

JAPAN INTERNATIONAL COOPERATION AGENCY

No. 2

DEPARTMENT OF FISHERIES

MINISTRY OF AGRICULTURE AND COOPERATIVES

KINGDOM OF THAILAND

THE STUDY
ON
FISHERY COMPLEX
ON
THE ANDAMAN SEA COAST

FINAL REPORT
(MAIN REPORT)

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July 1997

TETRA CO.,LTD.
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PREFACE

In response to the request from the Government of the Kingdom of Thailand, the Government of Japan decided to conduct the Study on Fishery Complex on Andaman Sea Coast and entrusted the study to Japan International Cooperation Agency (JICA).

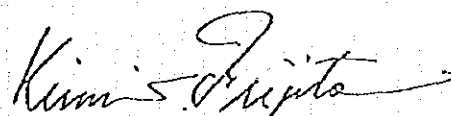
JICA sent to the Kingdom of Thailand a study team headed by Dr. Taiji Endo, TETRA Co., Ltd., four times during the period from December 1995 to July 1997.

The team held discussions with the officials concerned of the Government of the Kingdom of Thailand, and conducted field studies at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between two countries.

I wish to express my sincere appreciation to the officials concerned of the Kingdom of Thailand for their close cooperation extended to the team.

July, 1997



Kimio Fujita
President
Japan International Cooperation Agency



July, 1997

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Fujita

Letter of Transmittal

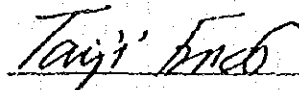
We are pleased to submit the report on the Study on Fishery Complex on the Andaman Sea Coast in Thailand. The report contains the advice and suggestions of the relevant authorities of the Government of Japan and the Government of the Kingdom of Thailand as well as the formulation of the above mentioned project.

This study was conducted by TETRA Co., Ltd. and System Science Consultants Inc., based on a contract with JICA, during December 1995 and July 1997. In this study, we formulated the master plan for development of Phuket Fishing Port up to the year 2012 and the short-term plan with examination of the feasibility for the period up to the year 2007.

In view of the urgency of promoting Thai tuna fishery in Andaman Sea and Indian Ocean, we recommend that the Government of the Kingdom of Thailand will implement this Project as a top priority.

We would like to take this opportunity to express our gratitude to the relevant officials of JICA, the Ministry of Foreign Affairs, and the Ministry of Agriculture, Forestry and Fisheries in Japan. We are also greatly indebted to the concerned officials of the Department of Fisheries and Fish Marketing Organization, and the Embassy of Japan in Thailand for their close cooperation and assistance extended to the team during the preparation of the report.

Yours faithfully,

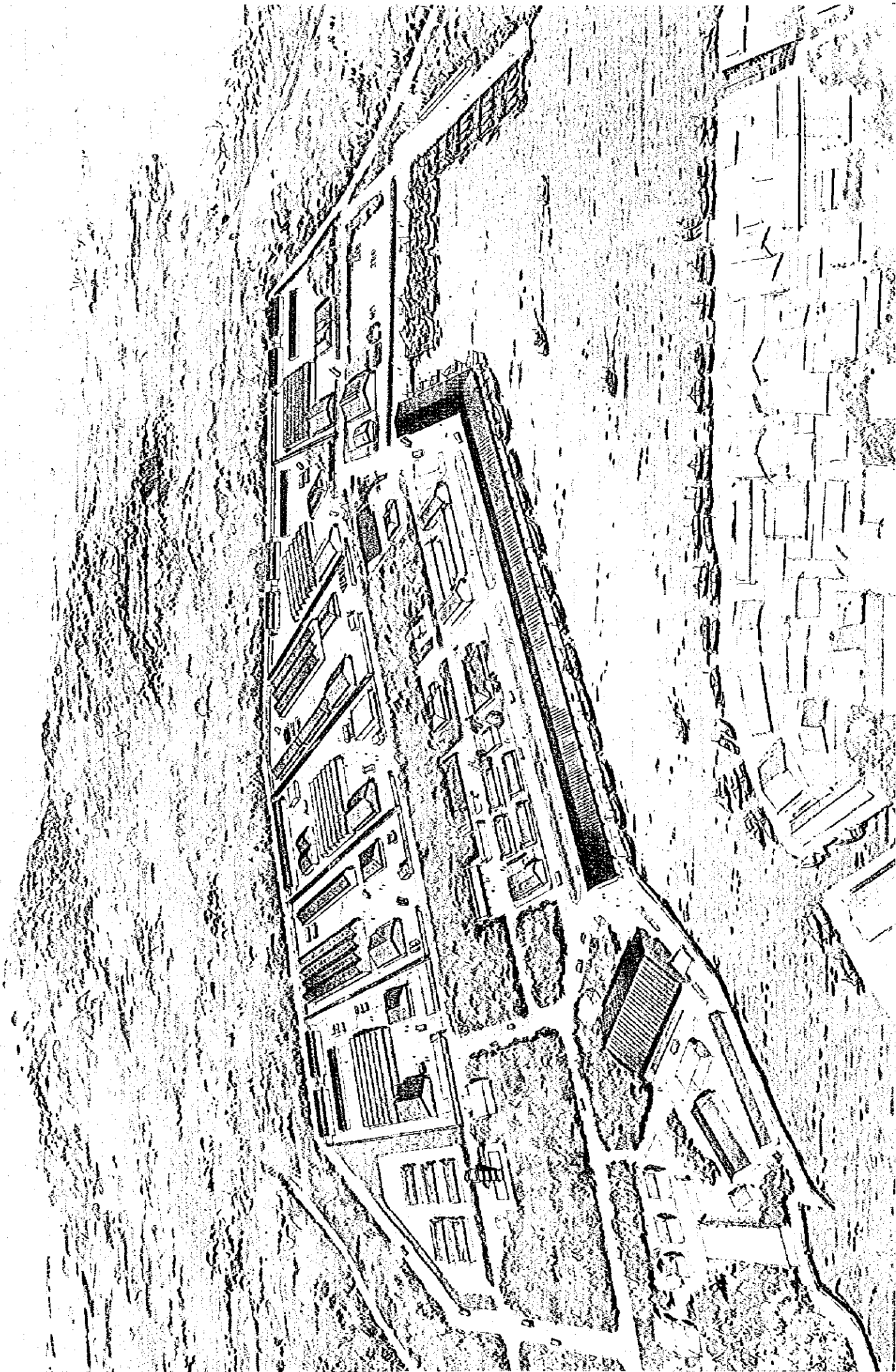


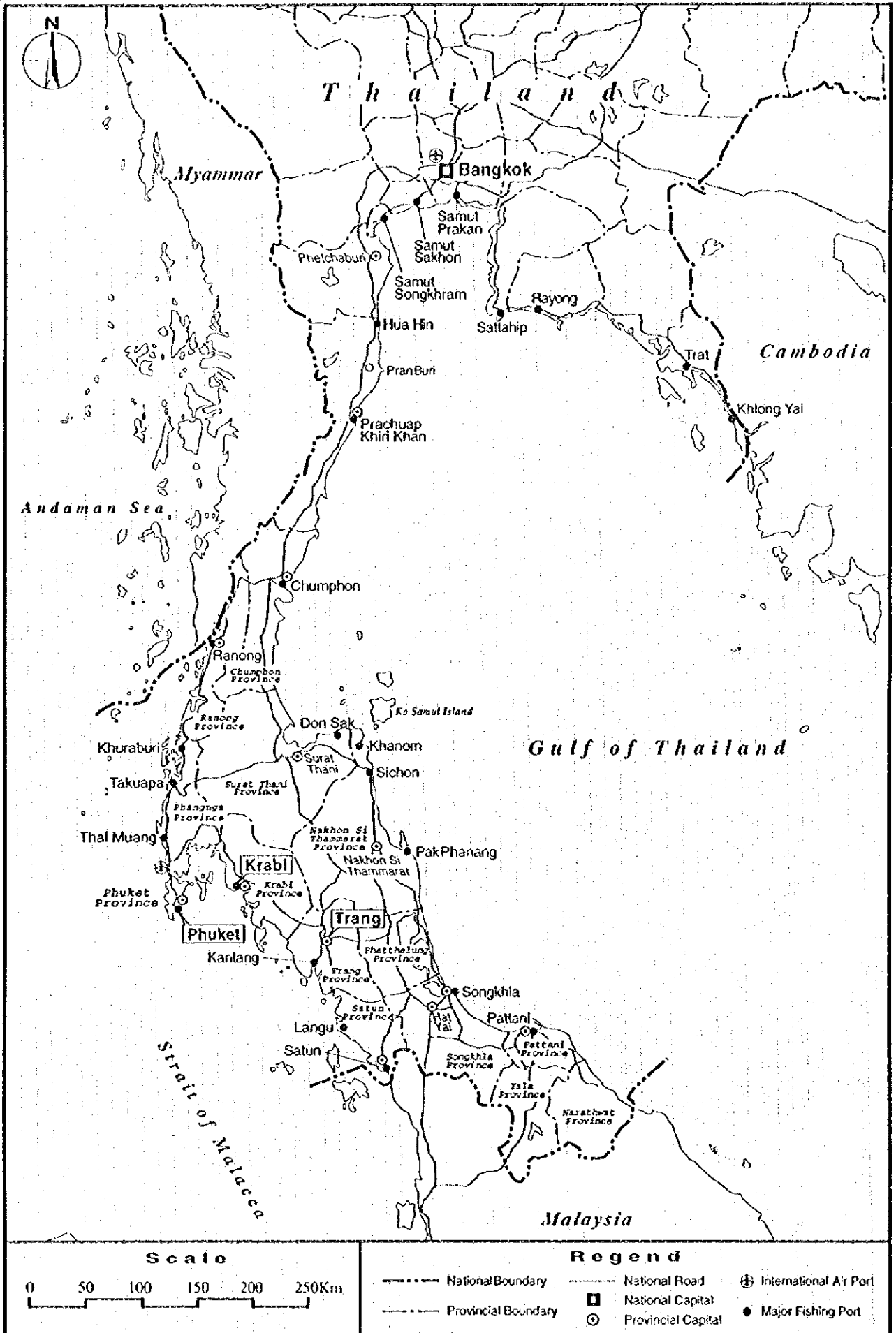
Taiji ENDO

Team Leader

The Study on Fishery Complex
on the Andaman Sea Coast









Overall View of the Project Site



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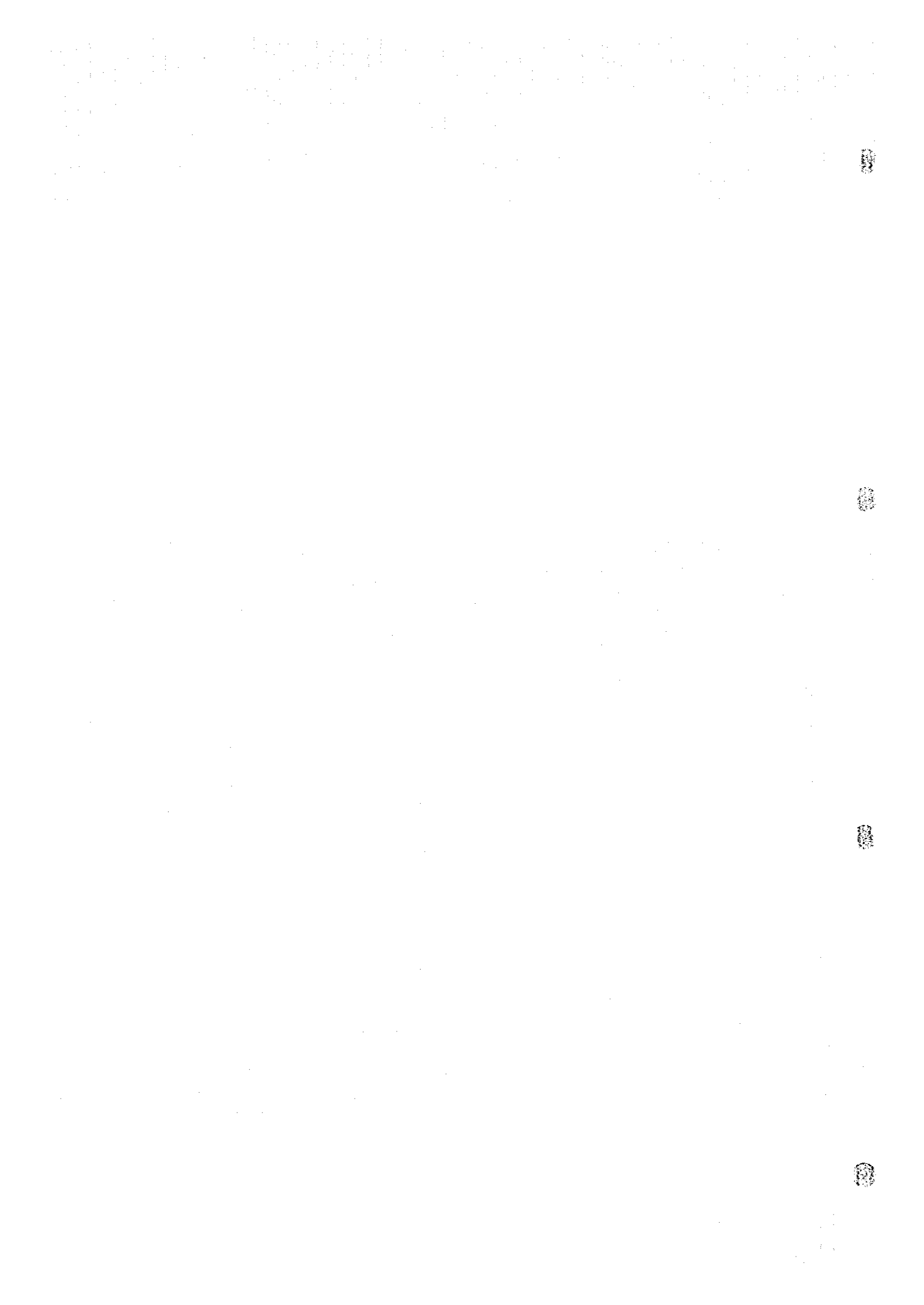
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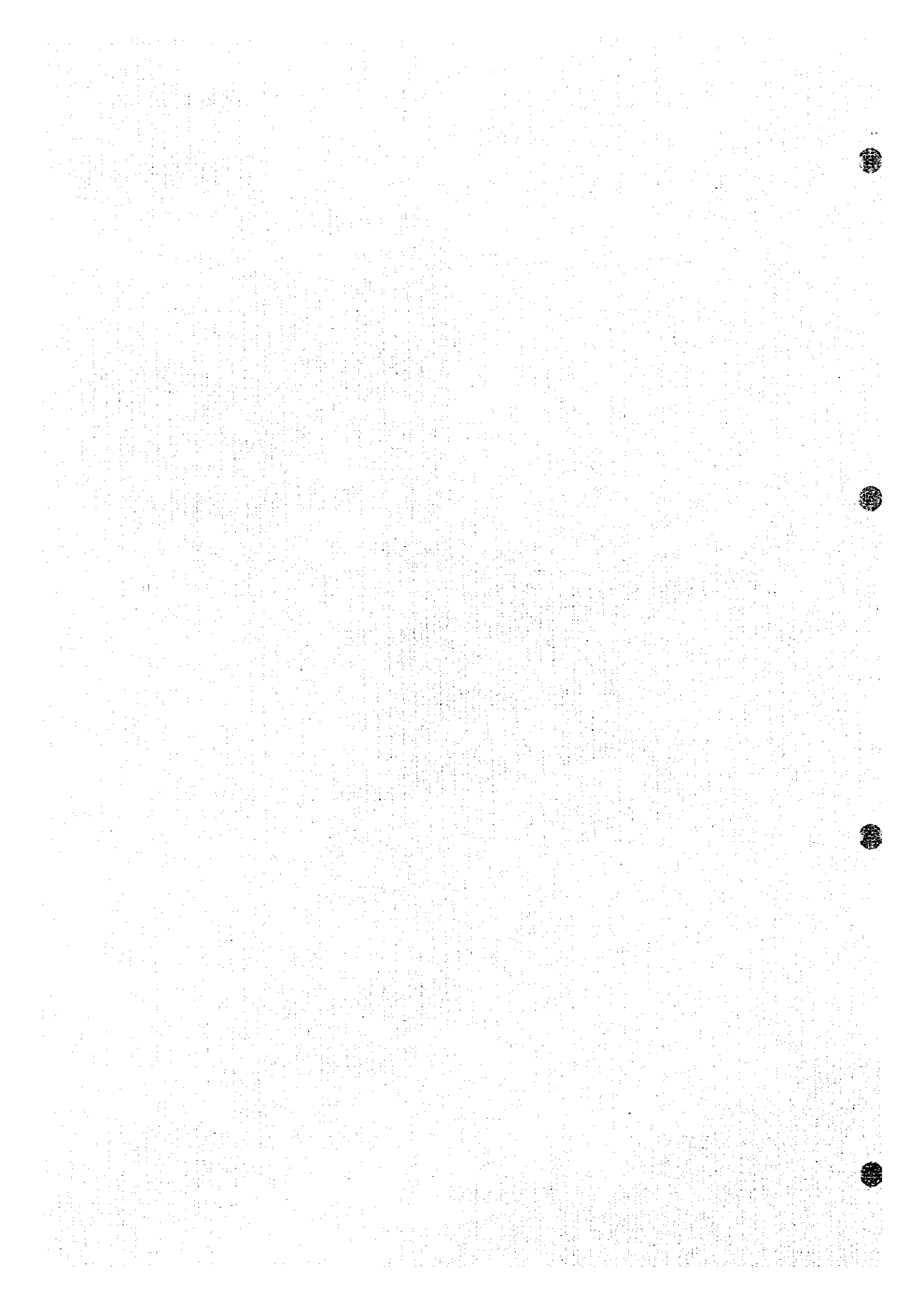
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- Figure 9.3.1 Phuket Fishery Complex Development Plan Marketing Flow (Target Year 2007)
- Figure 9.6.1 Transportation Volume and Transportation Route



PART I INTRODUCTION



1. INTRODUCTION

1.1. Background of the Study

Thailand has a coastline of 2,614 km with an excellent fisheries environment in Gulf of Thailand and the Andaman Sea. The fishery sector is a major industry and source of national income. Marine fish production in 1993 was 2,752,486 tons at a value of 36.1 billion Bahts. Thailand is one of the seven major exporting countries of fishery products; and its export of fish and processed fish in 1993 was 1,115,000 tons which was equivalent to 91.0 billion Bahts. The value of exported canned fish grew 22 times in the decade from 1980 to 1990.

With the establishment of EEZ by the countries neighbouring Thailand, namely Cambodia, Vietnam, Malaysia, Indonesia and Myanmar and Bangladesh, the fishing grounds for Thailand has greatly decreased since 1991 to 30 percent especially in the Gulf of Thailand. Since bilateral agreements with Malaysia and Myanmar has not been reached, fishing operation by Thai boats is restricted within Thai and Bangladeshi water. As a result, fishing efforts has increased in the fishing operation in the Andaman Sea with fishing boats from the Gulf of Thailand and from the coast of the Andaman Sea, but increase of fish catch volume has not been recorded from the fishing ground in the Andaman Sea. To compensate shortage of fish catch, these fishing boats likely operate fishing in the sea in the Myanmar, Bangladeshi, or Indonesian territories and slight increase of total landing volume in Thailand is recorded. Under this situation, it is expected that fishing operation in the Andaman Sea be controlled to maintain and nourish the stock.

Thai fishermen are making efforts to purchase a purse seiner for catching tunas from different fishing grounds. Long line fishing to catch tunas is being operated by Taiwanese and Chinese fishing boats which land fish catch at Phuket Fishing Port, and Thai fishermen are very keen to establish joint-venture companies with Taiwanese for operating long line fishing.

Processing plants around Bangkok for large tuna canning industry oriented to export is being considered to transfer to the southern part of Thailand where the labour cost is comparatively lower than that of plants around Bangkok.

In view of the above situation, the Government of Thailand is planning to construct a fishing port complex in the coastal area along the Andaman Sea incorporating an area exclusively for export fish processing, to improve the fish marketing system and to enhance the fisheries industry.

In accordance with this background, the Government of Thailand requested the Government of Japan technical cooperation to formulate a master plan and urgent development program on the Fishery Complex on Andaman Sea coast. Upon receiving the request, the Government of Japan conducted a preliminary study in July 1995 and the scope of work (S/W) was agreed upon between both governments. Based on this agreement, JICA dispatched a study team and commenced the study in January 1996.

1.2. Objectives

The objective of the study is to formulate a master plan for development of the a complete Fishery Complex on the Andaman Sea coast to meet the urgently necessity of the existing fishing activities, and to conduct a feasibility study for an immediate implementation project. The target year is 2012 for a master plan and 2002 for an urgent plan.

In addition, technology transfer on operations and management of a fishing port and methodology for planning a fishery complex will also be carried out.

1.3. Study Area

The study area shall be Andaman Sea coast in Thailand and cover relevant area such as the Gulf of Thailand and the surrounding of Bangkok.

1.4. Study Schedule

The study will be carried out in two phases as shown in the Flow Chart of Study and the scope of work covered in each phase is delineated below .

(1) Phase-1 Study

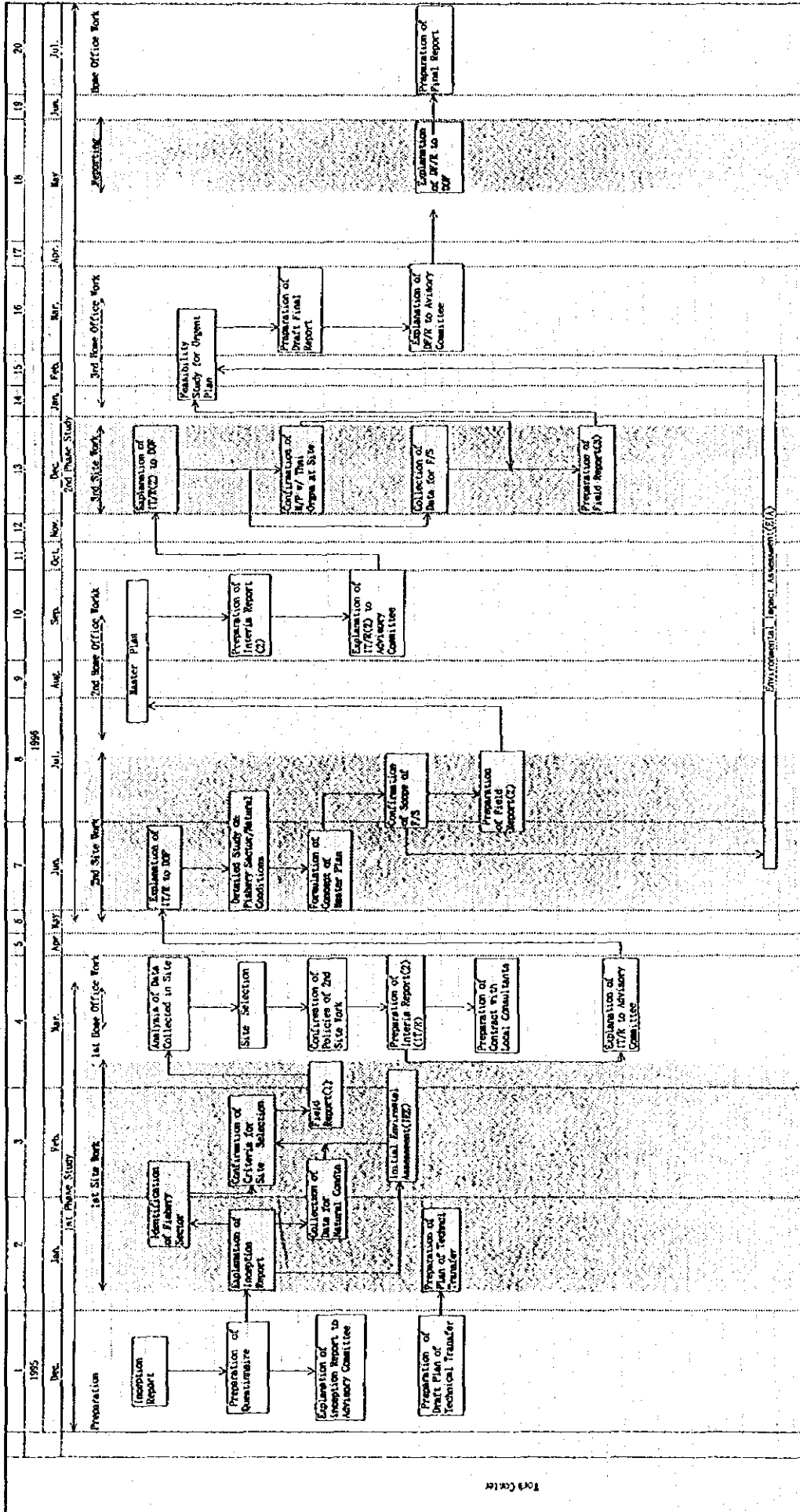
Based on existing data and field survey, an assessment of the fishery sector in Thailand has been undertaken. Necessary basic data and information for future forecast and confirmation of realization of the project has been collected and analyzed in order to formulate a basic structure of the master plan.

A natural condition survey and a preliminary environmental survey will be carried out at five proposed sites for the project. Project site will be selected by natural conditions, construction cost, social and natural environment surrounding the project site.

(2) Phase-2 Study

Detailed survey on the fishery sector and preparation of input data to design facilities for formulating a master plan will be made at the project site selected on the basis of the results of Phase - 1 study, and a basic concept of master plan will be formulated. Alternative plans for Fishery Complex will be examined with considering short term, medium term and long term plans, and a master plan will be formulated. Feasibility study for a short term plan will be conducted examining alternative plans.

Flow Chart of Study



Note :
 IIR : Interim Report
 DFIR : Draft Final Report
 DP : Department of Fisheries

Fish Center

1.5. Organization of the Study Team

(1) Advisory Committee

Mr. Juniji TANAKA	Chief Inspector, Fishing Port Construction Div., Fishing Port Department, Fisheries Agency, Ministry Agriculture, Forestry and Fisheries.
Mr. Katsuhiro MIKI	Senior Research Associate, Marketing Analysis Section, Fisheries Management and Economy Div., National Research Institute of Fisheries Science
Mr. Eisuke IWATA	Managing Director, Japan Far Seas Purse Seine Fishing Association

(2) Study Team

Name	Duty
Dr. Taiji ENDO	Leader, Fishing Port Planning
Mr. Teruo YABANA	Deputy Leader, Fisheries and Fish Marketing
Mr. Takashi INOUE	Fishery Economy (First phase)
Mr. Takao Ozaki	Fishery Economy (Second phase)
Mr. Iwao MIZUISHI	Management and Operation
Mr. Shigeru KOBAYASHI	Fishery Research
Mr. Masafumi ITO	Port Engineering
Mr. Mutsumi GANDO	Architect and Building Engineering
Mr. Hiroshi ABO	Mechanical/Utility Engineering
Mr. Noboru TANIGAWA	Economic and Financial Analysis
Mr. Geza TELEKI	Environmental Consideration
Dr. Norio TANAKA	Siltation Analysis

1.6. Thai Organization Concerned

1.6.1. Organization Concerned

- Department of Fisheries, Ministry of Agriculture and Co-operatives
- Fish Marketing Organisation
- Each Provincial Government
- Office of Environmental Policy and Planning
- Harbour Department, Ministry of Transport and Communication
- Meteorological Department, Ministry of Transport and Communication
- Forestry Department, Ministry of Agriculture and Co-operatives
- Department of Highway
- Phuket City
- Tambon Rasada Administration Office
- Tinsulanonda Songkhula Fisheries Collage
- Phuket Cold Storage Organisation
- Phuket Chamber of Commerce
- National Economic and Social Development Board (NESDB)
- Ministry of Finance
- Tourism Authority of Thailand (TAT)
- Ministry of Labour and Social Welfare
- Finance Division, Phuket Provincial Government
- Finance Division, Phang-nga Provincial Government
- Statistics Office, Phuket Provincial Government
- Statistics Office, Phang-nga Provincial Government
- Ministry of Interior
- Andaman Sea Fisheries Development Center
- Customs Office, Ministry of Finance
- Board of Investment
- Industrial Estate Authority of Thailand (IEAT)
- United Nations, International Labour Organisation (ILO)
- UN, Food and Agriculture Organisation (FAO)

1.6.2. Interviewees

(1) Department of Fisheries

Dr. Plodprasop Suraswadi	Director General
Mr. Chanintorn Sritongsuk	Deputy Director General
Mr. Sompong Hiranwat	Senior Fishery Advisor

Ms. Sune Suwapeepan	Senior Fishery Advisor
Ms. Smmalee Yuktanonda	Director
Dr. Somying Piumsombun	Director
Mr. Montree Krisaneephaibun	Director
Mr. Thanmasak Poreeyanon	Senior Biologist
Dr. Chaipat Rochanawipak	Senior Biologist
Mr. Pongpat Boonnchuwong	Senior Economist
Mr. Sompong Nimuchuar	Chief
Mr. Minoru Sasaki	JICA Expert
Dr. Hansa Chansang	Seagrass and Coral Specialist
Mr. Prawin Limpasichol	
Mr. Kaiteesak	Director
Mr. Manoon Boathong	Manager
Dr. Cherdsak Virapat	Fisheries Biologist
Mr. Sompong Kupramongarak	Chief, Songkhla Fish Inspector Center
Ms. Praulai Chantawong	Marine Biologist, Andaman Sea Fisheries Development Center

(2) Fish Marketing Organisation

Mr. Manus Hemunukul	Director, Fisheries Development Division
Mr. Somboon Thipyarat	Manager, Ranong Fish Marketing Organisation
Mr. Pramuan Rugjai	Manager, Phuket Fish Marketing Organisation
Mr. Tia Titipong	Manager, Satun Fish Marketing Organisation
Mr. Ekachai Soonkahotu	Manager, Samutprakarn Fish Market
Mr. Chaiyut Thomgronjay	Asst. Manager, Pak Pannang Fishing port
Mr. Boonjue Rattanasupa	Officer, Nakorn Si Thammarat Fisheries Office

(3) Phuket Provincial Government

Mr. Sudjit Nimitku	Governor
Mr. Kumpol Worapitayut	Vice Governor
Mr. Singkha	Director, Provincial Fisheries Office
Mr. Jate Pimoljinda	Acting Director, Andaman Sea Fisheries Development Center
Mr. Sumruay Suwon	Construction Management
Mr. Wachira Chobtang	Chief, City Planning Office
Mr. Thanee Thongprachun	Manager, Water Supply Authority
Mr. Jiamsak Tatklpmgkon	Engineer, Building & Construction Section

Mr. Suvit Sodsai	Civil Engineer, Engineer, Building & Construction Section
Mr. Chamras Ratanaburi	Officer, Provincial Electricity Authority
Mr. Phansak Dubson	Chief, Statistics Office
Mr. Niwat Chanprasitphon,	Chief, Finance Division
(4) Songkhla Provincial Government	
Mr. Prapan Tharnbupphar	Officer, Fisheries Office
(5) Nakorn Si Thammarat Provincial Government	
Mr. Boonjue Rattanasupa	Officer, Fisheries Office
(6) Krabi Provincial Government	
Mr. Amnaxy Ronegern	Vice Governor
Mr. Perapol Teng Rang	Deputy director, Fisheries Office
(7) Trang Provincial Government	
Mr. Yongyoot Wichaidit	Governor
Mr. Yuth Wihaidit	Vice Governor
Mr. Manu Bua Tong	Director, Fisheries Office
(8) Satun Provincial Government	
Mr. Patcharin Somsopon	Director, Fisheries Office
(9) Ranong Provincial Government	
Mr. Somporn Lohsawatkul	Director, Fisheries Office
(10) Phang-nga Provincial Government	
Mr. Chaiwat Petpomorn	Chief, Finance Division
Mr. Somsak Kacoon	Chief, Statistics Office
Mr. Panumas Sayangkull	Director, Phang-nga Provincial Fisheries Office
(11) Meteorological Department	
Mr. Poonsin Kantahiran	Director
Ms. Chavaree Varasai	Chief
Ms. Sumalee Prachua	Director
Ms. Chongkolnee Yusabye	Chief
(12) Harbour Department	
Mr. Vichet Rojanadhamkul	Deputy Director General
Mr. Suriya Tarepakdee	Chief
Ms. Soontaree Hirayanan	Chief, 5th Regional Harbour Master Office Phuket Branch

- Mr. Kritpeteti Ehaichuan Harbour Master, 5th Regional Harbour Master Office Phuket Branch
- (13) Asian Institute of Technology**
 Dr. Suphat Vongvisessomajai Professor
 Dr. Harumichi Kyotoh Assistant Professor
- (14) Office of Environmental Policy and Planning**
 Dr. Ampon Pintukanok Piyanan Saponkanabhorn, Chief of Transport Section
- (15) Royal Forestry Department**
 Mr. Sonjai Havanond Chief
 Mr. Joomron Tasanachant Director
 Mr. Manech Wongsuryart Chief
- (16) Kasetsart University**
 Dr. Sonit Aksornkoae Professor
- (17) Department of Highways**
 Mr. Chusak Gaywee Senior Engineer
- (18) Phuket City**
 Mr. Prasit Sangsue Director, Water Supply Division
- (19) Tambon Rasada Administration Office**
 Mr. Praachum Towong Mayor/Head Man, Tambon Rasada Administration Office
 Mr. Pisut Tanmanee Secretary, Tambon Rasada Administration Office
- (20) Tinsulanonda Songkhula Fisheries Collage**
 Ms. Pornpen Khundate Instructor, Food Processing Department
 Ms. Chollada Chalaruk Instructor, Food Processing Department
- (21) Phuket Cold Storage Organisation**
 Mr. Somchai Tarpinit Engineer
- (22) Phuket Chamber of Commerce**
 Mr. Khanchit Tamphanuwat Chairman
 Mr. Charn Wongsatayanont Vice-Chairman
- (23) National Economic and Social Development Board (NESDB)**
 Dr. Porameteer Vinolsiri Economic Analysis and Projection Division
- (24) Ministry of Finance**
 Mr. Kritsda Udyanin Tax Policy Office
 Ms. Siribha Sataanon Fiscal Policy Office

- Mr. Sithiporn Tripitak Chief, Customs Office of Phuket Port
Mr. Sonthaya Duangkhae Chief, Customs Office of Phuket Airport
- (25) Tourism Authority of Thailand (TAT)**
Ms. Anoma Vongyai Officer, Phuket Office
- (26) Ministry of Labour and Social Welfare**
Mr. Somjaet Khantigul, Chief, Employment Service Office, Phuket
Mr. Kopit Temsongsai, Chief, Employment Service Office, Phang-nga
- (27) Ministry of Interior**
Mr. Kosit Thongwattana Urban Planner, Phang-nga Office
- (28) Board of Investment**
Mr. Takao Yamataki, JICA Expert
- (29) Industrial Estate Authority of Thailand (IEAT)**
Mr. Somkiet Supunchanaburi Director, Technical Division

PART II SELECTION OF PROJECT SITE

2. Outline of Fisheries Sector

2.1. Government Policies

2.1.1. Government Policies on National Economic and Social Development Plan

The seventh National Social and Economic Development Plan (1992-96) has enhanced the development of the marine products industry through the following policy measures:

- Promote coastal aquaculture for exports and freshwater culture for domestic consumption.
- Protect the environment and limit the destruction of mangrove forests (which are the natural breeding grounds for a wide range of fish and shellfish) by restricting shrimp culture to a maximum of 80,000 hectares.
- Promote aquaculture of other species like squid through cage culture.
- Encourage commercial freshwater aquaculture of channel catfish and tilapia.
- Regulate the number of fishing vessels in operation to reduce the over-exploitation of resources.
- Suspend licenses for new fishing vessels, especially trawlers.
- Ban the operation of small boats harvesting pelagic fishes within 3 kms of the shore.
- Restrict minimum mesh size and ban the use of light attraction methods.
- Sign fishing agreements with several resource rich nations such as Bangladesh, Myanmar, India, Indonesia, Australia, Malaysia, etc., as a means of increasing annual fish production by 3 percent.

The result was the achievement of economic development far beyond the expectations of the 7th National Economic and Social Development Plan. However, this development occurred only around Bangkok. Therefore, the next step was to alleviate regional economic disparity. The 8th National Economic and Social Development Plan was drawn up to resolve this problem.

2.1.2. National Fisheries Development Plan

Department of Fisheries (DOF) prepared the National Fisheries Development Plan (1995-2001), and the plan was approved by the cabinet in 1993. The plan consisted of the following four sectors: 1. Fisheries in Thai territorial waters, 2. Fisheries in outside of Thai territorial waters, 3. Fishery industry, and 4. Aquaculture. The objectives and targets for each of the sectors are explained below.

(1) Fisheries in Thai Territorial Waters

The objectives of fisheries in Thai territorial waters are to increase the living standard of fishermen, and to achieve sustainable development through efficient resource management. The targets of this sector are:

- To maintain production at 1.7 million tons.¹

¹ This target volume is for only in Thai water. Landing data on "Fisheries Statistics" are included fish from outside of Thai water.

Thailand	1,700,000 ton
Gulf of Thailand	1,300,000 ton
Pelagic fish	400,000 ton
Demersal fish	750,000 ton
Coastal fish	150,000 ton
Andaman Sea	280,000 ton
Pelagic fish	50,000 ton
Demersal fish	200,000 ton
Coastal fish	30,000 ton
Inland	150,000 ton

Source : National Fisheries Development Plan

- To reduce improper fish utilisation by 100,000 tons.

(2) Fisheries Outside Thai Territorial Waters

The objectives of fisheries outside Thai territorial waters are to promote and develop fishing. The targets of this sector are:

- To carry out fishing operations with other countries in joint ventures, to comply with international laws, and to target a catch of 1.8 million tons
- To promote Thai vessels with a length of over 80 metres.

(3) Fishery Industry Sector

The objectives of this sector are to promote the export and domestic consumption of fishery products by raising the standard of the products and maintaining fish quality after catching or harvesting. The targets of this sector are:

- To maintain production in order to export not less than 1 million tons per year and to increase value added products by 10% annually.
- To distribute fisheries production to rural areas in order to keep domestic fish consumption to a minimum of 30 kg per capita.
- To set up a product investigation laboratory in every coastal province for detecting antibiotic residues in shrimp before harvest and sale to processing plants.

(4) Aquaculture

The objective of this sector is to attain sustainable development. The targets are:

- Increase production of coastal aquaculture for export by 5 percent annually, and to limit the total shrimp production area to 76,000 hectares. The production target for 1996 is 555,000 tons which consists of 250,000 tons of fresh water fish, and 305,000 tons of coastal aquaculture.
- Protect and maintain an environment needed to sustain the aquaculture industry.
- Encourage cooperation between relevant agencies in order to monitor the quality of coastal waters and to prevent or alleviate the deleterious effects of fishing activities on the environment.

2.2. Socio-economy and Fisheries Sector

2.2.1. National Economy

(1) Policy, Economy and Growth

Thailand is currently ranked among the lower middle-income countries with Gross Domestic Product (GDP) of 103.2 million baht and per capita of GDP \$2,395 (1995). During the 1960's and 70's, Thailand pursued a sound macro-economic policy, and gross domestic products (GDP) grew at an average rate of 5.6 per cent from 1971-75, and 7.9 from 1976-80. Economic policy in Thailand was marked by an emphasis on import substitution of industry. In the early 1970s, Thailand followed an economic expansion policy based on external debt. But in the late 1970s, its economic growth was marked by low level macro-disequilibrium, such as budget deficits, debt crisis, inflation, unemployment, etc. caused by world recession stemmed by a two time oil price hike.

In the early 80's, the government introduced a package of macro-economic policy adjustment based on a macro policy guideline agreement with the World Bank and other agencies, that emphasised a reduction of external debt, inflation control and resource allocation through market mechanisms. The government made an effort to improve current accounts through deregulation, further development of export and tourism industries, and promotion of labour working abroad. Meanwhile, a large quantity of direct foreign investment flooded into the manufacturing industry following devaluation in 1984. This policy had led the economy successfully and the actual economic growth rate in the latter half of the 1980s and early 1990s was 7.9 percent. Despite the world recession in the early 1990s, The Thai economy maintained favourable economic growth and the real economic growth rate in 1995 is estimated as 8.5 percent. The factors supporting economic expansion are (i) a higher rice price in the global agricultural products market, (ii) stronger recovery in the economy of major trade partners, (iii) a stable import oil price, and (iv) a boost from continued public investment and a policy to promote increased mobilisation of private sector resources.

Despite such favourable economic growth, the steep rise in the consumer price index began in 1994 and continued an upward trend until late 1995. The overall inflation rate surged to 6.9 percent in April 1996, from 5.8 percent average in 1995. Furthermore, public investment which is a inflation factor, increased. The current deficit account was 8.1 percent of the GDP in 1995, and it is estimated at 6.3 percent in 1996. Under these circumstances, the cabinet agreed to implement programmes including promotion of export industries to curb the current deficit.

Despite these negative factors in development, i.e. inflation and the current deficit, the country's domestic production is anticipated to remain robust with a forecast of 8.3 percent of growth in real GDP, with inflation expected to remain at 4.9 percent.

Gross Domestic Products (GDP) by sector from 1990 through 1994 are summarised in Table 2.2.1.

(2) Industrial Structure

Thai economy still remains predominantly agricultural, and its main export product is rice, with around 44 percent of the labour force being absorbed in the agriculture sector from 1978 to 1983, with only 12.7 percent engaged in manufacturing and 18.2 percent in commerce. Since devaluation in 1984, the industrial structure has transformed into secondary and tertiary sectors, which was caused by large-scale foreign investment in industries. As a result, the GDP share of the manufacturing sector was 28.2%, followed by the commercial, service, agriculture, transportation, communication, and other sectors which accounted for 16.4%, 12.6%, 10.2%, 7.4% and 25.2%, respectively.

The total GDP share of the entire agriculture sector has decreased while the fisheries sector has remained stable at 1.7% in 1994.

(3) Demand and Supply Gap in Labour Market

Thailand is attempting to promote export of higher value added products in the competitive international markets. However, the overall labour shortage is estimated to stand out at around 1.36 million, and a quantitative and qualitative manpower deficit will become a serious bottleneck for future economic development.

Minimum wage for unskilled labour was increased by the ministerial decree of the Ministry of Labour and Social Welfare, in June 1995, to a maximum 145 baht per day in Bangkok and its vicinities, followed by regional adjustments ranging from 126 baht to 118 bahts in all other provinces. While the government is allegedly considering a raise of the minimum wage rate by 10 bahts effective October 1, 1996, the labour union (the Labour Congress of Thailand) is politically on the move, demanding a 22 bahts increase reaching 167 bahts per day, retroactive from July 1, 1996. As a result, the move of foreign capital to other Asian countries, such as Vietnam, Indonesia, etc. is of concern.

Minimum wage rates by province is given in Table 2.2.2.

(4) Alien Workers in Thailand

In order to supplement the labour shortage of 1.36 million of labour shortage mentioned earlier, approximately 700,000 foreign labourers are estimated to be working in Thailand under Article 12 of the 1978 Work Act for Foreign Immigrants. Their major working place is low value added sectors in agriculture, construction, manufacturing and service industries. Predominantly, most part of the alien work force currently in border areas, such as the southern region, including Phuket and Phang-nga Provinces, are from Myanmar.

The act does not secure legal rights for duration of stay, working conditions, etc. for alien labourers. However, faced with a critical shortage of manpower, especially in lower wage sectors, the Ministry of Labour and Social Welfare, jointly with the National Security Council, proposed modifications of the act at the beginning of 1996. Consequently, in June 1996, alien labourers in 39 provinces were registered with the ministry as legal alien labourers for a period of up to two years. The modification will shortly be agreed on by the cabinet and enacted, thereby making it possible for new immigrants to register. But a political decision is still required in negotiations with the labour union which has requested that alien workers be limited

in the fisheries, agriculture, construction sectors, etc. excluding the manufacturing sector.

(5) Income Distribution and Poverty Alleviation

Recently, Thailand has achieved economic growth, but it is estimated that the income disparity has been increasing despite insufficient substantial analysis of income distribution. In the area of poverty alleviation, the decreasing rate of the living in poverty population is below the economic growth rate. Consequently, the number of people living in an absolute poverty in 1994 is estimated as 9 million or 21.8% of the total population. Based on these conditions, the Asian Development Bank conducted a study on poverty groups in 1995 to establish policies for poverty alleviation. In this study, ADB defined the "poverty line" as the "level that represents the minimum amount of income necessary to buy what is considered to be subsistence food and non-food requirements", and estimated which would serve as the poverty line according to region.

According to the study, the monthly income poverty line for the regions were estimated as follows. Greater Bangkok posted the highest poverty level at 791 Baht, followed by 769 Baht, 735 Baht, 725 Baht, and 646 Baht for central, southern, north-eastern, and northern regions, respectively. The ratio of the population in poverty in 1992 was estimated as 13% for the entire country, 3.0% in Greater Bangkok, 6.0% in the central, 11.6% in the southern, 19.5% in the north-eastern, and 15.5% in the northern regions. The level of population in poverty in southern region was the mean for the whole country.

During the Eighth National Economic and Social Development Plan period, 1997-2001, the government set a target to downsize the proportion of the poor to 10 percent of the total population by generating employment opportunities and redeploying the industry, combined with efforts to develop the infrastructure, and equalising opportunities for education and vocational training.

The head count ratios for poverty by region are given in Tables 2.2.3.

2.2.2. Role of Fisheries Activities in the National Economy

(1) Gross Domestic Product

Gross Domestic Products (GDP) in 1993 at the current market price was 3,161 billion baht of which 1.5% or 47 billion baht was produced by the fisheries sector (see Table 2.2.4). The total GDP share of the entire agriculture sector decreased while the fisheries sector has remained stable at 1.5 to 1.7% since 1989.

The value added (price) of the fisheries sector by region is shown in 1.2.5. Major fishery regions are found in the southern, eastern and Greater Bangkok regions. The highest fisheries production area is in the southern region, producing 63% of the total national production volume or 29 billion baht in 1993. Increases in the region's fishery production volume are also remarkable and the real annual growth rate has grown 12.8% from 1989. The growth rate in the eastern and Greater Bangkok regions in 1993 was 14% and 13%, respectively. Real values have been decreasing and annual growth rates were -2.6% and -2.4% in the eastern and Greater Bangkok region, respectively.

(2) Foreign Trade

1) Role of Fisheries Products in Foreign Trade

In 1993, the total import volume was 1,171 billion baht, the total export volume was 951 billion baht, and the trade balance deficit was 219 billion baht (see 1.2.6). The trade balance has been around 200 billion baht or more since 1990. However, foreign trade in fishery products has been in surplus and more than 40 billion baht has been earned since 1990, as shown in 1.2.7. Export volume of fishery products in 1993 was 91 billion baht or 9.6% of the total export earnings, showing a surplus of 69 billion baht.

Thailand has the world's largest export volume of fishery products and the highest trade surplus in fishery products (see 1.2.8). Despite the important share of processed fishery products in fishery exports, there is a shortage in the domestic supply of raw material fish for processing. As a result, many fish are imported.

2) Canned Tuna

The highest value of export fishery products was canned tuna in 1988, fresh and frozen shrimps in 1993 (see 1.2.9). The major markets are Japan and the US for fresh and frozen shrimps, the US and UK for canned tuna. Even though fresh and frozen shrimps were most important in 1993, canned tuna was in second place.

Tuna canning industry in Thailand grew rapidly in the 1970s and 1980s. In 1993, 230,000 tons or 20% of the total world production of canned tuna was produced in Thailand, the second largest production after the US. Most of the canned tuna is exported because of the low demand in the domestic market. As of 1985, Thailand has been the largest production of exported canned tuna. In 1993, Thailand exported 230,000 tons or 46 % of the total world market in canned tuna (see Table 2.2.10).

However, the tuna canning industry faces a shortage of local fish for raw materials, and many frozen tuna are imported. Table 2.2.11 shows that Thailand imports 402,000 tons of frozen tuna or 33% of the world market, which is the largest volume in the world.

The unit price of canned tuna is decreasing, reflecting increasing competition in world markets. The unit price was 65 baht/kg in 1988 and 57 baht/kg in 1993. The US, the biggest market of canned tuna, set quotas for imported canned tuna from developing countries, and fluctuations in the quota affects world markets.

3) New Markets for Exporting Tuna

The fresh tuna market in Japan pays a higher price for good quality tuna, a different species from the raw materials used in canning. The fishery industry in Thailand has begun to pay closer attention to the importance of the Japanese market and it has begun to emphasise export to Japan in recent years.

(3) Tuna Canning Industry

Benefiting from lower labour costs and the low priced skipjack, the tuna canning industry in Thailand developed during the 1980s. The export of canned tuna registered growth rates of 4.8% in quantity and 2.6% in FOB value during 1989 and 1994. Whole canned seafood earned a foreign exchange of US\$ 1.5 billion in 1994. Of the canned seafood exports, canned tuna accounts for around 50% or US\$ 700 million.

The canning industry in the southern region was established in the early 1980s, on the strength of raw materials being available from the Gulf of Thailand. As these local supplies have now declined, the industry is making use of frozen imported tuna traded through Bangkok or Songkhla. According to a study conducted by ADB, 70% of raw material consumed by the processed of marine fisheries products in the southern region, is imported tuna.

The international market price of tuna in December 1994 rose to about US\$ 1.0 per kilogram which was a historically high level, but in February 1995 it declined to US\$ 0.70-0.75 due to financial embarrassments of some Thai tuna canning manufacturers. Furthermore, the landing price of tuna at the Phuket port in the southern region slumped in March 1995 from 25-28 baht (US\$ 1.0-1.1) /kg to 8-15 baht (US\$ 0.3-0.5)/kg. Consequently, Thai fisheries business suffered serious damages. To deal with the situation, the government subsidised US\$ 60 million in buffer funds for financial assistance and to promote technological improvement in the four provinces of Pattani, Songkhla, Rayon and Phuket in the southern region which were affected most seriously. Market conditions recovered in the first half of 1996, and landing prices of tuna at Phuket port improved with 50-70 baht/kg for fresh and chilled, and 20-25 baht/kg for frozen fish. FOB price of fresh tuna at the Phuket airport for export to Japan and the US was US\$ 3.0/kg in June 1996.

Due to insufficient research and local and international policy papers, it is difficult to clearly estimate the prospects of Thai canning and other food processing industries, where tuna processing is dominant. However, the following has been pointed out by the research findings which applied the of Domestic Resource Cost (DRC) to Thai tuna canning factories for comparative analysis of manufacturing systems. Large-scale canning factories using imported tuna were favourable for effective utilisation of scarce resources. Small-scale factories using domestic tuna catch as raw material contributed to maximising economic welfare. Consequently, the following as recommended for policy implementation. Firstly, promote and support large-scale canning factories using imported tuna. The difference in DRCs attributed to each sub-category of the tuna canning factories by production size and by source of raw materials, is not significant since they all range between 0.81 to 0.90. Secondly, DRCs of Thai canning factories were comparatively high, therefore the government should support them to improve their efficiency and rationality, and to promote the industrial conversion of inferior factories.

(4) Food Supply

1) Present Conditions in Fish Consumption

Fishery products are an important source of nutrition for the people of Thailand. As shown in Table 2.2.12, per capita consumption of fish was 18 to 20 kg/year in the latter half of 1980s. Since 1990, it has increased gradually, due to a continuous increase in production. On the average, the fishery industry provided a per capita consumption of 26.3 kg of fish in 1994.

2) Target Fish Consumption

The Thai government has set per capita consumption target of 30 kg of fish.

2.2.3. Socio-economic Conditions in the Andaman Area

(1) Southern Region

1) Socio-economic conditions in the southern region

Amongst 76 provinces in Thailand, the southern region is composed of 14 provinces with a total land area of 1,673 square kilometres and 7.6 million inhabitants as of 1995. Geopolitically, the region of Bangkok and its vicinity is defined as "central", and the other areas of Thailand, including the southern region, is termed essentially as a "peripheral" economic zone whose main role is to provide raw materials, intermediate goods and low value added final products to Bangkok and foreign countries. As in other developing and industrialised country, production infrastructure and national wealth are extremely concentrated in the capital region. The nominal Gross Regional Products (GRP) of Bangkok and vicinity was 50.9% of the national aggregate in 1994, while the southern region was 8.5% or 307.5 billion baht. The other north-eastern, eastern, northern, central, and western regions were 11.2%, 10.3%, 9.5%, 5.4% and 4.2%, respectively. In terms of growth momentum through 1990 to 1994, the southern region was 10.7%, and the central, greater Bangkok, western, north-eastern, and northern regions were 13.6%, 13.4%, 10.0%, 9.8%, 9.4 and 9.3%, respectively.

In terms of industrial structure, the agriculture sector remains predominantly the largest segment of the region's economic activities, with a 36.0% share, followed by the service, wholesale and retail trading, construction, transportation and communication, manufacturing, and other sectors, each accounting for 14.9%, 14.9%, 7.3%, 5.5%, 5.1% and 16.3%, respectively. In the agricultural sector, the main sub-sectors are crops and fisheries which have the greatest share of the sector, each accounting for 47.5%, and 32.5%, respectively. The southern region's economy achieved a real growth of 6.7 percent in 1994, rising from 6.0 percent in the previous year, largely due to the increased price of rice, rubber, shrimp and other primary products, and an improved performance in the tourism and other sectors.

In 1995, agricultural production is expected to increase due to an improved infrastructure, and the regional economy is viewed favourably with an anticipated real GRP growth rate at around 7%. Statistical data on the regional economy are summarised and presented in Table 2.2.13.

2) Development Strategy of the Southern Region

The main factors for the future economic growth of Thailand are large-scale developments in infrastructure, human development and a steady market supply. These conditions have not been sufficient in the Bangkok metropolitan region, and the government has aimed to resolve these bottlenecks, to reduce regional disparities, and to expand social welfare under the industrial replacement policy, which includes eastern seaboard development. Based on these basic policies, the government planned large-scale investments in infrastructure development in the southern region, which included an inter-urban highway ("landbridge") and an oil refining base. Initiated in 1990, the Office of the Southern Seaboard Development Committee (SSDC) under the National Economic and Social Board (NESDB), the Government of Thailand, commissioned a study on the Southern Seaboard Development Plan (SSDP). In 1992, Master Plan of the Southern Seaboard Development Plan was submitted to the government, which recommended specific functions and an investment plan to develop the southern region into a petrochemical and export-oriented industrial zone, as well as a nodal point for West-to-Far East shipping. In compliance with this recommendation, the overall strategic objectives of the plan were set forth as follows: (i) provide additional maritime gateways to the country and establish an active maritime and fishery presence in the Andaman Sea, (ii) develop a stronger maritime industry in the country, (iii) create competitive industrial locations and trade and business centres together with new or upgraded towns to attract foreign investment and create job opportunities, (iv) promoting the development through the establishment of infrastructure as part of the globalization of Thailand, (v) develop new activities in an environmentally responsive manner and enhance existing activities with appropriate measures to mitigate adverse impact on the environment, and maximize the role of the private sector.

Similarly, the regional development plan under the guidance of the central government, called on each provincial government to develop their own development strategies based on the development of tourism and related infrastructure and facilities in order to utilise tourism resources along the west coast of Phuket and Phang-nga provinces. In addition, the provincial governments and private sector are discussing ways to promote light industries which process primary products for export and apply high technology. However, the budget is still not allocated for a feasibility study or trial investment. The Chambers of Commerce in Phuket and other provinces recognise the necessity of countermeasures against delay and changes to the "landbridge" plan in the SSDP master plan to avoid negative impact on the local economy.

(2) Gross Regional Product in the Andaman Area

1) Regional Differences in GRP

Gross Regional Products (GRP) in 1993 at the current market price is shown in Table 2.2.14. GRP of the southern region was 259 billion baht or 8.2% of Thailand's total GDP. Per capita GRP in the southern region was 32,000 baht or 60% of the national average. However, per capita GRP of the southern region is higher than average (28,000 baht), when the Greater Bangkok region which has the highest per capita GRP, is excluded.

In particular, the GRP in market prices in 1993 in the Andaman area was 74,857 million baht or 29% of the southern region. Per capita GRP was 43,000 baht or 1.4 times greater than the average of the southern region.

Per capita gross provincial products (GPP) of Phuket province is the highest in the Andaman area. Per capita GPP of Trang and Satun provinces is the lowest in this area, but higher than the average, with the exclusion of the Greater Bangkok region.

2) Role of Fisheries Industry in Regional Economy

The fishery industry plays an important role in the regional economy of the Andaman area. The total GPP of the province according to industry is shown in Table 2.2.15. The fisheries sector comprised 13.1% of the province's GRP in 1993, in contrast to 1.5% of the national GRP average and 11.3% of the GRP for the entire southern area. Fisheries is a leading industry especially in the Ranong and Satun provinces and contributes to 39% of the economy in Ranong and 21% in Satun.

The share of the fisheries sector in the regional economy is 7.8% in the three central provinces of Trang, Krabi and Phuket and it is lower than the average figure for the entire the Andaman area. This is because the GRP of the fisheries sector in Krabi province is only 171 million baht or 1.4% of the total GPP. Phuket province has the largest fishery production volume of the three provinces at 2,090 million baht. The GRP share of the fisheries sector in Phuket province is also the highest at 11%. In Trang province, the production volume of the fisheries sector is 1,510 million baht and comprises 9% of the GPP.

(3) Labour Conditions

1) Unemployment Rate

According to 1995 labour and employment statistics by the Department of Labour Protection and Welfare shown in Table 2.2.16, the unemployment rate is 1.4% in the southern region, lower than national average of 3.1%.

2) Labour Demand

The major source of employment in the Andaman area is the rubber, oil palm and fishery industries. Due to a shortage of Thai labour, many Myanmar people are employed illegally. In the fishery industry, many of the crew members of commercial fishing boats are Burmese.

According to a survey by the Labour Office in Phuket Province, there is a demand for 23,500 foreign workers, of which 8,000 are employed in the fishery industry. As the result, private industries want regulatory changes pertaining to the hiring of foreign workers.

(4) Fish Consumption

1) Local Demand of Fish Consumption

The total population of the six provinces in the Andaman area was 1,748,000 in 1993. It is estimated that the national average fish consumption volume is 44,000 tons annually.

In contrast, the 1993 annual fish production volume was 820,000 tons. If the national average consumption ratio is estimated at 44%, excluding fish earmarked for export and fish meal, 361,000 tons of fish was supplied from the Andaman area. The annual total consumption volume was only 52,000 tons, even when compared with the consumption volume targeted in the fisheries development plan. Production volume greatly exceeds local demand. Thus the Andaman area is an important fish supply area in Thailand.

2) Fish Consumption Demand in the Tourism Industry

Tourism is highly prevalent in the Andaman area. The number of tourists in 1994 was 262,000 in Trang Province, 659,000 in Krabi and 2.1 million in Phuket Province. In these provinces, tourism is an important industry with development potential. Many people are engaged in tourism and its related industries, and tourists have contributed to the regional economy.

One of the major tourist attractions is the local Thai cuisine and supplying food to meet this demand has become important. Although the number of tourists is smaller than the resident population, tourists consume high grade fish. At present, the tourist area is unable to meet this demand, and fish is transported in from surrounding areas.

2.3. Fisheries Conditions in Thailand

2.3.1. Condition of Fisheries

(1) Fishing Grounds and Production

Fisheries in Thailand consist of marine fisheries, inland fisheries, and aquaculture of which marine fisheries is the leading industry, producing more than 80 per cent of the total fish production since 1985. Its share was reached 90 percent at its peak in 1986 and 1987 (See Table 2.3.1). However, its growth has stagnated in recent years, and its share has decreased to about 80 per cent of the total fish production. In contrast, production in aquaculture has increased.

Major Thai fishing grounds are located in Thai territorial waters and in areas outside territorial waters. Territorial waters of neighbouring countries such as Arafura Sea in Indonesia, Myanmar territorial waters, etc. are main fishing ground for Thai fisheries, where fishing is carried out with trawls and purse seines.

The fishing grounds in Thai territorial waters are located in the Gulf of Thailand (304,000 km²) and the Andaman Sea (116,280 km²). Due to the EEZs established by neighbouring countries, such as Cambodia, Vietnam, Malaysia, Indonesia, Myanmar and Bangladesh since the late 1970's, Thai fishing grounds have decreased sharply. In particular, the fishing grounds in the Gulf of Thailand have decreased to about 30 percent. The Gulf of Thailand is relatively shallow, with a mean depth of approximately 58m, and the deepest area is 84m. The depth of the Andaman Sea is about 100 to 1,000m. Fishing activities are practised in a water depth of less than 90m.

Total marine landing has increased gradually from 2.058 million tons in 1985 to 2.752 million tons in 1993 (see Table 2.3.2). Much of the fish catch is composed of various fish species including trash fish. Of the total fish landing volume of 2.752 million tons in 1993, the landing volume of major fish species was 85% or 2.350 million tons. Major species of landed fish consist of pelagic fish at 855,000 tons (31% of the total landing volume), and demersal fish at 287,000 tons (10% of the total landing volume).

Marine capture fisheries are mainly carried out in the Gulf of Thailand. Of the total fish landing volume of 2.752 million tons in 1993, 70% or 1.93 million tons were landed from the Gulf of Thailand and 30% or 0.82 million tons were landed from the Andaman Sea. Prior to the 1990s, 80 percent of the total fish landing volume originated from the Gulf of Thailand. However, this ratio fell to 70% since 1991, because of increased production from the Andaman Sea (see Figure 2.3.1).

(2) Fishing Gear

Fisheries in Thailand consist of commercial and small scale fisheries. Commercial fisheries employ powerful fishing gear such as trawls and purse seines while the small scale fisheries use small traditional fishing gear and method and operate on a subsistence level. The production volume of small scale fisheries is about 13 % of the total fish landing volume.

Three types of trawlers are used in commercial fisheries, the otter board trawl, the pair trawl and beam trawl. The otter board trawl is the most popularly used fishing gear in both the Gulf of Thailand and the Andaman Sea. In 1993, 49% of total fish landing volume or 1.352 million tons were harvested by otter board trawl. Approximately 903,000 tons (47%) were landed in the Gulf of Thailand and 449,000 tons (55%) were landed in the Andaman Sea using this method (see Table 2.3.3). In contrast, the beam

trawl is operated only in the Gulf of Thailand. Fish landed by purse seiners comprised 701,000 tons or 25% of the total landing volume 496,000 (26%) from the Gulf of Thailand and 206,000 tons (25%) from the Andaman Sea.

(3) Fishing Season

There are two monsoon seasons in Thailand. One is the Southwest monsoon season between May and October, and the other is the Northeast monsoon season between November and April. During the Northeast monsoon, the Gulf of Thailand becomes rough. In addition, Nakhon Si Thammarat coastal region, located in the centre of the Gulf of Thailand, is closed to fishing due to fish spawning and nursery. Therefore, many commercial fishing boats that are based along the Gulf of Thailand move their fishing grounds to the Andaman Sea during this period.

There are two methods of transporting fishing boats between the Gulf of Thailand and the Andaman Sea. Small boats that are less than 15m in length are transported overland across the peninsula by trailer. Large fishing boats of more than 15m in length are transported via Singapore and the Malaka Straits by sea. It takes more than eight days to travel from the Gulf of Thailand to the Andaman Sea by boat, and permits from Malaysia and Singapore are required in order to transit their waters.

2.3.2. Fishery Resources

According to DOF, potential production of Indo-pacific mackerel in the Gulf of Thailand has been fully exploited since 1984 with a maximum sustainable yield (MSY) of 104,611 tons and an optimal fishing effort of 146,633 fishing days. The recent catch of this species shows a decreasing trend during 1990 to 1991. The indian mackerel is still underexploited and can be increased 20% with fishing effort. Sardines have been overexploited since 1988 with a MSY of 104,177 tons, optimal fishing effort of 190,290 fishing days or 680 fishing boats. Tunas and round scad have also been overexploited with a MSY of 86,000 and 100,000 tons, respectively. Other pelagic fish such as spanish mackerel, carrangids, hardtail scads, etc. have not been overexploited, yet.

Demersal fish has been overexploited since 1973 with a MSY of 750,000 tons and optimal fishing effort of 8.6 million trawling hours. Demersal fisheries in the Gulf of Thailand exploit a large number of species. Five abundant and dominant species were selected for cohort analyses and Thompson and Bell estimates of MSY and MSE (maximum economic sustainable). The selected species were bigeyes, threadfin bream (*Nemipterus hexodon*), lizardfish (*Saurida undosqamis*, *Saurida elongata*) and *Metapenaeus affinis*. The analysis showed overexploitation of all species under current high level fishing effort.

Catch per unit effort (CPUE) in term of kg/hr in both the Gulf of Thailand and the Andaman Sea, was nearly the same in recent years for otter board trawling, but CPUE per trip, day and haul in the Andaman Sea was higher than the Gulf of Thailand. This signifies that CPU in the Andaman Sea was higher than the Gulf of Thailand for otter board trawling. In contrast, CPUE of purse seiners per trip, day and haul were nearly the same or slightly higher in the Gulf of Thailand than in the Andaman Sea (see Table 2.3.4).

There is still opportunity for future development of some pelagic fish such as spanish mackerel, haretail scads, etc. in the Gulf of Thailand; and it is also possible to increase the yield of pelagic fishery in the Andaman Sea. However, DOF has reported that demersal fish in both the Gulf of Thailand and the Andaman Sea has been overexploited

In contrast, the total landing volume of both the Gulf of Thailand and the Andaman Sea has increased gradually since 1985. These figures reflect not only the catch from Thai waters but also the catch from outside waters.

Due to a drop in the fish catch from the Gulf of Thailand, many fishing boats have moved to fishing grounds outside Thai waters.

2.3.3. Problems in the Fisheries Sector

The major problems confronting the Thai fisheries sector are (1) fishing agreements with neighbouring countries, (2) insufficient number of crew members, (3) high price of fuel, and (4) controlling the number of specific fishing gear to conserve resources.

(1) Fishing Agreements with Neighbouring Countries

As mentioned earlier, many Thai fishing vessels have moved their fishing grounds to areas outside Thai waters. Most of them have contracted with a local company in the neighbouring countries of India, Indonesia and Myanmar.

DOF intends to increase fisheries production in areas outside of Thai waters from 800,000 tons to 2 million tons per year. However, fishing agreements were not signed between the Thai government and governments of other countries with the exception of Bangladesh. The conditions of existing fishing agreements are shown in Table 2.3.5.

(2) Insufficient Manpower

Previously, the majority of the crew members working on Thai fishing boats came from the northeastern area of Thailand. However, recently, many crew members are Burmese, due to a decrease in Thai crews. It was often observed that most of the crews of fishing boats operating along the Andaman Sea were Burmese in this field survey. The Myanmar government stopped issuing work permits to Burmese crew members working in Thailand from August 1995. This policy was reversed in June 1996; and Thai boat owners have been able to employ Burmese crews again.

(3) High price of fuel

The price of fuel has become a serious issue in recent years. Some fishing boats purchase their fuel from tankers out on the international sea, due to the lack of taxes. The normal price of fuel is about 8.50 Baht/litter in the Thai market, and only 5 bahts out at sea.

DOF held a seminar in June 1996 to resolve this problem, and a subsidy that decreases the fuel price by 1.67 baht/litter will be implemented from August 1996 to July 1997. This subsidy will be provided for fishermen who engage in small scale fisheries and who are members of a fishermen's association, a fishermen's cooperative or a member of FMO. In this case, small scale fisheries refers to operations by fishing boats less than 18m long.

2.3.4. Deep sea fishing in the Indian Ocean

(1) Tuna Resources in the Indian Ocean

The Indian Ocean is divided into two areas by FAO, the Western Indian Ocean and the Eastern Indian Ocean. These two areas are roughly the same size (See Table 2.3.6), but the production of tuna and tuna-like species varies considerably between them, with the Western Indian Ocean having nearly three times the catch of the Eastern Indian Ocean (See Table 2.3.7).

The most significant difference between the two areas comes from the purse seine fishery, which is concentrated in the west. Gill net and baitboat catches are also very low in the Eastern Indian Ocean. These fisheries are prevalent in Indonesia, but are concentrated mainly on the Pacific coasts. These artisanal gears catch as much as the high tech purse seine fishery in the Western Indian Ocean.

According to ITPT, a large proportion of the catch is made with unspecified gears and much of this is also of unclassified species in the Eastern Indian Ocean. These are probably mainly neritic tunas. It would appear, therefore, that resources of small tropical oceanic tunas, Skipjack and juvenile yellowfin and bigeye, are under exploited in the Eastern Indian Ocean, assuming that the density of fish is the same throughout the ocean.

ITPT also mentioned the sudden increases of longline catches in the Western Indian Ocean suggested that this fishery could produce more if effort were to rise. Whether these increased catches are sustainable, however, will presumably be seen in the future, as Indian Ocean coastal countries are becoming increasingly interested in longline fishing.

Attempts at purse seining in the Eastern Indian Ocean have been sporadic to date. This may have been partly due to the fact that the main fleet bases are in the Western Indian Ocean and catch rates there have been sufficient for the fleet to have little motivation to move further East.

There has been an expansion of the purse seine fleet in the Western Indian Ocean towards the east in recent years, notable with the good yellowfin catches made near the Chagos Archipelago. There are also indications that some purse seine vessels may soon move from the Pacific to the Indian Ocean, and they may choose to develop these new grounds, rather than face the competition in the West.

The status of the stocks of tuna and tuna like fish in the Indian Ocean by ITPT is shown in Table 2.3.8.

(2) Tuna Purse Seine Survey by DOF

DOF has carried out tuna fishing surveys in the Andaman Sea, the eastern and western part of the Indian Ocean by survey vessels Chulaphorn and Mahidol. The results of the survey are as follows:

a. Andaman Sea

The majority of the catch was skipjack (70%) and the rest were yellowfin and little tuna. The average length of skipjack and yellowfin was 30 cm and 50 cm, respectively.

b. Eastern area of the Indian Ocean

The majority of the catch was skipjack and yellowfin with an average length of 40 to 60 cm and 50 to 80 cm, respectively.

The highest tuna catch by Chulaphorn was about 2.2 tons/time, and the lowest was about 2.0 tons/time. The highest catch by Mahidol was 25 tons/time, and the lowest was 6 tons/time.

c. Western area of the Indian Ocean

The majority of the catch was skipjack and yellowfin with an average length of 65 cm and 100 cm, respectively. Bigeye tuna was also found.

The highest catch of tuna by Chulaphorn was about 24 tons/time, and the lowest was about 6 tons/time.

(3) Thai Tuna Oceanic Fishery Cooperatives (TOTFIC)

DOF has carried out tuna purse seine fishing in the Indian Ocean since 1995 to demonstrate deep sea fishing to Thai fishermen. Fishermen who are interested in deep sea fishing are able to join these fishing trips to experience tuna purse seine fishing in the Indian Ocean.

Induced by this demonstration, 42 fishermen organised a fishermen's group to engage in tuna fishing in the Indian Ocean. Thai Tuna Oceanic Fishery Cooperatives (TOTFIC) was established based on this fishermen's group on May 13, 1996. TOTFIC members consist of three groups of fishermen in Rayong, Pattani, and Phuket. They have already collected 10 million bahts to purchase a tuna purse seiner in June 1996.

(4) Tuna Fishing in the Indian Ocean by Taiwanese Fishing Boats

Taiwanese fishing boats have carried out tuna fishing in the eastern area of the Indian Ocean since 1956, and that fishing area has expanded to include the entire Indian Ocean since 1963. The landing volume of tuna by Taiwanese fishing boats increased from 12,639 tons in 1967 to 62,000 tons in 1992, despite fluctuations in landing volume. These Taiwanese fishing boats mainly used long lines and were chartered by coastal nations along the Indian Ocean, while sailing under the Taiwanese flag.

The number of tuna fishing boats flying the Taiwanese flag in the Indian Ocean increased from 185 in 1985, and peaked at 393 in 1990 (see Table 2.3.9). These fishing boats consisted of mainly large-scale boats of more than 500 tons.

In addition to these large-scale fishing boats, small-scale Taiwanese long liners have operated in the southwestern area of the Java Sea, Sumatra Sea, and the Andaman Sea since 1991. Most of these small boats were based in Singapore or Penang in Malaysia during the initial stages, but some of them have moved their mother port to Phuket. However, there is no statistical data about the number of these boats.

Tuna Purse Seine by Japanese Fishing Boats

Japanese purse seiners have carried out fishing in the eastern area of the Indian Ocean. Japan has been restricted to 11 fishing boats and one research vessel in this area. Seven Japanese fishing boats and one research vessel landed their catch at the Phuket commercial port in 1994 (see Table 2.3.10). However, the number of fishing boats decreased to five in the first half of 1995, and only three boats including one research vessel were in operation in 1996, due to an expanded limit on Japanese fishing boats in the Pacific Ocean in 1996 which caused Japanese fishing boats operating in this area to move to the Pacific Ocean.

2.3.5. Outline of Fishing Activities in the Andaman Sea

(1) Existing Fishing Conditions in the Andaman Sea

1) Main Fishing Grounds in the Andaman Sea

As already mentioned in "1.3.2", fishery resources in the Andaman Sea have also been overexploited. Therefore, major fishing grounds in the Andaman Sea have expanded to neighbouring countries' territories such as Myanmar, Malaysia and Indonesia. Some fishing boats also operate in the Indian Ocean.

Phang-nga Bay surrounded by Phuket, Phang-nga and Krabi province, was one of the main fishing grounds in the Andaman Sea. However, CPUE from trawling decreased from 160 kg/hr in 1969 (comprised of 48.5% high value species and 51.5% trash fish) to about 38 kg/hr in 1988 (comprised of 33.3% high value species and 66.7% trash fish), due to over fishing. Consequently, the Ministerial Regulation issued a prohibition against the use of all types of trawlers and bag nets of motorised fishing boat operation in Phang-nga Bay on August 1, 1979. In addition, the use of all types and sizes of trawlers, enclosed nets, gill nets with a mesh size of less than 4.7 cm were prohibited in the fishing operations of Phang-nga Bay and Kraburi area from April 15 to June 15 of every year as of April 11, 1985 (See Figure 2.3.2).

2) Major Fishing Gear and Fish Production

The major fishing gear employed in commercial fisheries in the Andaman Sea is the otter board trawl and purse seines. Fishing days using purse seines average one to three days. Normally, one operation takes one to two hours, and there are two to four operations per day. They operate purse seine for about 23 days in a month. Their catch is kept in ice storage, and sorting is done after the fish is landed at port.

The main species targeted by purse seines are short-bodied mackerel, roundbelly sardine, big eye scad, eastern little tuna, etc. In the Andaman Sea, total landing volume by purse seines increased from 96,525 tons in 1988 to 205,531 tons in 1993 (See Table 2.3.3).

Fishing days of the trawlers last between 15 to 60 days per trip, which are longer than fishing days using purse seines. One operation requires three to four hours of hauling, and five to six operations are done in a day. The catch is sorted roughly on the boat during the next operation, and fish is kept in ice containers, and sorted again at the market hall after landing. Three days of preparation are required for the next trip.

Species caught by trawler are quite varied and include silver wolf herring, hairtail, white pomfret, red snapper, quid, shrimps, etc.. The original species targeted by trawlers were economically viable demersal species. However, some of these fishing boats have changed their target species to trash fish for fish meal factories when resources declined. The landing volume of otter board trawlers also increased from 175,022 tons in 1988 to 449,475 tons in 1993 in the Andaman Sea area.

(2) Fish Landing Sites

There are eight main landing sites along the Andaman Sea. They are located in Muang district in Ranong Province, Kuraburi district and Taimuang district in the Phang-nga Province, Muang district in the Phuket Province, Muang district in the Krabi Province, Kantang district in the Trang Province, Muang and La-nga districts in the Satun Province. These landing sites are separated into two types of management organisation. One is managed by Fish Market Organisation (hereafter FMO), and the other is managed by fish agents or processing factories in the private sector.

There are only three fishing port which is managed by FMO along the Andaman Sea coast. These fishing ports are located in Ranong, Phuket and Satun. These facilities and lands are owned by FMO, and are lent to private sectors. Therefore, they are utilised by the private sector in actuality.

The majority of the landing sites managed by the private sector have been leased land from Department of Harbour, and the facilities have been built by private capital. Most of the landing site owners are fish agents or processing factories. Generally, only the fishing boat that sells fish to these owners are allowed to use the facilities.

Many of the commercial fishing boats are owned by fish agents or processing factories. The operation costs such as ice, fuel, etc. of independent boat owners, are also assisted by fish agents and processing factories with the exception of Ranong province. In such cases, their catch would be sold to the supporting fish agent in order to repay their loan. However, this loan is interest free and it does not affect producer price.

(3) Producer Price

Fish price differs among major landing sites on the Gulf of Thailand and the Andaman Sea. In 1992, the average price of tuna, indian pacific mackerel and indian mackerel were basically higher at the landing sites along the Andaman Sea area (See Figure 2.3.3 and Table 2.3.11).

As the result of field survey, fish price along the Andaman Sea is higher than the Gulf of Thailand due to the larger size of the fish.

(4) Fishermen's Income

Crew members of a fishing boat consist of the captain, deputy captain, fishery master, engineer and general crew. In many cases the captain had held the post of fishing master or deputy captain. The total number of crew members for a trawler is about 20, and about 30 to 40 members for a peruse seine.

Their salaries consist of monthly fixed salary and piece rates. The salaries of the captain and fishing master are usually based on a certain percentage of net profit or wholesale price. In contrast, the engineer and general crew receive a fixed monthly salary (See Table 2.3.12).

2.3.6. Fisheries Conditions of Each Province on the Andaman Sea Coast

Muang in Ranong Province is the landing site for the largest fish catch volume, with an annual landing volume of more than 150,000 tons. Phuket Fishing Port and Muang in Satung Province are the second largest landing sites with a fish catch of about 60,000 tons annually (see Table 2.3.13).

Ranong Province borders on Myanmar and their main fishing grounds are also in Myanmar territorial waters. Satun Province also borders Malaysia, and one of the main fishing grounds is Melaka Straits in Malaysian territorial waters. Some large-scale fishing boats based in Phuket also operate in Myanmar waters. Subsequently, landing sites with a large fish landing volume are located near major fishing grounds in neighbouring territorial waters.

The number of fishing boats registered in provinces along the Andaman seacoast has increased, despite annual fluctuations and 3,005 boats or 16.5% of the total number of boats in Thailand were registered in 1993 (see Table 2.3.14). However, fishing boats operating in the Andaman Sea are not restricted to these 3,005 boats. Many fishing boats migrate from the Gulf of Thailand during the northeast monsoon season. Ranong is a province that recorded the largest landing volume along the Andaman seacoast, but the number of registered boats is not high. However, many boats migrating from the Gulf of Thailand operate and unload at Ranong.

Trang Province has the largest number of large-scale boats (more than 18m long) registered, followed by Satun and Phuket provinces (see Table 2.3.15). These boats are mainly trawlers and purse seiners engaged in commercial fishing.

Thai boat owners who purchase their boats in neighbouring countries such as Myanmar and Malaysia must obtain fishing permits from these countries in order to operate in their territorial waters. Thai boat owners returning to Thailand must likewise obtain fishing permits from the Thai government in order to operate in Thai waters.

It has been very difficult for Thai fishing boats to receive fishing permits from the Myanmar government in recent years. Therefore, many fishing boats from the Gulf of Thailand move to Myanmar via Singapore and sail under the flag of Singapore when operating in Myanmar territorial waters.

The fishing conditions of each province along the Andaman seacoast are shown in Table 2.3.16.

2.3.7. Factors to Be Investigated To Select Project Site from the Fishing Standpoint

(1) Influence of Fish Agents and Processing Factories on Fishing Boat Owners

Many fish agents and fish processing factories along the Andaman seacoast own their own fishing boats. In addition, they support other individual fishing boat owners with operation expenses such as ice and fuel.

Although the actual number of fishing boats which receives assistance from fish agents is not known, about 50 to 100 percent are either owned by or work under fish agents or fish processing factories according to an interview survey of fishery cooperatives. These fishing boats must land their fish at the fish landing sites owned by fish agents and used as their base of operations.

According to the interview survey, very few number of fishing boats are expected to transfer to the new fishing complex, in view of their present relationship with fish agents and processing factories. Therefore, the transfer of fish agents and processing factories to the new complex will greatly influence the number of fishing boats that will be willing to relocate.

(2) Possibility of Moving the Fish Landing Site to Other Provinces

According to the field survey, the majority of the fish agents along the Andaman seacoast are also engaged in car sales, hotel businesses, livestock farms, etc., in addition to the fishery business. Due to the complexity of their business dealings, it will be difficult for fish agents to transfer only their fishing activities to another province, despite the favorable location of the new fishing complex.

Fishing boat owners were also perplexed at the idea of relocating the fish landing site to another province since their fishing grounds are located near their mother port. Hence relocating the mother port signifies changing their fishing grounds as well. If only the location of the mother port were to be moved, the distance to their fishing grounds would increase in addition to operating costs. Moreover, some fishermen operate in the resource-rich fishing grounds of Myanmar, Malaysia, and other neighboring countries. As a result, relocating the mother port to another province would place fishermen under difficult conditions.

(3) Incentives to Attract Fishing Boats to the New Fishery Complex

As mentioned earlier, commercial fishing boats are not expected to easily move their fish landing site to other provinces due to their relationship with fish agents. However, fishing boats supported by fish agents based in the Gulf of Thailand are better able to relocate to the new fishing complex.

Presently, there are no deep sea fishing facilities along the Andaman seacoast. In addition to the fishing boats from the Gulf of Thailand mentioned above, there is also a high possibility that deep sea fishing boats will transfer their base to the new fishing complex. The Deep Sea Fishing Development Project by the Thai government and the willingness to invest in the private sector are important key elements in estimating the scale of the facilities.

Consequently, the type of fishing boat which will be attracted to the new fishery complex is as follows:

- Existing fishing boats within the province of the project site
- Fishing boats which move and operate from the Gulf of Thailand to the Andaman Sea
- Fishing boats which operate in the Indian Ocean

2.4. Fish Marketing and Processing

2.4.1. Outline of Fish Marketing System in Thailand

There are two types of fish marketing routes in Thailand. One route is through fishing ports and fish markets managed by the Fish Marketing Organization (FMO), a public agency, and the other is the marketing route through fish agents and processing factories.

(1) Fish Marketing at FMO Fishing Ports and Markets

There are a total of eight fishing ports and three fish wholesale markets managed by the FMO in Thailand. The total fish landing volume for the entire country was 3,400,000 tons (including inland fishery and aquaculture) in 1993. Of this figure, 314,000 tons or about 10% are unloaded at FMO fishing ports and transported to local retail markets/processing factories, consumption areas, and processing factories outside the local area. Three fish wholesale markets are located in Bangkok and in Samut Prakan and Samut Sakhon at the surrounding areas of Bangkok. The total marketing volume of those markets is 499,000 tons and the marketing volume of each market is 140,000, 139,000 and 220,000 tons, respectively (refer to Table 2.4.1).

Major transactions of fish at FMO fishing ports and markets is carried out through direct consignments and there are few auctions. Transactions at the Bangkok fish market is mainly through auctions and 74% of the total handling volume at this market was sold through auctions in 1995.

The ratio of fresh fish which was transported over land from the seven provinces in southern Thailand along the Gulf of Thailand, including Songkhla and Pattani, to the Bangkok FMO Market in 1993, was 36%, followed by the four provinces on the east coast of the Gulf of Thailand such as Trade, at 23%, the three provinces of Samut Prakan, Samut Sakhon and Samut Son Khlam at 20%, and 19% from the Andaman seaboard (refer to Table 2.4.2).

(2) Fish Marketing Through Fish Agents and Processing Factories

Many small and large-scale private jetties exist along the seaboard. Fish unloaded at these private jetties are transported through traders who are also jetty owners, to the local retail markets and processing factories, consumption areas, and processing factories outside the local area.

All transactions at private jetties are direct consignments and there are no auctions.

(3) Fish Agent

Fish traders operating at fish landing sites and wholesale markets are called fish agents.

In accordance with the "Act Organizing the Activities of the Fish Market", the definition of "Fish Agent" is as follows.

A "Fish Agent" is a person who engages in any of the following tasks.

- Granting loans of money, hire-purchase and loan out of vessels, fishing gear or accessories in order to enable the borrower, the hirer or the hire-purchaser to undertake fishing activities or trade in fishery products based upon the agreement that the borrower, the hirer or the hire-purchaser will bring fishery products to the lender who acts as an agent for the sale of such fishery products.
- Undertakes to act as an agent for the sale of fishery products of other persons.
- The sale of fishery products through sale by auction.

Most fish agents own private jetties and fishing boats; and they are also closely connected with other boat owners through credit ties (supply of ice and oil, advance payment of operational funds). Their fishing boats are organized into groups comprised of boats owned by other owners. Fishermen who are supported by fish agents for their materials and funds have not been free to select buyers for their fish catch and they have been required to sell their catch at the price designated by fish agents. However, in recent years, fishermen have been able to select their buyers despite the support given them by fish agents, since fishermen are in a stronger position due to the shortage of fish.

Fish agents are usually engaged in diversified management businesses such as fishing gear sales, fish processing and transport related to the fishery industry, as well as hotel management, car dealerships and stock breeding. Some fish agents are leaders of the local industry sector.

2.4.2. Outline of Fish Marketing and Fish Processing Industry on the Andaman Seaboard

(1) Fishing Port and Fish Market

Of the eight major fish landing sites on the Andaman seaboard, three are FMO fishing ports/fish markets located in Ranong, Phuket and Satun. There are also many private jetties in Ranong, Phuket and Satun. The other landing sites are composed of several private jetties and there are no public facilities (refer to Table 2.4.3). All the FMO fishing ports/fish markets share common problems such as shallow and narrow channels, limited length of wharf/jetty, and narrow market halls.

(2) Fish Agent and Transaction System

All unloaded fish are transacted through fish agents. There are two types of transactions which take place at fish landing sites - auction (bidding) and direct consignment. High value fish is sold through auctions by fish agents and the remainder is sold through direct consignments in the Ranong and Phuket FMO fish markets. However, all fish which is landed at the private jetties and Satun FMO Fish Market is sold through direct consignments.

Fish agents deduct oil and ice charges and pay fishermen in one to two days from the date of purchase. The buyers pay fish agents after two to seven days and most of the processors usually pay fish agents seven days after the date of purchase.

(3) Fish Marketing

The destination and ratio of fish marketed from fish production areas on the Andaman seaboard to consumption areas and processing factories in and out of the province are shown in Table 2.4.4.

About half of the fresh fish which is landed are locally consumed, and processed to surimi, frozen, and semidried fish in modern processing factories in Ranong, Krabi, Trang and Satun. The rest is transported to processing factories and fish markets in Songkhla, Hat Yai, Samut Sakhon and Bangkok. A small quantity is transported to processing factories in other provinces on the Andaman seaboard and it is also exported overland to Malaysia and Singapore.

There are only a few modern processing factories in Phuket and Kuraburi. Therefore, most of the fresh fish are transported to Songkhla, Hat Yai, Samut Sakhon and Bangkok. Only a small quantity is locally consumed. Trash fish are processed in the local fish meal factories.

Frozen fish processing factories in Trang and Satun import mackerel from Norway and shrimp from Vietnam and Indonesia through the Songkhla commercial port. They also export their product through Songkhla. Frozen skip jack/tuna unloaded at Phuket commercial port by Japanese purse seine boats are transported over land to processing factories in Songkhla.

In addition, fresh tuna such as bigeye and yellowfin is unloaded at the Phuket fishing port by Taiwanese longline boats and transported by air to Japan through Phuket International Airport.

(4) Infrastructure Related to Transportation

The major national road network is well developed in southern Thailand. Therefore, fresh fish and processed fish products are transported by insulated and refrigerated trucks within the country.

There are also two commercial ports which serve as export/import bases in Songkhla and Phuket in southern Thailand. The products of processing factories located in the Andaman seaboard are exported through Songkhla. Raw materials are imported through Songkhla and Phuket.

(5) Fish Marketing Facilities

The wharves/jetties of the FMO fishing ports are made of concrete. Most of the private jetties are made of wood and some are made of concrete, with the approval of the Harbor Department. FMO fishing ports have an auction hall, administration building and offices for fish agents. Oil and water supply facilities are not well developed. Therefore, oil and water are supplied by tank lorries. Some facilities at the FMO ports have depreciated and are in need of maintenance and repair.

There are many private ice plants at the eight major fish landing sites on Andaman seaboard and there is only one public plant in Phuket. Ice is sufficient in provinces along the Andaman seaboard, except in Krabi where it is transported from Ranong, Trang and Phuket to meet the demand during the peak season.

All the processing factories, except the fish meal plant, own their own cold storage facility. There is only one public cold storage facility in Phuket owned by Cold Storage Organization (CSO). Some fish agents own small walk-in cold storage facilities and their capacity is inadequate to meet the demand during the peak season.

There are seven private shipyards on the Andaman seaboard with slipways and workshops for repairing and constructing wooden fishing boats. One shipyard in Phuket which is located at a FMO site, can be used for repairing vessels such as fishing boats, ferries and tourist boats of less than 350 gross tons.

(6) Fish Processing Factories

There are more than ten modern fish processing factories engaged in canning, surimi, frozen fish and semidried production which are located at fish landing sites on the Andaman seaboard. Traditional processing factories produce dried fish, fish ball/cracker, fish sauce, etc.

Out of ten modern factories, two factories are canning factories, two factories produce surimi and the remaining six are frozen and semi-dry factories. These factories export most of their product and only a small quantity is earmarked for domestic consumption.

There is one canning factory in Trang and Satun, respectively. Their total production volume in 1993 was equivalent to 18,200 tons of raw material which was 4% of the total national production volume of 483,900 tons, excluding skip jack and tuna. They produce canned shrimp, squid, baby clam and sardine for export to EU countries and the USA. The factory in Trang imports mackerel as a raw material from Norway and sells about half of its product to the domestic market.

There is one surimi factory in Trang and Ranong, respectively. They produced about 4,880 tons of surimi for export to Japan in 1993.

There are several freezing factories in Ranong, Krabi, Trang and Satun. They process about 63,400 tons of raw materials which is equivalent to 8% of the total national production volume of 845,400 tons. They mainly process and freeze shrimp and squid for export to Japan, Europe and the USA. Currently, some factories produce semi-dried fillets of threadfin bream, scad and smelt for export to Japan. Raw materials such as squid and shrimp are locally caught and some factories import a segment of their raw materials, in order to meet their demand.

There are thirty fish meal factories and they are dispersed in Ranong, Phang-nga, Phuket, Trang and Satun.

Their total production volume for 1993 was 71,700 tons which was equivalent to 20% of the total national production volume of 355,300 tons.

Most of the modern processing factories currently located on Andaman seaboard face such problems as a shortage of raw materials and man power, similar to factories in Zone 1.

As a result, their operational ratio is low (37 to 68%) with the exception of fish meal factories which are operating close to a break-even point (43 to 60%). This is especially true for new factories constructed after 1990. The operational ratio of fish meal factories is very low (17 to 37%) and the majority operate under a break-even point (25 to 39%).

Some factories import all or a part of its raw materials in order to meet their demand. They secure their domestic raw material supply by the following methods.

- They own fishing boats and engage in the fish agent business.
- They have strong ties with fish agents based on trust and long term transactions.

Another major problem is a shortage of labor. In Ranong 50 to 70 percent of factory employees are Myanmar people. The labor supply of the fishery sector in Phuket is inadequate due to tourism, a major industry. In addition, the people want to avoid dirty manual labour. The labor supply in Satun is in short supply because many laborers are employed by rubber plantations, which is a major industry in this area. In addition, labor tends to flow out from this area, especially from Satun to Hat Yai and Songkhla, a center of commerce and industry.