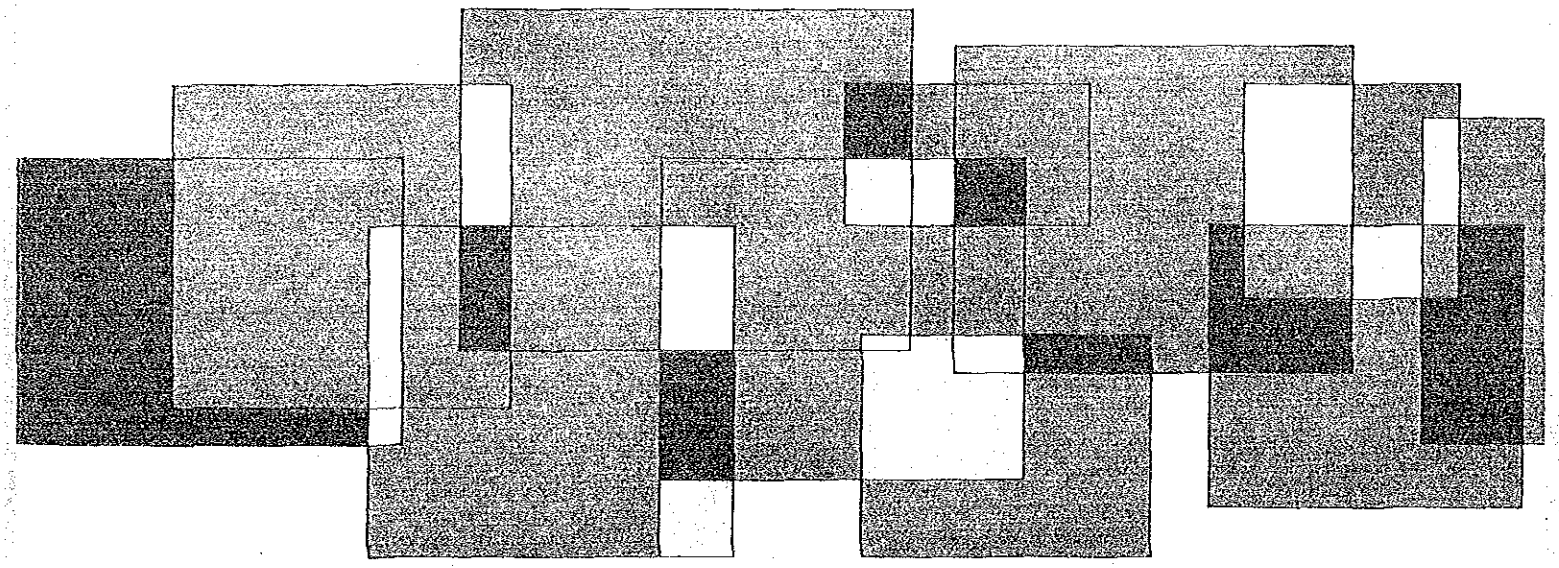
THE REPUBLIC OF THE PHILIPPINES

THE FEASIBILITY STUDY ON FISH TRANSPORT SYSTEM

VOLUME I
BASIC PLAN



FINAL REPORT

AUGUST, 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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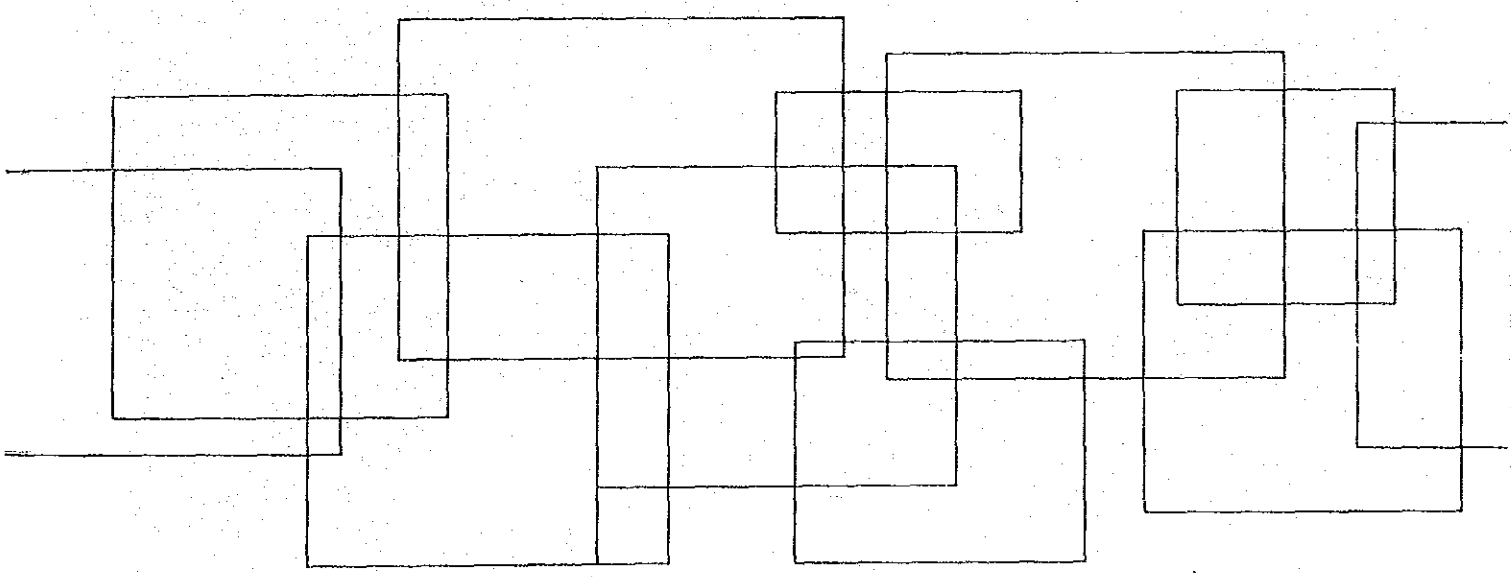

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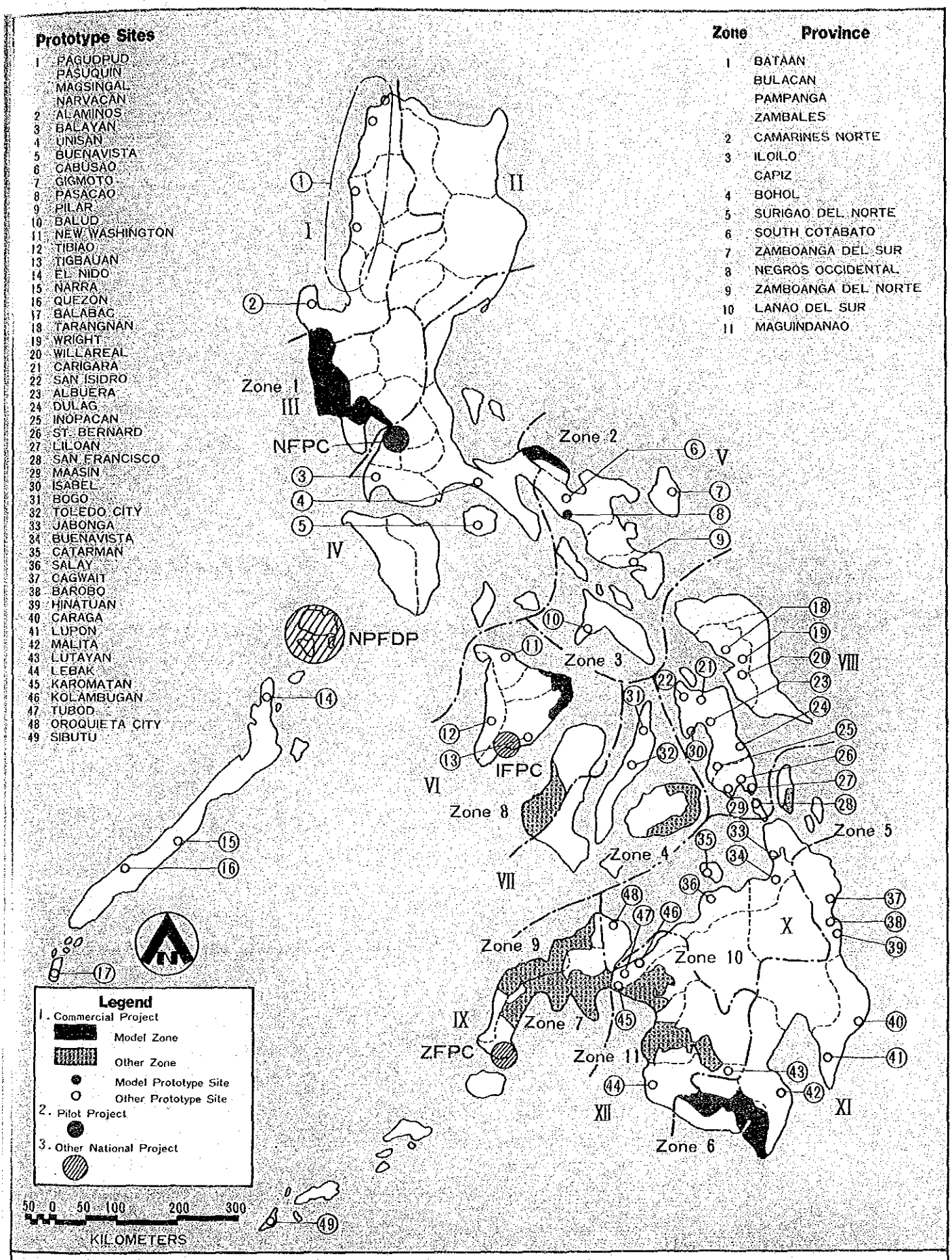

LOCATION OF SELECTED ZONES AND PROTOTYPE SITES OF FTS

THE REPUBLIC OF THE PHILIPPINES
THE FEASIBILITY STUDY ON
FISH TRANSPORT SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY

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ABBREVIATIONS

1. Public Agencies and Organizations

(1) Government of the Philippines

DA	: Department of Agriculture
DPWH	: Department of Public Works and Highways
BFAR	: Bureau of Fisheries and Aquatic Resources, DA
FIDC	: Fishery Industry Development Council
FNRI	: Food and Nutrition Research Institute
NCSO	: National Census and Statistics Office
NEDA	: National Economic and Development Authority
PFDA	: Philippine Fisheries Development Authority

(2) Government of Japan

OECF	: Overseas Economic Cooperation Fund
JICA	: Japan International Cooperation Agency

(3) International Organization

IBRD	: International Bank of Reconstruction and Development, World Bank

(4) Internal Units of PFDA

IFPC	: Iloilo Fishing Port Complex
NFPC	: Navotas Fishing Port Complex
ZFPC	: Zamboanga Fishing Port Complex

2. Plans / Programs / Projects

FTS	: Fish Transport System
IFDP	: Integrated Fisheries Development Program
IPCS	: Nationwide Ice Plants and Cold Storages Network System
NPFDP	: Northern Palawan Fisheries Development Project
FDCP	: Fisheries Development and Conservation Plan 1987-1992
MTPDP	: Medium-Term Philippine Development Plan 1987-1992

3. Technical Terms

EEZ	: Exclusive Economic Zone
EIRR	: Economic Internal Rate of Return

FIRR	: Financial Internal Rate of Return
F/S	: Feasibility Study
GDP	: Gross Domestic Product
GRDP	: Gross Regional Domestic Product
MFP	: Municipal Fishing Port
M/P	: Master Plan
NCR	: National Capital Region
O/D	: Origin and Destination
RFP	: Regional Fishing Port

TERMINOLOGY

1. Municipal Fisheries:

   Fishing utilizing fishing boats of three gross tons or less or using gear not requiring the use of boats (P.D. No. 704)

2. Commercial fisheries

   Fishing utilizing fishing boats more than three gross tons (P.D. No. 704)

3. Brokers - Merchants who sell fish for commercial and municipal fishermen and pond operators, receiving a commission of 5-7%. They do not own the fish, but rather it is given on consignment basis.

4. Viajeros - Transporters who buy and bring fish catch from fish landing sites/wholesale markets to other wholesale or retail markets by land and/or marine transport; may also be called shippers or truckers.

5. COD : Cash on Delivery

6. O A : Offset Account

7. CAT : Cash After Trading

1. INTRODUCTION

1. INTRODUCTION

(1) Background

Under the new Aquino administration, the Philippine government has framed a new national socio-economic development strategy, which has given rise to the medium-term Philippine Development Plan for the 1987-1992 period. In line with this policy, the Department of Agriculture - Philippine Fisheries Development Authority (DA-PFDA) is moving forward to implement on a nationwide scale, the National Fish Marketing Infrastructure Program (NFMIP), as part of the national fishery development plan. The PFDA NFMIP is composed of three sub-programs: Fishing Ports, the Fish Transport System (FTS), and the Ice Plant and Cold Storage Network System (IPCS). Of these programs, there has been steady progress mainly in the establishment of the commercial fisheries ports to accommodate large fishing vessels. These include the fishing ports at Navotas, Iloilo (which has recently become operational), and Zamboanga (which is presently under construction).

On the other hand, it is evident that the establishment of a fish product distribution infrastructure appropriate for municipal fisheries including small-scale fishermen and aquaculture, is falling behind. These three programs are primarily aimed at improving the fish distribution conditions of small-scale fisheries and the aquaculture industry, as well as raising the income of fishermen. In addition, the realization of these programs will also promote exports and ameliorate the gap between domestic supply and demand of fish products. For these reasons, the unified implementation of these three programs has become a pressing issue.

In response to the demands of the times, construction of municipal fishing ports (MFP) is under way throughout the country, with a part of these facilities already in the operational stage. Moreover, through the financing of OECF (Overseas Economic Cooperation Fund), design of IPCS has begun, and the third program, the implementation of FTS, is now urgently needed. The objective of the implementation of FTS is to establish an integral foundation for distribution, transportation and processing of fish products from their production to consumption, extending even to their export. FTS, with its unified implementation of the aforementioned

MFP and IPCS, can contribute to the development of municipal fishing and the aquaculture industry.

Based upon these circumstances, the Philippine government requested the Japanese government to provide technical assistance in conducting a study of the M/P and F/S in the development of FTS, in order to establish FTS through a project linked with MFP and IPCS. JICA (Japan International Cooperation Agency) and PFDA signed the I/A (Implementing Arrangement) to implement this study in February 1988. The study commenced in March 1988, and the local survey covering the Philippines was completed in December. The draft final report was written and submitted to DA-PFDA in May 1989 and the final report was completed in August 1989.

(2) Objectives of the Survey

The present survey covers the entire Philippines, with its principal objective being to draw up a basic plan in order to improve methods of handling fish products at each and every stage of their distribution, transportation and processing. Another objective of this survey is to draw up a M/P for development of FTS for various representative model regions selected according to this basic concept. Further, this survey is to present a proposal for facility improvement concerning the said M/P for regional FTS, study the technical and economical feasibility thereof, and to present suggestions for operation of the facilities.

(3) Method of the Survey

The survey was conducted in two periods, taking seasonal variation of the production of fish products into consideration, as shown in the attached work flow chart in Fig. 1.

1) The First Survey

a. Drew up an estimate of the supply and demand of fish products covering all of the Philippines, and created the basic plan for the establishment and development of FTS.

b. Conducted an interview survey in the zones and prototype sites which

were to be the model areas, defining the present condition of FTS from unloading sites to the final consumption area during the peak fishing season. The principal items surveyed were as follows: production of fish products; consumption of fish products; the distribution, transportation, and processing systems of fish products; the distribution, transportation, and processing facilities of fish products; and the quality of fish products.

Model areas referred to herein are the following four zones and one prototype site selected from among 11 zones and 52 prototype sites, all of which are listed in JICA's M/P for IPCS which are in particular need of development of distribution facilities for fish products:

Zone 1: the provinces of Zambales, Bataan, Pampanga, and Bulacan, located in the central Luzon region to the north of Manila Bay, which are areas with a surplus of fish products.

Zone 2: the province of Camarines Norte, located in the northern part of the Bicol region, which is an area with a surplus of fish products.

Zone 3: the northern part of Panay island, located in the West Visayas region, which is an area with a surplus of fish products.

Zone 6: an area with a surplus of fish products, located in the province of South Cotabato, in the south Mindanao region.

Prototype Site 8: Pasacao, located in the province of Camarines Sur, in the northern part of the Bicol region, which is the municipality that has the largest catch of all the prototype sites in the Philippines.

2) The Second Survey

a. Conducted an interview survey in the zones and the prototype sites which were to be the model areas, defining the present condition of

FTS from unloading sites to the final consumption area during the lean fishing season. In addition to the items surveyed in the first survey, the principal items surveyed here were preconditions for design/cost calculation and the organizational systems.

b. Drew up M/P for FTS for each model area.

c. Studied the technical and economical feasibility of FTS for each model area.

d. Submitted recommendations concerning the operations system for FTS.

(4) Outline of the report

The reports on the "Feasibility Study on Fish Transport System" are comprised of three volumes including the summary report. Volume I deals with the basic policy for the development of fish transport system (FTS). Volume II includes the regional master plan and the feasibility study on a FTS in the selected four zones and one prototype site, where FTS models will be introduced as pioneer projects in the Philippines. In volume I, present general conditions of the fisheries sector are analyzed. The existing conditions of FTS are assessed and the future demand and supply of fish are projected. Based on this assessment and the projected volume of fish demand and supply, a basic plan has been formulated in order to show the policy and strategies for the development of FTS.

The priority areas of the FTS development are the 4 zones and 1 prototype site: Zone 1 located in the Central Luzon Region along Manila Bay; Zone 2 in the Camarines Norte province of the Bicol Region; Zone 3 in the northern part of Panay Island; Zone 6 in the South Cotabato province of the southern part of Mindanao Island, and the prototype site Pasacao in the Camarines Sur province in the Bicol Region.

In volume II, based on the detailed survey and analysis of the fish marketing and transport system, the regional master plan for FTS by zones and a prototype site was formulated and has taken the regional characteristics of the fisheries sector into consideration. The layout plan of FTS was formulated and evaluated from the viewpoints of its

contribution to the national economy and financial viability in its management. The last two chapters are the master action plan including the establishment of the new organization and management of FTS after completion of the construction, and conclusions and recommendations for project implementation.

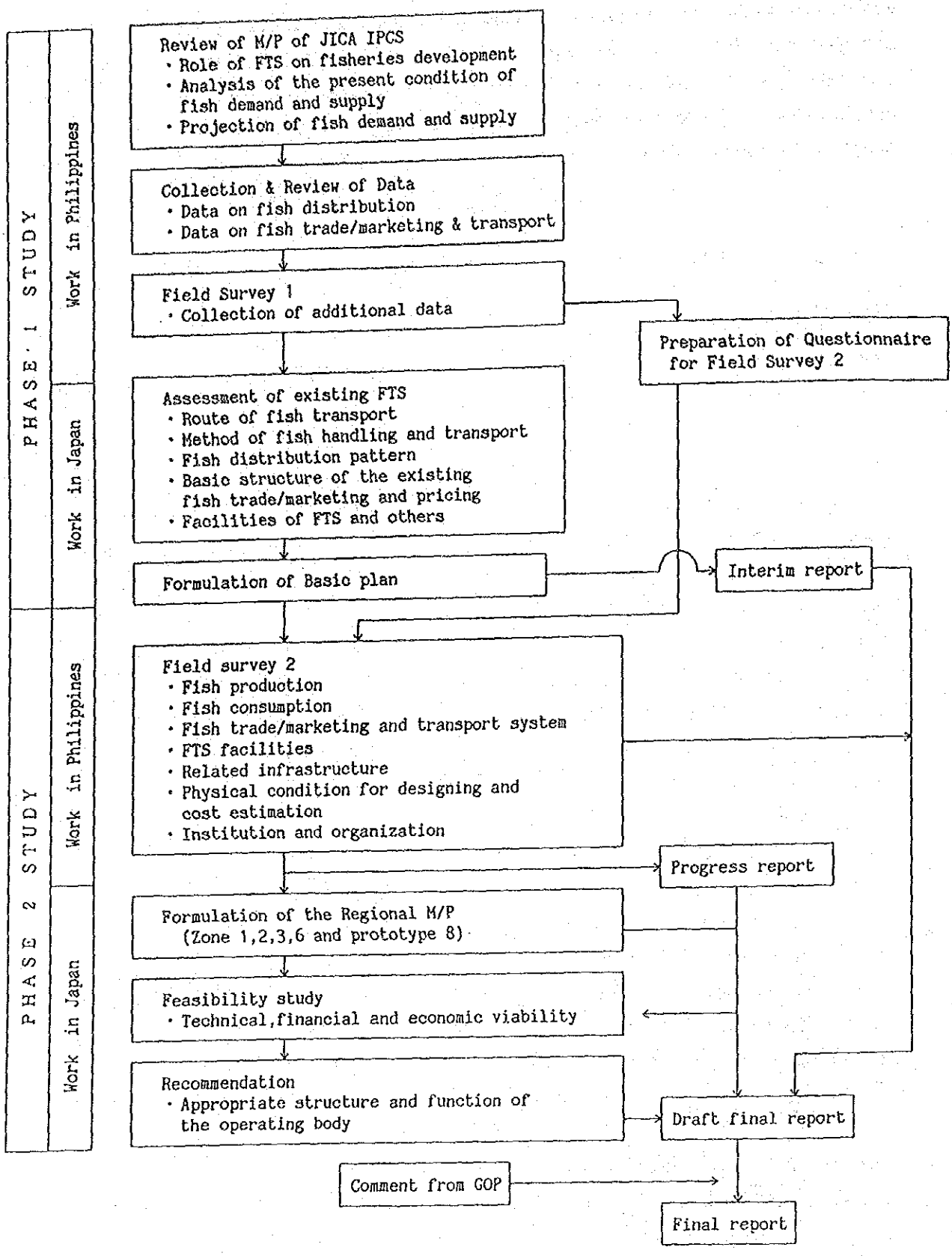

FIG. 1 WORK FLOWCHART OF THE STUDY

2. PRESENT CONDITIONS OF FISHERY SECTOR AND THE NATIONAL PROGRAM

2. PRESENT CONDITIONS OF FISHERY SECTOR AND THE NATIONAL PROGRAM

2.1 Present Condition and Issues of Fisheries Industry

The document of the International Bank for Reconstruction and Development (IBRD) reports the GNP of Philippines in 1986 to be US$30,110 million and its national per capita income as US$570. According to "Economic and Social Indicators 1986" by NEDA, the country's economic growth rate declined yearly during the first half of the 1980's, a period which saw political and economic chaos, especially in 1984 and 1985, when minus growth was recorded. Since then the country's economy has experienced an upward tendency with improvement in political stability and is expected to achieve an annual growth rate of over 6% in 1988.

The contribution of the fishing industry to the total GDP, which is approximately 5%, showed relatively steady growth from 1980 to 1985.

As the total yield of fish products in the Philippines ranks 12th in the world as of 1986, this country holds an important position as a fishing industry country in the international community. The volume of consumption of fish products per capita is also large: 33.2 kg as of 1986, which makes the Philippines one of the largest fish product consumer nation in Asia after Japan.

Production of marine products is concentrated in the central and southern part of the country, and consumption is concentrated in the northern part centering around Metro Manila. Furthermore, because the country consists of many islands, efforts to promote the distribution of fish products at nationwide levels encounter numerous difficulties in all aspects of collection, distribution, processing, and transport of fish. Therefore, development of the FTS covering all stages of transportation, from fishing and production to the final consumer as well as export is urgently required. With completion of the FTS, efficient and effective distribution of fish on a nationwide scale will become possible.

The Philippines, once an importing country of fishery products, has transformed itself into an exporting country and remains so to this day.

However due to various reasons including the price of its fish, which is higher than those of other Southeast Asian nations, and the quality of its fish products which are below international levels, exports are presently not showing a satisfactory growth. Economization of the costs of fish production and distribution and quality control are important tasks needed to promote export of fishery products.

According to documents by BFAR, the yield of fish products in 1986 was 2,089,000 tons, of which municipal fisheries operating principally along the coasts holds the largest portion with 1,072,000 tons, followed by commercial fisheries with 546,000 tons, and by aquaculture with 471,000 tons.

TABLE 1 FISH PRODUCTION BY SECTOR IN THE PHILIPPINES (1977-1986)

Unit: 1000 tons

Year	Commercial	Municipal			Aquaculture	Total
		Sub-total	(Marine)	(Inland)		
1977	518	827	711	116	164	1,509
1978	506	858	687	171	217	1,580
1979	501	839	636	204	241	1,581
1980	488	895	647	247	289	1,672
1981	495	939	710	229	340	1,773
1982	526	978	708	270	392	1,897
1983	519	1,146	771	375	445	2,110
1984	513	1,089	790	299	478	2,080
1985	512	1,045	785	260	485	2,052
1986	546	1,072	807	265	471	2,089

Source: Fisheries Statistics 1981-1986, BFAR

TABLE 2 FISH PRODUCTION OF MAJOR MARINE FISH BY FISHERIES SECTOR IN THE PHILIPPINES (1986)

Unit: tons

	English Name	Commercial	Municipal	Total
1.	Roundscad	151,298	24,557	175,855
2.	Anchovies	30,709	68,978	99,687
3.	Frigate Tuna	44,196	43,029	87,225
4.	Skipjack	51,778	25,253	77,031
5.	Sardines	28,272	45,031	73,303
6.	Slipmouth	27,835	37,580	65,415
7.	Yellowfin/Bigeye Tuna	16,758	42,752	59,510
8.	Threadfin Bream	11,088	35,188	46,276
9.	Eastern Little Tuna	20,348	22,097	42,445
10.	Indian Mackerel	20,791	18,151	38,942
11.	Bigeye Scad	14,315	20,092	34,407
12.	Grouper	1,435	27,408	28,843
13.	Round Herring	9,667	18,349	28,016
14.	Squid	10,254	16,378	26,632
15.	Indo-Pacific Mackerel	12,663	13,871	26,534
16.	Cavalle	7,406	17,574	24,980
17.	Goatfish	9,799	14,556	24,355
18.	Snapper	2,022	19,869	21,891
19.	White Shrimp	5,878	14,770	20,648
20.	Spanish Mackerel	1,111	14,039	15,150
21.	Others	68,607	267,753	336,360
	TOTAL	546,230	807,275	1,353,505

Source: Fisheries Statistics 1981-1986, BFAR

The result of excessive fishing, including illegal fishing, in the coastal areas is beginning to show up as resource depletion problems in some regions. Actually, yields from municipal fisheries show a slowdown or in some areas, even a diminishing tendency. What is important henceforth in developing the fisheries industry is promoting the aquaculture and developing the resources in the 200-mile fishing zone by commercial fisheries, as well as managing the coastal resources. According to the NCSO Census in 1980, the number of fishermen in marine fisheries sector was approximately 582,000 in municipal fisheries and 43,000 in commercial fisheries. Thus, protecting artisanal fishermen participating in municipal fisheries and increasing their income is an important problem, especially in view of one of the national targets: establishment of social equity.

2.2 National Fisheries Development Program and the Position of FTS

According to "Fisheries Development and Conservation Plan, 1987-1992" made by BFAR in order to re-evaluate the Medium-Term Five-Year Development Program, the basic principles for the development of fisheries in the Philippines are as follows:

(1) Objectives

1) To increase the income of fishermen

2) To maintain supply of fish products as food

3) To promote equity in the access to resources

4) To promote effective utilization of fish products

5) To enhance earning of foreign currency through export expansion

6) To maintain long-term sustainable yields and economic benefits from fishery resources through proper management, development and conservation of fisheries resources

(2) Strategy of Fishery Development

It is desirable that the fisheries industry be promoted principally by private organizations, with the government taking a supportive role. The following concrete measures shall be taken:

1) To advise on technology transfer to be adopted by government extension officers

2) To conduct resource assessment and resource conservation and enhancement

3) To supply fish production materials at reasonable prices through free competition

4) To give access to credit with reasonable interest rates

5) To give access to export markets

6) To give incentives needed to boost industrial development

7) To remove unnecessary and burdensome incentives such as sales taxes and import duties

8) To strengthen and consolidate institutions concerned with the policy, planning and management for fishery development and control of fisheries resources

9) To create an environment conducive to investment by restoring peace and order in the countryside.

(3) Role of FTS

In 1981, the Fisheries Industry Development Council of the Philippine Government (FIDC) made Integrated Fishery Development Program (IFDP) as a long-term project for the promotion of the fisheries industry for the period from 1981 to 1990. The fundamental idea of this plan is still being followed by the present government. The plan defines FTS's role as shown below.

1) Objectives

i) To stabilize seasonal and regional supply of fish products
ii) To improve the efficiency of marketing channels
iii) To reduce post-harvest losses
iv) To upgrade product quality
v) To strengthen marketability for export

2) Development Strategies

i) To develop fish product collection centers in areas with a surplus of fish products, to develop distribution centers in fish consumption areas and in areas with a shortage of fish products

ii) To develop a fish transport network in areas where fish transport is a major problem for fishermen in promoting fish production.

iii) To develop facilities for transport, handling, storage and processing fish in order to improve quality, facilitate fish transport, and thus increase their market value

iv) To develop an information distribution network and to offer information in order to raise awareness about fish transport and marketing within the private sector. Further, to help promote the improvement of the fish transport system and the development of new fishery products

v) To simplify the complicated fish transport system by strengthening the retailers' union and promoting direct trade between the fish producers and the retailers at the wholesale markets

vi) To promote the development of new products aimed at an unexploited export market, in anticipation of an oversupply of fish products domestically

vii) To develop systems and the framework to carry out these plans in both governmental and private sectors.

3. ASSESSMENT OF EXISTING FTS

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3.1 General Conditions of the Existing FTS

Regional gaps in fish demand/supply are considerable. It is important to control such regional gaps which indicate a shortage of fish supply in the north and a surplus in the central/southern part of this country.

The marketing area of fish products is divided by fish species into two categories. The first category is the marketing area which meets the demands of the local and neighboring regions. The second category meets the demands of the domestic market in Metro Manila and the export market. The characteristics of distribution according to fish group are shown in Table 3.1. Fish group A is suited for processing and group B contains popular/cheaper kinds of fish mainly distributed to local and neighboring fish markets with the exception of the fish production zone located near Metro Manila. Fish group C is high priced marine fish. Fish group D is tuna. Fish group E is prawn and fish group F is milkfish. They are distributed to distant marketing areas. Distribution depends not only on the preference of consumers but also on cost and capacity of fish transport and marketing. FTS should be established according to transport/marketing characteristics of the region and by fish grouping. A regional FTS based on fish grouping is recommended because the contribution of fish traders and processors is different according to the region and the fish group. It is absolutely essential to consider the fishermen, fish brokers, transporters, and processors who will be involved in the FTS.

Fish surplus areas, with the exception of a few limited areas, are located in regions with undeveloped physical infrastructure such as roads, communication facilities, and electricity. This factor is important in the selection and establishment of FTS sites.

FTS is expected to review the existing fish quality control system to promote fish export, to set up a suitable communication and information system to complete effective fish collection, and to establish FTS technology transfer as a sub-system.

The results of an interview survey conducted on fishermen, traders engaged in distribution, and consumers which reflect the present condition of the FTS in the Philippines, is outlined as follows.

3.2 Domestic Consumption of Fish Products

Seasonal fluctuations and regional differences in per capita fish consumption is considerable, and there is a strong tendency for livestock, including chicken, to be consumed as a substitute when marine products are in short supply.

Fish products are principally consumed in the form of fresh fish, with processed fish functioning as a regulating balance between the seasonal and regional supply and demand of fresh fish. Anchovy and acetes are fish which are often used in processed fish. A large amount of fish which constitute the greatest share of the catch in a fish producing zone, goes through simple processing and is consumed locally. Therefore, fish which is not sold as fresh fish at the market is also consumed, with practically no waste. The amount of frozen fish consumed is close to nil even in Metro Manila where consumers do not prefer frozen fish at all.

Although the freshness and sanitation tests conducted by this survey have proven that the quality of marine products falls short of desirable levels, consumers in general do not seem to see this as much of a problem. This is because of the method of processing and cooking fish. Fresh fish is thoroughly cooked and processed fish is strongly salted, so human health is not endangered. However, a survey on the actual conditions of consumption by income brackets shows a correlation between purchase prices and income levels. Expensive fish tend to be bought by those with high incomes. Therefore, there seems to be a general tendency that high quality fish is purchased by those in the high-income brackets at high prices, and low quality fish by those in the low-income brackets at low prices. It can be seen that each income bracket level consumes fish within a range of prices affordable for that level. Quality corresponds to price. Thus consumer dissatisfaction with quality has not been a problem.

However, with the improvement of income, quality levels demanded by consumers will also rise. Pressure will be brought to bear on the improvement of quality control technology of fish products.

Although in the long term, the improvement of quality control systems is desirable, the present role of the FTS project is how to effectively collect and transport adequate fish products, without dropping the level of quality or increasing the price, from areas where there is a surplus of fish products to areas with a large shortage of fish products, such as the Metro Manila area, other metropolitan areas, and inland regions.

Improvement in fish quality is important in rising consumer demand and health sanitation. However, if improvement in quality creates a rise in fish price which will affect the consumer in the lower-income brackets, it would be defeating the original purpose of the FTS development and therefore it is not desirable. With these factors in mind, improvement in quality must be undertaken with extreme care.

3.3 Quality of Fish Products

3.3.1 Results of Freshness Test of Fish Products

Most of the fish products unloaded at MFP area are already in the stage of mollification, having passed rigor mortis. Deterioration in freshness is particularly conspicuous when it takes a long period of time to transport fish products from the fishing ground to the MFP. Body surface temperature of the fish is rather high: the average body surface temperature in the four zones investigated was 24.6°C, only 5°C lower than the atmospheric temperature. K value was 18% for the MFP average. The average value at the public markets was 30%, 33% at the public market in the Metro Manila area, and an average of 26-28% for the public markets in the zones. These figures indicate that deterioration in freshness is obvious at the local distribution stage after unloading at the transport stage from the site to Manila. These results indicate that the most important factor in maintaining freshness is to keep the fish at lower temperatures.

Extreme differences in the freshness of yellowfin tuna which is an important export marine product, can be found in tuna caught between the west coasts of Luzon Island and General Santos in southern Mindanao. Off Masinloc on the west coast of Luzon Island, fish is caught by small bunker boats with small cargo capacities. The use of ice and the processing of fish on the boat is insufficient and chilling fish after the catch is impossible. Deterioration such as discoloration can be observed (internal body temperature of tuna caught at Masinloc is remarkably high, averaging 28-30°C). For this reason, fish that are on the market for domestic consumption at low prices, are not suitable for export.

General Santos located in the southern part of Mindanao Island is the largest tuna producing center in the Philippines. Fishing vessels there are relatively large, containing ample space for ice storage of their catches. Since sufficient ice is used, the inner body temperature of the tuna is 1 - 13°C, and it is considerably lower than that of Masinloc. As on-board processing of fish, such as removal of guts, etc., is also performed, they are able to maintain a relatively good level of freshness. Among the yellowfin tuna caught in the area, those containing a large amount of fat with meat of good color and freshness are exported to Japan for "sashimi". In order to prevent discoloration of the tuna, it is essential to remove the guts, blood and gills and perform rapid icing immediately after the catch.

3.3.2 Results of Storage Test of Fish Products

(1) Results of Preservation Test on Fish Products

Methods of preservation, transport and processing were carefully deliberated, taking characteristics of each kind of the fish into consideration after studying the change in freshness of fish at three stages of temperature, i.e. storage in ice, refrigeration (approx. 7 - 10°C), and room temperature.

According to the results of this test, if the inner body temperature of the fish is lowered from the present 23°C to 10°C, the period of storage could be lengthened by five times and should the temperature be maintained at 5°C, it could be lengthened by eight times. Therefore, with

development of a system to control the body temperature of the fish, long distance transport of fish products becomes possible, resulting in the expansion of the market area. However, as marketability and profitability vary according to the kind of fish, it will be necessary to study whether the additional cost due to temperature control can be absorbed or not.

The measures for maintaining the freshness of fish and its characteristics are given below based on the the results of the preservation test.

Though large differences in the rate of putrefaction and deterioration in freshness among various kinds of fish were observed at low temperatures, differences between the fish were not so noticeable at the high temperature of 23°C. Low-temperature treatment is highly effective with fish whose deterioration or putrefaction largely slows down with low-temperature storage, such as black tiger prawns, groupers, milkfish, yellowfin tuna, etc. These are expensive, high-grade fish and are suitable for export.

An example of typical ocean fish such as round scads, threadfin breams, groupers and yellowfin tuna are given. Round scads putrefy in three hours with an inner body temperature of 10°C, in 30 minutes at 23°C. It takes about one hour for the K value to reach 20% with the body temperature at 10°C, which is the maximum limit in freshness for fish. It takes about 20 minutes at 23°C. These results indicate a shorter time span compared to other kinds of fish, and indicate that roundscad deterioration and putrefaction is fastest among ocean fish. Although the deterioration and putrefaction rate of threadfin breams at 10°C is second after round scad, (1.5 hours for deterioration in freshness and 4 hours for putrefaction), the rate of deterioration and putrefaction at 23°C are both slower than that of black tiger prawns: 20 - 30 minutes for deterioration and 1 hour for putrefaction. The deterioration rate of yellowfin tuna is more or less in the median range at low temperatures (3 hours at 10°C) and is slower than other fish at the high temperature of 23°C (30 - 40 minutes). Its rate of putrefaction is the slowest of all (8 hours at 10°C and 1.5 hours at 23°C), so it does not putrefy easily. Grouper groups are high-class fish and their freshness is slow to deteriorate (5 hours at 10°C, 40 minutes at 23°C), however their

deterioration rate rapidly increases with a rise in body temperature. The rate of putrefaction is about in the middle range (4.5 hours at 10°C, approx. 1 hour at 23°C).

Milkfish putrefies as slowly as yellowfin tuna (7 hours at 10°C and 1.5 hours at 23°C). Propagation of internal bacteria is slow due to its acidity and a pH which is below 6. Black tiger prawns putrefy the fastest (4 hours at 10°C and 40 minutes at 23°C) due to a pH of 7 which is most conducive to the proliferation of bacteria. Milkfish is ranked in the middle range for deterioration in freshness at low temperatures (2 hours at 10°C), but is the slowest at high temperatures (40 minutes at 23°C). Black tiger prawns deteriorate slowly at low temperatures (3-4 hours), but deteriorate rapidly at high temperatures (20-30 minutes at 23°C).

(2) Measures for Handling of Fish Products

To preserve fish products economically, in other words, when their price and the cost of their freezing, storage in ice and transport are considered, the following methods for handling and processing fish products are recommended.

1) Black tiger prawns: To be frozen after processing at the unloading site and to be either exported or sold in the domestic market as high-class merchandise.

2) Milkfish, groupers: To store in ice at low temperatures from the time of catch until it reaches the final consumer.

3) Round scads, threadfin breams: They should be rapidly sold locally or in neighboring areas or be locally processed immediately since they are low in price and require a great amount of ice for storage due to fast deterioration and putrefaction.

4) Yellowfin tuna: Though they putrefy slowly, it is essential to keep the fish at low temperatures with large quantities of ice, because of rapid autolysis at high temperatures. If they can be exported as fresh tuna, it is possible to cover the cost of the ice.

3.3.3 Results of Sanitary Test of Fish Products

A survey was conducted at MFP in Hagonoy in Zone 1 and at popular public markets and markets for the low income on the number of MAB (Mesophilic Aerobic Bacteria), colon bacilli which is a source of contamination in human beings, and vibrios which contaminates marine products through sea water, through the ice and water in fish containers, and by tap water which is splashed on the fish at MFP and the markets. The results of the survey and the management problems in fish product sanitation are outlined below.

(1) Fish body

The number of colon bacilli is very high at all sites and indicates the need for management sanitation measures to be taken at all stages, from the time of catch and production to the time of purchase by the final consumer. A large quantity of MAB and vibrios have been found at the MFP in Hagonoy which stem from practices such as washing the fish with seawater. Vibrios has not been discovered at the public markets in Manila. The number of MAB has also been relatively low. These markets do not pose as large a problem in sanitation as the MFP.

(2) Tap Water

Based on the number of MAB discovered, the overall sanitary conditions of tap water are good, with the exception of the markets for the low income. However, the number of colon bacilli is rather large at all sites.

(3) Ice

A large number of colon bacilli were found in ice.

(4) Water in Fish Containers

MAB and colon bacilli exist in large numbers in the water found in fish containers. The source of bacteria is not only from the water

itself, but from the fish and ice as well.

(5) Splashing Water

The water in fish containers is used for splashing water on the fish. MAB and colon bacillis exist in large numbers in this water.

It can be deduced from the above that health sanitation related problems may occur. Therefore it is necessary to thoroughly review sanitation management practices of fish, water, and ice. Enterotoxin produced by Vibrio parahaemelyticus is resistant to heat treatment. Therefore it is important to take special care not to contaminate the seawater.

Contamination has not been a conspicuous problem in marine products supplied to the markets of Manila thus far, since much of the fish has been caught far out at sea by commercial fisheries. However, future health sanitation problems at the consumer level are anticipated, as fish products become widely distributed in mass consumer markets with the development of the FTS. Hence hygiene control is an important FTS issue.

3.4 Fish Information and Communication System

The existing conditions of the information and communication system have been identified through interviews with DOTC, TELOF (the former BUTEL), PLDT, RCPI and PT & T.

1) Management of the communication system has been carried out by the private sector. It is underdeveloped because of non-profitable conditions in the rural areas which include major fish landing sites.

2) The National Economic Development Plan has rated development of this sector as low priority.

3) A digitalized communication system in the rural area of northern part of Luzon Island has been developed recently as a model in this country.

4) There is almost no communication system in fish marketing and transportation with the exception of limited large scale traders.

The general conditions of the communication system by zones/prototype sites are as follows:

1) Zone 1: There are no telephone lines, except in the provincial capital and the neighboring area of Metro Manila.

2) Zone 2: There are no telephone lines in the entire zone, which includes Merceds, the major fish landing site for this zone.

3) Zone 3: There are telephone lines only in Roxas city. There are no telephone lines in the other areas including Estancia.

4) Zone 6: There are telephone lines in General Santos City. The communication system is utilized by large traders and owners of fishing boats.

5) Prototype site Pasacao: There are no telephone lines.

In order to overcome these constraints in communication, fish traders collect information on the market after transporting the fish from the landing sites to the consumption areas after a long delay. Fishermen and traders have no access to information and communication except through large firms. Introduction of a fish communication and information system which boosts effective fish distribution from landing site to consumption areas is indispensable.

3.5 Fish Trade/Marketing and Transport System

3.5.1 O/D Pattern of Fish Products

According to the results of the interview surveys with fish traders in 1988 and the aggregate of Auxiliary Invoice of BFAR, the distribution

patterns of fish products produced in the 11 zones were converted to the distribution flow in 1986. However, the distribution patterns of fish products including O/D within the respective zones are presented only for four zones and one prototype site. The distribution patterns of fish products in the other zones discussed here are concerned only with the amount of the products distributed out of the respective zone, i.e. the amount of products locally consumed is omitted from BFAR data.

The flow of fish products between regions are classified into the following two types:

Type 1: Zones, which principally aim at the Metro Manila

Zones 1, 3, and 8

These zones are the base of the aquaculture industry in the Philippines. Among their products, black tiger prawns are exported as well as consumed domestically.

Type 2: Zones which principally aim at neighboring regions

Zones 2, 4, 5, 6, 7, 9, 10, 11 & prototype site Pascao

Among them, Zone 6 is the largest base in the Philippines for yellowfin tuna for export.

Characteristics of a fish product movement pattern from each zone are as follows.

(1) Model Zones and Prototype site

1) Zone 1: Of the total catch of 90,935 tons, 54.9% is consumed within the zone, 21.7% of which is destined for Manila and 13.3%

for within Luzon Island. 10.1% of the catch is allotted for export, but the entire amount is cultivated black tiger prawns.

2) Zone 2: Of the total catch of 29,242 tons, 29.0% is consumed within the zone, 35.4% of which is destined for Manila, and 34.6% for the neighboring regions centered around the region of Bicol. Virtually none of the catch is allotted for export.

3) Zone 3: Of the total catch of 65,088 tons, 23.7% is consumed within the zone, 51.3% of which is destined for Manila and 27.0% for various areas in Panay Island, excluding the volume transported to Manila through Iloilo City as an intermediate point. 4.4% of the catch is allotted for export (mainly cultivated black tiger prawns.)

4) Zone 6: 21.9% of the total catch of 80,050 tons is consumed within the zone. The products for domestic consumption are not shipped to Manila; in fact, 62.7% of the zone's production flows to various locations throughout Mindanao Island. 15.4% of the catch is destined for export (primarily yellowfin tuna).

5) Prototype Site Pasacao: The entire catch 9,452 tons is consumed domestically, of which 11.1% is consumed within the zone. Only 9.8% of the catch is destined for Manila, with the remaining 79.1% being consumed within various provinces of the region of Bicol. None of the catch is allotted for export.

(2) Other Zones

1) Zone 4: This zone is a surplus area for seaweed. It does not produce sufficient surplus of fish to distribute outside the zone.

2) Zone 5: Nearly all of the outgoing marine products of the zone are transported to the neighboring regions of the zone, with

exception of a very small portion, which is distributed to Manila and Cebu Island.

3) Zone 7: Only 4% of the outgoing amount of the marine products from the zone goes to Manila. 80% of the outgoing amount is distributed to area No. 10 (northern Mindanao region) located in the central and northern part of Mindanao Island. The the remaining 16% is distributed to other regions in Mindanao.

4) Zone 8: Approximately 85% of the outgoing portion from the zone is distributed to Manila. The remaining 15% is distributed to its neighbor, area No. 7 (central Visaya region) centered around Cebu city.

5) Zone 9: Only 17% of the outgoing amount from the zone is distributed to Manila. 70% goes to the neighboring regions in Mindanao Island, viz. area No. 10, and 5% to area No. 9 (western Mindanao). This zone also plays a role as a supply base for inside Mindanao Island.

6) Zone 10: 70% of the outgoing amount from the zone goes to area No. 6 (western Visaya region) and 30% to area no. 12 (central Mindanao region).

7) Zone 11: 80% of the outgoing amount from the zone goes to area No. 12 and 20% to area No. 11 (southern Mindanao region) and other regions.

3.5.2 Fish Trade/Marketing and Transport System

According to the investigation conducted on the existing distribution system of fish products in the four zones, fish products are distributed mainly through broker-transporters over a wide area both locally and in neighboring regions. In the case of long distance transport to Manila, fish products are transported through broker-transporters or viajeros. Although some fish products purchased by local consumers are brought in directly by fishermen and sold by retailers in a public market. In

reality, brokers handle enormous quantities of fish products and earn 5% of the sales amount of these products as a handling charge. They take advantage of their influential positions which are derived from their ability to extend financing to fishermen, etc. Thus in addition to their proceeds earned as transporters, they reap considerable profit. Viajeros are also believed to earn equally high profits. They earn returns not only from rendering transport services, but also by purchasing fish from the fishermen at low prices, claiming they must make allowances for a sales risk factor. It would probably be correct to say that the fishermen earn very little in contrast to the high profits made by these traders. The traders' high profits are the reasons why the consumer price for fish has stabilized to such high levels.

The ramifications of this situation are especially apparent in the high price of black tiger prawn, milkfish, and yellowfin tuna. It is essential that income distribution is equalized and the bottleneck in fish marketing/transport services in the inter-regional fish distribution system is removed by reducing the cost of those services.

Fish distribution pattern by fish groups which is seen in the 1986 fish distribution route has been outlined as follows. This pattern is summarized based on chapter 5 in "Regional Master Plan and Feasibility Study of FTS".

(1) Zone 1

The type of transaction and the shipping destination differ according to the kind of fish.

Fish which is generally processed for consumption, such as anchovy and acetes, is also consumed as fresh fish; local areas account for nearly the entire consumption of this type of fish (3,245 tons among total fish catch 3,509 tons). The entire catch is handled through brokers to retailers, and is then sold to the consumer at the local market.

Approximately 70% of total fish catch of 13,708 tons in popular fish such as skipjack, flying fish and roundscad, are consumed locally. An estimated 66% is handled through brokers, and the remaining 34% is handled

directly between the fishermen and the retailers. About 80% of consumption outside the zone is consumed in the Metro Manila area. The remaining portion is transported to Pangasinan, a province to the north of Luzon. Nearly all of the transactions for fish products that flow out of the zone are handled through fishermen who compete with brokers or viajeros.

Approximately one third of the total fish catch of 2,040 tons in high-grade fish, such as white shrimp and Spanish mackerel is consumed locally, and nearly all transactions are handled by a broker. Fish product consumption outside the zone accounts for the remaining two thirds of the catch of which 70% are transported to Manila through brokers or viajeros. Moreover, it is quite common for brokers to work as viajeros at the same time. Thus they are involved in the entire distribution system.

Slightly over 60% of the total fish catch of 4.618 tons of yellowfin tuna caught in the coastal waters off the Zambales province is destined to be shipped outside the zone. Of this amount, a little less than 40% is sent to Manila, with viajeros bringing the products into Manila and completely bypassing the brokers. Slightly less than 40% of the total catch is for local areas.

Domestic consumption of cultured black tiger prawn corresponds to 50% of the total catch of 19,975 tons and 50% is for export. Within the amount of domestic consumption, 15% is for local consumption, 50% is for Manila, and the remainder is for neighboring cities in the zones. According to interviews with the traders, 30% of the black tiger prawn for export are processed locally and the remaining 70% are processed in Manila. Tiger prawns transported and processed exclusively in Manila are fresher than prawns processed by local processors. Fish brokers play a major role in fish marketing.

About 75% of the milkfish catch of 38,714 tons are consumed locally, all of which are handled through brokers. Nearly half of the remaining 25% which flows out of the zone, goes to Manila. The other half is sent to Pangasinan and Benget provinces. In both cases, all transactions are handled by broker-transporters.

(2) Zone 2

Marine products make up nearly all of the fish products, and as the fishing industry centers around very small-scale fishermen, transactions are almost exclusively left to brokers.

Approximately 20% of the total catch of 8,151 tons of acetes, anchovy and slipmouth are for local consumption. The buying and selling of these products are almost entirely handled through brokers. The remaining 80% are for the areas surrounding the zone and for Metro Manila, with the distribution being handled exclusively by broker-transporters and partially by viajeros. Processed fish corresponds to 5% of the total fish catch. 17% is for local consumption.

The production volume of such popular fish as roundscad is large, amounting to 13,954 tons and only 35% is allotted for local consumption. The remaining 65% is transported outside the zone. Over 50% of the volume that flows out of the zone are consumed in Metro Manila, and just under 40% is consumed in Cavite province. There is almost no consumption in the areas near this zone. Nearly all transactions are handled through a broker-transporter, while in rare instances, viajeros may be involved.

Slightly under 20% of the total fish catch of 5,868 tons of such high-grade fish as Spanish mackerel and the grouper family are allotted for local consumption. Nearly all of the remaining 80% is transported to outside zones, of which 65% is allocated for Metro Manila. Nearly half of the products allocated for local areas and their neighboring cities are handled through broker-transporters, and the remaining half handled through viajeros.

(3) Zone 3

Among the fish products consumed locally in this zone, the fishermen often directly handle fish transactions and not the brokers. The destination for the majority of the products transported outside this zone mainly by ship, is Manila. The connection between this zone and Iloilo, the largest city in Panay Island, is relatively minimal with the exception

of its function as a transit point. However, because of the difficulties involved in shipping directly from this zone to Manila, a part of the products must first be shipped to Iloilo City, then transshipped on to Metro Manila. As a result, the presence of brokers and transporters is conspicuous because of the transported volume. It is common for resident wholesalers and retailers in Manila to buy and sell marine products.

Approximately 30% of the haul of 16,444 tons for processed fish, such as anchovy and slipmouth, are for local use. 40% is taken to the local public market directly by the fishermen, and the remaining 60% are handled by brokers. Nearly all of the products shipped outside this zone are consumed throughout Panay Island, including Iloilo city. Most of the fish are transported to these areas through brokers. The buying and shipping of products for Metro Manila are handled by viajeros themselves. Processed fish corresponds to 23% of the fish catch and is a comparatively large volume. Most processed fish are transported to areas throughout Panay Island. It corresponds to 97% of the total processed fish, of which a part is shipped to Metro Manila.

The popular fish for consumption, such as mackerel or roundscad, corresponds to about 30% of the total catch of 15,715 tons and it is consumed locally. The share brought to the local market directly by the fishermen and through brokers is evenly divided. Approximately 80% of the remaining 70% of the fish which is shipped outside the zone, is for Manila. 20% is consumed in Iloilo City and the rest in Panay Island. Although two thirds of the marine products for distribution in Manila goes from local brokers -transporters or viajeros through the resident Manila wholesaler and retailer and on to the public market in Manila city, one third are cases where the local brokers are by-passed and the viajeros deal directly with the fishermen, and ship the products to Iloilo or Manila.

About 25% of the catch of 7,763 tons of high-grade fish such as Spanish mackerel, is consumed locally. Of the remaining 75%, over 80% is shipped to Manila. The fish products sent to local areas are mostly brought to the public market directly by the fishermen, and seldom through brokers. In many cases, the distribution system for Manila starts from the fisherman to the local broker-transporter and to the wholesaler and

retailer in Manila. However, there are many other cases where the local broker is by-passed and the viajeros deliver the products directly to the broker, wholesaler and/or retailer in Manila. A number of fishermen bring their products into the city themselves.

A mere 3% of the total 2,974 tons of cultured black tiger prawns appear in the domestic market as fresh seafood. The remaining 97% is for export. Approximately 24% of the total export is processed at local factories and then shipped to Manila. Although the remaining 43% are shipped to factories in Manila and 33% to those in Iloilo, the vast majority of this product is processed outside this zone. The broker does not interfere between the producer and the processing factory in the distribution flow. The viajeros function directly as the intermediary between the producer and the processing facility.

Local consumption of milkfish accounts for only 10% of the fish catch of 19,900 tons. The remaining 90% are consumed outside the zone; of which 90% are consumed in Metro Manila and the other 10% are consumed in Iloilo City and the rest of Panay Island. Fishermen supply the vast majority of milkfish for local consumption to the public markets. However the products shipped from these local areas to Manila are turned over to transporters either directly or through a broker, with each system accounting for roughly half of the cases. In Manila almost all of this is handled by Manila wholesalers and retailers acting as the middle-man.

(4) Zone 6

Over 65% of the total fish landing of 80,050 tons in this zone, is comprised of popular fish such as skipjack, frigate tuna and roundscad. The share of yellowfin tuna is 32%. The variety of fish is limited in this zone. Domestic consumption is 85% of the total landing, of which 25% are consumed locally, and 75% are distributed to the inland areas of Mindanao and the northern part of Mindanao. This zone is the most important base for supplying the eastern part of Mindanao Island with marine products. Approximately 15% of the total landing is for export. Of this amount, over 75% is canned locally for export, and the remaining amount is processed for export in fresh or frozen form. The fresh fish is transported passing through General Santos Airport or Davao Airport to

Manila for export and frozen fish by ship to Manila. The processing industry has been highly developed by private firms and retained to promote fish marketing, processing and a transport system maintained by their own investment. Although brokers for local consumption may seem rather predominant, the shipping of products outside the zone is divided evenly between broker-transporters and viajeros.

The haul of common fish such as skipjack, frigate tuna and round scad is large. Nearly 30% of the total catch of 53,012 tons is consumed locally; and the remaining 70% are consumed and shipped out over a wide area including inland areas and the northern part of Mindanao Island.

About 50% of the total catch of 25,242 tons of Various types of tuna, including yellowfin tuna are consumed domestically; and about 50% are exported. Local consumption accounts for only 17% and about 83% is distributed to other regions in Mindanao Island. Nearly all of the products for export are processed locally. Fish for canning accounts for 76%, fresh fish is 15%, and frozen fish is 9%. The share of the products for domestic distribution handled by broker-transporters is large and the remaining is handled mostly by viajeros. The broker-transporters supply the tuna to be used for canning and freezing to the processing factories. Brokers handle the total distribution of fresh yellowfin tuna which are for export.

(5) Prototype site Pasacao

The entire catch from this site is consumed locally or in the surrounding regions. The products are shipped to Manila only when there is a bumper catch. Most of the distribution is handled by brokers.

About 20% of the total catch of 1,507 tons, includes anchovy and sardine which are suitable for processing and are consumed locally as fresh fish. This entire amount of fresh fish consumed locally, is brought to the public markets through brokers. Almost all the rest of the fish catch is consumed in the Bicol region outside the Pasacao site are handled by brokers.

About 10% of the total catch of 6,104 tons of popular fish such as

Eastern little tuna and roundscad is consumed locally and the same percentage is shipped to Manila. The remainder is consumed in the Bicol region. Here brokers also act as middle-men for nearly all of the distribution.

Slightly under 10% of the 1,668 tons of high grade fish such as Spanish mackerel and white shrimp, is shipped to Manila. The remainder is consumed in the Bicol region, with brokers handling all of the products which are shipped out of the area.

TABLE 3 CLASSIFICATION OF FISH GROUP

Group	Criteria	Kind of fish
GROUP A	Fishes mainly used for processing	Acetes, Anchovy, Sardine, Slipmouth
GROUP B	Low-medium grade fishes	Croaker, Eastern little tuna, Flying fish, Frigate tuna, Goatfishes, Mackerels, Mullet, Roundscad, Other scads, Sillago whiting, Snappers, Threadfin bream, Other fishes
GROUP C	High grade fishes	Blue crab, Cavalla/Crevalle, Groupers, Spanish mackerel, Squids, White shrimps
GROUP D		Bigeyed/yellowfin tuna
GROUP E		Black tiger prawn
GROUP F		Milkfish
GROUP G	Freshwater fishes	Tilapia, Other fishes
OTHERS		Mangrove crab, Mussels, Oysters, Others

4. PROJECTION OF FISH DEMAND AND SUPPLY

4. PROJECTION OF FISH DEMAND AND SUPPLY

4.1 Demand of Fish Products

(1) Domestic Consumption of Fish Products

The increase in the domestic demand of fish products is determined by the increase in the population and the increase in per capita consumption. Per capita consumption is determined by the increase in personal income and income elasticity of consumption. The national average per capita consumption of fish products as of 1986 (the base year) was established at 33.2 kgs per year, based upon the results of the fish products consumption survey. Per capita consumption of fish products differed by region: Metro Manila was 34.3 kg per year; the average of those zones representing fish production areas was 34.6 kg per year; in urban areas, excluding the aforementioned areas, per capita consumption was 35 kg per year; and in rural areas, it was 31.9 kg per year. The income elasticity of fish products consumption was set at 0.17. The future population and GDP were based on NEDA estimates. Domestic consumption of fish products was 1,858,000 tons for 1986; the estimate for 1995 is 2,314,000 tons and 3,025,000 tons for 2010, respectively as shown in Table 8.

(2) Fish Products Exports

Yellowfin tuna and black tiger prawns predominate fish products for export. Their projected volume was estimated based upon the type of processing used for each fish product as presented below. The estimates were 130,000 tons for 1986, 180,000 tons for 1995 and 290,000 tons for 2010 as shown in Table 8. (However, in the above figures seaweed is excluded and fresh fish is included as raw material for processing).

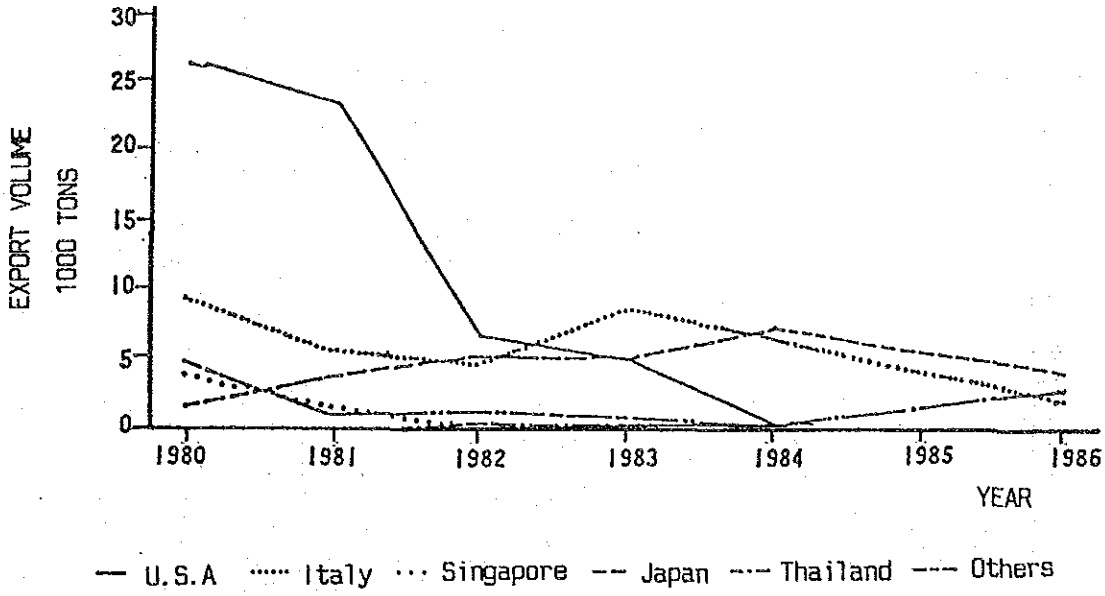
1) Fresh Yellowfin tuna

Almost all of the fresh yellowfin tuna produced in the Philippines is destined for Japan, but its share corresponds to only 4.3% of the total export of yellowfin tuna, 79,000 tons from the Philippines. The volume of exports grew at a rapid rate from 326 tons in 1980 to 3,415 tons in 1986.

Yellowfin tuna produced in Taiwan is high in quality and higher in price in comparison to tuna produced in the Philippines (yellowfin tuna produced in Taiwan is 950 - 1,200 yen per kg, tuna produced in the Philippines is 680 - 870 yen per kg). Yellowfin tuna meat is relatively light and is regarded as "comparatively cheap tuna for use as 'sashimi', good for the general public". Continuing growth in demand by the general public for this fish as 'sashimi' can be expected. Therefore, the export of fresh tuna produced in the Philippines has potential for growth, provided that the quality of the product can be improved.

2) Frozen Tuna

Exports of frozen tuna have been declining yearly. The reason for this is that exports to the United States, which prior to 1982 was the major market for tuna exports from the Philippines, have dropped sharply. The principal cause of this decline is that the canning industry in the United States, suffering from a sharp increase in the import of canned goods from Thailand and other countries, sought to move its canning production base overseas. This maneuver caused a severe drop in the import of frozen tuna for canning in the United States. Even if the United States were to institute import restrictions on canned goods in the future, the basic structure of the industry would be unaffected, with no prospects of increasing exports of frozen tuna from the Philippines to the United States. The export of frozen tuna to the United States may regain its highest export level since its steep drop in 1984, but export expansion beyond this level is not expected.



Remarks: Lack of data for 1985
Source: - Foreign Trade Statistics of the Philippines 1986, NEDA
- Fisheries Statistics 1986, BFAR

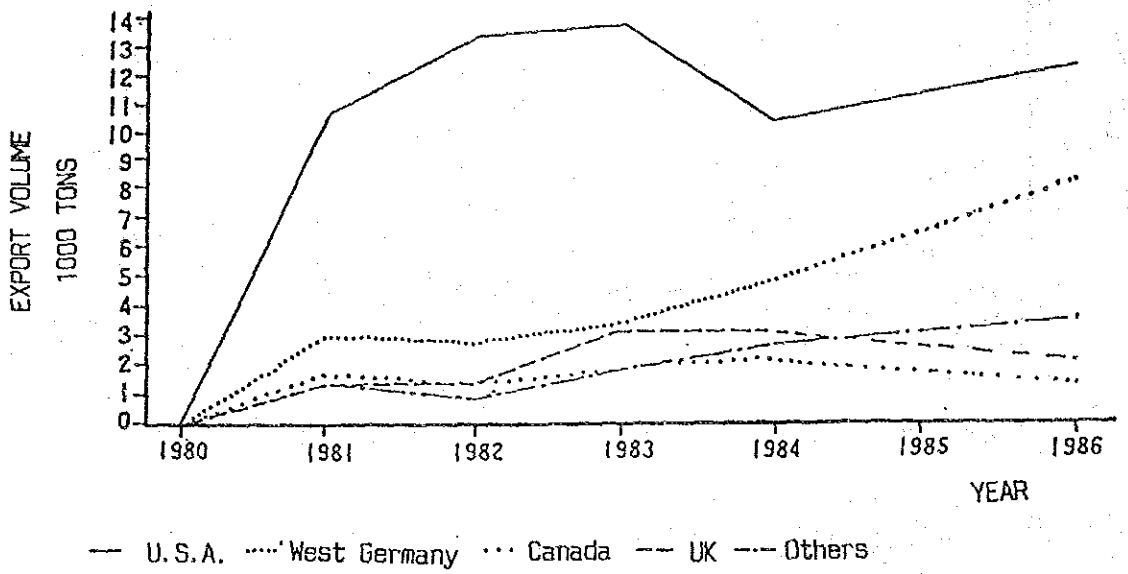
FIG. 2 EXPORT OF FROZEN TUNA BY DESTINATION (1980-1986)

3) Tuna (Canned)

The largest market for canned tuna exported from the Philippines is the United States. Exports to the United States from the Philippines have not shown significant growth since 1982, when exports from Thailand began to rise appreciably. Meanwhile the Philippines' exports to West Germany and other countries have grown. The overall effect of diversifying the export market has been able to produce only a slight upward trend in the export of canned tuna.

The international market for tuna will continue to expand through 1995. It is expected that exports from the Philippines can maintain their growth as they have in the past. However, after 1995, the rise in the production capacity of American overseas canning production bases, the implementation of import restrictions by the United

States, and the emergence of neighboring Latin American countries, such as Venezuela, Ecuador, Mexico, etc., as competitors, will all contribute to holding down the growth of Philippines exports.



Remarks: Lack of data for 1985
Source: - Foreign Trade Statistics of the Philippines 1986, NEDA
- Fisheries Statistics 1986, BFAR

FIG. 3 EXPORT OF CANNED TUNA BY DESTINATION (1980-1986)

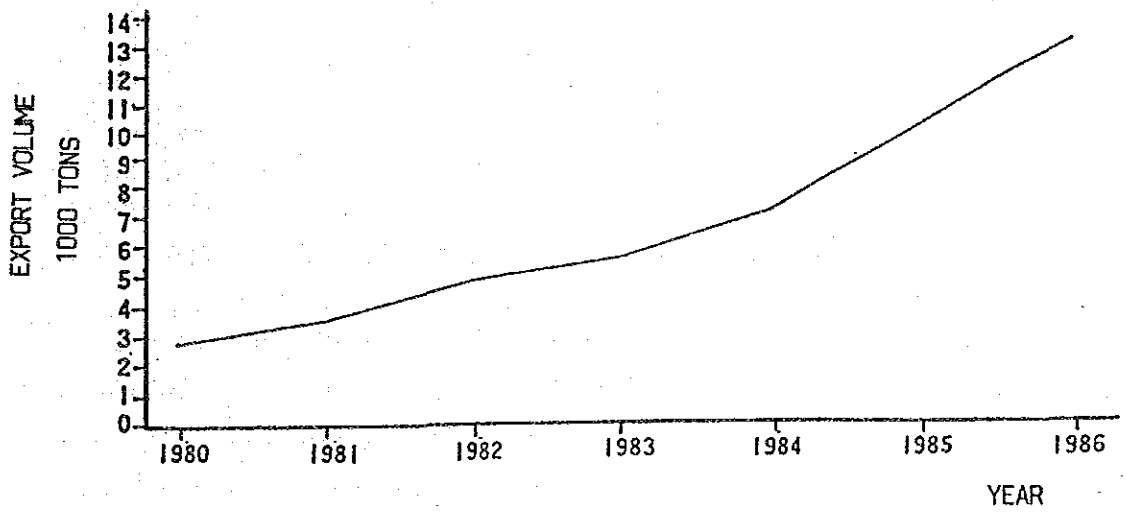
4) Prawns (Frozen Black Tiger Prawn and Other Varieties)

Prawns are exported mainly to Japan and the United States. According to 1986 data, Japan accounted for about 77% and the United States approximately 17% of the total export volume.

Exports of prawns have been showing yearly increases. Japanese imports of prawns have grown from 140,000 tons in 1980 to 210,000 tons in 1986, showing an annual growth rate of 6.8%. However, prices have shown a downward tendency with almost no increase in the monetary amount since 1982.

In order to successfully compete with such competitors in the export market as India, Indonesia, Taiwan, China, Thailand and Latin American countries, it is essential that a production system to produce low-cost, high-quality frozen prawns be established. Taiwan is presently experiencing problems such as the spread of fish disease arising from intensive aquaculture production, water shortages, etc. It is expected that their black tiger prawn production will suffer a serious drop. If the right conditions can be provided in the Philippines, which at present has none of these problems, there is a strong possibility that its international competitiveness will improve and its exports continue to increase.

The aquaculture industry will see active investments from the private sector, increase its international competitiveness due to the implementation of FTS, and thereby contribute to the growth in exports until 1995. Thereafter, however, due to intensified international competition, there will be a slowdown in export growth.



Remarks: Lack of data for 1985
Source: - Foreign Trade Statistics of the Philippines 1986, NEDA
- Fisheries Statistics 1986, BFAR

FIG. 4 EXPORT OF FROZEN SHRIMP (1980-1986)

4.2 Supply of Fish Products

(1) Imports of Fish Products

Imports of fish products have undergone drastic changes due to domestic political instability and a worsening international balance of payments. In 1986, the sharp increase in the import of frozen and fresh fish and the severe drop in the import of canned goods were caused by the liberalization of fish imports as raw material for canning. This was the result of a governmental policy promoting the import of raw materials and domestic processing of products.

TABLE 4 IMPORT OF FISH PRODUCTS EXCLUDING FISH MEAL (1980-1986)

Unit: tons

Year	Fresh/Frozen	Canned	Dried, Smoked, etc.	Total
1980	18	71,888	23	71,928
1981	20	75,808	26	75,853
1982	6,180	90,508	29	96,716
1983	3,524	13,493	60	17,077
1984	1,260	30,720	26	32,006
1985	5,283	518	37	5,838
1986	32,270	1,503	111	33,884

Source: Fisheries Statistics 1981-1986, BFAR

It is impossible to make a forecast on future volume of imports due to the affect of an unstable economic environment. Therefore, future estimates have been derived by using actual import volume from past years and arriving at an appropriate figure. The volume of imports of fish products in 1986 was 34,000 tons, and the estimates for 1995 was calculated at 78,000 tons and for 2010 at 87,000 tons as shown in Table 8.

(2) Domestic Production of Fish Products

Projected fish production is shown in Table 8.

1) Commercial Fisheries Sector

The volume of fishery resources harvested from the open seas by commercial fisheries is not clear, but this not a major concern of this survey, as the factor limiting fish production is focused on the trend of private investment. Investments in the commercial fisheries sector have slackened as explained below. Since rapid improvement in investment conditions is not anticipated, an increase in the number of fishing vessels or enlarging the size of the vessels cannot be expected. As a result, conservative forecasts till 1995 are given.

a. Sluggish investments in fishing vessels and fish-finding equipment.

b. The repayment rate of financing from the bank is low because the profitability of the fishing industry is very poor.

c. Unstable fish catches, approximately 80% of the species of fish concerned are pelagic fish.

d. Only a slight increase in the fish catch from 1977 to 1986.

e. There was little or no change in the number of fishing vessels during the same period; in fact, there was a downward trend between 1984 and 1986. There is also a trend towards reducing the size of the fishing vessels rather than enlarging their size. This is because the large numbers of used fishing vessels that were brought into the country during the reparations period have worn out, while the import of used vessels as replacements has not kept pace, and even now, small wooden vessels built locally occupy the majority.

f. The recent minor increase in the volume of fish caught is due to the increase in the efficiency per boat, and not because of any modernization on the part of the fishing industry oran enlargment in the size of the fishing vessels.

TABLE 5 FISH PRODUCTION PER BOAT AND GROSS TONNAGE OF BOAT OF COMMERCIAL FISHERIES (1981-1986)

Unit: tons

	1981	1982	1983	1984	1985	1986
1. Fish production (tons)	494,768	526,273	519,316	513,335	511,987	546,230
2. Number of boats	2,349	2,580	2,634	2,666	2,484	2,283
3. Total gross tonnage (GT)	99,471	105,113	103,298	97,673	NA	83,506
4. Fish production/boat (tons/boat)	210.63	203.98	197.16	192.55	206.11	239.26
5. Fish production/GT (tons/GT)	4.97	5.01	5.03	5.26	NA	6.54
6. Average GT/boat (tons)	42.35	40.74	39.22	36.64	NA	36.58

Source: Fisheries Statistics 1981-1986, BFAR

The production volume of fish products in the commercial fisheries sector was 559,000 tons in 1986. It is estimated to be 571,000 tons in 1995 and 682,000 tons in 2010.

2) Municipal Fisheries Sector

It would appear that the fishing grounds are not being effectively used in view of the fishing methods currently in use. Moreover, due to poor fishing techniques and equipment, there seems to be hardly any serious competition among Filipino fishermen. Coastal fisheries resources have not always passed the MSY level (Maximum Sustainable Yield). With the institution of appropriate resources management, steady increases sustained at present can be maintained. This notwithstanding, a drop in the volume of fish caught has been obvious at major fishing grounds in bays and coastal waters. There is a trend towards resources depletion and it has been forecasted that even if effective resources management were implemented, rapid recovery can not be expected. The basis for this evaluation of the situation is presented below.

a. There has been only a slight upward trend in the amount of fish caught in recent years.

b. Commonly used fishing techniques are extensive-type techniques such as gill netting (approximately 30%), and hand-line fishing (approximately 29%) etc. Fishing techniques which result in overfishing, such as small-scale trawls (approximately 3%), are still uncommon.

c. The destruction of fish resources due to the use of dynamite and poison in the shallow waters off the coast has been brought up. However, according to the interviews conducted in this study, the major fishing grounds of the municipal fisheries are 1-4 hours offshore. Therefore, with the exception of some regions including San Miguel Bay, etc., they have not had to face the problem of resource depletion.

d. Although the estimates of the volume of fish resources and MSY have already been given, there is very little reliable data concerning the relationship between the amount of effort put into catching fish and the amount of fish caught, thereby making the reliability of the estimates somewhat low.

The total catch by municipal fisheries in 1986 was 1,094,000 tons. Estimates for 1995 are 1,319,000 tons and for 2010 are 1,621,000 tons, respectively.

3) Aquaculture Sector

In line with the government's policy to develop this sector, private investment has been brisk. There are still many undeveloped sites suitable for aquaculture. The production capacity per surface area of pond in current fish farm production is 1.2 tons per hectare. This is still extensive-type productivity. Therefore, increase in productivity will continue its upward trend in the future. However, competition in the international market for prawns may become fierce, and some demerits related to intensive aquaculture may have to be taken into consideration. Therefore, a forecast was made taking into account, the slowdown in the rise of productivity over the long term.

The total catch from the aquaculture industry in 1986 was 302,000 tons. The estimates for 1995 are 526,000 tons and for 2010 are 921,000 tons.

4.3 Fish Demand and Supply by Zone

(1) Fish Demand in the Zone

1) Fish Consumption in the Zone

The fish consumption by zone was projected with the same methodology as that applied to the projection of domestic consumption.

2) Fish Product for Export

Export volume of fish products from the zone was estimated on the assumption that these products were basically exported in proportion to fish production in each zone, and the volume was adjusted by the results of the field survey. Projected volume of fish export is shown in Tables 9-11.

(2) Fish Supply in the Zone

1) Imports of Fish Products

The imported volume of fish products in the zone was calculated on the assumption that the import volume was in proportion to the domestic demand in each zone.

2) Fish Production

Fish production by sector and by zone in 1986 was estimated based on fish production from statistics by BFAR. Local characteristics such as the number of fishing vessels, the number of fishermen. and the area of fish pond as shown in Tables 6 and 7 were taken into consideration.

Fish production by sector and province in 1995 and 2010 was estimated and projected with 1986 as the base year, in proportion to the present average fish production by sector and province during 1982 to 1986. Projected fish production is shown in Fig. 5 and Tables 12-14.

a) Zone 1: The total catch in 1986 was 90,935 tons, of which 71.3% was accounted for by aquaculture, 19.9% by municipal fisheries, and 8.8% by commercial fisheries. This zone has the special feature of being the aquaculture base of the country. By 1995, the proportion that aquaculture occupies will increase further, rising to 81.1% of the estimated total catch of 131,172 tons. This zone serves as the supply base in cultured fish for neighboring consumer areas, such as the Metro Manila area and the central and northern parts of Luzon Island.

b) Zone 2: The total catch in 1986 was 29,242 tons, of which 67.6% was accounted for by municipal fisheries, 30.4% by commercial fisheries, and almost no aquaculture production. In 1995 and 2010, the catch by municipal fisheries will increase its share to over 70%, with almost no change in the structure of small-scale fisheries. Although this zone is a small base for fisheries, the neighboring areas have an insufficient supply of fish products. From this standpoint, this zone serves a very important function.

c) Zone 3: The total catch in 1986 was 65,088 tons, with the percentages held by various fishing industries being fairly balanced; aquaculture accounting for 37.7%, municipal fisheries holding 40.0%, and commercial fisheries with 22.6%. Development of aquaculture is proceeding at a rapid rate towards the years 1995 and 2010. The objective is for aquaculture to comprise 49.2% of the total catch in 1995, and 55.3% in 2010, with aquaculture occupying nearly the same proportion as the open-sea fishing industries. As the regions surrounding

this zone have a surplus of fish products, these surplus fish products are shipped out to distant regions including Manila.

d) Zone 4: The total catch for 1986 was 21,164 tons, of which 53.5% was accounted for by seaweed production. In the future, as the export of seaweed continues to increase, seaweed is expected to account for 81.8% of the total catch in 2010. If seaweed is excluded from this zone's fish products, the total catch shows this zone to be one with an insufficient supply of fish products.

e) Zone 5: The total catch for 1986 was 42,827 tons, of which 98.2% was accounted for by municipal fisheries. By 2010, it is expected that this proportion of the total catch will increase to 97.3%.

f) Zone 6: The total catch for 1986 was 80,050 tons, of which 61.4% was accounted for by commercial fisheries, 38.1% by municipal fisheries, and almost no aquaculture production. By 2010, through the implementation of facilities connecting the fisheries' bases which will result in the development of the municipal fisheries' tuna industry, the proportion held by municipal fisheries will increase to 53.5%, and the percentage held by commercial fisheries will decrease to 45.5%. The regions neighboring this zone have a large shortage of fish products. Thus this zone plays a very important role as the supply base of common fish to these regions. Moreover, this zone is the largest tuna supply base in the Philippines, necessitating long distance transportation for shipping the products destined for the Metro Manila area.

g) Zone 7: The total catch for 1986 was 74,311 tons, of which 58.0% was accounted for by municipal fisheries, 28.5% by aquaculture, and 13.5% by commercial fisheries. Due to future efforts to promote aquaculture, by 2010 the

proportion held by aquaculture will increase to 43.0%, with municipal fisheries having a 51.2% share. The proportion of commercial fisheries will hold only 5.8%.

h) Zone 8: The total catch for 1986 was 36,002 tons, of which 74.0% was accounted for by municipal fisheries, 22.9% by aquaculture and 3.0% by commercial fisheries. Since then, the expansion of the area used for aquaculture ponds (by converting sugar beet plantations and other methods) have been undertaken. By increasing productivity, increases in the catch from aquaculture are expected, with aquaculture rising to a 49.3% share, municipal fisheries decreasing to 49.1%, and commercial fisheries only 1.6% in 2010.

i) Zone 9: The total catch for 1986 was 55,332 tons, of which 92.4% was accounted for by municipal fisheries. This zone will continue to be a base for municipal fisheries in the future. Although the fishing industry in this zone is on a very small scale, due to the shortage in the supply of fish products in the neighboring regions, this zone is an important supply base of fish products for those regions.

j) Zone 10: The total catch for 1986 was 12,224 tons, of which 98.7% was accounted for by municipal fisheries. There are no foreseeable changes in this trend for the future. Municipal fisheries in this zone are centered around the fresh-water fishing industry. As regions in inland Mindanao suffer from a shortage in supply of fish products, this zone serves as an important supply base for these regions.

k) Zone 11: The total catch for 1986 was 20,987 tons, of which 95.2% was accounted for by municipal fisheries. This zone will continue to have the same tendency and to be a fishing industry base similar in function to Zone 10.

1) Prototype Site Pasacao: The total catch for 1986 was 9,452 tons of which 98.5% was accounted for by municipal fisheries, 1.5% by commercial fisheries, and no aquaculture production. This site will continue to have the same tendency and to be an industry base similar in function to Zone 2.

TABLE 6 NUMBER OF FISHING BOATS BY ZONE AND SIZE (1980)

Zone	Municipal <3 tons		Commercial							To-tal
	W/Eng.	WO/Eng.	3-5	2-10	10-20	20-50	50-100	100-500	>500 tons	
1	7,521	4,278	46	22	54	18	1	0	0	140
2	1,147	2,039	1	9	2	4	1	0	0	17
3	4,283	4,203	4	3	7	17	11	5	0	47
4	2,405	5,980	11	13	23	26	3	0	0	76
5	1,685	5,176	19	10	6	0	0	0	0	35
6	1,479	970	11	5	16	19	11	2	1	65
7	1,716	7,744	17	4	12	4	1	2	0	39
8	1,243	2,804	0	0	1	1	1	0	0	4
9	1,275	3,400	18	23	16	6	8	0	0	71
10	1,042	5,767	0	0	1	2	0	0	0	3
11	918	7,543	17	0	0	1	0	0	0	18
Zone Total	24,714	49,904	44	89	138	98	36	9	1	515
Other Total	80,376	212,844	1,000	470	590	362	203	191	4	2,720
PHIL TOTAL	105,090	262,748	1,044	559	728	460	239	200	5	3,235

Source: Number of fishing boats from Census of NCSO, 1980

TABLE 7 NUMBER OF FISHERMEN (1980) AND AREA OF FISH POND BY ZONE (1983)

Zone	Number of Fishermen		Area of Pond (ha)
	Municipal	Commercial	
1	29,933	1,571	46,370
2	3,191	435	2,105
3	7,253	911	16,220
4	9,640	1,294	4,584
5	8,543	149	3,648
6	2,445	1,581	393
7	9,309	441	10,531
8	0	57	2,975
9	5,067	992	1,337
10	6,708	97	61
11	6,699	364	1,511
Zone Total	88,788	7,891	89,734
Other Total	492,972	35,085	120,305
PHIL. TOTAL	581,760	42,976	210,039

Source: Number of fishermen from Census of NCSO, 1980
Fish pond area from Fisheries Statistics 1983, BFAR

(3) Fish Demand and Supply by Zone

Fish demand/supply balance by zone was projected as shown in Fig. 6 and Tables 15-17 through fish demand and supply analysis. There is a shortage in fish products in the Metro Manila area, the northern and central parts of Luzon Island, the eastern part of Visayas, the northern, central and southern parts of Mindanao Island as shown in Fig. 5.1 and Table 5.1. The areas where there is a conspicuous surplus of fish products are central-southern Luzon, the western Visayas region, the Western Mindanao region, etc.

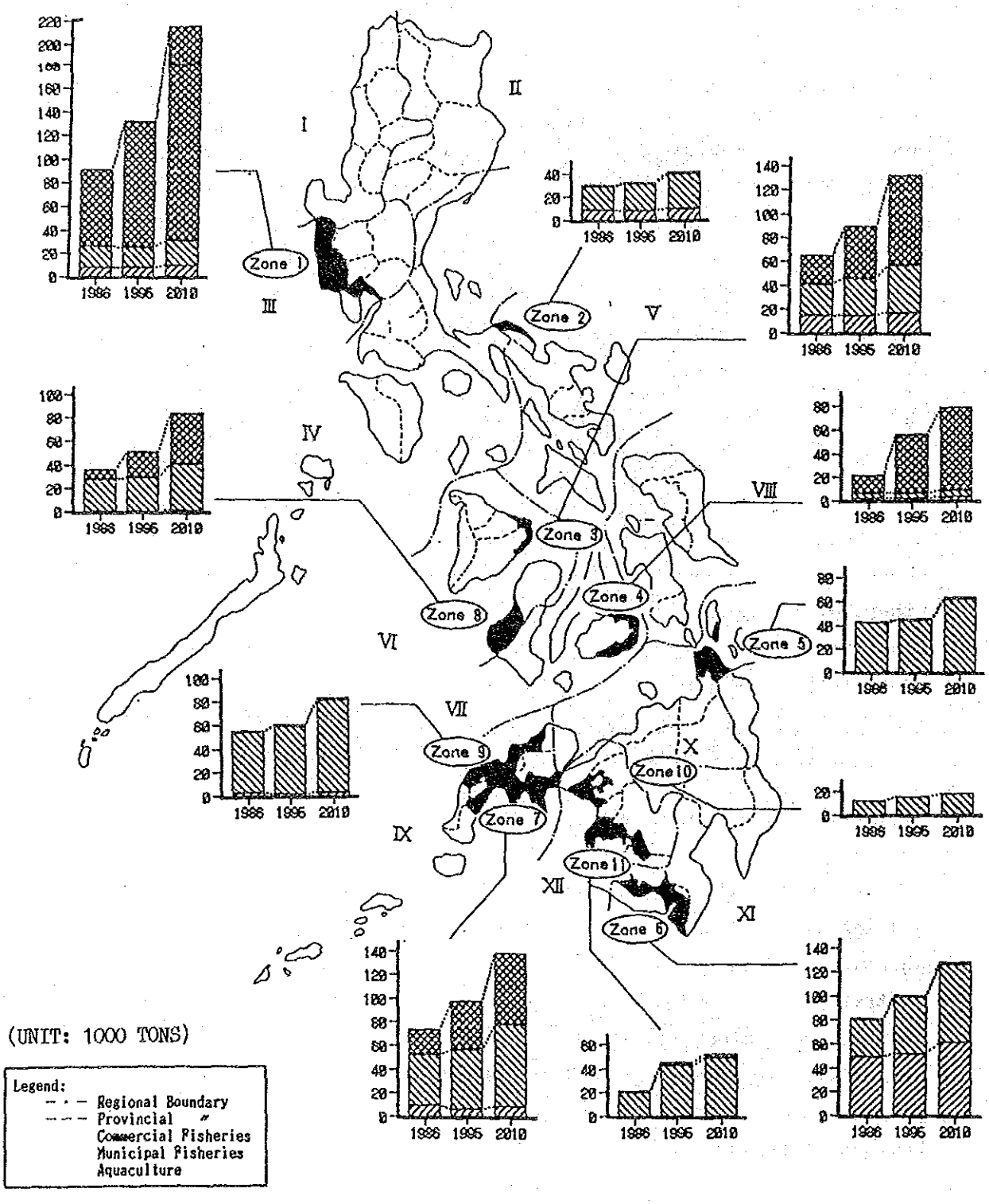


FIG. 5 FISH PRODUCTION BY SECTOR IN EACH ZONE (1986, 1995, 2010)

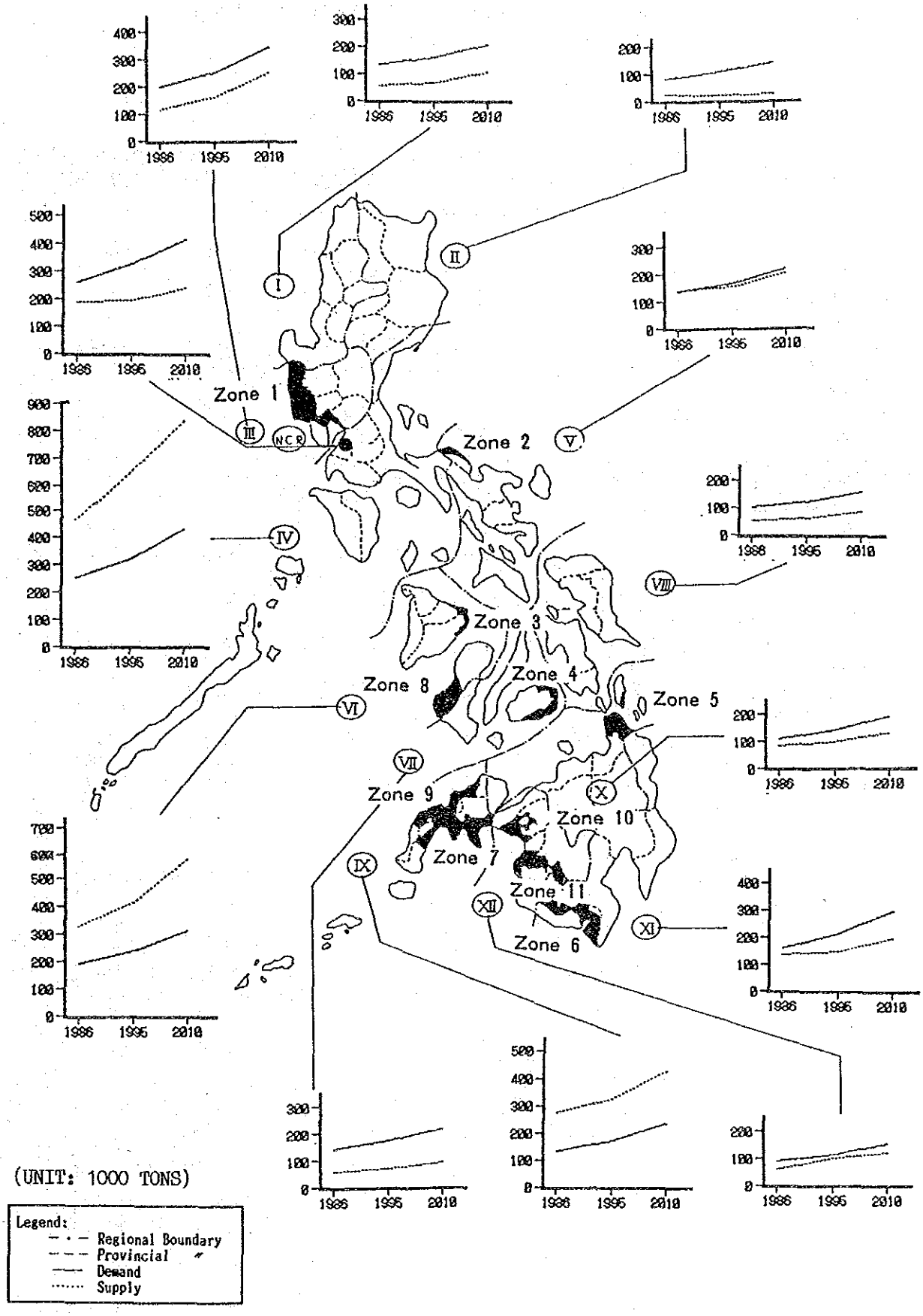


FIG. 6 FISH DEMAND AND SUPPLY BY REGION (1986, 1995, 2010)

TABLE 8 GDP, POPULATION AND FISH DEMAND/SUPPLY IN THE PHILIPPINES
(1986, 1995, AND 2010)

	1986	1995	2010	Average Annual Growth Rate(%) 1986-1995	1995-2010
GDP (billion Pesos)	93.0	135.3	253.0	4.3	4.3
Per Capita GDP (Pesos)	1,663	1,977	2,901	1.9	2.6
Population	55,988,000	68,424,000	87,206,000	2.3	1.6
Demand (tons)	1,988,505	2,493,217	3,311,672	2.5	1.9
Domestic Consumption	1,858,010	2,313,570	3,024,717	2.5	1.8
Export	130,495	179,647	286,955	3.6	3.2
Frozen Tuna	9,170	10,566	13,387	1.6	1.6
Fresh Tuna	3,415	11,234	31,315	14.1	7.1
Canned Tuna	66,005	107,685	162,712	5.6	2.8
Shrimp	16,171	27,641	55,329	6.1	4.7
Milkfish	1,834	4,618	6,309	10.8	2.1
Others	33,900	17,903	17,903	-6.8	0.0
Supply (tons)	1,988,505	2,493,217	3,311,672	2.5	1.9
Domestic Production	1,954,621	2,415,024	3,224,320	2.4	1.9
Commercial Fisheries	558,643	570,728	681,509	0.2	1.2
Municipal Fisheries	1,093,953	1,318,653	1,621,462	2.1	1.4
Aquaculture	302,025	525,643	921,349	6.4	3.8
Import	33,884	78,193	87,352	9.7	0.7

Remarks: 1) Seaweed and fish meal are excluded.
2) GDP is at constant price of 1972.

Source: 1) Philippines Population Projections 1980-2030, 1985, NCSO
2) Fisheries Profile 1986, Regional Office BFAR
3) Fisheries Statistics 1981-1986, BFAR
4) Foreign Trade Statistics of the Philippines 1986, NCSO
5) Second Nationwide Nutrition Survey in the Philippines 1982, FNRI
6) The Results of Field Survey of FTS 1988, JICA

TABLE 9 EXPORT OF FISH PRODUCTS BY ZONE AND BY MAJOR KIND OF FISH (1986)

UNIT : Tons

REGION	AREA	EXPORT VOLUME OF TUNA				EXPORT	EXPORT	EXPORT	EXPORT
		Frozen	Fresh	Airtight	Total	SHRIMP	BANGUS	OTHERS	TOTAL
1		2	1	11	13	984	158	418	1,573
2		0	0	1	2	5	17	413	436
3	Zone 1	6	3	42	51	9,174	392	535	10,151
	Other area	0	0	0	0	28	40	162	230
NCR		1,141	70	8,216	9,428	0	73	3,560	13,060
4	Luzon	21	10	149	180	1,177	249	6,165	7,771
	Mindro+Palawan	19	9	135	163	1,342	51	1,642	3,198
	Other area	4	2	27	33	34	1	281	348
5	Zone 2	5	0	39	45	11	5	588	649
	Pasacao	1	0	10	12	0	0	194	206
	Other area	17	1	123	141	210	86	1,762	2,198
6	Zone 3	221	9	1,590	1,820	1,249	190	837	4,095
	Zone 8	149	5	1,072	1,226	245	50	569	2,089
	Other area	1,055	43	7,597	8,695	1,290	263	3,893	14,141
7	Zone 4	1	0	7	9	31	29	136	205
	Bohol others	1	0	5	6	0	0	143	149
	Cebu	5	1	37	43	20	19	581	662
	Negros Oriental	2	0	12	14	14	13	204	246
8	Leyte	3	1	19	22	53	8	528	612
	Samar	3	1	18	22	92	13	457	584
9	Tawi-Tawi area	1,077	485	7,752	9,314	2	7	1,285	10,608
	Zone 7	589	269	4,236	5,094	18	63	1,091	6,265
	Zone 9	498	265	3,585	4,348	2	6	1,120	5,476
	Others	1,146	376	8,247	9,768	0	0	1,959	11,727
10	Zone 5	6	1	45	53	7	4	868	932
	Others	5	1	39	46	28	19	751	844
11	Zone 6	2,522	1,423	18,151	22,095	1	4	1,633	23,733
	Others	633	428	4,555	5,616	8	45	985	6,654
12	Zone 10	4	1	30	35	2	0	250	287
	Zone 11	8	2	59	69	33	7	414	523
	Others	27	7	194	227	113	23	478	842
Ground Total		9,170	3,415	66,005	78,590	16,171	1,833	33,900	130,495

Source: Estimation based on Fisheries Statistics 1986,BFAR
and the Results of Field Survey of FTS 1988, JICA

TABLE 10 EXPORT OF FISH PRODUCTS BY ZONE AND BY MAJOR KIND OF FISH (1995)

UNIT :Tons

REGION	AREA	EXPORT VOLUME OF TUNA				EXPORT SHRIMP	EXPORT BANGUS	EXPORT OTHERS	EXPORT TOTAL
		Frozen	Fresh	Airtight	Total				
1		2	2	18	22	1,642	363	154	2,180
2		0	0	2	3	6	28	143	180
3	Zone 1	7	10	69	85	16,132	945	237	17,399
	Other area	0	0	0	0	39	77	88	204
NCR		1,315	231	13,404	14,950	0	178	1,595	16,724
4	Luzon	24	33	244	301	1,750	956	3,476	6,482
	Mindro+Palawan	22	30	220	272	2,120	111	986	3,489
	Other area	4	6	44	54	140	7	180	382
5	Zone 2	6	1	64	72	21	12	297	402
	Pasacao	2	0	17	19	0	0	98	117
	Other area	20	2	201	223	269	151	894	1,536
6	Zone 3	255	29	2,595	2,878	2,258	486	429	6,051
	Zone 8	172	18	1,748	1,938	347	97	282	2,664
	Other area	1,216	141	12,394	13,751	2,091	585	2,070	18,496
7	Zone 4	1	1	12	14	40	51	63	168
	Bohol others	1	1	9	10	0	0	70	80
	Cebu	6	3	60	69	25	32	356	481
	Negros Oriental	2	1	20	23	17	21	85	146
8	Leyte	3	4	31	37	126	25	274	463
	Samar	3	4	30	37	196	38	224	495
9	Tawi-Tawi area	1,241	1,596	12,647	15,485	2	12	760	16,259
	Zone 7	678	886	6,911	8,475	33	156	544	9,208
	Zone 9	574	871	5,849	7,294	3	13	567	7,877
	Others	1,320	1,235	13,454	16,010	0	0	1,051	17,061
10	Zone 5	7	5	74	86	13	11	433	542
	Others	6	4	63	74	51	46	414	585
11	Zone 6	2,906	4,681	29,612	37,199	1	10	939	38,150
	Others	729	1,408	7,431	9,568	16	120	332	10,036
12	Zone 10	5	3	49	57	8	2	148	216
	Zone 11	9	7	96	113	92	26	411	642
	Others	31	23	316	370	204	58	300	931
	Ground Total	10,566	11,234	107,685	129,485	27,641	4,618	17,902	179,647

Source: Estimation based on Fisheries Statistics 1986,BFAR
and the Results of Field Survey of FTS 1988, JICA

TABLE 11 EXPORT OF FISH PRODUCTS BY ZONE AND BY MAJOR KIND OF FISH (2010)

UNIT : Tons

REGION	AREA	EXPORT VOLUME OF TUNA				EXPORT	EXPORT	EXPORT	EXPORT
		Frozen	Fresh	Airtight	Total	SHRIMP	BANGUS	OTHERS	TOTAL
1		2	6	27	35	3,290	496	162	3,983
2		0	0	4	4	11	39	147	201
3	Zone 1	9	27	104	139	32,267	1,289	241	33,936
	Other area	0	0	0	0	78	106	89	273
NCR		1,666	643	20,254	22,563	0	244	1,496	24,303
4	Luzon	30	93	368	492	3,704	1,306	3,174	8,676
	Mindro+Palawan	27	84	333	444	4,249	151	1,027	5,872
	Other area	5	17	66	89	281	10	195	574
5	Zone 2	8	2	97	107	43	16	309	475
	Pasacao	2	1	25	28	0	0	106	135
	Other area	25	6	304	334	540	206	919	1,999
6	Zone 3	323	80	3,921	4,323	4,322	664	443	9,752
	Zone 8	217	50	2,642	2,909	696	133	322	4,059
	Other area	1,541	392	18,728	20,661	4,190	799	2,070	27,720
7	Zone 4	2	2	18	22	80	69	69	240
	Bohol others	1	2	13	16	0	0	71	87
	Cebu	7	8	91	106	50	43	354	553
	Negros Oriental	2	3	30	35	34	29	88	186
8	Leyte	4	10	46	60	253	34	286	633
	Samar	4	11	45	60	391	52	239	743
9	Tawi-Tawi area	1,572	4,450	19,110	25,132	5	16	810	25,963
	Zone 7	859	2,469	10,443	13,771	65	213	612	14,662
	Zone 9	727	2,428	8,838	11,993	6	18	645	12,662
	Others	1,673	3,444	20,330	25,446	0	0	995	26,441
10	Zone 5	9	13	111	133	25	16	499	673
	Others	8	12	96	115	102	63	407	687
11	Zone 6	3,681	13,047	44,745	61,473	3	14	974	62,464
	Others	924	3,924	11,229	16,077	32	165	354	16,627
12	Zone 10	6	10	74	89	17	3	142	252
	Zone 11	12	19	146	177	185	36	392	789
	Others	39	63	477	580	409	79	266	1,334
Ground Total		13,387	31,315	162,713	207,415	55,329	6,310	17,902	286,955

Source: Estimation based on Fisheries Statistics 1986,BFAR
and the Results of Field Survey of FTS 1988, JICA

TABLE 12 FISH PRODUCTION BY SECTOR AND BY ZONE (1986)

UNIT : Tons

REGION	AREA	Grand Total	Exclusive Seaweeds	Commer-cial	Municipal			Aquaculture			
					Subtotal	Marine	Inland	Subtotal	Marine	Inland	Seaweeds
1		53,168	53,168	3,624	16,746	16,168	578	32,798	8,084	24,714	0
2		22,501	22,501	7,946	12,200	9,239	2,961	2,355	9	2,346	0
3	Zone 1	90,935	90,935	7,975	18,111	15,900	2,211	64,849	390	64,459	0
	Other area	21,412	21,412	0	7,899	4,167	3,732	13,513	192	13,321	0
NCR		185,121	185,121	167,205	6,321	6,314	7	11,595	3,622	7,973	0
4	Luzon	357,874	357,874	28,568	271,968	59,129	212,839	57,338	10,987	46,351	0
	Mindro+Palawan	91,496	89,576	25,573	54,483	53,545	938	11,440	0	9,520	1,920
	Other area	13,934	13,934	1,502	12,193	12,177	16	239	0	239	0
5	Zone 2	29,242	29,242	8,902	19,768	19,133	635	572	0	572	0
	Pasacao	9,452	9,452	140	9,312	9,312	0	0	0	0	0
	Other area	96,826	96,820	31,985	53,900	51,111	2,789	10,941	130	10,805	6
6	Zone 3	65,088	65,088	14,781	26,011	25,136	875	24,296	741	23,555	0
	Zone 8	36,002	36,002	1,096	26,644	26,641	3	8,262	2,086	6,176	0
	Other area	222,944	222,944	95,795	93,969	92,478	1,491	33,180	611	32,569	0
7	Zone 4	21,164	9,831	2,352	4,279	4,271	8	14,533	0	3,200	11,333
	Bohol others	6,954	6,954	309	6,645	6,645	0	0	0	0	0
	Cebu	30,544	30,369	14,616	13,695	13,683	12	2,233	0	2,058	175
	Negros Oriental	11,428	11,428	4,461	5,504	5,501	3	1,463	0	1,463	0
8	Leyte	30,690	26,730	8,538	17,218	17,057	161	4,934	0	974	3,960
	Samar	25,670	25,667	2,551	19,706	19,300	406	3,413	1,720	1,690	3
9	Tawi-Tawi area	191,708	63,464	10,335	52,311	52,208	103	129,062	0	818	128,244
	Zone 7	74,311	60,792	10,046	43,122	42,497	625	21,143	0	7,624	13,519
	Zone 9	55,332	55,332	3,461	51,129	50,547	582	742	0	742	0
	Others	104,902	95,486	48,966	46,520	46,520	0	9,416	0	0	9,416
10	Zone 5	42,827	42,827	301	42,036	41,536	500	490	0	490	0
	Others	38,746	38,746	5,909	30,721	28,778	1,943	2,116	0	2,116	0
11	Zone 6	80,050	80,050	49,150	30,464	30,453	11	436	0	436	0
	Others	53,821	53,529	2,207	45,815	45,051	764	5,799	7	5,500	292
12	Zone 10	12,224	12,224	96	12,071	2,552	9,519	57	0	57	0
	Zone 11	20,987	20,987	179	19,979	5,047	14,932	829	0	829	0
	Others	26,136	26,136	74	23,213	16,771	6,442	2,849	0	2,849	0
Ground Total		2,123,489	1,954,621	558,643	1,093,953	828,867	265,086	470,893	28,579	273,446	168,868

Source: Fisheries Statistics 1981-1986,BFAR
Census of Fishries 1980,NCSO
Area of Fish Pond by Municipality 1983,BFAR

TABLE 13 FISH PRODUCTION BY SECTOR AND BY ZONE (1995)

UNIT : Tons

REGION	AREA	Grand Total	Exclusive Seaweeds	Commer-cial	Municipal			Aquaculture			
					Subtotal	Marine	Inland	Subtotal	Marine	Inland	Seaweeds
1		64,827	64,827	2,861	13,324	12,657	667	48,641	12,101	36,541	0
2		17,639	17,639	3,487	11,584	9,868	1,717	2,568	8	2,559	0
3	Zone 1	131,772	131,772	8,267	16,787	14,503	2,285	106,718	6,314	100,403	0
	Other area	25,752	25,752	0	9,253	5,639	3,614	16,499	186	16,313	0
NCR		191,721	191,721	163,142	8,421	8,416	5	20,158	7,633	12,525	0
4	Luzon	500,389	500,389	28,940	335,603	60,881	274,722	135,846	20,902	114,944	0
	Mindro+Palawan	123,835	117,275	28,626	75,325	74,754	571	19,884	0	13,324	6,561
	Other area	19,781	19,781	679	18,223	18,206	17	879	0	879	0
5	Zone 2	32,341	32,341	8,497	22,871	22,069	802	973	0	973	0
	Pasacao	10,286	10,286	134	10,152	10,152	0	0	0	0	0
	Other area	106,929	106,926	31,426	62,961	60,341	2,620	12,542	263	12,275	4
6	Zone 3	88,747	88,747	14,220	31,070	30,044	1,026	43,457	4,611	38,846	0
	Zone 8	51,045	51,045	1,098	28,411	28,408	3	21,537	13,774	7,762	0
	Other area	272,015	271,334	107,082	112,515	110,768	1,747	52,418	4,983	46,754	681
7	Zone 4	56,206	10,319	2,648	4,042	4,036	7	49,516	0	3,629	45,887
	Bohol others	7,334	7,334	695	6,639	6,639	0	0	0	0	0
	Cebu	40,314	40,123	22,151	15,714	15,702	12	2,449	0	2,258	191
	Negros Oriental	10,520	10,520	2,855	6,141	6,139	2	1,524	0	1,524	0
8	Leyte	40,832	31,001	8,025	20,922	20,757	165	11,884	0	2,054	9,831
	Samar	29,329	29,328	2,562	20,985	20,742	243	5,782	2,600	3,181	1
9	Tawi-Tawi area	369,715	80,785	10,145	69,684	69,603	81	289,886	36	921	288,930
	Zone 7	97,560	69,354	6,755	50,393	49,792	600	40,412	0	12,206	28,206
	Zone 9	60,457	60,457	2,630	56,771	56,198	572	1,056	0	1,056	0
	Others	132,614	111,469	52,398	59,044	59,044	0	21,173	28	0	21,145
10	Zone 5	46,157	46,157	384	44,938	44,712	225	835	0	835	0
	Others	46,871	46,871	5,370	38,114	35,632	2,482	3,387	0	3,387	0
11	Zone 6	100,591	100,591	51,834	47,940	47,928	13	817	0	817	0
	Others	44,567	44,245	3,142	31,653	30,787	867	9,772	15	9,435	322
12	Zone 10	15,682	15,682	107	15,388	2,424	12,964	187	0	187	0
	Zone 11	45,056	45,056	449	42,551	5,331	37,220	2,057	0	2,057	0
	Others	35,898	35,898	119	31,235	16,773	14,462	4,544	0	4,544	0
Ground Total		2,816,782	2,415,024	570,728	1,318,653	958,942	359,711	927,401	73,454	452,189	401,758

Source: Fisheries Statisticce 1981-1986,BFAR
Census of Fisheries 1980,NCSO
Area of Fish Pond by Municipality 1983,BAFR

TABLE 14 FISH PRODUCTION BY SECTOR AND BY ZONE (2010)

UNIT : Tons

REGION	AREA	Grand Total	Exclusive Seaweeds	Commer-cial	Municipal			Aquaculture			
					Subtotal	Marine	Inland	Subtotal	Marine	Inland	Seaweeds
1		107,715	107,715	3,416	17,101	16,405	696	87,199	25,014	62,185	0
2		23,119	23,119	4,165	14,580	12,789	1,791	4,374	19	4,355	0
3	Zone 1	214,641	214,641	9,872	21,180	18,796	2,384	183,589	13,051	170,537	0
	Other area	39,554	39,554	0	11,079	7,310	3,769	28,475	385	28,090	0
NCR		242,815	242,815	194,809	10,914	10,909	5	37,093	15,778	21,314	0
4	Luzon	638,834	638,834	34,558	365,466	78,910	286,556	238,811	43,202	195,609	0
	Mindro+Palawan	163,419	154,346	34,183	97,489	96,893	596	31,747	0	22,674	9,073
	Other area	25,924	25,924	810	23,617	23,598	19	1,498	0	1,498	0
5	Zone 2	41,240	41,240	10,146	29,440	28,604	836	1,654	0	1,654	0
	Pasacao	13,319	13,319	160	13,159	13,159	0	0	0	0	0
	Other area	139,912	139,907	37,527	80,945	78,211	2,734	21,441	544	20,891	5
6	Zone 3	132,624	132,624	16,980	40,012	38,942	1,070	75,632	9,530	66,102	0
	Zone 8	83,766	83,766	1,389	39,007	39,004	3	43,370	30,159	13,210	0
	Other area	360,123	359,182	127,790	143,212	141,389	1,823	89,122	8,609	79,571	941
7	Zone 4	78,530	15,071	3,350	5,547	5,540	7	69,634	0	6,174	63,459
	Bohol others	8,939	8,939	643	8,296	8,296	0	0	0	0	0
	Cebu	50,921	50,656	26,450	20,364	20,352	12	4,107	0	3,842	265
	Negros Oriental	13,961	13,961	3,408	7,958	7,956	2	2,595	0	2,595	0
8	Leyte	53,749	40,154	9,583	27,076	26,904	172	17,090	0	3,495	13,595
	Samar	40,972	40,970	3,059	27,140	26,886	254	10,773	5,373	5,397	2
9	Tawi-Tawi area	503,638	104,056	12,114	90,301	90,216	85	401,223	74	1,568	399,582
	Zone 7	137,141	98,133	8,544	68,817	68,366	451	59,780	0	20,772	39,008
	Zone 9	82,706	82,706	3,326	77,581	77,161	420	1,798	0	1,798	0
	Others	159,588	130,347	61,905	68,382	68,382	0	29,301	60	0	29,241
10	Zone 5	63,781	63,781	486	61,875	61,392	483	1,421	0	1,421	0
	Others	57,241	57,241	6,388	45,088	42,746	2,342	5,765	0	5,765	0
11	Zone 6	129,096	129,096	61,895	65,811	65,797	13	1,390	0	1,390	0
	Others	61,091	60,646	3,750	40,807	39,904	903	16,535	33	16,057	445
12	Zone 10	18,106	18,106	136	17,651	3,327	14,324	318	0	318	0
	Zone 11	52,513	52,513	567	48,446	7,320	41,126	3,499	0	3,499	0
	Others	40,960	40,960	102	33,125	21,145	11,980	7,733	0	7,733	0
Ground Total		3,779,938	3,224,320	681,509	1,621,462	1,246,609	374,853	1,476,967	151,831	769,518	555,618

Source: Fishries Statistics 1981-1986,BFAR
Census of Fisheries 1980,NCSO
Area of Fish Pond by Municipality 1983,BFAR

TABLE 15 FISH DEMAND/SUPPLY BY ZONE (1986)

R	Region/Province Name	Demand			Supply			Balance
		Fish Consumption	Export	Total (D)	Fish Production	Import	Total (S)	(S)-(D)
T	Whole Country	1,858,010	130,495	1,988,505	1,954,621	33,884	1,988,505	0
0	Metro Manila	245,196	13,060	258,256	185,121	4,472	189,593	-68,664
1	Ilocos	130,256	1,573	131,829	53,168	2,375	55,543	-76,286
2	Cagayan Valley	79,645	436	80,081	22,501	1,452	23,953	-56,127
3	Central Luzon	187,711	10,382	198,093	112,347	3,423	115,770	-82,322
	1 Zone 1	50,816	10,151	60,967	90,935	927	91,862	30,895
	2 Other Area	136,895	230	137,126	21,412	2,497	23,909	-113,217
4	Southern Tagalog	241,714	11,317	253,031	461,384	4,408	465,792	212,761
	1 Luzon Area	188,072	7,771	195,843	357,874	3,430	361,304	165,461
	2 Mindoro/Palawan	40,496	3,198	43,694	89,576	739	90,315	46,620
	3 Other Area	13,146	348	13,494	13,934	240	14,174	679
5	Bicol	131,489	3,053	134,541	135,514	2,398	137,912	3,371
	1 Zone 2	8,627	649	9,276	29,242	157	29,399	20,123
	2 Prototype 8 (Pasacao)	1,068	206	1,274	9,452	19	9,471	8,198
	3 Other Area	121,793	2,198	123,991	96,820	2,221	99,041	-24,950
6	Western Visayas	173,323	20,326	193,648	324,034	3,161	327,195	133,547
	1 Zone 3	15,712	4,095	19,807	65,088	287	65,375	45,567
	2 Zone 8	22,776	2,089	24,865	36,002	415	36,417	11,552
	3 Other Area	134,835	14,141	148,976	222,944	2,459	225,403	76,427
7	Central Visayas	141,988	1,262	143,250	58,582	2,589	61,171	-82,079
	1 Zone 4 (in Bohol)	15,294	205	15,499	9,831	279	10,110	-5,389
	2 Other Bohol Area	14,312	149	14,461	6,954	261	7,215	-7,246
	3 Cebu	79,334	662	79,996	30,369	1,447	31,816	-48,180
	4 Negros Oriental/Siquijor	33,048	246	33,294	11,428	603	12,031	-21,264
8	Eastern Visayas	102,122	1,195	103,318	52,397	1,862	54,259	-49,058
	1 Leyte	58,677	612	59,288	26,730	1,070	27,800	-31,488
	2 Samar	43,445	584	44,029	25,667	792	26,459	-17,570
9	Western Mindanao	97,682	34,076	131,758	275,074	1,781	276,855	145,098
	1 Zone 7	25,286	10,608	35,894	60,792	461	61,253	25,359
	2 Zone 9	16,323	6,265	22,589	55,332	298	55,630	33,041
	3 Basilan/Tawi-Tawi/Sulu	28,231	5,476	33,707	63,464	515	63,979	30,272
	4 Other Area	27,842	11,727	39,569	95,486	508	95,994	56,425
10	Northern Mindanao	107,967	1,776	109,742	81,573	1,969	83,542	-26,200
	1 Zone 5	11,658	932	12,590	42,827	213	43,040	30,450
	2 Other Area	96,309	844	97,153	38,746	1,756	40,502	-56,650
11	Southern Mindanao	130,662	30,387	161,049	133,579	2,383	135,962	-25,087
	1 Zone 6	17,878	23,733	41,611	80,050	326	80,376	38,765
	2 Other Area	112,784	6,654	119,439	53,529	2,057	55,586	-63,853
12	Central Mindanao	88,256	1,652	89,908	59,347	1,609	60,956	-28,951
	1 Zone 10	11,082	287	11,370	12,224	202	12,426	1,056
	2 Zone 11	15,968	523	16,491	20,987	291	21,278	4,788
	3 Other Area	61,205	842	62,047	26,136	1,116	27,252	-34,795

Remarks : Estimated from Fisheries Statistics 1986, BFAR
Second Nationwide Nutrition Survey in the Philippines 1982, FNRI
Results of Fields Survey of FTS 1988, JICA

TABLE 16 FISH DEMAND/SUPPLY BY ZONE (1995)

R	Region/Province Name	Demand			Supply			Balance
		Fish Consumption	Export	Total (D)	Fish Production	Import	Total (S)	(S)-(D)
T	Whole Country	2,313,570	179,647	2,493,217	2,415,024	78,193	2,493,217	0
0	Metro Manila	307,085	16,724	323,808	191,721	5,477	193,817	-129,991
1	Ilocos	157,730	2,180	159,910	64,827	2,813	67,998	-91,913
2	Cagayan Valley	104,578	180	104,758	17,639	1,865	19,524	-85,234
3	Central Luzon	234,389	17,603	251,992	157,524	4,181	162,536	-89,456
1	Zone 1	62,473	17,399	79,872	131,772	1,114	133,543	53,671
2	Other Area	171,916	204	172,120	25,752	3,066	28,993	-143,127
4	Southern Tagalog	307,829	10,353	318,181	637,445	5,491	645,587	327,405
1	Luzon Area	241,054	6,482	247,536	500,389	4,300	507,251	259,715
2	Mindoro/Palawan	51,382	3,489	54,870	117,275	916	118,165	63,295
3	Other Area	15,393	382	15,775	19,781	275	20,170	4,395
5	Bicol	163,358	2,055	165,413	149,553	2,914	152,331	-13,082
1	Zone 2	10,868	402	11,270	32,341	194	32,510	21,240
2	Prototype 8 (Pasacao)	1,420	117	1,537	10,286	25	10,377	8,840
3	Other Area	151,070	1,536	152,606	106,926	2,695	109,444	-43,162
6	Western Visayas	212,056	27,211	239,266	411,126	3,782	414,184	174,918
1	Zone 3	19,524	6,051	25,575	88,747	348	89,289	63,713
2	Zone 8	29,180	2,664	31,843	51,045	520	51,880	20,037
3	Other Area	163,352	18,496	181,848	271,334	2,914	273,015	91,167
7	Central Visayas	170,720	875	171,595	68,297	3,045	70,991	-100,603
1	Zone 4 (in Bohol)	17,304	168	17,471	10,319	309	10,622	-6,850
2	Other Bohol Area	17,178	80	17,258	7,334	306	7,670	-9,588
3	Cebu	95,952	481	96,433	40,123	1,712	41,471	-54,962
4	Negros Oriental/Siquijor	40,286	146	40,432	10,520	719	11,228	-29,204
8	Eastern Visayas	123,065	958	124,023	60,329	2,195	62,630	-61,393
1	Leyte	70,951	463	71,414	31,001	1,266	32,247	-39,167
2	Samar	52,114	495	52,610	29,328	930	30,383	-22,227
9	Western Mindanao	120,646	50,405	171,050	322,065	2,152	324,337	153,287
1	Zone 7	35,538	9,208	44,745	80,785	634	70,264	25,519
2	Zone 9	19,642	7,877	27,519	69,354	350	61,142	33,623
3	Basilan/Tawi-Tawi/Sulu	34,603	16,259	50,862	60,457	617	81,659	30,797
4	Other Area	30,863	17,061	47,924	111,469	551	111,272	63,348
10	Northern Mindanao	137,319	1,128	138,447	93,028	2,449	95,943	-42,504
1	Zone 5	13,441	542	13,983	46,157	240	46,699	32,715
2	Other Area	123,878	585	124,463	46,871	2,210	49,244	-75,219
11	Southern Mindanao	163,536	48,186	211,723	144,837	2,917	147,158	-64,564
1	Zone 6	22,566	38,150	60,715	100,591	403	100,188	39,473
2	Other Area	140,971	10,036	151,007	44,245	2,515	46,970	-104,037
12	Central Mindanao	111,262	1,789	113,051	96,636	1,985	99,256	-13,795
1	Zone 10	13,250	216	13,465	15,682	236	16,021	2,556
2	Zone 11	19,895	642	20,537	45,056	355	45,704	25,167
3	Other Area	78,118	931	79,049	35,898	1,393	37,531	-41,518

Remarks : Estimated from Fisheries Statistics 1986, BFAR
Second Nationwide Nutrition Survey in the Philippines 1982, FNRI
Results of Fields Survey of FTS 1988, JICA

TABLE 17 FISH DEMAND/SUPPLY BY ZONE (2010)

R	Region/Province Name	Demand			Supply			Balance
		Fish Consumption	Export	Total (D)	Fish Production	Import	Total (S)	(S)-(D)
T	Whole Country	3,024,717	286,955	3,311,672	3,224,320	87,352	3,311,672	0
0	Metro Manila	390,615	24,303	414,919	242,815	7,481	239,086	-175,832
1	Ilocos	200,968	3,983	204,951	107,715	3,849	107,827	-97,124
2	Cagayan Valley	138,117	201	138,319	23,119	2,645	26,061	-112,257
3	Central Luzon	307,418	34,210	341,627	254,195	5,887	250,447	-91,180
1	Zone 1	79,311	33,936	113,247	214,641	1,519	207,413	94,166
2	Other Area	228,107	273	228,380	39,554	4,368	43,034	-185,346
4	Southern Tagalog	413,134	15,122	428,256	819,104	7,912	834,542	406,286
1	Luzon Area	325,113	8,676	333,788	638,834	6,226	649,517	315,728
2	Mindoro/Palawan	69,454	5,872	75,325	154,346	1,330	157,679	82,354
3	Other Area	18,568	574	19,142	25,924	356	27,346	8,204
5	Bicol	216,227	2,609	218,836	194,466	4,141	201,203	-17,633
1	Zone 2	14,553	475	15,029	41,240	279	42,396	27,367
2	Prototype 8 (Pasacao)	2,048	135	2,182	13,319	39	14,010	11,828
3	Other Area	199,626	1,999	201,625	139,907	3,823	144,797	-56,828
6	Western Visayas	270,283	41,531	311,814	575,571	5,176	573,971	262,157
1	Zone 3	25,456	9,752	35,208	132,624	488	130,422	95,214
2	Zone 8	40,159	4,059	44,218	83,766	769	84,220	40,002
3	Other Area	204,668	27,720	232,388	359,182	3,920	359,329	126,941
7	Central Visayas	215,011	1,066	216,077	88,627	4,118	92,502	-123,575
1	Zone 4 (in Bohol)	21,269	240	21,508	15,071	407	15,273	-6,235
2	Other Bohol Area	20,930	87	21,017	8,939	401	9,723	-11,294
3	Cebu	121,184	553	121,737	50,656	2,321	52,462	-69,275
4	Negros Oriental/Siquijor	51,629	186	51,815	13,961	989	15,044	-36,771
8	Eastern Visayas	158,889	1,376	160,265	81,123	3,043	85,519	-74,746
1	Leyte	91,471	633	92,105	40,154	1,752	42,599	-49,506
2	Samar	67,417	743	68,160	40,970	1,291	42,920	-25,240
9	Western Mindanao	157,506	79,728	237,234	415,242	3,016	427,963	190,729
1	Zone 7	41,832	14,662	56,493	104,056	801	100,897	44,403
2	Zone 9	25,794	12,662	38,456	98,133	494	86,828	48,372
3	Basilan/Tawi-Tawi/Sulu	44,641	25,963	70,604	82,706	855	108,739	38,136
4	Other Area	45,239	26,441	71,680	130,347	866	131,499	59,819
10	Northern Mindanao	187,368	1,360	188,728	121,022	3,588	129,258	-59,470
1	Zone 5	15,244	673	15,916	63,781	292	67,077	51,161
2	Other Area	172,125	687	172,812	57,241	3,296	62,181	-110,631
11	Southern Mindanao	217,935	79,091	297,026	189,742	4,174	195,045	-101,982
1	Zone 6	30,515	62,464	92,979	129,096	584	129,770	36,791
2	Other Area	187,420	16,627	204,047	60,646	3,589	65,275	-138,772
12	Central Mindanao	151,246	2,375	153,621	111,578	2,896	118,820	-34,800
1	Zone 10	17,065	252	17,317	18,106	327	19,294	1,977
2	Zone 11	26,460	789	27,249	52,513	507	55,241	27,992
3	Other Area	107,720	1,334	109,054	40,960	2,063	44,285	-64,769

Remarks : Estimated from Fisheries Statistics 1986, BFAR
Second Nationwide Nutrition Survey in the Philippines 1982, FNRI
Results of Fields Survey of FTS 1988, JICA