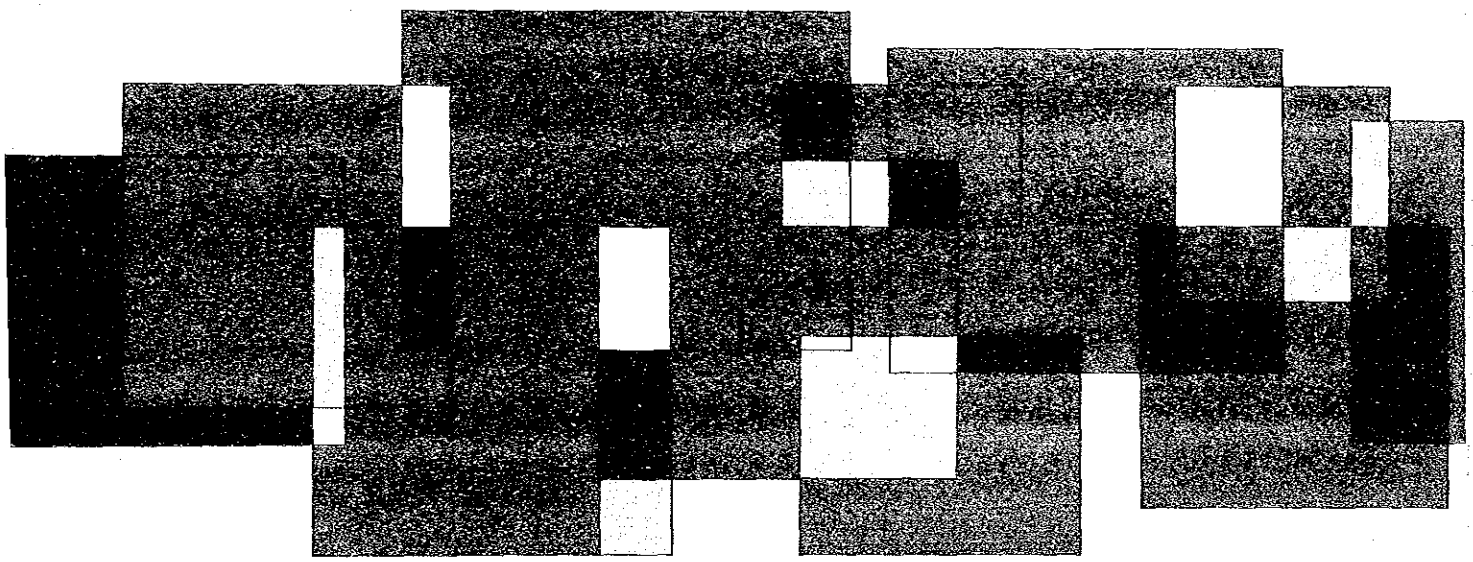
THE REPUBLIC OF THE PHILIPPINES

THE STUDY OF THE MASTER PLAN FOR THE NATIONWIDE ICE PLANTS AND COLD STORAGES NETWORK SYSTEM



FINAL REPORT

MARCH, 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

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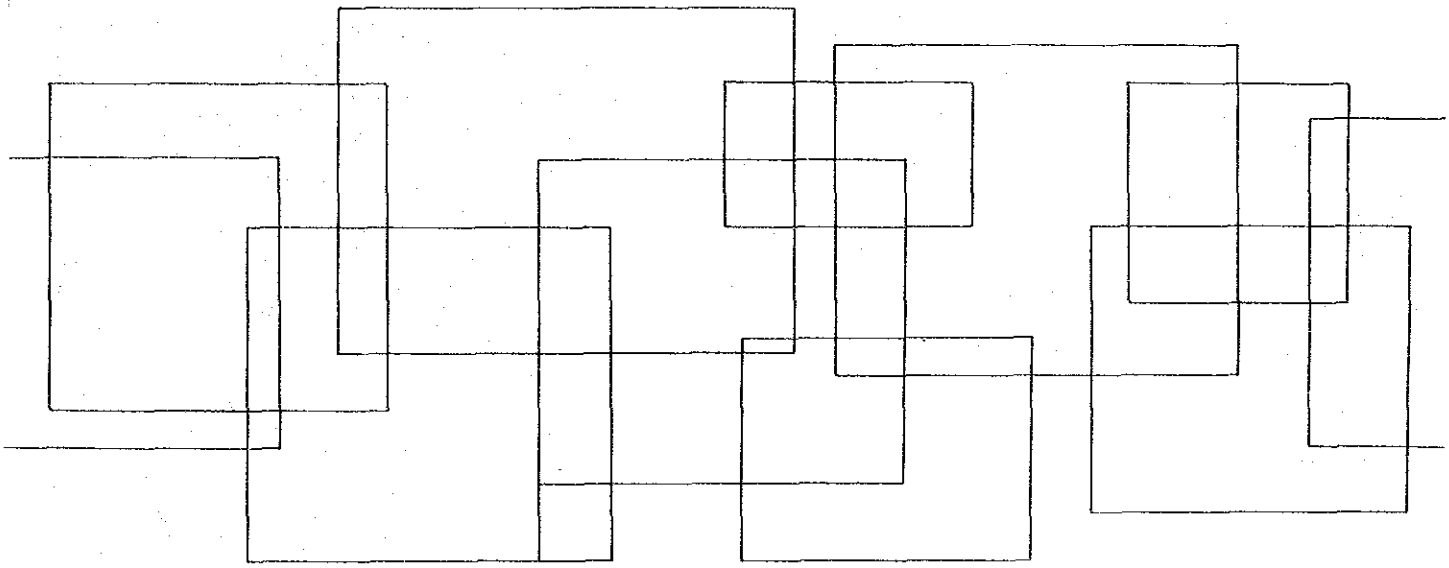

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Preface

In response to the request of the Government of the Republic of the Philippines, the Japanese Government decided to conduct a survey on the Master Plan for the Nationwide Ice Plants and Cold Storages Network System and entrusted the survey to the Japan International Cooperation Agency (JICA). The JICA sent to the Philippines a survey team headed by Mr. Tateo Kusano (System Science Consultants Inc. Ltd.) in 1983 and 1984.

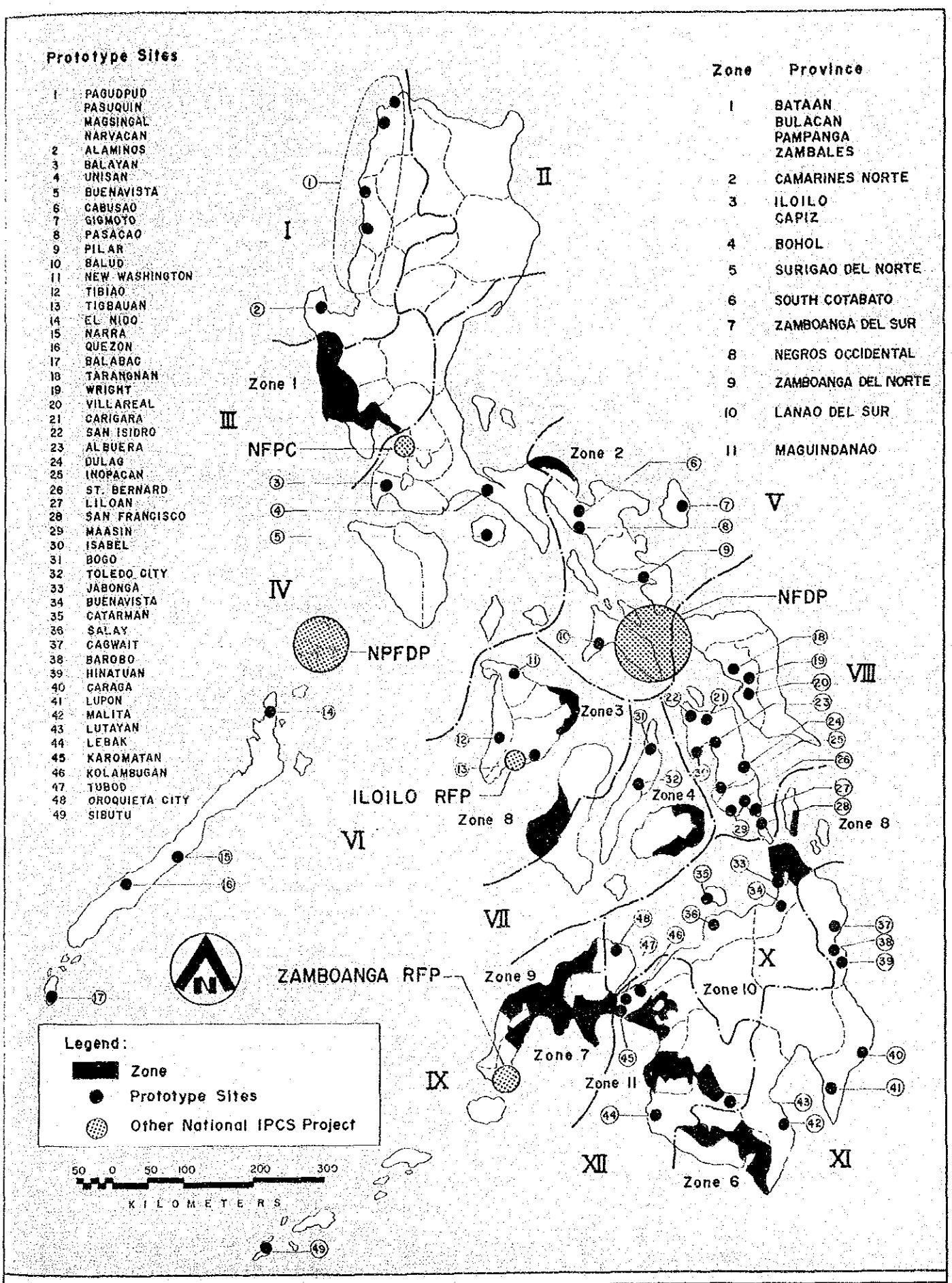
The team exchanged views on the Project with the officials concerned of the Government of the Philippines and conducted a field survey for seven and a half months. After the team returned to Japan, further studies were made and the present report has been prepared.

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

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

March, 1985

Keisuke Arita
President
Japan International Cooperation Agency



LOCATION OF SELECTED ZONES AND PROTOTYPE SITES

REPUBLIC OF THE PHILIPPINES
THE STUDY OF MASTER PLAN FOR THE NATIONWIDE ICE PLANTS AND COLD STORAGES NETWORK SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY

TABLES OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

I. Public Agencies and Organizational Units

(1) Government of the Philippines

BAECON	:	Bureau of Agricultural Economics, MAF
BC	:	Bureau of Construction, MPWH
BFAR	:	Bureau of Fisheries and Aquatic Resources, MAF
DBP	:	Development Bank of the Philippines
FIDC	:	Fishery Industry Development Council
FNRI	:	Food and Nutrition Research Institute
LWUA	:	Local Water Utilities Administration
MAF	:	Ministry of Agriculture and Food
MNR	:	Ministry of Natural Resources
MPWH	:	Ministry of Public Works and Highways
MWSS	:	Metropolitan Waterworks and Sewerage System
NCSO	:	National Census and Statistics Office
NEA	:	National Electrification Administration
NEDA	:	National Economic and Development Authority
NPC	:	National Power Corporation
NWRC	:	National Water Resources Council
PAGASA	:	Philippine Atmospheric Geophysical and Astronomical Services Administration
PFDA	:	Philippine Fisheries Development Authority
PMO-FPP I	:	Project Management Office - Fishing Port Package I, MPWH
PPA	:	Philippine Ports Authority
RWDC	:	Rural Waterworks Development Corporation

(2) Government of Japan

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

(3) International Organizations

ADB	:	Asian Development Bank
FAO	:	Food and Agriculture Organization, United Nations
IBRD	:	International Bank for Reconstruction and Development
ICLARM	:	International Center for Living Aquatic Resources Management

(4) Internal Units of PFDA

AOC	:	Area Operation Center
NFPC	:	Navotas Fishing Port Complex
OMD	:	Operations Management Development

II. Plans/Programs/Projects

CIADP	:	Cagayan Integrated Agriculture Development Project
FPP	:	Fishing Port Package (I and II)
IFDP	:	Integrated Fisheries Development Program
MFPDP	:	Municipal Fishing Port Development Program
NFDP	:	National Fisheries Development Project
NPFDP	:	Northern Palawan Fisheries Development Project
NTPDP	:	Nationwide Tertiary Ports Development Program
FTS	:	Fish Transport System

III. Private Sector

APICSO	:	Association of Private Ice Plants and Cold Storage Operators
MERALCO	:	Manila Electric Company
MIIPOA	:	Metro Lloilo Ice Plant Operators Association

IV. Technical Terms

B/C	:	Benefit/Cost Ratio
CIF	:	Cost, Insurance and Freight
EEA	:	Emergency Employment Administration
EEZ	:	Exclusive Economic Zone
EIRR	:	Economic Internal Rate of Return
GDP	:	Cross Domestic Products
IPCS	:	Ice Plant and Cold Storage
MCT	:	Multi-cylindder type
MFP	:	Municipal Fishing Port
NCR	:	National Capital Region
NPV	:	Net Present Value
RFP	:	Regional Fishing Port
SCT	:	Screw-compressor type
VOT	:	Vertical-open type

V. Metric Units

ha	:	hectare
km	:	kilometer
km^2	:	square kilometer
m^2	:	cubic meter
mm	:	millimeter
10^3	:	thousand
10^6	:	million
10^9	:	billion
MT	:	metric ton
°C	:	degree (in centigrade)

VI. Symbols

No.	:	number
—	:	Not available
%	:	per cent

TERMINOLOGY

1. Commercial fisheries

   Fishing for commercial purposes in waters more than seven fathomes deep with the use of fishing boats more than three gross tons (P.D. No. 704)

2. 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)

3. Commercial fishing ports

   Fishing ports serving as main fish collection and distribution centers.

4. Municipal fishing ports

   Fishing ports serving as the satellite sub-collection points of fish

5. Rated capacity

   Maximum capacity of ice production based upon the certain design conditions, which are raw water temperature, ambient temperature and brine or refrigerant evaporating temperature (tons/day)

6. Operational capacity

   Actual capacity of ice production (tons/day)

7. Operational ratio

   Operational capacity/Rated capacity

1. INTRODUCTION

1. INTRODUCTION

The Integrated Fisheries Development Program (IFDP) was formulated in October 1981, to provide the basic policies and strategies for the development of the fisheries sector on a long term basis over the period from 1981 to 1990. The Program includes the development of capture fisheries and acquaculture, marketing and research management, funding requirements and employment generation.

The present fish marketing system in the Philippines can be described as dispersed, inefficient and uncoordinated. Basic problems of the fish marketing sector are: (1) lack of supporting facilities, such as ice plant and cold storage facilities, necessary for efficient distribution of fish from surplus to deficit areas, (2) lack of fishing ports, markets and feeder roads, (3) the limited application of post-harvest technologies, (4) the extended marketing chain resulting in unstable and high fish prices, and (5) inadequate market information.

In order to consolidate all the development efforts in the fishing industry, the Philippine Fisheries Development Authority (PFDA) has launched the Nationwide Fish Marketing Infrastructure Program.

The Program includes the development of commercial and municipal fishing ports. The Program also aims at achieving optimum efficiency in food distribution by improving product handling and quality control through both the Fish Transport System (FTS) and the Natiowide Ice Plants and Cold Storages Network System (IPCS Network System).

The aim of the Fish Transport System is to support the collection and distribution terminals by providing marine and land transportation means, and will be closely linked through a communication network.

The IPCS Network System, as a supporting system for the fishing ports, has the role of supplying ice at all stages of catching, harvesting, transporting and marketing of fish. It will also aid in rationalizing fish prices by storing and preserving the surplus fish.

The IPCS Network System is expected to accomplish the following:

a. quality preservation and reduction of fish spoilage,
b. providing incentives for increased production of fish,

c. stable supply of ice, and
d. providing facilities necessary for the efficient nationwide fish distribution.

A preliminary study of the IPCS Network System was made by PFDA to solve such problems closely related to the Municipal Fishing Port Development Program (MFPDP).

The Government of the Republic of the Philippines requested the Government of Japan to review the outcome of the said preliminary study and to assess the existing ice plants and cold storages to formulate a master plan for the IPCS Network System.

In response to the request, the GOJ dispatched the Study Team to the Philippines according to the I/A on the technical cooperation which was agreed in September 1983 between JICA and MNR/PFDA. The executing agencies involved were JICA of Japan and MNR/PFDA of the Philippines. Both agencies set up the Advisory Committees for the effective execution of the Study.

In July 1984, PFDA was transferred from MNR to MAF. Accordingly, the executing agency on the part of the Philippines changed from MNR/PFDA to MAF/PFDA and the new Advisory Committee of MAF/PFDA was also set up in September 1984.

The objective of the Study is to formulate a Master Plan for the Nationwide IPCS Network System (Master Plan) which is closely related to the municipal fishing port system.

The Study for the Master Plan was carried out in the following two phases:

Phase I : (i) To review the preliminary study made by PFDA and to assess the existing IPCS system.

(ii) To clarify basic principles and study approaches for the formulation of the Master Plan.

Phase II : (i) To selet priority areas of for the IPCS system.

(ii) To finalize the Master Plan in the form of the IPCS Network System covering the whole country regarding the sites proposed by PFDA.

The Team collected data and information in close cooperation with MNR, MAF, PFDA, MPWH, BFAR, NEDA, DBP, as well as other government organizations and several associations in the private sector related to ice plants and cold storages.

Field surveys on the proposed sites and existing plants were conducted for about one month in Phase I Study and for two months in Phase II Study. The sites covered by the field surveys are shown in Fig. 1.1.

The progress of the Phase I Study was reported to the Advisory Committee of PFDA on February 14, 1984, and to the Joint Advisory Committee of PFDA and JICA on March 7, 1984. The Interim Report containing a summary of the Phase I Study and pointing out the basic principles of the Master Plan was submitted to the GOP in April 1984. The progress of the work in the Philippines regarding the Phase II Study was also reported to the Joint Advisory Committee on October 2, 1984.

The Draft Final Report was submitted by the end of 1984, and the Final Report was completed by the end of March 1985.

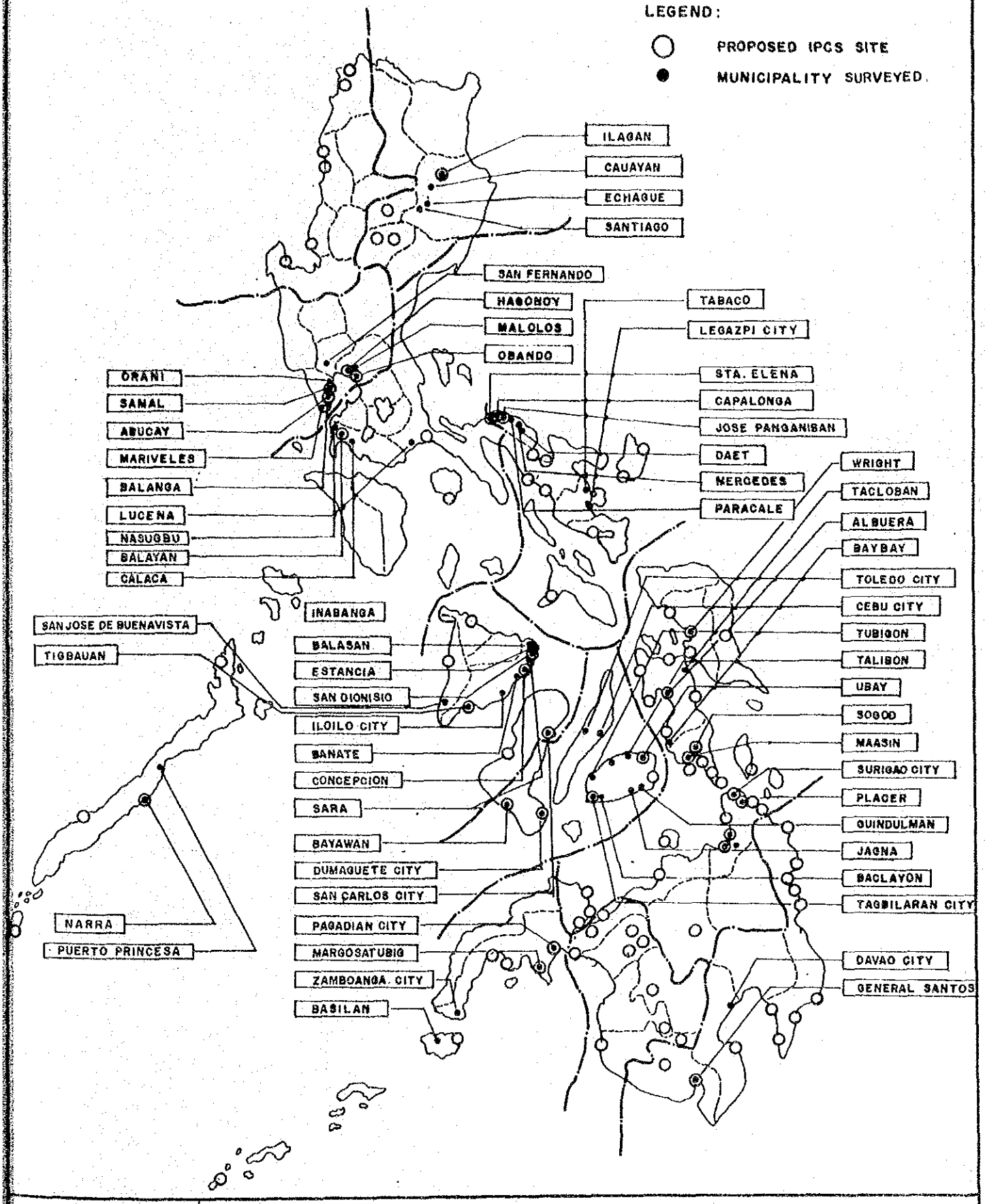


Fig. 1.1 SITES COVERED BY FIELD SURVEYS (I) AND (II)

REPUBLIC OF THE PHILIPPINES
THE STUDY OF MASTER PLAN FOR THE NATIONWIDE ICE PLANTS AND COLD STORAGES NETWORK SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY

2. BACKGROUND

2. BACKGROUND

2.1 Natural Conditions

(1) Geography and location

The Philippines consists of 7,100 islands and the archipelago extends to the distance of 1,851 km from north to south and the distance of 1,107 km from east to west. The archipelago borders on the South China Sea in the west on the Pacific Ocean in the east, on the Sulu and Celebes Seas in the south and on the Bashi Channel in the north.

(2) Land area

The total land area of the Philippines amounts approximately to 300×10^3 km^2, 93.5% of which is comprised of the 11 largest islands. The Philippines is divided into three major island groups: Luzon with an area of 141,395 km^2, Mindanao with an area of 101,999 km^2, and Visayas with an area of 56,606 km^2. The country is also divided into 13 Regions including the National Capital Region (NCR), 73 Provinces, 60 Cities, 1,493 Municipalities, 21 Municipal Districts and 40,207 Barangays. Regional and provincial boundaries of the Philippines are shown in Fig. 2.1.

(3) Coastline

The Philipines has an extensive coastline being indented with numerous bays, harbors and inlets. The length of the coastline totals 34,600 km, which is the longest in the world.

(4) Climate

There are three groups of seasonal winds: namely, 1) the north or the northeast monsoon during the period from October to January; 2) the trade winds, from east to southeast during the period from February to April; and 3) the equatorial or the southwest monsoon for the rest of the year.

The country is divided into the following four types of climatic zone as shown in Fig. 2.2.

a. First Type (I) : Two pronounced seasons, dry from November to April, and wet during the rest of the year.

b. Second Type (II) : No dry season with a very pronounced maximum rainfall from November to January.

c. Third Type (III) : Seasons not very pronounced with a relatively dry season from November to April and wet during the rest of the year.

d. Fourth Type (IV) : Rainfall more or less evenly distributed through out the year.

(5) Meteorology

Meteorological conditions based on the records of weather stations are shown in Fig. 2.2. There are no significant differences of annual average temperatures by Region. Annual average rainfalls manifest rather significant Regional differences. The highest record of 3,257 mm is seen in Region V in annual average, and the lowest 1,213 mm in Region VI.

The temperature is the highest in April or May and the lowest in January. There is little monthly difference in humidity which is about 80% in average, but it is comparatively high during the wet season in all Regions. The average velocity of wind is low for the whole year except in Regions VI and VIII. Winds that prevail in Region VI come from the north during December to April, while Region VIII is strongly affected by heavy winds throughout the year.

2.2 Fishing Port Development

Fishing ports are classified into two categories, i.e., commecial and municipal fishing ports. The former is composed of the Navotas Fishing Port Complex (NFPC) as a National Fishing Port and Fishing Port Packages (FPP) I and II of the Regional Fishing Ports, and serves as main collection and distribution centers for fish. The latter functions as satellite sub-collection points for the former, and also supplies fish directly to final consumers. Locations of the fishing ports are shown in Fig. 2.3.

The number of fishing ports and administrative arrangements by agencies are shown in Table 2.1, and construction schedule and capacity of ice plants, as well as cold storages in the commercial fishing ports are shown in Table 2.2.

(1) National Fishing Port

Basic facilities of NFPC were completed by MPWH in 1976, while the IPCS facilities were completed by PFDA in 1983. NFPC including the ice plant and cold storage has been managed by PFDA.

(2) Regional Fishing Ports

The Regional Fishing Port project is composed of two packages such as Fishing Port Package I (FPP I) and Fishing Port Package II (FPP II). Under the FPP I the Iloilo Fishing Port was completed in 1984, while Zamboanga Fishing Port is still under construction.

(3) Municipal Fishing Ports

The supplement of the function of the commercial fishing ports, Municipal Fishing Port Development Program (MFPDP) has been established for the fishing villages throughout the country, and the construction works are on progress. In relation to this, PFDA has prepared three types of MFP as shown in Fig.2.4.

The Infrastructure Program is annually formulated by MPWH based on the proposals from PFDA as well as the regional offices of MPWH, local governments and other agencies. There are two programs related to the development of the municipal ports, which are composed of MFP and municipal commercial ports, as follows:

a. Municipal Fishing Port Development Program (MFPDP):

   MFPDP worked out by PFDA includes 187 MFP, which are to be constructed by MPWH during the period from 1980 to 1990.

b. Nationwide Tertiary Ports Development Program (NTPDP):

   Under the NTPDP there are 310 priority tertiary ports which were selected from among 677 municipal sites. NTPDP is still under study by MPWH.

MPWH formulates annually the Infrastructure Program, considering MFPDP for MFP and NTPDP for the municipal commercial ports.

(4) MFP in relation to the IPCS proposed by PFDA

Out of the 101 IPCS sites proposed by PFDA as shown in Fig. 2.5, 82 sites are closely linked to MFP under MFPDP, while of the remaining 19 sites, 16 sites are connected to the existing fish landing places and 3 sites to the consumption centers. Out of the said 82 sites, both the stairlanding and the market hall have been completed at 29 sites, either a stairlanding or a market hall has been constructed at 14 sites, either of them is still under construction or has partially completed at 5 sites, no work has yet been started at 13 sites, causeway instead of stairlanding is being planned or under construction at 19 sites, and no information is available for the remaining 2 sites.

In spite of the progress achieved for basic facilities as indicated above, there has been little progress on supporting facilities for water and electricity supply in these fishing ports because of lack of funds.

MFP have been constructed by MPWH according to MFPDP prepared by PFDA and also to the terms indicated in the PFDA-MPWH agreement.[1] At the time of its implementation MPWH makes some revision on MFPDP due mainly to the feasibility of construction works for each sites.

2.3 Other Infrstructural Development

(1) Electricity

The following agencies are involved in the Philippine electric power industry:

The National Power Corporation (NPC) is a wholly government-owned/controlled corporation, charged with the generation and distribution of energy to bulk power users.

The Manila Electric Company (MERALCO) concentrates on the distribution of electricity purchased from NPC. Aside from the MERALCO, there are other agencies of electric utilities owned and operated by Municipal and Provincial Governments, private individuals and corporations.

The electric cooperatives extend power service to the country's remote regions. NPC is the main power source for electric cooperatives except for those in geographically isolated islands. The electric cooperatives cater

generally to residential dwellers for lighting and household appliances and to small commercial establishments.

As of 1981, a total of 109 electric cooperatives has been set up in almost all of the provinces in the country. For the construction of IPCS system, its close linkage with the electric cooperatives will be essential.

The current status of electric supply for the 101 proposed sites of IPCS is seen in Table 2.3. Electricity is available for almost all municipalities except some of the proposed sites in Region IV. However, there exist large disparities in energy charges. Energy charges are the lowest at P0.40 to P0.60/kwh in Naga and Payao of Region IX, almost in all municipalities of Region X and of Region XI, and more than half of the municipalities in Region XII, benefiting from the Maria Cristina hydro-power plant. The highest charge amounting to more than P2.00/kwh is seen in Narra of Region IV, in Gigmoto and Virac of Region V, in Borongan, Villareal and Wright of Region VIII, in Sibutu of Region IX, and Catarman of Region X. A geothermal plant was lately completed in Negros Island to supply cheaper energy.

(2) Water

As of 1980, only about 25.2×10^6 or 53% of the total population of the country were served by public water supply systems, while the service coverage was 82% of the total population in Metropolitan Manila (NCR) and its vicinity. The served population corresponds to 55% of the urban population outside of Metropolitan Manila, and 47% for the rural population.

MPWH formulates the Integrated National Water Supply Programs that are consistent with the framework prepared by the National Water Resources Council (NWRC). The programs are implemented by the Rural Waterworks Development Corporation (RWDC) charged with engineering and construction. The Metropolitan Waterworks and Sewerage System (MWSS) supplies water in Metropolitan Manila and contiguous areas.

The Local Water Utilities Administration (LWUA) supplies water to the cities and municipalities with population of 20×10^3 or more, while RWDC provides water to the rural sector and to other areas not covered by MWSS and LWUA.

Groundwater from shallow wells was utilized during the Spanish Regime (1521 - 1898). The actual drilling of deep well was started then by the Bureau of Public Works early in 1904 during the American Occupation.

(3) Road

The total length of road is 155×10^3 km in the country, composed of 24×10^3 km of national road, 30×10^3 km of provincial road, 16×10^3 km of municipal road and 85×10^3 km of barangay road. Municipal/barangay roads account for about 65% of the total road length, while the national road constitutes only about 15%.

Density of the national road is relatively low in the Cagayan Valley of Region II and Mindanao Island, compared with the national average. Road surface conditions are the worst in Region VIII of Eastern Visayas, Cagayan Valley and Mindanao Island. It seems that there exist road constraints in Palawan, Iloilo, Negros Occidental, Cebu, Bohol, Southern Leyte, Zamboanga del Sur, and in Region XI and XII.

Note 1): The activities for the MFP development, such as master planning, acquisition, installation-construction and management of the facilities for the preservation and processing of fishery products including IPCS shall be the responsibility of MNR/PFDA according to the agreement between MNR and MPWH concluded on March 24, 1983.

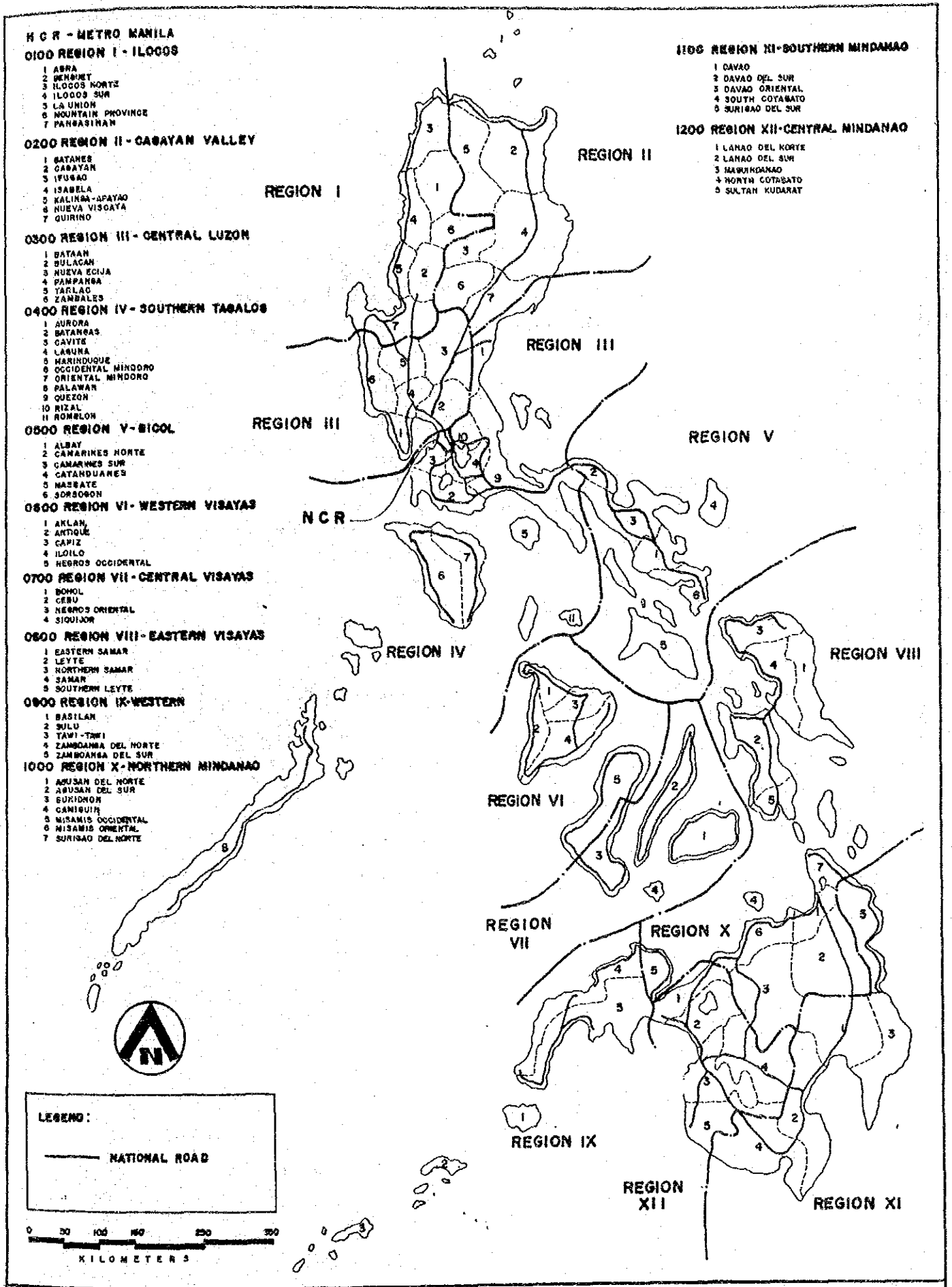


Fig. 2.1 REGIONAL AND PROVINCIAL BOUNDARIES OF THE PHILIPPINES

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THE STUDY OF MASTER PLAN FOR THE NATIONWIDE ICE PLANTS AND COLD STORAGES NETWORK SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY

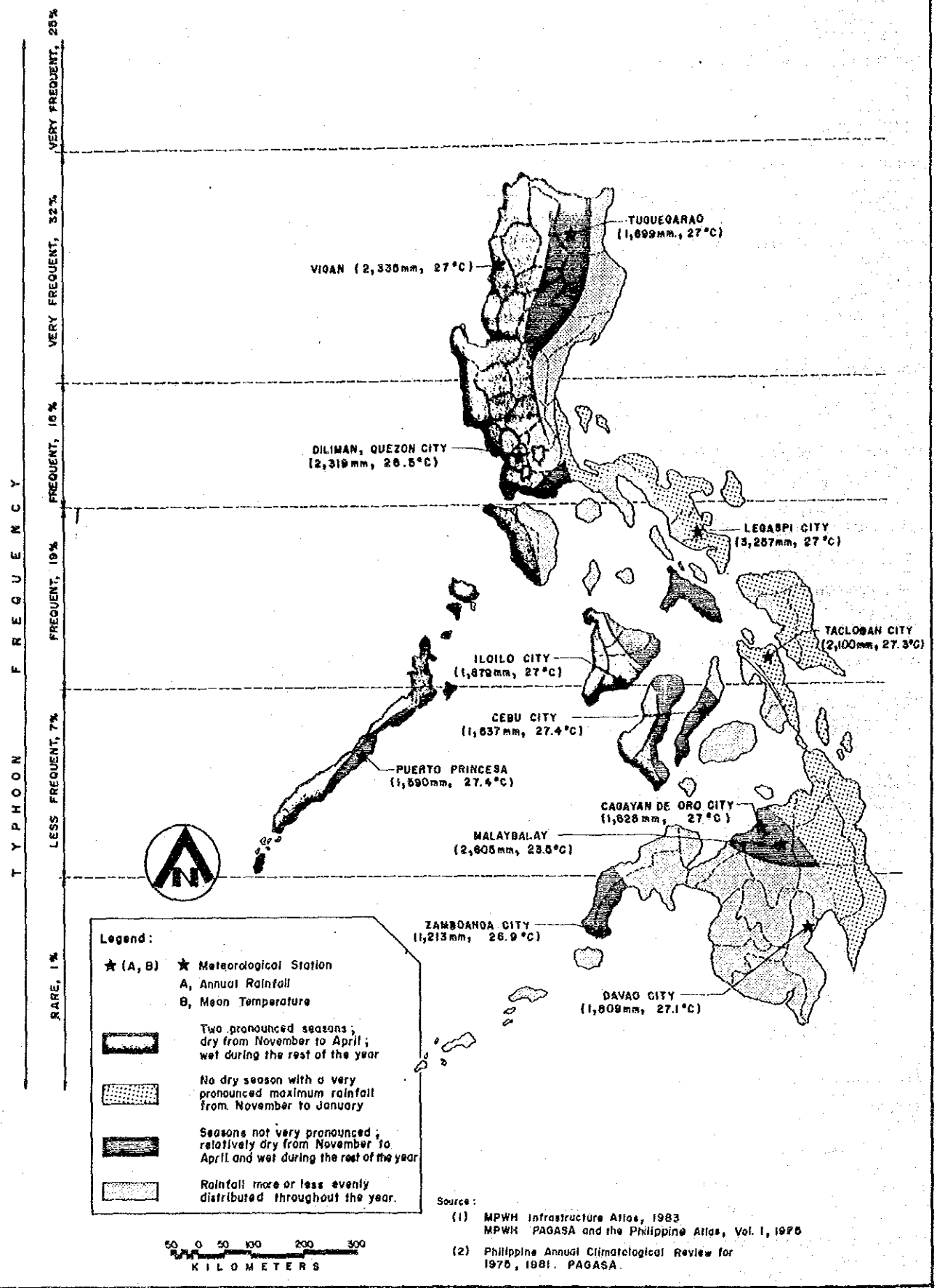

Fig. 2.2 CLIMATE MAP OF THE PHILIPPINES.

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JAPAN INTERNATIONAL COOPERATION AGENCY

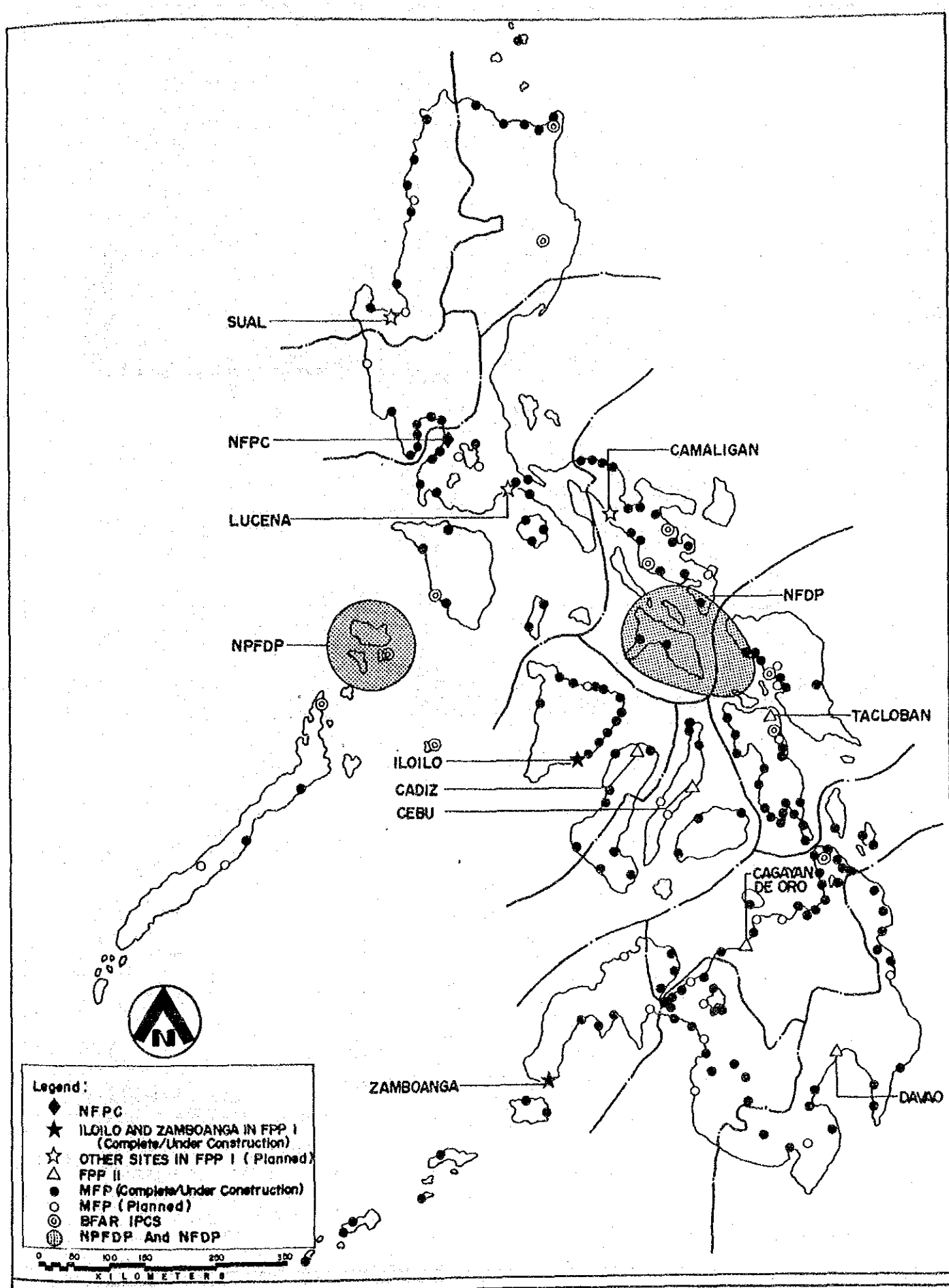

Fig. 2.3 LOCATION MAP OF FISHING PORTS AND IPCS IN THE PHILIPPINES

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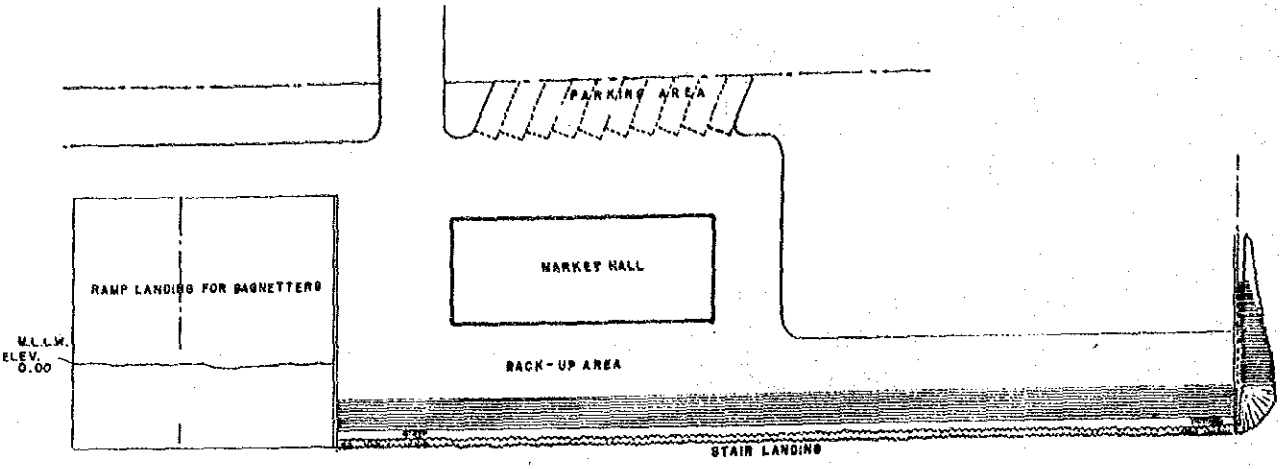
THE STUDY OF MASTER PLAN FOR THE NATIONWIDE ICE PLANTS AND COLD STORAGES NETWORK SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY



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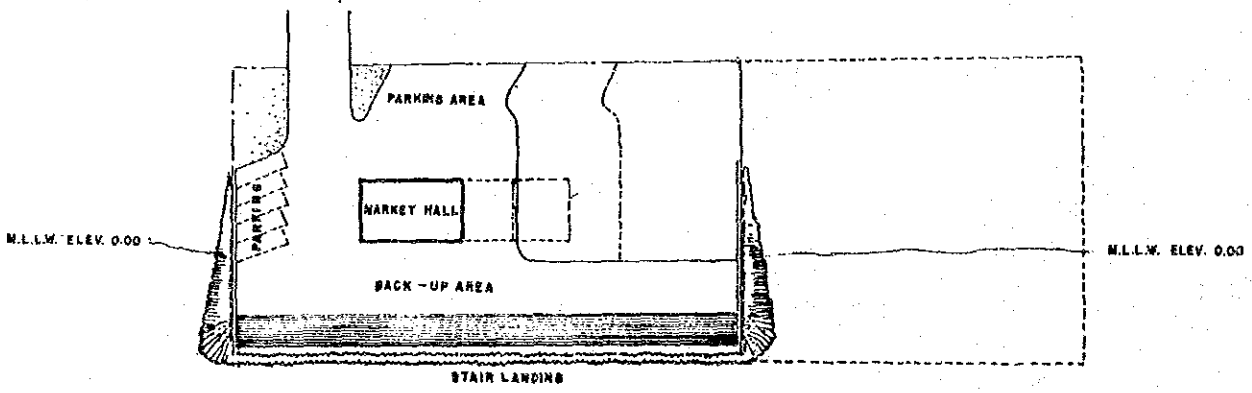

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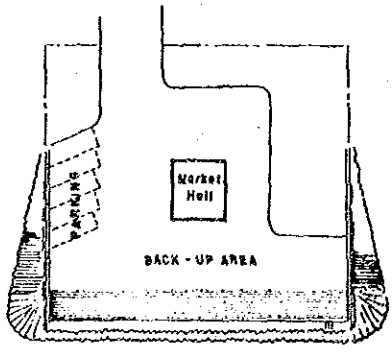

TYPE - C

SOURCE: Data was provided by PFDA in March, 1984.

Fig. 2.4 GENERAL PLAN OF MUNICIPAL FISHING PORT IN THE MFPDP

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THE STUDY OF MASTER PLAN FOR THE NATIONWIDE ICE PLANTS AND COLD STORAGES NETWORK SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY

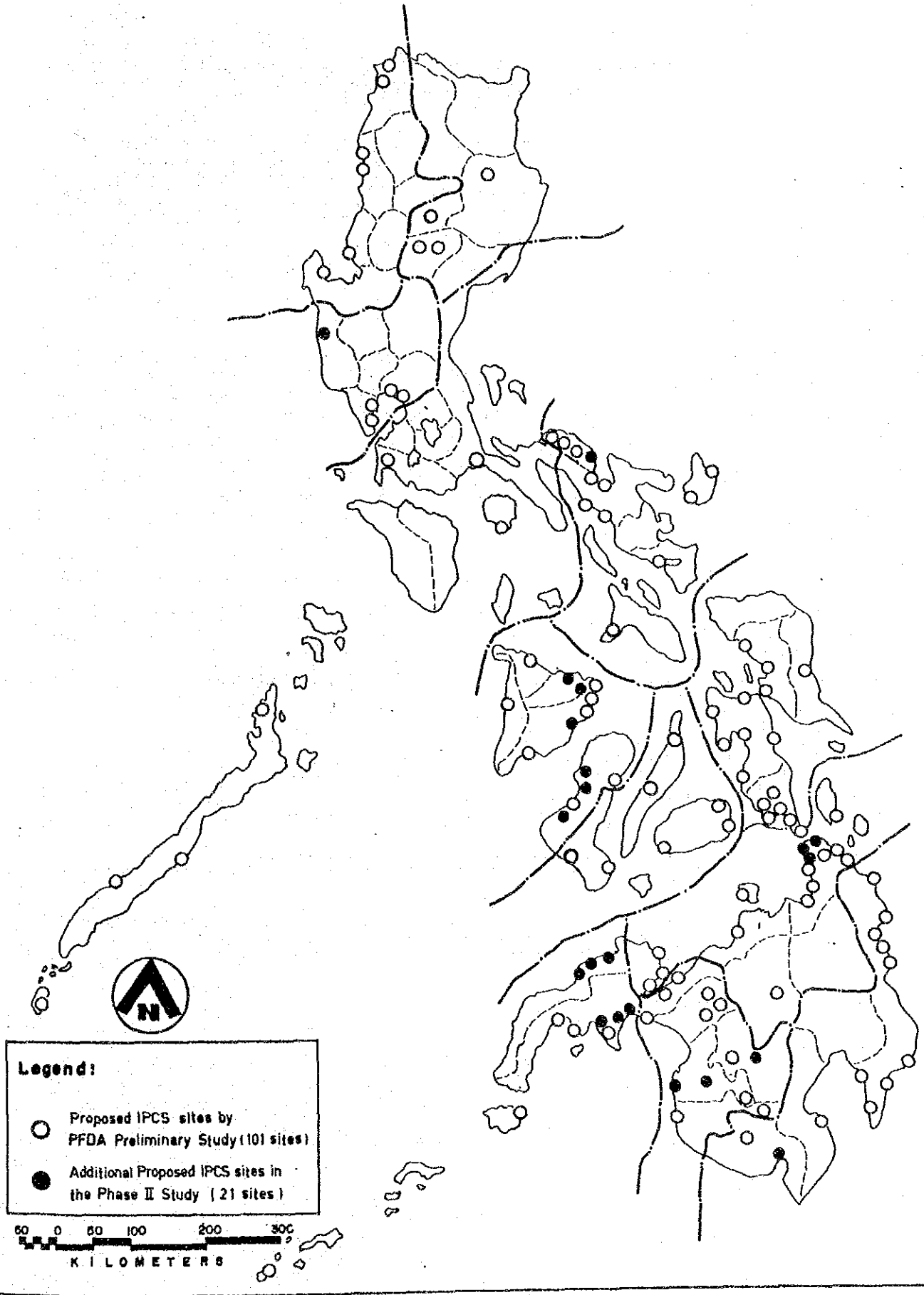


Fig. 2.5 LOCATION OF THE PROPOSED IPCS SITES BY PFDA

REPUBLIC OF THE PHILIPPINES
THE STUDY OF MASTER PLAN FOR THE NATIONWIDE ICE PLANTS AND COLD STORAGES NETWORK SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY

Table 2.1 FISHING PORTS DEVELOPMENT PROGRAMS AND PRESENT ADMINISTRATIVE/INSTITUTIONAL ARRANGEMENT

Type of Fishing Port	No. of Fishing Ports	Identification of Project and planning	Capital development and rehabilitation		Ordinary repair and maintenance		Operation and management
			Budgeting	Execution	Budgeting	Execution	
1. Commercial Fishing Ports							
1.1 National Fishing Port (NFPC)	1	PFDA	MPWH	MPWH	PFDA	PFDA	PFDA
1.2 Regional Fishing Ports							
(1) Fishing Port Package I (FPP I)							
a. Main Fishing Port	5	PFDA	MPWH	MPWH	PFDA	PFDA	PFDA
b. Satellite Fishing Port	5	PFDA	MPWH	MPWH	PFDA	PFDA	PFDA
c. Feeder Fishing Port	4	PFDA	MPWH	MPWH	PFDA	PFDA	PFDA
(2) Fishing Port Package II (FPP II)							
a. Main Fishing Port	5	PFDA	MPWH	MPWH	PFDA	PFDA	PFDA
b. Satellite Fishing Port	5	PFDA	MPWH	MPWH	PFDA	PFDA	PFDA
2. Municipal Fishing Ports /c (MFPDP)	82						
(1) Completed	29	LG/PFDA/MPWH /a	MPWH	MPWH	LG	LG	LG/PFDA /b
(2) Partially completed	19	LG/PFDA/MPWH /a	MPWH	MPWH	LG	LG	LG/PFDA /b
(3) Not yet started	13	LG/PFDA/MPWH /a	MPWH	MPWH	LG	LG	LG/PFDA /b
(4) No information on the progress	21	-	-	-	-	-	-

Remarks: (1) MPWH is responsible for construction of fishing port.

(2) Out of 101 sites proposed by PFDA, 82 sites coincide with MFPDP. Of the remaining 19 sites, 16 are located at other fish landing sites and 3 at consumption centers, i.e. Ifugas, Nueva Viscaya and Malaybalay.

(3) /a: Identification of project is normally initiated by Local Governments and planning and prioritization is done by the PFDA in coordination with the MPWH and the PPA.

/b: Municipal fishing ports are in fact managed by the Local Government even though under the PFDA charter all fishing ports are supposed to be managed by the PFDA.

/c: Numbers of municipal fishing ports given in this table refer to those of IPCS proposed by PFDA. Besides the fishing ports, however, there are 16 other landing centers and 3 fish consumption centers, for which PFDA has a plan to provide IPCS. Beside 82 municipal fishing ports (MFP), MPWH and PFDA still have a plan to provide some more MFP, the sites of which are not yet decided.

Source: Record of Discussion on NTPDP of ADB, 1983.

Table 2.2 CONSTRUCTION SCHEDULE AND CAPACITY OF ICE PLANTS AND COLD STORAGES FOR COMMERCIAL FISHING PORTS

	Name of Fishing Port	Construction Schedule	Rated capacity of the plants					
			Ice Making Plant (t/day)	Ice Storage (t)	Cold Storage (t/day) -5°	Cold Storage (t/day) -25° to -35°	Contact Freezer (t/cycle)	Blast Freezer (t/day)
I.	NFPC	completed in 1983	250	1200	1344	588	-	15.0
II.	Package I							
	(1) Iloilo	completed in 1984	50	200	100	500	3.84	5.0
	(2) Zamboanga	completed in 1985	60	150	70	750	3,86	-
	(3) Lucena	1984-86	25	75	50	50	0.8	-
	(4) Camaligan	1984-86	15	30	20	30	1.0	-
	Satellite/Feeder Port							
	a. Mercedes	1984-86	-	5	5	-	-	-
	b. Calabanga	1984-86	-	2	2	-	-	-
	c. Tinambac	1984-86	-	2	2	-	-	-
	d. Pasacao	1984-86	-	5	5	-	-	-
	e. Cabusao	1984-86	-	5	5	-	-	-
	(5) Sual	1984-86	15	60	25	100	1.92	-
	Feeder Port							
	a. Bolinao	1984-86	-	5	5	-	-	-
	b. Damortis	1984-86	-	-	-	-	-	-
	c. San Fabian	1984-86	-	2	2	-	-	-
	d. Dagupan	1984-86	-	2	2	-	-	-
III.	Package II							
	(1) Cebu	1985-88	20	40	20	150	10.0	-
	Satellite Port							
	a. Cogtong	1985-88	15	30	80		0	0
	b. Loay	1985-88	10	20	50		-	-
	c. Bayawan	1985-88	10	20	10		-	-
	d. Larena	1985-88	5	10	10		-	-
	(2) Davao	1985-88	50	150	50	500	20.0	-
	(3) Cadiz	1985-88	20	40	50	150	1.0	-
	(4) Tacloban	1985-88	20	40	30	350	1.0	-
	(5) Cagayan de Oro	1985-88	20	40	30	150	-	-
	Satellite Port							
	a. Surigao	1985-88	20	40	150		-	-

Remarks : (1) NFPC: Navotas Fishing Port Complex
(2) Construction schedule provided by PMO-FPPI, MPWH, March 1984

Source : (1) Bicol Fishing Port Network, update study, August 1983, PMO-FPPI, MPWH.
(2) Pangasinan Fishing Port Network, update studies, August 1983, PMO-FPPI, MPWH.
(3) Capacity of the Fishing Port Complex Facilities of Package II, MPWH.
(4) Comparison of Refrigeration Facilities (Iloilo, Sual, Lucena, Camaligan and Zamboanga), 1982 and 1983, MPWH.

Table 2.3 DEMAND CHARGE AND ENERGY CHARGE FOR INDUSTRIES AS OF JUNE, 1984

Region	IPCS Sites Proposed by PFDA	Demand Charge (₱ / Kw)	Energy Charge (₱ / Kwh)
I	Pagudpud	17.60	1.081
	Pasuquin	17.60	1.081
	Magsingal	25.00	1.010
	Narvacan	25.00	1.010
	Damortis	17.60	1.030
	Alaminos	22.50	1.100
II	Bayombong	15.00	1.021
	Nueva Viscaya	15.00	1.021
	Ifugao	15.00	1.360
	Ilagan	15.00	1.200
III	Hagonoy	20.00	1.010
	Obando	-	-
	Abucay	20.00	0.980
	Samal	20.00	0.980
VI	Narra	20.00	3.660
	Balabac	-	-
	Quezon	-	-
	El Nido	-	-
	Unisan	21.05	0.940
	Buenavista	-	-
	Balayan	20.00	0.820
V	Pasacao	20.00	1.080
	Calabanga	20.00	0.930
	Cabusao	20.00	1.080
	Balatan	18.68	1.160
	J. Panganiban	18.00	1.030
	Sta. Elena	18.00	1.030
	Capalonga	18.00	1.030
	Gigmoto	12.00	3.360
	Virac	12.00	3.360
	Pilar	17.00	1.170
	Balud	-	-
VI	Estancia	10.00	1.530
	Concepcion	10.00	1.530
	San Dionisio	10.00	1.530
	Tigbauan	25.00	1.180
	Himamaylan	15.00	1.458
	San Carlos	15.00	1.370
	New Washington	20.00	1.660
	Tibiao	14.00	1.670
VII	Tagbilaran City	15.00	1.000
	Ubay	13.20	1.240
	Cogtong	13.20	1.240
	Bogo	22.00	1.270
	Toledo City	20.00	1.090
	Dumaguete City	13.20	0.800
VIII	Maasin	15.00	1.360
	Sogod	15.00	1.360
	San Francisco	15.00	1.360
	St. Bernard	15.00	1.360
	Liloan	15.00	1.360
	Padre Burgos	15.00	1.360
	Inopacan	16.00	1.800
VIII	Isabel	15.00	1.170
	Carigara	15.00	1.320
	San Isidro	15.00	1.170
	Dulag	15.00	1.160
	Albuera	15.00	1.170
	Borongan	15.00	2.600
	Tarangnan	15.00	1.830
	Villareal	15.00	2.500
	Wright	15.00	2.500
IX	Naga	15.00	0.550
	Margosatubig	15.00	0.610
	Payao	15.00	0.530
	Tuburan	-	-
	Sibutu	-	3.000
X	Bacuag	11.00	0.480
	Placer	11.00	0.480
	Claver	11.00	0.480
	Dapa	11.00	0.470
	Buenavista	19.80	0.570
	Cabadbaran	19.80	0.570
	Jabonga	19.80	0.570
	Ozamis City	15.00	0.420
	Oroquieta City	12.00	0.680
	Tangub City	15.00	0.420
	Salay	24.00	0.580
	Catarman	15.00	2.310
	Malaybalay	19.00	0.470
XI	Bislig	15.00	0.750
	Cagwait	-	-
	Barobo	15.00	0.750
	Hinatuan	15.00	0.750
	Cantilan	-	-
	Mati	15.00	0.600
	Lupon	15.00	0.600
	Gov. Generoso	15.00	0.600
	Caraga	15.00	0.600
	Malita	10.00	0.550
	Surallah	10.00	0.830
XII	Karomatan	18.00	0.590
	Kolambugan	18.00	0.590
	Tubod	18.00	0.590
	Marawi City	19.80	0.470
	Poona-Bayabao	19.80	0.470
	Ganasi	19.80	0.470
	Lutayan	12.00	1.280
	Lebak	12.00	1.280
	Buluan	12.00	1.280
	Midsayap	19.80	1.190

Remarks: (1) Demand charge is basic charge per capacity (Kw) of motor installed.

(2) Energy charge is consumption charge per Kwh excluding foreign exhange rate (FXA), fuel cost rate (FCR) and steam cost rate (SCA).

Source: (1) Rates schedule in use as of June 30, 1984 provided by the NEA.

(2) List of Coop. Energized Municipalities as of December 31, 1983, NEA.

(3) Status of Energization, June 30, 1984, NEA.

3. REVIEW OF THE PRELIMINARY STUDY OF IPCS MADE BY PFDA

3. REVIEW OF THE PRELIMINARY STUDY OF IPCS MADE BY PFDA

The review of the preliminary study of IPCS made by PFDA was carried out to clarify the reliability and availability of the basic data on fish unloadings and technical background, and to identify the required plant capacity in each proposed site.

(1) Fish production aspect

The NCSO Census data and BFAR Statistics are the unique and comparable data available for the study in a national scale, even though these data are not sufficient for the study on individual or local level projects. Fish landing data provided in the preliminary study were reviewed and checked for their reliability by comparing them with the data and statistics mentioned above by sub-sectors of fisheries, i.e., commercial/municipal fisheries and aquaculture.

Among the 101 proposed sites, no data on fish landings are available in the preliminary study for 22 sites or 20% of the total proposed sites; data are available on the other 79 sites. The following criteria were adopted to review the data based upon the NCSO Census and BFAR Statistics:

a. Labor productivity: Fish production per fisherman

b. Fish productivity per fishing craft

Among the 79 sites for which fish landing data were made available in the preliminary study, it seems that fish landing statistics in 44 sites are reliable, while those in 25 sites appear to be overestimated and those in 10 sites underestimated.

(2) Marketing aspect

The capacity of ice plants proposed by PFDA was reviewed based on the present demand for ice preliminarily estimated during the Phase I Study.

It seems that in 15 sites the ice requirement is more than the capacity of a ten ton ice plant which is bigger than any capacity proposed by PFDA and that in other sites some plants will not be viable because of the low demand for ice.

(3) Technical aspect

a. Land

There are a number of proposed sites where the land is yet to be reclaimed. Present use and ownership of the proposed sites are as follows:

(i) Land use: MFP, poblacion (town center), public market, farm land outside town proper, fish pond, etc.

(ii) Land ownership: Public or private ownership.

b. Electricity

Data on power supply was hardly available in the MFPDP files 1980 -1983, PFDA. It was found that such data had to be collected through electric cooperatives, or directly by interviews with each coopeative.

c. Water

It was found that the availability of water, both in quantity and quality, was the greatest limiting factor for the effective operation of the ice plants, especialy in the summer season. Shortage of water would cause critical conditions in summer, because of the greatly increased demand for ice both in fisheries and other sectors.

Major sources of water supply for ice are as follows:

(i) Municipal water supply system
(ii) Deep wells
(iii) Shallow wells
(iv) Spring water
(v) Surface water such as river water

It was also learned through interviews with operators of private ice plants that successfully operated plants depend on deep wells or spring water as their major source of water. Since these plants are mostly located in inland areas, they have less water quality problems compared with those located in coastal areas. It was found that potential sources of water supply to meet the required quantity and quality for the ice plants and cold storages should be identified

based on site inspection in Phase II Study and further investigations before construction.

b. Accessibility

Road conditions were found to be major constraints in many sites with regard to the accessibility from the proposed sites to MFP and to the trunk road.

The constraints are as follows:

(i) Suffering from high tide or heavy rainfall
(ii) Poor road surface conditions
(iii) Narrow road width

4. ASSESSMENT OF THE EXISTING ICE PLANTS AND COLD STORAGES

4. ASSESSMENT OF THE EXISTING ICE PLANTS AND COLD STORAGES

4.1 General Conditions

In the Philippines, there were ice plants and cold storages having the total capacity of 15,171 tons/day and 136,186 tons, respectively as of 1983 as shown in Table 4.1. Out of the total capacity of the cold storages, 75,647 tons were capable of only chilling food at +5 to -5°C, and the remaining 60,539 tons were for frozen foods at the temperatures below -15°C.

Capacity of ice plants owned by the private sector was 14,576 tons/day or about 96% of the total capacity in the Philippines, while that of the public sector amounted to only 595 tons/day or 4% of the total capacity. The private sector also had 74,003 tons of cold storages for chilling of foods and 58,671 tons for frozen foods which correspond to about 98% and 97% respectively of the total capacity of the country. The public sector owned only 1,644 tons of cold storage capacity of chilled foods and 1,868 tons for frozen foods.

A regional gap was seen on the investment of ice plants and cold storages. Majority of them were located in NCR having 5,733 tons of ice plant, 61,107 tons of cold storage for chilling and 57,953 tons for frozen foods. NCR accounted for about 38% of the total ice plant capacity, about 81% of total cold storage for chilling and about 96% of the total cold storage capacity for frozen foods. Cold storages are highly concentrated in NCR.

Capacity of ice plants and cold storages in relation to fish landings in 1983 is shown by Region in Table 4.2. National average ratio was 1.41 times in case of ice plant, on the assumption of 300 operational days per year and 50% operational ratio. Ice plant capacity is extremely large in NCR, Regions I and II compared with other Regions, showing the ratios of 4.85 times in NCR, 4.08 times in Region I and 8.85 times in Region II. This is because, in these Regions, major customers of ice are general households and other sectors rather than fisheries sector, while ice is consumed mainly by the fisheries sector in the other Regions.

Capacity of the cold storage facilities in NCR corresponds to about 34% of the annual fish landings with respect to chilling and 33% with respect to storing frozen foods. And capacity for chilling was about 10% in Regions I, II and III, while that in the other Regions showed only less than 0.5%. For storing frozen foods, Region XI, where a large amount of tuna were landed for export, owned

cold storage capacity corresponding to 1% of fish production of this Region. In other Regions except NCR and Region XI, cold storage facilities for frozen foods showed the extremely low capacity amounting to less than 1% of fish production.

Needs for public IPCS are extremely great for fisheries sector outside NCR. Major role of the public sector is to meet demands in those areas, where little incentive exists for private sector investment in ice plant and cold storage facilities.

4.2 Public Sector

There are ice plants and cold storages in the public sector such as the plants under NFPC, FPP I/II, NPFDP and NFDP, and the plants turned over by BFAR to PFDA. Among these plants only those from BFAR were partly operational in 1983, and other plant were mostly under planning, construction or test run stage.

The ice plants and cold storages turned over by BFAR (BFAR IPCS) are located as shown in Fig. 4.1. They have been constructed in 35 sites,i.e., 12 sites under the fund arrangements by Danish Loan, 16 sites by Emergency Employment Administration (EEA), 6 sites by Japanese Reparations and 1 site under BFAR Special Projects, as shown in Tables 4.3 and 4.4.

10 plants were operational, accounting for about 40% of the 26 completed plants, while the other 16 plants under rehabilitation or out of operation as of December 1983. The remaining 9 plants were either under construction, test run, or ready for commencing construction. Operational conditions and PFDA's recommendations on future operation are shown in Table 4.3.

PFDA recommended the mode of operation managed by PFDA directly or indirectly as shown in Table 4.3 and Fig. 4.2. According to the recommendation as of 1983, PFDA would operate as a sole management agency, 7 sites including 5 sites which were operational and 2 sites which were under construction. One (1) site would be managed jointly by PFDA and NPFDP, while 1 site would be operated by CIDAP, 2 sites would be leased to municipal governments and private firms. Regarding the plants at the other sites no recommendations were made for their management except for 9 sites for which closure was recommended.

Ice type is exclusively flake ice in all of the 12 sites realized by Danish Loan, tube ice at 6 sites by Japanese Reparation, while there are 6 sites of block ice, 9 sites of flake ice and 2 sites of tube ice regarding plants, by EEA and BFAR

Special Projects. BFAR ice plants were designed mainly to produce flake ice in 21 sites in total, accounting for 60% of all plants as shown in Table 4.4.

Most of the BFAR ice plants are of rated capacity of less than 10 tons/day, only 5 plants having a capacity of 40 tons/day. Rated capacity of cold storages are 20 tons in 12 sites and 50 tons in 11 sites. There are three big cold storages of 350 tons each, which may prove too big in relation to the demand.

There are 12 sites having blast or contact freezers, the rated capacity being mostly 5 tons/day except for 3 sites having a 10 tons/day capacity.

Major problems of BFAR IPCS are summarized as follows:

(1) Technical aspect

a. Lack of spare parts

Owing to the delay in construction even after the arrival of machinery and equipment from the donating countries, some spare parts were lost and some machinery deteriorated and found unusable. Moreover, shortage of spare parts is chronical because of import difficulties and the lack of knowledge and information on local supply availabilities.

b. Short physical life of machinery

The physical life of plants was reduced due to faulty storing and management of the machinery. However, the machines can in no way be replaced by new ones, because of lack of budget allocated for this purpose.

c. Model change of machinery

The compressors of the ice plant were mainly of the vertical-open type (VOT) in the earlier stage of the construction of BFAR plants, while the compressors granted in recent years were of a new type, namely the multi-cylinder type (MCT) or screw-compressor type (SCT). In compressor-producing countries, the machines have changed from VOT to MCT and SCT. Difficulties in operation and maintenance of VOT may occur due to such a model change of the machines. The type of compressor is shown in Table 4.3 by sites.

d. Low mechanical efficiency

Mechanical efficiency is extremely low, compared with the rated capacity as shown in Table 4.3.

e. Inadequate control of documents

Operation manuals and lists of spare parts were missing in BFAR, due to the lack of systematic management and filing system of documents.

f. Inadequate budget for staff training

Practical training was not implemented regularly due to lack of budget. Consequently, operation and maintenance of plants may be hampered due to the inadequate training of staff of new models.

g. Water and energy

Water Supply

Major sources of water are the existing waterworks system and deep wells as shown in Table 4.5. Problems regarding water supply are summarized as follows:

(i) Frequent failures of water supply

(ii) Low water pressure

(iii) Regular water suspension

(iv) Salty water

(v) Inadequate additional budget for the water supply system

(vi) Absence of funds in the initial budget for the construction of deep wells

Electricity

Except for 6 sites which are supplied electric power by electric cooperatives and also equipped with generators, the plants will face power supply failures whenever electric supply systems or generators are out of order. Electricity conditions of BFAR IPCS are tabulated in Table 4.5 by site.

Other major energy problems include the frequent brownout and the inadequate supply of fuel oil for diesel engines.

h. Land acqusition

Only a few sites are located near fish landing sites or fish consumption centers as shown in Table 4.6. This is because of the fact that BFAR was responsible for selecting high priority fish collection centers for IPCS but, as far as the land acquisition for IPCS sites were concerned, was dependent on donation due to shortage of funds available to BFAR.

(2) Marketing aspect

a. Oversupply of ice

b. Type of ice consumed

BFAR's ice plants include 21 plants which produce flake ice, accounting for 60% of all the plants. However, fishermen are less familiar with flake ice compared with block ice. It will take time before flake ice is used in place of block ice.

c. Low demand for cold storage

Most of the cold storage components were not operated due to the incomplete/improper installation of wirings, pipings and insulations. Furthermore even in the case of operational storage facilities, problems such as high operating cost and low demand still remain.

(3) Financial aspect

a. Break-even analysis

The results of the break-even analysis are summarized in Table 4.7 and Fig. 4.3 as follows:

(i) The larger the opeational capacity and ratio, the greater the profit.

(ii) The plants with operating capacity of less than 2 tons/day are not viable.

(iii) The plants of extremely low operational ratio are not viable, even though they have a rated capacity of more than 10 tons.

b. Energy cost

The energy cost of BFAR plants is estimated to be 153 pesos/ton in average in case that the mechanically efficient capacity of the ice plant is realized as the operational capacity of the plant. This corresponds to 77% of the total cost and therefore strongly affects the plants' viability. Cost components are shown in Table 4.8.

(4) Management aspect

BFAR IPCS are not well related to MFP since these two projects were programmed independently. Consequently, BFAR plants still have the possibility to meet problems in operation and management, particularly in relation to appropriate use of MFP.

(5) Institutional aspect

BFAR was given the responsibility of construction, administration and management of these IPCS. However, over the years, most of BFAR IPCS have fared very poorly in terms of financial performance. BFAR, as a bureau wholly supported by the Government, often suffered delays in the release of funds.

More flexible procedures should be established for timely appropriation from its own revenue without significant delay. In order to overcome this problem, MNR decided in December 1982 to transfer the IPCS project to PFDA, with the rationale that PFDA, as a government corporation, would have more flexibility and freedom in handling financial matters.

4.3 Private Sector

The Team conducted a survey by means of interviews with operators of the existing private ice plants and cold storages and also held several meetings with the APICSO members, in order to clarify the existing conditions of the private sector.

APICSO which is the association of major plant operators dominates in Luzon, while, in the other areas, smaller firms operate successfully either

independently or with some connection with APICSO to meet the local specific conditions.

The private ice plants and cold storages were managed comparatively well, but recently they have suffered from inflation causing high cost for construction and repairs, as well as from the high energy cost. The private sector has much better experience in operation and maintenance of the plants than the public sector. However, they suffer from shortage of funds because of high interest rates and other severe loan conditions. Unless the government could take measures to ease the situation, there will be an increased amount of spoiled fish owing to the lack of IPCS facilities.

Most of the compressors used in the private sector are of the old type such as VOT, especially outside of Luzon Island where IPCS of larger scale have compressors of the MCT type. Hence there will be a need to install MCT model compressors in the areas except for Luzon in the near future. However, the private sector will face the difficulty in obtaining funds to replace compressors or to expand plants as commercial banks charge a high loan interest amounting to some 30% per year. The situation discourages the private sector from investing.

(1) Technical aspect

a. Availability of spare parts

In the case of VOT compressors, majority of the private firms have access to spare parts or manufacture the parts in their own factories. They are also capable of obtaining spare parts without delay, even in the case of compressors of the new type such as MCT.

b. Popular type of compressors

The most popular compressors are still of the VOT type while newly established plants are equipped with MCT as shown in Table 4.9. Many second hand MCT type compressors are used and well maintained even without an automatic device.

c. Operation and maintenance

Only a few plants employ full-time mechanical engineers or licensed mechanics, and use the services of unqualified but experienced persons to save on labor cost.

d. Water availability

Major source of water is the deep well in the private plants as shown in Table 4.10. Some plants depend on the waterworks system, shallow wells and springs. Water is short for plants located in Iloilo City, while the quality problem of hard water is noticed in Bohol and Negross Oriental.

e. Power supply

All plants investigated in Phase II Study are supplied by electric cooperatives as shown in Table 4.10 and some plants have reserve generators. About half of these plants suffer frequently from voltage fluctuation and/or brownout.

(2) Marketing aspect

a. Marketing area

The private ice plant opeators for the sake of the economy of scale, cover a wide marketing area and have established a dominant position. In some areas, the ice price is kept so high that it is even beyond the purchasing ability of municipal fishermen.

b. Type of ice

Predominantly, block ice is produced to meet the preference of the consumers.

(3) Financial aspect

a. Break-even price

The break-even price is extremely higher than the market price in case of a 1 ton plant. One (1) ton ice plants are not viable from the financial point of view. Any plants of more than 10 tons/day seem not viable under the conditions of a 50% operational ratio. The break-even price estimated is 86.3 pesos/block ice (135 kg) in case of the 1 ton plant which is much higher than the averge market price of 47.2 pesos/block ice found in the field survey in Phase I, while that of 10 ton ice plants is 40.4 pesos/block ice which is lower than the market price. As shown in Fig. 4.3, the bigger the plant operating capacity, the lower is the proportion of the production cost to the sales price of ice.

b. Energy charge

The energy cost of the total production cost is extremely high amounting to as much as about 70%. The energy charge differs by sources of energy. The lowest charge is found in Negros Island where energy is supplied by a geothermal power plant and in Mindanao Island which benefits from the Maria Cristina hydropower plant. Alternative economical sources of energy is expected to be developed for the other islands.

(4) Management aspect

Various types of management system are seen in the private sector as follows:

a. Sole management by a local firm

Most of the small scale private plants are managed by local owners. They have their own customers based on historical and social relationships.

b. Management by a manager locally employed by investors/owners residing in Metro Manila or other cities.

Plant management is under the direct responsibility of the manager employed. In this case, mis-management is likely to occur due to poor communication between the plant manager and the owner.

c. IPCS complex operated in a big scale

In San Fernando of Pampanga Province, there is the biggest plant except for Metro Manila. The operational ratio of the plant is comparatively high and the operating cost is extremely low benefitting from the economy of scale and effective plant system.

This private plant has been established as an integrated complex of ice plant and cold storage system as follows:

(i) Modern compressors, MCT, have been installed with an automatic capacity unloader system and evaporative condensor.

(ii) There is a large ice storage room with a capacity of 2,100 tons. it can meet the demand even during power failures and also meet the maximum demand in the peak season.

(iii) There are 4 deep wells of which 2 are reserved ones in case of emergency. Since the management operates also a machine shop, there are no difficulties in repairs.

(iv) This plant caters to ice demand for wide areas. It supplies ice to provinces of Pampanga, Bulacan and Nueva Ecija with its own ice distribution system with 5 insulated trucks. The management has established an oligopolistic position in the market.

(v) A branch ice plant, which functions as a sub-center, is located in Orion, but it will soon be closed because of low demand and stiff competition with other ice plants.

d. Fishery industrial complex

In General Santos City, a tuna unloading center located in South Cotabato Province, there are big scale ice plants and cold storages mainly for tuna and skipjack. Their operational ratio is extremely high, almost 100%, becuase ice is exclusively supplied to member fishermen of the association organized and controlled by the plant owners. They have introduced a credit system in which ice and fuel are supplied in advance to fishermen and recover the cost from the proceeds of fish.

These plants are operated exclusively by rich families. The families own not only ice plants and cold storages but also fishing vessels, private wharves, workshops and canning factories as fully organized fishery industrial complexes.

e. Management by multi-purpose corporation

In Jose Panganiban of Camarines Norte Province, there is a 40 ton ice plant.

The plant has been built as a part of an industrial complex which includes also the following:

(i) a smelter plant
(ii) a machine factory
(iii) a power plant using waste gas as power source, which makes it

unnecessary for the ice plant to rely on the Camarines Norte Electric Cooperative.

The Jose Panganiban ice plant covers a wide marketing area. In fact, it supplies ice to the area all over Camarines Norte including Mercedes, because this plant is in an advantageous position compared with other private plants both in production cost and sales price of ice. Even including charges on transport and delivery, the ice price is still lower than that from other plants in Mercedes.

f. Association among plant operators

In Metro Manila, there is the biggest association of plant operators called APICSO. Also in Iloilo city, plant operators have organized an association to prevent excessive competition among them.

There were actually eleven (11) ice plants in Iloilo in 1980, but seven (7) plants remain now under the Metro Iloilo Ice Plant Operators Association (MIIPOA).

The members have concluded an agreement on the price of ice to prevent an excessive competition among themselves. And the plants are operated well financially.

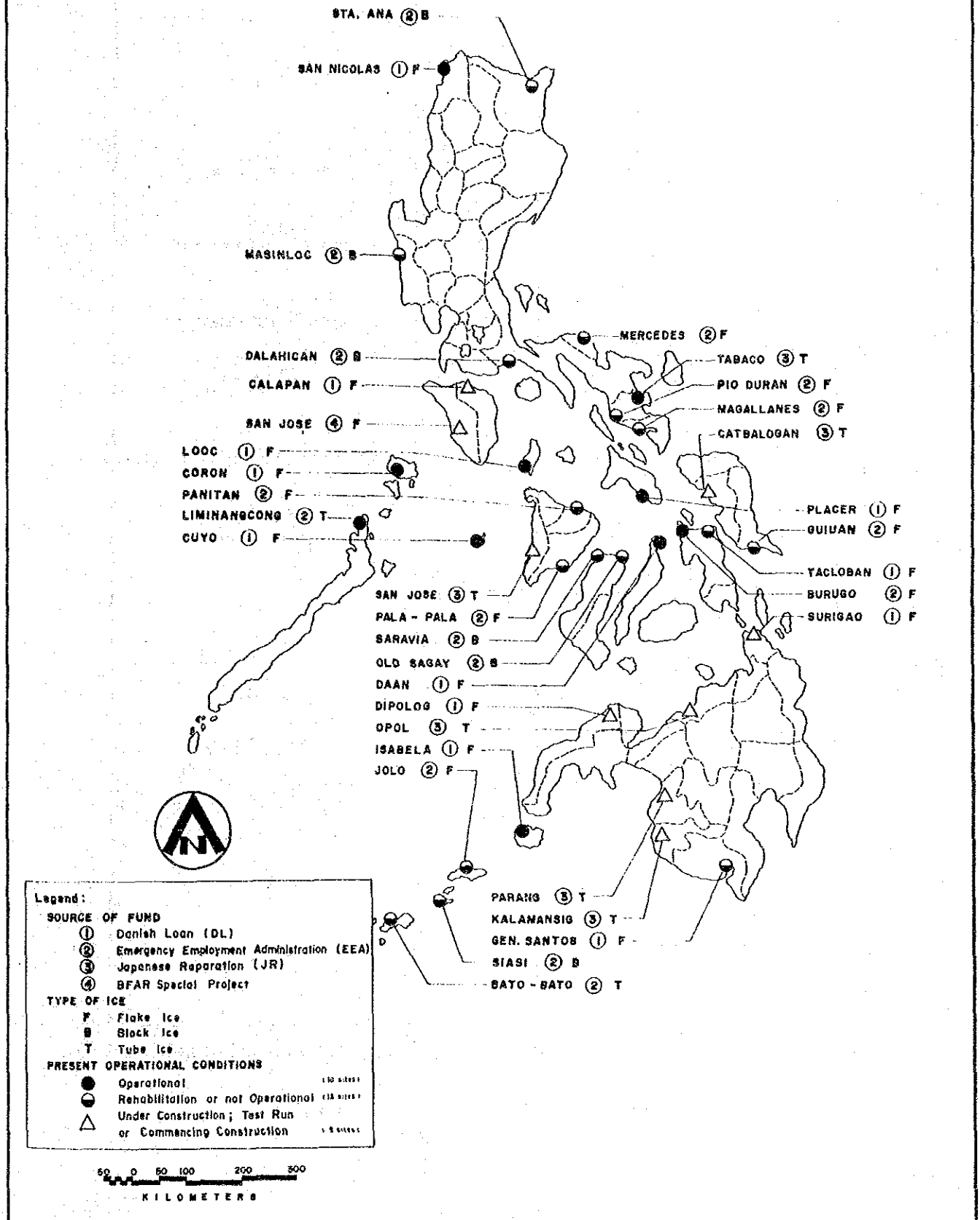


Fig. 4.1 LOCATION AND EXISTING CONDITIONS OF BFAR IPCS AS OF DECEMBER 1983

REPUBLIC OF THE PHILIPPINES
THE STUDY OF MASTER PLAN FOR THE NATIONWIDE ICE PLANTS AND COLD STORAGES NETWORK SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY

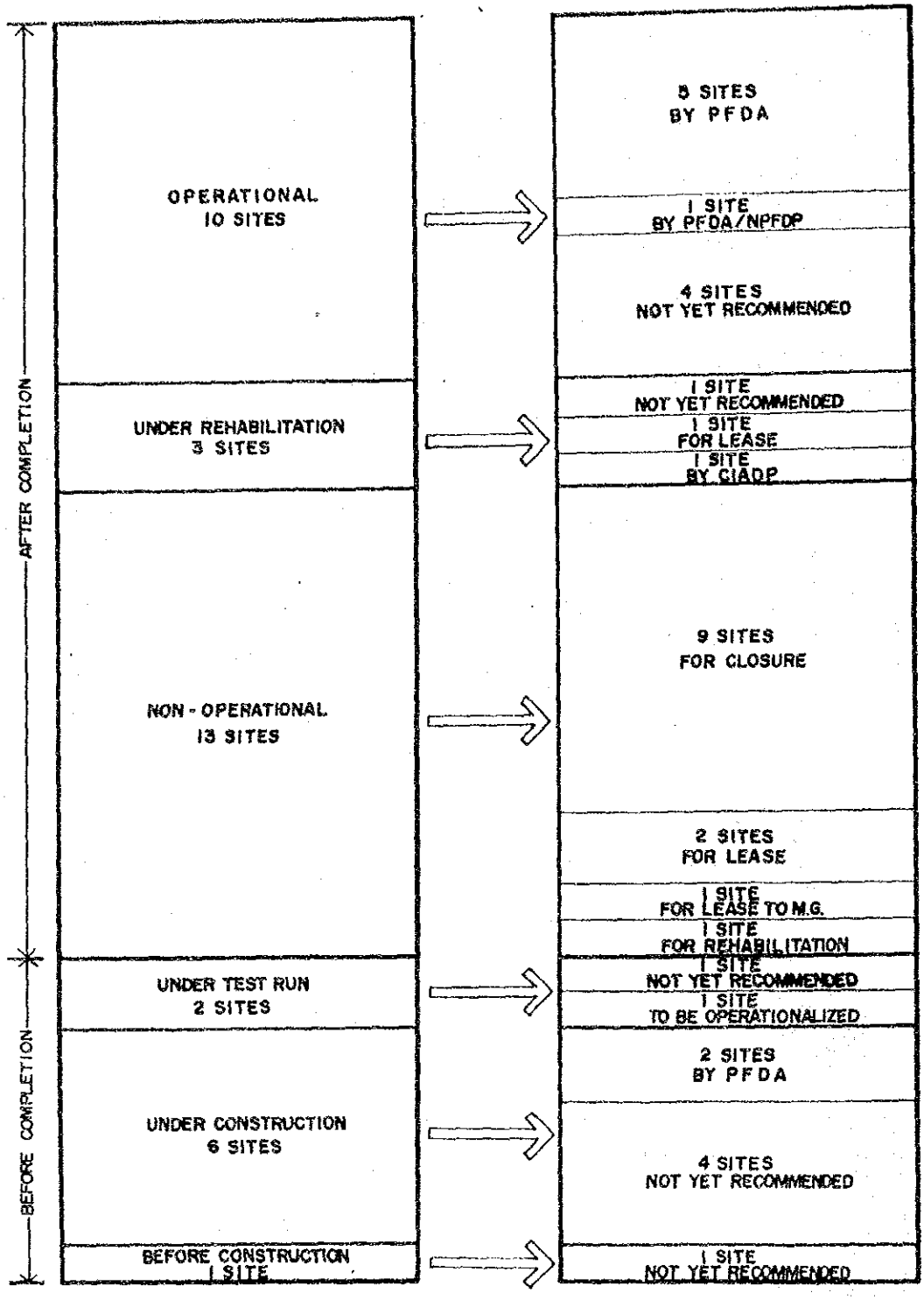
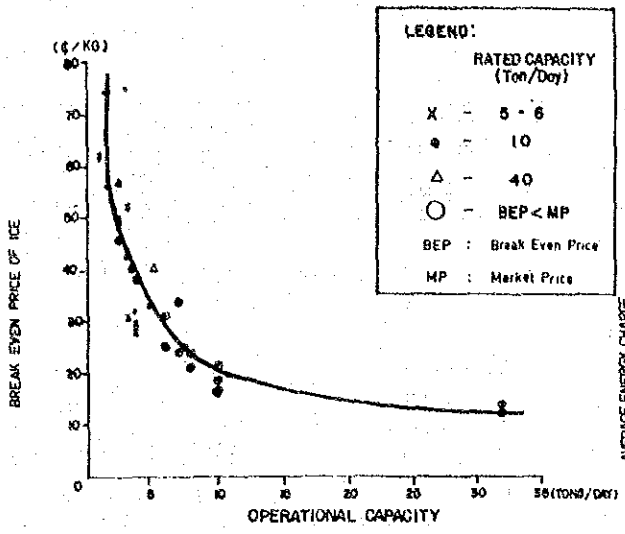
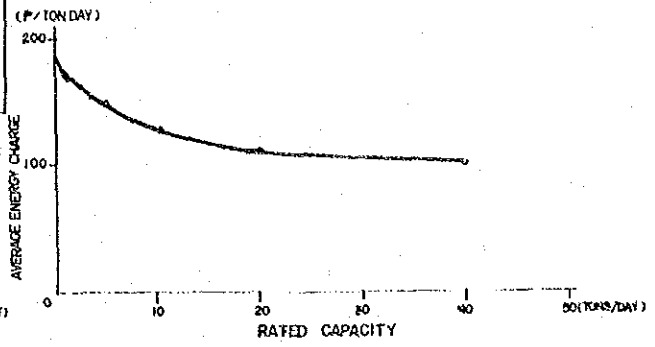


Fig. 4.2 EXISTING AND FUTURE OPERATIONAL PROSPECTS OF BFAR IPCS RECOMMENDED BY PFDA IN 1983

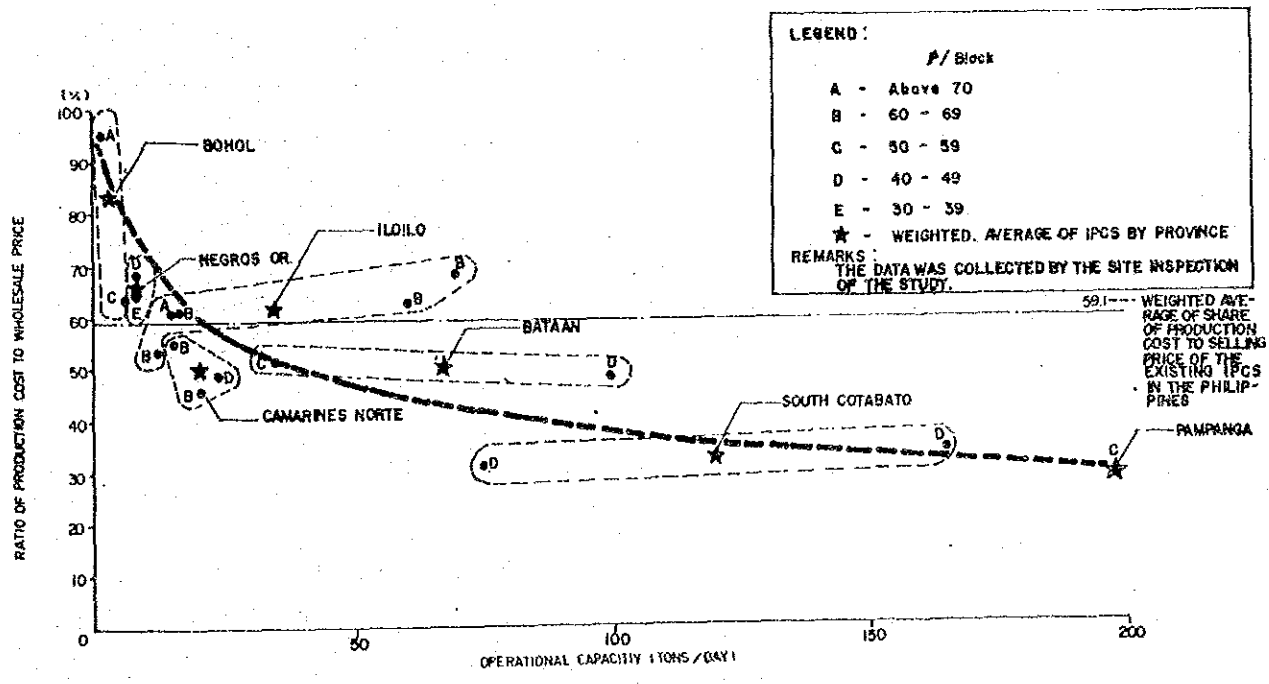
REPUBLIC OF THE PHILIPPINES
THE STUDY OF MASTER PLAN FOR THE NATIONWIDE ICE PLANTS AND COLD STORAGES NETWORK SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY



BREAK-EVEN PRICE AND OPERATION CAPACITY OF BFAR ICE PLANTS



CHANGE OF AVERAGE ENERGY CHARGE BY RATED CAPACITY OF ICE PLANTS (BLOCK ICE)



RATIO OF PRODUCTION COST TO WHOLESALE PRICE AND OPERATING CAPACITY OF PRIVATE IPCS AS OF 1984

Fig. 4.3 FINANCIAL CONDITIONS OF EXISTING IPCS

REPUBLIC OF THE PHILIPPINES
THE STUDY OF MASTER PLAN FOR THE NATIONWIDE ICE PLANTS AND COLD STORAGES NETWORK SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY

Table 4.1 RATED CAPACITY OF THE EXISTING COMPLETED ICE PLANTS AND COLD STORAGES

Region	Fish Production (10^3 t)	Ice Plant (t/day)			Cold Storage (t)						
					For chilling			For freezing			
		Private Sector	Public Sector	Total	Private Sector	Public Sector	Sub-Total	Private Sector	Public Sector	Sub-Total	Total
N C R	177.4	5,503	250	5,733	59,763	1,344	61,107	53,365	588	57,953	119,060
I	29.8	806	5	811	2,578	20	2,598	-	0	-	2,598
II	5.1	296	5	301	508	-	508	-	30	30	538
III	92.1	1,927	5	1,932	9,737	50	9,787	-	0	-	9,787
IV	335.7	1,847	75	1,922	533	80	593	195	0	195	788
V	106.3	576	25	601	228	20	248	46	100	146	394
VI	361.1	1,491	15	1,506	150	56	200	67	50	117	317
VII	51.0	416	10	426	-	20	20	275	0	275	295
VIII	46.3	246	60	306	193	0	193	37	400	437	630
IX	256.5	515	65	580	58	80	138	145	0	145	283
X	66.9	178	40	218	195	-	195	226	350	576	771
XI	61.7	580	40	620	-	-	0	315	350	665	665
XII	65.6	195	0	195	60	0	60		0	-	60
TOTAL	1,610.5	14,576 (96.1%)	595 (3.9%)	15,171 (100.0%)	74,003 (97.8%)	1,644 (2.2%)	75,647 (100.0%) (55.6%)	58,671 (96.9%)	1,868 (3.1%)	60,539 (100.0%) (44.4%)	136,186 (100.0%)

Remarks: (1) 1 m^3 of cold storage = 0.35 t

(2) Cold storage; C = Chilling (+5 to - 5°C) F = Freezing (below -15°C)

(3) PFDA's plants transferred from BFAR and NFPC are only the existing completed plants in public sector.

(4) Ice plants and cold storage closed or under/before construction are excluded.

Sources: (1) List of the Private Existing IPCS of APICSO in Metro Manila, Jan., 1984, APICSO.

(2) List of the Private Existing IPCS of APICSO in Luzon, Feb. 3, 1984, APICSO

(3) List of the Private Existing IPCS of APICSO, May 1984, APICSO.

(4) Situation on Ice Plant and Cold Storage in Zamboanga City, June 1982, PFDA.

(5) List of Operational and Non-Operational Ice plants in Iloilo, May 1984, PFDA-AOC.

(6) Field Survey I and II. The Study of Master Plan for Nationwide IPCS Network System, March 1984, JICA.

(7) Field Survey II, The Study of Master Plan for Nationwide IPCS Network System, August 1984, JICA.

(8) PFDA IPCS STATUS REPORT AS OF JULY 15, 1984, Aug., 1984.

(9) Bicol Fishing Port Network, update study, August 1983, MPWH.

(10) Pangasinan Fishing Port Network, update studies, August 1983, MPWH.

(11) Capacity of the Fishing Port Complex Facilities of Package II, MPWH.

(12) Comparison of Refrigeration Facilities (Iloilo, Sual, Lucena, Camaligan and Zamboanga), 1982 and 1983, MPWH.

(13) Technical Specifications of Navotas IPCS Facility, Published Dec. 1978, PFDA.

(14) Northern Palawan Fisheries Development Project (ADB).

(15) National Fisheries Development Project (IBRD).

(16) 1982 Fisheries Statistics of the Philippines, BFAR

(17) 1983 Fisheries Statistics of the Philippines, BFAR.

Table 4.2 RATIO OF EXISTING ICE PLANTS AND COLD STORAGES TO FISH PRODUCTION IN 1983

Unit: %

Region	Ice Plant	Cold storage	
		Chilling	Freezing
NCR	485	34.45	32.67
I	408	8.72	-
II	885	9.96	0.59
III	315	10.63	-
IV	86	0.18	0.06
V	85	0.23	0.14
VI	63	0.06	0.03
VII	125	0.04	0.54
VIII	99	0.42	0.94
IX	34	0.05	0.06
X	49	0.29	0.86
XI	151	-	1.08
XII	45	0.09	-
Total	141	4.70	3.76

Remarks: (1) Ratio for Ice Plant:

$$\frac{\text{Capacity of ice plant x 50\% x 300 days}}{\text{Annual fish production}} \times 100$$

(2) Ratio for Cold Storage:

$$\frac{\text{Capacity of Cold Storage}}{\text{Annual fish production}} \times 100$$

Table 4.3 CURRENT STATUS OF BFAR ICE PLANTS AND COLD STORAGES IN 1983

Location of plant	Source of fund	Rated Capacity	Efficiency ratio (IP) (%)	Type of Compressor	Type of ice	Operational conditions: Present	Operational conditions: Future	Number of employee
1. San Nicolas	D.L.	IP 5 CS 20	60	MCT	Flake	Oper. (1981)	-	5
2. Sta Ana	EEA	IP 5 CS 30 BF 5	72	VOT	Block	Reh. (1972)	To CIADP	5
3. Masinloc	EEA	IP 5 CS 50	70	VOT	Block	Not oper. (1967)	To M.G.	5
4. Dalahican	EEA	IP 10	30	VOT	Block	Not oper. (1973)	For closure	1
5. Liminangcong	EEA	IP 40	18	MCT	Tube	Oper. (1970)	To PFDA	2
6. Coron	D.L.	IP 10 CS 20	60	MCT	Flake	Oper. (1980)	To PFDA/ NPFDP	4
7. Looc	D.L.	IP 5 CS 20	80	MCT	Flake	Oper. (1980)	-	5
8. San Jose	BFAR special proj.	IP 10	80	MCT	Flake	Test run	Operated	2
9. Calapan	D.L.	IP 5	-	MCT	Flake	Before construction	-	-
10. Cuyo	D.L.	IP 10 CS 20	75	MCT	Flake	Oper. (1980)	To PFDA	3
11. Placer	D.L.	IP 5 CS 20	80	MCT	Flake	Oper. (1983)	-	4
12. Magallanes	EEA	IP 6 CS 10	66	VOT	Flake	Not oper. (1969)	For closure	4
13. Tabaco	J.R.	IP 10 CS 50 CF 6	60	MCT/SCT	Tube	Oper. (1982)	To PFDA	6
14. Pio Duran	EEA	IP 10 CS 50 BF 5	60	VOT/MCT	Flake	Reh. (1970)	On lease	5
15. Mercedes	EEA	IP 10 CS 50 BF 5	45	VOT	Flake	Not oper. (1967)	For closure	5
16. Pala-pala	EEA	IP 10 CS 50 BF 5	70	VOT	Flake	Not oper. (1983)	For closure	11
17. Saravia	EEA	IP 5 CS 50	70	VOT	Block	Reh. (1972)	-	5
18. Old sagay	EEA	IP 5	55	VOT	Block	Not oper. (1968)	For closure	3
19. San Jose	J.R.	IP 10 CS 50 CF 2	70	MCT/SCT	Tube	Under construction	-	5
20. Panitan	EEA	IP 10 CS 20	-	VOT	Flake	Not oper.	For closure	1
21. Daan	D.L.	IP 10 CS 20	70	MCT	Flake	Oper. (1984)	To PFDA	5
22. Cathalogan	J.R.	IP 10 CS 20 CF 2	80	MCT/SCT	Tube	Under construction	To PFDA	3
23. Tacloban	D.L.	IP 40 CS350 BF 10	60	MCT	Flake	Completed but not yet operated	For lease	-
24. Barugo	EEA	IP 10 IS 50 BF 5	100	VOT	Flake	Oper. (1969)	-	5
25. Guiuan	EEA	IP 5 CS 20	60	VOT	Flake	Not oper. (1967)	For closure	7
26. Isabela	D.L.	IP 10 CS 20	70	MCT	Flake	Oper. (1979)	To PFDA	5
27. Jolo	EEA	IP 10	60	VOT	Flake	Not oper. (1975)	Reh.	5
28. Siasi	EEA	IP 5 CS 20	80	MCT	Block	Not oper.	For closure	5
29. Dipolog	D.L.	IP 5 CS 20	50	MCT	Flake	Test run	-	4
30. Bato-bato	EEA	IP 40	-	MCT	Tube	Not oper. (1969)	For closure	2
31. Opol	J.R.	IP 10 CS 50 CF 2	100	MCT/SCT	Tube	Under construction	-	2
32. Surigao	D.L.	IP 40 CS350 BF 10	80	MCT	Flake	Under construction	To PFDA	2
33. Gen. Santos	D.L.	IP 40 CS350 BF 10	80	MCT	Flake	Not oper.	For lease	4
34. Kalamansig	J.R.	IP 10 CS 50 CF 2	100	MCT/SCT	Tube	Under construction	-	3
35. Parang	J.R.	IP 10 CS 50 CF 2	100	MCT/SCT	Tube	Under construction	-	5

Remarks : (1) I.P. = Ice Plant, C.S. = Cold Storage, B.F. = Blast Freezer, C.F. = Contact Freezer
VOT = Vertical open type, MCT = Multi cylinder type, SCT = Screw type, ME = Mechanical Engineer
D.L. = Danish Loar, J.R. = Japanese Reparation, EEA = Emergency Employement Administration
(2) Unit; I.P.= t/day, C.S. = t, B.F. = t /day, C.F. = t/da)
(3) Mechanical efficiency was estimated by PFDA through interview survey to each plant.

Source: PFDA IPCS Final Report 1982, December 1, 1983, IPCS Task Force, PFDA

Table 4.4 NUMBER OF BFAR ICE PLANTS BY TYPE OF ICE BY DONATING SOURCES

Ice Type	Source of Fund: Danish Loan	Source of Fund: EEA and BFAR Special Project	Source of Fund: Japanese Reparation	Total
1. Block Ice	0	6	0	6
2. Flake Ice	12	9	0	21
3. Tube Ice	0	2	6	8
Total	12	17	6	35

Source: PFDA IPCS Final Report 1982, Dec. 1983, IPCS Task Force, PFDA.

Table 4.5 WATER AND POWER SUPPLY CONDITIONS OF BFAR IPCS (Continued)

Name of Site	Water			Electricity		
	Source		Problem encountered	Source		Problem encountered
	Waterworks System	Other		Electric Cooperative	Generator	
1. San Nicolas	None	Deep well	Inadequate water supply	INEC (Ilocos Norte Electric Cooperative)	None	-
2. Sta Ana	None	Deep well	-	None	60 HPE	-
3. Masinloc	-	-	-	Available	None	Frequent brownouts
4. Dalahican	-	-	-	None	60 HPE x 1 set 30 KVA x 1 set	-
5. Liminangcong	None	Deep well	-	None	130 KW x 2 sets	-
6. Coron	None	Deep well	-	Available	None	-
7. Looc	Available	None	Low water pressure	None	170 HP x 1 set	Inadequate supply of diesel oil
8. San Jose	San Jose Water District	-	-	None	Available	-
9. Calapan	Calapan Waterworks System	None	-	OMEC (Oriental Mindoro Electric Cooperative)	None	Inadequate power supply
10. Cuyo	Cuyo Water-works System with pressure tank	None	Low water pressure and regular suspension	None	100 KVA	-
11. Placer	None	Deep well	-	None	75 KVA	-
12. Maga llanes	Free-flowing water	None	-	SEC (Sorsogon Electric Company)	115 HPE x 1 set 25 KVA x 1 set	-
13. Tabaco	Albay Water District	None	-	AEC (Albay Electric Company)	75 KVA x 1set	-
14. Pio Dulan	Available	Deep well		AEC (Albay Electric Company)	30 KVA	-
15. Mercedes	Available	Deep well	-	CEC (Camarines Norte Electric Company)	60 HP 30 KVA x 1 set	-
16. Pala-pala	NAWASA	None	-	PEC (Panay Electric Company)	None	-
17. Saravia	-	-	-	-	-	-

Source: PFDA IPCS Final Report 1982, December 1, 1983, IPCS Task Force, PFDA.

Table 4.5 WATER AND POWER SUPPLY CONDITIONS OF BFAR IPCS (Completed)

Site	Water			Electricity		
	Source			Source		
	Waterworks System	Other	Problem	Electric Cooperative	Generator	Problem
18. Old Sagay	NAWASA	None	-	None	65 HP x 1 set 50 KVA	-
19. San Jose	Rural Water works Development Cooporation	None	-	ANTECO (Antique Electric Cooperative)	Available	-
20. Panitan	None	Deep well	-	CAPELCO (Capiz Electric Cooperative)	None	-
21. Daan	None	Deep well	Salty water	None	Diesel 75 KW x 1 set	-
22. Catbalogan	Catbalogan Water District	None	Inadequate water supply: Negotiations with CWD underway	None	75 KVA x 2 sets	-
23. Tacloban	Leyte Metro-politan Waterworks	None	-	LEYECO II (Leyte Electric Cooperative II)	None	Frequent brownouts needs 1 gene-rator set
24. Barugo	Available	None	-	LEYECO II (Leyte Electric Cooperative II)	60 HPE x 2 sets 30 KVA x 1 set	-
25. Guiun	None	Rainwater collected in one big ground tank	-	None	92 HPE x 1 set 25 KVA x 1 set	-
26. Isabela	NAWASA	None	-	None	125 KVA x 1 set 25 KVA x 1 set	-
27. Jolo	Available	None	-	None	60 HPE x 2 sets	-
28. Siasi	-	-	-	None	Available	-
29. Dipolog	None	Deep well	-	None	75 KVA x 1set	-
30. Bato-bato	Available	None	-	None	200 HP x 2 sets	-
31. Opol	Available	None	-	None	75 KVA x 2 sets	-
32. Surigao	Available	None	-	-	-	-
33. Gen. Santos	Available	Free-flowing well	-	-	-	-
34. Kalamansig	None	Deep well	-	None	75 KVA x 2 sets	-
35 Parang	-	-	Lack of addi-tional budget	None	75 KVA x 2 sets	Lack of budget

Table 4.6 DISTANCE BETWEEN BFAR/PFDA EXISTING IPCS AND MFP/LOCAL CONSUMPTION CENTER

Site Number	Distance from fishing port	Distance from local consumption center
1	-	14 km. away from Laoag City
2	5 km. away from MFP in San Vicente	-
3*	Near fishing port	Near public market
4	800.m away from fishing port	-
5	30 m. away from fish landing site	-
6	-	2 km. away from town proper
7*	60 m. away from fish landing site	50 m. away from public market
8*	Near fish landing site	50 m. away from public market
9	-	-
10	500 m. away from PPA port	-
11*	Along fish landing site	500 m. away from public market
12	1 km. away from proposed MFP	-
13*	50 m. away from MFP	450 m. away from poblacion
14	500 m. away from MFP	500 m. away from poblacion
15	250 m. away from MFP	3 km. away from poblacion
16*	Near fishing port	10 m. away from public market
17	-	300 m. away from town proper
18	-	within town proper
19	Near PPA port	1 km. away from town proper
20	-	3 km. away from town proper
21	5 km. away from MFP	-
22	Within fishing port	-
23	6 km. away from proposed fishing port	9 km. away from city proper
24	5 km. away from MFP in Carigara	-
25	Inside BFAR's compound	-
26	-	-
27	100 m. away from MFP	-
28	300 m. away from proposed MFP	-
29	-	5 km. away from town proper 1 km. away from the National Highway
30*	Near fishing port	-
31*	Near fish landing site	1 km. away from town proper and near highway
32	500 m. away from proposed fishing port	Within city proper
33*	100 m. away from fishing port	7 km. away from city proper
34	500 m. away from fish landing site	300 m. away from town proper
35	-	300 m. away from town proper

Remarks: (1) Site number correspond to that in Table 4.3.
(2) Site number with * indicates that the location of IPCS seems to be more or less appropriate.

Source: PFDA IPCS Final Report 1982, December 1, 1983 IPCS Task Force, PFDA.

Table 4.7 BREAK-EVEN ANALYSIS OF BFAR ICE PLANTS

Site No.	Rated Capacity (ton/day)	Efficient Capacity (ton/day)	Operational Capacity (ton/day)	Variable Cost (₱/day)	Fixed Cost (₱/day)	Depreciation Cost (₱/day)	Break-even Price (₱/kg)	Market Price (₱/kg)	Break-even Price /Market Price
1	5.00	3.00	3.00	560.43	216.23	101	0.315	0.250	1.262
2	5.00	3.60	3.60	1,072.90	203.42	101	0.401	0.440	0.911
3	5.00	3.50	-	653.62	203.42	101	0.293	0.163	1.795
4	10.00	3.00	-	1,662.31	203.39	329	0.770	0.180	4.278
5	40.00	7.20	2.50	1,343.26	203.39	592	0.574	0.330	1.738
6	10.00	6.00	3.00	1,213.66	223.42	329	0.426	0.330	1.292
7	5.00	4.00	1.00	1,026.00	203.65	101	0.627	0.500	1.254
8	10.00	8.00	-	1,072.58	213.41	329	0.217	0.340	0.637
9	5.00	-	-	-	-	-	-	-	-
10	10.00	7.50	7.50	1,344.11	223.42	329	0.269	0.300	0.896
11	5.00	4.00	-	1,174.85	203.39	101	0.386	0.550	0.702
12	6.00	4.00	2.50	1,267.39	203.39	118	0.473	0.480	0.986
13	10.00	6.00	3.60	714.22	281.15	329	0.325	0.300	1.034
14	10.00	8.00	6.00	1,697.88	223.39	329	0.324	0.300	1.081
15	10.00	4.50	4.50	801.90	223.39	329	0.328	0.160	2.047
16	10.00	7.00	1.50	864.36	210.00	329	0.561	0.200	2.803
17	5.00	3.50	3.50	609.12	203.42	101	0.280	0.257	1.089
18	5.00	2.75	2.75	1,033.99	176.95	101	0.499	0.132	3.780
19	10.00	7.00	7.00	1,728.94	223.41	329	0.343	0.360	0.953
20	10.00	-	-	-	-	-	-	-	-
21	10.00	7.00	1.20	1,314.16	243.42	329	0.768	0.300	2.560
22	10.00	8.00	8.00	1,230.06	243.42	329	0.241	0.480	0.502
23	40.00	24.00	5.00	4,409.76	315.29	592	0.405	0.292	1.335
24	6.00	6.00	6.00	1,140.50	239.88	118	0.263	0.356	0.738
25	5.00	3.00	-	1,215.98	203.42	101	0.529	0.380	1.392
26	10.00	7.00	7.00	1,009.40	223.42	329	0.240	0.600	0.400
27	10.00	6.00	6.00	1,254.96	223.89	329	0.321	0.720	0.446
28	5.00	4.00	2.00	1,267.39	203.39	101	0.502	-	-
29	5.00	2.50	2.50	896.79	246.88	101	0.520	0.350	1.486
30	40.00	-	-	-	-	-	-	-	-
31	10.00	10.00	10.00	1,160.04	223.41	329	0.183	0.350	0.523
32	40.00	32.00	-	2,923.42	315.29	592	0.126	0.370	0.340
33	40.00	32.00	32.00	2,846.38	315.29	592	0.123	0.220	0.561
34	10.00	10.00	10.00	1,452.98	223.41	329	0.213	0.460	0.462
35	10.00	10.00	10.00	1,147.32	223.41	329	0.182	0.220	0.827

Remarks: Site number correspond to that in Table 4.3

Source of Data: PFDA IPCS Final Report 1982, PFDA

Table 4.8 COST COMPONENT OF BFAR ICE PLANTS

Site No.	Capacity (ton/day)		Cost (₱/day)					
	Rated Capacity	Efficient Capacity	Energy cost	Other Variable Cost	Salaries	Maintenance and repair	Other supplies	Total cost
1	5	3.0	460	100	168	32	16	777
2	5	3.6	907	166	168	30	5	1,276
3	5	3.5	468	186	168	30	5	857
4	10	3.0	1,633	29	168	30	5	1,866
5	40	7.2	1,306	38	168	30	5	1,547
6	10	6.0	1,075	138	168	50	5	1,437
7	5	4.0	756	270	168	30	5	1,230
8	10	8.0	967	105	158	50	5	1,286
9	5	-	-	-	-	-	-	-
10	10	7.5	1,148	196	168	50	5	1,568
11	5	4.0	1,134	41	168	30	5	1,378
12	6	4.0	1,210	58	168	30	5	1,471
13	10	6.0	571	143	168	50	63	995
14	10	8.0	1,633	65	168	50	5	1,921
15	10	4.5	740	62	168	50	5	1,025
16	10	7.0	789	75	78	78	55	1,074
17	5	3.5	500	109	168	30	5	816
18	5	2.75	944	90	142	30	5	1,211
19	10	7.0	1,414	315	168	50	5	1,952
20	10	-	-	-	-	-	-	-
21	10	7.0	1,148	166	168	70	5	1,558
22	10	8.0	1,075	155	168	50	25	1,473
23	40	24.0	4,147	267	195	100	20	4,729
24	6	6.0	922	219	180	55	5	1,380
25	5	3.0	1,075	141	168	30	5	1,419
26	10	7.0	910	99	168	50	5	1,233
27	10	6.0	1,109	146	169	50	5	1,479
28	5	4.0	1,210	58	168	30	5	1,471
29	5	2.5	700	177	186	80	11	1,124
30	40	-	-	-	-	-	-	-
31	10	10.0	1,130	30	168	50	5	1,383
32	40	32.0	2,784	139	195	100	20	3,239
33	40	32.0	2,784	62	195	100	20	3,162
34	10	10.0	1,436	17	168	50	5	1,676
35	10	10.0	1,130	18	168	50	5	1,371

Remarks: Site number correspond to that in Table 4.3.

Source: PFDA IPCS Final Report 1982, December 1, 1983, PFDA.

Table 4.9 CURRENT STATUS OF SELECTED PRIVATE ICE PLANTS

Location of plant	Rated capacity	Type of compressor	Type of ice	Commencement of operation	Number of employees
1. Orani (Bataan)	IP 35	VOT	Block	1976	14
2. Orion (Bataan)	IP 120	MCT	Block	1978	18
3. San Fernando (Pampanga)	IP 330 CS 30	MCT	Block	1978	34
4. Jose Pamganiban (Camarines Norte)	IP 40	MCT	Block	1980	25
5. Mercedes 1 (Camnrines Norte)	IP 45	VOT	Block	1980	10
6. Mercedes 2 (Camarines Norte)	IP 60	MCT/VOT	Block	1980	6
7. Balasan (Iloilo)	IP 20	VOT	Block	1976	14
8. Iloilo city 1 (Iloilo)	IP 110	VOT	Block	1977	12
9. Iloilo city 2 (Iloilo)	IP 100 CS 20	MCT	Tube	1978	28
10. Iloilo city 3 (Iloilo)	IP 25	-	Block	1927	8
11. Iloilo city 4 (Iloilo)	IP 15	-	Block	1952	8
12. Iloilo city 5 (Iloilo)	IP 28	-	Block	1981	6
13. Ubay (Bohol)	IP 2	VOT	Block	1979	4
14. Tagbilaran city (Bohol)	IP 15	VOT	Block	1978	7
15. Bayawan (Negross Ori.)	IP 4	VOT	Block	-	-
16. Dumaguete city 1 (Negross Ori)	IP 10	-	Block	1965	5
17. Dumaguete city 2 (Negross Ori)	IP 25	VOT	Block	-	10
18. General Santos city 1 (South Cotabato)	IP 50 CS 400	VOT	Block	1977	3
19. General Santos city 2 (South Catabato)	IP 75	VOT	Block	1949	20
20. General Santos city 3 (South Catabato)	IP 110	VOT	Block	1967	23

Remarks: (1) IP: Ice plant, CS: Cold Storage
(2) Unit; IP = t/day, CS = t
(3) Type of compressor: VOT = Vertical open type, MCT = Multi cylinder type

Source: Data was provided by private ice plant operators during field survey in Phase II Study.

Table 4.10 SOURCE OF WATER AND POWER SUPPLY AND WORKING CONDITIONS OF PRIVATE ICE PLANTS AND COLD STORAGES

Location of Plant	Water			Electricity		
	Source		Problem	Source		Problem
	Waterworks system	Other		Electric cooperative	Generator	
1. Orani	None	Deep well		BATELCO	Yes	
2. Orion	None	Deep well		BATELCO	-	
3. San Fernando	None	Deep well	Hard water	SFELTCO	None	
4. Jose Panganiban	None	Spring		NPC	None	Daily voltage fluctuation
5. Mercedes 1	Yes	Deep well		CANORECO	Yes	Often brownout
6. Mercedes 2	Yes	None		CANORECO	Yes	Often brownout
7. Balasan	None	Shallow well		CAPECO	Yes	
8. Iloilo city 1	Yes	None	Carry water from Guimaras Island	PECO	None	Daily brownout
9. Iloilo city 2	None	Deep well		PECO	Yes	Daily voltage fluctuation
10. Iloilo city 3	Yes	None	Not sufficient	PECO	-	
11. Iloilo city 4	Yes	None	Not sufficient	PECO	-	
12. Iloilo city 5	None	Deep well		PECO	-	
13. Ubay	None	Shallow well	Hard water	BOHECO II	Yes	
14. Tagbilaran city	None	Deep well	Hard water	NPC	None	
15. Bayawan	None	Shallow well		NORECO II	None	Daily, voltage fluctuation
16. Dumaguete city 1	None	Deep well	Hard water	NORECO II	None	Daily voltage fluctuation
17. Dumaguete city 2	None	Deep well	Hard water	NORECO II	Yes	
18. General Santos city 1	None	Deep well		SOCORECO	Yes	
19. General Santos city 2	None	Deep well		SOCORECO	Yes	Often brownout
20 General Santos city 3	None	Deep well		SOCORECO	Yes	Often brownout

Source: Data was provided by private ice plants and electric cooperatives during field survey in Phase II Study.

5. SUPPLY AND DEMAND FOR FISH

5. SUPPLY AND DEMAND FOR FISH

5.1 Socio-economic Framework

(1) GDP

NEDA provided in August 1984, the preliminary Revised Five-Year Development Plan considering the economic difficulties in the Philippines.

GDP in 1983 amounted to 100.1×10^9 pesos at the constant price of 1972, showing an annual growth rate of only 1.1% over the previous year. The Revised Five-Year Plan shows a negative growth of GDP from 1983 to 1984, but projects a recovery to the positive growth of 3.8% from 1986 to 1987, the last year of the Plan period. The averge annual growth rate of GDP during the Plan period is estimated at 0.8%.

The Government of the Philippines encourages private investments in construction, exports of goods and non-factor services, while the contribution of the government sector to the national economy is planned to decrease both in consumption and investment.

Under such a policy, GDP was projected to be 115.8×10^9 pesos in 1990 and 168.4×10^9 pesos in 2000, assuming the average annual growth rate of 2.1% for the period from 1983 to 1990 and 3.8% for the period from 1990 to 2000 as shown in Table 5.1.

(2) Population

According to NEDA's population projection for the Philippines as a whole and by Regions during the period from 1980 to 2030, the population is estimated to be $52{,}055 \times 10^3$ for 1983, $61{,}481 \times 10^3$ for 1990 and $75{,}224 \times 10^3$ for 2000 as shown in Table 5.1; the annual growth rates will be 2.4% for 1983 to 1990 and 2.0% for 1990 to 2000.

(3) Per capita GDP

Per capita GDP was 1,923 pesos in 1983 and was projected to be 1,883 pesos for 1990 and 2,239 pesos for 2000 at the constant price of 1972. A negative annual growth rate, -0.3%, is projected for the period from 1983 to 1990, but it is expected to recover to 1.7% during the period from 1990 to 2000.

5.2 Demand for Fish

The following factors were considered for the projection of the domestic demand for fish.

(i) Per capita fish consumtpion of 30.4 kg/person in 1982
(ii) Real growth rate of per capita income
(iii) Income elasticity of 0.2 of fish consumption

Domestic demand for fish was estimated at $1,582 \times 10^3$ tons in 1983 and is projected to be $1,937 \times 10^3$ tons in 1990 and $2,475 \times 10^3$ tons in 2000 as shown in Table 5.1.

Fish export was projected to be 57×10^3 tons in 1983, 98×10^3 tons in 1990 and 190×10^3 tons in 2000, based upon the past trend and the government export promotion policy.

5.3 Supply of Fish

Increase of fish import will be kept at a low level, considering the Government policy and past trends. Fish import amounted to 29×10^3 tons in 1983 and according to the above assumption the import is projected to be 34×10^3 tons for 1990 and 31×10^3 tons for 2000, with an annual growth rate of 2.2% during the 1983 to 1990 period and a negative growth of -0.7% during the 1990 to 2000 period.

Domestic supply of fish was $1,611 \times 10^3$ tons in 1983 and is projected to be $2,001 \times 10^3$ tons for 1990 and $2,634 \times 10^3$ tons for 2000, as shown in Table 5.1.

5.4 Fish Production by Sub-sector

The domestic supply of fish are regarded hereunder as target production figures for 1990 and 2000 respectively. Fish production was projected to achieve the target production for each fishery sub-sector, i.e., commercial/municipal fisheries and aquaculture as shown in Table 5.2.

In 1983, municipal fishery dominates, accounting for 50.3% of the total prouction or 809.6×10^3 tons. The commercial fisheries came next with a

production of 519.3×10^3 tons, 32.2% of the total catch, while aquaculture produced 281.6×10^3 tons or 17.5% of the total.

Fish production in capture fisheries was projected based on the following:

(i) The government promotion policy indicated in IFDP

(ii) Maximum potential yield within the Exclusive Economic Zone (EEZ)

(iii) Recent trends of fish catch according to BFAR statistics

The allocation of the target production figures to each sector of the fishery was made primarily in consideration of the estimated potentials as follows:

(i) For both marine commercial and municipal fisheries: Potential as given in IFDP proposed by FIDC.

(ii) For inland municipal fishery in Laguna de Bay: Potential estimated by International Center for Living Aquatic Resource Management (ICLARM).

(iii) For inland municipal fishery for other waters: Standard potentials as often being used for tropical rivers and lakes

(iv) For aquacutures: Maximum potential yield as given in IFDP proposed by FIDC.

The above materials suggest that both traditional commercial and marine municipal fisheries may not have a good potential to increase the production, while both the oceanic commercial fisheries and aquaculture particularly brackish water fishpond culture may have a good possibility to increase their production.

The growth rate of fish production in the municipal fisheries sector will decline during the 1983 to 2000 period in view of the present exploitation near the maximum potential yield. Fish production in this sector will increase at a low annual growth rate of 1.8% from the 1983 to 1990 period and only 1.0% from the 1990 to 2000 period, being projected to be 914.3×10^3 tons in 1990 and $1,006.1 \times 10^3$ tons in 2000. Similarly, fish catch may not increase at a significant rate during the 1983 and 2000 period in the traditional commercial fisheries.

Considering the above factors, fish production in commercial fisheries was projected to be 638.4×10^3 tons in 1990 and 888.6×10^3 tons in 2000.

IFDP expected a rapid increase of fish production in aquaculture. The possible maximum yield in brackish water aquaculture which constitutes the predominant part of aquaculture, was assumed to be 3.0 tons/ha/year due to the development of the semi-intensive culture method. The annual growth rate of fish production in aquaculture will reach 6.9% in the 1983 - 1990 period and 5.1% in the 1990 - 2000 period, provided that the semi-intensive culture method is widely used. Fish production in aquaculture is projected to be 447.9×10^3 tons in 1990 and 739.0×10^3 tons in 2000 as shown in Table 5.2.

5.5 Fish production by Region

Fish production by Region is shown in Tables 5.3 to 5.6.

(1) Fish production in 1983

Fish production is concentrated on certain Regions, among which NCR produced 177.4×10^3 tons, in Region IV 335.7×10^3 tons, in Region VI 316.1×10^3 tons and in Region IX 256.5×10^3 tons. Total fish production of these Regions accounted for 67.4% of the total production in the Philippines.

The characteristics of fish production in these Regions are as follows:

a. NCR: Fish production is owed mainly to commercial fisheries, which amounted to 170.2×10^3 tons, accounting for 96% of the total production of this Region.

b. Region IV: Dominant fisheries are municipal fisheries and aquaculture. Fish production amounted to 181.7×10^3 tons in municipal fisheries and 101.2×10^3 tons in acquaculture, while that in commercial fisheries was only 52.8×10^3 tons. Aquaculture production of this Region was prominent, accounting for 36% of the total production of the country.

c. Region VI: All the fisheries sectors have improved their production, consisting of 136.5×10^3 tons in municipal fisheries, 123.9×10^3 tons in commercial fisheries and 55.7×10^3 tons in aquaculture.

d. Region IX: Municipal fisheries is the dominant sector in this Region, corresponding to 22.7% of the total production of the country or 183.5×10^3 tons, while only 8.6×10^3 tons were produced in aquaculture and 64.4×10^3 tons in commercial fisheries.

(2) Fish production in 2000

Fish production will be much more concentrated in the advanced Regions owing to the development of the fish carrier system, as shown in Table 5.3.

Fish production will be concentrated in the following Regions, NCR with 385.8×10^3 tons, Region IV with 488.2×10^3 tons, and Region VI with 466.7×10^3 tons, these corresponding to 88.9% of the total production of the Philippines.

Fish production in commercial fisheries will be much more concentrated in NCR with NFPC, a national fishing port, reaching 376.6×10^3 tons, corresponding to 42.4% of the total production, as compared with 32.8% in 1983 as shown in Table 5.4.

Production in the municipal fisheries sector has decreased in Regions, NCR, I, II, III, V, VII, VIII, X, and XI and increase in Regions IV, VI, IX and XII. Fish production in this sector was projected as shown in Table 5.5, with the assumption that adequate management would be practiced on fisheries resources. Fish production in the Regions with decreasing trend will remain at the similar level of production in the 1983 -2000 period, while the resources in the Regions with increasing trends of production will be further exploited in the 1983 -2000 period. Fish production in this sector will be the highest in Region IX at 248.1×10^3 tons followed by Region IV at 226.8×10^3 tons and Region VI at 185.7×10^3 tons.

In aquaculture, the Regions were divided into two groups according to the different stage of development of the semi-intensive culture. One group includes the advanced Regions such as Regions I, III and VI and another includes other underdeveloped Regions. Region IV belongs to the latter group although its production in aquaculture is the largest in the country. It was assumed that brackish water fish ponds in the advanced Regions would have the maximum productivity of 3.0 tons/ha/year by 1990, while the rest by 2000. Thus fish production in this sector will be the largest still in Region IV with 208.6×10^3 tons being followed by Region III with 169.8×10^3 tons and Region VI with 148.2×10^3 tons as shown in Table 5.6.

5.6 Balance between Supply and Demand for Fish by Region

There were four fish surplus Regions in 1983. Fish surplus amounted to 129×10^3 tons in Region IV, 4×10^3 tons in Region V, 172×10^3 tons in Region VI and 180×10^3 tons in Region IX. On the contrary, fish deficit was seen in the following Regions:

(i) Luzon Island: NCR, Regions I, II and III
(ii) The middle part of the country: Regions VII and VIII
(iii) Mindanao Island: Regions X, XI and XII

Fish deficit will be 241×10^3 tons in Regions I, II and VII in 1990, 300×10^3 tons in 2000, while fish surplus will be 565×10^3 tons in Regions IV, VI and IX in 1990 and 717×10^3 tons in 2000.

The regional gap of the supply and demand situation of fish will be a more serious problem in 2000 than in 1983 as shown in Table 5.7. The effective transportation of fish between Regions will be a critical issue as the regional gap will widen towards 2000 as shown in Fig. 5.1.

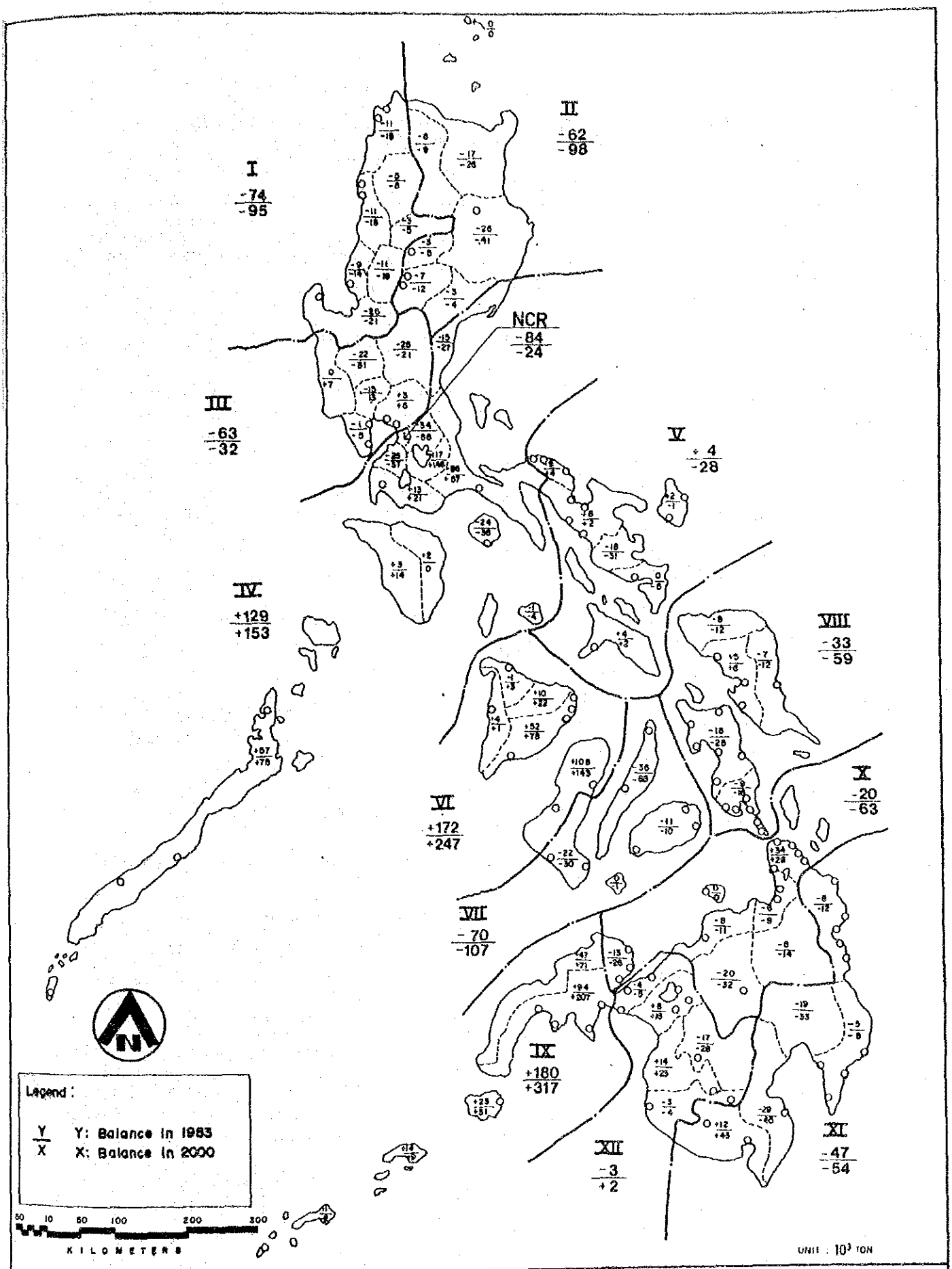


Fig. 5.1 BALANCE BETWEEN FISH PRODUCTION AND LOCAL FISH DEMAND, 1983 AND 2000

REPUBLIC OF THE PHILIPPINES
THE STUDY OF MASTER PLAN FOR THE NATIONWIDE ICE PLANTS AND COLD STORAGES NETWORK SYSTEM
JAPAN INTERNATIONAL COOPERATION AGENCY

Table 5.1 PROJECTION OF GDP, POPULATION, PER CAPITA GDP, AND FISH DEMAND IN THE PHILIPPINES

	1983	1990	2000	Average Annual Growth Rate (%) 1983-1990	1990-2000
1. GDP (₱ 10^6 at 1972 price)	100,120	115,796	168,401	2.1	3.8
2. Population (10^3)	52,055	61,481	75,224	2.4	2.0
3. Per Capita. GDP (₱ at 1972 price)	1,923	1,883	2,239	-0.3	1.7
4. Demand & Supply for Fish (10^3 t)					
4.1 Demand					
1) Domestic demand	1,582.3	1,936.6	2,474.9	2.9	2.5
2) Export	57.2	97.8	190.2	8.0	6.9
4.2 Supply					
3) Import (less)	29.0	33.8	31.4	2.2	-0.7
4) Domestic Supply (Fish Production)	1,610.5	2,000.6	2,633.7	3.1	2.8

Remarks: (1) Annual growth rate of GDP for 1986 to 1987 as given in Source (1) was used for the projection of GDP for 1990 and 2000.

(2) Population data for 1990 and 2000 were quoted from Source (2) below.

(3) Per capital fish consumption was projected, taking into account annual growth rate of per capita income and income elasticity of 0.2 for fish consumption.

(4) Export and import of fish for 1990 and 2000 were projected by referring to their past trend.

(5) Fish production figures hereunder always refer to the total catch minus the quantity of seaweeds gathered and the weight of the shell of molluscs collected. The both data are disclosed in Fisheries Statistics of BFAR.

Sources: (1) GPD; Preliminary Revised Five-Year Development Plan, Aug. 1984, NEDA.

(2) Population; Population Projections of the Philippines and its Regions, 1980-2030, NEDA.
(Based on the 1980 Census of Population and Housing Revised Population Projection, Series 2)

Table 5.2 PROJECTION OF FISH PRODUCTION BY SUB-SECTOR IN THE PHILIPPINES

Sub-sector	Fish Production (10^3 MT)			Average Annual Growth Rate (%)	
	1983	1990	2000	1983-1990	1990-2000
1. COMMERCIAL FISHERIES					
1) Marine Traditional Commercial Fisheries	479.3	556.2	671.1	2.1	1.9
2) Marine Oceanic Commercial Fisheries	40.0	82.2	217.5	10.8	10.2
SUB - TOTAL	519.3 (32.2)	638.4 (31.9)	888.6 (33.7)	3.0	3.4
2. MUNICIPAL FISHEIRES					
1) Marine Municipal Fisheries	690.3	769.8	841.0	1.6	0.9
2) Inland Municipal Fisheries	119.3	144.5	165.1	2.8	1.3
SUB - TOTAL	809.6 (50.3)	914.3 (45.7)	1,006.1 (38.2)	1.8	1.0
3. AQUACULTURE	281.6 (17.5)	447.9 (22.4)	739.0 (28.1)	6.9	5.1
TOTAL IN THE PHILS.	1,610.5 (100.0)	2,000.6 (100.0)	2,633.7 (100.0)	3.1	2.8

Remarks: Fish production figures hereunder always refer to the total catch minus the quantity of seaweeds gathered and the weight of the shell of molluscs collected.

Source: (1) Revised Data of IFDP, 1984, FIDC.
(2) Fisheries Statistics in the Philippines, 1977-83, BFAR.
(3) 1983 Philippine Statistical Yearbook; 1983, NEDA.
(4) Preliminary Revised Five-Year Development Plan, Aug., 1984, NEDA.

Table 5.3 PROJECTION OF FISH PRODUCTION BY REGION
– WHOLE FISHERIES –

Unit: 10^3 M.T.

Region	Production (10^3 MT)			Annual Growth Rate (%)	
	1983	1990	2000	1983 - 1990	1990 - 2000
NCR	177.4	246.7	385.8	4.8	3.8
I	29.8	50.7	60.0	7.9	1.7
II	5.1	6.2	9.6	2.8	4.5
III	92.1	166.4	209.3	8.8	2.3
IV	335.7	375.1	488.2	1.6	2.7
V	106.3	109.3	131.5	0.4	1.9
VI	316.1	395.8	466.7	1.3	1.7
VII	51.0	53.1	70.5	0.6	2.9
VIII	46.3	47.0	60.7	0.2	2.6
IX	256.5	320.2	437.3	3.2	3.2
X	66.9	69.8	80.0	0.6	1.4
XI	61.7	76.4	120.4	3.1	4.7
XII	65.6	84.1	113.7	3.6	3.1
Philippines	1,610.5	2,000.6	2,633.7	3.1	2.8

Remarks: Fish production figures hereunder always refer to the total catch minus the quantity of seaweeds gathered and the weight of the shell of molluscs collected.

Sources: 1982 Fisheries Statistics of the Philippines, BFAR.
1983 Fisheries Statistics of the Philippines (Preliminary Data), BFAR.

Table 5.4 PROJECTION OF FISH PRODUCTION BY REGION
– COMMERCIAL FISHERIES –

Unit: 10^3 M.T.

Region	Production (10^3 MT)			Annual Growth Rate (%)	
	1983	1990	2000	1983 - 1990	1990 - 2000
NCR	170.2	239.2	376.6	4.9	4.6
I	2.1	2.1	2.1	0.0	0.0
II	1.5	1.5	1.5	0.0	0.0
III	7.2	10.7	18.8	5.8	5.8
IV	52.8	52.8	52.8	0.0	0.0
V	34.1	34.1	34.1	0.0	0.0
VI	123.9	126.0	132.8	0.2	0.5
VII	20.3	21.9	26.7	1.1	2.0
VIII	9.1	9.1	9.1	0.0	0.0
IX	64.4	92.9	155.2	5.4	5.3
X	5.0	6.7	9.1	4.3	3.1
XI	27.7	40.4	68.8	5.5	5.5
XII	1.0	1.0	1.0	0.0	0.0
Philippines	519.3	638.4	888.6	3.0	3.4

Remarks and Source: Refer to Table 5.3.
Commercial Fisheries: Commercial traditional and oceanic fishing.

Table 5.5 PROJECTION OF FISH PRODUCTION BY REGION
– MUNICIPAL FISHERIES –

Unit: 10^3 M.T.

Region	Production			Annual Growth Rate (%)	
	1983	1990	2000	1983 - 1990	1990 - 2000
NCR	6.5	6.5	6.5	0.0	0.0
I	9.1	9.3	9.5	0.3	0.2
II	2.4	2.5	2.5	0.6	0.0
III	18.1	19.6	20.7	1.1	0.6
IV	181.7	205.6	226.8	1.8	1.0
V	65.5	66.4	67.2	0.2	0.1
VI	136.5	162.5	185.7	2.5	1.3
VII	26.2	26.2	26.2	0.0	0.0
VIII	32.3	32.3	32.3	0.0	0.0
IX	183.5	217.6	248.1	2.5	1.3
X	59.4	60.2	60.9	0.2	0.1
XI	29.2	29.5	29.7	0.2	0.1
XII	59.2	76.1	90.0	3.7	1.7
Philippines	809.6	914.3	1,006.1	1.8	1.0

Remarks and source: Refer to Table 5.3.
Municipal Fisheries: Municipal marine and inland fisheries.

Table 5.6 PROJECTION OF FISH PRODUCTION BY REGION
– AQUACULTURE –

Unit: 10^3 M.T.

Region	Production			Annual Growth Rate (%)	
	1983	1990	2000	1983 - 1990	1990 - 2000
NCR	0.7	0.8	2.7	1.9	12.9
I	18.5	39.3	48.4	11.4	2.1
II	1.2	2.2	5.6	9.1	9.8
III	66.8	136.1	169.8	10.7	2.2
IV	101.2	116.7	208.6	2.1	6.0
V	6.7	8.8	30.2	4.0	13.1
VI	55.7	107.3	148.2	9.8	3.3
VII	4.5	5.0	17.6	1.5	13.4
VIII	4.9	5.6	19.3	1.9	13.2
IX	8.6	9.7	34.0	1.7	13.4
X	2.5	2.9	10.0	2.1	13.2
XI	4.8	6.5	21.9	4.4	12.9
XII	5.4	7.0	22.7	3.8	12.5
Philippines	281.5	447.9	739.0	6.9	5.1

Remarks and Source: Refer to Table 5.3.
Aquaculture: Brackishwater and freshwater fishpond, fish pen and cage and sea farming.

Table 5.7 FISH PRODUCTION, DOMESTIC DEMAND AND BALANCE BY REGION

Unit : 10^3 tons

Region	1983			1990			2000		
	Supply (S)	Demand (D)	Balance (S-D)	Supply (S)	Demand (D)	Balance (S-D)	Supply (S)	Demand (D)	Balance (S-D)
NCR	177	261	-84	246	323	-77	386	410	-24
I	30	104	-74	51	124	-73	60	155	-95
II	5	67	-62	6	83	-77	10	108	-98
III	92	155	-63	166	189	-23	209	241	-32
IV	336	207	+129	375	257	+118	488	335	+153
V	106	102	+4	109	125	-15	132	160	-28
VI	316	144	+172	396	175	+221	467	220	+247
VII	51	121	-70	53	144	-91	71	178	-107
VIII	46	79	-33	47	95	-48	61	120	-59
IX	257	77	+180	320	94	+226	437	120	+317
X	67	87	-20	70	109	-39	80	143	-63
XI	62	109	-47	76	135	-58	121	175	-54
XII	66	69	-3	84	85	-1	114	112	+2
Total	1,611	1,582	+28	2,001	1,937	+64	2,634	2,475	+159

6. SHORTAGE OF ICE PLANTS AND COLD STORAGES

6. SHORTAE OF ICE PLANTS AND COLD STORAGES

6.1 Shortage of Ice Plants

Demand for ice in the fisheries sector was projected according to the following formula:

$$D_j = \sum_k r_k \cdot f_j \cdot Y_{kj}$$

where,

D_j : Ice demand in fisheries sector in Region j
f_j : Fresh fish ratio in Region j
Y_{kj}: Fish production by fisheries activities in Region j
r_k : Ice/fish ratio by fisheries activities as follows:
- k=1 : 0.8 for fishing of commercial fisheries
- k=2 : 0.5 for fishing of municipal fisheries
- k=3 : 0.4 for harvesting of aquaculture
- k=4 : 0.9 for inter-provincial flow of fresh fish
- k=5 : 0.6 for inter-municipal flow of fresh fish within the province
- k=6 : No use of ice in the internal flow of fresh fish within the municipality

The ice/fish ratio was estimated based upn the field survey of the Study as shown in Fig. 6.2 and Tables 6.1 to 6.3.

The fresh fish ratio by Region was estimated according to the following formula:

$$f_j = FY_j / Y_j$$

$$FY_j = Tx \sum_i Y_{ij} \cdot f_i / \sum_i \sum_j Y_{ij} \cdot f_i$$

where,

f_j : Fresh fish ratio in Region j
f_i : Fresh fish ratio for species i
Y_j : Fish production in Region j
Y_{ij} : Fish production by species in Region j
FY_j : Fresh fish production in Region j

T : Total fresh fish production in the country
(Estimated by fish distribution study by AOC)

The fresh fish ratio by species is shown in Table 6.4 and fish production by species and by fishing ground in 1982 is shown in Fig. 6.1 The fresh fish ratio by Region in 1983 was estimated as shown in Table 6.5 and the maximum fresh fish ratio in 2000 was estimated considering the following factors:

a. Acetes (Alamang) are consumed exclusively as fish paste

b. Certain fish species are strongly preferred as processed fish

c. Other species preferred as fresh fish

d. Fish distribution system is advanced in NCR, where people prefer high quality fresh fish to processed fish even though the same species of fish are consumed in a processed form in other Regions.

The demand for ice in the fisheries sector is shown in Table 6.7 at the rated capacity of ice plant, assuming that the number of operational days of the plants are 300 days in a year and the operational ratio is 50%.

The ice supply was estimated based upon the rated capacity of the existing ice plants and proportion of ice sales to the fisheries sector, i.e., 42% in NCR and 80% in other Regions. This proportion in NCR was derived from "Philippine Ice and Cold Storage Industry Study, Dec. 1982, DBP", while that for other Regions was estimated according to the data collected in the field survey. The rated capacity of the operating ice plants for all sectors in 1983 is shown in Table 6.6.

The insufficiency in ice plant capacity for the fisheries sector was estimated as shown in Table 6.7 and Figs. 6.3 and 6.4, assuming that no additional investment in ice plants will be made after 1983.

The supply and demand for ice for the fisheries sector was almost balanced in 1983 in the country as a whole, but there were significant Regional differences of balance because of limitations of ice transportation between Regions. The surplus in plant capacity was evidenced in Luzon Island, where the overproduction of ice was 1,380 tons/day in NCR and 1,003 tons/day in Region III, while a shortage of 1,321 tons/day in Region IX and 925 tons/day in Region VI was noted in 1983.

For the country as a whole, the shortage is likely to increase up to 3,142 tons/day in 1990 and 7,122 tons/day in 2000 at a rated capacity assuming that no