Overview of the Fisheries Sector in Indonesia

ADP Working Paper No. 3

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by

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TABLE OF CONTENTS

GLOSSARY	iv
LIST OF FIGURES	v
LIST OF TABLES	vi
FOREWORD	vii
EXECUTIVE SUMMARY	ix
CHAPTER ONE **PHYSICAL ENVIRONMENT**	1
CHAPTER TWO **ROLE OF FISHERIES**	1
EMPLOYMENT AND ECONOMIC IMPACT	1
DOMESTIC CONSUMPTION	2
CHAPTER THREE **GOVERNMENT PLANS**	3
PELITA VI	3
EXTERNAL ASSISTANCE	4

CHAPTER FOUR
FISHERIES PRODUCTION

5

PRODUCTION BY SUBSECTOR 5
MARINE CAPTURE 7
Geographic Distribution 7
Human Resources 7
Fishing Fleet 8
Fishing Methods and Gear 8
Production by Species 9
Fishing Ports and Landing Sites 10
Vessel Construction and Repair 11
Expansion Potential 11
INLAND CAPTURE 12
AQUACULTURE 14
Brackishwater Ponds 14
Freshwater Ponds 16
Freshwater Cages 18
Paddy/Fish Culture 19
Marine Culture 19

CHAPTER FIVE
PROCESSING, DISTRIBUTION AND MARKETING

21

ICE PLANTS 21
FREEZING/COLD STORAGE 21
CANNERIES 22
OTHER PROCESSING 23
FISH MEAL PLANTS 23
AUCTION HALLS 24
DOMESTIC MARKETING AND DISTRIBUTION 24
INDUSTRY ASSOCIATIONS 25

CHAPTER SIX
FISHERIES EXPORTS AND IMPORTS 26

INDUSTRY PERFORMANCE 26
INSPECTION AND QUALITY CONTROL 27
EXPORT PROSPECTS 28

CHAPTER SEVEN
PUBLIC ADMINISTRATION AND SUPPORT SERVICES 29

FISHERIES ADMINISTRATION 29
INTER-GOVERNMENT LINKAGES 30
STATE PRODUCTION ENTERPRISES 30
NUCLEUS ESTATES 31
COOPERATIVES 32
EDUCATION 32
EXTENSION 32
RESEARCH 33
ENFORCEMENT 34

CHAPTER EIGHT
ENVIRONMENTAL CONSIDERATIONS 35

COASTAL ZONE MANAGEMENT 35
EFFLUENT STANDARDS 36
RESOURCES BASED FISHERIES MANAGEMENT 36

BIBLIOGRAPHY 37

ANNEX 1: TABLES

GLOSSARY

ADB	Asian Development Bank
CPUE	Catch Per Unit Effort
DGF	Directorate General of Fisheries
EEZ	Exclusive Economic
GDP	Gross Domestic Product
MSY	Maximum Sustainable Yield
NTT	Nusa Tenggara Timur
Pelita VI	Indonesian Five Year Development Plan (1994 - 1998)
PJPT II	Second 25 year long-term development plan
PL	shrimp post larvae
Rp.	Rupiah (Indonesian Currency - exchange rate, one US$ to Rp. 2100, in February 1994)
tambak	brackishwater aquaculture pond
US	United States

Note: Where possible official Indonesian Government statistics are used. While these numbers are generally accurate and very helpful in defining trends, the difficulty of their collection and compilation is significant. As a result, caution is urged in their application especially in regard to industrial production which is generally believed to be under reported. Also fisheries statistics are gathered at the point of landing. Thus, caution is warranted when using these statistics to determine specific locus of capture or culture.

LIST OF FIGURES

Figure 1	Map of Indonesia
Figure 2	Employment, 1991
Figure 3	Projected Annual Per Capita Fish Consumption, 1994 - 1998
Figure 4	Product Disposition, 1991
Figure 5	Projected Fisheries Production, Pelita VI, 1994 - 1998
Figure 6	Fisheries Production by Subsector, 1991
Figure 7	Projected Composition of Production, 1998
Figure 8	Projected Growth Rate of Production by Commodity, 1994 - 1998
Figure 9	Projected Growth Rate of Production by Subsector, 1994 - 1998
Figure 10	Projected Export Volume, 1994 - 1998
Figure 11	Projected Export Value, 1994 - 1998
Figure 12	Total Catch by Principal Producers in 1991
Figure 13	Actual Fisheries Production, 1987 - 1991
Figure 14	Production by Region, 1991
Figure 15	Aquaculture Production, 1987 - 1991
Figure 16	Aquaculture Production by Subsector, 1991
Figure 17	Marine Production, 1987 - 1991
Figure 18	Vessel Type, 1991
Figure 19	Marine Production by Gear Type, 1991
Figure 20	Marine Production by Species, 1991
Figure 21	Marine Resource Potential and Production, 1991
Figure 22	Marine Resource Potential and Production, 1991
Figure 23	Tambak Production by Species, 1991
Figure 24	Tambak Production by Province, 1991
Figure 25	Freshwater Pond Production by Province, 1991
Figure 26	Freshwater Pond Production by Species, 1991
Figure 27	Paddy/Fish Production by Province, 1991
Figure 28	Paddy/Fish Production by Species, 1991
Figure 29	Export/Import Value, 1987 - 1991
Figure 30	Export/Import Volume, 1987 - 1991
Figure 31	Export Value by Commodity, 1991
Figure 32	Export Value by Destination, 1991
Figure 33	Organization Chart, Directorate General of Fisheries

LIST OF TABLES

Table 1	Projected Fisheries Consumption, Repelita VI
Table 2	Projected Volume of Fisheries Exports, Repelita VI
Table 3	Projected Fisheries Production by Commodities, Pelita VI
Table 4	External Assistance to the Fisheries Sector, 1993
Table 5	Fisheries Production by Sub Sector by Year, 1987 - 1991
Table 6	Projected Fisheries Production , Pelita VI
Table 7	Fisheries Production by Sub Sector and Province, 1991
Table 8	Number of Fishermen and Fishfarmers, 1987 - 1991
Table 9	Fisheries Production per Fisherman by Area, 1991
Table 10	Number of Marine Fishing Crafts by Size, 1987 -1990
Table 11	Gear Type and Production, 1991
Table 12	Marine Fisheries Production by Major Species, 1991
Table 13	Fishing Ports in Indonesia, 1993
Table 14	Number of Fish Landing Sites in Indonesia, 1992
Table 15	Fishing Crafts Needs, 1991
Table 16	Marine Resources Potential and Production, 1991
Table 17	Area Under Culture by Type of Culture and Province, 1991
Table 18	Shrimp Culture Technology in Indonesia, 1993
Table 19	Cold Storage and Canning Plants, 1991
Table 20	Disposition of Fisheries Production, 1991
Table 21	Disposition of Marine Fisheries Production, 1987 - 1991
Table 22	Disposition of Inland Capture Fisheries Production, 1987 - 1991
Table 23	Disposition of Aquaculture Production, 1987 - 1991
Table 24	Export Volume, Value and Average Price of Fisheries Products, 1987 - 1991
Table 25	Balance of International Trade of Fisheries Products, 1981 - 1991
Table 26	Laws and Regulations
Table 27	State Fisheries Enterprises, 1990
Table 28	List of Fisheries School and Fisheries Academies, 1991

FOREWORD

The Agribusiness Development Project (ADP) is commissioning four sector-specific background/baseline papers during the first year of project implementation (1993/94). These papers are intended to provide an overview of the major agriculture sectors in which ADP works: fisheries, horticulture, livestock, and estate crops. The objectives of the papers are to:

- provide an overview of each sector as contextual background for the project's agribusiness development activities;
- summarize available data and reports regarding each sector and the potential priorities for agribusiness development in the sector;
- identify major constraints and opportunities influencing agribusiness development in the sector; and,
- provide key baseline information on each of the major ADP activity areas -- the policy and regulatory environment, public sector support services, and business associations.

We asked the authors of these reports to work primarily with secondary information and to be as objective as possible in presenting the perceived strengths and weaknesses of the available statistics. We also asked that the length of the reports be kept to a maximum of twenty-five pages so that presentation is compact and to the point. These reports are the starting point for diagnosing constraints and opportunities and, as such, asked the authors to concentrate on broad areas of concern rather than on specific project programming options.

The background paper on the fisheries sector is the first of these reports to be completed. The report has been reviewed and discussed by representatives from both the private and public sector in Indonesia. We appreciate the excellent input received from those who took the time to comment and have endeavored to respond to all of the issues raised.

EXECUTIVE SUMMARY

Physical Environment: Indonesia is the world's largest archipelago with over 13,000 islands and has seas covering 5.8 million square kilometers, equivalent to 75% of the nation's total area. The coastline, stretching over 80,000 kilometers, is the world's longest.

Role in GDP: Fisheries share of GDP, although modest, has grown by over 40% in the last 15 years from 1.4 to 2.0%.

Employment: Fisheries provides a disproportional large contribution to employment giving direct jobs to over 4.0 million workers. Direct and indirect jobs are about 5% of the total labor force. Direct employment is 46% in aquaculture, 42% in marine capture and 12% in inland capture.

Consumption: With 1993 per capita fish consumption of about 17.0 kg, fish is the most important protein source in the Indonesian diet. Per capita fish consumption varies greatly by region, ranging from 8.7 kg on Java to 74.4 kg in Maluku/Irian. Pelita VI targets an annual 2.4% increase in consumption reaching 19.2 kg per capita in 1998.

Form of Consumption: Over 90% of fish is consumed domestically. Currently fisheries production is utilized 54% fresh, 38% prepared (dried/salted, boiled, fermented), 6% frozen, 1% canned and 1% fish meal.

Production: With total 1991 production of 3.3 million metric tons, Indonesia had the eighth largest fisheries landings in the world contributing 3.3 percent of global yield. Source of production was marine capture 76 percent, aquaculture 15 percent and inland capture 9 percent.

Production Growth: Over the period 1981 to 1991, fisheries production grew at an annual rate of 5.8 percent increasing from 1.91 to 3.3 million metric tons.

Marine Production: Marine capture landings in 1991 totaled 2.5 million metric tons with landings from Sumatra (29 percent), Java (23 percent), Sulawesi (18 percent), Bali/NTT (10 percent) and Maluku/Irian (10 percent).

Marine Production Composition: Marine harvest is comprised of 87 percent fin fish, 6 percent crustaceans, 4 percent seaweed, and 2 percent mollusca. In order of production, groups with yields over 100,000 metric tons per year include: (1)

scads; (2) eastern little tuna; (3) Indian oil sardinella; (4) Indian mackerels; (5) *Fringescale sardinella*; (6) anchovies; (7) tunas; (8) seaweeds.

Fleet: Indonesia has the world's largest fishing fleet with over 350,000 vessels of which 65 percent are non-motorized, 21 percent outboard motored and 13 percent inboard powered. Over 95 percent are less than 5 gross tons. There are approximately 1,000 foreign registered vessels fishing under license in the Indonesian EEZ. On a yield basis, the most production is by purse seiners followed by drift gill nets.

Infrastructure Support: There are 2 international (Jakarta; Kendari), 6 archipelagic, and 20 coastal fishing posts in the country as well as 583 fish landing sites. Auction halls totalling over 600 are located at all fishing ports and landing sites. There may be a need for additional ports and landing sites in eastern Indonesia. Also most ports, landing sites and auction halls would prefer to upgrade sanitary and hygiene conditions. Domestic shipyards number approximately 185 of which 30 are in the public and 155 the private sectors. Adequate ship building capacity exists for vessels of less than 50 gross tons. However, production constraints are felt for vessels of over 50 gross tons with serious shortfalls in the 50 to 100 gross tons size range.

Marine Production Potential: DGF's estimate of the MSY for the major commercial species of fish and crustaceans in Indonesian waters is 4.2 million metric tons. The 1991 production was about 55 percent of MSY. In the Malacca Strait and north coast of Java harvest in excess of MSY is taking place, resources are being depleted and fisheries rehabilitation is needed. East and West Sumatra, South Sulawesi and Bali/NTT are heavily exploited with yields between 60 and 80 percent of MSY. Moderate growth potential exists in South Java, East Kalimantan and North Sulawesi. The greatest fisheries potential exists in Maluku/Irian and South/West Kalimantan. On a species basis, carangid stocks are being over fished, shrimp heavily fished, most pelagic and demersal stocks moderately exploited and good expansion potential remains for tuna, cephalopods and seaweed.

Inland Capture Fisheries: In 1991, production for inland capture fisheries was 0.3 million metric tons with catch by area Kalimantan (52 percent), Sumatra (29 percent), Sulawesi (10 percent) and Java (8 percent). Production growth was only 1.3 percent per annum over the period 1987 to 1991. Given low yield per fisherman, high level of exploitation and increasing pressure from habitat loss and pollution, prospects for growth of the subsector are limited.

Aquaculture Production: In 1991, aquaculture production of 0.5 million metric tons came from brackishwater ponds (tambaks) (62 percent), freshwater ponds (21 percent), paddy/fish fields (16 percent) and other (1 percent). Between 1987 and 1991 aquaculture production grew at an overall annual rate of 6.6 percent with the highest annual growth rate of 11.0 percent recorded by tambaks.

Tambaks: There are approximately 300,000 hectares of tambaks in Indonesia with over 85 percent located in the provinces of South Sulawesi, East, Central and West Java and Aceh. Total 1991 production of about 323,000 metric tons was 44 percent milkfish and 36 percent tiger or white shrimp. On a value basis tiger and white shrimp account for over 50 percent of sales. For shrimp culture, approximately 85 percent of farmers use extensive, 10 percent semi-intensive and 5 percent intensive culture methods. Between 1987 and 1991 annual growth rate of production was 5.9 percent for milkfish and 30 percent for shrimp. The incidence of shrimp disease is believed to have dramatically slowed growth in 1992 and 1993. Milkfish fry are sourced from the wild, while most shrimp fry come from the country's over 300 hatcheries.

Freshwater Ponds: Indonesia has approximately 54,000 hectares of freshwater ponds with over 90 percent located on Java, Sumatra and Sulawesi. Total 1991 production of about 107,000 metric tons was 34 percent common carp, 14 percent tilapia, 11 percent Java barb and 10 percent gourami. Sixty percent of production came from West Java. The average pond size is small with 78 percent of units less than 0.1 hectare However, the total number of farmers at 1.2 million is large representing 64 percent of all aquaculturists. Between 1987 and 1991 annual growth rate of production was only 2.3 percent. Fry comes from natural breeding in ponds and hatcheries.

Other Freshwater Culture: Although characterized by limited production (less than 1 percent of national output) and negligible growing area, significant expansion potential exists for cage culture. Culture of ornamental fish also exhibits good development potential. Paddy/fish culture in 1991 provided 81,000 metric tons from 114,000 hectare Over 80 percent of paddy/fish culture is in East and West Java. Perhaps as a result of lack of compatibility with terrestrial crop systems, production and per hectare yields of paddy/fish culture over the last few years have declined.

Seaweed and Other Marine Culture: Seaweed production in 1991 was 97,000 metric tons. Over 80 percent of production is recorded from Bali. Production increased annually by 13.6 percent from 1985 to 1990 and then marginally declined. Declines are thought to be related to market considerations. Provided

marketing arrangements can be worked out, excellent seaweed culture and downstream extractive industry potential exist. Excellent development potential is also available for pearl, marine fin fish and mollusc culture.

Freezing/Cold Storage: There are approximately 175 seafood freezing plants with a capacity of about 900 metric tons/day. Cold storage capacity is about 40,000 metric tons. Overall national freezing capacity utilization is estimated at 60 percent. The situation in areas such as East Java and North Sumatra is even more depressed with 1993 utilization estimated at less than 40 percent largely due to decreased shrimp production from farms hit by disease.

Canneries: Indonesia is one of the largest tuna canners in the world with 12 of the country's 22 fish canneries concentrating almost exclusively on tuna. Others also can mackerel and sardines. Capacity utilization for canneries appears to be only 30 percent of capacity. Low utilization is due to: (1) lack of coordination between canneries and sources of raw materials; (2) limited domestic demand; and (3) lack of export marketing arrangements.

Other Processing: About 1.3 million metric tons of fish (40 percent of production) is processed using traditional methods such as drying, salting, smoking, boiling and fermenting. Modern mechanized factories produce about 30 percent and approximately 4,300 traditional units 70 percent of processed fish products. In 1991, approximately 50 fish meal plants operating at only about 10 percent of capacity produced about 11,000 metric tons of product.

Industry Organizations: Major fisheries associations include: (1) Indonesian Fisheries Federation (GAPPINDO); (2) Cold Storage Association; (3) Tuna Association; (4) Union of Indonesian Aquaculture Producers; and (5) Canners Association. There are numerous other smaller industry organizations. GAPPINDO, as an umbrella group for more than 150 public and private interests, is especially active in representing the interests of its membership.

Exports: Fisheries exports have recorded impressive growth. From 1987 to 1991 export value of fisheries products increased at an annual rate of 28 percent reaching $1,256 million. Fisheries products which were 1 percent of agriculture exports in 1968 were 30 percent by 1991. Volume of fisheries exports over the same period grew by an annual 30.8 percent reaching over 400,000 metric tons in 1991. On a value basis, shrimp exports represent about 60 percent and tuna 15 percent of fisheries exports. By value, exports are sent to Japan (51 percent), USA (15 percent), Singapore (10 percent) and Thailand (7 percent).

Imports: Fisheries imports are very small, equivalent to only 4 percent of export value. Imports in 1991 were only 72,000 metric tons worth $52 million. The major import item is fish meal.

Quality Control: Implementation and maintenance of quality control standards is of paramount importance for export development and to promote domestic fish consumption. The Government through the Departments of Agriculture, Trade and Health and with strong private sector assistance has been very active in the establishment of standards, quality control laboratories, training programs and inspection and licensing systems. Continuation of these programs is necessary for industry growth.

Directorate General of Fisheries (DGF): DGF within the Department of Agriculture is responsible for the administration, management and development of fisheries in Indonesia. Responsibilities include collection of statistics, applied research, planning, fisheries management, training, provision of infrastructure facilities and development and control of state fisheries enterprises. These tasks are executed by approximately 5,000 workers located at the Jakarta headquarters, all 27 provinces, 5 fisheries stations and the fishing ports.

Other Fisheries Institutions: Fisheries education is offered at: (1) 10 private and 10 public universities; (2) 4 fisheries academies; (3) 11 senior fisheries high schools; and (4) 5 adult training centers. Public sector training institutions are the responsibility of the Agency for Agriculture Education, Training and Extension (BPLPP).

Research: The Agency for Agricultural Research and Development (AARD), a specialized agency of the Department of Agriculture, coordinates research through the Central Research Institute for Fisheries (CRIFI). CRIFI with a staff of over 800 conducts research in marine capture, freshwater culture and coastal aquaculture through 13 research stations located throughout the country. Other research is undertaken the National Oceanographic Institute (LON), the Traditional Fish Processing Center, universities and provincial governments.

Enforcement: Except for processing industries, enforcement of Indonesia's fisheries regulations and laws governing resource exploitation are the responsibility of the navy, customs and police services.

Environmental Concerns: Major areas of environmental concern are the need for : (1) better coastal zone management; (2) establishment of standards and

enforcement of effluent discharge standards for fisheries industries; (3) resource-based fisheries management; and (4) fisheries rehabilitation.

PELITA VI: The Government's sixth year development plan (Pelita VI), covering the period 1994 to 1998, forms the first step in the second 25 year long term development program (PJPT II). Major objectives include: (a) improvement in human resources; (b) increased quality and quantity of seafood; (c) increased employment opportunities; and (d) increased industrial growth and foreign exchange earnings.

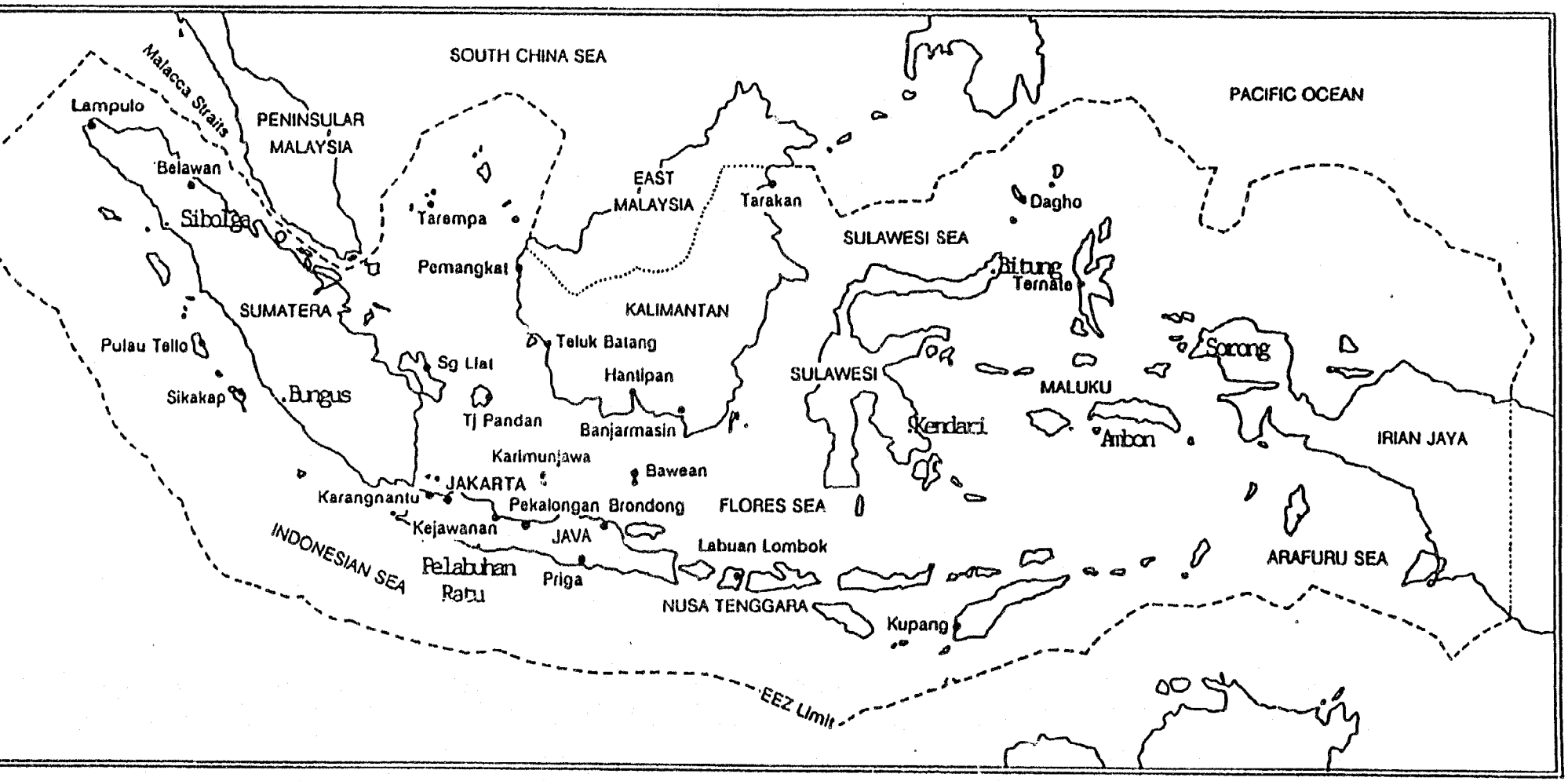
PELITA VI Production Projections: Fisheries production over the period 1994 to 1998 is projected to grow at an annual rate of 4.9 percent rising from 3.9 to 4.7 million metric tons. Production will come 70 percent from marine capture and 25 percent from aquaculture. Production in 1998 by commodities is 59 percent non-tuna ocean fish, 18 percent inland fish, 10 percent tuna, 9 percent shrimp and 3 percent seaweed. Tuna is projected to increase annually by 10.7 percent, shrimp by 5.9 percent, inland fish by 4.8 percent, non-tuna ocean fish by 4.0 percent and seaweed by 2.1 percent. Fastest growth by subsector is for cage culture and marine aquaculture.

PELITA VI Export Projections: Exports from 1994 to 1998 will grow by both volume and value at 9.7 percent per year. Reaching a volume of 800,000 metric tons with a value of $2,134 million in 1998.

PELITA VI Funding: Total cost of PELITA VI is estimated at Rp 1,849 billion ($885 million) consisting of bank credit (48 percent), central government funds (21 percent), private equity investment (17 percent), external assistance (10 percent) and local government contribution (5 percent).

FIGURE 1

Map of Indonesia Showing Location of Major Fishing Centers



rce: Fishery Export Industry Profile, ADB/Infofish, 1991.

CHAPTER ONE
PHYSICAL ENVIRONMENT

Indonesia is a geographically diverse country comprising the world's largest archipelago (see Figure 1). Seas cover 75 percent of the nation's total 7.7 million square kilometers. The country has over 13,000 islands with a land area of 1.9 million square kilometers. Indonesia measures 5,400 kilometers from east to west and 1,900 kilometers from north to south. Sea space is divided into territorial waters, archipelagic waters and the Exclusive Economic Zone (EEZ). Indonesia's territorial waters cover 0.3 million square kilometers and archipelagic waters 2.8 million square kilometers. With promulgation of the 200 nautical mile EEZ in 1983, Indonesia's jurisdiction was extended by 2.7 million square kilometers to a total sea area of 5.8 million square kilometers. Stretching 82,600 kilometers, Indonesia's coastline is one of the longest in the world. Inland waters consist of swamps, rivers and lakes. Aquaculture area is 458,499 hectares of which 290,933 hectares are brackishwater ponds (tambaks), 113,731 hectares mixed paddy/fish areas and 53,835 hectares freshwater ponds.

With a 1991 population of 186 million growing at an annual rate of 1.6 percent, Indonesia is the world's fourth most populous nation. Java, Bali, Madura and Lombok which account for 7 percent of land mass contain 70 percent of population. Land and sea use on these islands is at or exceeding ecological optimums while resources in other areas generally remain underutilized.

CHAPTER TWO
ROLE OF FISHERIES

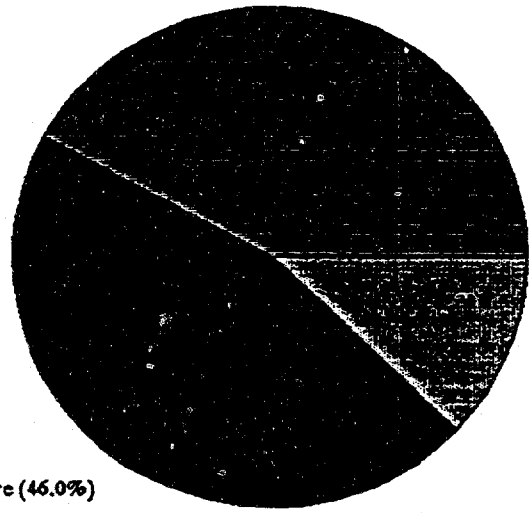
EMPLOYMENT AND ECONOMIC IMPACT

Agriculture's share of Indonesia's Gross Domestic Product (GDP) is about 20 percent and that of fisheries 2.0 percent. Over the period 1981 to 1991, fisheries production grew at an annual rate of 5.8 percent, increasing from 1.91 million metric tons to 3.35 million metric tons. For comparison, GDP average annual growth in constant prices over a similar period was 5.5 percent. As a result of rapid growth, fisheries share of GDP has increased over 40 percent in the last 15 years from 1.4 percent in 1976 to 2.0 percent in 1991.

Forming only a modest percent of GDP, fisheries makes a disproportionately large contribution to employment providing in 1991 direct jobs

FIGURE 2

EMPLOYMENT, 1991



SUBSECTOR	NUMBER EMPLOYED
1. Marine Capture	1,632,630
2. Aquaculture	1,845,968
3. Inland Capture	493,370
Total	3,971,968

Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

for 4.0 million workers. The labor force was employed 46 percent in aquaculture, 42 percent in marine capture and 12 percent in inland capture (see Figure 2). In addition, the fisheries sector provides employment for an estimated additional 100,000 workers in processing, transportation, marketing and support industries (eg. boat building, aquaculture feeds, etc.). Direct and indirect employment is equivalent to 5 percent of Indonesia's total labor force. Productivity of fisheries is low with 5 percent of the labor force providing only 2 percent of GDP. This low productivity is, in part, due to the part time nature of the work. Within the sector, comparison of production with employment reveals that marine capture produces 5.5 times more kg of fish per person than does aquaculture. This ratio narrows if value rather than volume is measured.

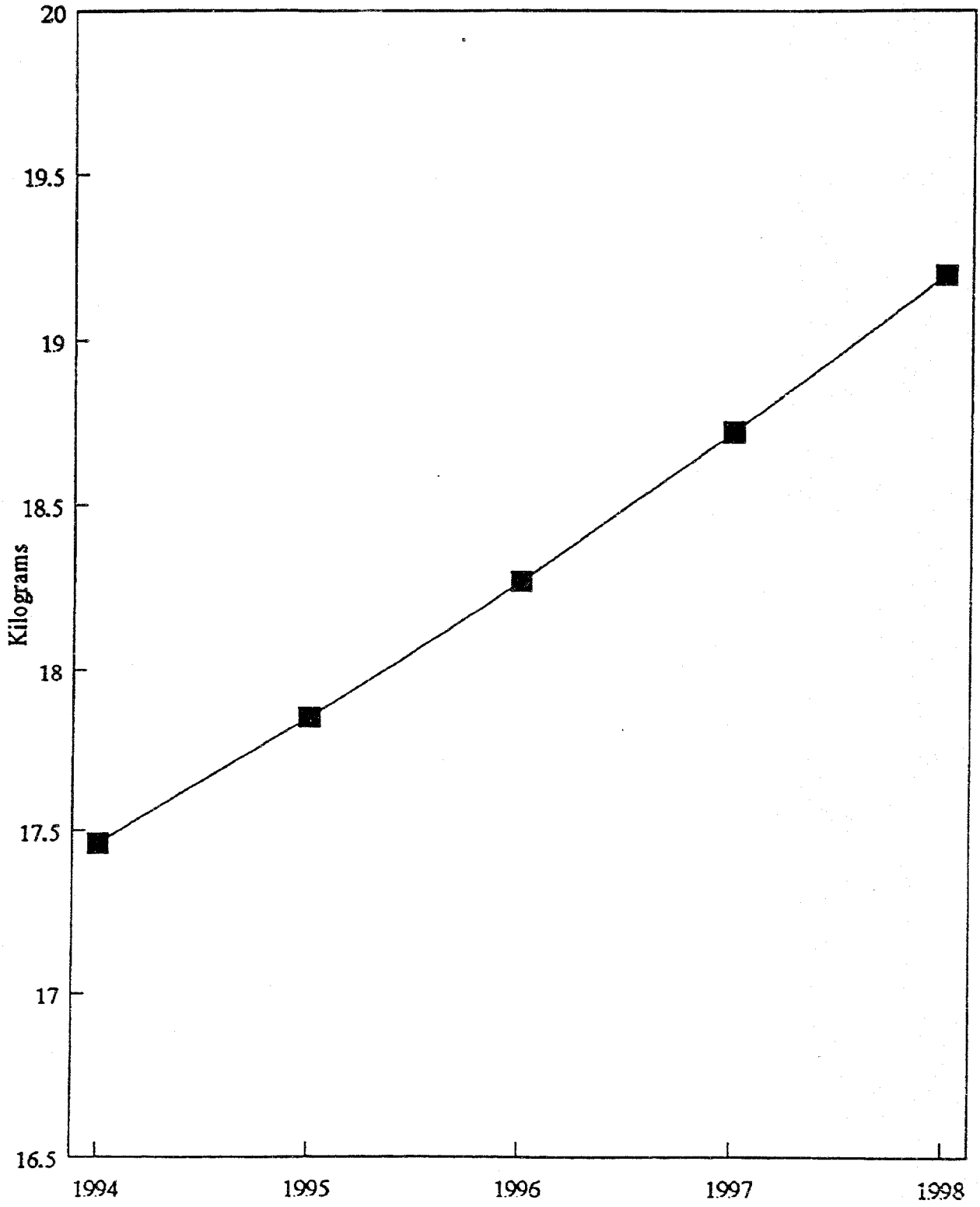
DOMESTIC CONSUMPTION

Fish is the most important protein source in the Indonesian diet contributing 63 percent of total animal protein intake. Continued increases in per capita fish consumption are considered essential to improved nutritional standards and resultant health benefits. Over the five year period 1987 to 1991, total fisheries production increased from 2.7 to 3.5 million metric tons, equivalent to an average annual growth rate of 4.6 percent. Due to population increase over the same period of 1.6 percent, on a per capita basis fish supplies rose from 15.5 kg in 1987 to 18.0 kg in 1991, equivalent to 3.0 percent per year, thus allowing for a steady growth in per capita fish consumption. Fish consumption varies greatly throughout the nation conditioned primarily by location and culture. For example 1991 per capita fish consumption in Maluku/Irian Jaya at 74.4 kg is over eight times that of Java's 8.7 kg. Per capita fish consumption has doubled over the last 30 years from 8 kg in 1960 to 15.9 kg in 1991. Per capita fish consumption has continued to increase and is expected to reach 17.5 kg in 1994. A 2.4 percent annual growth in consumption is projected over Pelita VI reaching 19.2 kg per capita in 1998 (see Figure 3 and Table 1).

Over 90 percent of fisheries production is domestically consumed with over half of the catch eaten fresh. In 1991, 54 percent of fisheries production was utilized fresh, 38 percent prepared (dried/salted, boiled, fermented, sauce, smoked), 6 percent frozen, 1 percent canned and 1 percent for fishmeal (see Figure 4). Fresh and prepared product, largely consumed domestically, represent 99 percent of inland capture, 97 percent of marine capture and 81 percent of aquaculture industries. Although domestic prices for fish have risen rapidly over the last decade, fish, and particularly cured products, remain the cheapest source

FIGURE 3

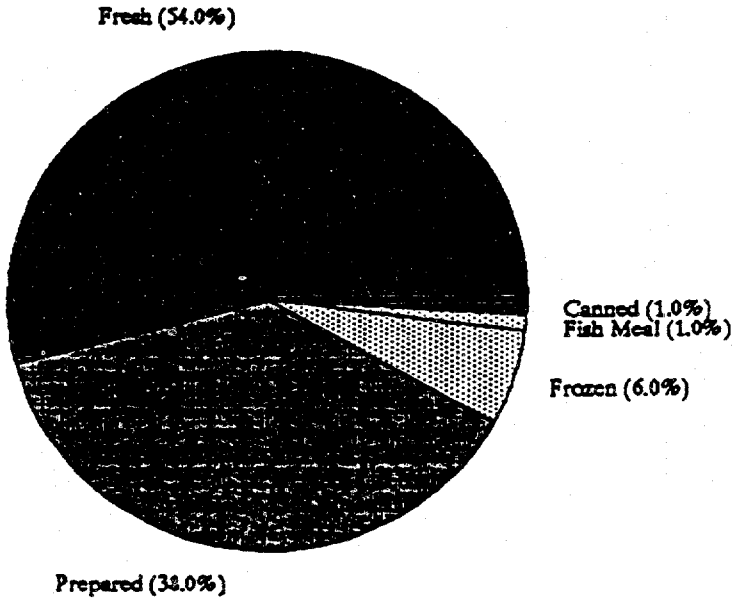
PROJECTED ANNUAL PER CAPITA FISH CONSUMPTION



Source: Fisheries Program Under Pelita VI (Rancangan Pelita VI Perikanan), 1993

FIGURE 4

PRODUCT DISPOSITION, 1991



Source: Estimate by author based on DGF 1991 statistics

of animal protein with per kg prices generally 40 percent below that of comparable unit prices for beef or chicken.

CHAPTER THREE
GOVERNMENT PLANS

PELITA VI

The Government's sixth five year development plan (Pelita VI) forms the first step in the second 25 year long-term development program (PJPT II). Pelita VI covers the period 1994 to 1998. The general pelita framework is drafted by the Directorate General of Fisheries (DGF) and after internal discussions passed on to the planning section of the Department of Agriculture for review and refinement. The revised draft pelita is then submitted to the national planning body (BAPPENAS) for final review and acceptance. Pelita VI acceptance is anticipated in late 1993 with implementation beginning in April 1994. Based on preliminary and not yet official documentation, the following information is provided.

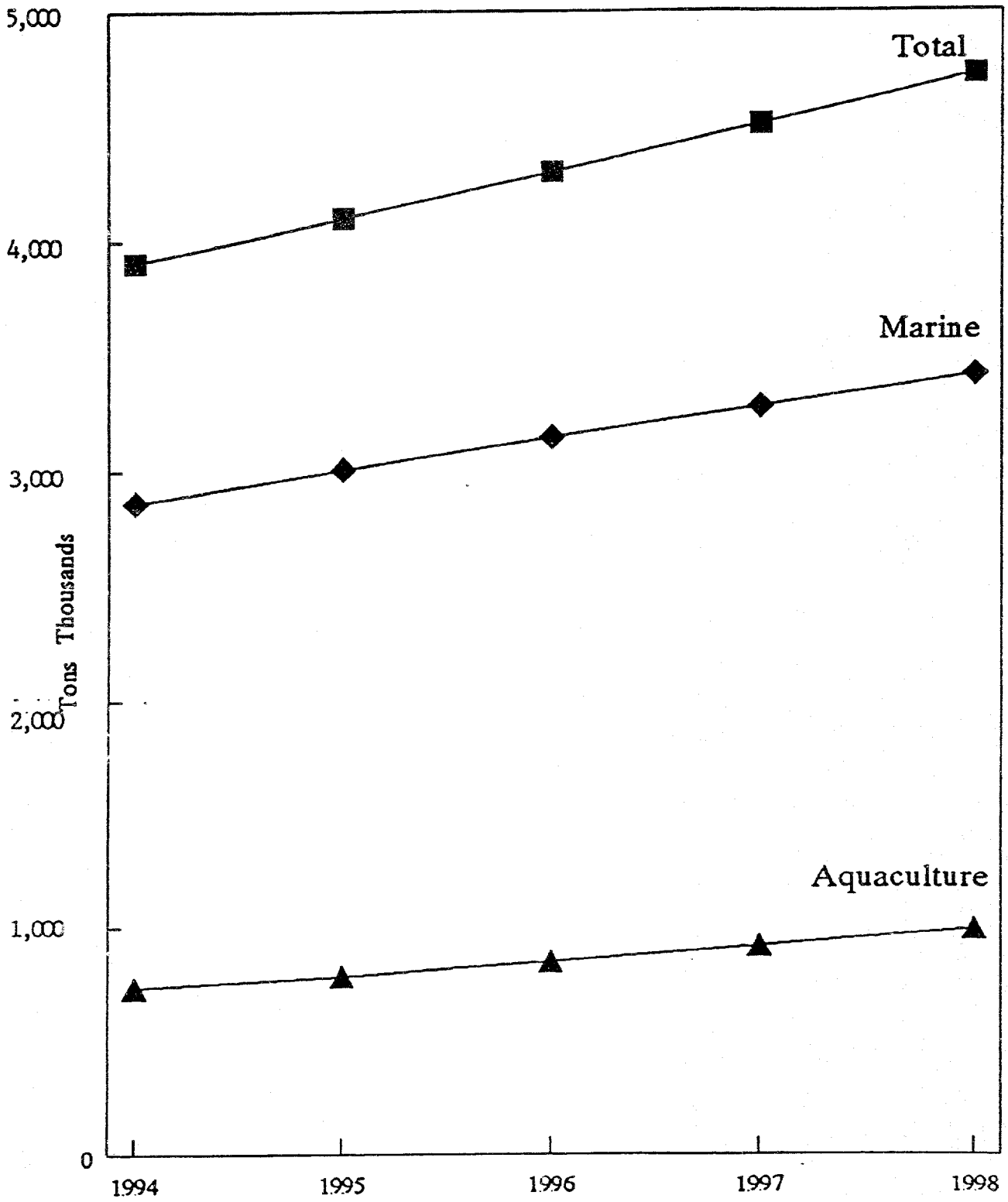
Pelita VI objectives are to:

1. Increase the quality of human resources and incomes in the fisheries sector by optimizing the exploitation of natural resources through application of knowledge and technologies which give due consideration to the environment and growth of production;
2. Increase the availability and distribution of seafood so as to improve its quality and nutritional value;
3. Increase productive employment and business opportunities;
4. Increase domestic industrial growth through processing of raw material and increase foreign exchange earnings.

Fisheries production over the period 1994 to 1998 is projected to grow at an annual rate of 4.9 percent rising from 3.9 million metric tons to 4.7 million metric tons (see Figure 5). This target is quite ambitious with 1998 marine production reaching 80 percent of the Maximum Sustainable Yield (MSY). Of the total, 70 percent of production comes from marine capture, 25 percent from tambaks and the remaining 5 percent from inland capture as compared with 1991, on a percentage basis, production from both marine and inland capture fisheries is projected to decline and that of aquaculture increase (see Figure 6). Composition

FIGURE 5

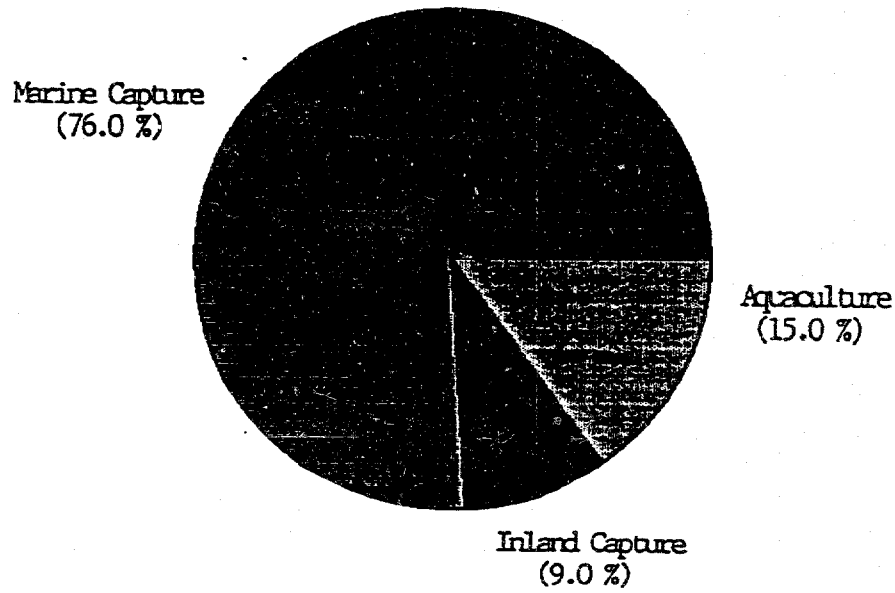
PROJECTED FISHERIES PRODUCTION PELITA VI



Source: Fisheries Program Under Pelita VI (Rancangan Pelita VI Perikanan), 1993

FIGURE 6

FISHERIES PRODUCTION BY SUB SECTOR, 1991

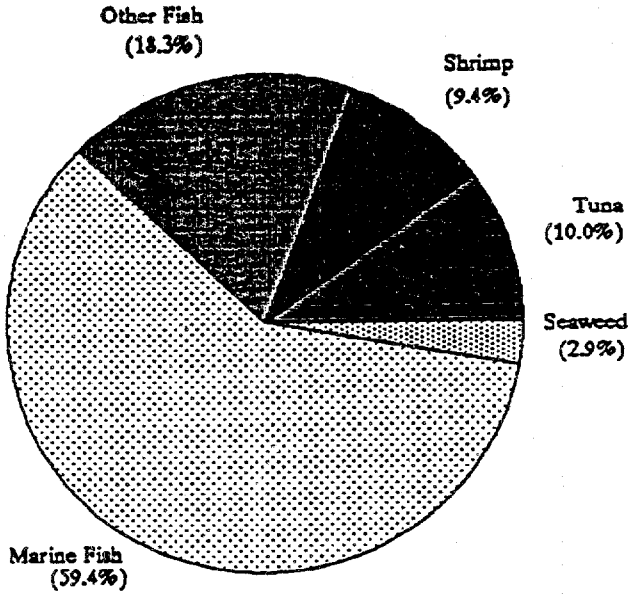


SUBSECTOR	PRODUCTION (mt)
1. Marine Capture	2,537,612
2. Aquaculture	517,512
3. Inland Capture	294,477
Total	3,349,601

Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

FIGURE 7

PROJECTED COMPOSITION OF PRODUCTION 1998



Source: Fisheries Program Under Pelita VI (Rancagan Pelita VI Perikanan), 1993

FIGURE 8

PROJECTED
GROWTH RATE OF PRODUCTION
BY COMMODITY
1994 – 1998

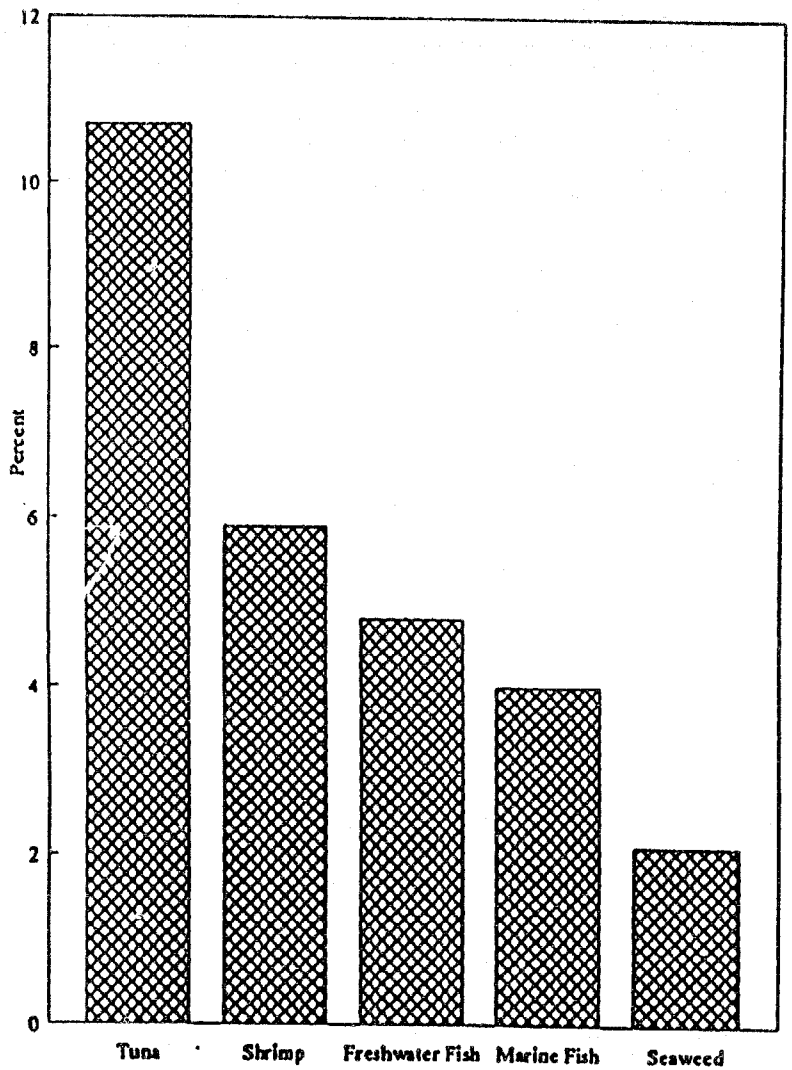
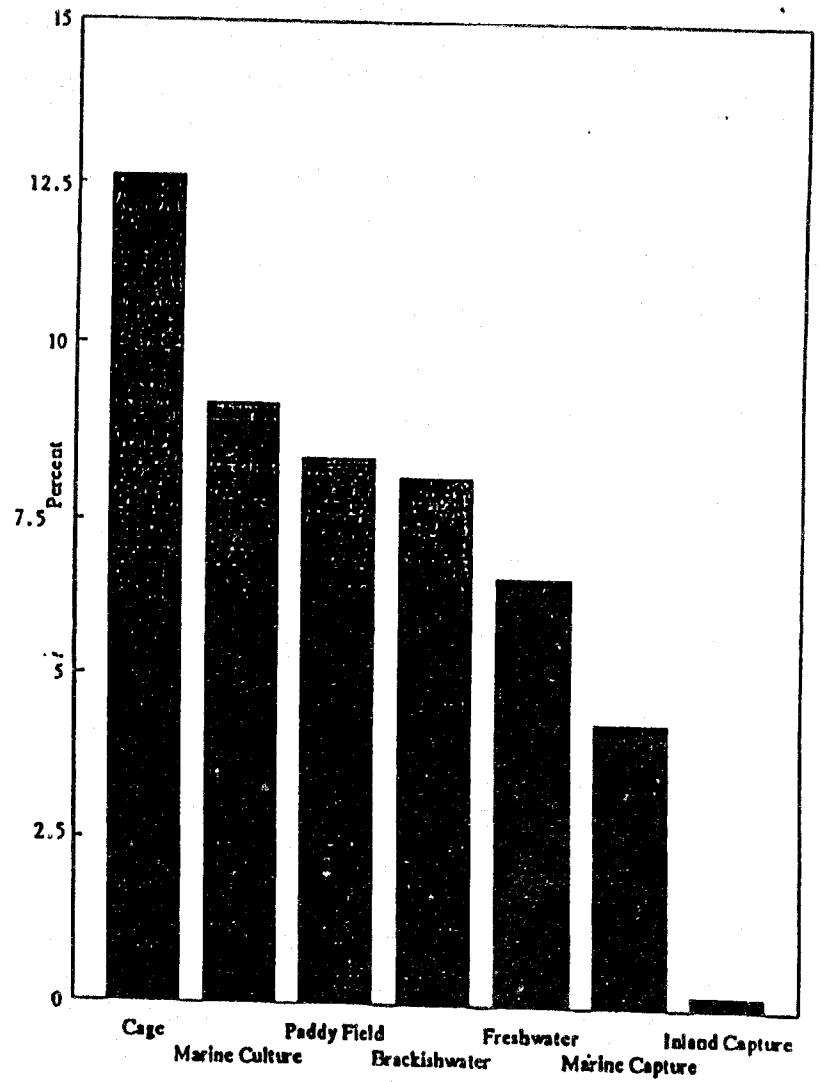


FIGURE 9

PROJECTED
GROWTH RATE OF PRODUCTION
BY SUBSECTOR
1994 – 1998



Source: Fisheries Program Under Pelita VI (Rancangan Pelita VI Perikanan), 1993

FIGURE 10

PROJECTED
EXPORT VOLUME
1994 – 1998

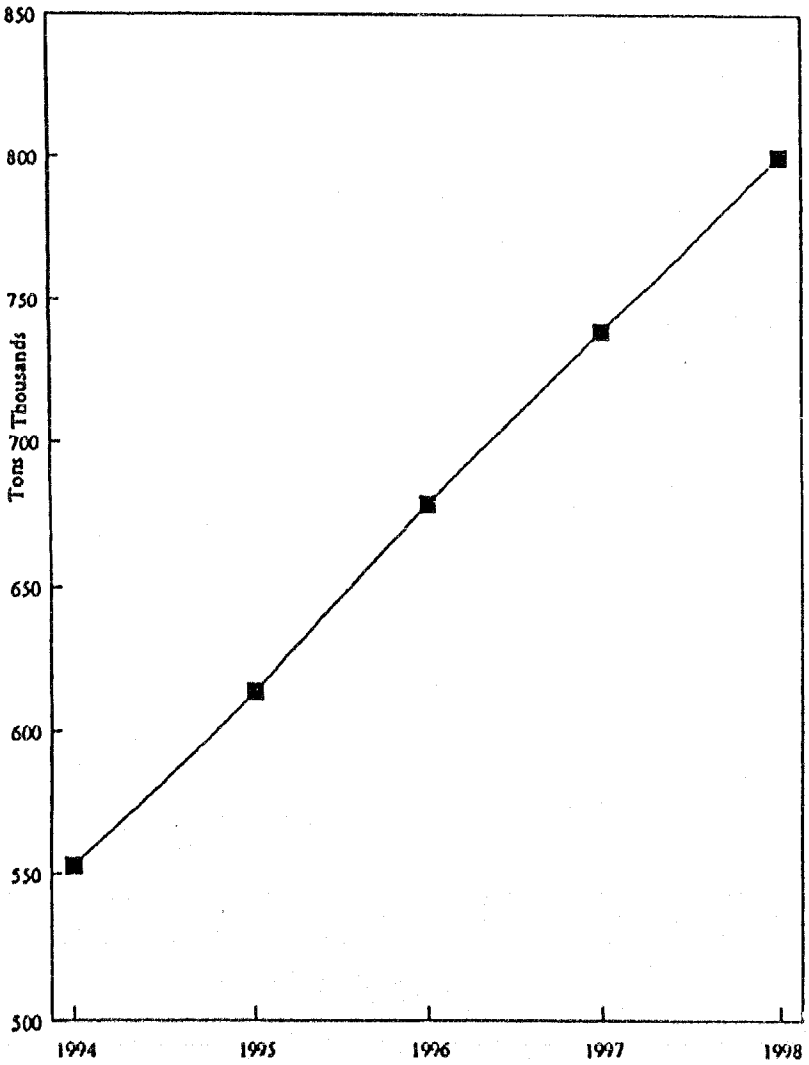
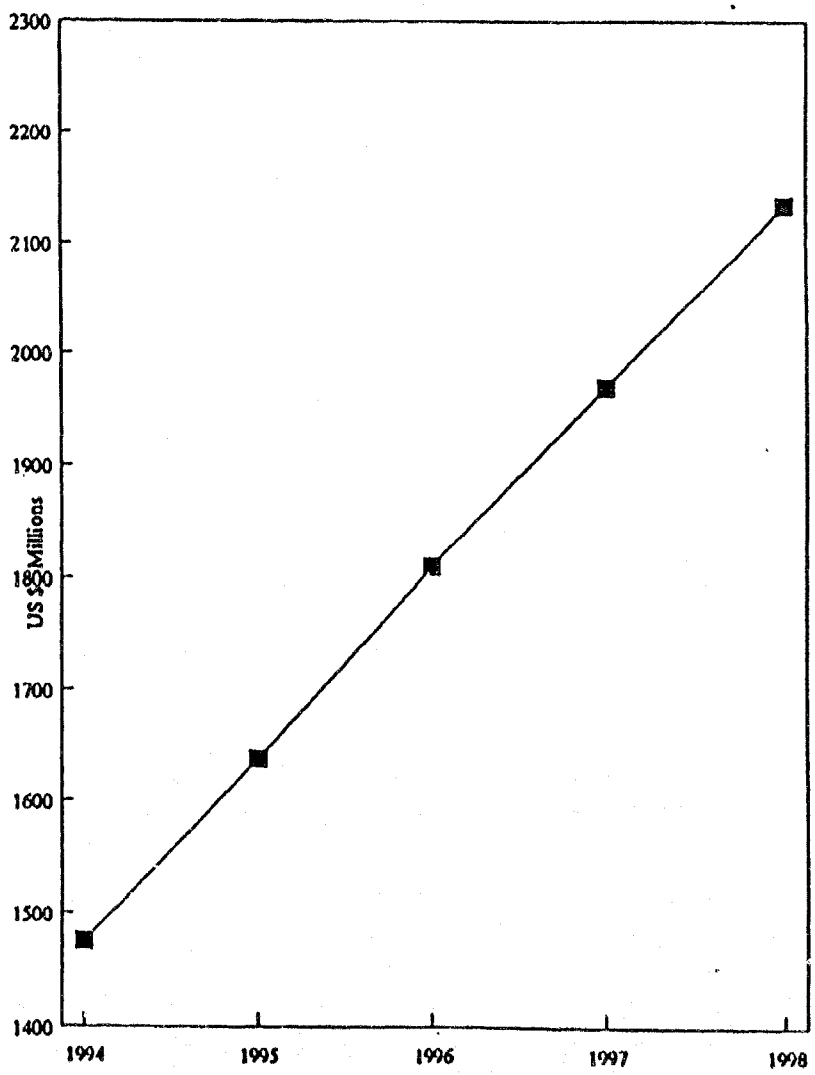


FIGURE 11

PROJECTED
EXPORT VALUE
1994 – 1998



Source: Fisheries Program Under Pelita VI (Rancangan Pelita VI Perikanan), 1993

of 1998 production by commodities is non-tuna ocean fish 59 percent, inland fish 18 percent, tuna 10 percent, shrimp 9 percent and seaweed 3 percent (see Figure 7).

Tuna is projected to increase annually at 10.7 percent, shrimp 5.9 percent, inland fish 4.8 percent, non-tuna ocean fish 4.0 percent and seaweed 2.1 percent (see Figure 8). Fastest growth is registered by cage culture and marine aquaculture, the slowest by inland and marine capture (see Figure 9). Production increases will be generated from an additional 29,975 vessels, 9,400 marine culture units, 9,050 freshwater culture units, 29,400 hectares of tambaks, 8,540 hectares of freshwater ponds and 27,840 hectares of intensified tambaks.

To attain production goals, numerous improvements in infrastructure are envisaged including the construction/rehabilitation of 2,253 kilometers of tambak water distribution canals and 282 kilometers of roads. Direct employment generation in the sector is estimated at 45,800 per year. Exports from 1994 to 1998 will grow both by volume and value at 9.7 percent per year (see Table 2). Export volume will increase from 553,000 metric tons in 1994 to 800,000 metric tons in 1998; and in value from $1,475 million to $2,134 million (see Figures 10, 11). Major growth is anticipated in tuna /skipjack, shrimp and freshwater and marine fish production (see Table 3).

The general policy areas identified for strengthening include: (1) human resources; (2) food self sufficiency; (3) poverty alleviation; (4) agribusiness development; (5) sustainable fisheries exploitation; (6) regional development; (7) production growth; (8) post harvest handling and marketing; (9) private investment; (10) infrastructure; (11) technology; (12) organizations; and (13) inter-sectoral linkages. Each of the thirteen policy areas is addressed by an action plan with defined programs. Total cost of Pelita VI is estimated at Rp. 1,849 billion ($885 million) consisting of bank credit 48 percent, central government funds 21 percent, private investment 17 percent, external assistance 10 percent and local government contribution 5 percent.

EXTERNAL ASSISTANCE

Cumulative external assistance as of 1993 to the Indonesian fisheries sector totalled $521.9 million. Multilateral sources provided $423.0 million (83 percent) with $98.9 million (17 percent) from bilateral donors (see Table 4). The largest single source of external assistance is the Asian Development Bank (ADB). The ADB has provided a total of $350.0 million consisting of loans in the amount of

$347.6 million and technical assistance grants of $2.4 million. Other major donors include Japan $57.1 million, World Bank $49.0 million, the United Nations $21.0 million, Germany $13.3 million, Kuwait $10.0 million, Italy $7.2 million, US $5.1 million, UK $2.5 million, Canada $2.1 million and New Zealand $1.3 million.

CHAPTER FOUR
FISHERIES PRODUCTION

PRODUCTION BY SUBSECTOR

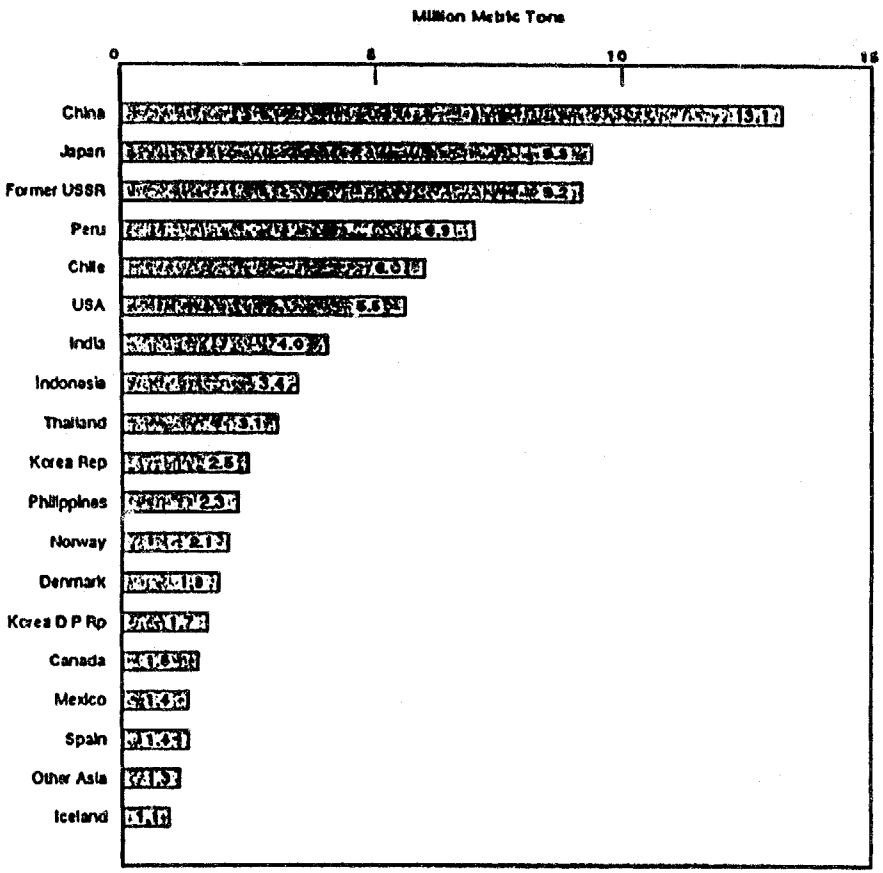
With total 1991 fisheries production of 3,349,601 metric tons, Indonesia had the eight largest fisheries landings in the world contributing 3.3 percent of global landings (see Figures 12 and 13). From 1987 to 1991 total fish production grew at an annual rate of 4.7 percent (see Table 5). In 1991, marine capture contributed 76 percent of all yield followed by aquaculture 15 percent and inland capture 9 percent. Over the last five years the shift in the relative contribution of each subsector has continued to change with aquaculture exhibiting strong (6.6 percent), marine capture moderate (4.7 percent) and inland capture low (1.3 percent) annual growth. High growth in aquaculture, static or low growth in marine capture and low growth or decline in inland capture production is expected to continue (see Table 6). The most fisheries products were landed in Java by Sumatra and Sulawesi (see Figure 14 and Table 7).

Over the last decade marine capture as a percent of total landings has remained stable at about three quarters of national production. Consistent annual growth in landings has occurred and in absolute terms the increase in production remains impressive rising by an average of 104,052 metric tons per year from 1987 to 1991. Indonesia has the world's largest fishing fleet with over 350,000 vessels of which 65 percent are non-motorized and over 95 percent less than 5 gross tons. Trends are continuing to motorize vessels, upgrade fishing gear, expand fishing into new areas and improve fisheries infrastructure. Although the northern coasts of Java, Sumatra and Bali are already heavily fished, there remains room for industry expansion in eastern, southern and South China Sea waters. Landings of 2.5 million metric tons in 1991 are estimated at 60 percent of MSY. Potential exists for increased yields of tuna/skipjack, spiny lobsters, cephalopods and seaweeds.

Prospects for growth in inland capture fisheries are limited. Given the low yields per fisherman, the high level of exploitation, existing and potential pollution

FIGURE 12

TOTAL CATCH BY PRINCIPAL PRODUCERS IN 1991

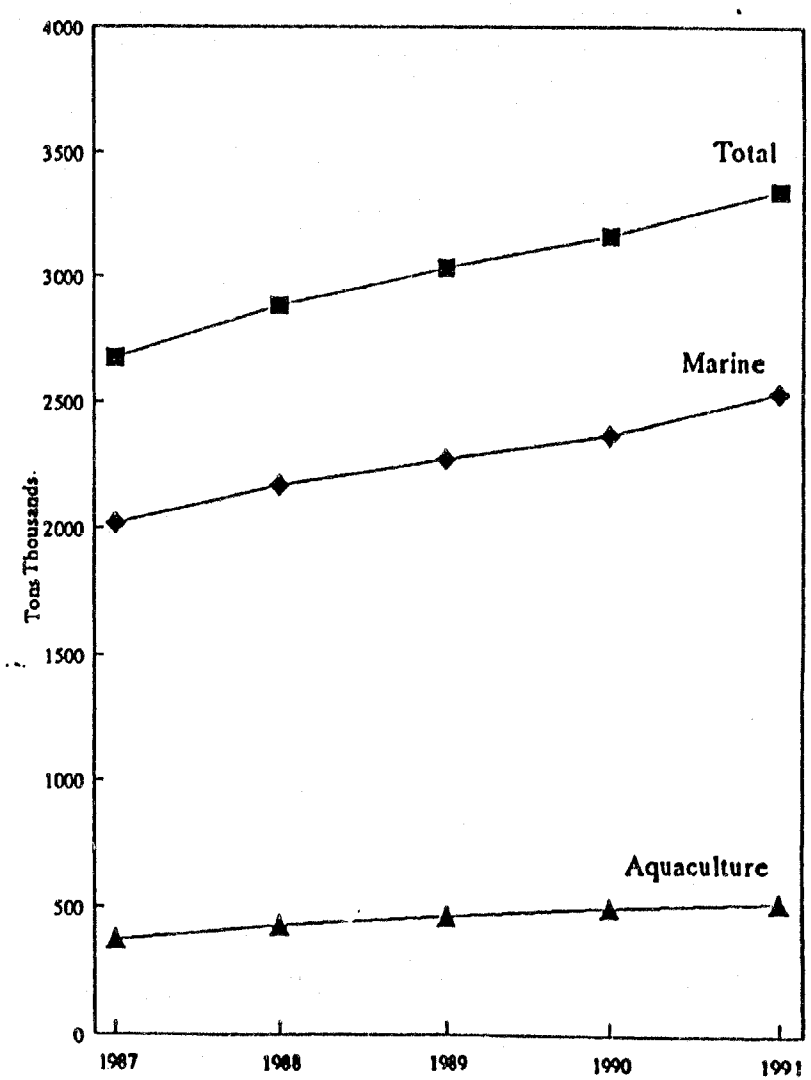


Countries listed are those with total catch above 1,000,000 metric tons.

Source: FAO Yearbook, 1991

FIGURE 13

ACTUAL FISHERIES PRODUCTION 1987 – 1991



Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

FIGURE 14

PRODUCTION BY REGION
1991

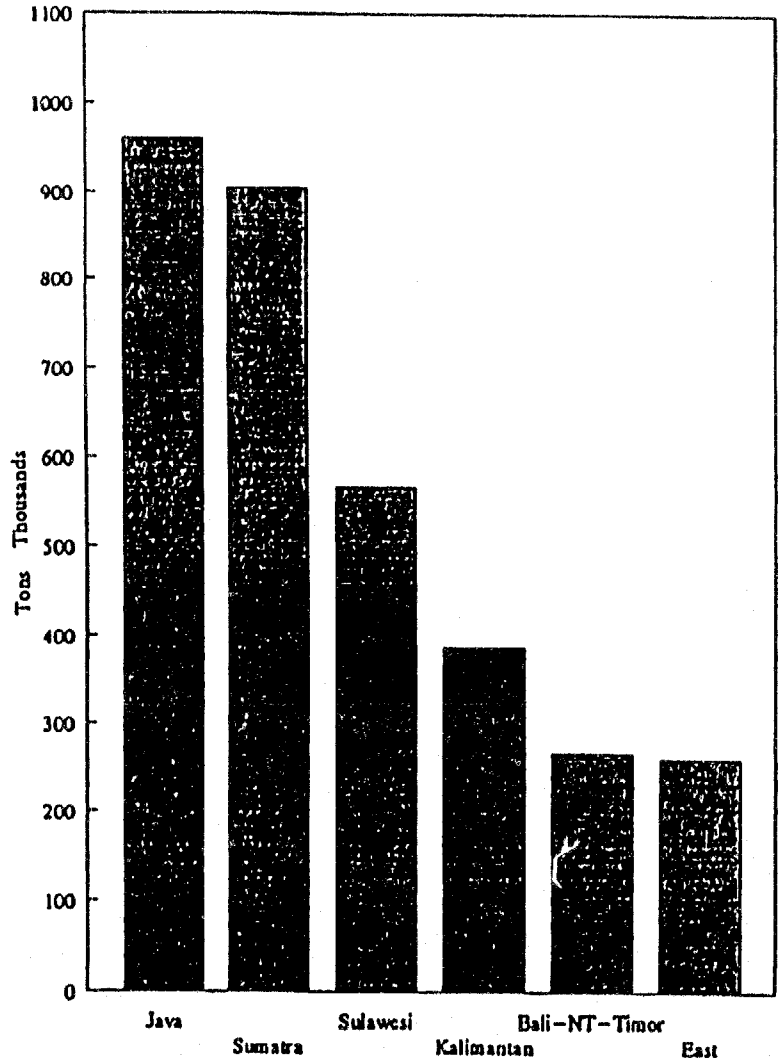
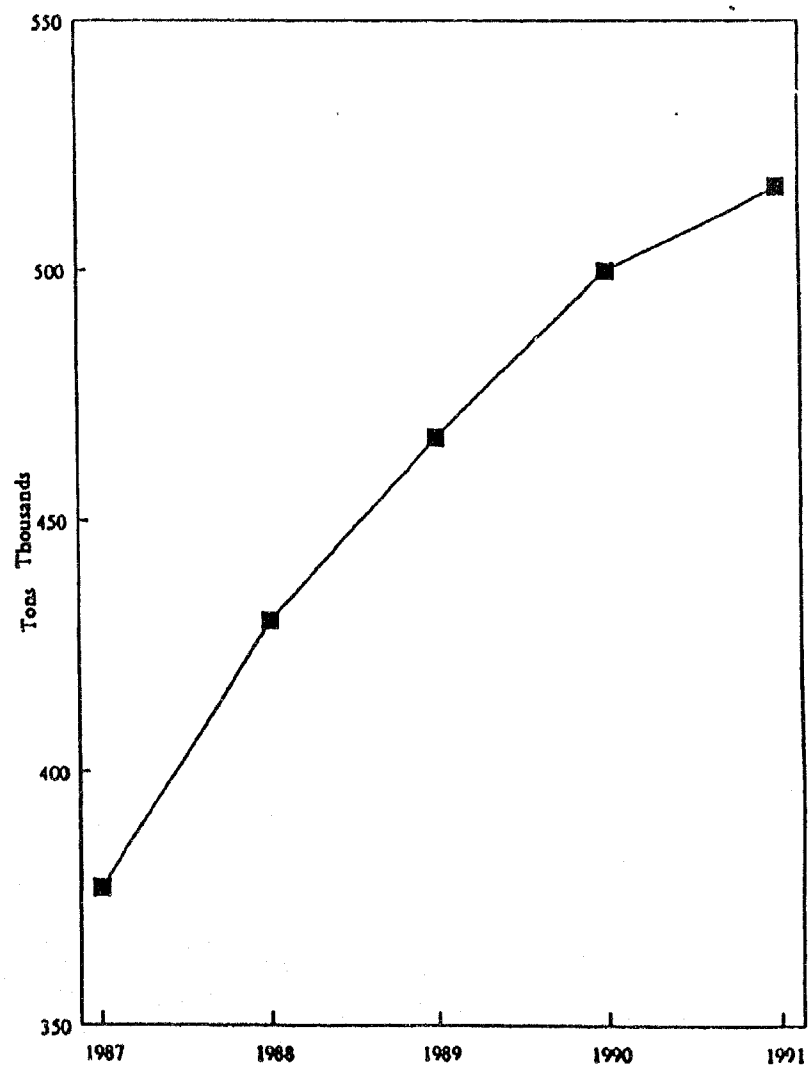


FIGURE 15

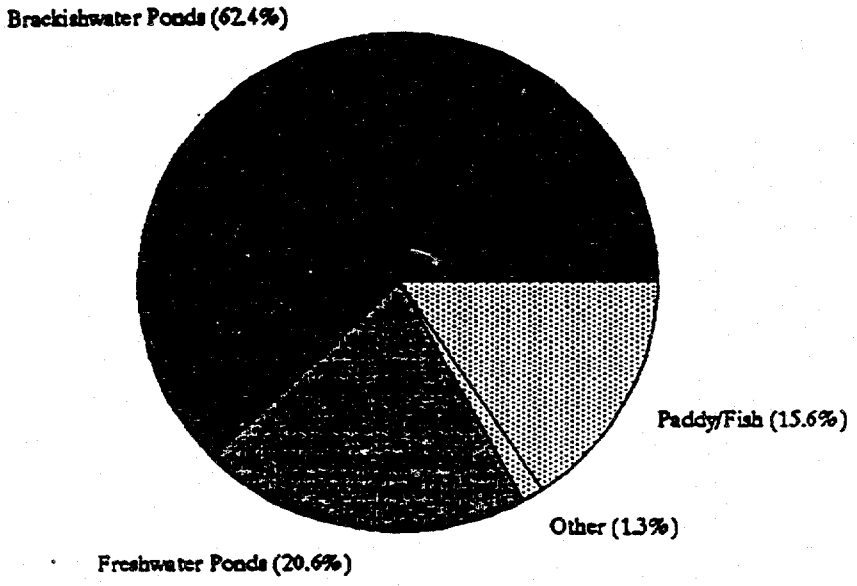
AQUACULTURE PRODUCTION
1987 – 1991



Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

FIGURE 16

AQUACULTURE PRODUCTION BY SUBSECTOR 1991



Source: DGF, Indonesia Fisheries Statistics (Statistik Perikanan Indonesia) 1991

problems from increasing population pressure and competing uses of inland waters, the prospects for production rising much beyond the 1991 level of 294,477 metric tons is not anticipated. Inland capture fisheries are concentrated on Kalimantan (over 50 percent) and on Sumatra (30 percent).

The expansion of aquaculture production from 367,772 metric tons in 1987 to 517,512 metric tons in 1991 has been largely due to increases in productivity rather than increases in pond area (see Figure 15). In 1991, aquaculture production came from brackishwater ponds (62 percent), freshwater ponds (21 percent), paddy/fish fields (16 percent) and other (1 percent) (see Figure 16). Between 1987 and 1991 production grew at an annual rate of 6.6 percent, while the area under cultivation increased at 2.3 percent per year.

Within the aquaculture subsector, tambak production increased annually at 11.0 percent, freshwater production at 2.3 percent and mixed paddy/fish culture declined by 1.6 percent. The most rapid growth in production was for giant tiger prawns where aquaculture production increased from 25,202 metric tons in 1987 to 96,811 metric tons in 1991, an annual growth rate of 30.9 percent. From 1987 to 1991 brackishwater aquaculture yields grew from 847 kg/ha to 1,295 kg/ha equivalent to an annual growth rate of 8.9 percent. The rapid growth of brackishwater aquaculture reflects the high profitability of shrimp culture.

Indonesian aquaculture producers are among the lowest cost producers in the world. Under both traditional and modern systems direct production costs are less than $3.00/kg for 33 g tiger prawns which currently market for a farm gate price of $7.65/kg. Although statistics are not yet available, it is widely believed in government and industry that due to the incidence of shrimp diseases there has been little growth in total production in 1992 and 1993.

Freshwater aquaculture is expected to maintain its modest growth as pond productivity increases outside of West and Central Java. Although growing rapidly, due to its limited production area, cage culture is anticipated to make only very modest contributions to production. Influenced by the incompatibility of modern farming methods with fish rearing, paddy/fish culture probably will continue its decline. Ornamental fish culture does have good development potential. The most significant potential for new crops is in marine aquaculture with seaweed, marine fish and shellfish culture.

MARINE CAPTURE

Geographic Distribution

Marine capture landings in 1991 totalled 2.5 million metric tons (see Figure 17). Sumatra accounted for 29 percent, Java 23 percent, Sulawesi 18 percent, Maluku/Irian Jaya 10 percent, Bali/NTT 10 percent and Kalimantan 9 percent, . Since nearly two thirds of Indonesia's population reside on Java, landings in Java fall far short of demand. Thus, Java is the main market outlet for marine fish landed elsewhere in the archipelago. As the country's greatest fishery resource potential is in eastern Indonesia, it is anticipated that Java's share of landings will continue to decline and the movement of fish products from outer islands to Java will grow steadily.

Human Resources

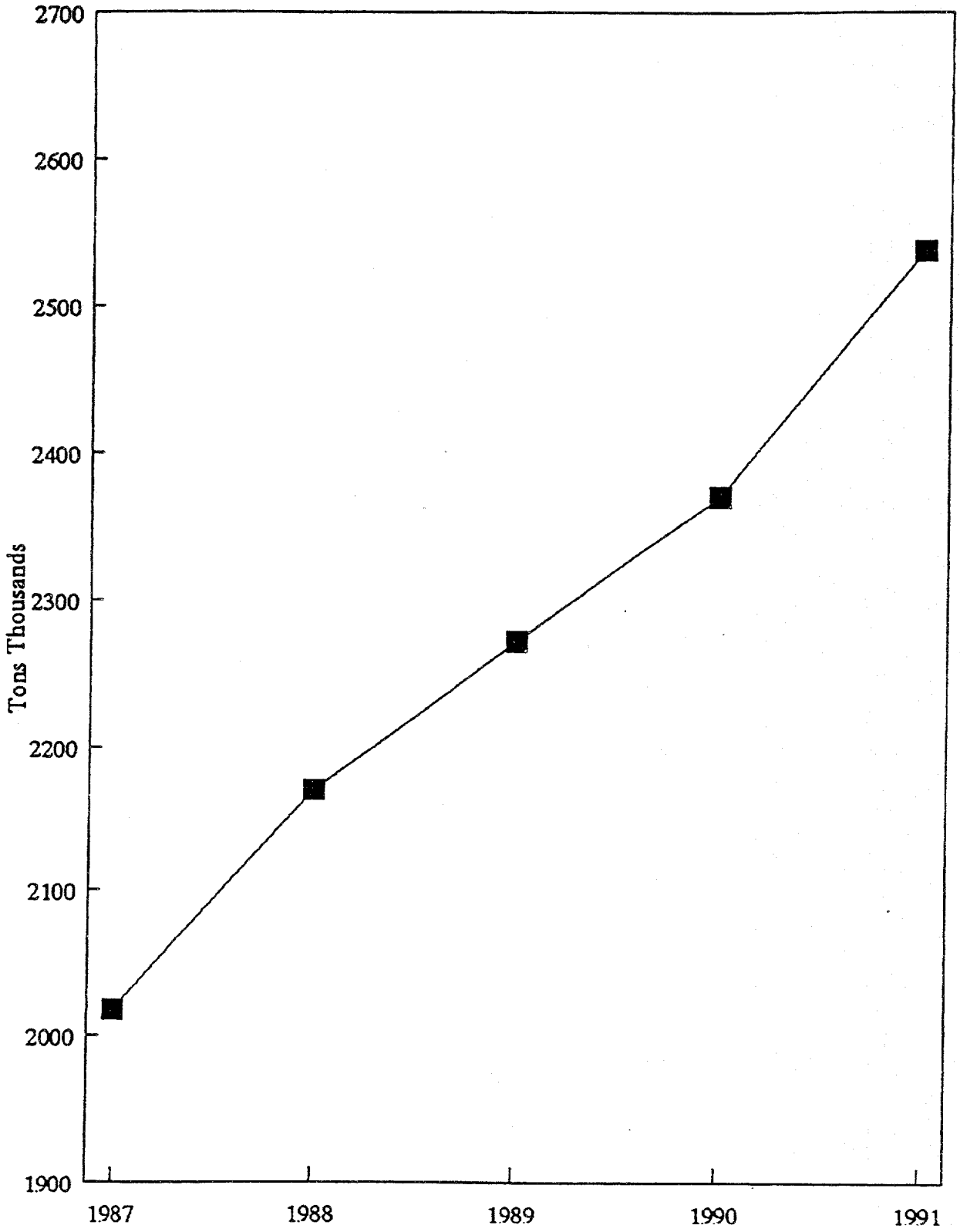
The 1991 total number of marine fisherman was 1,632,630 (see Table 8). The largest number was found on Java (27 percent), followed by Sumatra (25 percent), Sulawesi (19 percent), Kalimantan (8 percent), Maluku/Irian Jaya (12 percent) and Bali - NTT (9 percent). In parallel with production increases over the last decade, the number of fishermen has decreased in western and increased in eastern Indonesia. In an aggregate sense, the ratio of fisheries production to the number of fishermen is in relative balance.

It appears that operations are most efficient in Sumatra where 25 percent of fisherman produce 29 percent of catch and least efficient in Irian Jaya where 12 percent of fisherman catch 10 percent. Catch per fisherman is lowest in Maluku/Irian with an average yield per fisherman of 1,296 kg per year (see Table 9). On a per vessel basis, production has increased only slightly rising from 6,039 kg in 1987 to 7,153 kg in 1991.

Indonesia's richest marine resources are located in eastern Indonesia where the greatest number of large fishing vessels are concentrated. However, the catch of the small scale fishermen is lowest there. Attention needs to be paid to improving the efficiency of small scale fishing operations especially in eastern Indonesia, and upgrading infrastructure, marketing and distribution links for marine fish from eastern Indonesia whether for export or the large domestic markets of Java and Bali.

FIGURE 17

MARINE PRODUCTION
1987 – 1991



Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

Fishing Fleet

In 1991, Indonesia's total fishing fleet of 354,784 vessels was comprised of 231,659 (65 percent) non-motorized craft, 75,416 (21 percent) outboard motor boats, and 47,709 (13 percent) inboard power vessels (see Figure 18 and Table 10). Less than 4 percent of vessels were inboard power vessels over 5 gross tons. Two thirds of the marine fishing fleet consists of small non-motorized boats utilizing relatively simple, traditional gear and methods. The percent of non-motorized vessels remains high at 65 percent. Nevertheless, it has declined substantially since the mid 1980's when non-motorized vessels represented 70 percent of the fleet. The total number of marine fishing boats increased from 334,072 craft in 1987 to 354,784 in 1991, an annual growth rate of only 1.2 percent. However, growth in the number of vessels was not uniform with the motorized fleet growing at an annual rate of 4.5 percent and that of the non-motorized sector only 1.1 percent. As a result, a change in fleet composition continues to take place with the percentage of motorized vessels increasing over the last 5 years from 31 to 35 percent.

During the same period, especially rapid annual growth was recorded for large size inboard power vessels over 200 gross tons (48.4 percent), 100 - 200 gross tons (29.4 percent), 50 - 100 gross tons (41.2 percent) and 30 - 50 gross tons (16.9 percent). These changes reflect increased commercialization of the fleet with the commensurate movement to high technology, industrial fisheries exploitation. At the other end of the spectrum, only minimal growth (1.1 percent) has occurred in the non-motorized fleet. The number of boats less than 50 gross tons grew at rather modest rates averaging an annual 4.3 percent. On a per vessel basis, production in recent years has increased only slightly, rising from 6,039 kg in 1987 to 7,153 kg in 1991.

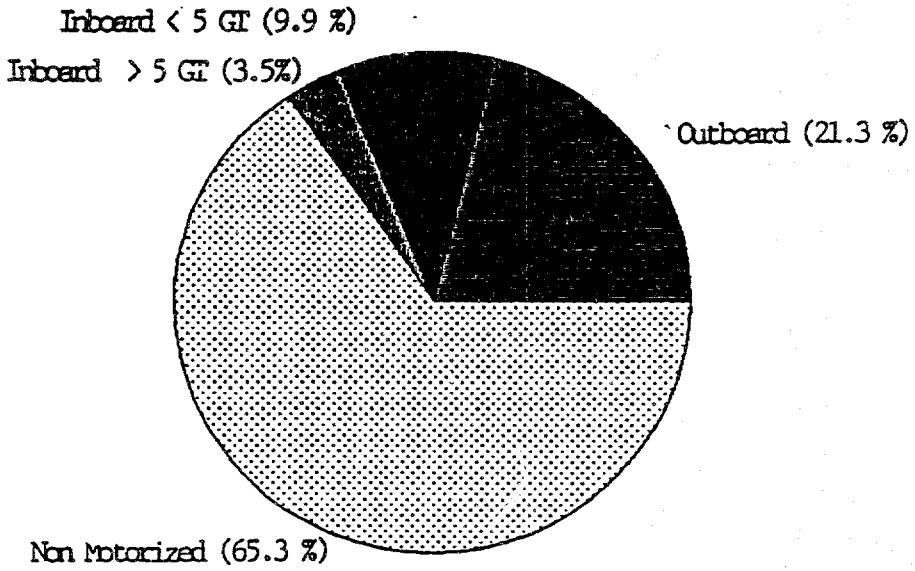
In 1991, in addition to the national fleet, there were 933 foreign registered vessels fishing under license in the Indonesian EEZ. Of the total, 722 were less than 100 gross tons, 104 between 100 and 200 gross tons and 107 greater than 200 gross tons.

Fishing Methods and Gear

Fishermen have traditionally used a wide variety of traps, lines and nets to capture the numerous fish species found in Indonesian waters. 1991, over 534,770 units of fishing gear segregated by over 25 principal capture methods were in operation. In terms of numbers of units, almost half the industry was represented

FIGURE 18

VESSEL TYPE, 1991



Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

by pole-and-line vessels (other than skipjack) (24 percent), drift gill nets (12 percent), troll lines (8 percent) and set gill nets (8 percent). On a unit basis, the fastest annual growth over the last five years has been for tuna long lines which increased rapidly at an annual rate of 97.2 percent from 111 in 1987 to 3,311 in 1991. Between 1987 and 1991 rapid growth occurred in the use of these gear: muro ami (60.1 percent), shrimp nets (21.5 percent), set long lines (11.3 percent) and Danish seines (10.0 percent). Declines were recorded for purse seines, shrimp gill nets, fishing platforms (i.e. bagan) and troll lines.

In 1991, five types of fishing gear supplied half the marine catch, namely purse seine (17 percent), drift gill nets (11 percent), large net (i.e. payang) (8 percent), non-skipjack pole-and-line (7 percent) and raft nets (6 percent) (see Figure 19 and Table 11). Primary bases for purse seines are North Java, Bali and North Sumatra; drift gill nets - North Java and Bali/NTT; large net - North Java; non-skipjack pole-and-line - Sulawesi and Maluku/Irian Jaya.

On a production basis, the most rapid annual growth over the last five years has been for tuna long line yields which increased at an annual rate of 54.7 percent from 3,741 metric tons in 1987 to 33,168 metric tons in 1991. From 1987 to 1991 other rapid annual growth in production occurred with shrimp nets (25.2 percent), non-tuna drift long lines (16.3 percent) and Danish seines (10.3 percent). Declines were recorded for shrimp gill nets, fishing platforms, scoop nets, stow nets, shellfish collection and muro ami.

A comparison of fisheries production with gear type demonstrates purse seine vessels to be a very efficient gear type providing 17 percent of all capture production from only 1 percent of units. Also efficient appear to be shrimp nets, skipjack pole-and-line, stow nets, boat/raft nets and seaweed collection. Least efficient are many of the traditional methods of capture including drift, shrimp and set gill nets, trammel nets, scoop nets, lift nets, other pole-and-line, troll line, other traps and shellfishing.

Production by Species

The 1991 marine harvest of 2,537,612 metric tons was comprised of 87 percent finfish, 6 percent crustaceans, 4 percent seaweed and 2 percent mollusks. The following eight groups recorded yields of approximately 100,000 metric tons or more: (1) scads (213,274 metric tons; 8 percent); (2) eastern little tuna (150,439 metric tons; 6 percent); (3) Indian oil sardinella (145,055 metric tons; 6 percent); (4) Indian mackerels (144,094; 6 percent); (5) *Fringescale sardinella* (136,626 metric

FIGURE 19

MARINE PRODUCTION BY GEAR TYPE
1991

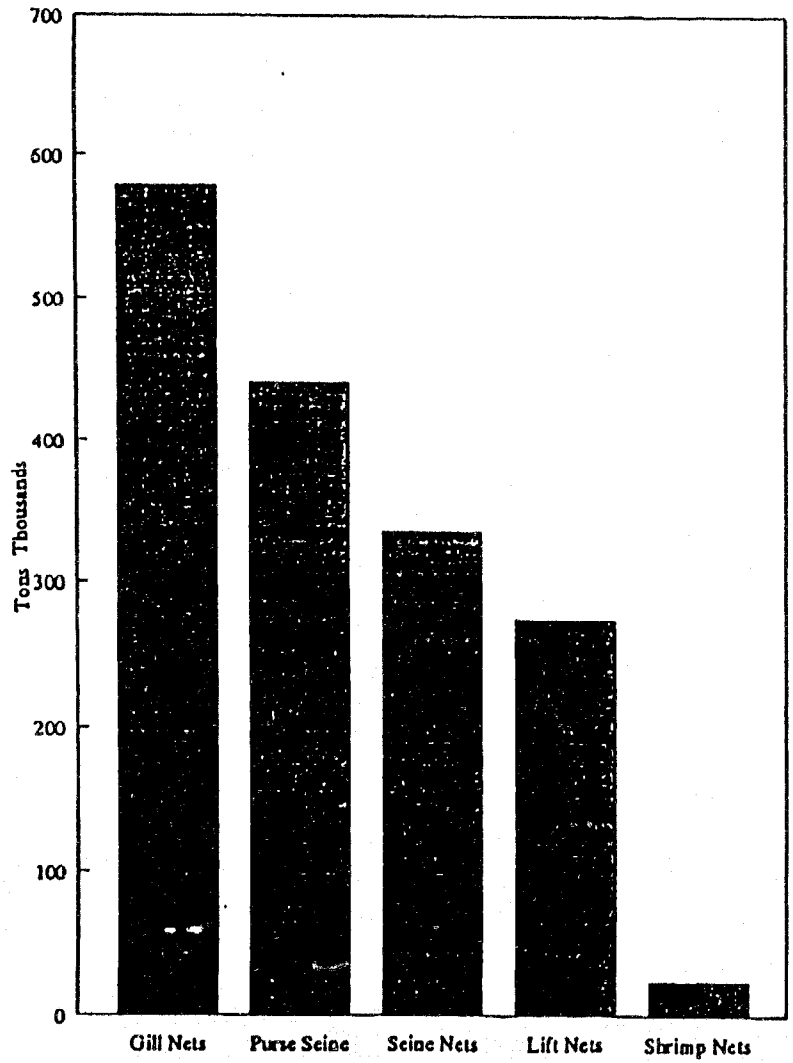
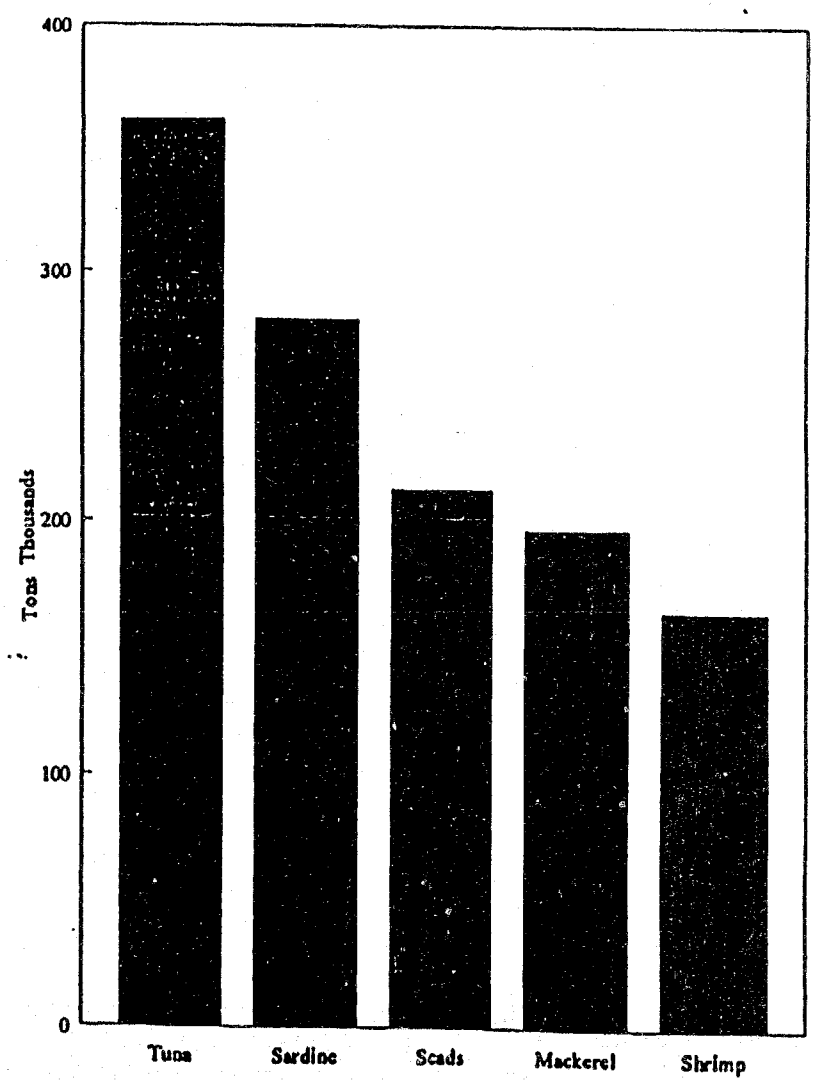


FIGURE 20

MARINE PRODUCTION BY SPECIES
1991



Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

tons; 5 percent); (6) anchovies (135,633 metric tons; 5 percent); (7) tunas (132,695 metric tons; 5 percent) and (8) seaweeds (97,815 metric tons; 4 percent) (see Figure 20 and Table 12). Of these major fisheries groups, the fastest annual growth from 1987 to 1991 was recorded by Indian oil sardinella with 18.7 percent followed by scads 8.0 percent over the same period, all other groups grew by 5.0 percent or less.

Fishing Ports and Landing Sites

The DGF classifies fishing ports and landing sites as: (1) Type A - International; (2) Type B - Archipelagic; (3) Type C - Coastal; and (4) Type D - Fish Landing Sites. In 1993, there are 2 Type A, 6 Type B, 20 Type C and 583 Type D sites (see Tables 13 and 14). The major international fishing ports of the country are located at Jakarta and Kendari. These ports are both of relatively new construction and provide for the requirements of the international fisheries trade. Port infrastructure includes wharves, fuel and ice sales, vessel repair facilities, freezer space, ice making facilities, cold storage and an auction hall. Type B ports typically supply wharf space, fuel and ice sales and most shore-based fish handling facilities. Type C ports provide wharf space, fuel and ice sales and an auction hall. Type D facilities include simple landing sites and limited capacity auction halls. Management of Type A and B ports is by DGF while Type C and D are the responsibility of the provincial and district administrations.

In 1993, some DGF managed ports were handed over to a separate state enterprise. The DGF utilizes a staff of 808 to assist in operation of facilities. Funds to operate the ports are recovered from product sales (i.e. ice, fuel, salt and water), space rental and a minimum charge of 5 percent on landings as an auction fee. In addition, each of the 5 state fishing companies and a few large private companies operate their own port facilities. Otherwise large vessels, particularly in eastern Indonesia, use commercial cargo port facilities operated by one of the four state port companies for off loading, transshipment and re-supply.

In general, the western and central parts of Indonesia are well serviced by port and landing facilities. However, there is still a need for additional facilities in eastern Indonesia. Although generally adequate, the government would like to improve sanitation and hygiene conditions at most of the sites.

Vessel Construction and Repair

Indonesia has an estimated 185 shipyards of which 30 are in the public and 155 in the private sector. Government shipyards are managed by the Departments of Industry (3), Technology (1) and Mining, Communications and Agriculture (26). There are approximately a dozen major shipyards building steel hull vessels, a large number of smaller boat builders producing wooden vessels and a limited number of producers using fiberglass and laminated woods. Most yards build coastal freighters and work boats and only a limited number of fishing vessels. Total annual productive capacity of the national yards is 2,250,000 gross tonss for repairs and 90,000 gross tonss for new construction. On a yearly basis, national shipyards can construct numerous vessels of less than 50 gross tonss, 116 units of 51 - 100 gross tonss, 57 units of 100 - 200 gross tonss and 78 units of greater than 200 gross tonss.

To increase the national fleet, replace foreign fishing vessels and replace old national vessels, the anticipated requirement under Pelita VI for new fishing vessels is 3,816 vessels composed of an annual need of 414 vessels of less than 50 gross tonss, 124 units of 51 - 100 gross tonss, 142 units of 100 -200 gross tonss and 84 units of greater than 200 gross tonss. Adequate capacity exists to produce the country's needs for less than 50 gross tonss vessels (see Table 15). There are modest shortfalls in the size ranges 51 -100 gross tonss and greater than 200 gross tonss. Based on DGF and Ministry of Industry projections, however, a serious production constraint exists for the production of fishing vessels in the 51 - 100 gross tonss size range. Compounding the problem of vessel production limitation is a ban on imports of vessels less than 100 gross tonss and imports of vessels of any size by joint venture companies. The inability to import vessels is a major constraint to the development of large-scale commercial fisheries.

Expansion Potential

The MSY in Indonesian waters for the major commercial species of pelagic (surface/midwater) fish, demersal (bottom) fish, tuna/skipjack, carangids (i.e. jacks), penaeid shrimp and spiny lobsters is estimated by DGF at 4.2 million metric tons (see Table 16). MSY estimates have been reduced approximately 20 percent from five years ago. Although subject to refinement, DGF's MSY estimates are, at present, generally accepted as the best available tools for fisheries management. The 1991 marine fisheries yield is 2.3 million metric tons or 54.5 percent of DGF's MSY estimate.

FIGURE 21

MARINE RESOURCE POTENTIAL AND PRODUCTION 1991

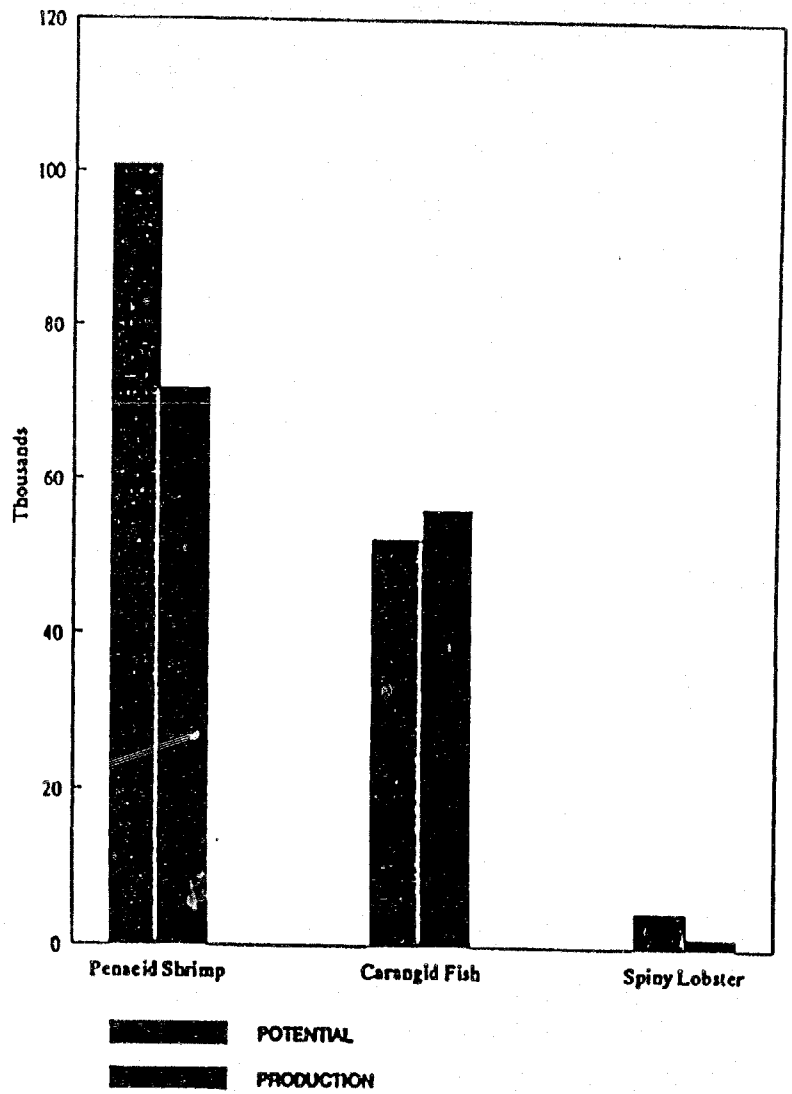
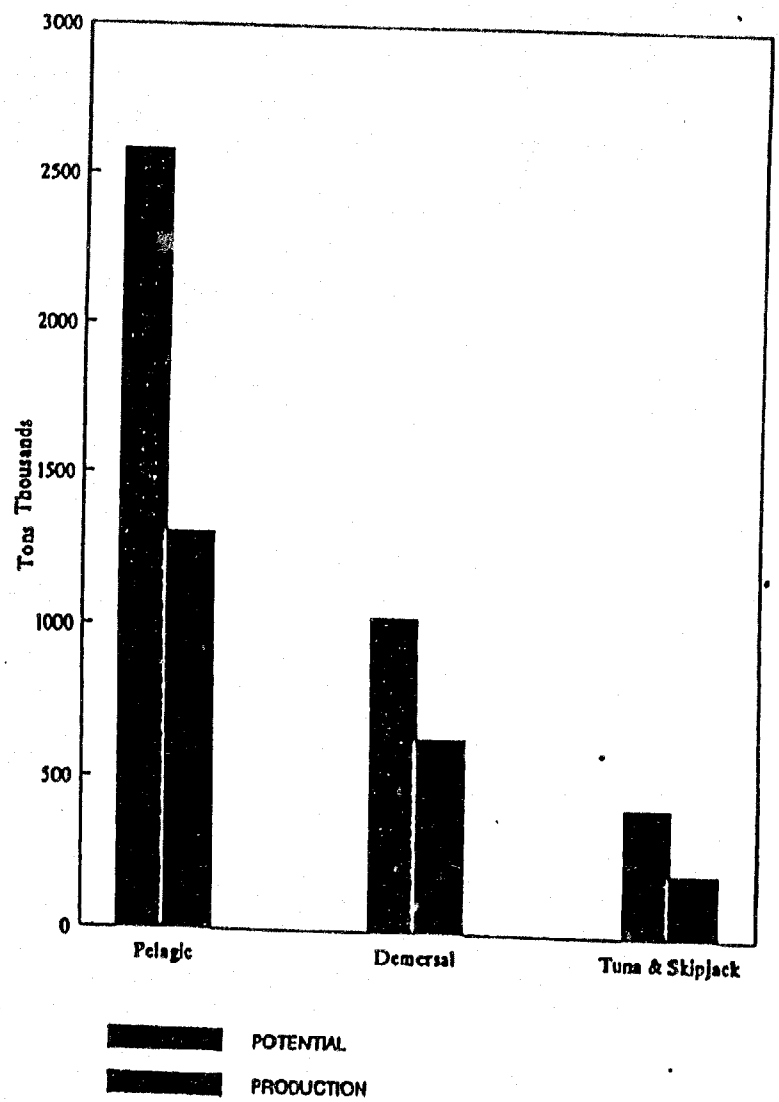


FIGURE 22

MARINE RESOURCE POTENTIAL AND PRODUCTION 1991



Source: Potential and Distribution of Marine Fisheries Resources in Indonesian Waters (Potensi dan Penyebaran Sumber Daya Ikan Laut di Perairan Indonesia), DGF, 1991

In some areas, such as the Malacca Strait and North Java, capture levels are already above the MSY and resource depletion is taking place. Both regions are in need of fisheries rehabilitation. The areas of East and West Sumatra, South Sulawesi and Bali/NTT are also very heavily exploited with yields between 60 and 80 percent of MSY. There is still moderate growth potential in South Java, East Kalimantan and North Sulawesi. However, the greatest fisheries potential exists in Maluku/Irian Jaya and South/West Kalimantan where stocks are fished at less than 20 percent of MSY. Thus, although in general, fisheries resources can be further exploited, additional harvests will have to be selective (see Figures 21 and 22).

On a species basis, immediate attention is needed for carangid stocks (i.e. jacks, trevallies, scads) which are already being overfished with particularly acute situations in the Malacca Strait, South Java, Bali/NTT and North Sulawesi. Exploitation of carangid stocks in the Malacca Strait is above the MSY estimate. Penaeid shrimp are also heavily fished at about 70 percent of the MSY level with excessive fishing in Bali/NTT, East Sumatra and West Sumatra. Both pelagic and demersal stocks are being over exploited in the Malacca Strait and North Java, however, in other areas further exploitation remains an option. Potential exists to expand tuna/skipjack and spiny lobster capture as exploitation is at the 50 and 31 percent levels of MSY respectively.

The potential cephalopod (i.e. squid, cuttlefish, octopus) resource in Indonesian waters is estimated at 193,180 metric tons versus 1991 production at 17,897 metric tons. With exploitation at only 9 percent of MSY, further development of the cephalopod fishery should be encouraged. Large potential also exists to expand the harvest of seaweeds in Indonesia. DGF Pelita VI projections of marine capture production at 3,225,600 metric tons are at about 80 percent of MSY. However, it is important to note that in all fisheries the catch per unit of effort (CPUE) increases as the MSY is approached. As a result, in real terms, exploitation at levels above 80 percent of MSY are often uneconomic and should only be approached with caution. In those areas where resource depletion is taking place, fisheries rehabilitation combined with better management practices should be implemented. In near shore areas community-based fisheries management practices are an effective development tool that can greatly assist in fisheries rehabilitation programs.

INLAND CAPTURE

In 1991, there were about 493,370 inland capture fishermen of whom 36 percent were full time, while 45 percent fished on a "major" part-time basis and 19

percent on a "minor" part-time basis. Distribution of fishermen by area was Sumatra 34 percent, Kalimantan 30 percent, Java 27 percent, Sulawesi 5 percent, Bali/NTT 3 percent and Maluku/Irian Jaya 1 percent. Of total inland capture fishing households, 58 percent operated without boats, 40 percent without power boats, 1 percent with outboard motor boats and less than 0.5 percent with inboard power boats.

The fishermen use a variety of gear including gill nets, lift nets, scoop nets, long lines, hand lines, guiding barriers and traps. Of the total inland capture fisheries production of 294,477 metric tons, 22 percent was caught by gill nets, 14 percent by traps, 12 percent by hand lines, 11 percent by guiding barriers, 5 percent by long lines, 4 percent by portable lift nets, 3 percent by scoop nets and 29 percent by other means. The 1991 distribution of catch by area was Kalimantan 52 percent, Sumatra 29 percent, Sulawesi 10 percent, Java 8 percent, Bali/NTT 1 percent and Maluku/Irian Jaya negligible.

Inland capture fishermen are typically members of lower income groups with average incomes below that of both marine fishermen and aquaculturists. For example, in 1991, Java contained 130,860 inland capture fishermen (27 percent of the nation's total) and yet produced only 7.8 percent of the inland fisheries catch. Per capita yield was only 175 kg/fisherman/year. In Kalimantan per capita yield was 1,044 kg/fisherman/year or almost 6 times the Java average.

Production from inland capture fisheries increased from 276,291 metric tons in 1987 to 294,477 metric tons in 1991, equivalent to an average annual growth rate of only 1.3 percent. Although data on this fishery is extremely difficult to collect because of the numerous, widely dispersed fishermen (493,370 in 1991) with small average annual catches (597 kg/fisherman), it appears total catch has remained static since 1972 when a catch of 301,000 metric tons was recorded. As the total number of fishermen in 1991 is approximately the same as it was in the mid 1970's, yield per fisherman has also remained static.

Given the low yields per fisherman, the high level of exploitation, existing and potential pollution problems from increasing population pressure and competing use of inland waters for irrigation, the prospects for growth in this subsector are limited. The DGF maintains that an annual MSY for inland capture fisheries of 680,000 metric tons can be achieved by resource management, stocking, upgrading of fishing gear and further exploitation of inland waters in remote, sparsely populated areas. Although this may be theoretically possible, resource management measures would probably require significant transmigration

and a major and costly effort to provide the necessary artificial stocking, extension, infrastructure and marketing facilities.

AQUACULTURE

Brackishwater Ponds

In 1991, there were 290,933 hectares gross area (249,605 hectares net) of brackishwater ponds (tambaks) in Indonesia. The primary species cultured was milkfish with over 44 percent (141,024 metric tons) of total production followed by tiger prawns 30 percent (96,811 metric tons), tilapia 7 percent (22,799 metric tons), metapenaeus shrimp 6 percent (20,248 metric tons) and banana/white shrimp 6 percent (19,337 metric tons) (see Figure 23).

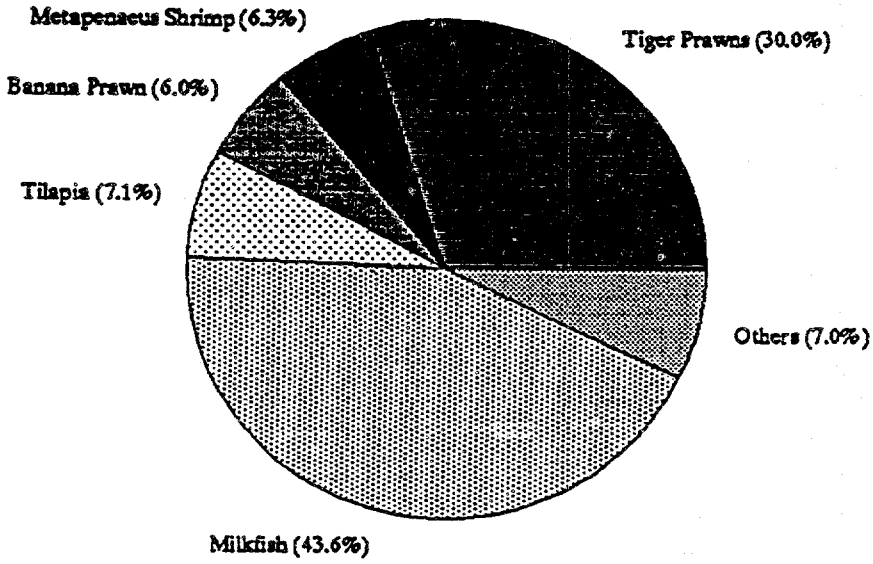
Over 85 percent of pond area was located in five provinces: South Sulawesi 27 percent (78,258 ha), East Java 17 percent (48,601 ha), West Java 18 percent (52,523 ha), Aceh 14 percent (40,402 ha) and Central Java 10 percent (29,638 ha) (see Figure 24 and Table 17). Total production was 323,156 metric tons of which 56 percent was fish and 44 percent shrimp. The total number of tambak farmers in 1991 was 176,087 equivalent to an average holding of 1.65 hectares with production of 1,835 kg/ha/year. Kg/ha/year averages by major growing areas were: West Java 2,972; East Java 2,458; Central Java 1,960; South Sulawesi 1,804 and Aceh 1,302.

Tambak milkfish production has grown at an annual rate of 5.9 percent over the period 1987 to 1991 from 105,947 metric tons to 141,024 metric tons. This rate of growth although significant is only a fifth that of tiger prawns. Typically milkfish fry are reared in traditional systems with simple ponds, no artificial feeding and fry collected from the wild by a variety of beach seining and trapping techniques. Yields are low seldom exceeding 1 metric ton/hectare/crop.

On a value basis, tiger prawns and white shrimp account for over 50 percent of total tambak sales. As there are abundant natural shrimp resources in Indonesia, formerly all shrimp fry were ocean captured. By 1991, however, there were over 300 shrimp hatcheries in Indonesia. Captured fry, although still used especially by traditional producers, probably account for only about 10 percent of current stocking. Fry are often purchased directly by farmers from hatcheries. However, there is also a system of private fry dealers who buy shrimp fry from hatcheries and fry collectors and distribute to pond operators.

FIGURE 23

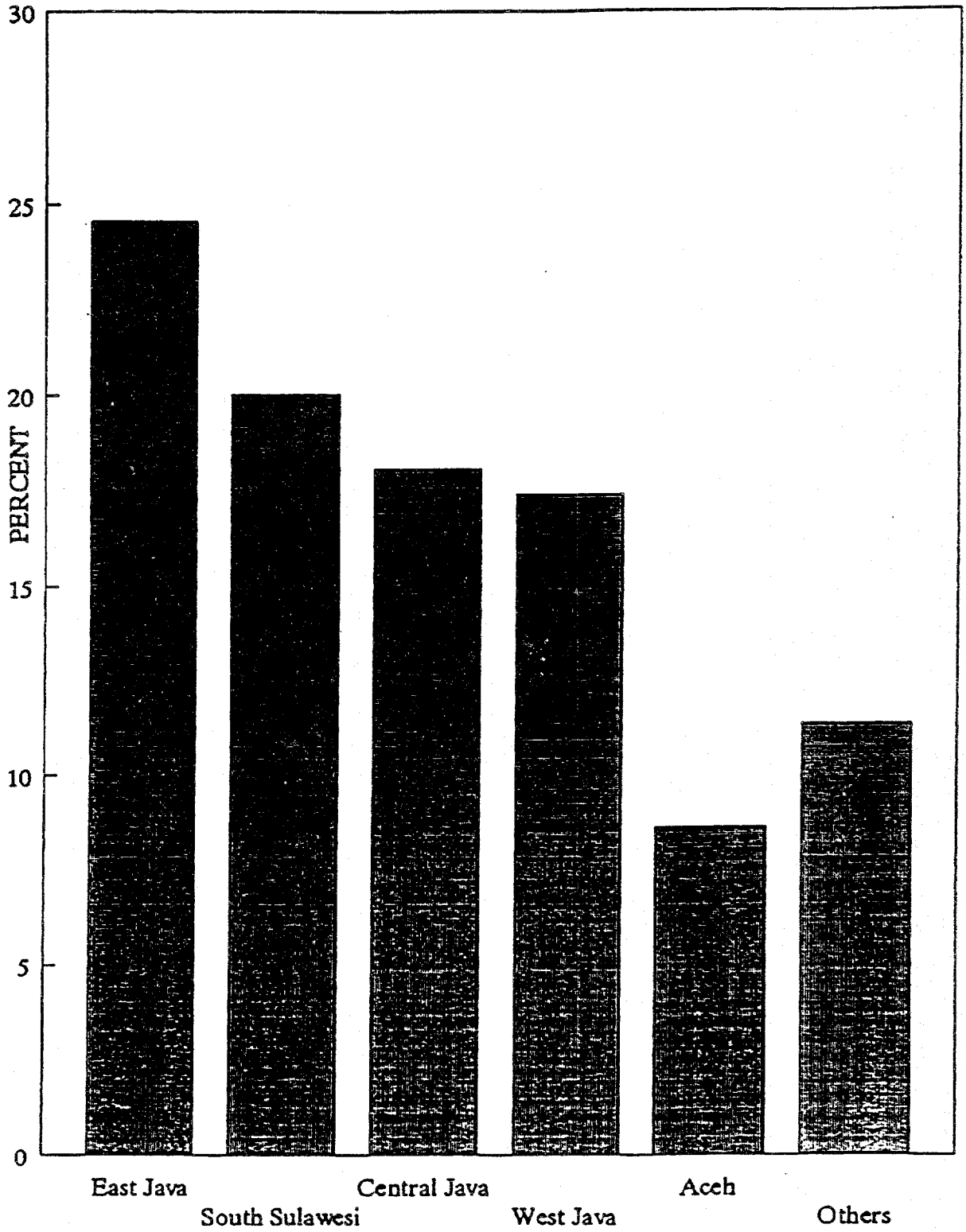
TAMBAK PRODUCTION BY SPECIES, 1991



Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

FIGURE 24

TAMBAK PRODUCTION BY PROVINCE
1991



Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

Pond-rearing systems can be segregated by culture technology as extensive, semi-intensive and intensive (see Table 18). Generally extensive systems stock fry at less than 8 post larvae (PL)/square meter, use natural feed, no pumps or aerators and have yields averaging 500 kilograms/hectare/crop. Semi-intensive systems stock fry at 9 to 20 PL/square meter, use prepared feeds, pumps and aerators and have yields between 1,000 and 3,000 kilograms/hectare/crop. Intensive systems stock fry at over 20 PL/square meter, use prepared feeds, pumps and aerators and have yields greater than 3,000 kilograms/hectare/crop.

On an area or number of farmer basis, approximately 85 percent of ponds utilize extensive, 10 percent semi-intensive and 5 percent intensive practices. However, since yields from intensive and semi-intensive systems are so much higher than those of extensive, it is estimated that 50 percent of tambak shrimp production is from intensive, 20 percent from semi-intensive and only 30 percent from extensive producers. Although the trend appears to be slowing down, intensive and semi-intensive operations specializing in tiger prawn production has been the fastest growing area of the subsector experiencing a growth rate of production in excess of 30 percent per year over last five years.

Indonesian brackishwater culture practices range from traditional extensive to modern intensive systems. Productivity of less than 100 in traditional to over 8,000 kg/ha/year on intensive farms is found. There has been significant progress in increasing farm yields. Average production per hectare in 1987 was 730 kg, by 1991 this had risen by over 50 percent to 1,111 kg. The rise was even more dramatic on a value basis as most production increase was for high priced shrimp species. Since traditional extensive culture ponds with yields of less than 1,000 kg/ha/year comprise 85 percent of the total area or about 250,000 hectares there is substantial potential for increased production from existing tambaks. If effort is directed to improve pond construction, water supply, management practices and supply of seed to traditional tambak farmers considerable scope exists to increase yields of both fish and shrimp.

In addition, there are extensive areas of mangrove forest in Indonesia that are suitable for development into tambaks. While many of these areas are environmentally sensitive and important to retain in their present state as nurseries for commercial species and to preserve natural habitat for biodiversity and open space, there still exists scope for increased in tambak area. The DGF's estimate of the gross potential area for increased tambak development is 800,000 hectares (about 19 percent of mangrove resources). DGF proposes to develop 29,400 hectares of new tambaks under Pelita VI. The annual rate of production

increase from tambaks over the period 1994 - 1998 is expected to reach 8.0 percent. Production in 1998 is anticipated as 984,700 metric tons.

Significant increases in productivity can be limited by the availability of fry. In 1991, approximately 11,400 million milkfish fry were stocked. There are no clear estimates of the MSY for milkfish fry. However, the situation is not yet believed to be critical as most fry collection is done near tambak areas and there are believed to be large unexploited fry collecting grounds in Kalimantan, Sulawesi and Irian Jaya. It is unlikely that technically and economically viable milkfish hatcheries will be operating soon in Indonesia. Hence, milkfish seed stock will have to come from wild sources. The economics of milkfish supply will most likely favor hatchery reared fry in the near future on a per cost basis. As a result, further large gains in milkfish production will depend on development of milkfish hatchery technology and improved farm management practices.

In 1991, approximately 9,500 million shrimp fry were stocked in tambaks. Approximately 200 million (2 percent) of which were sourced from the wild. To meet DGF's 1998 Pelita VI production goal, approximately 16,000 million shrimp fry will be required. Wild caught shrimp fry may supply 500 million PL per annum. Hatcheries will be required to produce approximately 15,500 million fry per year. Present national hatchery production capacity at full operations is about 9,000 million per year. Unlike milkfish, shrimp hatchery technology is well known and wide spread throughout the country. Therefore, hatchery production is expected to expand to meet DGF goals.

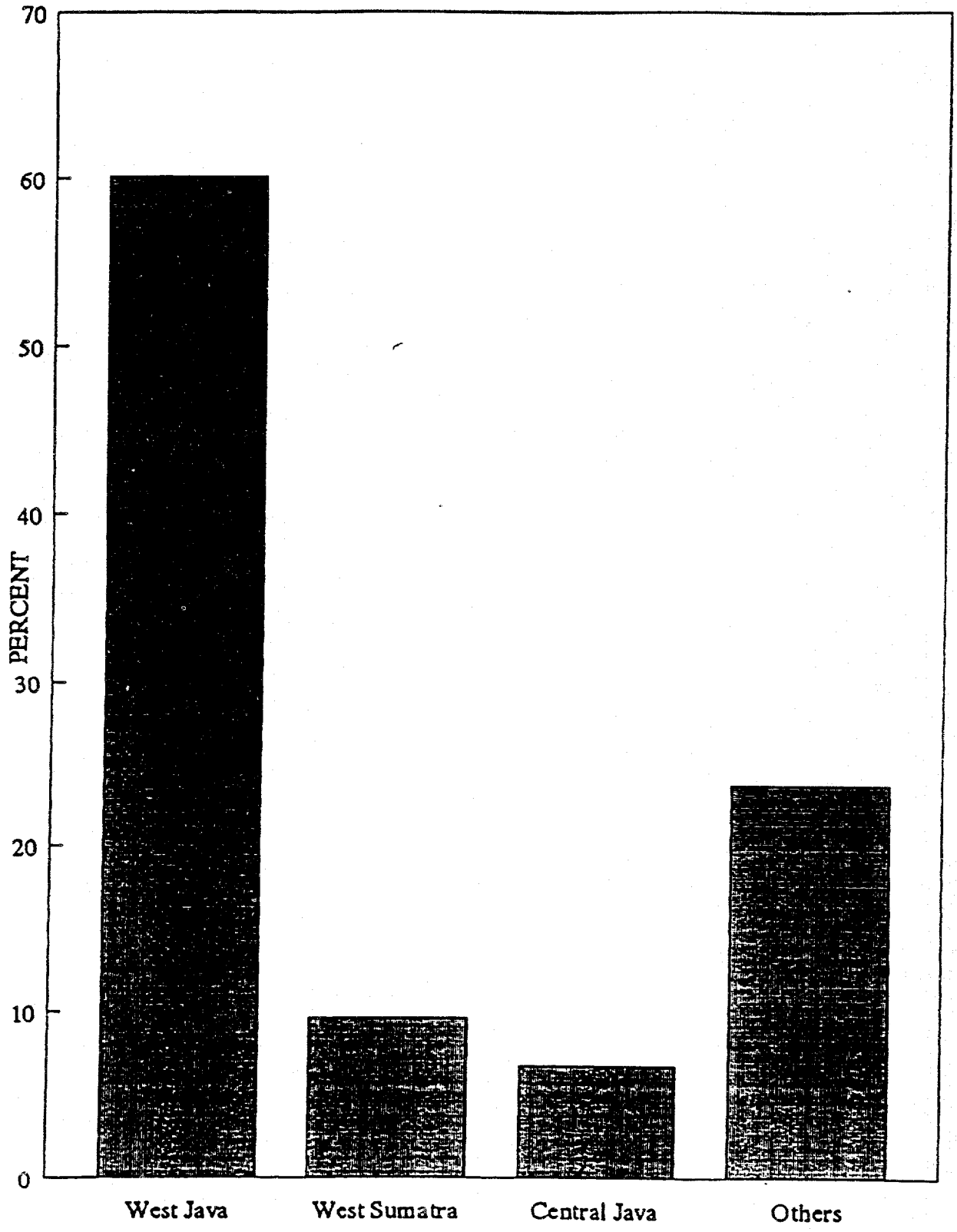
Freshwater Ponds

In 1991, there were 53,824 hectares gross area (46,460 hectares net) of freshwater ponds in Indonesia. This is less than one fifth the area of tambaks. Ponds are distributed 43 percent on Java, 39 percent Sumatra, 11 percent Sulawesi, 4 percent Bali, 2 percent Kalimantan and less than 0.1 per cent on Maluku/Irian Jaya (see Figure 25). With 34 percent of hectarage, West Java dominates the subsector containing over three times more growing area than its closest competitor West Sumatra. Aside from these two provinces, ponds are fairly equally distributed throughout Sumatra, Sulawesi and the remainder of Java. Total 1991 production was 106,862 metric tons of which 60 percent was from West Java.

The primary species cultured was common carp with 34 percent (35,947 metric tons) of total production followed by tilapia 14 percent (27,142 metric

FIGURE 25

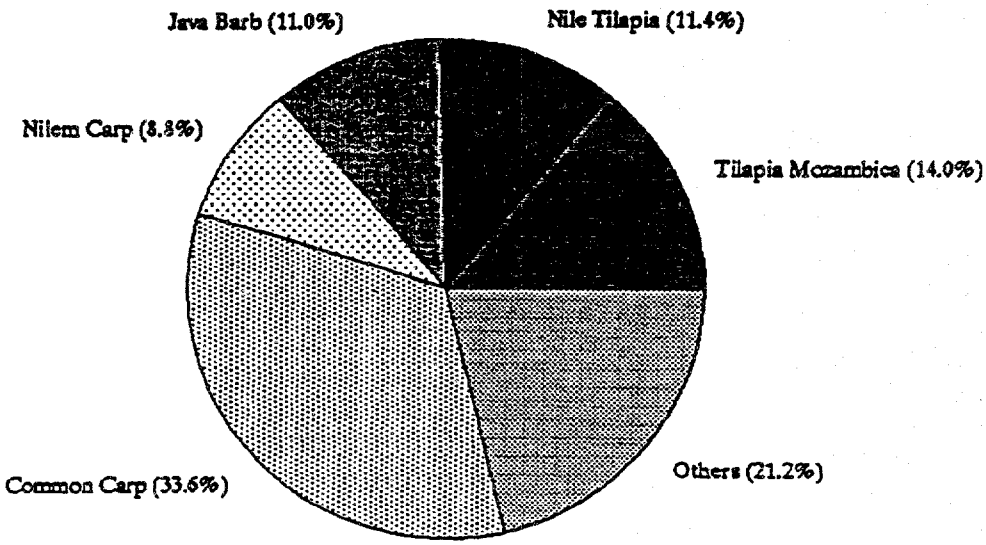
FRESHWATER POND PRODUCTION BY PROVINCE, 1991



Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

FIGURE 26

FRESHWATER POND PRODUCTION BY SPECIES, 1991



Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

tons), Java barb 11 percent (11,738 metric tons), gourami 10 percent (10,237 metric tons) and catfish 4 percent (4,566 metric tons) (see Figure 26). The total number of freshwater pond operators in 1991 was 1,184,776 representing 64 percent of all culturists. Freshwater pond operations are generally quite small with 78 percent of management units less than 0.1 hectares, 15 percent 0.1 - 0.3 hectares, 5 percent 0.3 - 0.5 hectares and only 2 percent greater than 0.5 ha.

Despite the fact that freshwater ponds cover only one fifth the area of tambaks, the total number of freshwater operators was 6.7 times greater than that of brackishwater operators or 34 times more farmers per unit area. Much, but not all, of this difference is attributable to the small unit size and the consequent part time nature of the work. National average kg/ha/year is 1,985 with the major growing areas averaging in West Java 3,535, Central Java 3,932, West Sumatra 1,955 and East Java 1,874. The high productivity of fish ponds in West and Central Java is due to the well developed technological base and the predominance of small carefully managed ponds. Freshwater pond production has grown at an annual rate of 2.3 percent over period 1987 to 1991 from 95,353 metric tons to 106,862 metric tons. Over the same period the fastest annual increase by species was 24.7 percent recorded by catfish followed by *tilapia mozambica* 9.6 percent and Nile tilapia 5.8 percent.

There are two predominant pond management strategies used by the most progressive farmers: stagnant water culture where the exchange rates of pond water are low (about 10 percent or less per week); and running water ponds where exchange rates are as high as 100 percent every 10 minutes. With both methods the fish are fed. Feeding regimes can be as simple as using agricultural and/or household wastes. The more sophisticated farms also feed rice bran and in many cases formulated feeds. In the most intensively managed running water ponds, fish are stocked at rates up to 50 kg/cubic meter and fed at rates up to 3 percent of body weight per day. These ponds are typically small about 200 square meter with yields of 15 metric tons/hectare/year and higher reported.

In 1991, a total of 15.5 billion fish seed were stocked in freshwater ponds of which 5.4 billion were carp, 5.3 billion tilapia, 1.7 billion Java barb and 0.3 billion gourami. The great majority of fish seed were produced by natural breeding in ponds or by small private hatcheries. Although DGF operates numerous freshwater fish hatcheries, its production is less than 5 percent of national freshwater fish fry production.

Freshwater culture technology is well developed in West and Central Java where fishpond operations are highly profitable. It is likely that the West/Central

Java technology will be further disseminated by farmers themselves and DGF extension programs. Although the average annual production throughout Indonesia was 2.0 metric tons/hectare in 1991, the data is distorted by the high levels of production being achieved in Central and West Java (up to 4 metric tons/hectare/year), where 38 percent of the nation's freshwater ponds are located.

As the technology spreads to other parts of Indonesia, it appears likely that production levels of 2.0 metric tons/hectare/year can be achieved in other areas with the high levels of production in Central and West Java being maintained or possibly improved. It is also likely that private production of fish seed stock will be able to keep pace with market demand. Increases in production, plus the expected development of 8,540 hectares of new ponds during Pelita VI will allow freshwater pond production to continue its growth of recent years and result in total production by 1998 of 217,400 metric tons.

In recent years, freshwater prawn, (*Macrobrachium rosenbergii*) hatchery technology was introduced in Indonesia and there are now many hatcheries capable of producing several million fry per month. Precise data is not available, but it is estimated that several hundred ha of ponds are now used for the production of freshwater prawns. Freshwater prawns are a high value crop which are already being processed in Indonesia for export markets and the development of this culture practice has good potential.

Freshwater Cages

There were 18,392 fish farmers practicing cage culture in 1991. Total yield was 6,648 metric tons from 11 hectares of cages. Although this subsector grew rapidly from 1987 to 1991 at an annual rate of 28.8 percent it is still is characterized by very limited production (0.2 percent of national output) and negligible growing area. Production is concentrated 64 percent in Java, 18 percent in Maluku/Irian Jaya and 9 percent each in both Sumatra and Kalimantan. The principal species cultured is common carp which constitutes 81 percent of total yield. Although cage culture practice can be highly effective for fish production in selected rivers and lakes, the subsector remains extremely small. Development is further limited by the availability of suitable sites with acceptable water quality, high capital requirements and high feed costs. Pelita VI plans call for 12.6 percent annual growth of the subsector but the resultant production of 14,800 metric tons in 1998 is still very low.

Paddy/Fish Culture

In 1991, 113,731 hectares of paddy mostly located in East and West Java were used to culture fish in combination with rice (see Figure 27). Total fish production was 80,846 metric tons. Harvested fish were 53 percent common carp, 9 percent Java barb, 4 percent *Tilapia mozambica* and the remaining total spread over numerous species (see Figure 28). Production over the period 1987 - 1991 grew slowly by only 1.7 percent per annum. Average yields per hectare increased up until 1988 and decreased thereafter. Over the period 1989-1991 both absolute and per hectare yields have decreased annually by 10.1 percent from 879 to 711 kg/ha/year.

Successful paddy/fish culture requires limited use of insecticides and pesticides. This strategy is at odds with the trend toward using high yield rice strains that require more intensive use of chemicals. In addition, rice/fish culture requires slight modification of paddy field configuration, more careful water management and in some cases, supplemental fish feeding. Potential appears limited with further expansion requiring major extension and training efforts. Nevertheless, Pelita VI calls for continued growth of the paddy culture of fish. The annual growth rate of production is expected to be 8.3 percent from 1993 to 1998 with a 1998 production of 166,600 metric tons projected.

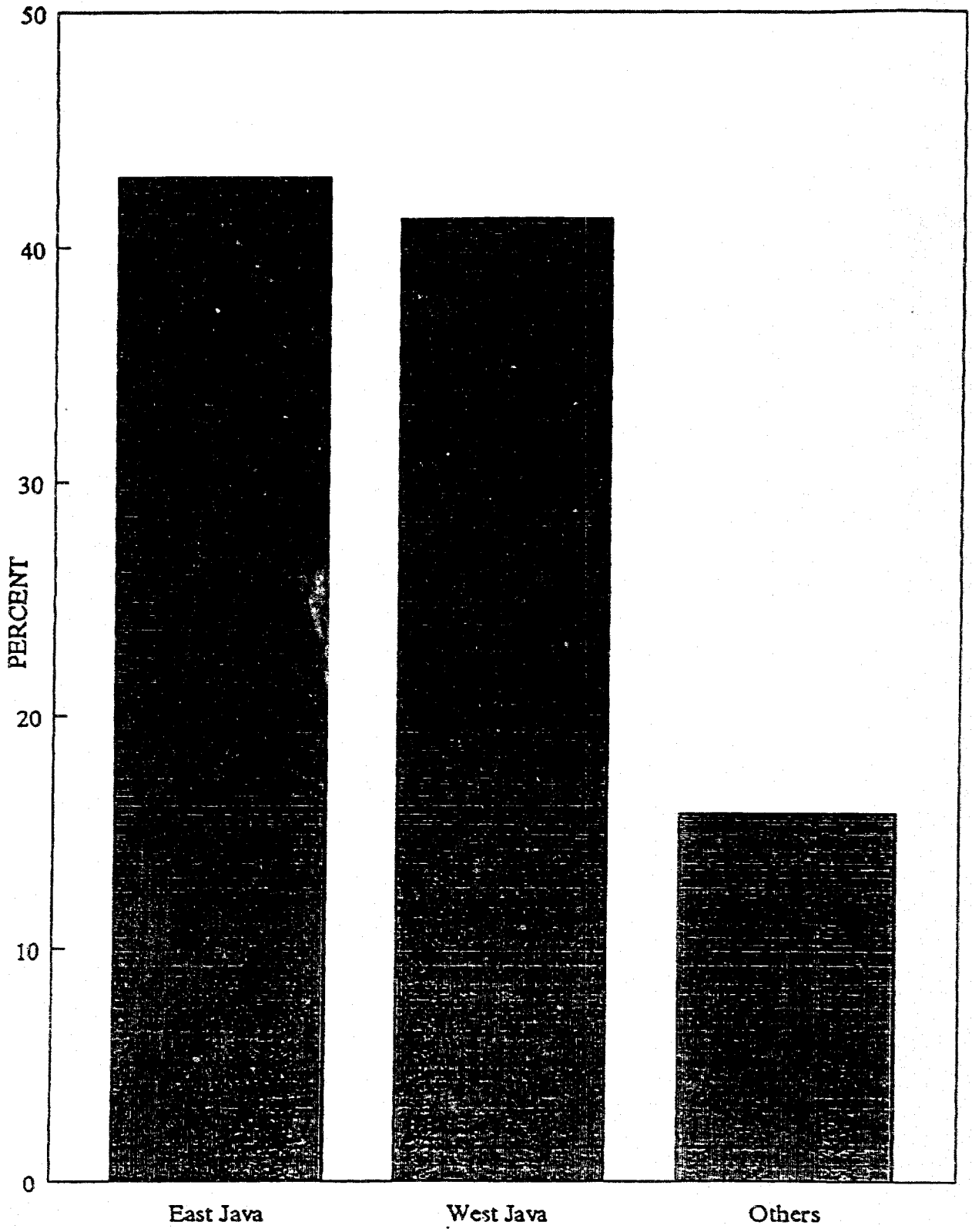
Marine Culture

Seaweed production in 1991 was 97,356 metric tons. Production increased sevenfold between 1984 and 1985, grew annually by 13.6 percent over the period 1985 to 1990 and most recently declined by 21 percent between 1990 and 1991. The recent downturn is probably as a result of industry response to marketing difficulties. Of the total production, 88 percent was recorded from the province of Bali. However, official statistics reflect site of collection rather than growing grounds and most product probably originated from Nusa Penida, eastern Indonesia and Sulawesi. Raw material is usually from natural collection as compared to culture.

Seaweed production has been shown to be economically successful both from wild sourcing and culture. Culture technology is practiced extensively using both wooden grid networks and rafts. The usual species cultured include *E. cottonii, Gelidiem, Gracelaria, E. spinosum* and *Hypnea*. *Gracelaria* is utilized for the production of agar for which there is both a domestic and an international market. Other seaweed species for which the market is more limited are used as

FIGURE 27

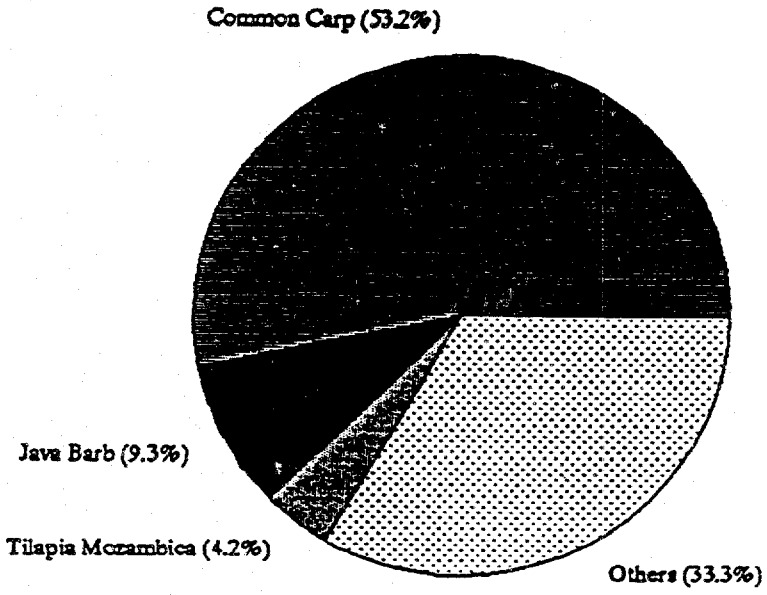
PADDY/FISH PRODUCTION
BY PROVINCE, 1991



Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

FIGURE 28

PADDY / FISH PRODUCTION BY SPECIES, 1991



Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

the basis for specialized extracts (eg. iota - carrageen from *E. spinosum*). Provided marketing arrangements are worked out, potential, exists for increased seaweed culture and the development of downstream extraction industries. Pelita VI calls for continued growth of the seaweed production industry at a per annum rate of 2.1 percent. Total 1998 seaweed production is projected to reach 135,000 metric tons. With the exception of pearls, other marine culture activities while exhibiting excellent development potential are practiced on only a limited scale. Particularly bright potential exists for sea bass, groupers, other fish species, mollusca and pearls.

At present cage culture of sea bass (*Lates sp.*) and groupers (*Epinephelus spp.*) is practiced to a limited extent in country. Sea bass and groupers are carnivorous and fed fish and/or a high protein formulated feed. Since most fish in Indonesia are used for human consumption, competition for product occurs and as a result, sources of feed fish are rather high priced. In addition, the hatchery technology for these fish species is very sophisticated and is only in limited practice. Consequently marine fish culture operations are most commonly stocked from wild caught fry with the fry resource for these species little understood and not yet properly investigated.

Stake culture of mussels, and to a lesser extent oysters and clams, is common throughout the world. In the region it has been successfully introduced in the Philippines where production has become sizeable. The technology is not sophisticated and stakes or rafts can be constructed from locally available, inexpensive materials.

In a related industry, pearl culture has grown rapidly increasing nearly five fold from a 1987 production of 474 kg to a 1991 production of 2,237 kg. Rearing technology is now known in Indonesia and many excellent pearl culture sites exist in the country. If pearl quality is maintained and supported by careful marketing, export potential is excellent and pearl production can continue to increase rapidly. Culture of shellfish can be particularly useful as biofilter systems in the discharge waters of shrimp and fish culture farms.

The potential for cultured production of shellfish in Indonesia is good, but with the exception of secondary uses (e.g. shrimp/fish feed) the local market for the crop is limited. Nevertheless, the crop could serve an environmentally sound role and, as good export potential exists, development of mussel, clam and oyster culture is thought to present excellent prospects.

CHAPTER FIVE
PROCESSING, DISTRIBUTION AND MARKETING

ICE PLANTS

Indonesia has over 400 ice plants with a capacity of 7,000 metric tons/day. Capacity has increased by about 75 percent since the early 1980's. Ice production is concentrated in urban areas with most ice going to non-fisheries uses. Typically ice plants produce 50 kg blocks from municipal water that is not re-treated. The quality of ice is variable. Ice making and ice storage facilities are provided at Class A, B and C fishing ports and some landing sites. General access to ice is good in all but the most remote fishing areas. Ice is in common use for preservation of shrimp and other high value fish. Its use in other fisheries is limited, but not uncommon, being conditioned by market considerations. Increased use of ice for fishing and aquaculture operations continues to be encouraged by processors and DGF to reduce post-harvest losses and improve fish quality.

FREEZING/COLD STORAGE

Parallelling the growth of export markets, the number and capacity of freezing/cold storage facilities has increased dramatically. Most seafood is frozen for export with a small but growing proportion consumed domestically. While there were 40 freezing plants with a production capacity 300 metric tons/day in 1980 by 1990 the industry had grown threefold to 175 plants with a capacity of 892 metric tons/day (see Table 19). Similarly cold storage capacity has tripled from 14,245 metric tons in 1980 to 40,210 metric tons in 1990. It is estimated that approximately 214,000 metric tons of seafood was frozen in 1991. Since most freezing/cold storage facilities are dedicated exclusively to seafood processing with particular focus on shrimp, on an overall basis it is estimated that less than 60 percent national freezing capacity is utilized. In many areas such as East Java and North Sumatra, the situation is even more depressed with 1993 utilization estimated at less than 40 percent of capacity due to decreased shrimp production from farms hit by diseases.

Recently built freezing/cold storage facilities were constructed to accommodate the rapid growth of shrimp aquaculture. For ocean captured shrimp, most are handled (sorted, de-headed, etc) by facilities located near jetties before transport to large plants for final processing. Many plants which formerly concentrated on cultured shrimp are now attempting to make up for aquaculture

shortfalls by sourcing more product from the marine fleet. A relatively small proportion of the ocean catch is processed on board trawlers operating in eastern Indonesia. There is a minor but further need for growth of inter-island transport of frozen fish from eastern remote areas to the main consumption centers; such fish need not be marketed as frozen fish, but can be sold as fresh fish after thawing.

Over the medium term, significant additional investment in freezing/cold storage plants is not envisaged as there is currently idle capacity. Higher utilization of existing capacity can be accomplished by using more than one shift per day and improved management can increase throughput. Additional investment is expected to be carefully weighted and only considered when linked to production increases, for example, with planned aquaculture projects or new fishing and transport operations.

CANNERIES

In 1993, there were 22 fish canning plants in Indonesia. While in the past sardines and mackerel were the main raw material, this has changed to tuna over the last five years with 12 of the 22 plants concentrating almost exclusively on tuna. Indonesia is now one of the largest tuna canners in the world. Total annual production capacity for all fish canning is estimated at 500,000 metric tons of which tuna canneries comprised 70 percent (350,000 metric tons) of the total. While canned tuna is mostly exported, sardines and mackerel are usually consumed domestically. Over 80 percent of the plants are located in either East Java (45 percent), Bali (18 percent), North Sulawesi (9 percent) or North Sumatra (9 percent).

On a production basis, most canning capacity is found in East Java followed by North Sumatra and then Bali. The highest concentration of new tuna canneries is in Bitung, North Sulawesi. Estimates are not made for domestic consumption of canned fisheries products. However, if it is assumed that 20 percent of the sardine and mackerel catch are canned, the total canned would equal approximately 100,000 metric tons. Statistics do exist for exports of canned fisheries products which totalled 43,287 metric tons in 1991. Therefore, total 1991 production of canned fisheries products is estimated at 150,000 metric tons or less 30 percent of capacity. This low capacity utilization conforms to industry opinion. The low utilization is due to lack of coordination between canneries and sources of raw materials, limited domestic demand for the products and lack of export marketing arrangements.

OTHER PROCESSING

It is estimated that in 1991 about 1.3 million metric tons of fish (40 percent of total production) was processed and consumed using traditional methods such as drying, salting, smoking, boiling or fermenting (see Tables 20, 21, 22, and 23). On a tonnage basis, modern mechanized factories produce about 30 percent and approximately 4,300 traditional units 70 percent of processed fish products. Traditional processing units are encouraged as labor intensive activities useful in enhancing the consumption of low value fish.

The most popular processing method is drying with about a quarter of all fish landed dried and salted. Salted/dried product is a very popular diet item largely because it is easily transported and stored and is relatively cheap. Dried product often has a shelf life of up to 3 months. Drying and salting is done almost entirely by traditional means using both pelagic and demersal fish as a raw material.

Smoking is undertaken for both preservation and flavoring. Boiling in brine is a common method of short term preservation especially for mackerels and large pelagics. However, boiled product is a delicacy item lasting only about a week. Boiled and smoked fish are relatively cheap but largely consumed only on Java.

The most popular species for drying and smoking is skipjack in eastern Indonesia and aquaculture produced milkfish on Java. Significant potential exists both to expand the number of modern curing plants and to upgrade traditional producers. In light of the lack of transport options from capture grounds in eastern Indonesia to the consumption areas on Java and Bali, further development of these processing technologies could be especially useful.

FISH MEAL PLANTS

Largely in response to increased demand for aquaculture feeds, between 1987 and 1991 fish meal production in Indonesia grew at an annual rate of 51.4 percent. The number of fish meal plants has also expanded rapidly over the last five years. By 1991 there were approximately 50 fish meal plants with a total installed capacity of about 150,000 metric tons per year. However, capacity utilization is extremely low with 1991 production of 11,000 metric tons only about 10 percent of capacity. Since fish meal is the largest fisheries import item both in terms of quantity [in 1991 68 percent of all imports by volume (48,676 metric

tons)] and value [in 1991 58 percent of all imports by value ($30.6 million)] it is likely efforts for import substitution will continue. Pushed by strong demand for aquaculture feeds, a drive to increase installed capacity utilization and a move to decrease imports, the trend toward increased domestic fish meal production is likely to continue.

AUCTION HALLS

Auction halls totalling over 600 are located at Class A, B and C fishing ports and all fish landing sites. Auction halls are typically constructed with funds from DGF and organized, managed and supervised by local government. If a local fishermen's cooperative (KUD) meets a basic set of criteria it is charged with responsibility for daily auction operations. If capabilities are not met by the KUD, an alternate body such as the Provincial Fisheries Services (Dinas Perikanan) is appointed temporarily by the local government to manage the auction place. Close coordination between the port and/or landing site authority, the provincial fisheries service and the KUD is required to ensure proper division of duties and responsibilities. Cost of operations are met by a 5 percent fee charged on auction sales. Under such arrangements, many KUD's are reported to be profitably operating auction halls. Further improvement of auction halls will require additional business management training and increased emphasis on sanitation and hygiene.

DOMESTIC MARKETING AND DISTRIBUTION

With nearly two-thirds of the national population, Java is the primary domestic market for fish. Since less than 30 percent of Indonesia's fish production comes from Java, it is a large net fish importer. Fresh fish supplies for Java's large urban markets are mostly generated by marine landings and aquaculture production located along the northern Java coast. The fresh fish marketing chain is comprised of numerous transaction steps among producers, intermediaries and customers.

Although there are many variations, typically fish buyers make purchases from fishermen and fishfarmers at fish landing sites and bring the catch to nearby local auctions where it is purchased by rural wholesalers. The rural wholesalers, in turn, pack and transport the fish to urban markets where it is sold or auctioned to urban wholesalers.

On Java, the largest fresh fish markets are Jakarta, Pekalongan and Juwana. At this point, the fish may be consigned to fish dealers who in turn supply retailers, or in some cases, the dealers may be by-passed, with fish going directly from the urban wholesalers to the larger retailers in public markets or supermarket chains. The inter-island transport of fisheries products to Java involves primarily dried, salted and smoked fish with virtually all shipment utilizing small, private unrefrigerated cargo vessels. In addition, salted and dried fish is transported within Java by overland transport.

The largest wholesale market for dried and salted fish in the country is located in Jakarta where annual turnover is estimated at 60,000 metric tons. The dried or cured fish marketing chain is more direct than that of fresh fish with sales from provincial collectors/traders to urban wholesalers to urban dealers to retailers.

INDUSTRY ASSOCIATIONS

The major fisheries associations are: (1) Indonesian Fisheries Federation (GAPPINDO); (2) Union of Indonesian Fisheries Industries; (3) Association of Shrimp Hatcheries; (4) Union of Fish Farmers; and (5) Cold Storage Association. There are in addition numerous smaller local fisheries associations. The most active association is GAPPINDO which was established in 1989, based on a collective agreement of fisheries entrepreneurs. Membership in GAPPINDO includes a wide cross section of about 150 public and private firms with interests in all industry sectors including capture, aquaculture and processing.

Parallelling commercial growth, most representatives are from either the tuna or shrimp industries. GAPPINDO's primary objectives are: (1) sustained growth of fisheries; (2) equitable distribution of benefits; and (3) industry stability. GAPPINDO attempts to attain these objectives through coordination and cooperation of diverse private and public industry interests. GAPPINDO has been most active in sponsoring training programs to improve culture techniques and product quality especially for exports and developing new export markets through promotion of Indonesian products and attendance at overseas shows.

CHAPTER SIX
FISHERIES EXPORTS AND IMPORTS

INDUSTRY PERFORMANCE

As a result of enhanced investment in fishing, aquaculture and processing industries, exports of fisheries products have recorded impressive growth in recent years. From 1987 to 1991 export value of fisheries products increased at an annual rate of 28.1 percent from $475 million to a record $1,256 million (see Figure 29 and Table 24). Relative to other agriculture exports, fisheries performance has been impressive increasing from 1 percent of all agriculture export in 1968 to 30 percent in 1990. A healthy trade balance was maintained (see Table 25). Compared to exports, fisheries imports are very small. Total 1991 fisheries imports were only 4 percent by value and 17 percent by volume of exports.

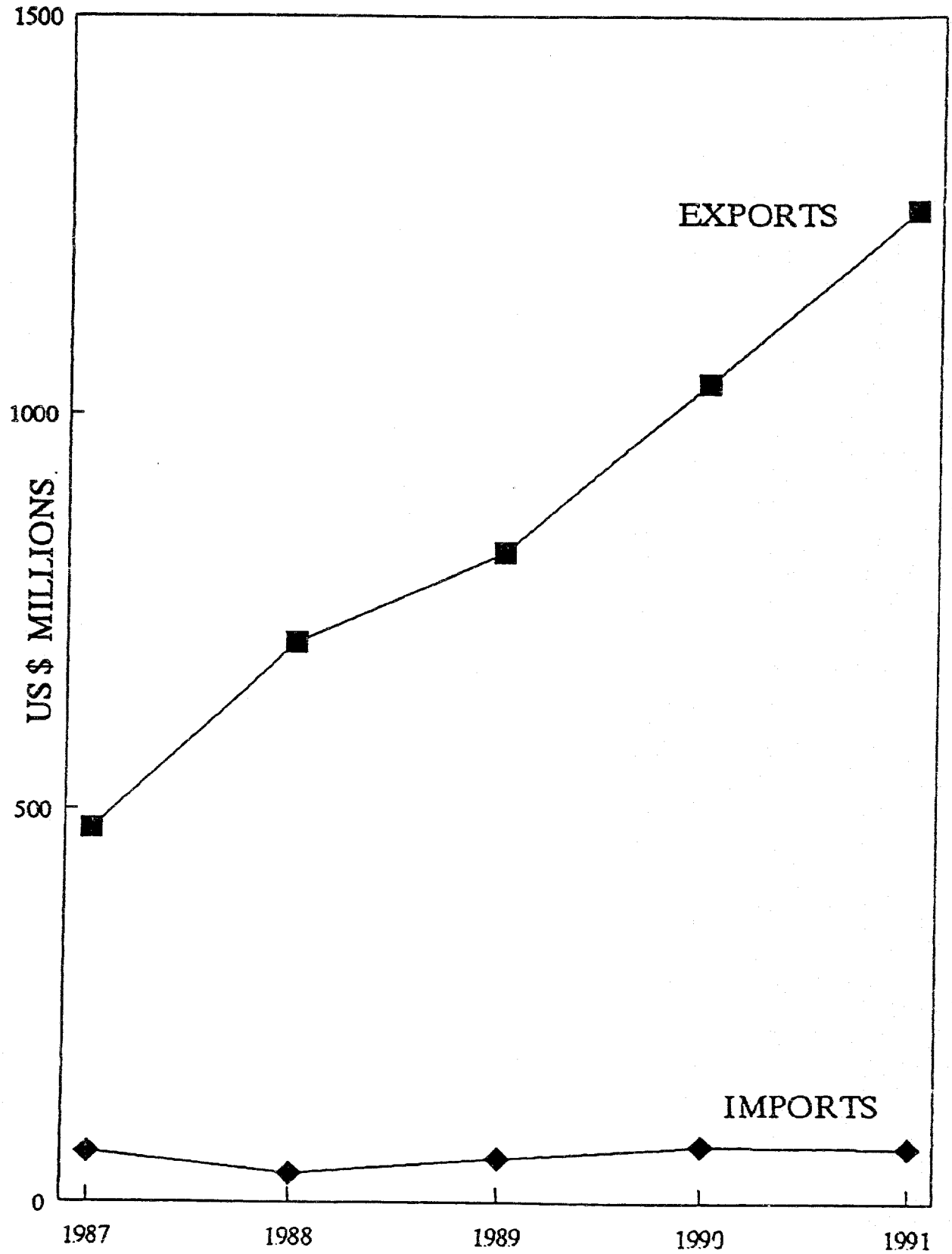
National development goals encourage increased export and decreased import of fisheries products. These goals were generally fulfilled over the five year period 1987-1991 when the overall balance of trade both as a percent and in absolute terms consistently improved. In 1987, exports exceeded imports by $448 million with imports 6 percent of exports. By 1991 exports exceeded imports by $1,203 million, a nearly two and a half times increase, with imports only 4 percent of exports.

From 1987 to 1991 exports of fisheries products by volume increased by 30.8 percent per year from 140,378 metric tons to 409,043 metric tons (see Figure 30). Value over the same period rose at an annual rate of 28.1 percent from $475 million to $1,256 million. By commodities shrimp and tuna/skipjack (fresh/frozen) were the predominate export items. In 1991, shrimp exports formed 23.4 percent of total volume and 61.3 percent of total value; while tuna was 25.3 percent of total volume and 14.7 percent of total value (see Figure 31).

Over the period 1987 to 1991 the annual value of shrimp exports grew by 22.1 percent and that of tuna by 49.1 percent. Shrimp exports as a percent of export value have consistently declined from a 1985 high of 78 percent to the 1991 value of 61 percent. Reflecting the large increase in canned production and sashimi export, tuna over the same period increased as a percent of export value from 6 to 15 percent. Other major seafood exports, in order of value, include marine fish other than tuna, frogs legs, fish oil, crab, shrimp crackers, jellyfish and aquarium fish.

FIGURE 29

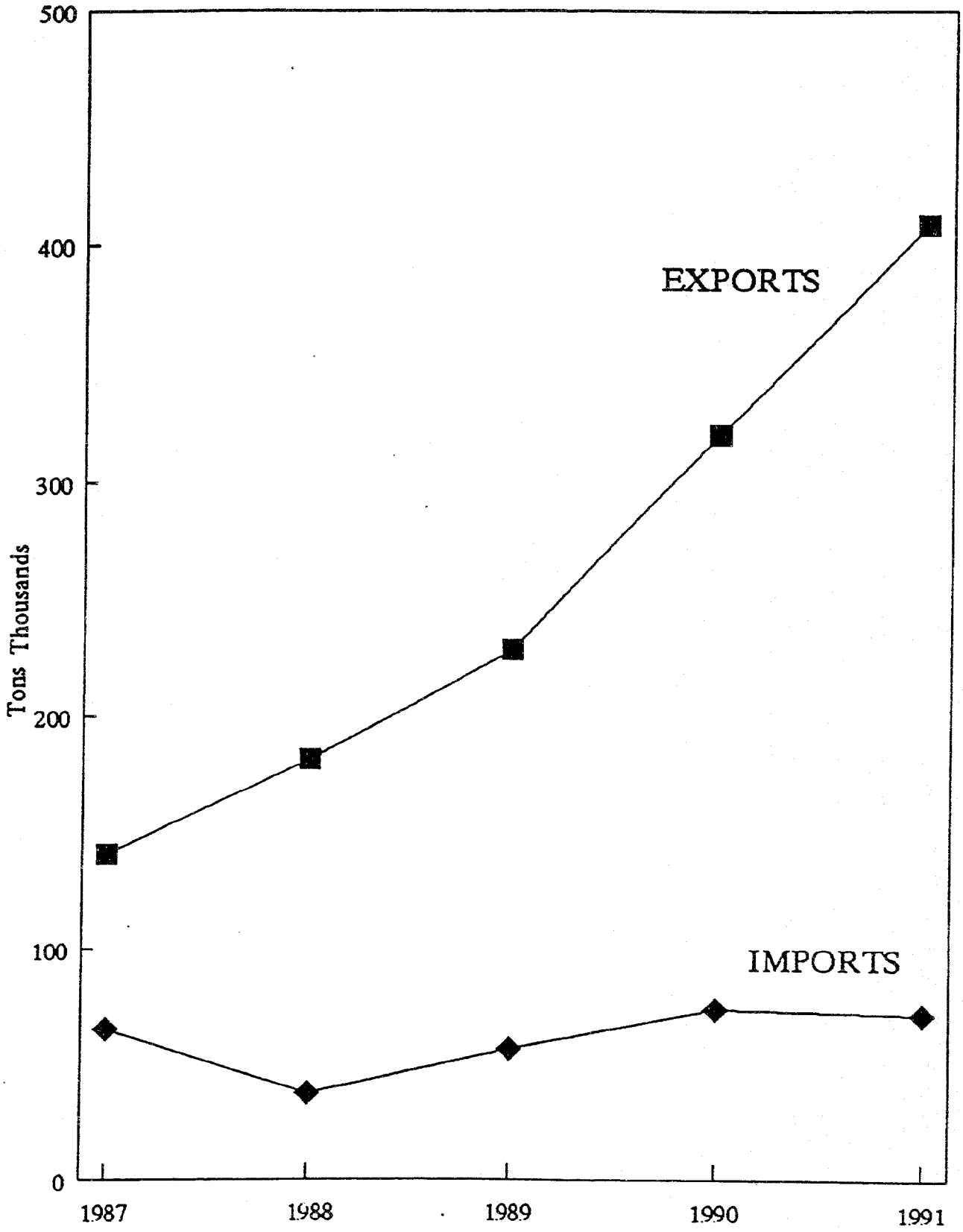
EXPORT/IMPORT VALUE
1987 – 1991



Source: DGF, International Trade Statistics of Fisheries Commodities

FIGURE 30

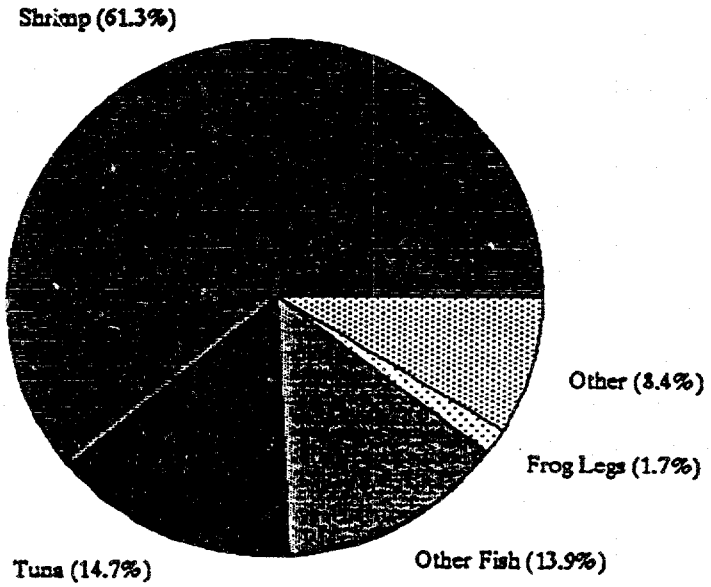
EXPORT / IMPORT VOLUME
1987 – 1991



Source: DGF, International Trade Statistics of Fisheries Commodities (Statistik Ekspor & Impor Hasil Perikanan), 1991

FIGURE 31

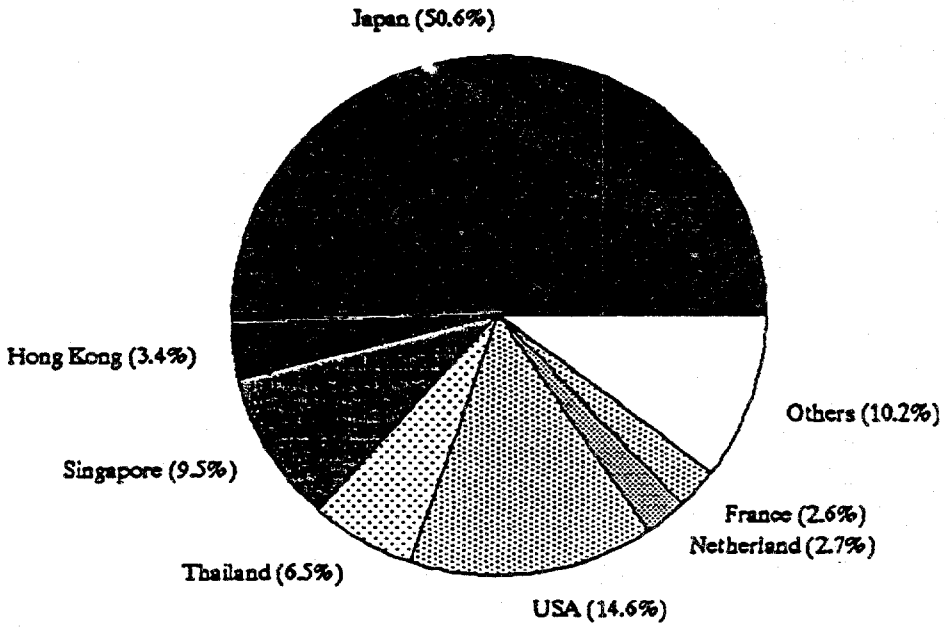
EXPORT VALUE BY COMMODITY, 1991



Source: DGF, International Trade Statistics of Fisheries Commodities (Statistik Ekspor & Impor Hasil Perikanan), 1991

FIGURE 32

EXPORTS VALUE BY DESTINATION 1991



Source: DGF, International Trade Statistics of Fisheries Commodities (Statistik Ekspor & Impor Hasil Perikanan), 1991

Total exports of fisheries products by value in 1991 went principally to Japan 51 percent, USA 15 percent, Singapore 10 percent, Thailand 7 percent and Hong Kong 3 percent (see Figure 32). Shrimp by value was directed to Japan 63 percent, USA 15 percent and Singapore 10 percent. Tuna by value was directed to Japan 50 percent, USA 27 percent, Netherlands 5 percent, Germany 4 percent and Thailand 4 percent. Thailand, although a relatively minor importer of Indonesian fisheries products in general, imports a significant quantity of tuna for domestic canning.

Average price of fisheries products declined by 1.9 percent per annum during the period 1987 - 1991 with shrimp prices increasing only about 1.1 percent per year and that of tuna more robust at 16.4 percent per year. Seafood prices, in general, are quite volatile. For example, in the third quarter of 1989 shrimp prices dropped by about 40 percent. Shrimp prices have since recovered to their 1989 high. Both shrimp and tuna prices are expected to remain close to 1991 levels in the long term (ie. next 5 years) but exhibit large cyclical swings around these levels.

Fisheries imports are very small. Total 1991 fisheries imports were only 4 percent by value and 17 percent by volume of exports. From 1987 to 1991 imports of fisheries products increased by 8.6 percent per annum from 65,371 metric tons in 1987 to 71,552 metric tons in 1991. Over the same period, value of imports increased per annum by 22.0 percent from $27.8 million to $52.4 million. The major import item was fish meal which constituted 68 percent of total imports by volume (48,676 metric tons) and 58 percent by value ($30.6 million) in 1991. Principal sources of fish meal are Chile, Peru, Japan, Thailand and China. Other less important imports are: other meals, fish oil and fresh and frozen fish.

INSPECTION AND QUALITY CONTROL

Implementation and maintenance of quality control standards is of paramount importance for export development. Major export markets of Japan, USA and Western Europe all have strict entry requirements. Although Indonesia's record in meeting foreign entry standards has improved dramatically since the 1980's when US authorities automatically detained all Indonesian shrimp exports, quality control remains a government priority area. Responsibility for fisheries quality control is divided among the Departments of Agriculture for raw material, Trade for final product and Health for health requirements of both raw and final product. Joint regulations with division of jurisdiction are issued in areas of mutual concern. Joint regulations stipulate compliance on codes of practice,

technical specifications, testing methods, safety, health requirements, packaging, labelling and processing methods.

Each processor must obtain a "Good Manufacturing Certificate" issued by the DGF on the basis of a mandatory inspection system. The DGF is supported by a network of 24 provincial fish quality control and inspection laboratories. Processing facilities are subject to continuing inspection and, if violations are found, certification can be revoked. In addition, very processor must employ at least one person holding a "Fish Processor Certificate" also issued by the DGF. All new products require an "Examination Certificate" before being allowed to market and products for export also need an "Export Quality Certificate". DGF has set quality standards for 33 fisheries products. Standards have been set for organoleptic, microbiological and chemical tests.

An "Export Quality Certificate" issued by a testing laboratory accredited by the Department of Trade based on norms set by the National Council of Standardization is mandatory for only three products: frozen shrimp, frozen tuna and frozen froglegs. Current efforts to improve the quality of fisheries exports emphasize introduction of the "Hazard Analysis Critical Control Point" (HACCP) concept throughout the entire production, processing and distribution chain.

EXPORT PROSPECTS

Over the near term future, seafood exports are expected to increase, albeit at a reduced annual growth rate of approximately 10 percent. Shrimp/prawn exports will continue to dominate exports but their share of total export value will decline and further market diversification away from Japan will occur. Though shrimp diseases will continue to plague intensive growers, increased yields from extensive and semi-intensive farms should allow for moderate growth in production.

In addition, Indonesia should be able to take advantage of increased shrimp export sales through more value added processing. Supported by recent investment in plant and equipment, excellent raw material supplies and low labor costs, tuna exports are expected to maintain strong growth. Product should be available as tuna resources are considered to offer good potential for increased exploitation in eastern and southern Indonesian waters. The sashimi market is limited to Japan with significant competition from other producers and, as a result, export sashimi sales are expected to increase only slightly. However, major expansion is expected to continue in canned tuna exports especially to Europe.

Other species including cephalopods, other marine fish and seaweed offer good export potential after value added processing.

CHAPTER SEVEN
PUBLIC ADMINISTRATION AND SUPPORT SERVICES

FISHERIES ADMINISTRATION

DGF within the Ministry of Agriculture is the primary agency responsible for the administration, management and development of fisheries in Indonesia. The DGF oversees all matters relating to fisheries administration at the central, provincial, district and subdistrict levels. These responsibilities include collection of statistics, applied research, planning, fisheries management, training and extension, provision of infrastructure facilities and development and control of fisheries enterprises (see Table 26).

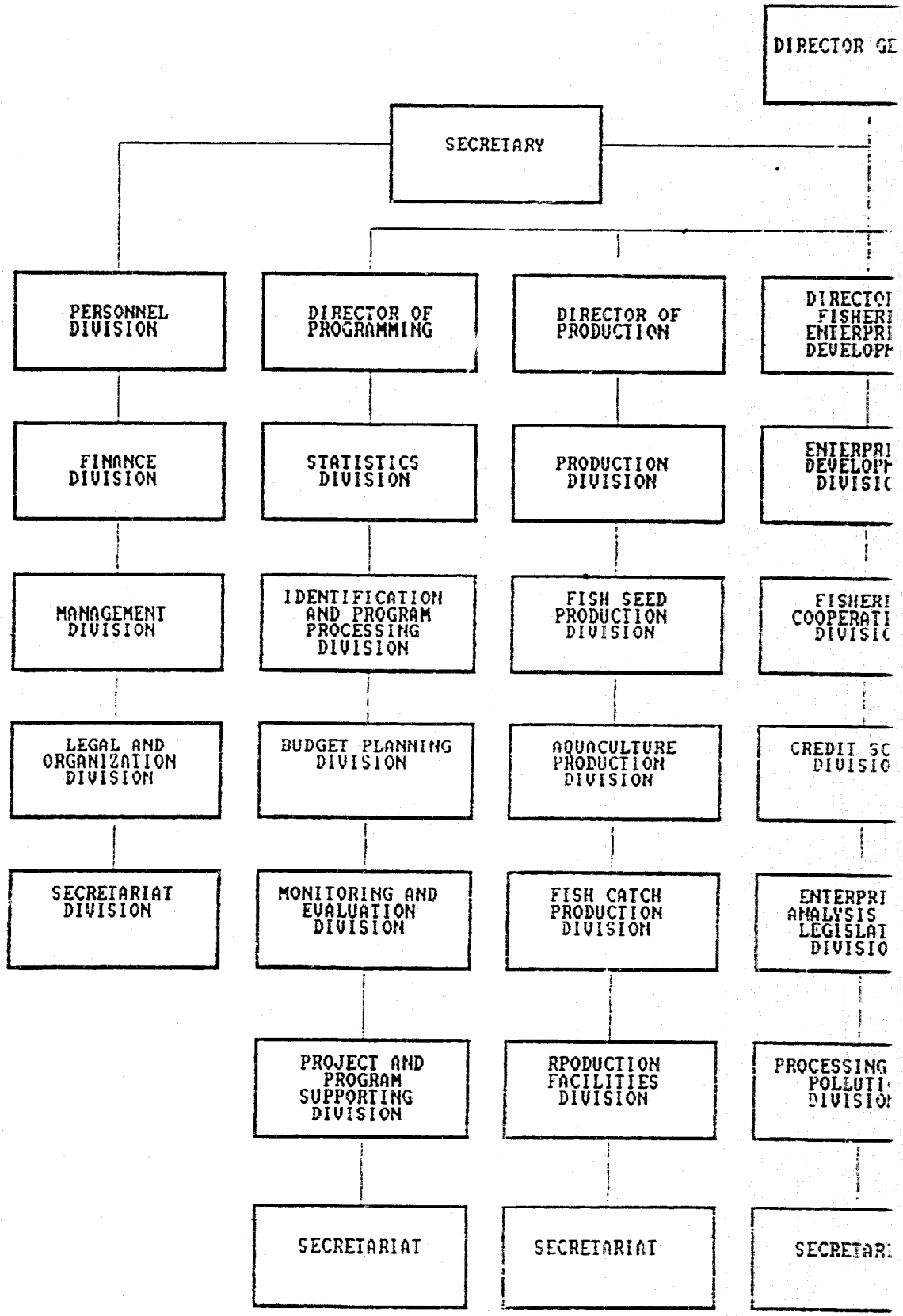
The DGF is organized into six technical directorates: (1) planning; (2) resources; (3) production; (4) fisheries enterprises; (5) infrastructure; and (6) extension and an administrative secretariat (see Figure 33). In addition to its Jakarta headquarters, DGF has fisheries stations dedicated to: (1) brackishwater culture (Jepara); (2) freshwater culture (Sukabumi); (3) marine fisheries (Semarang); (4) post harvest (processing, quality control) (Jakarta); and (5) marine culture (Lampung). In 1993, total DGF staff numbered 5,090 located 937 at Jakarta (578 core staff; 87 special projects; 272 for 6 state enterprises), 2,766 posted to the provincial fisheries services (Dinas Perikanan), 579 at the 5 fisheries stations and 808 at fishing ports.

DGF functions at provincial, district and subdistrict level are discharged by the Dinas Perikanan located throughout the country. The 2,766 DGF Dinas Perikanan staff work at 27 provincial fisheries offices, 285 district fisheries offices and numerous subdistricts. The Dinas Perikanan offices and staff facilitate assistance to local fishermen and fishfarmers, and assist in coordinating government programs, disseminating information, collecting statistics and providing technical advice on fishing and related activities. The provincial fisheries offices have separate sections for planning, education, research, technical services and administration, and are jointly funded by the central government and the appropriate agencies of the provincial government. Fishing licenses for operations using foreign capital or personnel and for local vessels over 100 gross tons or greater than 20 m in length are issued by DGF headquarters. Licenses for smaller local fishermen and enterprises are issued by the provincial government.

F I G U R

ORGANIZATIO

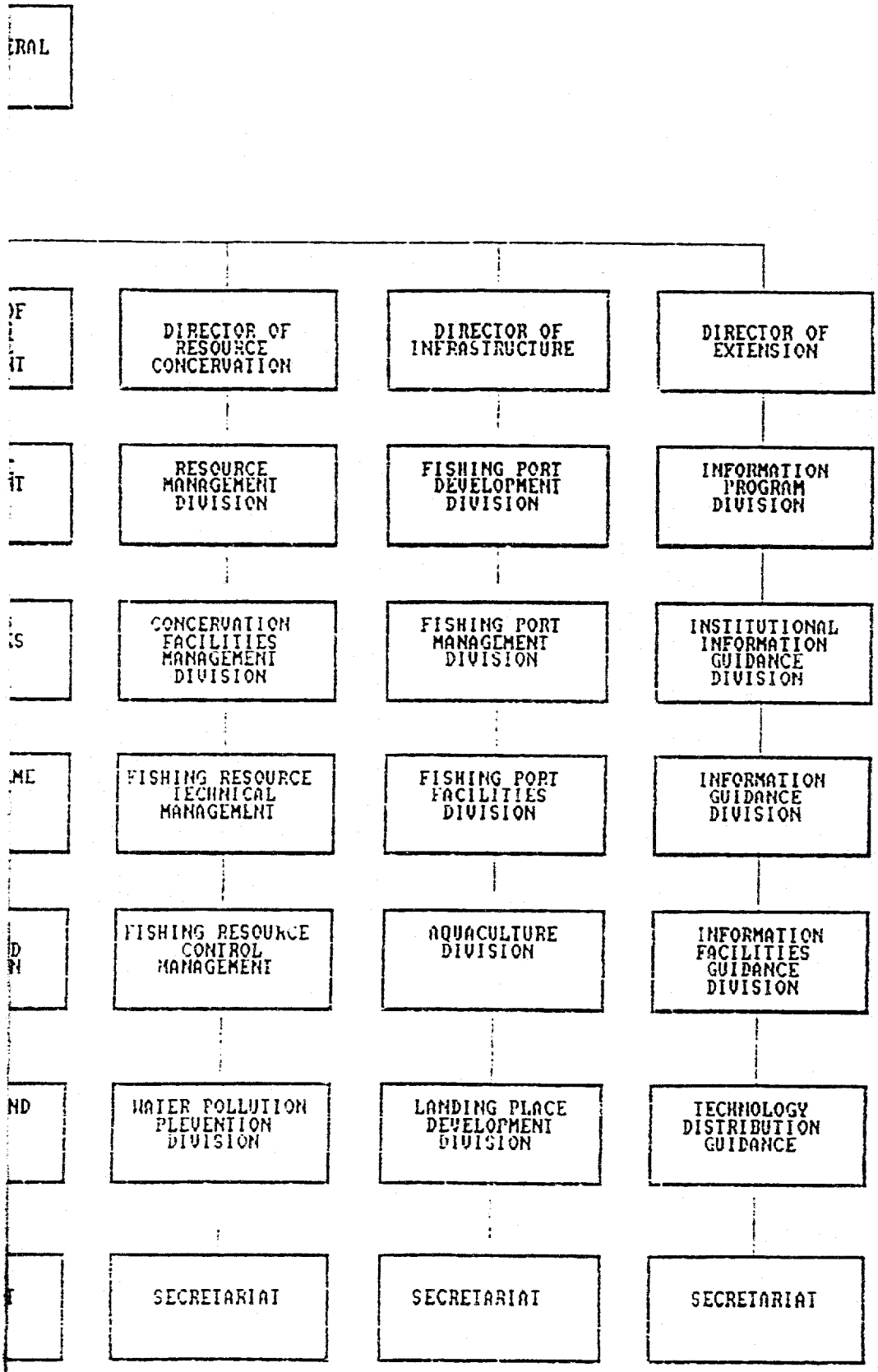
DIRECTORATE GENERA



E 33

CHART

OF FISHERIES



INTER-GOVERNMENT LINKAGES

Fisheries development requires coordination between eleven principal government ministries. Areas of responsibility by department include:

1. Planning - formulation of development plans, coordination with foreign donors;
2. Finance - funding in the sector, coordination with foreign donors and creditors;
3. Industry - vessel construction and repair, shipyards, processing plants, cold storage, feed mills, ice plants;
4. Environment - environmental impact assessment, mitigation of negative impacts, review of operating and monitoring plans;
5. Trade - domestic and export marketing, market information systems, product diversification and standards;
6. Transport - domestic and international shipping, product movement from areas of production to processing and/or consumption;
7. Public Works - production to processor/market connecting roads, tambak water distribution canals and infrastructure, fisherman/farmer settlements including water and sanitation systems;
8. Interior - determination of provincial distribution of development and technical assistance;
9. Transmigration - implementation of fisheries/culture transmigration programs;
10. Cooperatives - fisheries, processing and marketing cooperatives, auction hall management;
11. Armed Forces - enforcement of fisheries laws and regulations especially at sea.

The range of activities varies from granting of permits to physical project implementation depending on the specifics of the government program. In all cases liaison is required with DGF and often between several of the executing departments. Additional linkages occur with local government which is responsible for granting of building permits, land use rights, territorial fishing rights and other local issues.

STATE PRODUCTION ENTERPRISES

There are 5 state owned fisheries enterprises (BUPM) all of which were originally set up in the mid 1970's to exploit resources which had not attracted

private investment. Three (P.T. Usaha Mina in Sorong, Irian Jaya; P.T. Perikani in Bitung, North Sulawesi; Perum Perikanan Maluku in Ambon, Central Maluku) are engaged in skipjack pole and line fishing, fish purchase and collection from small fishermen, processing and sales.

One, (PT. Perikanan Samudra Besar) headquartered in Bali, is engaged in long line fishing, processing and sales. PT. Perikanan Samudra Besar is under joint management with a private firm, PT. Bali Raya, a division of the Mantrust Group. PT. Tirta Raya Mina, located in Central Java, specializes in fish purchase, processing and sales. Sales are made to both domestic and international markets. Though these enterprises have already lost their pioneering function in the fast growing free market economy, they are still very active and pursuing further expansion and growth.

The largest tuna company in Indonesia, P.T. Usaha Mina, has continued to expand operations under a nucleus/plasma system offering credit for smallholder fishing vessels and gear on condition that tuna catch is then sold back at preset prices to its collection system. In 1990, all enterprises, except Perum Perikanan Maluku (loss Rp. 647 million), recorded profits. The largest profit was made by P.T. Tirta Raya Mina (Rp. 759 million) followed by P.T. Usaha Mina (Rp. 554 million), P.T. Perikanan Samudra Besar (Rp. 471 million) and P.T. Perikani (Rp. 364 million) (see Table 27). Total catch at 21,987 metric tons was only about 1 percent of the total marine finfish catch. The largest landings were made by P.T. Usaha Mina with 18,035 metric tons or 82 percent of the total state enterprise catch.

NUCLEUS ESTATES

In an effort to fulfill its goals of private sector development, promotion of enhanced technologies and improvement of smallholder incomes, the Government is active in encouraging nucleus estate type projects. Nucleus estates have been used in agriculture and the model extended to fisheries. In general, projects include a nucleus, large-scale commercial operation which supplies sophisticated technological inputs and marketing assistance surrounded by a plasma of small-scale producers. The model is applied to both the aquaculture and capture fisheries. In aquaculture projects, the nucleus company develops smallholder ponds, provides extension support including credit, sells shrimp fry and other inputs and purchases final product for processing. In the capture fishery, a nucleus company gives extension support, provides materials and purchases product from small-scale fishermen.

Government policy is to promote nucleus estate type projects wherever the model can accommodate development objectives. Examples of nucleus estate aquaculture projects are found in several of the transmigration and foreign donor supported shrimp tambak projects. P.T. Usaha Mina, the largest tuna producer in the country, is a marine capture nucleus estate company.

COOPERATIVES

The Government through the Ministry of Cooperatives actively encourages cooperatives as a vehicle to better provide services to fishermen. Cooperatives in all sectors of enterprise including fisheries are organized into Village Cooperative Units (Koperasi Unit Desa (KUD)). There are over 750 fisheries KUD's with about 400,000 members. Fisheries KUD's can be found in every province. A KUD usually consists of both an administrative and an operational echelon. Fisheries KUD's are active in purchase of inputs, management of small stores to service local communities and marketing. One of the most important activities of KUD's in the sector is the management and operation of fish auction halls in facilities constructed with funds from DGF. Many KUD's are reported to be profitably operating auction halls.

EDUCATION

Formal fisheries education is offered at: (i) fisheries departments within faculties of agriculture at 10 private and 10 public universities; (ii) 4 fisheries academies; (iii) 11 senior fisheries high schools; and (iv) 5 adult training centers (see Table 28). The public sector institutions are the responsibility of the Agency for Agriculture Education, Training and Extension (BPLPP) under the Ministry of Agriculture which is organized into Bureaus of Extension, Education and Training and Personnel Training. Within each bureau are sections devoted to fisheries.

EXTENSION

Formerly BPLPP played the major role in fisheries extension. However, two years ago BPLPP's responsibility was reduced to a policy and methodology role with additional responsibility only for extension officer training. The separate directorates under the Ministry of Agriculture (including DGF) have been given responsibility for the administration of extension services. With the recent establishment of a Directorate of Extension under DGF, extension officers now

can better focus their efforts on marine and aquaculture extension activities. The fisheries extension staff which totals 4,411, is active in all 27 provinces of the nation. Local government provides budgetary support for 56 percent of the extension workers and DGF, mostly through Dinas Perikanan programs, the remaining 44 percent. Of the total workers, 325 are university graduates. Technical programs are formulated at DGF headquarters in Jakarta and disseminated by the field staff. Extension efforts are targeted at all the major production sectors.

RESEARCH

The Agency for Agricultural Research and Development (AARD), a specialized agency of the Department of Agriculture, coordinates fisheries research through the Central Research Institute for Fisheries (CRIFI) located in Jakarta. CRIFI consists of three divisions: marine capture, freshwater culture and coastal aquaculture. The principal research station for marine capture is located in Jakarta with subcenters at Jakarta (Ancol), Jakarta (Slipi), Semarang and Ambon. The principal research station for freshwater culture is in Bogor with substations in Depok, Jatiluhur and Palembang. The principal research center for coastal aquaculture is in Maros (South Sulawesi) with substations in Gondol (Bali), Bojonegara (West Java) and Tanjung Pinang (Riau).

Operational linkages exist between CRIFI and the respective technical sections of DGF. CRIFI total staff at all facilities numbers about 825. The center actively disseminates its findings through frequent seminars and publications. For example, in August 1993 CRIFI organized the first annual symposium of Indonesian fisheries which included over 200 technical presentations supported by published works, which attracted an audience of several thousand. Coordination between AARD, DGF and other Directorates is maintained through a Research Board chaired by the Minister of Agriculture.

Other institutions which are involved in fisheries research are:

1. Universities including those at Jakarta, Bogor, Bandung, Semarang, Malang, Yogyakarta, Ambon and Lampung.
2. National Oceanographic Institute (LON) at Ancol (Jakarta) with a substation at Ambon is administered by the National Academy of Science (LIPI).

3. Traditional Fish Processing Center (TFPC), in North Jakarta works to develop the skills of traditional fish processors and improve the quality of their products.
4. Institute of Fishery Technology at Jakarta is administrated by the Ministry of Education and carries out chemical and microbiological research on fisheries products and the utilization and standardization of fisheries products.
5. Provincial research facilities principally focus on various aquaculture programs.

ENFORCEMENT

Except in the case of processing industries, neither the Ministry of Agriculture nor DGF has direct control over enforcement of Indonesia's fisheries regulations and laws governing resource exploitation and management. These duties are the responsibility of the Coordination Board for Sea Security (BAKORKAMLA) which consists of navy, customs and police personnel. To successfully manage fisheries resources credible enforcement of the law is required. However, due to constraints of information flows, funding, equipment and manpower, illegal fishing activities frequently take place across Indonesia's ocean space from near shore violations (i.e. use of explosives, poisons, etc) to EEZ territorial trespass, false reporting of fishing areas and violation of ministerial degrees (e.g. By ministerial degree 30 percent of total crew on foreign flag fishing vessels are to be Indonesian nationals).

Mitigation of destructive fisheries practices occurring at the local level can be approached through better information dissemination and fishing community participation. However, more effective open sea enforcement will require a closer working relationship between DGF and BAKORKAMLA. Especially needed is the monitoring, surveillance and control of fishing activities permitted under license in the EEZ to ensure flag of vessel, nationality of crew, gear type and production are as authorized.

CHAPTER EIGHT
ENVIRONMENTAL CONSIDERATIONS

All new projects, including those in fisheries, are required to follow the environmental impact assessment process (AMDAL). In certain cases, previously established projects have to submit retro-active environmental permits, a process known as SEMDAL. The environmental management agency (BAPEDAL) in coordination with the appropriate government directorate and department is responsible for permit issuance. In the fisheries sector, DGF manages the AMDAL process for: (1) fishing harbors, landings and facilities; (2) aquaculture; (3) traditional fish processing; and (4) on-board ship processing. The Ministry of Industry manages: (1) fish processing; (2) freezing/cold storage; and (3) canning. Typically an environmental impact statement (ANDAL), management plan (RKL) and monitoring plan (RPL) are required. While the AMDAL process is generally effective in mitigating environmental degradation on a project basis, there remains serious concern over several major environmental issues.

COASTAL ZONE MANAGEMENT

To insure sustainable near shore fisheries, management of fishing effort and coastal zone activities are necessary. Degradation of resources from lack of coastal zone management (CZM) is already serious in certain regions (northern Java, Bali, South Sulawesi, Malacca Strait). Better coastal land and near shore sea use planning and plan implementation is needed. The land-sea interface is an especially sensitive environmental zone due to its function as a fish and crustacean nursery area. Degradation of the coastal zone can result in the loss of aquatic breeding grounds which seriously impacts on fisheries.

Mangroves are an especially productive area. With a total of 4.25 million hectares of mangroves, Indonesia contains about 27 percent of the world's mangrove resources. Mangroves are spread across the entire nation. However, most mangrove area is in Irian Jaya with 2.93 million hectares (69 percent). Other large concentrations are found in Sumatra 667,700 hectares (16 percent) and Kalimantan 383,000 hectares (9 percent). Approximately 740,000 hectares are set aside as protected areas. Regulations are in place mandating the use of coastal and riverain mangrove "green belts". However, understanding and enforcement of the law is weak and much development took place before the law's implementation.

As a result, many of the more heavily populated areas are in need of mangrove rehabilitation. Human settlements and intrusion of industry into environmentally sensitive coastal areas such as limited water exchange bays, rivers, estuaries and swamps is common. Only through comprehensive CZM can laws be effectively applied, further degradation of the coastal zone be avoided and near shore fisheries preserved.

EFFLUENT STANDARDS

The framework exists to control discharge water quality from fisheries operations. Government regulations contain ambient water quality criteria categorized to protect specific uses. Regulations also include provisions for water control systems (licensing, data collection, inspection and enforcement) and specify that the conditions detailed in the RKL and RPL be incorporated into a hindrance ordinance permit. Water effluent standards are established for 14 industrial categories mostly relating to chemical process industries. However, effluent discharge standards for fisheries industries are non-existent. Specific concern is raised for: (1) shrimp aquaculture where untreated effluent leads to the incidence of shrimp disease and crop losses; (2) auction halls; (3) processing plants; and (4) canneries. Furthermore, solid waste considerations exist for auction halls, processing and canning operations.

RESOURCE BASED FISHERIES MANAGEMENT

Government fisheries policies have historically been driven by the need for food production and generation of employment and foreign exchange. Although relevant under previous levels of exploitation, should such policies continue, exploitation will exceed optimum MSY levels for many species. MSY is already being exceeded in the Malacca Strait for nearly all species and other areas on a species basis. Due to increasing concern, resource based management has recently been accorded a stronger role in fisheries management. There remains a pressing need to more fully integrate and strengthen the system of resource based management. Improvement in each of the various steps of: (1) estimate of MSY; (2) license issuance; (3) monitoring of effort and yield; (4) evaluation of data is immediately warranted as tools in the preservation of Indonesia's fisheries resources; and (5) where practical implementation of community based management systems.

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ANNEX 1: TABLES

TABLE 1
Projected Fisheries Consumption
1994 – 1998

Category	1994	1995	1996	1997	1998	Average Annual Growth Rate (%)
1. Per Capita Consumption (kg/year)	17,46	17,85	18,27	18,72	19,20	2,40

Source : Fisheries Program Under Pelita VI (Rancangan Pelita VI Perikanan), 1993

TABLE 2
Projected Volume of Fisheries Exports
Repelita VI

Category	1994	1995	1996	1997	1998	Average Annual Growth Rate (%)
1. Volume (1,000 ton)	553,00	614,10	678,60	738,30	800,00	9,7
2. Value (US$ million)	1.475,00	1.638,00	1.811,00	1.970,00	2.134,00	9,7

Source : Fisheries Program Under Pelita VI (Rancangan Pelita VI Perikanan), 1993

TABLE 3
PROJECTED FISHERIES PRODUCTION BY COMMODITIES
PELITA VI

CATEGORY	1994	1995	1996	1997	1998	Average Annual Growth (%)
Shrimp	352,0	372,0	394,0	417,0	443,0	5,9
Tuna/Skipjack	315,0	351,0	391,0	430,0	473,0	10,7
Marine Fish	2.397,0	2.496,0	2.597,0	2.700,0	2.805,0	4,0
Freshwater Fish	719,0	753,0	788,0	826,0	866,0	4,8
Seaweed	124,0	127,0	130,0	132,0	135,0	2,1
Total	3.907,0	4.099,0	4.300,0	4.505,0	4.722,0	4,9

Source: Fisheries Program Under Pelita VI (Rancangan Pelita VI Perikanan), 1993

TABLE 4
External Assistance to the Fisheries Sector

			$ '000
1.	Asian Development Bank (ADB)		
	A. Loans		
1 .	94	Riau Fisheries Development (SF)	2.500
2 .	154	Irian Jaya Fisheries Development (SF)	5.100
3 .	155	Irian Jaya Fisheries Development	2.750
4 .	216	Java Fisheries Development	13.200
5 .	474	Sumatra Fisheries Develompent	14.000
6 .	566	Second Irian Jaya Fisheries Development	34.000
7 .	598	Brackishwater Aquaculture Development	23.000
8 .	693	Fisheries Infrastructure Sector ($10 Million from Kuwait Bank)	60.000
9 .	742	Fisheries Industries Credit	65.000
10 .	959	Second Brackishwater Aquaculture Development	38.000
11 .	1.095	Second Fisheries Industries Credit	100.000
		Sub Total	357.550
	B. Technical Assistance		
1 .	236	Sumatra Fisheries Development	98
2 .	368	Sumatra Fisheries Development (A&O)	200
3 .	395	Second Irian Jaya Fisheries Developmet	150
4 .	415	Brackishwater Aquaculture Development	100
5 .	422	Java Fisheries Development	180
6 .	464	Fisheries Sector Study (A&O)	50
7 .	529	Fisheries Sector Study (A&O)	237
8 .	661	Fisheries Infrastructure Development	260
9 .	818	Second Brackishwater Aquaculture	75
10 .	847	Fisheries Economy Study (A&O)	455
11 .	1.232	Second Fisheries Industries Credit	97
12 .	N/A	Fisheries Development Potential Eastern Indonesia	500
13 .	N/A	Shrimp Disease	In process
14	N/A	Fisheries Sector Study	In process
		Sub Total	2.402
2.	IDA (Loans)		
1 .		First Fisheries Project (Credit 211–INO)	3.500
2 .		Fisheries Project (Credit 480–INO)	6.500
3 .		Fisheries Component Under Rural Credit Project (Credit 827–INO)	14.500
4 .		Fisheries Support Services (Credit 1592–1232–INO)	24.461
		Sub Total	48.961

3.	UNDP A. Grants	
1.	Naval Architects (Fishing Boats) 1970	10
2.	Training Center on Improved Fishing 1971–1973	125
3.	Fish Preservation (Madura) 1972	23
4.	Brackishwater Shrimp and Milkfish Culture Research and Training, 1972–1981	1.587
5.	Training Center (Flores) 1973	385
6.	Fisheries Development Training 1973	1.051
7.	Marine Fisheries Development (Irian Jaya), 1977	1.669
8.	Inland Fisheries Development (Irian Jaya), 1977	165
9.	Sumatra Fisheries Development Project (Cost–sharing with ADB), 1978	87
10.	Marine Fisheries Training 1979	3.491
11.	Fisheries Management and Development 1979	2.209
12.	Sub–Project of the Indian Ocean Fishery Survey and Development Program "Joint Eastern Fishery Survey" 1979–1981	400
13.	Fishery Extension Services 1979–1983	2.921
14.	South China Sea Fisheries Development Program, 1980–1984	3.560
15.	Brackishwater Aquaculture Development Project (Cost–sharing with ADB), 1981	88
16.	Site Selection for Shrimp Culture Development, 1981	81
17.	Seafarming Project, 1982–1985	1.800
18.	Integrated Extension Service Support to Small Scale Fisheries Particularly in Outer Islands (INS/83/014)	1.349
	Sub Total	21.001
	B. Technical Assistance	
1.	Support to National Fisheries Development Centre (INS/86/021)	831
2.	Sea Farming Development Project (INS/81/008)	832
3.	Shrimp Culture Development Project (INS/85/009)	1.314
	Sub Total	2.977
4.	Canada (Grants)	
		124
1.	Research on Fish Parasites Fish Culture 1979	1.010
2.	Study on the Development of the Sea Fish 1980–82	
3.	Feasibility Study for Development of Fisheries in Kepulauan Tujuh and Sangihi (TA 176), 1980–82	811
4.	Indonesian Fisheries Information System	158
	Sub Total	2.103

5.	United Kingdom (Grants)	
1.	Assistance to Institute of Fisheries Technology Jakarta 1976–1979	239
2.	Post Harvest Fish Research 1977–1979	210
3.	Study on Post–Harvest Losses of Fish in Indonesia (1986–1989)	24
4.	Support to Coastal Prawn Culture in Northeast Sumatra (1990/91, 1994/95), (£ 1,098,000)	2.000
	Sub Total	2.473
6.	France (Grants)	
1.	Lake Research and Development Jatiluhur, 1967–74	177
	Sub Total	177
7.	Sweden/Germany	
1.	Improved Earnings of Small–Scale Coastal Fisherfolk (GCP/RAS/118/Nul)	283
	Sub Total	283
8.	Federal Republic of Germany (Grants)	
1.	Demersal Fisheries Research 1975	
2.	Regional Surveys of Fish Resources (with FAO)	1.256
	1979–1982	2.750
3.	Advistory Assistance in the Development of Small–Scale Fishing in Bali/Lombok (ATA–175)	2.308
4.	Advisory Assistance of Small Scale Fisheries Development in Lombok and Adjacent Waters/ATA 175	
	* Phase I (1982–1986) – DM 3,200,000	
	* Phase II (1986–1989) – DM 4,226,229	
	* Phase III (1989–1991) – DM 2,540,870	
	* Phase IV (1991–1993) – DM 1,000,000	7.000
	Sub Total	13.314
9.	Italy (Grants)	
1.	Study on Fresh Fish Marketing in East Java	3.790
2.	Fresh Fish Marketing Pilot Project in East Java (ATA–236)	3.411
	Sub Total	7.201

10.	Japan (Loans)	
1.	Tuna Fisheries Development Project	7.856
2.	Jakarta Fishing Port	37.867
3.	Jakarta Fishing Port Phase IV	In process
	(Grants)	
1.	Study on Fishing Port in Pelabuhan Ratu 1979	100
2.	Jakarta Fishing Port/Market Development OECF	2.100
3.	Fishing Advistory Team (ATA–40) 1972–80	1.929
4.	Strengthening of Academy of Fisheries 1977–80	2.000
5.	Study on Coastal Resources Management and Enhancement	5.200
	Sub Total	57.052
11.	New Zealand (Grants)	
1.	Fresh Fish Marketing Pilot Project 1976	432
2.	Supply of Fish Trawler for Marine Fisheries Training and Development 1976	285
3.	Fisheries Cold Storage Padang 1976–78	600
4.	Feasibility Study for Fish Port Ujung Pandang 1977	5
	Sub Total	1.322
12.	United States of America (Grants)	
1.	Small–Scale Fisheries Development	3.000
2.	Tambak Irrigation Study	477
3.	Brackishwater Aquaculture	805
4.	Fisheries Production 1976	388
5.	Fisheries Research & Education Program Jakarta 1969–1972	270
6.	Fishery Research & Education Program Ambon 1969–1974	108
7.	Study on Coastal Resource Management	In process
	Sub Total	5.048
	TOTAL	521.864

Source : DGF, 1993

a. Listed are loans and grants primarily directed at the fisheries sector. Portions of other assistance especially in the agro–industry sector also support fisheries industries.

TABLE 5
Fisheries Production by Sub Sector by Year
1987 – 1991

Unit : Ton

No.	SUBSECTOR	1981	1987	1988	1989	1990	1991	Percent 1991
1	Total	1.907.000	2.670.413	2.881.169	3.035.268	3.162.469	3.349.601	100
2	Marine Capture	1.401.000	2.017.350	2.169.557	2.272.179	2.370.107	2.537.612	76
3	Sub Total (4,5)	506.000	653.063	711.612	763.089	792.362	811.989	24
4	Inland Capture	N/A	276.291	281.264	296.385	292.537	294.477	9
5	Sub Total (6 – 9)	N/A	376.772	430.348	466.704	499.825	517.512	15
6	Brackishwater Ponds	N/A	192.123	233.283	258.491	287.073	323.156	10
7	Freshwater Ponds	N/A	95.353	104.187	113.673	120.598	106.862	3
8	Cages	N/A	1.879	3.625	4.924	4.481	6.648	–
9	Paddy/Fish	N/A	87.417	89.253	89.616	87.673	80.846	2

Source : DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991
1981 FAO Yearbook of Fisheries Statistics.

TABLE 6
Projected Fisheries Production
Pelita VI

Unit : 1,000 Ton

Category	1994	1995	1996	1997	1998	Average Annual Growth Rate (%)
1. Marine Fisheries	2.859,1	3.004,9	3.140,5	3.276,0	3.416,4	4,6
a. Marine Capture	2.724,4	2.857,9	2.980,2	3.101,1	3.225,6	4,3
b. Marine Culture	134,7	147,0	160,3	174,9	190,8	9,1
2. Inland Fisheries	1.047,90	1.094,20	1.159,10	1.229,30	1.305,60	5,7
a. Capture	318,30	318,90	319,60	320,20	320,90	0,2
b. Aquaculture	729,60	775,30	839,50	909,10	984,70	7,8
1. Brackishwater	430,00	454,70	494,80	538,50	585,90	8,0
2. Freshwater	169,30	179,40	191,30	203,90	217,40	6,5
3. Cage and Other	9,20	10,00	11,40	12,90	14,80	12,6
4. Paddy Field	121,10	131,20	142,00	153,80	166,60	8,3
Total	3.907,00	4.099,10	4.299,60	4.505,30	4.722,00	4,90

Source : Fisheries Program Under Pelita VI (Rancangan Pelita VI Perikanan), 1993

TABLE 7
Fisheries Production by Sub Sector and Province
1991

Unit : Ton

Province		Total	Marine Capture	Sub Total	Inland Capture	Aquaculture				
						Sub Total	Brackish-Water Pond	Freshwater Pond	Cage	Paddy Field
	Total	3.349.601	2.537.612	811.989	294.477	517.512	323.156	106.862	6.648	80.846
Sumatra		905.423	740.695	164.728	84.263	80.465	47.279	24.116	549	8.521
	D.I. Aceh	106.959	74.701	32.258	1.590	30.668	27.894	1.828	0	946
	North Sumatra	247.702	222.534	25.168	6.844	18.324	10.720	4.309	228	3.067
	West Sumatra	76.368	58.842	17.526	5.312	12.214	0	10.258	0	1.956
	Riau	187.216	172.821	14.395	13.384	1.011	224	723	24	40
	Jambi	23.313	17.508	5.805	4.907	898	6	721	157	14
	South Sumatra	135.466	92.570	42.896	39.675	3.221	73	2.395	38	715
	Bengkulu	15.957	12.128	3.829	1.674	2.155	109	791	102	1.153
	Lampung	112.442	89.591	22.851	10.877	11.974	8.253	3.091	0	630
Java		961.256	593.626	367.630	22.945	344.685	193.849	76.653	5.476	68.707
	DKI Jakarta	28.833	28.278	555	0	555	3	552	0	0
	West Java	298.011	134.417	163.594	4.518	159.076	56.170	64.201	5.355	33.350
	Central Java	286.533	213.620	72.913	6.725	66.188	58.330	7.200	77	581
	D.I. Yogyakarta	1.889	701	1.188	1.012	176	0	120	31	25
	East Java	345.990	216.610	129.380	10.690	118.690	79.346	4.580	13	34.751
Bali-Nusatenggara-Timor		266.787	253.327	13.460	2.730	10.730	8.294	1.194	3	1.239
	Bali	135.272	130.954	4.318	666	3.652	2.837	343	3	469
	West Nusatenggara	73.294	64.825	8.469	1.648	6.821	5.350	719	0	752
	East Nusatenggara	57.267	56.604	663	416	247	107	122	0	18
	East Timor	954	944	10	0	10	0	10	0	0
Kalimantan		387.145	230.560	156.585	152.549	4.036	2.780	897	355	4
	West Kalimantan	88.287	63.537	24.750	24.044	706	38	668	0	0
	Central Kalimantan	84.030	41.915	42.115	42.115	0	0	0	0	0
	South Kalimantan	126.239	64.681	61.558	60.576	982	807	115	56	4
	East Kalimantan	88.589	60.427	28.162	25.814	2.348	1.935	114	299	0
Sulawesi		568.004	460.693	107.311	30.631	76.680	70.839	3.296	170	2.375
	North Sulawesi	78.485	73.776	4.709	1.683	3.026	113	1.524	170	1.219
	Central Sulawesi	50.371	47.726	2.645	1.471	1.174	944	230	0	0
	South Sulawesi	325.490	233.396	92.094	25.341	66.753	64.705	892	0	1.156
	Southeast Sulawesi	113.658	105.795	7.863	2.136	5.727	5.077	650	0	0
Maluku-Irian Jaya		260.986	258.711	2.275	1.359	916	115	706	95	0
	Maluku	167.880	167.851	29	0	29	29	0	0	0
	Irian Jaya	93.106	90.860	2.246	1.359	887	86	706	95	0

urce : DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

TABLE 8
Number of Fishermen and Fisherfarmers
1987 – 1991

CATEGORY	1987	1988	1989	1990	1991	Percent 1991
I. Marine Fishermen						
A. Total	1.372.430	1.417.424	1.463.875	1.524.348	1.632.630	42
B. Full Time	679.714	701.998	727.205	754.953	817.301	21
C. Part Time (Major)	508.173	524.833	539.575	564.423	617.544	16
D. Part Time (Minor)	184.547	190.593	197.095	204.972	197.785	5
II. Inland Capture						
A. Total	457.553	461.619	437.504	470.942	493.370	12
B. Full Time	163.642	165.096	156.471	168.430	178.161	4
C. Part Time (Major)	206.976	208.816	197.908	213.033	221.873	6
D. Part Time (Minor)	86.935	83.125	83.125	89.479	93.336	2
III. Fisherfarmers						
A. Total	1.550.355	1.691.922	1.602.175	1.622.296	1.845.968	46
B. Brackishwater Ponds	145.235	150.816	155.136	150.627	176.087	4
C. Freshwater Ponds	1.057.281	1.163.243	1.098.737	1.119.050	1.184.776	30
D. Cages	5.358	7.524	11.955	11.111	18.392	–
E. Paddy/Fish	342.481	370.339	336.347	341.508	466.713	12
IV. Total	3.380.338	3.570.965	3.503.554	3.617.586	3.971.968	100

Source: DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

TABLE 9
Fisheries Production Per Fisherman By Area
1991

No.	Area	Production (mt)	Number of Fisherman	Kg per Fisherman
1.	Sumatra	740.695	413.404	1.792
2.	Bali/NTT	253.327	142.034	1.784
3.	Kalimantan	230.560	135.001	1.708
4.	Sulawesi	460.693	303.870	1.516
5.	Java	593.626	438.638	1.353
6.	Maluku/Irian	258.711	199.683	1.296

TABLE 10
Number of Marine Fishing Craft by Size
1987 – 1991

Unit : No

No.	Size of Boat	1987	1988	1989	1990	1991	Per Cent of Fleet 1991	Annual Per Cent Percentage Change
1	Total (2,7)	334.072	334.202	335.088	345.045	354.784	100	1.2
2	Sub Total (3 – 6)	222.233	220.138	218.553	225.359	231.659	65	0,8
3	Dug Out	112.445	111.707	106.741	112.246	117.361	33	0,9
4	Plank (Small)	66.805	64.569	66.573	70.295	70.047	20	1,0
5	Plank (Medium)	36.627	36.653	38.801	35.895	35.396	10	0,7
6	Plank (Large)	6.356	7.209	6.438	6.923	8.855	2	6,9
7	Sub Total (8,9)	111.839	114.064	116.535	119.686	123.125	35	1,9
8	Out Board Motor	70.380	71.154	71.122	73.144	75.416	21	1,4
9	In Board Motor (10–17)	41.459	42.910	45.413	46.542	47.709	13	2,9
10	< 5 GT	32.196	29.674	34.663	35.435	35.179	10	1,8
11	5 – 10 GT	5.896	9.194	6.658	6.897	7.391	2	4,6
12	10 – 20 GT	2.092	2.406	2.348	2.336	2.726	1	5,4
13	20 – 30 GT	713	974	1.006	831	909	–	5,0
14	30 – 50 GT	385	429	334	631	738	–	13,9
15	50 – 100 GT	42	70	187	119	185	–	34,5
16	100 – 200 GT	88	98	156	173	272	–	25,3
17	> 200 GT	47	65	61	120	309	–	45,7

Source : DGF, Fisheries Statistics of Indonesia (Statistik Perikanan Indonesia), 1991

TABLE 11
Gear Type and Production
1991

	Percent of All Gear (A)	Percent of Production (B)	Ratio (B/A)
Total	98,5	98	53
BED Shrimp Nets	0,0	1,0	N/A
Payang	3,0	8,0	2,7
Danish Seine	1,0	1,0	1,0
Beach Seine	2,0	4,0	2,0
Purse Seine	1,0	17,0	17,0
Drift Gill Nets	12,0	11,0	0,9
Encricling Gill Nets	2,0	2,0	1,0
Shrimp Gill Nets	4,0	2,0	0,5
Set Gill Nets	8,0	5,0	0,6
Trammel Nets	4,0	2,0	0,5
Boat/Raft Nets	2,0	6,0	3,0
Bagan	2,0	3,0	1,5
Scoop Nets	2,0	1,0	0,5
Other Lift Nets	2,0	1,0	0,5
Tuna Long Line	1,0	1,0	1,0
Drift Tuna Long Line	1,0	1,0	1,0
Set Long Line	2,0	2,0	1,0
Skipjack Pole and Line	0,5	3,0	6,0
Other Pole and Line	24,0	7,0	0,3
Troll Line	8,0	3,0	0,4
Guiding Barriers	2,0	2,0	1,0
Stow Nets	1,0	4,0	4,0
Portable Traps	1,0	1,0	1,0
Other Taps	3,0	2,0	0,6
Shellfish Collection	2,0	1,0	0,5
Seaweed Collection	1,0	4,0	4,0
Muro Ami	1,0	0,0	0,0
Cast Nets	6,0	3,0	0,5

TABLE 12
Marine Fisheries Production by Major Species
1991

Unit: Ton

SPECIES	1991	Percent 1991
TOTAL	2.537.612	100,0
FINFISHES	2.215.143	87,3
Scads	213.274	8,4
Eastern Little Tuna	150.439	6,8
Indian Mackerel	144.094	5,7
Indian Oil Sardine	145.055	5,7
Fringescale Sardinella	136.626	5,4
Anchovies	135.633	5,3
Skipjack	132.695	5,2
Trevallies	95.989	3,8
Tuna	78.383	3,1
Narrow Barred King Mackerel	52.510	2,1
Croackers, Drums	28.008	1,1
Giant Sea Perch/Barramundi	22.520	0,9
Mullets	24.060	0,9
Yellow Tails	21.183	0,8
Black Pomfret	18.885	0,7
Hairtails, Cutlass Fishes	18.897	0,7
Silver Pomfret	14.096	0,6
Others	1.772.443	69,8
CRUSTACEANS	164.134	6,5
Banana Shrimp	41.731	1,6
Metapenaeus Shrimp	16.348	0,6
Black Tiger Shrimp	13.743	0,5
Others	8.677	0,3
Mud Crab	4.022	0,2
Panulirid Spiny Lobster	1.398	0,1
Other Shrimps	78.215	3,1
MOLLUSCS	54.578	2,2
OTHER AQUATIC ANIMALS	5.942	0,2
SEAWEEDS	97.815	3,9

TABLE 13
Fishing Ports in Indonesia
1993

Type A : International
1. Jakarta Fishing Port 2. Kendari, Southeast Sulawesi
Type B : Archipelagic
1. Pekalongan, Central Java 2. Belawan, North Sumatra 3. Brondong, East Java 4. Bungus, West Sumatra 5. Pelabuhanratu, West Java 6. Sibolga, North Sumatra
Type C : Local
1. Sungai Liat, P. Bangka, South Sumatra 2. Tanjung Pandan, P. Belitung, South Sumatra 3. Karang Antu, Serang, West Java 4. Karimun Java, Central Java 5. Bawean, South Java 6. Teluk Batang, West Kalimantan 7. Hantipan, Central Java 8. Banjarmasin, South Kalimatan 9. Lampulo, Banda Aceh 10. Tarempa, P. Natuna, Riau 11. Dagho, Sangir Talaut, North Sulawesi 12. Pulau Telo, Nias, North Sumatra 13. Sikakap, Pariaman, West Sumatra 14. Labuhan Lombok, Lombok, West Nusatenggara 15. Kupang, South Nusatenggara 16. Pemangkat, West Kalimantan 17. Tarakan, East Kalimantan 18. Ternate, North Maluku 19. Kejawaan, West Java 20. Prigi, East Java

Source: DGF, 1993

TABLE 14
Number of Fish Landing Sites in Indonesia
1992

No.	Province	Number of Fish Landings
	Total	535
1	Aceh	22
2	North Sumatra	23
3	West Sumatra	22
4	Riau	14
5	Jambi	3
6	Bengkulu	3
7	South Sumatra	8
8	Lampung	16
9	DKI Jakarta	1
10	West Java	96
11	Central Java	87
12	D.I.Yogyakarta	2
13	East Java	58
14	Bali	13
15	West Nusatanggara	26
16	East Nusatenggara	5
17	West Kalimantan	35
18	Central Kalimantan	3
19	South Kalimantan	4
20	East Kalimantan	8
21	North Sulawesi	18
22	Central Sulawesi	6
23	South Sulawesi	42
24	Southeast Sulawesi	10
25	Maluku	4
26	Irian Jaya	6
27	East Timor	0

Source : Study of Fisheries Development Potential in Eastern Indonesia, DGF, 1992

TABLE 15
FISHING CRAFT NEEDS
1991

NO.	FISHING CRAFT NEEDED	SUBTOTAL	BED SHRIMP NETS	POLE & LINE	LONG LINE	FISH NETS	PURSE SEINE	GILL NETS	OTHERS	FISH CARRIER
1.	Indonesian Craft Added	2.484	376	166	391	594	688	195	14	60
	Less than 30 GT	473	66	93	68	194	7	30	3	12
	30 – 50 GT	940	82	58	144	165	433	46	2	10
	51 – 100 GT	329	37	7	45	70	107	53	2	8
	101 – 150 GT	333	60	0	40	112	109	10	1	1
	151 – 200 GT	166	95	0	16	20	15	3	6	11
	Greater than 200 GT	243	36	8	78	33	17	53	0	18
2.	Charter Craft Changed	1.185	0	0	553	260	245	113	14	0
	Less than 30 GT	207	–	–	162	11	23	11	–	–
	30 – 50 GT	415	–	–	249	82	52	32	–	–
	51 – 100 GT	294	–	–	95	76	102	20	1	–
	101 – 150 GT	83	–	–	32	19	21	2	9	–
	151 – 200 GT	42	–	–	3	21	2	14	2	–
	Greater than 200 GT	144	–	–	12	51	45	34	2	–
3.	Old Craft Changed (Greater than 15 years old)	157	88	4	32	20	0	0	0	13
	Less than 30 GT	28	–	–	8	20	–	–	–	–
	30 – 50 GT	5	–	–	1	–	–	–	–	4
	51 – 100 GT	6	6	–	–	–	–	–	–	–
	101 – 150 GT	84	62	1	15	–	–	–	–	6
	151 – 200 GT	0	–	–	–	–	–	–	–	–
	Greater than 200 GT	34	20	3	8	–	–	–	–	3
	TOTAL	3.826	464	170	976	874	933	308	28	73
	SUMMARY									
	Less than 30 GT	708	66	93	238	225	30	41	3	12
	30 – 50 GT	1.360	82	58	394	247	485	78	2	14
	51 – 100 GT	629	43	7	140	146	209	73	3	8
	101 – 150 GT	500	122	1	87	131	130	12	10	7
	151 – 200 GT	208	95	0	19	41	17	17	8	11
	Greater than 200 GT	421	56	11	98	84	62	87	2	21

Note: Estimation of Charter Craft Needed and Changed by the tonnage and fishing gear is up to June 1992 and based on data calculation up to March 1992.

TABLE 16
MARINE RESOURCE POTENTIAL AND PRODUCTION
1991

AREA	Pelagic			Demersal			Penaeid Shrimp			Spiny Lobster			Tuna & Skipjack			Carangid Fish			Total		
	Potential	Production	%	Potential	Production	%	Potential	Production	%	Potential	Production	%	Potential	Production	%	Potential	Production	%	Potential	Production	%
West Sumatra	115.000	102.928	89,5	78.700	39.746	50,5	2.100	2.457	117,0	734,80	219,00	29,8	•	18.056	•	5.144	5.281	102,7	201.679	168.687	
South Java	61.000	41.975	68,8	93.500	22.534	24,1	5.500	1.084	19,7	234,00	125,00	53,4	•	3.252	•	1.108	1.787	161,3	161.342	70.757	
Malacca Strait	108.000	133.676	123,8	116.900	137.524	117,6	22.900	14.574	63,6	427,80	424,00	99,1	•	2.466	•	6.526	13.301	203,8	254.754	301.965	
East Sumatra	137.000	96.473	70,4	119.000	74.442	62,6	4.700	5.944	126,5	241,30	•	•	•	1.558	•	3.916	3.985	101,8	264.857	182.402	
North Java	125.000	364.020	291,2	94.700	115.627	122,1	12.000	9.047	75,4	529,60	77,00	5,1	•	4.452	•	5.512	4.590	83,3	237.742	497.763	
Bali – NTT	121.000	109.650	90,6	132.000	28.732	21,8	500	922	184,4	330,50	291,00	88,0	•	19.330	•	3.095	4.038	130,5	256.926	162.963	
South/West Kalimantan	405.000	42.848	10,6	67.200	45.299	67,4	14.000	6.942	49,6	122,40	•	•	•	97	•	1.301	330	25,4	487.623	95.516	
East Kalimantan	158.000	56.666	35,9	83.300	47.717	57,3	12.600	8.926	70,8	299,30	116,00	38,8	•	731	•	2.981	2.256	75,7	257.180	116.412	
South Sulawesi	236.000	198.630	84,2	67.200	67.201	100,0	8.100	5.309	65,5	356,90	156,00	43,7	80.850	43.459	53,8	11.914	9.270	77,8	404.448	324.025	
North Sulawesi	176.000	74.675	42,4	50.200	16.038	31,9	300	72	24,0	424,70	28,00	6,6	99.068	23.585	23,8	4.130	5.019	121,5	330.150	119.418	
Maluku/Irian Jaya	938.000	82.601	8,8	131.100	48.960	37,3	18.000	16.545	91,9	786,40	12,00	1,5	246.095	94.092	38,2	6.594	6.245	94,7	1.340.602	248.455	
Total	2.580.000	1.304.143	50,5	1.033.800	643.820	62,3	100.700	71.822	71,3	4.488	1.398	31,2	426.013	211.078	49,5	52.221	56.102	107,4	4.197.303	2.288.363	

ce : Potential and Distribution of Marine Fisheries Resources in Indonesian Waters (Potensi dan Penyebaran Sumber Daya Ikan Laut di Perairan Indonesia), DGF, 1991.

ta is not available

TABLE 17
Area Under Culture, Culture Type and Province
1991

Province	Total		Brackishwater Pond		Freshwater Pond		Cage	Paddy
	Area of Fish Pond (Net Area)	Area of Water Surface (Net Area)	Gross Area	Net Area	Gross Area	Net Area	Net Area	Net Area
Total	409.371	369.351	263.162	228.604	46.528	41.056	2	99.679
Sumatra	71.985	62.993	43.634	36.761	16.623	14.494	0	11.728
D.I. Aceh	37.716	31.941	35.617	29.952	845	735	–	1.254
North Sumatra	13.540	12.200	3.745	3.183	3.853	3.075	–	5.942
West Sumatra	6.129	5.747	–	–	4.646	4.264	–	1.483
Riau	707	612	185	153	522	459	–	–
Jambi	746	553	25	20	721	533	–	–
South Sumatra	4.575	4.233	–	–	3.254	2.912	–	1.321
Bengkulu	1.843	1.766	43	37	765	684	–	1.035
Lampung	6.729	5.941	4.019	3.416	2.017	1.832	–	693
Java	232.011	211.935	134.888	117.406	21.971	19.377	2	75.150
DKI Jakarta	948	830	595	501	194	170	–	159
West Java	110.201	101.167	49.641	42.691	17.552	15.468	1	43.007
Central Java	44.424	40.275	30.497	26.558	2.197	1.987	–	11.730
D.I. Yogyakarta	3.603	3.597	–	–	413	407	–	3.190
East Java	72.835	66.066	54.155	47.656	1.615	1.345	1	17.064
Bali–Nusateng–Timor	13.642	12.507	5.592	4.603	1.809	1.663	0	6.241
Bali	4.408	4.254	752	610	111	99	–	–
West Nusatenggara	8.369	7.523	4.231	3.512	1.628	1.501	–	3.545
East Nusatenggara	865	730	609	481	70	63	–	2.510
East Timor	–	–	–	–	–	–	–	186
Kalimantan	3.174	2.652	1.978	1.570	1.176	1.062	0	20
West Kalimantan	734	663	–	–	721	650	–	13
Central Kalimantan	–	–	–	–	–	–	–	–
South Kalimantan	1.575	1.280	1.317	1.054	251	219	–	7
East Kalimantan	865	709	661	516	204	193	–	–
Sulawesi	88.157	78.933	77.011	68.223	4.606	4.170	0	6.540
North Sulawesi	5.125	4.764	572	475	2.138	1.874	–	2.415
Central Sulawesi	994	854	660	549	316	287	–	18
South Sulawesi	75.400	67.932	69.886	62.544	1.407	1.281	–	4.107
Southeast Sulawesi	6.638	5.383	5.893	4.655	745	728	–	–
Maluku–Irian Jaya	402	331	59	41	343	290	0	0
Maluku	260	203	36	24	224	179	–	–
Irian Jaya	142	128	23	17	119	111	–	–

Source : DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

TABLE 18. SHRIMP CULTURE TECHNOLOGY IN INDONESIA

Shrimp Culture Practices	Technology Input:					
	Density shrimp/sq m	Type of Foor	Aerator unit/ha	Water Sources	Soil Management	Harvest Target kg/ha/crop
Traditional	2 – 3	natural	none	tidal flux	none	200 – 300
Extensive	4 – 8	natural man made	none	tidal flux & pumps	simple	600 – 800
Semi–Intensive	9 – 20	man made	used at the end of grow (age greater than 3 months, 3 units)	using pumps, regular water exchange	good land preparation	1,000 – 3,000
Intensive	21 – 40	man made	using aerator from beginning to harvest 8 – 10 units	using water pumps, regular water exchange	good land preparation	3,000 – 8,000

TABLE 19
Cold Storage and Canning Plants
1991

Province	Canning Plants			Cold Storage			
	No. Canning Plants	Production Capacity (Ton/Day)	Actual Production (Ton/Day)	No. Cold Storage	Production Capacity (Ton/Day)	Actual Production (Ton/Day)	Storage Capacity (Ton)
Total	**23,0**	**434,8**	**142,0**	**159,0**	**1.052,4**	**623,9**	**36.662,0**
Sumatra	2,0	7,0	4,0	37,0	187,2	82,8	10.220,0
D.I. Aceh	–	–	–	4,0	15,5	6,0	950,0
North Sumatra	2,0	7,0	4,0	17,0	117,0	52,0	3.685,0
West Sumatra	–	–	–	–	–	–	–
Riau	–	–	–	5,0	13,7	8,3	1.950,0
Jambi	–	–	–	1,0	2,5	–	790,0
South Sumatra	–	–	–	8,0	21,5	11,5	1.770,0
Bengkulu	–	–	–	1,0	2,0	1,0	25,0
Lampung	–	–	–	1,0	15,0	4,0	1.050,0
Java	10,0	175,0	88,0	64,0	466,5	389,1	13.592,0
DKI Jakarta	–	–	–	19,0	122,5	211,5	5.480,0
West Java	–	–	–	8,0	36,0	18,0	952,0
Central Java	1,0	8,0	4,0	10,0	114,0	36,6	2.770,0
D.I. Yogyakarta	–	–	–	–	–	–	–
East Java	9,0	167,0	84,0	27,0	194,0	123,0	4.390,0
Bali–Nusateng–Timor	5,0	50,0	10,0	12,0	44,0	55,5	2.490,0
Bali	5,0	50,0	10,0	10,0	34,0	53,0	2.170,0
West Nusatenggara	–	–	–	1,0	5,0	0,5	120,0
East Nusatenggara	–	–	–	1,0	5,0	2,0	200,0
East Timor	–	–	–	–	–	–	–
Kalimantan	2,0	102,8	20,0	17,0	63,5	33,7	3.720,0
West Kalimantan	1,0	40,0	20,0	4,0	23,5	9,0	1.050,0
Central Kalimantan	–	–	–	1,0	3,0	0,4	100,0
South Kalimantan	1,0	62,8	–	4,0	13,0	6,0	800,0
East Kalimantan	–	–	–	8,0	24,0	18,3	1.770,0
Sulawesi	3,0	75,0	20,0	8,0	102,0	33,0	2.120,0
North Sulawesi	3,0	75,0	20,0	2,0	40,0	11,5	550,0
Central Sulawesi	–	–	–	–	–	–	–
South Sulawesi	–	–	–	4,0	24,0	10,0	1.070,0
Southeat Sulawesi	–	–	–	2,0	38,0	11,5	500,0
Maluku–Irian Jaya	1,0	25,0	0,0	21,0	189,2	29,8	4.520,0
Maluku	–	–	–	13,0	63,2	9,5	1.720,0
Irian Jaya	1,0	25,0	–	8,0	126,0	20,3	2.800,0

Source : DGF, Profile, 1991;
List of Tuna in Companies in Promotion (Daftar Perusahaan Perikanan Dalam Rangka Promosi), 1993

Table 20
Disposition of Fisheries Production
1991

Unit : 1,000 Ton

Type of Disposition	Marine Capture	Inland Capture	Aquaculture	Total	Percent 1991
Fresh	1.323	194	277	1.794	54
Prepared	1.025	99	138	1.262	38
Frozen	122	1	97	220	6
Fish Meal	34	0	5	39	1
Canned	34	0	1	35	1
Total	2.538	294	518	3.350	100

Source: Estimate by author based on DGF 1991 statistics

TABLE 21
Disposition of Marine Fisheries Production
1987 – 1991

Unit : Ton

Disposition	1987	1988	1989	1990	1991	Percent 1991
Total	2.017.350	2.169.557	2.271.994	2.370.107	2.537.612	100
Fresh	1.061.060	1.188.406	1.230.445	1.266.462	1.322.850	52
Dried/Salted	626.887	667.373	660.416	682.769	745.851	29
Boiled	119.554	84.036	118.416	121.157	134.323	5
Fermented: Belachan	45.262	51.723	55.077	56.562	53.190	2
Fermented: Fish Peda	7.706	6.619	13.586	13.641	12.092	1
Fermented: Fish Sauce	2.005	1.145	311	874	1.242	0
Smoked	54.998	43.186	44.752	52.182	60.886	2
Other	17.412	16.439	16.141	21.456	17.998	1
Frozen	65.163	81.541	84.605	108.768	122.104	5
Canned	13.015	11.991	28.063	25.945	33.488	1
Fish Meal	4.288	17.098	20.182	20.291	33.588	2

Source : DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

TABLE 22
Disposition of Inland Capture Fisheries Production
1987 – 1991

Unit : Ton

Type of Disposition	1987	1988	1989	1990	1991	PERCENT 1991
Total	276.291	281.264	296.385	292.537	294.477	100
Fresh	188.007	186.383	191.768	198.109	193.898	65
Dried/Salted	73.705	80.761	90.156	80.688	84.492	29
Boiled	655	504	744	679	556	--
Fermented: Belachan	1.030	1.035	1.509	1.202	1.650	1
Fermented: Fish Peda	97	62	197	132	438	--
Fermented: Fish Sauce	0	32	0	0	0	--
Smoked	9.449	8.074	8.682	8.679	8.174	3
Other	2.470	3.529	1.937	1.907	4.439	2
Frozen	872	869	1.006	1.040	760	--
Canned	0	0	44	84	0	--
Fish Meal	6	15	342	17	70	--

Source : DGF, Indonesian Fisheries Statistics (Statistik Perikanan Indonesia), 1991

Table 23
Disposition of Aquaculture Production
1987 – 1991

Unit : Ton

Type of Disposition	1987	1988	1989	1990	1991	Percent 1991
Fresh	230.235	254.225	266.768	286.985	280.640	54
Prepared	115.117	127.112	133.383	143.492	140.492	27
Frozen	31.408	49.013	66.554	69.349	96.556	19
Total	376.760	430.350	466.705	499.826	517.514	100

Source : Estimate by author based on DGF 1991 statistics

TABLE 24
Export Volume, Value and Average Price of Fisheries Products
1987 – 1991

Commodity	1987	1988	1989	1990	1991
Volume (ton)	140.378	181.218	228.590	320.241	409.043
– Shrimp (fresh, frozen, canned)	44.513	56.793	77.190	94.037	95.626
– Tuna, (fresh, frozen, canned)	38.269	49.257	56.678	72.756	103.368
– Other Marine Fish (fresh, frozen, salted, canned)	20.803	27.243	48.760	107.851	153.061
– Frog Legs (fresh, frozen)	3.076	5.101	4.570	3.916	5.082
– Jellyfish (dried, salted)	3.372	7.220	5.668	2.222	4.211
– Seaweed	9.878	10.835	12.020	11.788	11.305
– Crab (fresh, frozen, canned)	2.950	3.495	4.388	5.123	5.907
– Coral/Shells	3.033	2.979	2.461	1.713	1.322
– Fish Oil	1.114	982	1.071	1.170	1.255
– Ornamental Fish	530	955	1.624	1.827	2.322
– Snails (fresh, frozen)	1.236	1.804	2.296	2.054	1.659
– Shrimp Crackers	2.918	2.998	3.836	4.537	4.614
– Other	8.683	11.556	8.029	11.247	19.309
– Pearls (kg)	327	556	474	884	2.237
Value ('000 US$)	475.523	712.199	825.125	1.039.680	1.255.663
– Shrimp (fresh, frozen, canned)	353.084	500.312	556.760	690.230	769.982
– Tuna, (fresh, frozen, canned)	39.254	73.620	102.667	124.748	184.426
– Other Marine Fish (fresh, frozen, salted, canned)	19.111	39.583	63.081	115.771	174.371
– Frog Legs (fresh, frozen)	8.952	17.995	15.541	13.340	21.144
– Jellyfish (dried, salted)	7.370	16.453	8.669	3.553	7.458
– Seaweed	2.698	3.782	6.018	7.865	5.676
– Crab (fresh, frozen, canned)	5.770	5.831	10.126	10.672	10.533
– Coral/Shells	10.255	13.900	14.461	10.760	5.508
– Fish Oil	3.459	2.840	3.700	7.954	12.410
– Ornamental Fish	1.609	4.905	9.971	7.683	6.985
– Snails (fresh, frozen)	2.597	4.486	3.648	2.717	2.746
– Shrimp Crackers	4.021	4.444	5.083	6.662	8.069
– Other	11.681	17.917	17.153	22.149	30.479
– Pearls	5.662	6.132	8.247	15.576	15.876
Average Cost (US$ per kg)	3,39	3,93	3,61	3,25	3,07
– Shrimp (fresh, frozen, canned)	7,93	8,81	7,21	7,34	8,05
– Tuna, (fresh, frozen, canned)	1,03	1,49	1,81	1,71	1,78
– Other Marine Fish (fresh, frozen, salted, canned)	0,92	1,45	1,29	1,07	1,14
– Frog Legs (fresh, frozen)	2,91	3,53	3,40	3,41	4,16
– Jellyfish (dried, salted)	2,19	2,28	1,53	1,60	1,77
– Seaweed	0,27	0,35	0,50	0,67	0,50
– Crab (fresh, frozen, canned)	1,96	1,67	2,31	2,08	1,78
– Coral/Shells	3,38	4,67	5,88	6,28	4,17
– Fish Oil	3,11	2,89	3,45	6,80	9,89
– Ornamental Fish	3,04	5,14	6,14	4,21	3,01
– Snails (fresh, frozen)	2,10	2,49	1,59	1,32	1,66
– Shrimp Crackers	1,38	1,48	1,33	1,47	1,75
– Other	1,35	1,55	2,14	1,97	1,58
– Pearls	17.315	11.029	17.399	17.620	7.097

Source : DGF, International Trade Statistics of Fisheries Commodities (Statistik Ekspor & Impor Hasil Perikanan), 1991

TABLE 25
Balance of International Trade of Fisheries Products
1981 – 1991

Year	Volume (ton)			Value (1,000 US$)		
	Export	Import	Balance	Export	Import	Balance
1981	75.178	63.220	11.958	225.387	38.475	186.912
1982	89.629	83.410	6.219	249.416	45.544	203.872
1983	88.365	57.878	30.487	257.048	34.347	222.701
1984	75.695	50.668	25.027	248.063	28.789	219.274
1985	84.497	54.287	30.210	258.444	23.891	234.553
1986	107.443	57.426	50.017	374.117	28.177	345.940
1987	140.378	65.371	75.007	475.523	27.832	447.691
1988	181.218	37.861	143.357	712.199	20.704	691.495
1989	228.590	56.736	171.854	825.125	32.884	792.241
1990	320.241	73.285	246.956	1.039.580	47.587	992.093
1991	409.043	71.550	337.493	1.255.663	52.375	1.203.288

Source: DGF, International Trade Statistics of Fisheries Commodities (Statistik Ekspor & Impor Hasil Perikanan), 1991.

TABLE 26
Laws and Regulation Relevant to Fisheries

No.	Law & Regulation	Enforcement/Application	Recommendation
	LAWS (U.U.)		
1.	No. 4, 1960 on Indonesian Waters	effective	none
2.	No. 16, 1964 on Fishery Production Sharing	no longer relevant	formulation of a new law
3.	No. 1, 1973 on The Continental Shelf	effective	none
4.	No. 5, 1983 on Indonesian Exclusive Economics Zone	effective; regulatory measures related to fisheries incorporated in fisheries regulations	none
5.	No. 9, 1985 on Fisheries	shortcomings in follow up of regulatory measures	urgent need for formulation and issuance of supporting Gov. Regulations and Decrees, as follow up of Law No. 9, 1985
	GOV. REGULATION (PP)		
1.	No. 8, 1962 Peaceful Passage for Foreign Vessels in Indonesian Waters	effective	none
2.	No. 15, 1984 The Management of Biological Resources in Indonesian Exclusive Economic Zone	effective, as basis for formulation and issuance of permits/licences for vessels fishing in Indonesian Exclusive Economic Zone	none
3.	No. 17. 1986 Authority for the Regulation and Development of the Industry	issuance of licences for fish processing plants by the Ministry of Industry not in consultation with the Ministry of Agriculture leading to over capitalization and mislocation	need for better coordination and consolidation among Ministries concerned
4.	No. 15, 1990 Conduct of Fishery Business	application as basis for formulation and issuance of licences/permits	need for strict issuance of licences, and stronger sanction for offences; stronger coordination and cooperation between central and regional authorities for issuance of licences/permits

No.	Law & Regulation	Enforcement/Application	Recommendation
	PRESIDENTIAL DECREES		
1.	No. 8, 1975 Taxation on Fishery Business and on Fishery Products within Domestic Capital Investment	effective and sufficient, periodic review of rate of tax or due applied	none
2.	No. 39, 1980 Trawl Ban	well implemented in accordance with applied measures and procedures	none
3.	No. 23, 1982 Mariculture Development	little progress of cooperative formation unclear because difficult to organize labour	continuous extension services towards creation of cooperatives
4.	No. 85, 1982 The Use of Shrimp Net	applied to waters surroundings the islands of Kei, Tanimbar, Aru, Irian Jaya, and Arafura Sea east of longitude 130 East; violation of the 10 m isobath bounderies very common, causing negative impact on shrimp fishery management; no accurate definition of shrimp net causing misinterpretation	intensify monitoring and control; definition of shrimp net should be redefined, by changing the word shrimp net to shrimp trawl
5.	No. 18, 1984 Tambak Inti Rakyat Project	ongoing/project at Krawang	encouragement for further development of TIR in other areas; make conditions conducive to investors
6.	No. 47, 1986 Increasing Post–Harvest Handling of Agriculture Products	ongoing, in line with the development of technology	continuous guidance by Government on improved application of technology
	PRESIDENTIAL INSTRUCTIONS		
1.	No. 11, 1982 Implementation Procedure for Pres. Decree No. 39, 1980 on Trawl Ban	implemented, as follow–up of Pres. Decree No. 39, 1980	none
	MINISTRIAL DECREES		
1.	Joint Decree, Minister of Transmigration & Cooperatives and Minister of Agriculture No. 48/Kpts/Mentranskop/69 No. 201/Kpts/Ekku/6/1969 Promoting Development of Fisheries Cooperatives	slow progress; the cooperation Agency for Education/Training in Fisheries Cooperatives is no longer functioning, if not abanonned	needs re–organizing and restructuring
2.	Agric. Minister, No. 431/Kpts/Um/9/70 Obligation for Fishing Companies under Foreign Investment Scheme to construct cold storage	implemented	none

No.	Law & Regulation	Enforcement/Application	Recommendation
3.	Joint decree, Min. of Transkop and Ministry of Agriculture No. 282/Kpts/Um/6/71 No. 2250/Kpts/Transkop?71 Policy Guidance ea Fisheries Development	insufficient coordination, integration and synchronization between DGF and Directorate General of Cooperatives in its implementation such as in budgeting and marketing of fishery product	eliminate
4.	Agric. Minister, No. 68/Kpts/Um/2/72 Re–opening of Shrimp Fishing for Foreign Investors	implemented	issuance of new entry to this sector should be stopped
5.	Agric. Minister, No. 327/Kpts/Um/7/72 Additinal Protected Animal Species Based on Dierenbescherming Ordonantic 1931 jis. diere .oerscherming–veror–dening 1931, and Agric. Minister Decree No. 421/Kpts/Um/8/1970	Implemented, incorporated in Forestry Regulation.	none
6.	Joint Decree, Min. of Transkop and Min. of Agriculture No. 367/Kpts/Um/8/1972 No. 332/Kpts/Mentranskop/72 Development of Small Scale Fishery	slow progress in developing fisheries through cooperatives; poor coordination among concerned parties	continuous encouragement for the establishment of fishery cooperatives
7.	Agric.Minister, No.561/Kpts/Um/11/73 Utilization of By catch	facing technical difficulties in its implementation	refer to Min. Decree No. 40/Kpts/Um/1/74
8.	Agric.Minister, No.241/Kpts/Um/5/73 Prohibition to take a number of variety of fishes outside Indonesian Territory	No longer relevant	formulation of new regulation for the export of fish seeds and ornamental fish.
9.	Agric. Minister, No. 40/Kpts/Um/1/74 Change of Decree No. 561/Kpts/Um/11/73 on Utilization of By–Catch	Facing difficulties in implementation	for fishing companies operating a fleet of trawlers to establish fish meal plant(s) to process eventually own by catch; trawlers not belonging to this category should sell their by catch to the fish meal plant; the size of fish meal plant should be based on proper estimate of raw material supply.
10.	Agric. Minister, No. 01/Kpts/Um/1/75 Sustainability of Indonesian Fisheries Resources.	application according to the condition and extent of resource exploitation in certain areas and of particular species, by applying specific measures.	continuous evaluation, assessment, and control towards proper management DGF and research institutions
11.	Agric. Minister, No. 02/Kpts/Um/1/75 Sustainability of Marine Fisheries Resources in West Irian seas	very poor implementation; trespassing in restricted areas within the 10m isobath line common by illegal fishing by trawlers from outside; no yearly analysis assessment of shrimp stock	strengthening of monitoring and controls; need of strong MCS mechanism at regional as well as Central Government level
12.	Joint Decree, Min. of Health and Min. of Agriculture No. 31/Kpts/Um/3/1975 No. 32/1/Kep/B.P./1975 Quality of Fishery Products	partially applied, still facing problems in its application to small scale and traditional processors to meet the requirements	continuous control of products, and extension services

No.	Law & Regulation	Enforcement/Application	Recommendation
13.	Agric. Minister No.123/Kpts/Um/3/75 Purse Seine mesh size regulation for catching Chub mackerel, Jack mackerel, Sardine and the like	difficult to sustain, particularly in densely populated fishing areas where traditional fishermen are operating in current years there is a tendency to use smaller mesh size	create awareness amongst traditional fishermen of the negative impact to fish population
14.	Agric. Minister No. 317/Kpts/OP/9/1975 Utilization of Fresh Resources in North Java and Madura Coastal waters and Madura Strait	regulatory measures applied to fishing met by fishermen	sustain
15.	Agric. Minister No. 607/Kpts/OP/9/76 Zonation of Fishing Area	with the recent trend in fishery development, some measures can no longer be applied; in practice many violations occur	need review of decrees
16.	Agric. Minister No. 608/Kpts/Um/9/76 Zonation of Fishing Area for State Companies Fishing Vessels	effective	none
17.	Agric. Minister No. 609/Kpts/Um/9/76 Fishing Area for Trawlers	with the enforcement of Pres. Decree No. 39. 1980; no longer relevant	none
18.	Agric. Minister No. 424/Kpts/Um/7/77 Fee Tariff for Fishery Enterprises and Fishery Products within the Domestic and Foreign Capital Investment	effective; adjustment of tariff could be imposed from time to time	none
19.	Agric. Minister No. 425/Kpts/Um/7/77 Procedures for payment and Accounting of Fee/Taxes of Fishery Enterprises and Fishery Products within Domestic and Foreign Capital Investment	effective	none
20.	Agric. Minister No. 330/Kpts/Um/5/78 Identify Marking for Vessels in regards with fishing zonation	no longer relevant	none
21.	Agric. Minister No. 503/Kpts/Um/5/78 Procedures on the Execution of Trawl Ban, phase I	implemented, as follow up of Pres. Decree No. 39, 1980	none
22.	Joint Decree, Min. of Internal Affairs, Min. of Agriculture, and Min. of Trade and Cooperative No. 183/Year 1980 No. 596/Kpts/Um/8/1980 No. 345/Kab./VIII/1980 Guidance for the Transfer of ex–Trawlers	implemented, as follow up of Pres. Decree No. 39, 1980	none
23.	Agric. Minister No. 633/Kpts/Um/9/80 Guidance for Implementation of Presidential Decree No. 39, 1980	implemented, as follow up of Pres. Decree No. 39, 1980	none
24.	Agric. Minister No. 694/Kpts/Um/9/80 Area Limitation in Use of Trawl Net	implemented, as follow up of Pres. Decree No. 39, 1980	none

No.	Law & Regulation	Enforcement/Application	Recommendation
25.	Agric. Minister no. 819/Kpts/Um/11/80 Bringing in (import) of Live Fish to Indonesia	illegal acts are still observed (smuggling)	intensify control by Agencies concerned
26.	Agric. Minister No. 820/Kpts/Um/11/80 Prohibition for Transportation of Live Fish out of Jakarta and West Java	no longer relevant	eliminate
27.	Agric. Minister No. 542/Kpts/Um//6/81 Total allowable number of Trawlers operating in Provinces outside Java, Bali and Sumatra	implemented, as follow up of Pres. Decree No. 39, 1980 no longer relevant with present conditions	none
28.	Agric. Minister No. 179/Kpts/Um/3/82 Prohibition for Bringing dangerous fish species into Indonesia	effective	continuos observation and control by Agencies concerned
29.	Agric. Minister No. 473/Kpts/Um/7/82 Guidance for Mariculture Development in Indonesia	as follow up of Pres. Decree no. 23, 1982; implemented	none
30.	Agric. Minister No. 545/Kpts/Um/7/82 Implementation Procedures of Presidential Instruction No. 11, 1982 on Trawl Ban	implemented	none
31.	Agric. Minister No. 930/Kpts/Um/12/82 Implementation Procedures of Presidential Decree No. 85, 1982, on the Use of Shrimp Net	deviation and offenses observed in its application; trespassing of 10m isobath boundaries, uncontroled licencing; difficulties in retrieving by-catch; weakness in enforcement.	definition of shirmp net should be re-defined; intensifying monitoring and control; strengthen MCS mechanism and its operation
32.	Agric. Minister No.473a/Kpts/IK.250/6/85 Amount of Allowable Catch in Indonesian Exclusive Economic Zone	illegal fishing by foreign fishing vessels repoted; monitoring and control very weak; ignorance of fishing companies to report their catches, thereby very difficult to determine the level of exploitation	pursuade companies to fulfill obligation for submission of required reports to be used for analyzing the extent of exploitation in EEZ
33.	Agric. Minister No. 475/Kpts/IK.120/7/85 Permit for Foreign Companies fishing in Indonesian Exclusive Economic Zone	uncontroled issuance of fishing permits/licences; monitoring and control very weak to prevent violation and no observance of regulatory procedures	review number of permits issued for the different areas within the EEZ; strengthen MCS system, and intensify operation; need a strong mechanism for MCS
34.	Agric. Minister No. 476/Kpts/IK.120/7/85 Reporting Places (Port of Call) for Fishing Vessel operating in Indonesian Exclusive Economic Zone	poorly implemented; transfer of catch to fish carriers for direct export reported	stronger sanctions for vessels not complying with the rules
35.	Agric. Minister no. 477/kpts/IK.120/7/85 Fishing Fee applied to Individual or Legal Bodies (Enterprises) fishing in Indonesian Exclusive Economic Zone	effective	none

No.	Law & Regulation	Enforcement/Application	Recommendation
36.	Agric. Minister No. 582/Kpts/KU.430/9/85 Change of Fee Tariff applied to Fishery Companies under Domestic and Foreign Investment, with no activities in fish capture or Mariculture	effective	none
37.	Agric. Minister No. 50/Kpts/IK.110/2/86 Establishment of Agency for the Management of National Shrimp Programme Brackishwater Shrimp/Fish Culture Development Project	implemented, Agency established, Shrimp/Fish Culture Project ongoing	none
38.	Agric. Minister No. 334/Kpts/IK.210/6/86 Shrimp Culture Development by Tambak Inti Rakyat (TIR) Concept	development rather slow	encouragement and need to make conditions conducive to private sector
39.	Agric. Minister No. 438/Kpts/IK.210/7/86 Supplement to Minister of Agriculture Decree No. 477/Kpts/IK.120/7/85, on Fishing Fee	effective	none
40.	Agric. Minister No. 815/Kpts/IK.120/11/90 Fishery Licencing	shortcoming in monitoring and control of fishery operations by DGF; fishing companies are ignorant of need to submit six monthly reports; three monthly reports from Companies operating foreign vessels are too minimal	strict issuance of licences; control at sea should be intensified; establishment of an efficient mechnism at Central and Regional levels backed up by necessary instruments; stronger sanction to companies for non observance or regulation
41.	Agric. Minister No. 816/Kpts/IK.120/11/90 Foreign Flag–flying Vessels through Charter System for Fishing in Indonesian Exclusive Economic Zone	replacement up to 30% of crew members by Indonesian nationals after six months of vessel operation is not met by most of the fishing companies; the term 'pukat ikan' is confusing, which in fact means fish net, not specifically mention what kind of fishing gear; violation of rules by chartered vessels in term of allowable fishing area; trespassing of Indonesian internal water prevail	pursuade fishing companies to meet their obligation for immediate recruitment of Indonesian nationals working on board vessel; definition of 'pukat ikan' should be redefined; review of number of vessels operating in EEZ; intensify monitoring and control; application of stronger sanctions.

Source : Study on Fisheries Development Potential in Eastern Indonesia, DGF, 1992

TABLE 27
STATE FISHERIES ENTERPRISES
1990

Company	Capture			Purchase			Sales						Profit Loss Rp Mi
							Export			Domestic			
	Target (mt)	Result (mt)	Excess/ Shortage	Target (mt)	Result (mt)	Excess/ Shortage	Target (mt)	Result (mt)	Excess/ Shortage	Target (mt)	Result (mt)	Excess/ Shortage	
1. Tirta Raya Mina	0	0	0	1.422	356	(1.066)	351	689	338	2.005	2.130	125	75
2. Usaha Mina	18.035	17.194	(841)	8.599	8.555	(44)	16.232	13.513	(2.719)	1.803	2.138	335	55
3. P. Samudra Besar	90	14	(76)	0	0	0	43	6	(37)	13	11	(2)	47
4. Perikani	2.502	1.620	(882)	3.688	5.089	1.401	5.503	5.402	(101)	697	1.108	411	36
5. Perikanan Maluku	1.360	966	(394)	1.668	949	(719)	750	1.092	342	1.668	280	(1.388)	(64
Total	21.987	19.794	(2.193)	15.377	14.949	(428)	22.879	20.702	(2.177)	6.186	5.667	(519)	1.50

Source : DGF, 1993

TABLE 28
List of Fisheries Schools and Fisheries Academies
1991

Name of Institution	Period of Study (MOS)	Capacity	Enrollment	Description
A. Senior Secondary Schools				
1 Agriculture School for Development Fisheries Sector (ASD–F), Lodong, Aceh.	3	70	55 – 60	Marine Fisheries Aquaculture
2 ASD – F, Pariaman	3	70	55 – 60	Marine Fisheries
3 ASD – F, Tegal	3	70	55 – 60	Marine Fisheries
4 ASD – F, Mataram, West Nusatenggara	3	70	55 – 60	Aquaculture
5 ASD – F, Pontianak, West Kalimantan	3	70	55 – 60	Marine Fisheries
6 ASD – F, Bone	3	70	55 – 60	Aquaculture
7 ASD – F, Manado	3	70	55 – 60	Marine Fisheries and Engineering
8 ASD – F, Wae Heru Ambon	3	70	55 – 60	Marine Fisheries
9 ASD – F, Sorong, Irian Jaya	3	70	55 – 60	Marine Fisheries
B. Academies of Fisheries :				
1 Agriculture, Education, Training and Extention (AETE)–Bogor, Fisheries Claster (D3).	3	80	40	Aquaculture
2 AETE – Malang, Fisheries Claster in Sidoarjo (D3)	3	80	40	Aquaculture
3 Fisheries Interprise Education and Training (D4)	4	210	70	5 Faculties : Fishing, Preservation, Engineering, Procesing, and Aquaculture
C. Fishing Operation Training Centers :				
1 Tegal	NA	NA	NA	Marine Fisheries
2 Singaraja	NA	NA	NA	Marine Fisheries
3 Belawan	6 month	30	NA	Marine Fisheries
4 Aer Tembaga	NA	NA	NA	Marine Fisheries
5 Ambon	6 Weeks	30 – 40	NA	Marine Fisheries

Source : Agency for Agriculture Education, Training and Extension, Ministry of Agriculture, 1991