(2) Fishing in the vicinity of the Codrington landing site

1) Fishing base

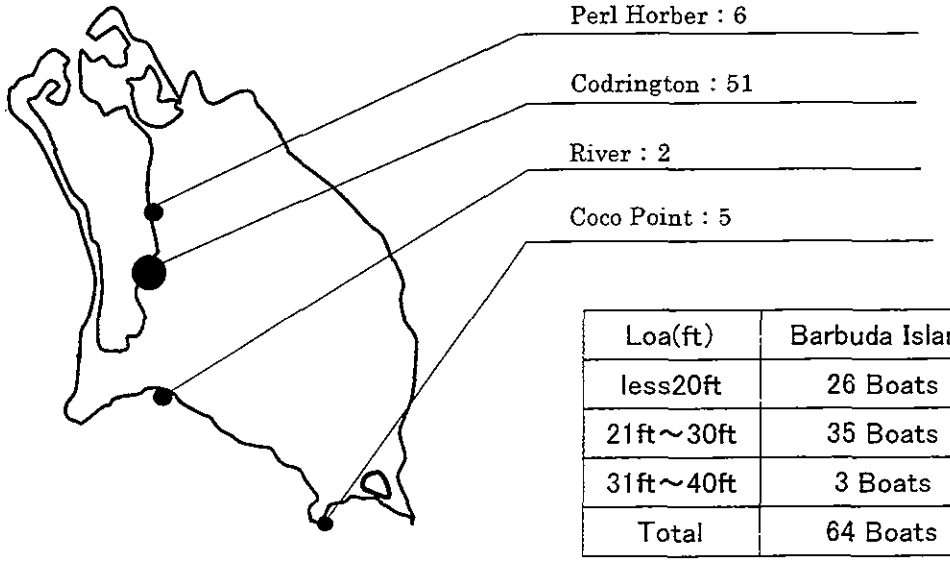
On Barbuda Island, there are four landing sites: Codrington, Pearl Harbor, River and Coco Point. None of these landing sites has fishing harbor facilities. Codrington and Pearl Harbor are located in a lagoon very close to each other. River (on the Caribbean Sea side) and Coco Point (on the Atlantic Ocean side) face the open sea, and are located 2 km or 5 km from the Codrington landing site respectively.

2) Number of fishing boats and number of fishermen

(a) Number of fishing boats

According to data issued by the Fisheries Department of the Ministry of Agriculture, Land and Fisheries, there were 74 fishing boats in Barbuda as of November 2002. However, according to the register of the Barbuda Council Fisheries Division, there were 64 registered fishing boats (all operational) as of July 2003. The distribution according to length is as shown in Fig.1-2-2(3). It can be seen that almost all boats are 30 ft or less.

Of the above four landing sites, Codrington has 51 fishing boats, which is the greatest number. Next is Pearl Harbor (six boats), followed by Coco Point (five boats). The fishermen move from one harbor to another on a seasonal basis, so the number of fishing boats at each base varies. Particularly, during the tourist season (between November and April), the number of fishing boats at Coco Point and River, which are near tourist hotels, increases. These fishing boats supply the hotels with fish and other marine products.



Loa(ft)	Barbuda Island
less20ft	26 Boats
21ft～30ft	35 Boats
31ft～40ft	3 Boats
Total	64 Boats

Fig.1-2-2(3) Number of Fishing Boat in Barbuda

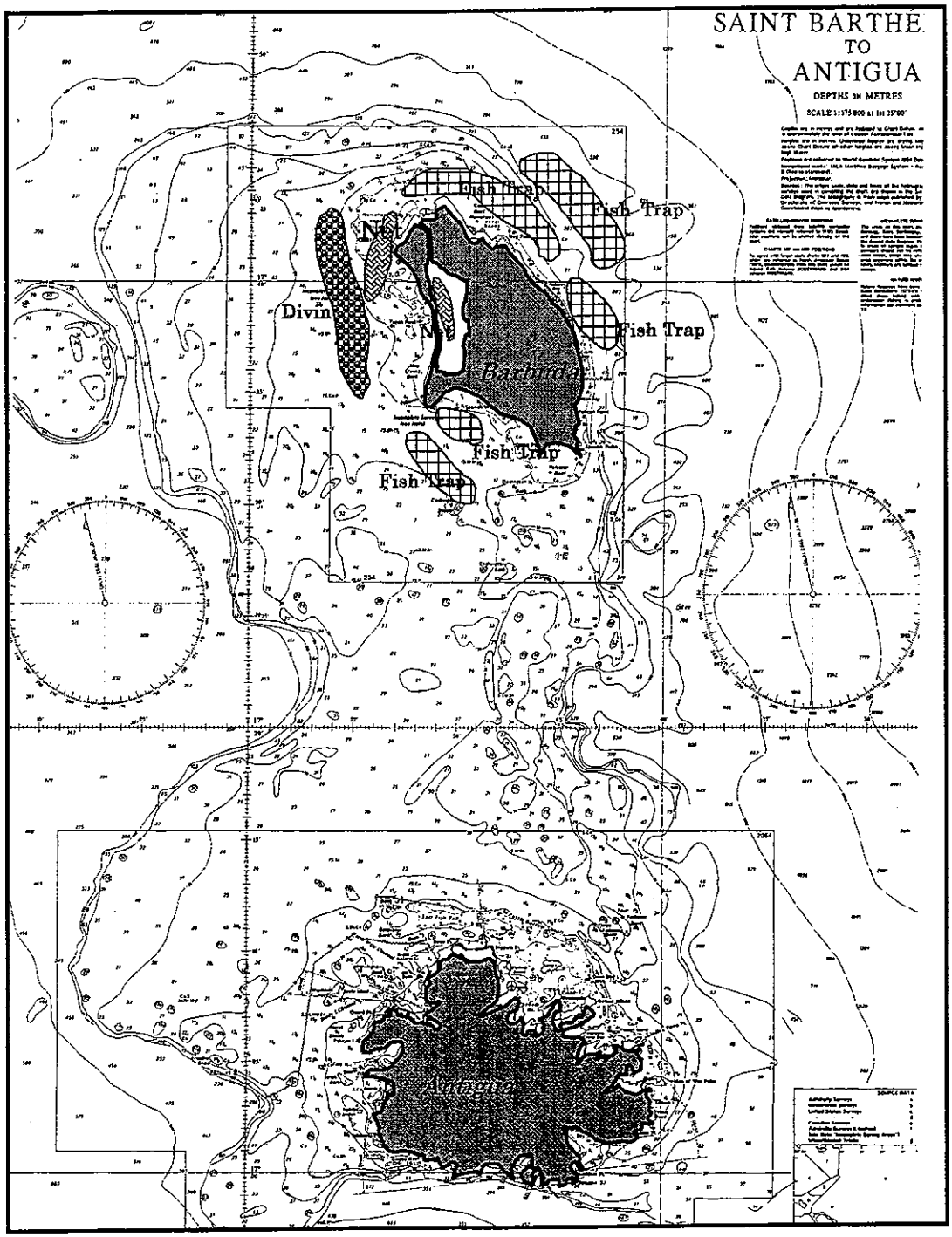
(b) Number of fishermen

There are 110 fishermen on Barbuda Island. Sixty of them are registered fishermen, and remaining 50 are non-registered fishermen. Codrington is where the majority of the islanders make their livelihood, so it is also an important center for the daily lives of fishermen in other landing sites as well.

3) Features of the fishing

(a) Fishing grounds

The fishing grounds are located around Barbuda Island. The east side of the island faces the Atlantic Ocean. Here, the sea is often rough, making fishing dangerous. About two miles offshore, the seabed abruptly slopes downward, so fishing with fish traps is normally carried out within two miles of the shore. The length of the rope is as much as 65 fathoms. On the north side as well, the seabed slopes down sharply, and also the tidal currents are fierce, so fishing is by no means easy. Fishing is carried out within a range of 5 to 6 miles from the west side, and 3 to 4 miles from the south side. The corresponding rope lengths are 20 fathoms and 16 fathoms, respectively. Fishing in the lagoon is done using gill net, drive-in net, and so on. (Refer to Fig.1-2-2(4).)



Diving : Lobster, Conch
Fish Trap : Lobster・Grouper・Snapper・Reef Fish・Others
Net : Small Pelagic Fish・Mackerel・Barracuda・Reef Fish

Fig.1-2-2(4) Fishing Ground for Barbudan Fishermen

(b) Fishing methods

i) Lobster fishing

* Features of the fishing operation

Lobster fishing is performed throughout the year. The high season is between January and July. The fishing grounds are located between half an hour and two hours away from the landing site. At the northern side of the island, the fishing grounds are located 30 minutes away from the landing site, on the west side one hour, and on the northeast and south sides between 1.5 and 2.0 hours. The fishing boats leave the landing site at 6 a.m. and return between noon and 2 p.m. The lobsters and fish caught in the fish traps are recovered between two and four days after the fish traps are set.

During the high season, fishing is carried out two to three days a week.

The average catch per week is about 120 - 200 lbs of lobsters and 200 - 400 lbs of fish, in the high season, and about 60 - 150 lbs of lobsters and 100 - 250 lbs of fish in the low season. The ratio of fish versus lobsters caught is 65% versus 35% on average.

* Lobster resource management

Resource management of lobster fishing grounds, fishing season and fishing gear is not carried out. However, there is a minimum size restriction: Lobsters must weigh at least 1.5 lbs and have a carapace of at least 9.5 inches long. Also, it is not permitted to catch lobsters that are carrying eggs. If these rules are not observed, a penalty of 500 dollars may be levied.

ii) Gill net fishing

Gill net fishing takes place at night. The fishing boats set off at 5 p.m., and arrive at the fishing ground in about 30 minutes. The nets are in place by 6 p.m. and at 8 p.m. the nets are raised for the first time. At 9 p.m., the nets are lowered once again, and at 11 p.m. they are raised again, and then the boats return to the harbor around 1 a.m. The catch is stored in a refrigerator and sold the following morning.

The size of the gill net is 65 ft length, 12 ft height and the mesh is 2 inches. This net is intended for catching pelagic fish along the coast. Average catch per week is 90 lbs. Fishing is not carried out during the roughly one-week period of the full moon.

(c) Number of days when fishing is carried out

The fishing season at Barbuda Island is divided into the high season (October - April) and the low season (May - September). The number of days a month that the boats go out fishing is 12 days during the high season and 8 days during the low season.

Small fishing boats operate 124 days a year, as indicated in Table 1-2-2(9). The number of days on which the boats can go out fishing in a year is 258 days. This is because the total number of rest days, consisting of 96 days for Saturdays and Sundays, 4 days for religious holidays, and 7 national holidays, is 107 days. Consequently, of the 365 days in a year, the boats cannot leave the harbor on 193 days (= 365 – 124 – 107), either because the likelihood of a catch is small, or because of the weather, side-businesses, and so on. The fishermen of Barbuda go out fishing comparatively freely, and it appears that they go fishing even on a Saturday, Sunday or holiday when the waves are not rough.

High season: October - April (7 months)
= 12 days operation
= 1.7 weeks/months (12 days ÷ 7 days)
Low season: May - September (5 months)
= 8 days operation
= 1.1 weeks/month (8 days ÷ 7 days)

Table 1-2-2(9) Monthly Operation Days of Fishing Boat

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Operation Days	12	12	12	12	8	8	8	8	8	12	12	12	124

Note: High Season Source: Interview 2003

3) Estimated catch on Barbuda Island

At Barbuda, statistical data concerning unloading of caught fish is not collected, so the unloading amount was estimated based on the results of interviews, as shown below.

(a) Amount of fish caught per week for each type of fishing boat

The amount of fish unloaded per week for each type of fishing boat, during the high season and the low season, obtained based on interviews is as shown in Table 1-2-2(10). From the results of these interviews, the rate at which boats leave the harbor was estimated to be 80% during the high season, and 30% during the low season.

Table 1-2-2(10) Weekly Fish Catch Volume by Fishing Boat Size

Season	Species	Loa 10-19ft	Loa 20-29ft	Loa>30ft
High Season	Fish	200lbs	300lbs	400lbs
	Lobster	120lbs	150lbs	200lbs
	Total	320lbs	450lbs	600lbs
Low Season	Fish	100lbs	200lbs	250lbs
	Lobster	60lbs	100lbs	150lbs
	Total	160lbs	300lbs	400lbs

Loa: Length overall

(b) Estimation of the amount of each kind of fish caught

The annual catch on Barbuda Island is estimated to be 272,451 lbs, as shown in Table 1-2-2(11). The amount of each kind of fish caught was calculated from Table 1-2-2(12). The ratio of the amount of fish versus lobster caught based on the interview was estimated to be 65% versus 35%.

Table 1-2-2(11) Estimated Fish Catch Volume in Barbuda Island

	High Season	Off Season	Total
Daily Catch Volume	2,932lbs/day Fish : 1,906lbs/day Lobster : 1,026lbs/day	655lbs/day Fish : 452lbs/day Lobster : 229lbs/day	
Monthly Catch Volume	35,183lbs/month Fish : 22,869lbs/month Lobster: 12,314lbs/month	5,234lbs/month Fish : 3,402lbs/month Lobster : 1,832lbs/month	
Annual Catch Volume			272,451lbs/year Fish : 177,093lbs/year Lobster : 95,358lbs/year

Table 1-2-2(12) Estimated Amounts of Catch per Annum in Barbuda

	*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
① 30ft<	3													
Fish Season		High	High	High	High	Low	Low	Low	Low	Low	High	High	High	
(a) Number of operational days/month		12	12	12	12	8	8	8	8	8	12	12	12	
(b) Number of operational week/month		1.7	1.7	1.7	1.7	1.1	1.1	1.1	1.1	1.1	1.7	1.7	1.7	
(c) Weekly catch/boat		600	600	600	600	400	400	400	400	400	600	600	600	
(d) Rate of boats depaarting for fishing		80%	80%	80%	80%	30%	30%	30%	30%	30%	80%	80%	80%	Annual catch
(e) Monthly catch volume (3boats × b × c × d)		2,448	2,448	2,448	2,448	396	396	396	396	396	2,448	2,448	2,448	19,116lbs/year
(f) Dayly catch (e÷a)		204	204	204	204	49.5	49.5	49.5	49.5	49.5	204	204	204	
② 20～29ft	35													
Fish Season		High	High	High	High	Low	Low	Low	Low	Low	High	High	High	
(a) Number of operational days/month		12	12	12	12	8	8	8	8	8	12	12	12	
(b) Number of operational week/month		1.7	1.7	1.7	1.7	1.1	1.1	1.1	1.1	1.1	1.7	1.7	1.7	
(c) Weekly catch/boat		450	450	450	450	300	300	300	300	300	450	450	450	
(d) Rate of boats depaarting for fishing		80%	80%	80%	80%	30%	30%	30%	30%	30%	80%	80%	80%	Annual catch
(e) Monthly catch volume (35boats × b × c × d)		21,420	21,420	21,420	21,420	3,465	3,465	3,465	3,465	3,465	21,420	21,420	21,420	167,265lbs/year
(f) Dayly catch (e÷a)		1,785	1,785	1,785	1,785	433	433	433	433	433	1,785	1,785	1,785	
③ 10～19ft	26													
Fish Season		High	High	High	High	Low	Low	Low	Low	Low	High	High	High	
(a) Number of operational days/month		12	12	12	12	8	8	8	8	8	12	12	12	
(b) Number of operational week/month		1.7	1.7	1.7	1.7	1.1	1.1	1.1	1.1	1.1	1.7	1.7	1.7	
(c) Weekly catch/boat		320	320	320	320	160	160	160	160	160	320	320	320	
(d) Rate of boats depaarting for fishing		80%	80%	80%	80%	30%	30%	30%	30%	30%	80%	80%	80%	Annual catch
(e) Monthly catch volume (26boats × b × c × d)		11,315	11,315	11,315	11,315	1,373	1,373	1,373	1,373	1,373	11,315	11,315	11,315	86,070lbs/year
(f) Dayly catch (e÷a)		943	943	943	943	172	172	172	172	172	943	943	943	
④ Monthly catch volume by all boats		35,183	35,183	35,183	35,183	5,234	5,234	5,234	5,234	5,234	35,183	35,183	35,183	272,451lbs/year
Fish	65%	22,869lbs/month				3,402lbs/month					22,869lbs/month			177,093lbs/year
Lobster	35%	12,314lbs/month				1,832lbs/month					12,314lbs/month			95,358lbs/year
⑤ Dayly catch volume by all boats		2,932lbs/day				655lbs/day					2,932lbs/day			
Fish	65%	1,906lbs/day				425lbs/day					1,906lbs/day			
Lobster	35%	1,026lbs/day				229lbs/day					1,026lbs/day			

*: Number of boats

Chapter 2

Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Project Purpose

Antigua and Barbuda has a monoculture economy that is dependent on tourism. Although GDP per capita income has reached nearly US$ 7,970 (2002), the economy of the country is very sensitive to the economic trends of developed countries and the effects of damage caused by hurricanes. The national development plan aims to achieve sustainable economic development through industrial diversification and to improve the nature of the economy, now dependent on tourism. The plan places development of the fishing industry as a major objective as an important industry that utilizes the country's resources and encourages independence of nation.

The Codrington region of Barbuda has the character of a fishing village as it is heavily dependent on the fishing industry and most of the residents of this area either work in the fishing industry or are relatives of those who do. There is a high degree of dependence of fishing activities on the export of live lobster to the French Caribbean islands (Martinique and Guadalupe) and the distribution of marine products to St. John's, where is the highest marine product consumption on Antigua, is carried out by only a few fishermen. At the same time, amidst concerns about depletion of lobster resources, even though fishermen wish to have their high priced demersal fish distributed to St. John's in Antigua, they are faced with a major problem in terms of distributing marine products since there are no production facilities for the ice required to distribute their catch to Antigua.

At the Point Wharf landing site, the area with the largest number of fishing boats in St. John's (largest also in Antigua and Barbuda), wharf facilities are dilapidated and damage from repeated hurricanes has impaired the unloading function, presenting a major obstacle to the distribution of catch and leaving the area unable to receive marine products from Barbuda.

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 the European Union and the United States. At the same time, with the shift to CSME by 2005, the safety of marine products must be improved through better quality standards in order to strengthen the export competitiveness.

Given the above context, the plan aims to improve the marine product distribution system and to develop infrastructure for the fishing industry with the objective of providing healthy and sanitary marine products that are of a high value.

2-1-2 Challenges in marine product distribution at project sites

From the result of field survey conducted on July, 2003, there are following issues to be solved at both project sites.

(1) Issues in the port at the St. John's and Point Wharf landing sites

There are the following issues to be solved with the Point Wharf landing site, the area with the largest number of fishing boats in Antigua, as the distribution base for marine products.

i) Develop a distribution base to receive products from hinterland residents and Barbuda
ii) Supply a healthy, sanitary, and safe catch to meet the needs of the tourism industry and consumers
iii) Establish a mooring area for fishing boats to improve the safety of boats navigating in the fishing port
iv) Refurbish and recover basic fishing facilities that have been lost
v) Clarify the use of land for fishing activities and assure space for various operations
vi) Establish an evacuation route for fishing boats in the port to be used during emergency
vii) Re-establish management functions and create a space for communication

(2) Issues in Barbuda and the Codrington landing site

The plan is based on the resolution of the following issues in order to support fishing activities and improve distribution since Barbuda has no developed fishing industry infrastructure.

i) Increase scale of operation and establish a distribution market by establishing means for refrigeration
ii) Develop a distribution base for marine products on the islands
iii) Diversify the fishing industry and establish a system for resource management through the development of new marine product resources
iv) Develop facilities to support fishing activities
v) Establish an evacuation route for fishing boats during emergency
vi) Create a space that can be used for information and correspondence regarding fishing on the island
vii) Establish an unloading function

2-1-3 Basic policy of the project

The priorities of the plan for the overall fishing industry of Antigua and Barbuda, the Codrington landing site and the Point Wharf landing site are as follows, including development issues and the basic policies of the project.

Overall goal: Promote artisanal fishery by improving the distribution system for marine products and developing facilities for the fishing industry

Basic principle: Provide healthy, sanitary and high-quality marine products

Basic policy: Policy 1: To assure functions on Barbuda Island for preserving the freshness of fish catches and plan for the distribution of the fish to Antigua Island where the scale of the market is large, in order to effectively utilize the fish catches from Barbuda which has rich resources.

Policy 2: Create a base area where local residents can easily access fish product.

Policy 3: Create a base area where fishermen can easily unload fish.

Policy 4: Strengthen the quality improvement function and establish a control function for the health and sanitation of catches.

Policy 5: Develop processing technology that can appropriately meet the demand from domestic and foreign consumers and provide processed goods.

Policy 6: Create an area that can be used as a distribution base where the circumstances of the fishing industry can be confirmed and control can be implemented over the communication and exchange of opinions of those engaged in fishing.

Policy 7: Offer logistic support services to those engaged in fishing from a base for fishing activities that is functional and easy to use.

Policy 8: Create a foundation for the fishing industry that fits in well with the surrounding area (environmentally and scenically).

Policy 9: Establish a mooring area for fishing boats that can be used as a fishing base.

Policy 10: Establish an evacuation route for fishing boats to be used in case of emergency.

In order to achieve the above-mentioned objectives, necessary and reasonable facilities that meet the needs of fishing activities at Codrington landing site and Point Wharf landing site would be required.

2-1-4 Review of the necessity and relevance of the plan

The priorities of this plan are to improve the distribution system for marine products (soft) and to refurbish infrastructure (hard) for the fishing industry based on the overall goals summarized in the previous section and the problems and issues seen in the distribution of marine products in Antigua and Barbuda along with the problems and issues at the project sites.

Many of the issues at these project sites are almost similar to issues faced by the fishery sector of the country. This is due to the fact that the project sites of Codrington and Point Wharf are the largest landing sites on each island. Resolution of these issues through planned improvements will contribute greatly to the resolution of nationwide problems and those improvements are therefore indispensable.

If the necessity of the plan were to be approached largely from the perspective of marine product distribution, the relationship between the two project sites is largely one of supply and demand as shown in Figure 2-1-4 (1). In other words, the Codrington landing site supplies the catch and the Point Wharf landing site is a large market that provides the demand for the catch and the marine product distribution system will be formed through the refurbishment of both.

In terms of the "hard" (tangible) side that will supplement the "soft" or intangible, the facilities of fishing industry infrastructure at both project sites are currently either non-existent or non-functioning due to disasters or deterioration, and the refurbishment and improvement of those facilities is therefore very urgent.

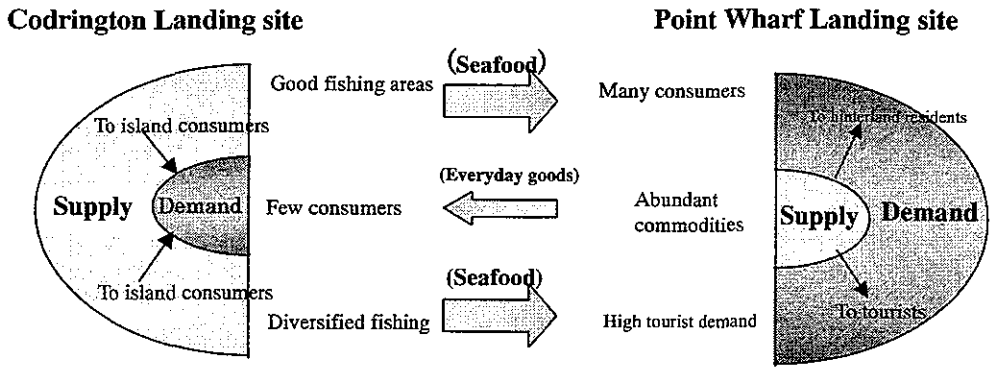


Figure 2-1-4 (1) Distribution System for Codrington Landing Site and Point Wharf Landing Site after Improvements

2-1-5 Priority of the project sites

In the request submitted by the Government of Antigua and Barbuda, both the Codrington and the Point Wharf are to be developed simultaneously. As described earlier, in order to "improve the distribution of marine products", the refurbishment of the facilities at both sites is mutually relevant to each other. In other words, in order to improve distribution by refurbishing the facilities at Codrington, it will be necessary to "refurbish fishery infrastructure" at Point Wharf, which is receiving terminal for fish catches from the island of Barbuda.

On the other hand, in Antigua and Barbuda, "the supply of sanitary and valuable marine products" is an important issue that must be solved in order to control marine products under enforcement of Sanitary regulation and to strengthen the export competitiveness of marine products against the CSME. Improvement of this issue is necessary in order to promote the whole fishing industry in Antigua and Barbuda. It is therefore, believed that refurbishment of the Point Wharf facilities will contribute to promoting the whole fishing industry in Antigua and Barbuda.

In considering the priority order refurbishing the facilities at both sites, it is considered reasonable and proper that Point Wharf should take priority from the view of the cost effectiveness and number of beneficiaries. It is advisable to develop the Codrington facilities taking a step by step approach according to the operation status of Point Wharf as receiving terminal.

2-2 Examination of Components

2-2-1 Request components

The original request components of the Government of Antigua and Barbuda and one that based on the results of discussions at the preliminary study conducted in February 2003 and one at basic design study are shown in Tables 2-2-1(1) through2-2-1(2).

Table 2-2-1(1) Requested and examined Components following Discussions (Point Wharf landing site)

Component	Original request	At preliminary study	At basic design study	Contents of changes, discussions, and investigations
1. Administration office building	○	—	○	An administrative office is necessary for the administration and operation of fishing port facilities.
2. Processing plant	○	○	○	
3. Hygienic laboratory	○	○	○	
4. Ice-making machinery	○	—	—	
5. Research and development building	○	—	—	
6. Meeting hall	○	○	○	
7. Fishing gear locker	○	○	○	
8. Repair area for fishing gear	○	○	○	
9. Slipway	○	○	○	
10. Repair area for boat/engines	○	○	○	
11. Wharf	○	—	○	
12. Revetment	—	○	○	
13. Improvements to drains and paving	○	—	○	Paving is necessary for smooth flow of fish and vehicles.
14. Parking lot	—	—	○	Since Antigua and Barbuda is a country in which motorized vehicles are used and most of the people utilizing the facilities, including fishermen, will access them by car, a parking lot is necessary.
15. Water storage tank	—	—	○	Due to low rainfall levels on Antigua there are frequent disruptions of the water supply and it is common for household to have water storage tanks.
16. Generator	—	—	○	The necessity of a generator for sustaining functionality of facilities will be reviewed as power outages occur every 2 to 3 months in Antigua and Barbuda, and when there is damage from a hurricane, the recovery can take a week or more.
17. Survey vessel	○	—	—	
18. Survey equipment	○	—	—	
19. Tools	○	—	—	
20. Market equipment and materials	○	—	—	

Table 2-2-1(2) Requested and examined Components following Discussions (Codrington landing site)

Component	Original request	At preliminary study	At basic design study	Contents of changes, discussions, and reviews
1. Land reclamation	○	—	—	Facilities will be built on land and therefore land reclamation is not necessary.
2. Wharf for unloading	○	—	—	The Codrington landing site and adjacent Pearl Port landing site are both located in tidal flats, with no evacuation areas and no landings for fishing boats during hurricanes and other emergencies. It is necessary to provide on-shore storage facilities and slipways that would function both as easy-access small-scale landing sites for taking in catches to the sorting area when necessary and as evacuation areas for fishing boats during hurricanes.
3. Slipway	○	—	○	
4. On-shore storage facilities	○	—	○	
5. Mooring winch	○	—	—	Use outside of emergencies would be very infrequent, thus this is deemed unnecessary.
6. Workshop	○	—	—	Since fishermen will perform repairs independently as they do currently, this is deemed unnecessary.
7. Meeting hall	○	○	○	
8. Ice-making equipment/ ice-storage	○	○	○	
9. Fishing gear locker	○	○	○	
10. Generator	○	○	○	
11. Exterior				
(1) Toilets	○	○	○	If administrative office is used, building separate outdoor toilets is not necessary.
(2) Parking lot	○	○	○	
(3) Storage tank	○	○	○	
12. Sorting area	—	○	○	
13. Administration office	—	○	○	
14. Fishing gear selling area	—	○	○	

2-2-2 Examination of necessary components

(1) Point Wharf landing site

Components : Hygienic laboratory, Processing plant, Wharf / Revetment, Slipway and Workshop for boats and engines, Repair and Manufacturing open yard for fishing gear, Administration office, Meeting hall, Fishing gear locker, Water storage tank, Generator, Parking lot

1) Hygienic laboratory

At this time, two quality and health inspectors work in the Fisheries Division. They mainly conduct lobster inspections by organoleptic sensory evaluation and issue export health certificates. When exporting live lobsters they request tests on coliform levels of the seawater in the fishpond from the only inspection laboratory in the country at Department of Agriculture, Ministry of Agriculture, Land and Fisheries. However, the inspection laboratory is aged twenty years old, therefore its several instruments are not working well. For that reason, advanced analysis such as that for heavy metals is currently conducted overseas on samples sent from the laboratory.

Inspection mission by EU carried out the study of quality and hygienic control as respects to export inspections of marine products in Antigua and Barbuda on November 2002. EU mission reported that export inspections should be improved the check system for analysis results and enhance it. For these reasons Antigua and Barbuda is not able to export marine products to EU and U.S.A. except live lobsters.

In light of this, the Fisheries Division has indicated a heightened awareness of the importance of safety and quality and intends to establish a law (regulating the safety and quality of fish and fisheries products) that would implement mandatory control under international standard (HACCP: Hazard Analysis and Critical Control Point System) to improve the health conditions of marine products starting in August of this year. In addition, since Antigua and Barbuda depends heavily on the tourism industry, it is necessary to prevent food poisoning resulting from seafood provided to restaurants and hotels. Moreover, as seafood products start to be distributed across national borders when CSME is launched in 2005, it is crucial that Antigua and Barbuda's inspections are recognized as being reliable internationally in order for high-quality and safe food products to compete in the international market. For that reason a hygienic laboratory is essential.

The following is a list of the inspection items generally required to ensure the safety of food products. The shaded inspection items are ones that are not frequently conducted however, and require advanced analysis technology for inspection.

After reviewing the requested contents, the following shaded items are

not planned as inspection items by the Fisheries Division at this time. When these high-level inspections become necessary they will have to be conducted externally.

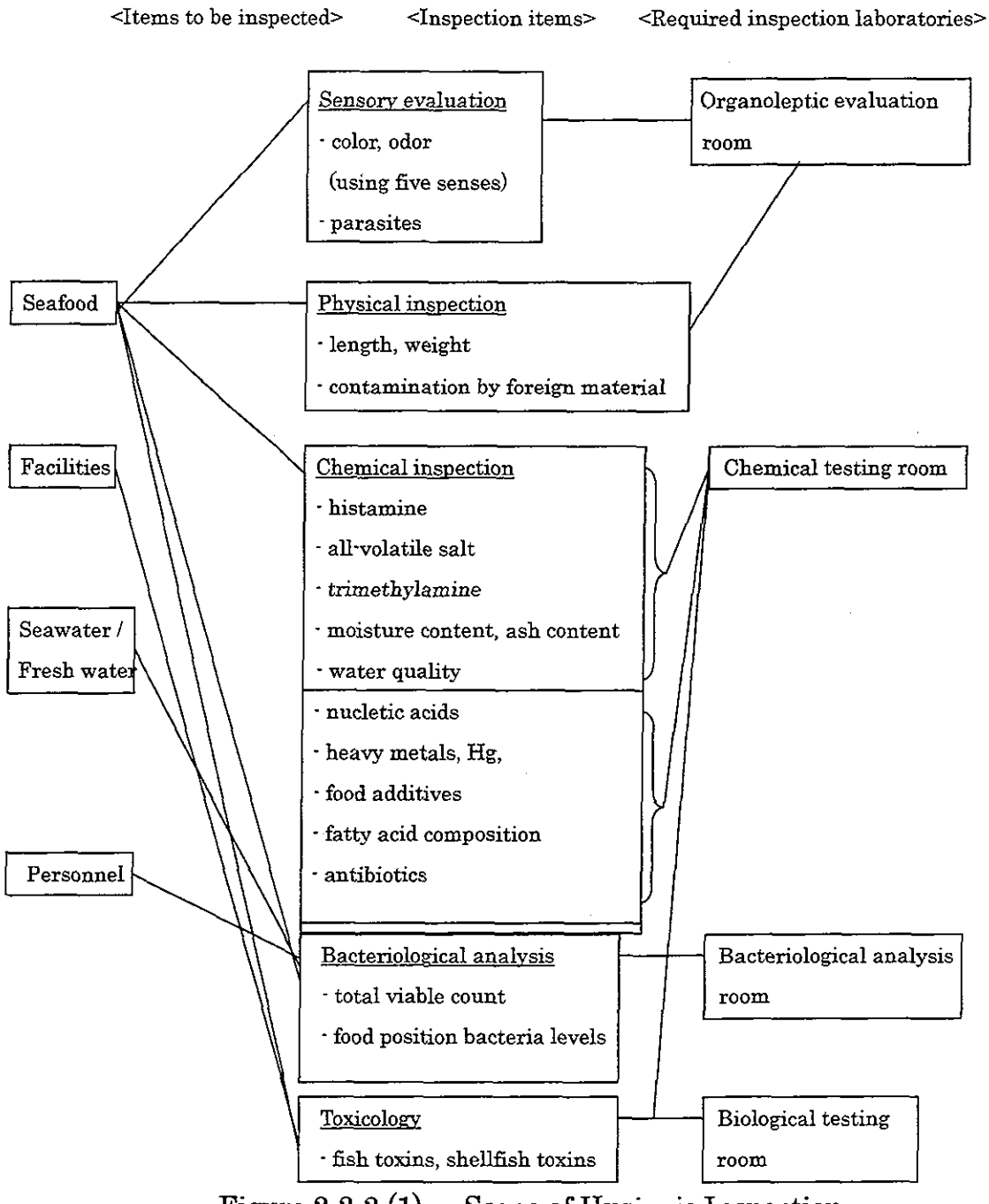


Figure 2-2-2 (1) Scope of Hygienic Inspection

2) Processing plant

There are no fish processing plants in Antigua and Barbuda that meet international request. Although there is a processing plant at Antigua Fisheries Limited (AFL), it is one that was built prior to the time when international standards had gained recognition and the flow of processing personnel and products is therefore not well-developed and the plant does not have separate clean areas and contaminated areas. (Despite the fact that the processing plant

was independently remodeled by AFL after it was built in order to carry out more sanitary processing, it is still not up to international standard.)

AFL had exported fish to Martinique and Guadalupe (French Caribbean Islands) in the past, but currently does not export to those islands as the processing plant is unsuitable sanitation and health standards of EU.

In terms of the domestic market, as well, since the country's main industry is tourism, the sanitation, health, and quality control of marine products must be improved in order to satisfy hotels that accommodate guests from foreign countries. Cross-border distributive competition is also expected to become fierce once the previously mentioned CSME is established. The law regarding marine products must be developed in the country in order to establish reliability and competitiveness in both domestic and international markets.

Finally, as most of the tourists to visit Antigua and Barbuda are from Western countries, it is essential to supply fish products complying with HACCP to them. Due to the above a processing plant satisfying with international standard is required under new concept of sanitation and health code to be enforced.

3) Wharf and Revetment

The existing wharf and revetment at the Point Wharf landing site has suffered from deterioration and extensive damage due to hurricanes and is essentially non-functional in terms of being used as a basic facility in the fishing port such as unloading, mooring, and preparations for fishing. This landing site has the largest fishing boats and fishermen in St. John's. It is essential to plan a rehabilitation of the fishing port in order to recover the unloading function. The refurbishment of a wharf and revetment is extremely urgent.

4) Slipway and workshop for boats and engines

There is no area in St. John's Bay for repairing fishing boats nor is there a lift facility for repairing boats. As a result, fishermen must either rent a truck crane and lift out the damaged part from the boat for repair or repair the boat itself while it is raised by a self-propelled crane rented from the private Jolly Harbor. Repairs to outboard engines are made by fishermen at their homes. The number of fishing boats repaired using the lift facilities at Jolly Harbor is small, only about 25 a year. This is because the landing site is far away and the high cost of using the facility is a heavy burden on the fishermen.

At the same time, many fishing boats have been damaged in the past since there is no lift facility to safely evacuate fishing boats when large hurricanes struck St. John's Bay.

It is for the above reasons that there is a great need and urgency on the part of the fishermen that are based on St. John's Bay to have a slipway and

boat engine repair area constructed.

5) Fishing Gear Repair and manufacturing open yard

Most fishing on Antigua is done using fish traps that are manufactured and repaired on the wharf or on unused land. The conditions for manufacturing these fish traps are very poor and the traps that have been made are piled up over a large area of open space, creating a problem in terms of traffic flow and use of land on the island. The government must consolidate all of the fishing gear repair and manufacturing sites into one area and manage it by preventing environmental destruction and setting limits on nets and wooden frames used for traps.

Therefore, it is essential to provide a repair and manufacturing yard for fishing gear and to create an orderly yard for repair work and storage.

6) Administration office

Various operations will become necessary at the administration office facility. These include the management of facilities such as wharf, mooring basin, and landing sites, as well as management and maintenance of the hygienic laboratory, processing plant, meeting hall, and fishing gear lockers for fishermen. It will be necessary to provide an office where the management and operation personnel can work.

7) Meeting hall

About once a month the Fisheries Division sponsors educational campaigns by offering a variety of courses for fishermen on topics such as improving the fishing industry, environmental conservation and engine repair, as a part of the fishing industry training program in an effort to ensure further development of the industry. However, since the Fisheries Division does not have a meeting hall, it conducts these courses at a rented meeting hall at the civic center. There is also no place for the fishermen themselves to get together to discuss fishery-related problems, such as problems with theft of fishing gear and to communicate with each other.

In light of the current situation, the Fisheries Division is hoping and planning to provide a more substantial program of seminars in the future aimed at improving fishing technology, and it is anticipated that the meeting hall will be used even more frequently as a result. Given these circumstances, the refurbishment of a meeting hall is thought necessary in order to improve the "soft" or intangible side of the industry because it will contribute to improving the lives of the fishermen and to the advancement of fishing technology.

8) Fishing gear locker

Since there is currently no storage available at the unloading site for fishermen they must take their engines, nets, fuel, and water tanks home with them. Fishermen locker where the fishermen can store their fishing gear is an

essential facility from the standpoint of improving the working conditions in the fishing industry and providing a good place to store and maintain equipment such as engines and fishing gear. It is also necessary from the standpoint of reducing the amount of time and energy that has until now been spent on managing and maintaining fishing gear.

9) Water storage tank

Due to low rainfall levels on Antigua and Barbuda there are frequent disruptions of the water supply and it is common for each government agency and household to have water storage tanks. Because of the functions at this facility, however, such as the production processing plant and hygienic laboratory, the water has to be of high quality and high sanitation levels. Consequently, it is necessary to plan that the water tank at the facility will be not be used for storing rainwater, but rather will be used as a water intake tank for storing water from the public water supply.

10) Emergency power generator

The APUA (Antigua Public Utility Authority) supplies and manages the power supply on Antigua and Barbuda, and every region has its own power plant. The power supply for the project site is sent from a power plant located approximately 10 km north of the area. However, power outages occur about twice a month (for an average of 30 minutes each time) due to some sort of problem with the feeder. It has been reported that particularly in times when hurricanes damage the transmission network, recovery can take up to a week or more depending on the location. A generator is necessary in order to maintain functionality of main facilities.

11) Parking lot

Since cars are a primary method of transportation in Antigua and Barbuda and most of the people utilizing the facilities including fishermen will access them by car, a parking lot is necessary.

(2) Codrington landing site

Components : Ice-making machinery/ice-storage, Sorting area, Fishing gear selling area, Office, Meeting hall, Fishing gear lockers for fishermen, Water storage tank, Generator, Parking lot

1) Ice-making machinery/ice-storage

There are no commercial ice-making/ice-storage facilities in Barbuda. For that reason some fishermen make ice at their homes to keep their catches fresh, but most fishermen do not have any ice and are forced to make day trips to close fishing grounds. This presents a major obstacle to marine product distribution in terms of preserving the freshness, safety, and quality of the catch from the

fishing areas to the landing site and then subsequently to consumers.

Furthermore, although the fishermen would like to ship their catches to the consumer area of Antigua, they do not have the ice required to keep the freshness, so that distribution route is currently unavailable to them.

It is for the above reasons that ice-making and ice-storage facilities are very important in terms of supporting fishing activities and improving distribution to Antigua and other consumer areas.

2) Fish sorting area

Distribution within the island is currently limited to direct sales from fishermen to consumers. Since there are no fish markets on the island, each fishermen unloads his or her catch at irregular times under the hot sun on existing sand beaches, and cleans and sell the fish on the roads or at home.

The refurbishment of ice-making facilities will improve distribution between Barbuda and Antigua, allowing red snapper and other fish that are in high demand by the tourism industry of Antigua to be packed in ice and consolidated to that market.

For that reason, once the fish have been sorted, cleaned, packed in ice, unloaded and efficiently stocked, a handling facility will be necessary for shipping them to Antigua. It is also expected that refurbishing such a facility will create more flexibility in distribution to consumers on Barbuda itself so that fish can be made available at all time.

3) Fishing gear selling area

There are no shops that deal specifically in fishing gear on Barbuda. Barbuda fishermen generally have to go to Antigua to obtain fishing gear, which is very inconvenient and time consuming, and in order to do so they have to stop working. The demand for fishing gear on the island is high and it is therefore necessary to provide a location where fishing gear can be sold.

4) Administration offices

Following the planned refurbishment of the fishing port facilities at the Codrington landing site, a variety of operations will become necessary including management of ice, fishing gear sales and management of the use of the sorting area, meeting hall, and fishing gear locker as well as maintenance of the facilities. It is therefore necessary to set up administration offices where the management and operation personnel of the facilities can work.

5) Meeting hall

The fishermen on Barbuda are divided into two different organizations, the Fishermen's Cooperative and the Fishermen Associates. These groups gather several times a month to have meetings and discuss joint purchases of

products such as fishing gear and fuel and discuss such topics as social security issues and measures for protecting against theft of gear. Frequent seminars for improvement of fishing technology are also held at the landing site for fishermen that are sponsored by the Fisheries Committee under the Antigua and Barbuda Fisheries Division of the Ministry of Agriculture, Land and fisheries and the Barbuda Council, in addition to many other opportunities for fishermen to assemble.

However, there are no facilities on Barbuda for fishermen to assemble and discuss issues, so at present they must rent the Barbuda council room for their meetings and assemblies. This presents a problem, however, since the council room is used not only for meetings by the fisheries sector, but also for other meetings held on the island, and this can sometimes interfere with the ability to hold discussions and meetings. Moreover, the Fisheries Division is planning to bolster and substantiate the seminars held on the topic of improved fishing techniques, and it is anticipated that the meeting hall will be in even more frequent use as a result. Given this situation, it is thought necessary to provide a meeting hall as a place where fishing-related activities can be promoted and technologies improved.

6) Fishing gear locker

Since there is currently no storage available at the unloading site for fishermen, they must take their engines, nets, fuel, and water tanks home. Fishermen locker for fishing gears is an essential facility from the standpoint of improving the working conditions in the fishing industry and providing a good place to store and maintain equipment such as engines and fishing gear. It is also necessary from the standpoint of reducing the amount of time and energy that has until now been spent on managing and maintaining fishing gear.

7) Water storage tank

Barbuda's water supply comes from wells and 4 inch PVC pipes lay underground along the road in front of the project site. However, this city water is only able to provide low pressure which results in frequent disruptions of the water supply. Additionally, as the water is high contained salinity, it is common for each household and government agency to have water storage tanks to catch rainfall as a backup water supply.

From this standpoint, it is important to build a water supply system that can combine the public water supply and the use of rainfall in order to provide the water necessary for the planned facilities. It will be necessary to provide water storage tanks to catch rainfall.

8) Emergency power generator

The island of Barbuda is dependent on a single power plant, the APUA

power plant, for its power supply. Although there are two generators at the power plant, power outages occur about once or twice a month on average (for one to two hours at a time) due to change-over of operation and during times when both generators malfunction.

For this reason, an emergency power generator is necessary to ensure that the facilities can perform their functions.

9) Parking lot

Since motorized vehicles are used in Antigua and Barbuda and most of the people utilizing the facilities, including fishermen, will access them by car, a parking lot is necessary.

2-2-3 Components to be implemented in this project

As a result of investigation, it was judged that there is the necessity for the above-mentioned components for both sites. At the same time, however, because of constraint on project costs and on implementation of the construction (procurement of materials, construction schedule, etc.) and other factors, it was considered that it would be more appropriate to give priority to the Point Wharf rather than refurbishing both sites simultaneously. Project at Codrington is examined whether implement or not according to the operating situation of distribution facilities at Point Wharf.

If the work is to be implemented simultaneously at both sites, it is predicted that a number of components will be eliminated and slimed down from both sites. The functions at both sites would be inadequate and would be lowered, and it would become more difficult to solve the problems at the each site. In deep consideration of priority for the two sites, the refurbishment of the facilities at Point Wharf is higher priority. This does not negate the necessity for refurbishing the facilities in the Codrington area.

Given the above, the basic design is implemented only for the project at Point Wharf.

The components targeted for the facility design are as noted below:

Hygienic laboratory, Processing plant, Wharf and revetment, Slipway and boat/engine repair area, Repair and manufacturing of fishing gear, Administration office, Meeting hall, Fishing gear lockers, Generator, Parking lot, Water storage tank

2-3 Basic Design of the Requested Japanese Assistance

2-3-1 Basic policy

2-3-1-1 Items for consideration at project site

The project site faces St. John's Bay and scattered remnants of the dilapidated public facilities that were damaged by hurricanes still remain. The wharf and revetment at the unloading site are damaged in many places and there are numerous problems in terms of safety, usability and aesthetics. The project takes into consideration safety, usability, aesthetics as well as the ability to administer and maintain the facilities.

2-3-1-2 Basic policy for planning the layout plan of facilities

(1) Functional zoning layout

At this project site, upon request by the Antigua and Barbuda Government, the following buildings will remain: one preschool, one house, two historic buildings, and one steel band storehouse. In addition, although it was not part of the request, there is a unique eight-sided building that has not had much wear and tear and is currently used as a break facility for the fishermen. Since this facility is in good condition and is one that the people are familiar with, the plan is to continue using the facility in the future. For that reason, the plan for the layout of the project site is based on being positioned around the six existing buildings at the site.

The site comprises three functional zones; a distribution function zone, a fishermen facility function zone and a management zone.

The distribution function zone includes a unloading wharf, a processing plant, and distribution truck yard (distribution parking lot). The distribution function zone will be located on the west side of the site taking into consideration the neighboring private White Fish Market, the current use of the wharf and access for automobile traffic.

The fishermen facility function zone includes revetment with mooring function, a slipway for repairing boats, boat yard, an area for repairing fishing gear, an area for manufacturing fish traps and fishing gear lockers. The plan for the slipway is located on the east side of the site. The conditions of the land and the existing fishermen's facilities will be taken into consideration.

In the management function zone are an administration office, a meeting hall and a hygienic laboratory. Since this function will manage the overall Point Wharf facility, it is located in the center of the site and will provide overall control of the other two functional zones. Since the hygienic laboratory is closely related to the processing plant it will need to be positioned near the processing plant.

Figure 2-3-1-2 (1) indicates the functional zoning layout.

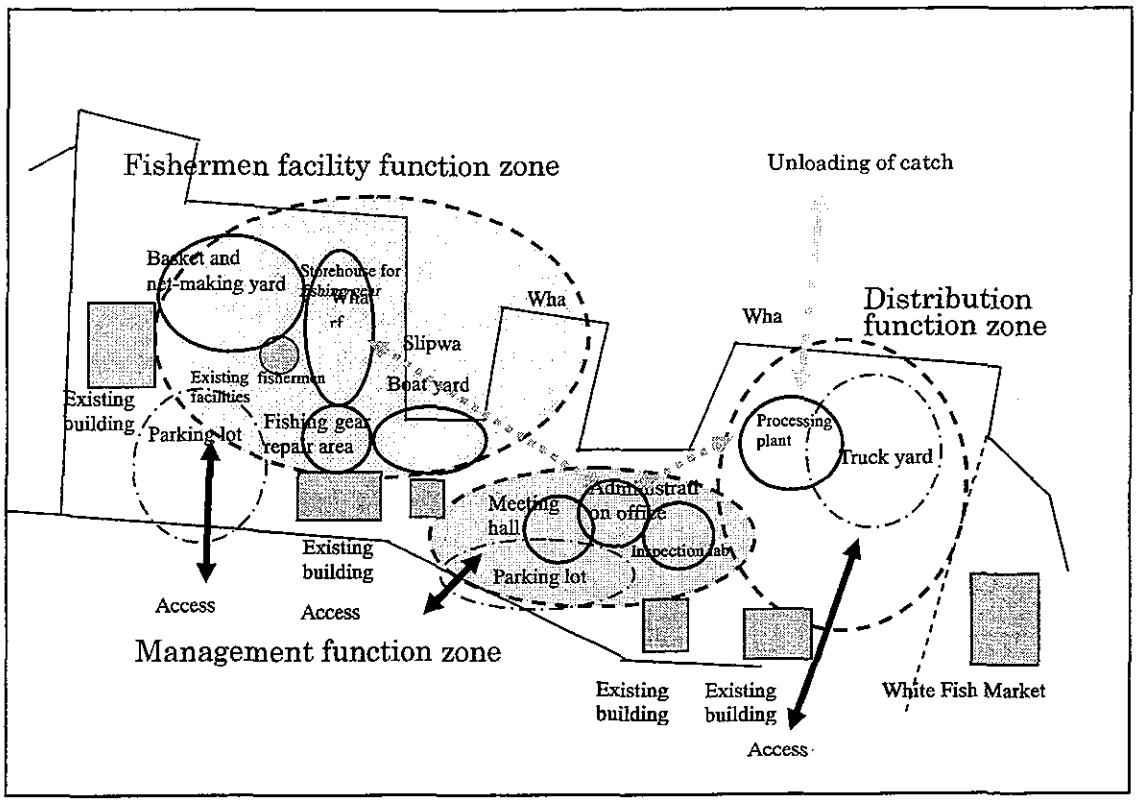


Figure 2-3-1-2 (1) Diagram of Functional Zone Layout

(2) Diagram of basic layout plan

The plan for facility layout at each project site based upon the functional zoning layout is as follows.

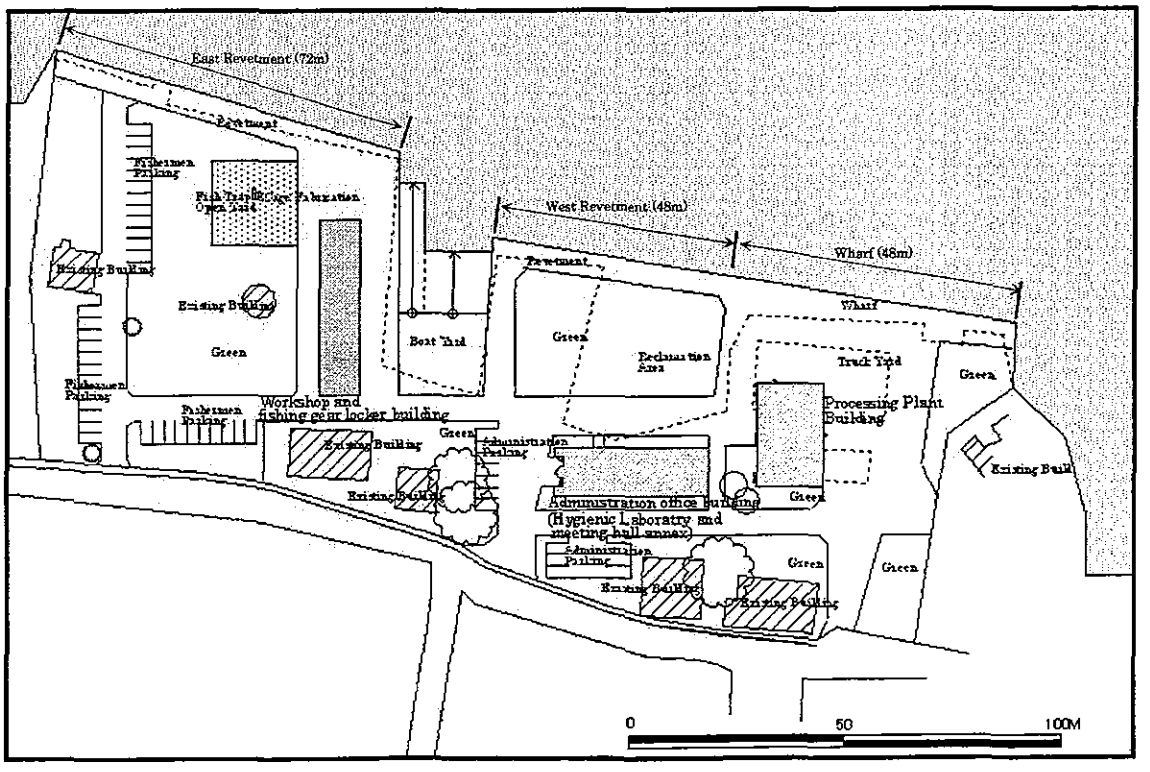


Figure 2-3-1-2 (2) Ground Plan Diagram

2-3-1-3 Basic policy for facility design

Facilities will be designed noting the following items:

(a) Construction work will be compatible with the existing fishing activities and daily life of the town.
(b) Sufficient attention will be given to not dramatically changing the conventional operating customs of the fishing industry.
(c) Buildings will be designed to appropriately reflect natural conditions. The design will be harmonious with the surrounding vegetation and natural environment of the site as it is located in the trade winds.
(d) Specifications and construction will be appropriate and facilities will be simple in order to ensure easy maintenance.
(e) The project plan will be streamlined and include the selection of appropriate construction methods and processes.
(f) The plan will be one that is harmonious with and will not dramatically change the surrounding natural environment or living environment.
(g) The plan will comply with the construction-related laws and standards of the country.
(h) The plan will place importance on scenic value when developing the waterfront.

2-3-2 Basic facility plans

2-3-2-1 Basic civil engineering design

(1) Contents of civil engineering design

Fishing industry facilities planned for this area include repair and restoration of the dilapidated and hurricane-damaged wharf and revetment. As many fishing boats use this landing site as a base, a revetment that will also serve as a mooring facility will be developed. In addition, the wharf that is in front of the existing storehouse is being used as a landing wharf for unloading catches and transporting everyday goods to Barbuda.

(2) Design standards

There are no specific regulations in Antigua and Barbuda regarding design standards that relate to civil engineering facilities and building standards are therefore set independently by those involved in the design. For that reason, design plans for fishing port structures will comply with "Design Standards for Fishing Port Structures" and the supplementary "Technical Standards and Description for Port and Port Facilities" that are Japanese design standards for fishing port structures.

(3) Natural conditions

The designs for each project site will take into consideration the following items with respect to the natural conditions of the area.

(a) Storm surges

At the project site it is reported that during hurricanes there are storm surges and there are also records of flooding in the past. Storm surge conditions have been estimated at approximately 1.0 m based on interviews and the results of numeric simulations. Consideration of storm surges will be given at this project site as well with respect to facilities that will be built on land.

(b) Wave condition

Strength calculations will be made giving consideration to rough sea conditions during hurricanes.

(c) Seismic force

Designs will take seismic force into consideration as earthquakes have been recorded in Antigua and Barbuda.

(d) Land use

There are some historical buildings on the project site and there is a storehouse for a Calypso steel band, typical music of the Eastern Caribbean, that has been used for the last thirty years or more. Care will be given to preserving some of these historical and cultural buildings. The design will consider these issues along with usability in the layout of the facilities.

(4) Functionality and maintenance

The water line at Point Wharf landing site is a complicated shape, the plan will be economical and to locate fishing industry activities in zones in the space so that they can progress smoothly with an efficient traffic flow.

(5) Construction work and time schedule

A construction method for the civil engineering facilities will be chosen which is advantageous from the standpoint of ease of construction work and time schedule, giving consideration to the terrain and foundation conditions at site.

Construction time schedule will be set based on the scale of the facilities and the time required for construction as well as on construction costs. Furthermore, as the project site is being used as a landing site, temporary planning will be painstakingly formulated to minimize the effects on existing fishing activities and assure the safety of fishermen. Plans for carrying in and out construction equipment and materials, plans for the

setting up and operation of temporary yards, and plans for the construction process will be given particularly careful attention. Since the existing wharf at the Point Wharf landing site is being used by fishing boats and by ships that carry everyday goods to Barbuda, the plan will be drawn up to carry out construction in consideration of those activities.

(6) Environmental and scenic considerations

In terms of the policy of the tourism board of Antigua and Barbuda, dilapidated facilities at the project site that have been destroyed by hurricanes and are scattered around very close to the tourist wharf, it causes scenic problem. The plan will take into consideration the form, color, and texture of facilities.

2-3-2-2 Basic plan for architectural design

(1) Design standards

Designs will take into account the Organization of Eastern Caribbean States Building Code and the Caribbean Uniform Building Code (CUBIC) that are used in Antigua and Barbuda and will use applicable Japanese construction standard laws and Japanese Industrial Standards (JIS).

(2) Architectural design

(a) Standard horizontal seismic coefficient

Antigua and Barbuda is located in a volcanic zone. Data from the United States Geological Survey (USGS) shows that an earthquake with a magnitude of 7.5 hit near Antigua and Barbuda in 1975. Therefore, the standard horizontal seismic coefficient will be set at 0.2.

(b) Wind pressure

Design standards will be set to accommodate 80 m/sec wind velocity to conform to the Organization of Eastern Caribbean States Building Code and CUBIC.

(c) Ground bearing capacity

Since the planned buildings will be either single-story or two-story structures, foundation constructions with pilings will be avoided and the plan will instead employ a construction system that uses a spread foundation in an effort to be economical. For that reason, the topsoil bearing capacity will be determined from the N-value based on soil boring data at the site.

Point Wharf landing site: 7-20 tons/m^2

(3) Wastewater standards

The Central Board of Health has set the standard for wastewater that flows to beaches where swimming is allowed at Class-1 (BOD 30 ppm) and the standard for wastewater to ports at Class-2 (BOD 150 ppm). In addition, since regulations apply not only to sewage but also to incidental wastewater, a merged wastewater treatment system will be required. Given these wastewater standards, Class-2 standards would meet regulations for the Point Wharf landing site. However, in recent years since the water quality at St. John's Bay has continued to worsen, the Development Control Authority (DCA) has recommended strict wastewater regulations to St. John's Bay particularly in the St. John's development plan. For that reason, Class-1 standards will be adopted for the wastewater standards at Point Wharf landing site.

(4) Measures for hurricanes

The land that will be used for the constructed facilities at the site is very close to shore-line and there are records of the areas flooding during previous hurricanes. It is essential to ensure that there are no effects on the buildings from storm surge during hurricanes by raising the floor of the ground floor above the usual sea level.

(5) Measures against salt water damage

The project site is exposed to damage from salt water since they are located at shore-line. For that reason, principal construction materials and electrical fixtures that are directly exposed on the outside of buildings will be ones that are resistant to salt water damage.

(6) Geographic and regional characteristics of the Caribbean

Due to Antigua and Barbuda geographic location trade winds, prevailing winds, the solar altitude and rain during squalls, adequate consideration must be given when designing building layouts, cross-sectional designs and openings.

In addition, planners should look into Caribbean-style designs that have been cultivated over years of living under the blazing sunlight.

(7) Method of construction and maintenance

Productivity during construction will be enhanced by adopting construction methods that are commonly used in the local.

Selected construction materials will either be ones that are very durable and require as little maintenance as possible, or ones that are easy to procure locally when repair of facilities will be required.

(8) Construction work and time schedule

With respect to the timing of civil engineering construction at the water's edge and construction work on building facilities at the project site, construction plans that secure delivery roads and clarify the compliance and construction order of earthwork will be drawn up so that both types of work proceed smoothly.

2-3-2-3 Basic plan for equipment design

(1) Equipment to be provided

The equipments that are necessary to make the following main facilities functional will be provided.

(a) Hygienic laboratory

Equipment and materials necessary for testing and analysis

(b) Processing plant

Equipment necessary for processing

(c) Administration office building

Equipment and materials necessary for fishermen's meetings and for management

(2) Technical level of equipment to be provided

For effective utilization and maintenance, the plan is to provide equipment that are consistent with the local technological level. The project will, however, plan to provide the following equipment for hygienic laboratory and the processing plant:

(a) Technical level of equipment for the hygienic laboratory

As there are no testing laboratories in Antigua and Barbuda for marine products and since this is the first time such equipment and materials will be introduced, only basic equipment is planned for the facility, and the country can conduct further development in the future under its own efforts.

Sensory testing is an important and valid method in primary testing on marine products and particularly for quality control under the HACCP method that requires quick responses and for export inspections. In terms of sanitation and quality control for the everyday marine product-related facilities and the marine products, it is necessary to control against bacterial contamination and ensure freshness levels by numerical values to confirm whether products are in deviation of the Critical Control Point (CCP) tolerance levels. Therefore the bacteriological testing and chemical testing rooms are indispensable. The equipment and materials provided will be those

necessary to conduct the minimum required tests. The plan excludes tests such as those for heavy metals, nucleic acids, fatty acid composition, and toxicology that require the operation of advanced instruments.

The plan allows for equipment and materials for the following tests and analyses:

i) Organoleptic evaluation

Items to be tested : mainly fresh foods, panel test of products not included

Tested items : odor, color, firmness of fish, taste, general measurement, check for parasites, check for foreign material

ii) Bacteriological analysis

Items to be tested : seawater, fresh and frozen fish, facility surfaces, fixtures and equipment

Tested items : visual check through microscope, total viable count, and laboratory cultures for food-poison causing bacteria such as coliform, staphylococcus, and salmonella

iii) Chemical testing

Items to be tested : seawater, fresh and frozen fish, imported processed marine products

Tested items : general analysis of food products (protein, lipids, moisture, ash, water activity) and freshness measurements

(b) Technical level of equipment for processing plant

Local processed products mainly comprise fresh and frozen products, and the plan will therefore provide equipment and materials based on the premise of producing the same types of products. The point that will be clearly different from existing processed products will be the production of safe and good quality products that are controlled for sanitation and quality. Though the level of the processing method may be simple, facilities and equipment will be designed to maintain cool temperatures, to prevent cross-contamination, to prevent contamination by foreign materials and to train personnel in order to ensure the safety and quality of food products.

Smoked and salted products are currently not produced in Antigua and Barbuda. However, training of processing are conducting Caribbean States training projects in Trinidad and Tobago on fisheries processing techniques for fish caught in the Caribbean. Attendees of the course from Antigua and Barbuda are hoping to produce products in their own countries that would

substitute for the smoked and salted products that are currently being imported from developed countries.

Thus, the planned processing plant will have the equipment and materials necessary to produce the following types of products:

i) Processed fresh products
ii) Frozen products
iii) Smoked products
iv) Salted products

(3) Equipment specifications

There are no manufacturers or distributors of the above types of equipment in Antigua and Barbuda. Therefore, the equipment provided should have very simple specifications and few malfunctions. It should be equipment for which it is easy to procure spare parts and should require low maintenance costs. Nevertheless, it must also meet functional requirements.

(4) Procurement countries to supply equipment

As stated above, there are no manufacturers or distributors of the planned equipment in Antigua and Barbuda. For that reason, equipment must be procured from Japan or third countries. Taking into account the specifications, quality and control over delivery time, most of the equipment will be procured from Japan.

2-3-3 Basic numbers used in determining size

2-3-3-1 Review of targeted number of fishing boats

The number of targeted fishing boats is based on calculations from the size of facilities at the mooring, slipway and boat yard facilities used by fishing boats at Point Wharf.

(1) Fishing boats in operation

The number of fishing boats in operation at the fishing bases in St. John's Bay (Point Wharf, Market Wharf, High Street, and Keeling Point) was checked in interviews based on registered fishing boats. Results showed 129 fishing boats currently in operation. The fishing boats in operation at St. John's Bay are listed by fishing base in Table 2-3-3-1 (1).

Table 2-3-3-1 (1) Fishing Boats Operating in St. John's Bay

Length of boat	Point Wharf	Keeling Point	High Street	Market Wharf
10ft≤Loa<20ft	12	8	2	9
20ft≤Loa<30ft	21	14	9	27
30ft≤Loa<40ft	10			
40ft≤Loa<50ft	7	1	1	2
50ft≤Loa	3	0	1	2
Total	53	23	13	40
% of 129 boats	41%	18%	10%	31%

Source: interviews

(2) Targeted number of fishing boats for basic facilities such as the wharf and revetment

As mentioned above, there are four fishing bases in St. John's Bay. The Antigua and Barbuda government is prompting the fishing boats that use two of those bases, Keeling Point and High Street, to move to other locations as they affect the navigation safety of cruise ships in the current areas. According to interviews, there are 15 fishing boats that will move from Market Wharf, High Street and Keeling Point to Point Wharf upon completion of the facilities, bringing the total number of fishing boats using Point Wharf to 68 boats.

Thus, 68 fishing boats will be targeted under the plan.

2-3-3-2 Specifications of fishing boats targeted under the plan

The average specifications by length of fishing boats in operation at Point Wharf are listed below:

Table 2-3-3-2 (1) Specifications of Fishing Boats at Point Wharf targeted under the Plan

specifications \ Loa		10ft< Loa <20ft	20ft< Loa <30ft	30ft< Loa <40ft	40ft< Loa	Average	Maximum
Length (Loa)	Ft	17.7	26.4	33.9	44.9	30.7	50.0
	M	5.4	8.0	10.3	13.7	9.4	15.2
Beam (B)	Ft	4.9	8.4	10.0	13.6	9.2	14.4
	M	1.5	2.5	3.0	4.2	2.8	4.4
Draft (D)	Ft	1.3	2.0	2.0	5.0	2.6	4.9
	M	0.4	0.6	0.6	1.5	0.8	1.5
Freeboard (C)	Ft	2.3	2.3	3.6	4.9	3.3	5.6
	M	0.7	0.7	1.1	1.5	1.0	1.7

Source: measurements and interviews

2-3-4 Basic design for civil engineering facilities

2-3-4-1 Basic design for wharf and revetment

By function, the wharfs include a landing wharf for the efficient unloading of catches, a preparations wharf for loading fuel and fishing gear to prepare to go out fishing, and a lay-by wharf. In Japan, the plan is to prepare each wharf according to these functions so that the various types of work can be carried out efficiently without any congestion. However, at Point Wharf the revetment used as the preparations wharf and the unloading wharf (the revetment of the storehouse and administration office from around 1910, built also to be used as a wharf. Reference material: A History of Antigua) is dilapidated and bumpy and does not even have any fender material. This barely surviving wharf is falling down and half of it is unusable, while the other half is used as a wharf for boats carrying everyday goods to Barbuda and for unloading catches. Given these circumstances, the plan is to refurbish the half of the wharf that is currently in use and to use it as a loading and landing site for inter-island transports as well as to use it as an unloading wharf for fish from Barbuda and catches at Point Wharf. The dilapidated and falling down revetment will also be refurbished and the plan will consider adding fixtures and equipment so that it can serve as a break and preparations area for fishing boats.

(1) Required wharf length

There are three cargo boats at the wharf that transport everyday goods to Codrington (one is currently under repair). If the fishing boats from Barbuda that currently use the wharf are also counted, there are about five fishing boats. As previously mentioned, there are 68 fishing boats that currently use Point Wharf as their base. Therefore, the total planned number of boats that use Point Wharf is 76, including the 68 Point Wharf fishing boats, the three cargo boats, and the five fishing boats from Barbuda.

(a) Required wharf length

The required length will be calculated based on the number of boats using the unloading wharf that include three cargo boats and 73 fishing boats. The cargo boats will pull up alongside the wharf to ensure safe and efficient handling of cargo. According to the field study, the time required for unloading and loading cargo onto the cargo ship is two days. The percentage of fishing boats that use the wharf in a day will be set at 80% of boats in operation. The windows for arriving and clearing are indicated in Table 2-3-4-1 (1) based on a survey of arrival and clearance from Point Wharf and Market Wharf. While there is no window of concentrated activity at the markedly damaged Point Wharf and the unloading times are long, there is a 3.5-hour period of time in which unloading is concentrated at Market Wharf where there is an unloading facility, and the average unloading time is 30 minutes. For that reason, the concentrated unloading time at Point Wharf once facilities are

developed will be set at 3.5 hours and the unloading time for each boat will be set at 30 minutes. The plan will be for fishing boats to moor perpendicular to the wharf, and extra length will not be provided.

Table 2-3-4-1 (1) Windows of Arrival and Clearance from Point Wharf and Market Wharf

Landing site	Clearance window	Arrival window	Window of concentrated activity	Average unloading time
Point Wharf	1:00 to 12:00	8:00 to 20:00	--	1 hour
Market Wharf	1:00 to 10:00	5:00 to 8:00	5:00-8:30	30 minutes

* Cargo boats
  i) Length of boat: 15 m (50 ft)
  ii) Number of boats: 3
  iii) Time required for unloading and loading of cargo: 2 days
  iv) Number of required berths: 3 berths, extra width 2 m
  v) Required extension: 3 × 15 m + 2 × 2 m = 49 m

* Fishing boats
  i) Width of boat: 2.8 m (average width of boats at Point Wharf)
  ii) Average number of boats using port daily: 58 (73 × 0.8 (operating boat clearance rate))
  iii) Unloading time per boat: 0.5 hours
  iv) Available unloading hours: 3.5 hours
  v) Number of berth turnovers: 3.5 hours / 0.5 hours = 7
  vi) Required length: 58 / 7 × 2.8 m = 22 m

The wharf length will be 49 m + 22 m = 71 m based on the above calculations. Since the extension to the existing wharf will be 68 m, the extension of the wharf that will be repaired will be 68 m.

(2) Required revetment extension

According to the terrain map, the revetment length is approximately 196 m. However, the available mooring extension is 120 m due to the water depth in front of it. From the standpoint of economy and land use, the normal line of the revetment will be a straight line and will be established by reclaiming the area in front of the planned administration building. In this case, the revetment will be extended by 120 m and the existing extension that enables mooring will be assured.

Taking into account economic feasibility and disturbances caused by reflecting waves during rough weather, the structural form of the revetment will

be of rubble-mound type. The mooring and preparations wharf will use this revetment. Therefore, a landing stage like a boardwalk-style wooden walkway for preparation work will be placed as function of mooring in front of the revetment and this will fit in with the waterfront development plan.

(3) Setting the slipway width

As there are no landings in St. John's Bay, fishermen lease cranes to lift up their boats in open areas or lift them up at Jolly Harbor in order to perform repairs and maintenance. However, only a few fishermen are using these methods as they are very costly. Many fishermen are struggling to find a way to cope with repairs and maintenance to their fishing boats. In light of the current conditions, a boat landing will be provided at Point Wharf for the 129 fishing boats operating at St. John's Bay which will provide a place for repairs.

According to interviews, fishermen lift out their fishing boats about once a year and spend approximately two weeks (14 days) on repairs and maintenance.

The number of fishing boats that can use the boat landing is calculated as five boats, as shown below, based on the frequency and timing of repairs and on concurrent use of the slipway and boat yard.

$$129 \text{ boats} \times 14 \text{ days} \div 365 \text{ days} = 4.9 \text{ boats (5 boats)}$$

The width of the boat landing is 20 m as shown below.

$$L = \Sigma B + b(n+1)$$

Here,

L : Length of required width for boat landing
B : Average beam (2.8 m)
b : Length of extra width between boats (1.0 m)
n : Number of boats using boat landing on a typical day (5 boats)

$$L = 5 \text{ boats} \times 2.8 \text{ m} + 1.0 \text{ m} \times (5 \text{ boats} + 1) = 20 \text{ m}$$

However, due to the large hull specifications of fishing boats that are 40 ft or more, the plan is to use a dolly and to lift boats out of the water by winch. The required width will be set to 5 m to allow for the 4.2 m average beam of fishing boats 40 ft or more in length and the width of the supporting rail that will be fixed to the dolly.

(4) Crown height of wharf and revetment

(a) Setting of crown height from conditions of use

The wharf currently in use is approximately 80 cm from the average sea level. The average freeboard height of fishing boats that utilize Point Wharf is 1 m. From a usability standpoint, the current height is extremely convenient for unloading and discharge. The current height of the wharf is 1.09 m and the planned wharf height will be 1.10 m.

(b) Setting of planned ground and building floor height considering damage conditions during hurricane Louis as obtained from interviews

According to the results of estimates on high waves during hurricane Louis, the rise in sea level was D.L. + 1 m, which is a degree that would flood the current wharf by approximately 30 cm. However, according to interviews, flooding at the water's edge was about 1 m. There is currently a distance of about one to two meters in ground level height from the water's edge to the road at the rear. So that there are no effects on the housing areas behind the project site, the project ground level will abut the rear road from the height of the revetment. The plan will utilize the highest portion of the current revetment that is D.L. +0.9 m and even if flooding occurs, this is not an area with buildings, so damage would be minimal. Therefore, the floor height of the buildings will be set high enough not to flood during storm surges.

(c) Investigation of sea level during storm surge based on the results of estimates of high waves

According to the results of estimates on high waves, abnormal high sea levels of D.L + 1 m occur during storm surges. This height is one that is approximately 30 cm higher than the current height of the wharf, but since the wharf is not used during unusually high sea levels, there is no problem with the current height even if it does flood. The same can be said for the planned ground. However, flooding of the buildings would render equipment inside unusable and therefore the floor height will be set higher than unusually high sea levels. (+1.4 m or more)

(d) Establishment of planned heights

Given the above considerations, the planned height for each facility is as shown in Table 2-3-4-1 (2).

Table 2-3-4-1 (2) Establishment of Facility Height

Wharf	Revetment	Port ground level	Floor height of buildings
+1.1 m	+0.9 m	+0.9 m to+1.5 m	greater than+1.4 m

(5) Cross-sectional design of wharf

(a) Setting of design depth of wharf

The plan is based on fishing boats targeted by the design with the specifications indicated in Table 2-3-4-1 (3).

Table 2-3-4-1 (3) Fishing Boats targeted by Design

Boat length	15.2 m
Boat beam	4.4 m
Draft	1.5 m

The design depth of the wharf will be such that fully loaded boats using the facility can moor freely. Therefore, the depth of the wharf will be as shown below given the maximum draft of fully loaded boats and extra depth, rounded up in units of 0.5 m. (Technical Guidelines for Fishing Ports, p. 388)

Design depth of wharf = maximum draft + extra depth

With hard sea bed 0.5 m or greater

With soft sea bed 0.5 m

For that reason, the design depth of wharf will be set as follows:

Design depth=1.5 m + 0.5 m=observed reference level - 2.0m

(6) Design conditions

(a) Design waves

Calculations on the design waves at Point Wharf are as follows:

i) Results of estimated high waves

The offshore wave conditions will be set as shown in Table 2-3-4-1 (4) based on the results of estimates performed on the high wave conditions of hurricane Louis. The hurricane data used is time series data obtained from the United States National Oceanic and Atmospheric Administration.

Table 2-3-4-1 (4) Offshore Wave Conditions on the North Coast of Antigua

Wave direction Wave height / period	W	WNW	NW	NNW	N	NNE
Wave height H_0 (m)	5.38	7.19	7.82	8.18	8.50	10.33
Period T0 (sec)	8.6	9.5	9.8	10.0	10.2	11.3

ii) Estimated approaching waves

For approaching waves, wave deformation calculation was performed on a total of seven cases, including six cases categorized by bearing based on the offshore conditions shown in Table 2-3-4-1 (4) and one case of an incoming wave (wave direction: W) coming toward the mouth of the port

with maximum specifications as indicated in Table 2-3-4-1 (4). Based on the results of each case, the maximum wave in front of Point Wharf is as follows:

$H_1 = 0.4$ m、 $T_1 = 8.6$ sec (wave height: W)

iii) Estimated wind waves generated in St. John's Bay

Estimates were performed using the SMB method of rough seas in the bay resulting from winds accompanying hurricanes. Wind data used was the average wind velocity during the time when hurricane Louis was close at hand. The fetch was set as the distance from the dry land at the west of Point Wharf.

Calculation conditions:

Fetch:	2,000 m
Wind velocity:	18.5 m/sec (Estimates based on average values from observational data from September 5, 1995)

Estimate conditions:

Wave height:	$H_2 = 0.6$ m
Period:	$T_2 = 2.3$ sec

iv) Wave height in front of structures

Given the above calculations, the design wave at Point Wharf will be set as follows:

Wave height $H = \sqrt{H_1^2 + H_2^2} = \sqrt{(0.4^2 + 0.6^2)} = 0.7m$

Period $T = 8.6$sec

(b) External force

Surcharge:	1.0 tf/m^3 (when stationary), 0.5 tf/m^3 (during an earthquake)
Berthing velocity:	0.5 m/sec
Lateral seismic factor:	0.15

(c) Unit volume weight

Reinforced concrete:	in air 2.45 t/m^3	in water 1.42 t/m^3
Plain concrete:	in air 2.30 t/m^3	in water 1.27 t/m^3
Covering rock:	in air 2.60 t/m^3	in water 1.57 t/m^3
Seawater:	1.03 t/m^3	

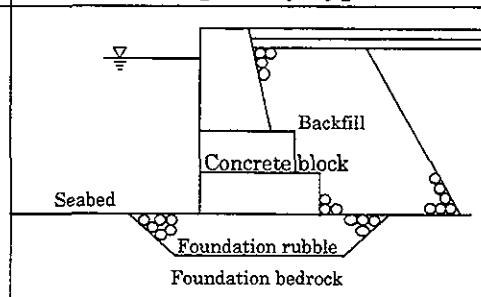
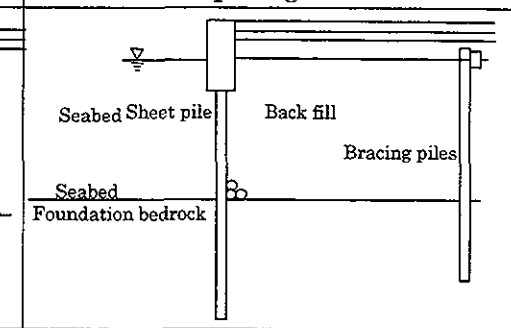
(7) Planned structural type of wharf and revetment

(a) Planned structural type of wharf

Structural types considered for the wharf are the block gravity type and steel sheet piling with braced piles type. A design comparison of the two methods of construction showed that the block gravity type would be less expensive than the steel sheet piling method. In addition, as shown in Table 2-3-4-1 (5), the foundation bedrock is clay soil with small stones mixed in that

has an N value of 40 or higher and as a result it may not be possible to drive in steel sheet piles. For that reason, the construction method adopted for the wharf will be the block gravity type.

Table 2-3-4-1 (5) Results of Comparative Review of Wharf Structure

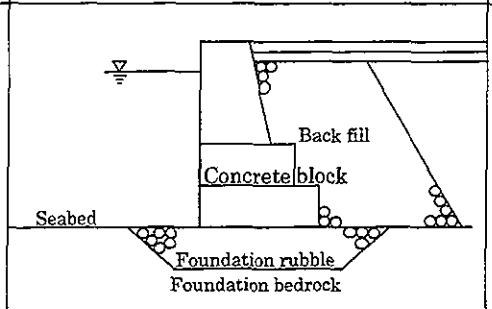
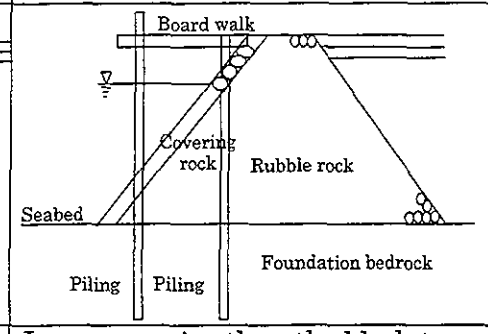
	Block gravity type	Sheet piling method
Cross-section		
Economical efficiency	All materials and heavy equipment except the large crane can be obtained locally. Less expensive than sheet pile construction.	Requires the use of heavy equipment such as a vibratory hammer and large crane along with machinery that must be procured from a third country. Sheet piling and tie-wire procured from Japan. Part of the work must be done offshore. High construction costs.
Construction	All work can be carried out from land, thus construction is easier than with the sheet pile method. Requires a block-manufacturing yard.	Requires part of the work to be done offshore. Possibility exists that if a waterjet is not used the sheet pilings cannot be driven due to fact that the foundation bedrock is clay soil with small stones mixed in that has an N value of 40 or higher.
Timeline	Requires slightly more time than the sheet pile method.	If a waterjet is not used, requires less time than the block gravity type.
Evaluation	○	×

(b) Structural type of revetment

Structural types considered for the revetment are the block type and the rubble-mound type. After conducting a comparative design of each type of construction the rubble-mound type was found more advantageous based on economical efficiency, constructability, and timeline as shown in Table 2-3-4-1 (6). Therefore, the construction method adopted for the revetment will be the rubble-mound type.

A landing stage like a boardwalk will be constructed along with the revetment for mooring function. In case the board panels connect with crossbeam strongly not to depart from the crossbeam by wave action, the penetrated piles will be pulled up by uplift force and the landing stage will be broken. Therefore, the panels will be allowed to depart from crossbeam by wave attacking. Spaces will be left between the panels of the boardwalk in order to reduce uplift and increase resistance against waves.

Table 2-3-4-1 (6) Results of Comparative Review of Revetment Structures

	Block type	Rubble-mound type
Cross-section		
Economical efficiency	Uses concrete, making costs higher than for rubble-mound type.	Less expensive than the block type.
Construction	Requires more advanced technology than the rubble-mound type.	Does not require as much advanced technology as the block type.
Timeline	Requires more time than the rubble-mound type.	Requires less time than the block type.
Evaluation	×	○

(8) Structural design of slipway

A simple slope of 1:6 to 1:10 is generally preferred for the grade of slipways. Given the limitations at the landing area of the plan, the grade will be 1:8.

The crown height of the landing will be the same crown height as the revetment, at 1.1 m.

The fishing boats using the slipway vary from 10 feet to 50 feet (draft 0.5 m to 1.5 m). The height of the wall at the top of the slipway will be set at -1 m for fishing boats from 10 feet to 30 feet that will be lifted out of the water by human means, and -2.0 m for fishing boats that are 40 feet or more.

(9) Accessory for wharf

(a) Fender material

In selecting the fender material, calculations were based on a 10 gross ton (GT) fishing boat, a 0.5 m/sec berthing velocity, and the energy that must be absorbed by the material. The required height of the fender material is 150 mm. The length of the fender material is set at 1,000 mm based on the crown height of the wharf + 1.1 m and the additional 0.21 m of average low tide. Accordingly, the fender material standard is 150 H x 1,000 L of the fishing port-type material.

The fender material spacing is set at 1/6 of the longest boat, or in this case 2.5 m, as the longest boat (Loa) is 15.2 m.

(b) Mooring posts

The type of mooring posts used will be the post type used for small fishing boats. Considering the tractive force of the 10 gross ton (GT) fishing boats targeted under the plan, 3t mooring posts will be required.

Mooring posts will be spaced at intervals of 5.0 m, which is equivalent to the value of the revetment -3 m or less based on the Technical Policy for Fishing Ports.

2-3-5 Basic design of architectural facilities

2-3-5-1 Design of architectural facilities

(1) Hygienic laboratory

1) Facility / equipment and material design policy

As is mentioned in the content of the request, Antigua and Barbuda are trying to carry out legislative preparations for the health, sanitation and quality control of marine products (including facilities, equipment and materials). Control will be based on the HACCP method, and as the national laboratory, tests will be conducted in line with the main points of that method. However, in order to carry out control under HACCP, the key is to establish a sanitary environment and a testing system. In order to establish this testing system, it is expected that the following three types of safety hazards will be the object of testing, mainly as they exist in food products.

- physical hazards (contamination by glass, metal, insects, etc.)
- biological hazards (mainly bacterial contamination)
- chemical hazards (substances formed due to deterioration in freshness, water quality, heavy metals, natural toxins)

The following types of tests will be required to test for these safety hazards.

- organoleptic evaluation (including physical testing)
- chemical testing
- bacteriological testing

Thus, the plan is to have facilities, equipment and materials designed for these three testing functions that make possible these types of tests.

That said, in light of the fact that there have never been testing facilities for marine products here in the past, the plan will only provide for basic testing and analysis necessary at present.

Specifically, the planned facilities and equipment will not provide for analysis and testing of heavy metals, nucleic acids, fatty acid composition and toxic substances that require advanced analysis technology.

2) Size specifications

Each laboratory will have minimum floor space for the functions listed below with consideration given to preventing contamination from outside. In particular, the design for the bacteriological testing room will allow for the acceptance of materials, sterilization, and washing. In providing equipment for each laboratory, equipment will be chosen that fulfills the function of the testing laboratory, does not require advanced technology for operation, and for which parts are easily supplied.

(a) Organoleptic evaluation room

Items to be tested :	mainly fresh foods; product panel test not included
Tested items :	odor, color, firmness of fish, general measurement, check for parasites, check for foreign material
Laboratory size :	4 m x 6 m with a work table to be used as a testing bench placed against two of the walls

(b) Bacteriological testing room

Items to be tested :	seawater, fresh and frozen fish, facility surfaces, fixtures and equipment
Tested items :	visual check through microscope, total viable count and laboratory cultures for bacteria that cause food poisoning, such as coliform, staphylococcus and salmonella
Laboratory size :	6 m x 5.5 m with a work table to be used as a testing bench placed against two of the walls, and a 1.5 m x 2.4 m center table

(c) Chemical testing room

Items to be tested :	seawater, fresh and frozen fish, imported processed marine products
Tested items :	general analysis of food products (protein, lipids, moisture, ash, water activity) freshness measurements, oxidation measurement
Laboratory size :	6 m x 5.5 m with a work table to be used as a testing bench placed against two of the walls, and a 1.5 m x 2.4 m center table

(2) Processing plant

1) Facility design policy

The planned processing facilities and equipment will take into account the technical level of the country and will aim to carry out processing that meets the local technical capabilities as much as possible without increasing the level of processing all at one time. They will also be controlled for sanitation and quality, and will be compatible with the standards demanded by the international market. At the same time, they will serve as a model for marine product processing in the country and a base for future advancement of marine product processing.

The chilled room will be used for temporary storage of fresh fish in a freezer until they are processed. In principle, fresh products will be delivered on the same day. Frozen products will be held short-term in cold storage until they are sold.

In this processing plant, processing of smoked product and salted product are planned.

2) Size specifications for processing facility, storage facility, and equipment

Under the plan, fresh fish will be items that are unloaded to the project site from fishing boats that arrive in port, items that are transported by automobile from somewhere on the island, items shipped on carrying vessels from Barbuda, and items imported by air shipments from neighboring countries. The facility will serve as a distribution base and will aim to sell products mainly to the domestic market (restaurants, hotels, supermarkets) and the export to neighboring countries in near future.

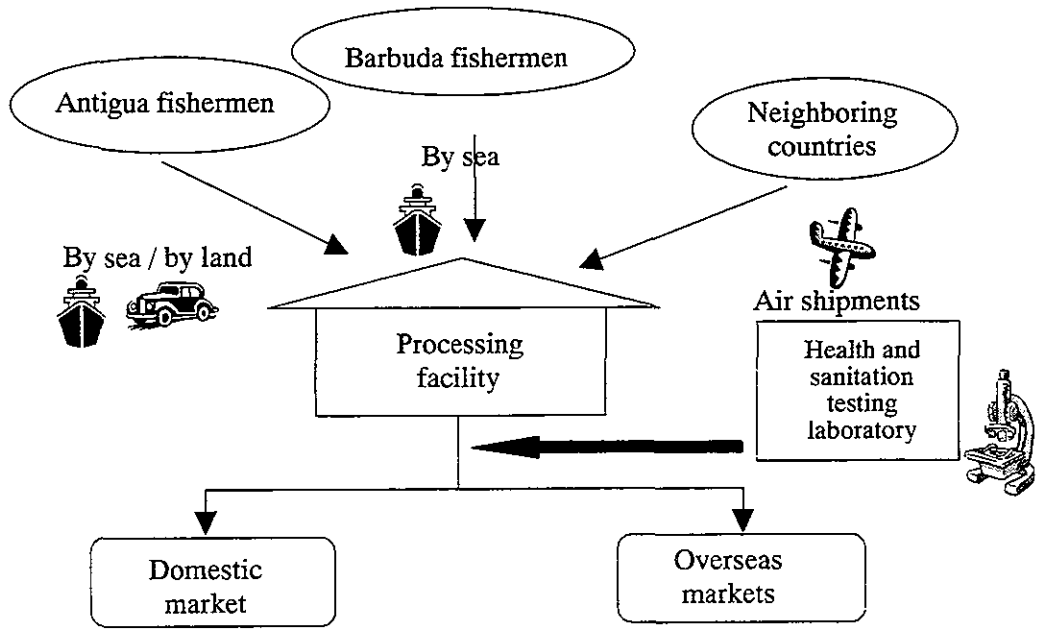


Figure 2-3-5-1 (1) Processing Plant Distribution Route

i) Organization of facility

The organization of the processing facility will be divided up as follows, by function:

- Sorting area (a space for temporary storage of, sorting by owner of, and sorting by fish type of catches that are unloaded from fishing boats)
- Pre-processing room (removing scales from and gutting catches)
- Ice-making equipment (ice-making equipment to make cubed ice for ice-packing at processing plant)
- Processing room (production of fresh, frozen, smoked and salted products)
- Packaging room (packing in Styrofoam, packing in cardboard, affixing labels)
- Freezer and cold storage (shelf freezing by air blast, with the frozen items stored in the same room)
- Cold storage (temporary storage of fresh fish for processing plant and temporary storage space for catches selected at sorting area)
- Auxiliary facilities (small kitchen area, changing room, toilet, work space for on-site personnel, machine room, power supply facility, water supply facility and waste water treatment facility)

ii) Planned annual production volume / items

The production amounts at the planned processing facility are estimated as follows based on the country's unloaded volume, export and import volumes, and the production amounts at the existing processing plant. It can be anticipated that the following types of fish will be unloaded at the site as fresh fish targeted for processing.

Table 2-3-5-1(1) Types of Fresh Fish at the Processing Plant

Processing method	Category	Type of fish targeted for processing
Fresh fish processing	High-value fish	Red snnaper, grouper, sierra, croaker
	Low-value fish	Filefish, shark, reef fish
Freezing	High-value fish	Sea bream, grouper, sierra, croaker
	Low-value fish	Filefish, shark, reef fish
Curing	-	Horse mackerel, mackerel, shark
Smoking	-	Horse mackerel, mackerel, shark, flying fish, reef fish

(a) Items for production

The following items are envisioned for production, given the consumer tastes and the available processing technology prowess in Antigua and Barbuda.

Table 2-3-5-1(2) Items Produced at Processing Plant

Type	Production ratio	Details
Fresh products	60%	Fresh products such as dressed, semi-dressed, filleted, and sliced fish, and peeled shrimp
Frozen products	30%	Frozen products of the above fresh products (IQF)
Smoked products	5%	Smoked products of pelagic fish such as horse mackerel and mackerel
Cured products	5%	Cured products of pelagic fish such as horse mackerel and mackerel

Smoked fish and salted fish are items that have not been produced in Antigua and Barbuda in the past, but imported items are generally available on the market, and efforts are being made to produce these domestically and bring them to the market stage. Consequently, these two items are included in the planning as production items, but this will not increase the scale of the facility. For smoked fish, a smoker is being planned as part of the materials planning, but no special materials are planned for salted products.

(b) Markets targeted for sales

Markets include the domestic market and the international market, but the domestic market will be targeted first. Investigations into the international market will be made once a certain level of operation in the domestic market is established.

- Experience and expertise in quality control methods will be attained in the domestic market where it is easy to deal with market demands and claims.
- The first aim will be for diversification of products in the domestic market where test marketing is easy to conduct, and then the aim will be to increase processing skills based on the needs of the market.

[Markets targeted for sales in the domestic market]

There is a significant demand for the supply of healthy, sanitary, and quality-controlled marine products from Antigua and Barbuda's hotels and restaurants that are engaged in the tourism industry, the key industry of the country. Meanwhile, the country's marine product processing level is low, and there are significant issues particularly in sanitation and quality control in terms of the safety of food products. At present, there is no

processing plant that can supply healthy, sanitary, and quality-controlled marine products.

The planned processing plant will be one that is controlled in terms of health, sanitation and quality, and will produce and sell healthy and sanitary and quality-controlled products to the domestic market in which they are in great demand. In other words, the sales targets will be hotels, restaurants, and volume retailers in the domestic market and not general customers who purchase small amounts.

(c) Scale of production volume

The scale of the volume produced will fluctuate depending on the item produced, the packaging, and the capabilities of the employees, but the items as shown in Table 2-3-5-1(2) are planned to produce, the volume to be handled at the project processing plant is envisioned as outlined below.

* FAO prediction of increase in demand

Based on FAO predictions, the increase in the total domestic demand for marine products in Antigua and Barbuda between 2001 and 2015 is expected to be 40%. It is already at a high level (2001) of 37.3 kg/year of consumed marine products per person. The future increase in demand is expected to be for high quality products that are currently unavailable, and is expected to come mainly from the hotels, restaurants, volume retailers and cruise ships that are the core of the tourism industry. There are no processing plants that can cope with their demand at present.

The current volumes of raw materials processed at the existing processing plants are indicated below (2002).

Table 2-3-5-1(3) Volume of Raw Materials processed at Existing Processing Plants

Company	Volume of raw materials processed (tons / year)	Remarks
AFL	55	AFL documents (2002)
WFM	50	Interview
CSF	30	Calculated based on scale of facility
Total	135	

* Scale of raw materials handled at the project processing plant

The project processing plant will carry out processing for the domestic market as indicated above.

Assuming that the rate of increase in domestic demand predicted by the FAO is 40%, the processed volume of raw materials will increase by

approximately 55 tons annually.

(Volume of raw materials handled at the existing processing plant
= 135 tons per year x 40% = approximately 55 tons per year)

The future increase is mainly expected to be healthy, sanitary and quality-controlled marine products as explained above. However, there are currently no facilities at the existing plants that can control quality and there is no room for improvement in terms of physical space. The production that will meet the increase in demand for high quality products will be carried out at the project processing plant. In other words, the scale of the project processing plant will be about 55 tons of raw materials handled per year.

Daily capacity of processing raw materials will be calculated as follows:

At the site, there are 20 operating days per month. The operating rate of a processing plant in Japan is normally 75%, but after taking into account the track record at the site, the operating rate will be set at 62% of Japan's operating rate.

(Raw materials handled daily: 55 tons x 1/12 months ÷ 20 days/month
÷75% ÷ 62% = 0.49 tons / day)

Therefore, raw materials handled will be estimated at 0.5 tons per day, based on raw material conversion.

(If we assume, according to Chart 2-3-5-1(4) Volume of raw materials handled at AFL, that the month with the largest volume handled is at the same level as Japan's operating rate, the monthly average volume of raw materials handled over a four-year period will be 62% of that.)

Table 2-3-5-1(4) Volume of Raw Materials handled at AFL

(Unit: LBS, Source: AFL)

Year	Volume	Remarks
1998	53,044	Max. month: 7,889 LBS / Min. month: 2,711 LBS
1999	71,562	Max. month: 10,878 LBS / Min. month: 3,667 LBS
2000	No data	
2001	113,510	Max. month: 12,744 LBS / Min. month: 6,482 LBS
2002	121,125	Max. month: 16,790 LBS / Min. month: 5,206 LBS
Average month	7,484 LBS/month (62% of max. month)	Average max. month: 48,301 LBS / month

Once technical and marketing skills are acquired, it will be possible to produce and market products to international markets if product quality and sanitation is controlled by HACCP. The following table on the past export record is provided for reference.

Table 2-3-5-1(5) Past Export Volumes and Destinations

(Source: Fisheries Division, volumes are based on raw materials)

Year	Fish (tons)	Lobster (tons)	Conch shells (tons)	Export destinations (%)
1996	88	27	15	Guadeloupe (43) , Martinique (5) USA (39), Canada (13)
1997	57	17	-	Guadeloupe (42), Martinique (4) USA (39), Canada (14)
1998	55	8	-	Guadeloupe (21), Martinique (1) USA (49), Canada (27)
1999	6	16	-	-

When the basic design study was conducted (July 2003), fish were not being exported because of inadequate health and sanitation control and quality control. All of the export destinations in Table 2-3-5-1(5) above require products that are HACCP-controlled. If processing is controlled by HACCP, there is a possibility of resuming exports to these countries.

Note: Since Guadeloupe and Martinique are French territories, EU sanitation and hygiene standards are applied.

iii) Size specifications of main facilities

The plan is for processing facilities of adequate size for the main functions listed below and for the function of a storage facility.

(a) Sorting area

The nature of the work requires a space where people and things can move freely. Although there will not be an occasion in which one ton of fresh fish arrives all at one time, the planned space would allow for sorting work of that scale. This sorting area is the first room in which fresh fish are received at the processing plant, as receiving and sorting are carried out efficiently so that the fish can then be transferred to the pre-processing room. Since fresh fish do not remain in this room, the space planned will be 3.8 m x 7.5 m, the required space in which to continuously carry out the work of sorting by fish type or size.

(b) Pre-processing room

This is the work area where the quality of fresh fish is checked, and where the fish are washed, scales are removed, and the fish are gutted. The project allows for space in which 0.5 ton of fresh fish per day can be processed. In the center of the pre-processing room is one work bench with a two-meter width of space on all four sides for work, a simple ice-making machine and aisles as described later, for a total room space of 4.5 m x 7.5 m.

(c) Ice-making machine

Ice is used at the pre-processing stage and therefore a simple ice-making machine will be placed in the pre-processing room. Since this ice-making machine is one that is intended to supply ice that is used in the processing plant, the supply of ice to fishing boats has not been taken into consideration.

(d) Processing room

The actual processing area of the existing AFL processing facility is 6 m x 12 m, but it has no pre-processing room or packaging room, and is unable to control sanitation health and quality. In addition, since the area of the processing room is too small, it is limited in the varieties of processing it can accommodate. The plan for the processing room at this facility is for about the same area as the AFL processing room, but the facility will also have the necessary functions of a pre-processing room and a packaging room.

From a sanitary and healthy standpoint, packaging in inner bags and packing in trays will also be carried out.

In the center of this processing room are three work benches with a two-meter width of space on all four sides for work and aisles for a total room space of 7.5 m x 7.5 m.

(e) Packaging room

In the packing room, items will be packed in Styrofoam and in cardboard, and the room will have sufficient space to facilitate such work. In the center of the packaging room is one work bench with a two-meter width of space on all four sides for work and aisles for a total room space of 3.6 m x 6 m.

(f) Storehouse for refrigerated/frozen goods

Volume of frozen goods :	One quarter of the overall product volume (65% of the average yield) is to be frozen. In other words, the target for freezing is to be 163 kg per day (500 kg x 65% x 1/2 = 163 kg).
Method of freezing :	Shelf-type air blast method, use of pans for freezing, room temperature - 30°C

(g) Chilled room

In terms of the processing time at the processing plant, the work begins largely at a given time, but because the fish are not always received from the fishing boat at a given time, there must be a place where they can

be left temporarily until they can be processed. Moreover, the facts must also be taken into consideration that imported fish are transported by air whenever the need arises and that fish are brought in from Codrington at irregular intervals.

(3) Administration office

1) Facility design policy

Since the administration office functions as a control post for this entire Point Wharf facility, it must be located in a central position in the overall facility, and in a position from which it is possible to physically look out over the entire facility as well. At the same time, the design layouts of the various offices have to be planned based on the administrative organizational system.

Space is also required for document rooms that will double as reception and waiting rooms, stack rooms and storehouses as annexed spaces.

2) Specification of scale

This facility is planned for management and operation by the Fisheries Division of the Ministry of Agriculture, Land and Fisheries or AFL. There are 18 employees who will require office space, based on the organizational personnel positions plan. Of those 18, because it is more efficient for the three employees in the hygienic laboratory and the two employees overseeing the marine products processing work site to have offices (testing rooms) at their work sites, this administration office is planned to provide office space for 13 people.

The practice of using a large common office for all of the employees except for the office of the fishing port manager, who oversees the entire facility, is already well-established in Antigua and Barbuda. The office space per person is as follows, with reference to "Architectural Database" compiled by the Architectural Institute of Japan.

Fishing port manager's office	Approximately 25m^2
Manager-class personnel	Approximately 12 m^2
Ordinary employees	Approximately 9 m^2

Moreover, space is necessary for reception and waiting rooms, and a depth of 3 m will be provided for these, including the corridors.

(4) Meeting hall

1) Facility design policy

This facility must be available not only to the fishermen at Point Wharf, but to all of the fishermen of the St. John's port as well. The facility is planned to serve as a place for meetings, meaning meetings initiated and held by the fishermen among themselves, as well as a venue for instructional and guidance activities and seminars over which the Fisheries Division presides, such as promotion of the fisheries industry, guidance in improvements, and instruction in environmental protection. The space needed and the number of participants at the facility will vary depending on the topic being addressed, but one multi-purpose meeting hall is being planned that can accommodate different types of meetings by rearranging the chairs and desks. Because this indoor meeting hall will be used for purposes such as lectures and seminars, the target users will be the owners of fishing boats that are registered with the Fisheries Division of the St. John's Bay. At the same time, the number of people, including fishermen who are not boat owners, can be estimated based on statistics compiled by the Fisheries Division in the past that put the figure at 2.6 people per fishing boat. For meetings of all of the fishermen including part-timers, the fishing gear repair and manufacturing open yard can be used.

2) Specification of scale

The total number of fishing boats operating in the Point Wharf, Market Wharf, Keeling Point, and High Street wharves in the St. John's port is 129 (53 + 40 + 23 + 13), and more than a few fishermen possess more than one fishing boat, so the number of boat owners is largely the same, at around 129.

In the past, however, the number of fishermen participating in fishermen's gatherings such as seminar-style meetings and panel discussions, where a topic such as social insurance for fishermen, medical care, or the problem of theft, for example, was discussed, has been around 60 people. Also, seminar-style technical courses sponsored in the past by the Fisheries Division on topics such as new methods of fishing, engine maintenance training, and processed goods development, have drawn anywhere from five or six to 20 people, depending on the topic. Based on these figures, it is desirable to assume a scale designation for the indoor meeting hall that would provide space for lecture-style meetings attended by 60 fishermen.

According to Architectural Database compiled by the Architectural Institute of Japan, a floor space of $1.4m^2$ per person is required for lecture-style meetings such as these. Consequently, the meeting hall will have a floor space of 84 m^2 (=60 persons $\times$ $1.4m^2$).

(5) Fishing gear locker

1) Facility design policy

Although an oral survey conducted in the field showed that there is strong demand for a fishing gear locker, the items stored in the storehouse will vary depending on the scale and format of the fishing boat, and fishing gear cannot be accommodated within a uniform storehouse scale. Consequently, storehouse units will be specified in different types for different demands. Also, to prevent theft, the storehouse units will be lined up in a row with as few dead angles as possible, and there will be no outer walls; the units will be designed so that they can be seen through from the outside, on all four sides.

2) Specification of scale

Because there are currently no fishing gear lockers at all at the various fishing bases in the St. John's port, the fishermen are putting up with a situation in which they have no recourse but to take their fishing gear, etc. home with them, even though this may be inconvenient, or, if a fishing boat has a cabin, fishing gear is being stored there. Under these circumstances, although there is strong demand for fishing gear lockers, interviews and statements by Fisheries Division personnel based on the assumption that there would be a charge for using the completed facility indicate that the percentage of owners of fishing boats that do not have locked cabins, meaning fishing boats of 20 feet or less, who would rent space at the fishing gear locker, even at a charge, would be close to 70 to 90%. Here, a storehouse is needed in which items could be stored such as ice boxes, ropes, buoys, nets, oil tanks, water tanks and navigational safety devices. This is referred to here as the « Type A » storehouse. On the other hand, opinions were also given that owners of fishing boats with locked cabins, meaning those 20 feet or longer, would prefer a locker-style storage facility that would offer a higher level of security, even if it were on a smaller scale, and the demand for such a facility comprises approximately 40 to 50% of the fishing boat owners to whom this project is applicable. This is referred to here as the Type B storehouse.

For the scale of the Type A storehouse, based on the items to be accommodated, one unit would have an effective surface area of 2,100 x 1,500 mm, while for Type B, if a school locker designed to hold changes of clothing and valuables were used as the standard, the unit surface area would be 975 x 975 mm.

Of all of the fishing boats currently using the Point Wharf, there are 12 boats that are 20 feet or less in length, demand for the number of Type A units is calculated to be 23% of the overall number of boats, so the planned number of boats targeted for Type A for Point Wharf would be (68 x 0.23) x 0.8 = 12 units. For Type B, the number of units would be (68 x 0.77) x 0.45 = 24.

(6) Workshop for boat and engine repair area

1) Facility design policy

There is no engine repair site on the fishing bases in the St. John's port. Consequently, this engine repair area at the Point Wharf site must take into consideration not only the fishing boats that use Point Wharf as their fishing base, but all of the fishing boats in the St. John's port. Also, this engine repair area will function as a venue for the refurbishment and storage of the outboard engines of the fishing boats, as well as the repair and refurbishment of inboard engines.

2) Facility scale

There are 129 operating fishing boats in the St. John's Bay (53 at Point Wharf, 40 at Market Wharf, 23 at Keeling Point, and 13 at High Street). Of these, according to a field study, fishing boats that use outboard engines are those that are 20 feet or less in length, which total 31 boats (12 at Point Wharf, 9 at Market Wharf, 8 at Keeling Point, and 2 at High Street). Thus, there are 98 boats that use inboard engines, which are over 20 feet in length. In addition to the repair of outboard engines that break down, these engines must undergo regular inspections around once every other month. Inboard engines undergo regular inspections at the same frequency, but because these inspections are done on the boat, the facility scale must take into consideration only the occasions on which these engines break down. As a result, the basic number of boats used in determining the scale of the engine repair site will be the 31 boats that use outboard engines.

Because regular inspections are carried out on the applicable outboard engines every other month, 15.5 engines will be targeted for refurbishment every month.

Because the fishermen work nine to twelve days per month, and do not work on Saturdays, Sundays and holidays (nine days), each fishermen is likely to bring an outboard engine in for regular maintenance one out of ten days a month. Not all of the fishermen are off on the same days, but it is thought possible that more than one fisherman may bring an outboard engine in for maintenance on the same day. If the overlapping coefficient is set at 50%, and the average number of days on which the repair area is able to be in operation is set at 20 days per month, the number of outboard engines that can undergo regular refurbishment on any given day is calculated as follows:

Number of target outboard engines x overlapping coefficient / average number of days per month on which operation is possible = 15.5 x 150% ÷ 20 = 1.2 engines per day.

Moreover, adding in repairs of minor breakdowns, the number of

engines that can be refurbished and repaired in a single day is two engines. The amount of space required is calculated based on this figure.

For the number of engine hangars, taking into consideration two outboard engines that require long-term repairs, enough engine hangars to store four outboard engines are necessary. Because it takes half a day per engine to carry out regular refurbishment of an outboard engine, there is one (2÷2) work table used for refurbishment, but two are necessary if engines requiring long-term repairs are taken into consideration. These will also be used as work tables for inboard engine repairs. Also, one tank will be provided for outboard engine testing.

Consequently, the following equipment will be provided in the engine repair area.

Work tables	2 (each with a frontage of 2 m, a depth of 1 m, and a work space of 2 m)
Engine hangar	Overall length 4 m (1 m per outboard engine, work space of 2 m)
Test tank	1 (1.5 x 2 m, work space 1.5 m each in 3 directions)
Tuning block	1

(7) Boat yard

1) Facility design policy

This is a yard used for repairs after fishing boats have been taken out of the water via a ramp, as well as an emergency evacuation area. Because there is no such facility for fishing use in the St. John's port, this facility is planned to accommodate not only the Point Wharf fishing boats, but all of the fishing boats in the St. John's port. It will be positioned so that it is a continuation of the ramp and is also close to the engine repair area. Also, because large numbers of boats are taken out of the water using the ramp when a hurricane occurs, this boat yard for fishing boat repairs is positioned in the course along which the fishing boats travel, so the yard will be planned as an open yard, to avoid being a structure that might hinder the movements of the fishing boats.

2) Specification of scale

There are 129 operating fishing boats in the St. John's port (53 at Point Wharf, 40 at Market Wharf, 23 at Keeling Point, and 13 at High Street). According to a field study targeting boat owners, regardless of the scale of the fishing boat, the boats are taken out of the water once a year, for around two weeks, to have the hull painted and to make repairs. Consequently, the scale was specified by taking 129 as the number of targeted fishing boats and assuming that the boats are taken out of the water at a frequency of once a year, and that the time they are out of the water is two weeks.

Each fishing boat is used for fishing 124 days a year. The time that all of the fishing boats are out of the water during the entire year was calculated, and the space required for the boat yard where hulls would be painted and repairs made was calculated. Assuming that the number of days on which the boat yard can be in operation during the year is 365, and then considering the number of days on which the boats are drying after being painted, the fishing boat space required for a boat yard for hull repairs is as follows.

No. of targeted fishing boats x 14 days (2 weeks) / 365 = 129 x 14 / 365
= space for 4.9 boats

The amount of space in the depth direction required for one boat was calculated by assuming the maximum length of an operative fishing boat in the St. John's port and adding two meters each at the front and rear, for a total of 19 meters (2 m + 15 m + 2 m).

For the frontage, the average fishing boat width was used, and using the same approach as for the overall length required for the location where boats are taken out of the water, the frontage was set at 20 meters (5 boats x boat width of 2.8 m + margin width of 1 m (5 boats + 1)).

If 129 boats were evacuated to the planned site during a hurricane, a ground surface area of approximately 3,400m^2 would be required (using the average specifications of the targeted fishing boats). Ample space can be assured if the eastern part of the ramp, the yard for fishing gear manufacturing and repair, and the surface area of the parking lot are all added together.

(8) Fishing gear repair and manufacturing open yard

1) Facility design policy

In Antigua and Barbuda, the principal fishing gear consists of baskets used for basket and net fishing. Manufacturing these baskets involves welding together the reinforcing bars of the framework and stretching the wire netting over them, and because several baskets are manufactured in a day, a large amount of space is required that exceeds the scale of the indoor work space that can be assured. As a result, this yard will be set up as an outdoor open yard adjacent to the fishing gear locker and the engine repair area, providing easy access to power sources for welding. Also, the yard can be used as a place where fishing nets can be spread out and mended.

2) Specification of scale

When basket-type nets are manufactured, one fisherman hires one or two helpers, so a space of 20 m x 20 m per unit is required, including the location for the finished nets. Because the finished nets are moved the same

day, it is possible for the 68 fishing boat owners in the Point Wharf to share the same 1-unit space.

(9) Parking lot

1) Facility design policy

The functions of the Point Wharf can be generally classified into three groups: a distribution function, a management function, and a fishermen facility function. The flow line between "people" and "things" varies depending on the differences between these functions, so access gates to the site using cars, which are the means of access, and parking lots are planned in dispersed locations depending on the differences in their functions.

2) Specification of scale

(a) Parking lots (truck yards) under the distribution function

The "distribution function" of the Point Wharf is the zone that includes the processing plant as the center of the wharf where the marine products are unloaded. This unloading wharf functions not only as the place where marine products are unloaded, but also as a wharf for the distribution of everyday living items for Antigua Island and Barbuda Island. It is also the point from which shipments of processed marine products are shipped from the processing plant. In other words, the yard must fulfill two different types of distribution measures. Here, space will be assured where four 4-ton trucks can stop to unload their cargoes, and one truck can be parked, as well as the space required for trucks to turn around.

(b) Parking lot under the management function

The parking lot under this function takes employees and visitors to administration offices into consideration. Because the number of employees is 18 based on the setup of the organizational structure, it is assumed that approximately 60% of them will use the parking lot, meaning space for 12 passenger cars, along with space for two visitors' cars. This means assuring enough space for a total of 14 cars. With respect to a parking lot for visitors to meeting facilities, because the temporary element is strong, the parking lot for the fishermen' facility (described later) and the space around the wharf will be used, so there is no particular need to take this into consideration.

(c) Parking lot under the fishermen' facility function

There are 68 targeted boat owners in the Point Wharf port, and the number of days of operation is nine to 12 days per month. Leaving out Saturdays, Sunday and holidays, this corresponds to between 45 and 55% of the month. The days on which fishermen are working and off are not fixed,

so it can be assumed that the amount by which working days overlap is 50%. As a result, the number of parking spaces for fishermen is set at 34 (68 x 0.5), and the parking space per car is set at the space required for a pickup-type car (3 m x 6 m).

(10) Water tank

1) Facility design policy

The facility requires high-quality water for the production processing plant and hygienic laboratory. Consequently, the water tank at this facility will serve for emergency purposes, but rather than being used for storing rainwater, it is planned for use as a water intake tank for storing water from the public water supply. The pipes will be used for normal water supply and for water supply during times when the supply runs out, and in order to keep the water in the tank sanitary and hygienic, this water tank is being planned as an "intake water tank + pump pressure-feed" system. In other words, it will be part of the normal water supply system.

2) Specification of scale

In the water supply planning, if an "intake water tank + pump pressure-feed" system is used, the capacity is normally planned at 50% of the volume of water used in one day. However, because this project aims at having the facility in operation with the water tank being used during times of emergency (water supplies being cut off), even if it operates under restricted conditions, the capacity is being planned at another half of that base 50%, meaning another 25% of the volume of water used in a day. Also, the range over which water can be supplied during an emergency will consist of the production processing plant area, the health and sanitation testing laboratory area, the management office area, and the meeting hall area. Thus, the intake water tank capacity will be as follows:

18,232 x 50% x 50%=4.56 tons (4.8-ton tank available in the market)

The figure of 18,232 was calculated by subtracting the volume of water used in the engine repair area, which is 1,080m^3, from the total volume of water shown in Table 2-3-5-6 (1), which is 18,232m^3, and the assembly-type tank made by FRP will be used.