tourism industry and is very sensitive to the economic trends of developed countries and the effects of damage caused by natural disasters such as hurricanes. Due to the destruction caused by Hurricane Luis the country's year-on-year GDP growth in 1995 was negative, at a rate of -2.09%. Also, following the 2001 terrorist attacks in the U.S., the tourism and transportation sector recorded a negative growth of -3.66%. Consequently, the country has formulated a national development plan that focuses on sustainable economic development, improving the nature of the economy that is now dependent on tourism through industrial diversification, and a redistribution of socio-economic benefits. The plan recognizes the fishing industry as having great potential as a means to encourage economic development and the independence of the country's citizens, while utilizing the country's resources.

The per capita consumption of marine products in the country is 2.2 times the world average, at 31.8kg/year (FAO Fisheries Department). Barbuda exports marine products including live lobster to the French Caribbean islands (Martinique and Guadalupe), but the country imports nearly 48% of the marine products it consumes, and it is an important national goal to reduce imports.

Meanwhile, the fishing industry is faced with the challenges of promoting artisanal fishery through improvements in catch and distribution to meet the safety and quality needs of tourists, who are mainly from E.U. and U.S.A.. At the same time, Antigua and Barbuda are now under increasing pressure to take on the increased competition for fish marketing that will arise among the Caribbean countries with the shift in 2005 to a Caribbean Single Market Economy (CSME: a single market created to liberalize trade, investment, and financial transactions among 12 Caribbean countries, including Antigua and Barbuda).

Given the above context, the country requested to the Government of Japan for Grant Aid Assistance in order to formulate a plan for the construction of a Fishery Development Center where advanced processing, fishery training, and studies can be carried out in order to increase the production of healthy and sanitary marine products that are of a high value, while continuing to safeguard against overfishing through effective fishery management.

The details of the request included four main goals: 1) improvements in distribution including the development of facilities and ice-packing at the production site in order to support artisanal fisheries, 2) construction of distribution facilities for retail sales and consumers of marine products, 3)

construction of a Fishery Development Center where advanced processing and fishery training can be carried out and where studies on fishery resources can be conducted, and 4) construction of a center for fishermen with the aim of supporting the welfare of fishermen. The request details, however, covered such a broad range that the relationship between the goals and the request details was unclear. For that reason, in February 2002, the Government of Japan conducted a preliminary study in order to clarify the items in the request that were the most important and to define the scope of possible cooperation from Japan. Through this study it became clear that the item of highest priority was improving the distribution of the marine products taken by artisanal fishermen.

From the results of the preliminary study it was found that nearly all of the 1,500 residents of the island of Barbuda live in the Codrington region and that the Codrington Landing site, the largest in terms of both fishermen and fishing boats, is close in proximity to good fishing grounds around the island. It was also ascertained that although this is very productive region for lobster and other high-value products, the quality of such products cannot be maintained due to lack of ice-making and storage facilities. This was found to be a major constraint in terms of consumption of products on the island and in distribution of marine products to the St. John's region of Antigua Island where there is a high consumer demand.

Meanwhile, the Point Wharf landing site, the area with the largest number of fishing boats in St. John's (largest also in Antigua and Barbuda), has long been recognized as the base for unloading and distribution as well as for fishery administration because there used to be an office of Fisheries Division in the past. However, the area has lost its function as a base due to repeated hurricane damage to and aging of the fishery facilities including the wharf and the buildings of the Fisheries Division. The extreme damage to the fishery facilities has become a major obstacle to the distribution of catches as it has greatly reduced the function of the fishing port. Moreover, the study discovered that since Point Wharf, Antigua's distribution base, does not have healthy and sanitary inspection facilities, it is unable to correspond with the strict demands of consumers who place a great deal of value on product quality.

Given the above context, the plan study investigated the provision of facilities with the goals of reestablishing the lost fishing port function of the Point Wharf Landing site, and improving the distribution of Antigua's marine products through the construction of a marine product processing facility that will improve the sanitary and quality of catches, improving distribution off of the island through the construction of distribution facilities at the Codrington Landing site of Barbuda.

Note that the preliminary study has confirmed that the plan will not include the components of a Fishery Development Center, a fishermen's community center, or a retail area.

The following table lists the details of the original request and the details that were confirmed through the preliminary study.

Table 1-1 (1) Request Details

Plan Area	Details of original request	Request details following preliminary study discussions
Point Wharf Landing site	(1) Marine product development center	
	• Administrative office wing	-
	• Research and development wing (including various laboratories)	• Hygienic laboratory
	• Boat repair area	• Boat and engine repair area
	• Slipway	• Slipway
	• Fishing gear repair area	• Fishing gear repair area
	• Fishermen's center (storehouse for fishing gear)	• Fishing gear lockers
	• Fishermen's center (meeting hall)	• Meeting hall
	• Fish market wing (including processing and ice-making equipment)	• Processing area
	• Unloading pier	• Wharf
	• Improvements to drains and paving	-
(2) Equipment and materials (survey vessels, instruments, tools, and market equipment and materials)	-	
Codrington Landing site	• Land reclamation	-
	• Slipway	-
	• Winch	-
	• Boat yard paving	-
	• Workshop	-
	• Fishery operators' hall	• Meeting hall
	• Ice-making equipment	• Ice-making equipment/icehouse
	• Storehouse for fishing gear	• Storehouse for fishing gear
	• Emergency power generator	• Power generator
	• Exterior (including parking lots)	• Parking lots • Toilets • Water storage tank
		• Sorting area
		• Administrative offices
		• Fishing gear selling area

1-2 Situation of the Project Sites

1-2-1 Natural Conditions

(1) Meteorological Conditions

We collected past local meteorological data at the Antigua Airport (V. C. Bird International Airport) Meteorological Office.

1) Wind Direction and Wind Speed

Table 1-2-1(1) gives the mean wind speed and predominant wind directions for the each month. The island is in the low latitude zone (northeastern trade winds zone), and the annual mean wind speed is approx. 6 m/s. The predominant wind direction is E~ESE. In Barbuda Island there is no wind observation station, but Barbuda Island is located in almost same latitude and longitude of Antigua Island. Therefore wind condition is considered same as Antigua Island.

Table 1-2-1(1) Monthly Mean Wind Speed and Wind Direction(1998~2002)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
M. Wind	12.1	11.8	11.8	12.2	12.6	13.5	13.8	12.3	9.5	10.1	9.8	11.4
M. Wind (m/sec)	6.2	6.1	6.0	6.3	6.5	6.9	7.1	6.3	4.9	5.2	5.1	5.9
Direction	E	ESE	ESE	ESE	ESE	ESE	ESE	E	ESE	ESE	ESE	E

Source : Antigua Air Port Meteorological Office

2) Air Temperature

The difference between the annual mean high and mean low in air temperature is small like 3-5 degrees, and the mean high is above 30 degrees from June to October. It goes below 30 degrees from November to May, but the temperature differential is not very big (see Table 1-2-1(2)).

Table 1-2-1(2) Monthly Mean Temperature (°C)(1998~2002)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
M. Max.	28.2	28.3	28.6	29.2	29.8	30.5	30.7	30.9	30.7	30.4	29.5	28.6
M. Min.	22.3	22.1	22.5	23.3	24.3	25.3	25.4	25.4	24.8	24.3	23.7	22.8
Max. Temp	31.0	31.0	33.0	32.0	33.0	33.0	34.0	33.0	33.0	33.0	32.0	31.0
Min. Temp.	17.0	17.0	18.0	18.0	20.0	22.0	21.0	22.0	21.0	20.0	19.0	16.0
Mean Temp.	25.2	25.2	25.6	26.2	27.1	27.9	28.1	28.2	27.8	27.3	26.6	25.7

Source : Antigua International Air Port Meteorological Office

3) Humidity

The mean humidity for the whole year is high and almost constant like 73-81% (see Table 1-2-1(3)).

Table 1-2-1(3) Monthly Mean Humidity (%) (1998~2002)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave.Hum	75	73	73	81	77	75	76	76	77	78	77	77

Source : Antigua International Air Port Meteorological Office

4) Precipitation

The monthly mean precipitation is above 100 mm from September to November when is hurricane season, and it is particularly high precipitation in Antigua Island. (Table 1-2-1(4)).

Table 1-2-1(5) shows precipitation at Spring View Hospital in Barbuda Island. The tendency of precipitation is almost same as Antigua Island. The monthly mean precipitation is above 100mm from September to December.

Table 1-2-1(4) Monthly Mean Precipitation (mm) at V.C.Bird Air Port (1960~2002)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.Monthly Pre	160	111	180	199	460	193	244	278	410	357	588	221
Min.Monthly Pre	18	10	8	12	8	6	14	34	28	12	23	26
M. Monthly Pre	57	39	44	66	101	52	84	96	129	125	134	87

Source : Antigua International Air Port Meteorological Office

Table 1-2-1(5) Monthly Mean Precipitation (mm) in Barbuda (1960~2002)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.Monthly Pre	99	130	117	213	196	292	175	284	254	328	671	290
Min.Monthly Pre	20	0	0	10	3	31	25	25	10	58	43	0
M. Monthly Pre	55	53	40	79	61	68	91	85	106	157	166	100

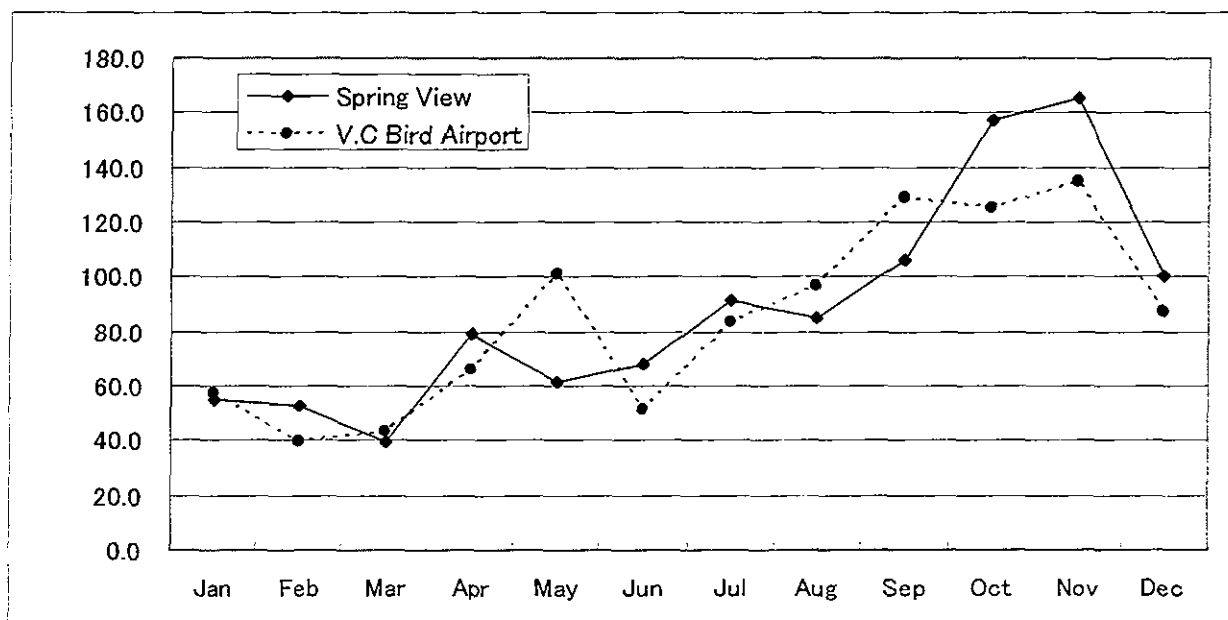


Figure 1-2-1(1) Precipitation of Antigua Island and Barbuda Island

5) Hurricanes

Information on hurricanes was collected from the airport weather station at Antigua's V.C. Bird International Airport and the U.S. National Hurricane Center (NHC).

In particular, at the time of approach of Hurricane Luis in 1995 (10:30 hours on September 5) the mean wind speed was 105 kn. (about 54 m/s), the maximum wind speed was 127 kn. (about 65 m/s), and total precipitation was 254 mm. As for Hurricane Lenny in 1999, its course was not the same as the usual ones. She was born in the Caribbean and moved eastward across it. When she approached Antigua and Barbuda her mean wind speed was 30 kn. (about 15 m/s), her maximum wind speed was 50 kn. (about 26 m/s), and her precipitation was recorded at 241 mm.

According to the interview, at the time of approach of Hurricane Luis to Antigua and Barbuda, water caused by storm surge had risen up to the road behind the Point Wharf area. In Barbuda Island two parts of sand dune of Codrington Lagoon had been washed out by the wave attack, the construction site area was flooded by storm surge.

(2) Sea Conditions

1) Wave

St. John's Bay located on the west side of the island of Antigua is very calm because of shielded from predominant wind direction from E to ESE.

2) Tide

(a) Point Wharf

The result of Harmonic Analysis at Parham and Urlings site carried out on the basic design on "the project for the rehabilitation of the artisanal fishery" was just about matching the figures for the four main component tides (St. Johns) shown in the "Admiralty Tide Tables, Volume 2, 2000". Therefore, we use the following value mentioned in the Admiralty Tide Tables.

M.H.H.W.	+0.41m
M.S.L.	+0.31m
M.L.L.W.	+0.21m

(b) Codrington

Tide gage was installed at Codrington site in the sea and tide level was observed during 17 days. The result of the observation is as follows.

M.H.H.W.	+0.39m
M.S.L.	+0.31m
M.L.L.W.	+0.23m

3) Tidal Currents

At St. John's Bay the tides have little influence on currents because tidal fluctuation is small there.

Tidal current at Codrington area is also very small because of locating in back of the lagoon.

4) Storm Surge

Abnormal tide will be occurred at the time of approach of hurricane. From the result of wave height estimation of Hurricane Luis, the abnormal tide level will rise up D.L. +1.00m. Therefore, floor level of buildings will be considered not affected by the abnormal tide at Point Wharf and Codrington sites.

(3) Study of Land Topography and Seabed Topography

The land topography survey in land and offshore area at Point Wharf site was carried out and the land topography survey carried out at Codrington site, the results are shown in Figures 1-2-1(2), (3) and (4).

Regarding the seabed topography of the Point Wharf site, the water depth in front of the existing broken wharf and revetment is shallow because concrete blocks and stones fallen down in the sea.

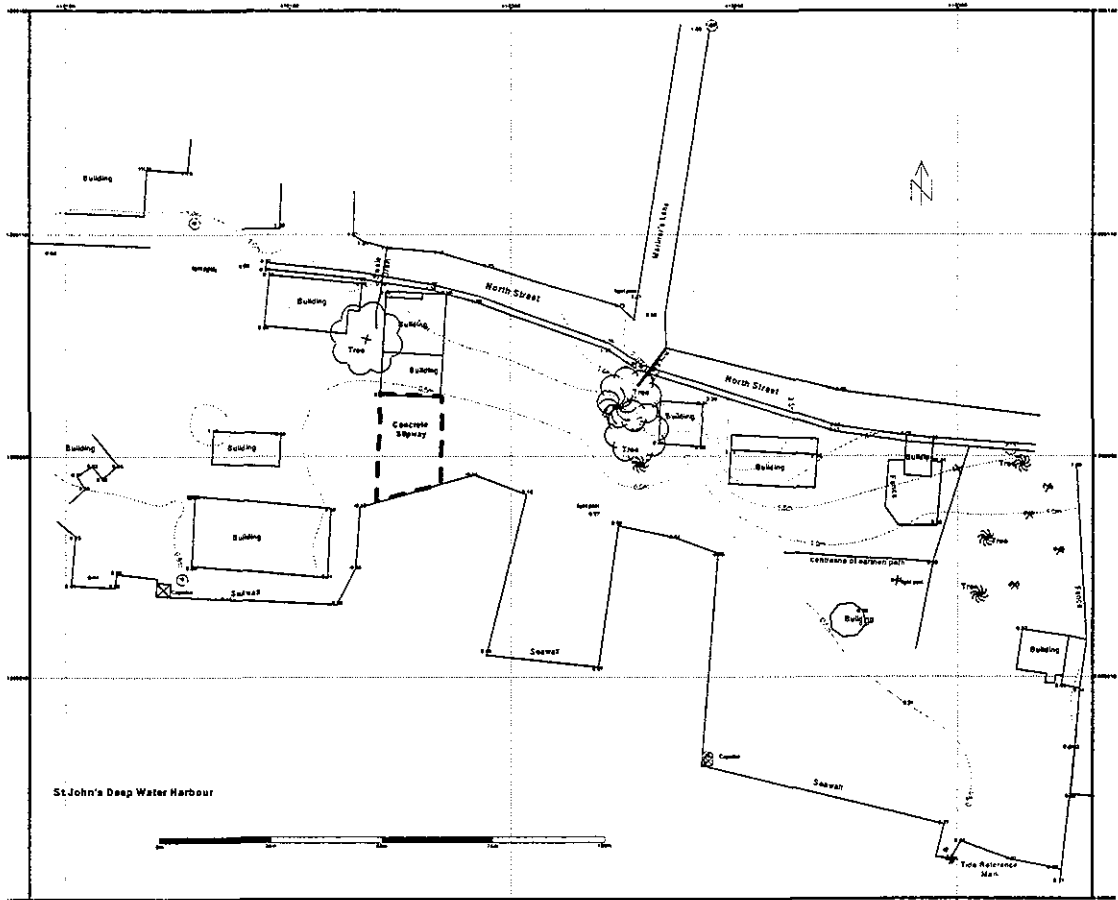


Figure 1-2-1(2) Topography of Point Wharf Site

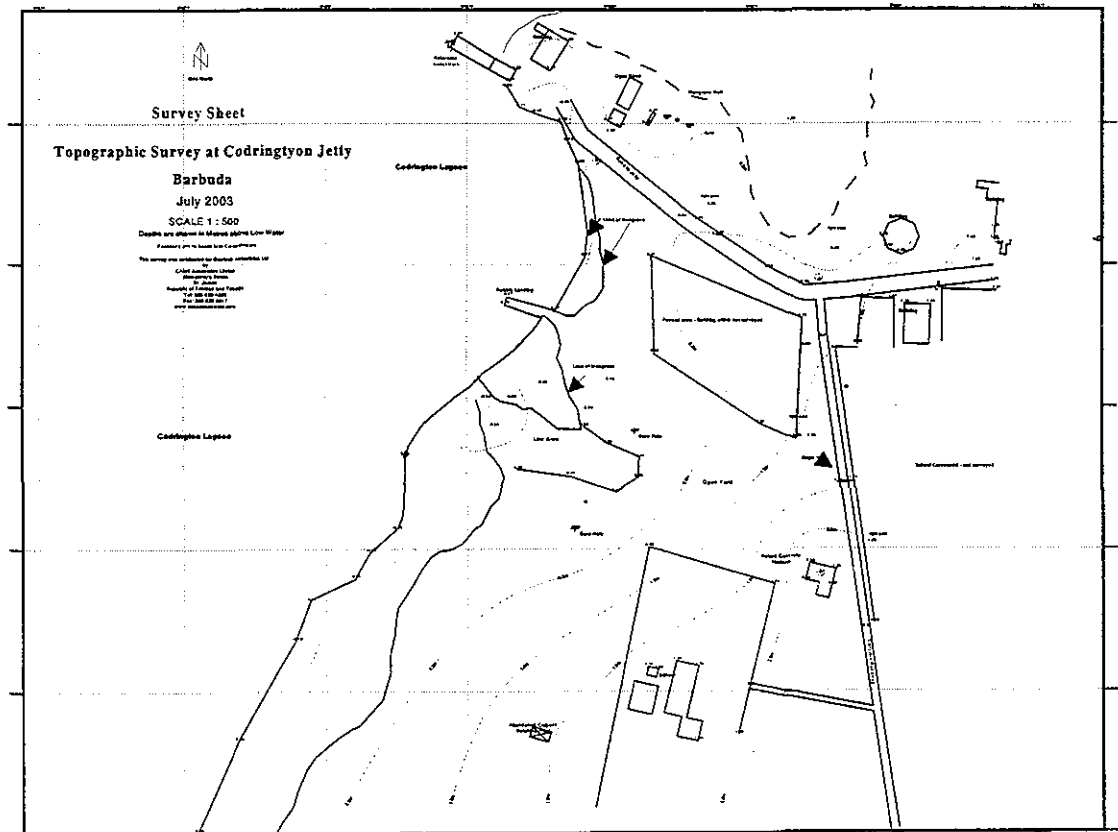


Figure 1-2-1(3) Topography of Codrington Site

(4) Soil Condition

The soil investigation was conducted by marine borings and land borings at the both sites. The vertical section results of the boring survey are shown in Figures 1-2-1(5) and (6). The soil conditions of the project sites as based on those survey results can be described as follows.

«Point Wharf»

Under the sea there is a gravel layer with a thickness of 2.0 m from the seabed. From the depth of 2.0m to 7.0m, there is a dense silt and silty sand layer with N value of 40. The bedrock appears under depth of 7.0m to 11m. On land there is a layer of sand with gravel in the shallow ground near the surface that has a thickness of 2.0 m, and under this sand layer there is a hard dense silty sand layer and N value of over 40.

«Codrington»

Surface of the land is covered by soil with thickness of 0.5m to 1.0m. Under the surface soil, Coral rock appears.

(5) Sea Bottom Materials Analysis

Six samples of sea bottom materials were taken from seabed offshore of Point Wharf site, the results are shown in Figure 1-2-1(7).

At sampling points SQ 6, 7 and 8 far from coast line silt and clay represents a comparatively high percentage more than 50% of the total composition. On the other hand, at sampling points SQ 4, 5 and 6 sand represent small quantity.

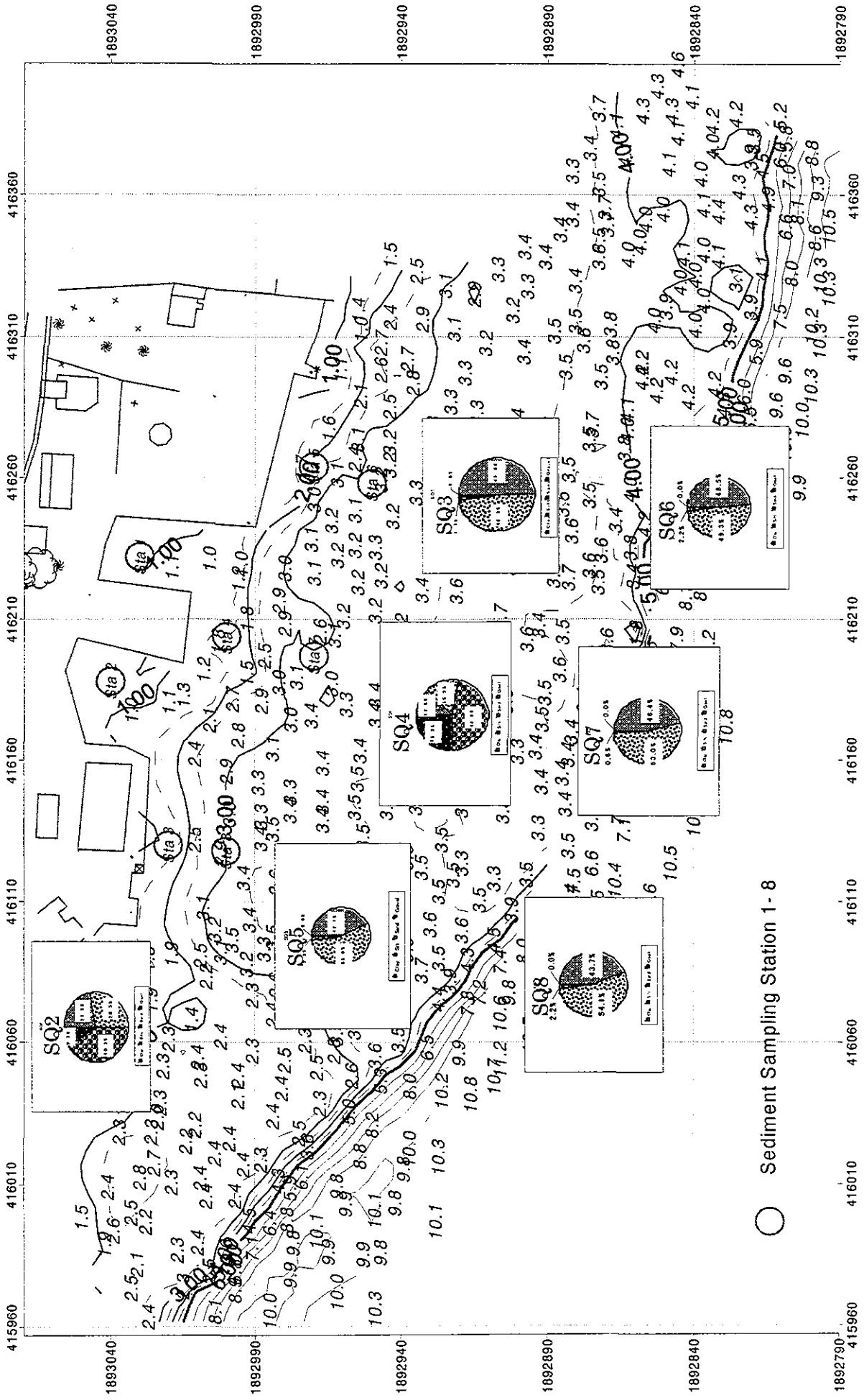


Fig.1-2-1(7) Result of Sea Bottom Material Analysis at Point Wharf

(6) Water Quality Analysis at Condition

Water Quality Analysis of city water of Codrington was carried out. The result of the Analysis is shown in Table1-2-1(6). Salinity and M. alkalinity (CaCO₃) is very high. Ammonium-nitrogen is not detected.

Table 1-2-1(6) The Result of Water Quality Analysis

Analysis Item	Result	Japan Water Standard	Antigua Standard	Japan Society of Refrigeration and Air Conditioning Engineer's Standard
Water Temperature	28.9°C			
Turbidity	0.26 degree	< 2degree	<5degree	
pH	7.23	5.8~8.6	>6.5	
DO	1.41mg/l			
SS	18.35 mg/l			
Viable Bacteria (CFU/100ml)	<1	<100/1ml		
Ammonium-Nitrogen	Not detect			<0.3mg/l
Phosphorus	0.07mg/l			
Salinity	1,296mg/l		<3mg/l	<50mg/l
DDT	<0.05µg/l			
Magnesium Ion	91.44mg/l	<300mg/l		
M Alkalinity(CaCO ₃)	1235.8 mg/l			<50mg/l

(7) Earthquakes

Earthquake data obtained from the U.S. Geoseismic Information Center (USGS) was sorted out with respect to past earthquakes in the Caribbean Sea area.

The island of Antigua is located near the boundary between the Caribbean plate and the North American plate and in an old volcanic belt.

According to the earthquake record, 4 earthquakes over magnitude 5.0 occurred between 1990 and 1999 near Antigua Island. The one with a magnitude of 7.5 that occurred on October 8, 1971, (epicenter: north latitude 17.3 degrees, west longitude 62.0 degrees; depth of center: 47 km) is reported to have caused damage on Antigua, including destruction of a part of a church building in St. Johns. (refer to appendix-6)

1-2-2 Current Situation Regarding the Fishing Industry at Project sites

(1) Fishing in the vicinity of the Point Wharf landing site

1) Fishing base

Near St. John's, the largest city in Antigua and Barbuda and the location of the seat of government, there are four landing sites: Point Wharf, Market Wharf, Keeling Point and High Street. Of these, only the Market Wharf landing site, which was developed in 1997, has been constructed as a fishing port, and functions as a center to enable fishermen to distribute marine products to the consumers. On the other hand, Point Wharf landing site, which is the largest fishing port in Antigua and Barbuda and has a residential area behind it, urgently needs to have its facilities restored and its marine product distribution function improved, partly because of damage due to hurricanes and deterioration.

2) Number of fishing boats and number of fishermen

(a) Number of fishing boats

According to the register of the Fisheries Division, as of July 2003 there are 76 fishing boats that use Point Wharf as a base. However, as a result of a survey of operating boats, it was found that there are a) boats that have changed their fishing base to another harbor, b) boats that have sunk, c) boats whose owner died and whose present status is unknown, d) boats that have been changed to freighters, and e) boats that have returned to their overseas base. As a result, the number of fishing boats that currently operate using Point Wharf as a base is 53.

As a result of an interview with the Fisheries Division, the number of operating fishing boats of each size using the vicinity of St. John's bay as a base is 129 compared with a total of 191 boats registered at the harbor as shown Table 1-2-2(1).

Table 1-2-2(1) Number of Boats in St. John's Bay

	Loa	No. of Boats Registered (a)	No. of Operational Boats (b)	Ratio between (a) and (b)
Point Wharf	10~19ft	27	12	44%
	20~29ft	27	21	77%
	30~39ft	13	10	76%
	40~49ft	7	7	100%
	50ft<	5	3	60%
	Total	79	53	Ave.67%
Market Wharf	10~19ft	11	9	81%
	20~29ft	31	24	77%
	30~39ft	4	3	75%
	40~49ft	3	2	67%
	50ft<	3	2	67%
	Total	52	40	Ave.77%
Keeling Point	10~19ft	16	8	50%
	20~29ft	22	12	54%
	30~39ft	3	2	67%
	40~49ft	1	1	100%
	50ft<			
	Total	42	23	Ave.55%
High Street	10~19ft	2	2	100%
	20~29ft	8	6	75%
	30~39ft	4	3	75%
	40~49ft	2	1	50%
	50ft<	2	1	50%
	Total	18	13	Ave.72%
St. John's Bay Area		191	129	Aprox.70%

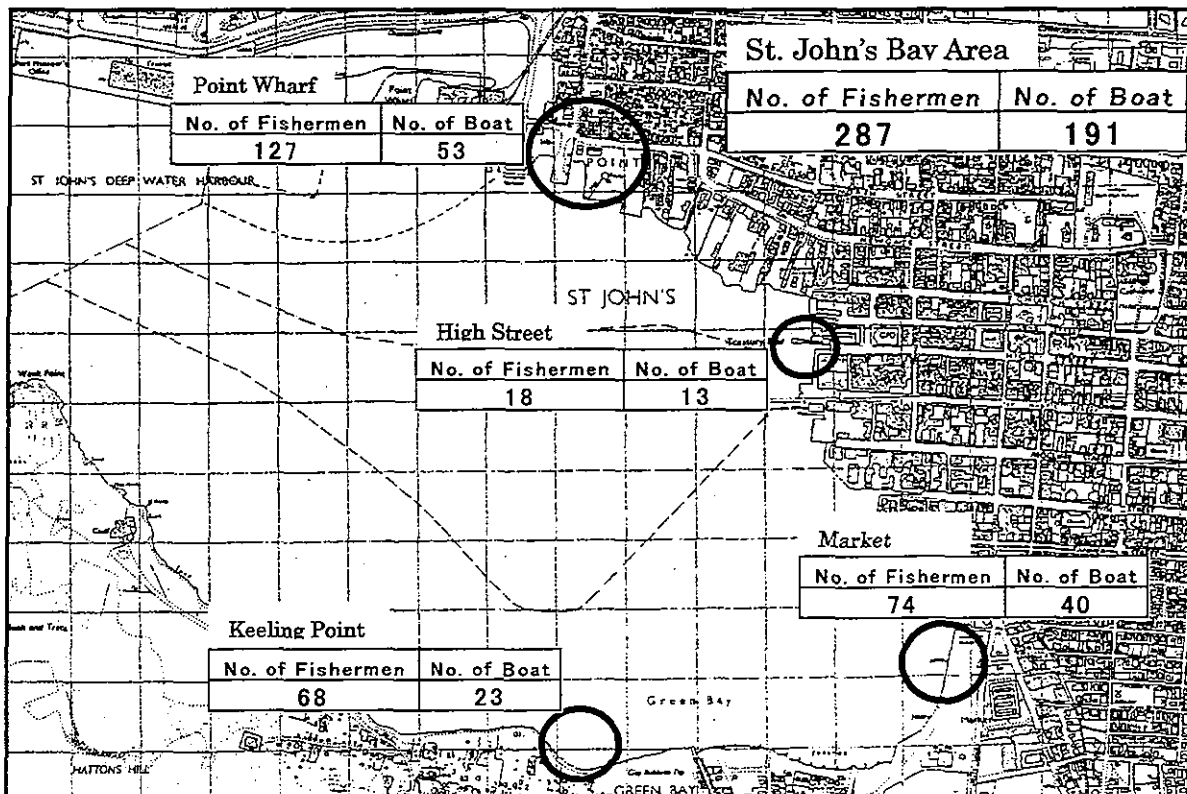


Figure 1-2-2(1) Number of Registered Fishermen and Fishing Boats in St. John's Bay

3) Features of the fishing industry

(a) Fishing grounds

The fishing grounds are located around Antigua Island and Barbuda Island. Large fishing boats visit to near Barbuda Island to catch lobsters with 2 to 3 days trip or 3 to 4 days trip. Other small fishing boats are 1day trip within 12miles area. Fishing ground of Antiguan fishermen is shown in Figure 1-2-2(2).

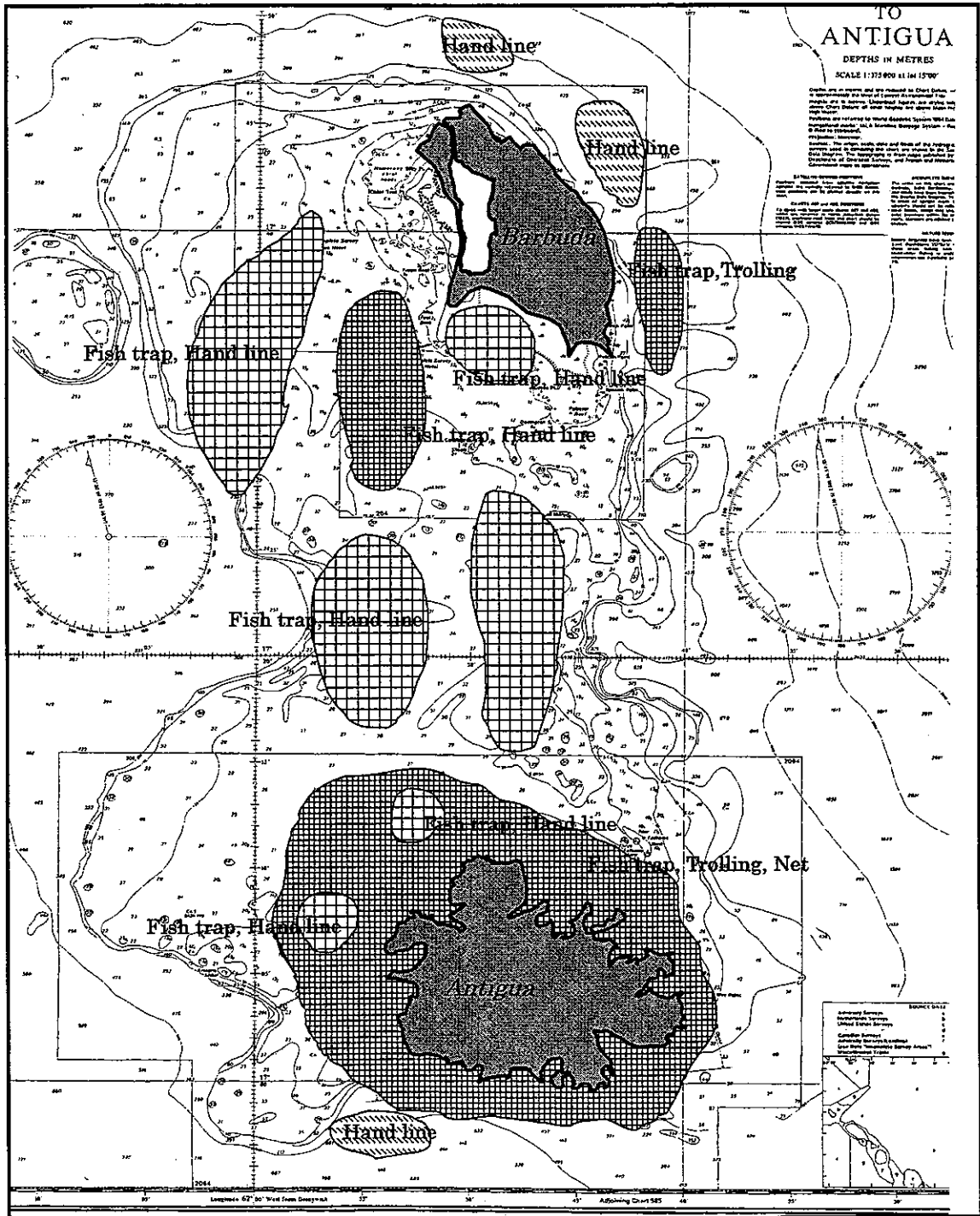


Figure 1-2-2(2) Fishing Ground for Antiguan Fishermen

(b) Features for each boat size

The result of a survey regarding the features of the fishing industry based on interviews with owners and captains, for each boat size, is shown in Table 1-2-2(2).

Table 1-2-2(2) Operational Pattern and Catch Volume by Fishing Boat Size

Length of Boat(Loa) (No. of Boats)	Operational Pattern	Fishing Gear & method	Fishing Ground	Target Species	Catch/one fishing trip
Loa10~19ft (12)	Daily 3days/week	Trap, Hand line, Trolling	North, North-west of Antigua Isl.	Lobster, Grouper, Snapper	High:200lbs Low:100lbs
Loa20~29ft (21)	2 nights 3days once a week	Trap, Hand line, Trolling	North of Antigua Isl.	Lobster, Grouper, Snapper	High:400lbs Low:200lbs
Loa30~39ft (10)	2 nights 3days once a week	Trap, Trolling, Long line	North of Antigua Isl.	Lobster, Snapper	High:650lbs Low:300lbs
Loa40~49ft (7)	3 nights 4days once a week	Trap, Hand line, Trolling, Long line	Bank of surroundings Barbuda Isl.	Lobster, Snapper	High:700lbs Low:550lbs
Loa over 50ft (3)	3 nights 4days once a week	Trap, Hand line, Trolling, Long line	Bank of surroundings Barbuda Isl.	Lobster, Snapper	High:850lbs Low:600lbs

(c) Number of days when fishing is carried out

The number of days when fishing boats in Antigua operate is classified for each boat size as follows. The rate at which boats leave the harbor to go fishing is 80% during the high season, and 30% during the low season.

Table 1-2-2(3) Number of Operational Days at Point Wharf

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Operational days (Number of Operation.)
10ft~20ft (Daily)	12 (12)	12 (12)	8 (8)	8 (8)	8 (8)	8 (8)	8 (8)	8 (8)	12 (12)	12 (12)	12 (12)	12 (12)	120 (120)
20ft~39ft (1trip=2nights)	12 (4)	12 (4)	12 (4)	12 (4)	6 (2)	6 (2)	6 (2)	6 (2)	6 (2)	6 (2)	12 (4)	12 (4)	108 (36)
40ft~49ft (1trip=3nights)	16 (4)	16 (4)	16 (4)	16 (4)	8 (2)	8 (2)	8 (2)	8 (2)	8 (2)	8 (2)	16 (4)	16 (4)	144 (36)
Over 50ft (1trip=3nights)	16 (4)	16 (4)	16 (4)	16 (4)	8 (2)	8 (2)	8 (2)	8 (2)	8 (2)	8 (2)	16 (4)	16 (4)	144 (36)

3) Estimated catch brought to the landing site of St. John's bay

The annual catch in St. John's bay is estimated to be 1,455,540 lbs, as shown in Table 1-2-2(4). Of this, the estimated annual catch at Point Wharf is 630,900 lbs, which accounts for 43% of the fish caught in St. John's bay. The estimated catch for each kind of fish was calculated from Table 1-2-2(5) - (8). Also, it was estimated that the ratio of fish versus lobsters and shellfish is 82.5% versus 17.5% from the data of FAO (2001).

Note : Total catch of fish, lobster and conch in Antigua Island=1,544tons

Total catch of fish=1,274tons, $1,274/1,544=82.5\%$

Total catch of lobster=233tons, $233/1,544=17.5\%$

Table 1-2-2(4) Total Estimated Catch of 4 Landing Place in St. John's Bay

	High Season	Low Season	Total
Daily Catch	17,360lbs/day Fish : 14,322lbs/day Lobster : 3,038lbs/day	3,454lbs/day Fish : 2,849lbs/day Lobster : 604lbs/day	
Monthly Catch	218,560lbs/month Fish : 180,312lbs/month Lobster : 38,248lbs/Month	24,030lbs/month Fish : 19,825lbs/month Lobster : 4,205lbs/month	
Annual Catch			1,455,540lbs/year Fish : 1,200,821lbs/year Lobster : 254,720lbs/year

Table 1-2-2(5) Estimated Catch at Point Wharf

Season	3	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
(a) Number of operational days/month		16	4	16	4	16	4	16	4	16	8	2	8	2	8	2	8	2	8	2	8	16	4	16	4
(b) Number of operation/month		4	850	4	850	4	850	4	850	2	600	2	600	2	600	2	600	2	600	2	600	850	2	850	2
(c) Catch volume/operation/boat		3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	3,400	1,200	3,400	1,200
(d) Monthly catch/boat (b x c)		80%	80%	80%	80%	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	80%	30%	80%	30%
(e) Rate of boats departing for fishing		8,160	8,160	8,160	8,160	8,160	8,160	8,160	8,160	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080	8,160	1,080	8,160	1,080
(f) Monthly catch volume (3boats x d x e)		510	510	510	510	510	510	510	510	135	135	135	135	135	135	135	135	135	135	135	135	510	135	510	135
(g) Daily catch (f ÷ a)																									
② 40ft ~ 49ft	7																								
(a) Number of operational days/month		16	4	16	4	16	4	16	4	16	8	2	8	2	8	2	8	2	8	2	8	16	4	16	4
(b) Number of operation/month		4	700	4	700	4	700	4	700	2	550	2	550	2	550	2	550	2	550	2	550	700	2	700	2
(c) Catch volume/operation/boat		2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	2,800	1,100	2,800	1,100
(d) Monthly catch/boat (b x c)		80%	80%	80%	80%	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	80%	30%	80%	30%
(e) Rate of boats departing for fishing		15,980	15,980	15,980	15,980	15,980	15,980	15,980	15,980	2,310	2,310	2,310	2,310	2,310	2,310	2,310	2,310	2,310	2,310	2,310	2,310	15,980	2,310	15,980	2,310
(f) Monthly catch volume (7boats x d x e)		980	980	980	980	980	980	980	980	289	289	289	289	289	289	289	289	289	289	289	289	980	289	980	289
(g) Daily catch (f ÷ a)																									
③ 30 ~ 39ft	10																								
(a) Number of operational days/month		12	4	12	4	12	4	12	4	12	6	2	6	2	6	2	6	2	6	2	6	12	4	12	4
(b) Number of operation/month		4	650	4	650	4	650	4	650	2	300	2	300	2	300	2	300	2	300	2	300	650	2	650	2
(c) Catch volume/operation/boat		2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	600	600	600	600	600	600	600	600	600	600	600	600	2,600	600	2,600	600
(d) Monthly catch/boat (b x c)		80%	80%	80%	80%	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	80%	30%	80%	30%
(e) Rate of boats departing for fishing		20,800	20,800	20,800	20,800	20,800	20,800	20,800	20,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	20,800	1,800	20,800	1,800
(f) Monthly catch volume (10boats x d x e)		1,733	1,733	1,733	1,733	1,733	1,733	1,733	1,733	300	300	300	300	300	300	300	300	300	300	300	300	1,733	300	1,733	300
(g) Daily catch (f ÷ a)																									
④ 20 ~ 29ft	21																								
(a) Number of operational days/month		12	4	12	4	12	4	12	4	12	6	2	6	2	6	2	6	2	6	2	6	12	4	12	4
(b) Number of operation/month		4	400	4	400	4	400	4	400	2	200	2	200	2	200	2	200	2	200	2	200	400	2	400	2
(c) Catch volume/operation/boat		1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	400	400	400	400	400	400	400	400	400	400	400	400	1,600	400	1,600	400
(d) Monthly catch/boat (b x c)		80%	80%	80%	80%	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	80%	30%	80%	30%
(e) Rate of boats departing for fishing		26,880	26,880	26,880	26,880	26,880	26,880	26,880	26,880	2,520	2,520	2,520	2,520	2,520	2,520	2,520	2,520	2,520	2,520	2,520	2,520	26,880	2,520	26,880	2,520
(f) Monthly catch volume (21boats x d x e)		2,240	2,240	2,240	2,240	2,240	2,240	2,240	2,240	420	420	420	420	420	420	420	420	420	420	420	420	2,240	420	2,240	420
(g) Daily catch (f ÷ a)																									
⑤ 10 ~ 19ft	12																								
(a) Number of operational days/month		12	4	12	4	12	4	12	4	12	8	4	8	4	8	4	8	4	8	4	8	12	4	12	4
(b) Number of operation/month		4	2,400	4	2,400	4	2,400	4	2,400	2	800	2	800	2	800	2	800	2	800	2	800	2,400	2	2,400	2
(c) Catch volume/operation/boat		23,040	23,040	23,040	23,040	23,040	23,040	23,040	23,040	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	23,040	2,880	23,040	2,880
(d) Monthly catch/boat (b x c)		80%	80%	80%	80%	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	80%	30%	80%	30%
(e) Rate of boats departing for fishing		94,560	94,560	94,560	94,560	94,560	94,560	94,560	94,560	10,590	10,590	10,590	10,590	10,590	10,590	10,590	10,590	10,590	10,590	10,590	10,590	94,560	10,590	94,560	10,590
(f) Monthly catch volume (12boats x d x e)		78,012	78,012	78,012	78,012	78,012	78,012	78,012	78,012	8,737	8,737	8,737	8,737	8,737	8,737	8,737	8,737	8,737	8,737	8,737	8,737	78,012	8,737	78,012	8,737
(g) Daily catch (f ÷ a)																									
⑥ Monthly catch volume by all boats																									
Fish	83%	78,012	78,012	78,012	78,012	78,012	78,012	78,012	78,012	8,737	8,737	8,737	8,737	8,737	8,737	8,737	8,737	8,737	8,737	8,737	8,737	78,012	8,737	78,012	8,737
Lobster, etc.	18%	16,548	16,548	16,548	16,548	16,548	16,548	16,548	16,548	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	16,548	1,853	16,548	1,853
Daily catch volume by all boats																									
Fish	83%	6,031	6,031	6,031	6,031	6,031	6,031	6,031	6,031	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	1,241	6,031	1,241	6,031	1,241	
Lobster, etc.	18%	1,292	1,292	1,292	1,292	1,292	1,292	1,292	1,292	263	263	263	263	263	263	263	263	263	263	263	263	1,292	263	1,292	263

Table 1-2-2(6) Estimated Catch at Market Wharf

Season	2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
(a) Number of operational days/month		16	16	16	16	16	16	16	16	16	16	16	16	
(b) Number of operation/boat		4	4	4	4	4	4	4	4	4	4	4	4	
(c) Catch volume/operation/boat		850	850	850	850	850	600	600	600	600	600	850	850	
(d) Monthly catch/boat (b x c)		3,400	3,400	3,400	3,400	3,400	1,200	1,200	1,200	1,200	1,200	3,400	3,400	
(e) Rate of boats departing for fishing		80%	80%	80%	80%	80%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (2boats x d x e)		5,440	5,440	5,440	5,440	5,440	720	720	720	720	720	5,440	5,440	36,960lbs/year
(g) Daily catch (f ÷ a)		340	340	340	340	340	90	90	90	90	90	340	340	
② 40ft ~ 49ft	2													
(a) Number of operational days/month		16	16	16	16	16	8	8	8	8	8	16	16	
(b) Number of operation/month		4	4	4	4	4	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat		700	700	700	700	550	550	550	550	550	550	700	700	
(d) Monthly catch/boat (b x c)		2,800	2,800	2,800	2,800	1,100	1,100	1,100	1,100	1,100	1,100	2,800	2,800	
(e) Rate of boats departing for fishing		80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (2boats x d x e)		4,480	4,480	4,480	4,480	660	660	660	660	660	660	4,480	4,480	30,840lbs/year
(g) Daily catch (f ÷ a)		280	280	280	280	83	83	83	83	83	83	280	280	
③ 30 ~ 39ft	3													
(a) Number of operational days/month		12	12	12	12	12	6	6	6	6	6	12	12	
(b) Number of operation/month		4	4	4	4	4	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat		650	650	650	650	300	300	300	300	300	300	650	650	
(d) Monthly catch/boat (b x c)		2,600	2,600	2,600	2,600	600	600	600	600	600	600	2,600	2,600	
(e) Rate of boats departing for fishing		80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (3boats x d x e)		6,240	6,240	6,240	6,240	540	540	540	540	540	540	6,240	6,240	40,680lbs/year
(g) Daily catch (f ÷ a)		520	520	520	520	90	90	90	90	90	90	520	520	
④ 20 ~ 29ft	24													
(a) Number of operational days/month		12	12	12	12	12	6	6	6	6	6	12	12	
(b) Number of operation/month		4	4	4	4	4	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat		400	400	400	400	200	200	200	200	200	200	400	400	
(d) Monthly catch/boat (b x c)		1,600	1,600	1,600	1,600	400	400	400	400	400	400	1,600	1,600	
(e) Rate of boats departing for fishing		80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (24boats x d x e)		30,720	30,720	30,720	30,720	2,880	2,880	2,880	2,880	2,880	2,880	30,720	30,720	201,600lbs/year
(g) Daily catch (f ÷ a)		2,560	2,560	2,560	2,560	480	480	480	480	480	480	2,560	2,560	
⑤ 10 ~ 19ft	9													
(a) Number of operational days/month		12	12	12	12	12	8	8	8	8	8	12	12	
(b) Number of operation/month		4	4	4	4	4	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat		200	200	200	200	100	100	100	100	100	100	200	200	
(d) Monthly catch/boat (b x c)		800	800	800	800	300	300	300	300	300	300	800	800	
(e) Rate of boats departing for fishing		80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (9boats x d x e)		17,280	17,280	17,280	17,280	2,160	2,160	2,160	2,160	2,160	2,160	17,280	17,280	116,640lbs/year
(g) Daily catch (f ÷ a)		1,440	1,440	1,440	1,440	270	270	270	270	270	270	1,440	1,440	
⑥ Monthly catch volume by all boats		64,160	64,160	49,040	49,040	6,960	6,960	6,960	6,960	6,960	6,960	64,160	64,160	426,720lbs/year
Fish	83%	52,932lbs/month	52,932lbs/month	40,456lbs/month	40,456lbs/month	5,742lbs/month	5,742lbs/month	5,742lbs/month	5,742lbs/month	5,742lbs/month	5,742lbs/month	52,932lbs/month	52,932lbs/month	352,044lbs/year
Lobster, etc.	18%	11,228lbs/month	11,228lbs/month	8,582lbs/month	8,582lbs/month	1,218lbs/month	1,218lbs/month	1,218lbs/month	1,218lbs/month	1,218lbs/month	1,218lbs/month	11,228lbs/month	11,228lbs/month	74,676lbs/year
Daily catch volume by all boats		5,140lbs/day	5,140lbs/day	3,970lbs/day	3,970lbs/day	1,013lbs/day	1,013lbs/day	1,013lbs/day	1,013lbs/day	1,013lbs/day	1,013lbs/day	5,140lbs/day	5,140lbs/day	
Fish	83%	4,241lbs/day	4,241lbs/day	3,275lbs/day	3,275lbs/day	835lbs/day	835lbs/day	835lbs/day	835lbs/day	835lbs/day	835lbs/day	4,241lbs/day	4,241lbs/day	
Lobster, etc.	18%	900lbs/day	900lbs/day	695lbs/day	695lbs/day	177lbs/day	177lbs/day	177lbs/day	177lbs/day	177lbs/day	177lbs/day	900lbs/day	900lbs/day	

Table 1-2-2(7) Estimated Catch at Keeling Point

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
① 50ft	0												
Season													
(a) Number of operational days/month	16	16	16	16	8	8	8	8	8	8	16	16	
(b) Number of operation/month	4	4	4	4	2	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat	850	850	850	850	600	600	600	600	600	600	850	850	
(d) Monthly catch/boat (b x c)	3,400	3,400	3,400	3,400	1,200	1,200	1,200	1,200	1,200	1,200	3,400	3,400	
(e) Rate of boats departing for fishing	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (10boats x d x e)	0	0	0	0	0	0	0	0	0	0	0	0	0lbs/year
(g) Daily catch (f ÷ a)	0	0	0	0	0	0	0	0	0	0	0	0	
② 40ft ~ 49ft	1												
Season													
(a) Number of operational days/month	16	16	16	16	8	8	8	8	8	8	16	16	
(b) Number of operation/month	4	4	4	4	2	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat	700	700	700	700	550	550	550	550	550	550	700	700	
(d) Monthly catch/boat (b x c)	2,800	2,800	2,800	2,800	1,100	1,100	1,100	1,100	1,100	1,100	2,800	2,800	
(e) Rate of boats departing for fishing	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (10boats x d x e)	2,240	2,240	2,240	2,240	330	330	330	330	330	330	2,240	2,240	15,420lbs/year
(g) Daily catch (f ÷ a)	140	140	140	140	41	41	41	41	41	41	140	140	
③ 30 ~ 39ft	2												
Season													
(a) Number of operational days/month	12	12	12	12	6	6	6	6	6	6	12	12	
(b) Number of operation/month	4	4	4	4	2	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat	650	650	650	650	300	300	300	300	300	300	650	650	
(d) Monthly catch/boat (b x c)	2,600	2,600	2,600	2,600	600	600	600	600	600	600	2,600	2,600	
(e) Rate of boats departing for fishing	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (20boats x d x e)	4,160	4,160	4,160	4,160	360	360	360	360	360	360	4,160	4,160	27,120lbs/year
(g) Daily catch (f ÷ a)	347	347	347	347	60	60	60	60	60	60	347	347	
④ 20 ~ 29ft	12												
Season													
(a) Number of operational days/month	12	12	12	12	6	6	6	6	6	6	12	12	
(b) Number of operation/month	4	4	4	4	2	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat	400	400	400	400	200	200	200	200	200	200	400	400	
(d) Monthly catch/boat (b x c)	1,600	1,600	1,600	1,600	400	400	400	400	400	400	1,600	1,600	
(e) Rate of boats departing for fishing	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (12boats x d x e)	15,360	15,360	15,360	15,360	1,440	1,440	1,440	1,440	1,440	1,440	15,360	15,360	100,800lbs/year
(g) Daily catch (f ÷ a)	1,280	1,280	1,280	1,280	240	240	240	240	240	240	1,280	1,280	
⑤ 10 ~ 19ft	8												
Season													
(a) Number of operational days/month	12	12	12	12	8	8	8	8	8	8	12	12	
(b) Number of operation/month	200	200	200	200	100	100	100	100	100	100	200	200	
(c) Catch volume/operation/boat	2,400	2,400	2,400	2,400	800	800	800	800	800	800	2,400	2,400	
(d) Monthly catch/boat (b x c)	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(e) Rate of boats departing for fishing	15,360	15,360	15,360	15,360	1,920	1,920	1,920	1,920	1,920	1,920	15,360	15,360	103,680lbs/year
(f) Monthly catch volume (8boats x d x e)	1,280	1,280	1,280	1,280	240	240	240	240	240	240	1,280	1,280	
(g) Daily catch (f ÷ a)	37,120	37,120	23,680	23,680	4,050	4,050	4,050	4,050	4,050	4,050	37,120	37,120	247,020lbs/year
⑥ Monthly catch volume by all boats	30,624lbs/month	30,624lbs/month	19,536lbs/month	19,536lbs/month	709lbs/month	709lbs/month	709lbs/month	709lbs/month	709lbs/month	709lbs/month	30,624lbs/month	30,624lbs/month	203,782lbs/year
Fish	6,496lbs/month	6,496lbs/month	4,144lbs/month	4,144lbs/month	581lbs/day	581lbs/day	581lbs/day	581lbs/day	581lbs/day	581lbs/day	6,496lbs/month	6,496lbs/month	43,229lbs/year
Lobster, etc.	3,047lbs/day	3,047lbs/day	2,007lbs/day	2,007lbs/day	480lbs/day	480lbs/day	480lbs/day	480lbs/day	480lbs/day	480lbs/day	3,047lbs/day	3,047lbs/day	
⑦ Daily catch volume by all boats	2,514lbs/day	533lbs/day	1,656lbs/day	1,656lbs/day	102lbs/day	102lbs/day	102lbs/day	102lbs/day	102lbs/day	102lbs/day	2,514lbs/day	2,514lbs/day	
Fish	533lbs/day	533lbs/day	351lbs/day	351lbs/day							533lbs/day	533lbs/day	
Lobster, etc.													

Table 1-2-2(8) Estimated Catch at High Street

Season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
① 50ft													
(a) Number of operational days/month	16	16	16	16	8	8	8	8	8	8	16	16	
(b) Number of operation/boat	4	4	4	4	2	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat	850	850	850	850	600	600	600	600	600	600	850	850	
(d) Monthly catch/boat (b x c)	3,400	3,400	3,400	3,400	1,200	1,200	1,200	1,200	1,200	1,200	3,400	3,400	
(e) Rate of boats departing for fishing	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (1 boat x d x e)	2,720	2,720	2,720	2,720	360	360	360	360	360	360	2,720	2,720	18,480lbs/year
(g) Daily catch (f ÷ a)	170	170	170	170	45	45	45	45	45	45	170	170	
② 40ft ~ 49ft													
(a) Number of operational days/month	16	16	16	16	8	8	8	8	8	8	16	16	
(b) Number of operation/month	4	4	4	4	2	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat	700	700	700	700	550	550	550	550	550	550	700	700	
(d) Monthly catch/boat (b x c)	2,800	2,800	2,800	2,800	1,100	1,100	1,100	1,100	1,100	1,100	2,800	2,800	
(e) Rate of boats departing for fishing	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (1 boat x d x e)	2,240	2,240	2,240	2,240	330	330	330	330	330	330	2,240	2,240	15,420lbs/year
(g) Daily catch (f ÷ a)	140	140	140	140	41	41	41	41	41	41	140	140	
③ 30 ~ 39ft													
(a) Number of operational days/month	12	12	12	12	6	6	6	6	6	6	12	12	
(b) Number of operation/month	4	4	4	4	2	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat	650	650	650	650	300	300	300	300	300	300	650	650	
(d) Monthly catch/boat (b x c)	2,600	2,600	2,600	2,600	600	600	600	600	600	600	2,600	2,600	
(e) Rate of boats departing for fishing	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (3boats x d x e)	6,240	6,240	6,240	6,240	540	540	540	540	540	540	6,240	6,240	40,680lbs/year
(g) Daily catch (f ÷ a)	520	520	520	520	90	90	90	90	90	90	520	520	
④ 20 ~ 29ft													
(a) Number of operational days/month	12	12	12	12	6	6	6	6	6	6	12	12	
(b) Number of operation/month	4	4	4	4	2	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat	400	400	400	400	200	200	200	200	200	200	400	400	
(d) Monthly catch/boat (b x c)	1,600	1,600	1,600	1,600	400	400	400	400	400	400	1,600	1,600	
(e) Rate of boats departing for fishing	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (6boats x d x e)	7,680	7,680	7,680	7,680	720	720	720	720	720	720	7,680	7,680	50,400lbs/year
(g) Daily catch (f ÷ a)	640	640	640	640	120	120	120	120	120	120	640	640	
⑤ 10 ~ 19ft													
(a) Number of operational days/month	12	12	12	12	8	8	8	8	8	8	12	12	
(b) Number of operation/month	4	4	4	4	2	2	2	2	2	2	4	4	
(c) Catch volume/operation/boat	400	400	400	400	200	200	200	200	200	200	400	400	
(d) Monthly catch/boat (b x c)	1,600	1,600	1,600	1,600	400	400	400	400	400	400	1,600	1,600	
(e) Rate of boats departing for fishing	80%	80%	80%	80%	30%	30%	30%	30%	30%	30%	80%	80%	Annual catch
(f) Monthly catch volume (2boats x d x e)	3,840	3,840	3,840	3,840	480	480	480	480	480	480	3,840	3,840	25,920lbs/year
(g) Daily catch (f ÷ a)	320	320	320	320	60	60	60	60	60	60	320	320	
⑥ Monthly catch volume by all boats	22,720	22,720	19,360	19,360	2,430	2,430	2,430	2,430	2,430	2,430	22,720	22,720	150,900lbs/year
Fish	18,744lbs/month	18,744lbs/month	15,912lbs/month	15,912lbs/month	2,005lbs/month	2,005lbs/month	2,005lbs/month	2,005lbs/month	2,005lbs/month	2,005lbs/month	18,744lbs/month	18,744lbs/month	124,493lbs/year
Lobster, etc.	3,976lbs/month	3,976lbs/month	3,388lbs/month	3,388lbs/month	425lbs/month	425lbs/month	425lbs/month	425lbs/month	425lbs/month	425lbs/month	3,976lbs/month	3,976lbs/month	26,408lbs/year
⑦ Daily catch volume by all boats	1,790lbs/day	1,790lbs/day	1,530lbs/day	1,530lbs/day	356lbs/day	356lbs/day	356lbs/day	356lbs/day	356lbs/day	356lbs/day	1,790lbs/day	1,790lbs/day	
Fish	1,477lbs/day	1,477lbs/day	1,262lbs/day	1,262lbs/day	294lbs/day	294lbs/day	294lbs/day	294lbs/day	294lbs/day	294lbs/day	1,477lbs/day	1,477lbs/day	
Lobster, etc.	313lbs/day	313lbs/day	268lbs/day	268lbs/day	62lbs/day	62lbs/day	62lbs/day	62lbs/day	62lbs/day	62lbs/day	313lbs/day	313lbs/day	