R. Ashton

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

# INDONESIA
# FISHERIES RESEARCH AND DEVELOPMENT PROJECT

PROJECT PAPER

497-0352

VOLUME I - MAIN TEXT

August 1986

CONTENTS

# LIST OF FIGURES AND TABLES

ANNEXES

# GLOSSARY

## Government and Development Agencies

| | |
|---|---|
| AAETE | - Agency for Agriculture Education, Training and Extension |
| AARD | - Agency for Agricultural Research and Development |
| ADB | - Asian Development Bank |
| ASEAN | - Association of Southeast Asian Nations |
| BAPPENAS | - National Development Planning Board |
| DGF | - Directorate General of Fisheries |
| DGHE | - Directorate General of Higher Education |
| GOI | - Government of Indonesia |
| IBRD | - International Bank for Reconstruction and Development (World Bank) |
| IPB | - Institute of Agriculture, Bogor |
| ISNAR | - International Services for National Agriculture Research |
| LAPAN | - National Space Agency |
| LIPI | - Indonesian Institute of Sciences |
| LON | - National Institute of Oceanology |
| MOA | - Ministry of Agriculture |
| MOE | - Ministry of Education and Culture |
| NARP | - National Agriculture Research Project (World Bank) |
| NFRA | - National Fisheries Research Agenda |
| RCCs | - Research Coordinating Centers |
| RDA | - Resource Development Associates (USAID Contractor) |

| | |
|---|---|
| RCCF | - Research Coordinating Center for Fisheries |
| RICA | - Research Institute for Coastal Aquaculture |
| RIFF | - Research Institute for Freshwater Fisheries |
| RIMF | - Research Institute for Marine Fisheries |
| UNHAS | - University of Hassanudin |
| UNPATTI | - University of Pattimura |
| UNRI | - University of Riau |

Technical Terms

| | |
|---|---|
| BED | - By-catch Escape Device |
| Demersal | - Bottom dwelling (marine fish - organisms) |
| FAR | - Fixed Amount Reimbursement |
| GDP | - Gross domestic product |
| HBCU | - Historically black college - university |
| MSY | - Maximum sustainable yield |
| Pelagic | - Open sea waters |
| Repelita IV | - The GOI Fourth Five-Year Development Plan |
| RFP | - Request For Proposal |
| Rupiah | - U.S. $1.00 = Rp 1,123 |
| Sarjana | - 5 year university diploma |

AGENCY FOR INTERNATIONAL DEVELOPMENT

# PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number: _____ — DOCUMENT CODE: 3

2. COUNTRY/ENTITY: Indonesia

3. PROJECT NUMBER: 497-0352

4. BUREAU/OFFICE: ANE 04

5. PROJECT TITLE (maximum 40 characters): Fisheries (Aquaculture) Research and Development

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 09 DD 30 YY 92

7. ESTIMATED DATE OF OBLIGATION (Under "B." below, enter 1, 2, 3, or 4): A. Initial FY 86 B. Quarter 4 C. Final FY 87

8. COSTS ($000 OR EQUIVALENT $1 = )

| A. FUNDING SOURCE | FIRST FY 86 B. FX | C. L/C | D. Total | LIFE OF PROJECT E. FX | F. L/C | G. Total |
|---|---|---|---|---|---|---|
| AID Appropriated Total | 4,194 | 1,430 | 5,624 | 5,055 | 2,050 | 7,105 |
| (Grant) | ( 2,550 ) | ( 770 ) | ( 3,320 ) | ( 2,550 ) | ( 770 ) | ( 3,320 ) |
| (Loan) | ( 1,644 ) | ( 660 ) | ( 2,304 ) | ( 2,505 ) | ( 1,280 ) | ( 3,785 ) |
| Other U.S. 1. | | | | | | |
| Other U.S. 2. | | | | | | |
| Host Country | | 24 | 24 | | 4,207 | 4,207 |
| Other Donor(s) | | | | | | |
| TOTALS | 4,194 | 1,454 | 5,648 | 5,055 | 6,257 | 11,312 |

9. SCHEDULE OF AID FUNDING ($000)

| A. APPROPRIATION | B. PRIMARY PURPOSE CODE | C. PRIMARY TECH. CODE 1. Grant | 2. Loan | D. OBLIGATIONS TO DATE 1. Grant | 2. Loan | E. AMOUNT APPROVED THIS ACTION 1. Grant | 2. Loan | F. LIFE OF PROJECT 1. Grant | 2. Loan |
|---|---|---|---|---|---|---|---|---|---|
| (1) FN | 100B | 077 | 077 | | | 3,320 | 3,785 | 3,320 | 3,785 |
| (2) | | | | | | | | | |
| (3) | | | | | | | | | |
| (4) | | | | | | | | | |
| TOTALS | | | | | | 3,320 | 3,785 | 3,320 | 3,785 |

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 966

11. SECONDARY PURPOSE CODE:

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

| A. Code | BR | RGEN | TECH | | | | |
|---|---|---|---|---|---|---|---|
| B. Amount | | | | | | | |

13. PROJECT PURPOSE (maximum 480 characters)

To install viable fisheries research programs at Ministry of Agriculture and key universities that will address significant regional fisheries production and marketing constraints.

14. SCHEDULED EVALUATIONS: Interim MM 06 YY 89 — Final MM 03 YY 92

15. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [X] 941 [X] Local [ ] Other (Specify) _____

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a _____ page PP Amendment.)

17. APPROVED BY — Signature: William P. Fuller — Title: Director, USAID/Indonesia — Date Signed: MM 08 DD 28 YY 86

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1330-4 (8-79)

## 2. PROJECT AUTHORIZATION

INDONESIA

FISHERIES RESEARCH AND DEVELOPMENT PROJECT
497-0352

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961 as amended, I hereby authorize the Fisheries Research and Development Project (the "Project") for Indonesia (the "Cooperating Country"), including planned obligations of not to exceed Three Million Seven Hundred Eighty Five Thousand United States Dollars ($3,785,000) in loan funds and Three Million Three Hundred Twenty Thousand United States Dollars ($3,320,000) in grant funds, over a six year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing certain foreign exchange and local currency costs for the Project. The planned life of this Project is six years from the date of initial obligation.

2. The purpose of the Project is to install viable fisheries research programs at the Ministry of Agriculture's Agency for Agricultural Research and Development (AARD) fisheries research institutes and key universities to address significant regional fisheries production and marketing constraints. The project will focus on the establishment of a National Fisheries Research Agenda to coordinate the fisheries planning, training, and research activities of the Ministry of Agriculture and Ministry of Education and Culture. It will also provide for special studies involving assessment of fisheries policy and marketing opportunities, and strategies for establishing national research and marketing policies. A.I.D. assistance will finance the design and construction of research facilities, imported and local equipment, training, technical assistance, policy studies, and monitoring and evaluation.

3. The Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

4. a. Interest Rate and Terms of Repayment. The Cooperating Country shall repay the Loan to A.I.D. in United States Dollars within forty (40) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D. in United States Dollars interest from the date of first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years, and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Commodities, Nationality of Services. Commodities financed by A.I.D. under Project loan funding shall have their source and origin in the Cooperating Country or in countries included in A.I.D. Geographic Code 941, or if grant-funded, in the Cooperating Country or the United States, except as A.I.D. may otherwise agree in writing. Except for ocean shipping, suppliers of commodities or services shall have their nationality in countries included in Code 941 or Indonesia if loan-funded, and if grant-funded, shall have their nationality in the United States or Indonesia, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States if grant-funded, or Indonesia, the United States and other Code 941 countries if loan-funded.

Signature _____
William P. Fuller

Date: August 28, 1986

Clearance: ARD:RCobb _____
PRO:RRedman _____
FIN:RMcClure _____
DD:JAnderson _____
_____

Drafted: LA:GBisson

# 3. PROJECT SUMMARY AND BACKGROUND

## 3.1 Project Summary

### 3.1.1 Problem Identified

There is significant unexploited potential for increasing Indonesian marine fisheries and aquaculture production. Although the Directorate General of Fisheries (DGF) estimates that current production levels are only about 20 percent of potential, the limited introduction of modern technology in recent years has supported production gains averaging 4.2 percent per year. To sustain and increase these growth trends, the GOI and other donors are making significant investments in fisheries sector development. Given the high priority currently placed on increasing foreign exchange earnings in light of declining oil revenues, emphasis has focused on the rapid increase of fish products for export. Production to meet rapidly rising domestic consumption needs and the strengthening of human resources, institutional, and analytical capacities to complement existing investments and sustain and expand production have received little attention.

### 3.1.2 Project Goal, Purpose, and Components

The goal of the Fisheries Research and Development Project is to improve the technological and management resources available to public and private entities involved in Indonesia's fisheries sector. Both are essential to increase production, employment, per capita income and efficiency. The purpose of the project is to install viable fisheries research programs at the Ministry of Agriculture (MOA) and key universities that will address significant regional fisheries production and marketing constraints.

The project will establish a national coordinated fisheries research agenda, support research programs at the MOA and at key universities to address priority production constraints, and improve academic training at selected universities with mandated responsibilities for fisheries training. The project will focus on the identification and testing of

production constraints associated with freshwater aquaculture production in South Sumatra, brackishwater aquaculture production in South Sulawesi, Eastern Indonesian pelagic fisheries production and processing, and the development of a national research agenda with special emphasis on common problems of fish production and marketing.

Freshwater Fisheries Development: This component will develop technologies appropriate for improving freshwater fish culture. It will seek to mitigate declines in production of important freshwater fish species by developing and testing new production technologies related to fish nutrition, broodstock quality, and fry production. Relatively strong academic staffs at the Institute of Pertanian Bogor (IPB) and the University of Riau (UNRI) will be utilized to strengthen the Agency for Agricultural Research and Development (AARD) fisheries research programs at the Bogor and Palembang facilities. Production increases as a result of this project are not expected to encounter marketing problems. However, the potential for longer-term demand for fish products in South Sumatra will be assessed in the latter stages of the project under a special studies component.

Brackishwater Research: Component activities are focused in South Sulawesi, one of Indonesia's major milkfish-shrimp production areas. Strengthening the fisheries program at the AARD Research Institute for Coastal Aquaculture (RICA) at Maros, through collaboration with the University of Hasanuddin (UNHAS) will provide a good foundation for sustained growth in the South Sulawesi fisheries industry. Priority is assigned to solving constraints limiting milkfish-shrimp production, specifically, issues of production management, water quality and bacterial contamination of fish products. The research is complementary to major GOI and other donor investments underway to improve the construction and management of brackishwater ponds.

Eastern Indonesia Fisheries Development: This component will improve technologies needed to decrease the costs of processing and marketing domestically consumed fish products. The project will test economical techniques for developing the data base required to articulate sustained yield management policies for Eastern Indonesian marine fishery resources. A staff development program at the University of Pattimura

(UNPATTI), will allow the new Fisheries Faculty to strengthen collaboration with AARD in the area of marine fisheries and strengthen capacity for the academic and/or speciality training of DGF provincial staff in Maluku and Irian Jaya.

Fishery Research Management and Fishery Policy and Planning:
Activities within this project component address staff, data and management constraints faced by the MOA in establishing national fishery policies. Two major foci are planned: (a) development of a comprehensive national fisheries research agenda and policies to address key fisheries production and marketing issues; and (b) improved planning, implementation and management of fisheries research.

Critical policy questions need to be addressed. These include priority issues such as the identification of factors affecting high ocean freight rates, the role of public vs. private investment in fisheries development, fish market structure and its effects on consumption and welfare, and the impact of foreign investment on export fish production.

3.1.3 Project Implementation and Financing

The project will be implemented over a six year period. Project implementation and coordination responsibilities will rest with the Agency for Agricultural Research and Development (AARD), Ministry of Agriculture (MOA) in collaboration with the Directorate General of Higher Education (DGHE) in the Ministry of Education and Culture (MOE).

The project will support technical assistance, training, research, and minor facilities development and equipment purchases. Loan funds totalling $3.785 million will support the cost of in-country English language training, U.S. training for 20 degree candidates (5 PhDs and 15 MScs), and the design and construction of AARD facilities at Palembang and university research facilities at IPB and UNHAS. In addition, loan funds will be used to purchase equipment. A $3.320 million grant will provide 6 person years of long-term technical assistance in fisheries

research planning and policy, and 68 person months of short-term technical assistance in fisheries research, production and management, and some equipment. Special studies will support research in areas such as national fisheries policy formulation and implementation, research management, fisheries curriculum development and training, fish processing and marketing issues.

GOI funds will support in-country short-term training for 200 participants, administration costs of the project, and some of the commodity costs. The GOI's contribution totalling $4.207 million constitutes 49 percent of total project costs; $1.507 million in Rupiah contributions and $2.700 in in-kind contributions.

### 3.1.4 Monitoring and Evaluation

Project monitoring and evaluation will focus on three distinct but related project outputs: the volume and relevance of research developed under the project, the degree to which institutional capabilities to plan and carry-out research within collaborating institutions have been strengthened, and the impact of project-related changes on fisheries production. The project monitoring plan has identified key indicators of increased institutional and research capacity which will be tracked over the life of the project. Mid-term and final evaluations will examine project impact, particularly the capability of AARD and the universities to plan and carry out fisheries research in the three areas supported under the project.

### 3.1.5 Constraints to Achieving Objectives

During the discussion of the Project Identification Document, several issues were identified by the Mission. While a detailed analysis of each of these issues appears in Annex F, the Mission's concern over the ability of the GOI to support the counterpart budget outlined in this project necessitates discussion here.

Recent GOI budget cuts mandated by declining oil revenues have severely limited counterpart funds which GOI agencies can pledge in support of foreign-assisted development projects. In developing this project USAID staff have discussed this issue with GOI officials and have designed the project in such a way as to minimize risk. First, USAID's support of training early on in the project and the delayed support of research, an area of major AARD fiscal involvement, will provide AARD with sufficient time to secure additional funding, complete heavy capital investment commitments, and shift funds from infrastructure to operational research support. While these steps will not ensure the required reallocation of funds in support of fisheries research which both USAID and Indonesian colleagues believe is necessary, it will facilitate budgetary change and increase the probability that counterpart funds are available when needed.

## 3.2 Project Background

Indonesia is an aquatic nation. Its 775,000 sq. km. of continental shelf, 5.2 million sq. km. of ocean, 277,000 hectares of fresh and brackishwater ponds, and abundant rivers constitute an invaluable natural resource which is beginning to play an increasingly important role in national development. In 1984, the value of all fish and fish products harvested was Rp 1,220 billion, or about 1.6 percent of Indonesia's gross domestic product (GDP) at current prices. Production gains reached 2.26 million metric tons in 1984: 75 percent from marine fisheries, 12 percent from inland capture fisheries, and 13 percent from aquaculture. The sector provides jobs for 5 percent of Indonesia's workforce, employing 1.29 million marine fishermen and 1.59 million inland fishermen and aquaculture workers, as well as a large number of people engaged in transport, processing and marketing.

Recent evidence suggests that there are significant opportunities for continued growth in marine and aquaculture production, despite heavy fishing pressure in specific coastal areas. The exploitation of marine resources (approximately 1.71 million metric tons in 1984) represents less than 25 percent of the estimated maximum sustainable yield. Brackishwater milkfish and shrimp production, which earned $57 and $80 million respectively in 1984, are also at low levels. For instance, average annual tiger shrimp yields of 90 kilograms per hectare are only 27 percent of average yields in Asia. Currently 225,197 hectares are in brackishwater pond production; an additional 600,000 hectares are suitable for inclusion. For inland areas, it is estimated that an additional 143,000 hectares of rice land could be used to increase freshwater fish production by 75,000 metric tons annually.

International and domestic demand would support increased production. The World Bank (IBRD) suggests that an additional 200,000 metric tons of shrimp per year will be required over the next decade by major importing nations: the United States, Japan and Europe. Projected world demand far exceeds Indonesia's potential annual growth of 10,000 metric tons. Projected domestic demand for fish will also increase and exceed domestic supply. Per capita fish consumption of 12.9 kilograms per year, while providing 62 percent of total domestic animal protein supplies, remains at 30-50 percent of the consumption levels in other Asian countries. Although total fish production has doubled during the past ten years, domestic demand has outstripped supply, driving up prices. Between 1973 and 1984, the index of fish prices rose 1.4 percent per annum in real terms. Fish products, however, remain the cheapest source of animal protein, at 30-50 percent below the comparable unit prices for chicken and beef. Favorable relative prices, the current low level of per capita fish consumption, and rising personal income will result in a 4.1 percent per year increase in demand throughout the next decade according to World Bank estimates.

### 3.2.1 Constraints to Increasing Fish Production

To meet domestic and export demand for fish, Indonesia must raise production by 6.3 percent per year or 128,000 metric tons: 88,000 metric tons from marine capture fisheries, and 40,000 metric tons from fresh and brackishwater fisheries. A number of constraints, however, must be overcome at both the national and subsector levels in order to meet these targets. The national-level constraints, which largely involve problems of human resources and institutions, are discussed in Section 3.3.2.

#### The Fresh Aquaculture Subsector

With increasing pressure being placed on coastal fisheries and the resultant decline in yields, the freshwater pond, river and irrigated rice paddy cultivation of carp, catfish and tilapia has become financially attractive to small producers. However, serious technical, managerial and marketing problems constrain growth in this subsector. Low levels of hatchery production are attributed to poor management, outdated technology and the poor quality of broodstock. Field production of carp is low due to poor water quality and diseases. Feed, credit and other inputs are difficult to obtain. Different cropping cycles in rice-cum-fish cultivation areas have led to complex marketing systems for transporting fingerlings and fry from hatcheries and nursery ponds to production fields. Mortality is high and supplies of fry and fingerlings often are not sufficient to meet demand.

New water management techniques that integrate fish and rice production are required. Simple management methods to solve low broodstock quality, disease and predator control problems in hatcheries, nursery ponds and fields need to be developed, tested and applied. In addition, least-cost feed rations for fish at each stage in the production cycle should be formulated and private sector involvement in feed production and distribution encouraged.

The Brackishwater Subsector

Similar problems constrain growth in brackishwater milkfish-shrimp production. Since the late 1970s, wild capture of post-larvel shrimp has declined dramatically and the number of shrimp hatcheries has risen from 20 to 57. However, hatchery productivity is extremely low, operating at 10 percent of capacity, and meets only 17 percent of demand. The most severe problem is the lack of fry. Hatcheries also suffer from poor water quality, disease, feed constraints, poor location and management. Four of the seven shrimp hatcheries in South Sulawesi, Indonesia's major shrimp production area, have closed. There are no commercial milkfish hatcheries in Indonesia.

At the farm level, production is inhibited by the absence of fresh water to maintain brackishwater pond salinity and temperature, low quality pond construction, and lack of credit for fertilizer, feed and agro-chemicals. Semi-intensive cultivation techniques have not been widely tested at the farm level, and integrated packages of technologies and management techniques are not yet available for dissemination. There is an absence of extension materials and effective demonstration programs. Demonstration ponds are not well maintained and poor post-harvest practices result in low quality fisheries products.

To reach the production targets mandated by the government, milkfish and shrimp (the most important species for internal consumption and export, respectively) farmers need to change from capture systems which rely on the surrounding environment for fry and feed to more intensive techniques requiring hatchery-reared fry, fertilizer, improved feed and improved management.

The Marine Subsector

The 1980 government ban on large trawlers in Indonesian waters west of 130 degrees longitude has led to a resurgence of coastal fish production in Java, Sumatra, Kalimantan and Sulawesi. However,

facilities are inadequate to support the small-scale entrepreneurs involved in this sector. These entrepreneurs are among the lowest paid groups in Indonesia, earning incomes averaging Rp 456,000 per household per year.

In Eastern Indonesia, significant marine fishery resources exist. Yet the level of exploitation of deep water species in seas around the Malukus and Irian Jaya is only 4 percent of the sustainable yield. Little is known of the migratory patterns of fish in these waters; thus, per-unit capture costs are high and the volume of landings varies significantly throughout the year. This affects processing as well as catch costs.

Limited information on the location and prices of fish at both landing sites and markets further inhibits the development of an efficient marketing system. Transportation costs between landing sites in Eastern Indonesia and major Java markets remain prohibitive. Techniques to improve the quality and shelf life of fish products will play a critical role in reducing marketing and transportation losses, moderating prices, and increasing consumer demand.

### 3.3 The Institutional Setting

Major responsibility for Indonesia's fishery sector research and human resources development is vested in the Ministry of Agriculture's Agency for Agricultural Research and Development (AARD) through its Research Coordinating Center for Fisheries, and in the Directorate General of Higher Education, through 10 of its 45 public universities. In response to requests from the Ministries of Agriculture and Education, USAID staff and their Indonesian colleagues reviewed the infrastructure, staffing and budgets for the institutions that will participate in the Fisheries Research and Development Project. These are: The AARD's Research Coordinating Center for Fisheries, and four universities: the Institute of Pertanian in Bogor, the University of Riau in Pekanbaru, the University of Hasanuddin in Ujung Pandang, and Pattimura University in Ambon.

### 3.3.1 Agency for Agricultural Research and Development (AARD) and the Research Coordinating Center for Fisheries (RCCF)

The Structure of AARD's Fisheries Research Program. Created by Presidential Decree in 1974, AARD has the mandate to conduct research on new technologies that support the nation's agricultural and fisheries development. In pursuit of its mandate, AARD has adopted a multi-tiered management structure composed of a Secretariat with various supporting Centers, a system of seven Research Coordinating and Research Centers, and a network of Research Institutes. A schematic diagram illustrating the linkages between the Secretariat, Centers and Institutes appears in Figure 1.

The organizational structure of the Research Coordinating Center for Fisheries (RCCF) and its affiliated field research units is depicted in Figure 2. The RCCF is managed by a director who reports directly to the Director General of AARD and is the administrator of the research programs conducted by the institutes under his control. The Director plays a critical role in defining research agendas, managing resource flows from the Secretariat in support of field research, and administering personnel and facilities. He also has planning, coordination and budgetary authority over the Directors of the Fisheries Research Institutes. However, once funds are assigned to the institutes, there is little central control over expenditures or research implementation and few, if any funds, are available to meet emergency needs or opportunities.

Figure 1. Organizational Structure of the Agency for Agricultural Research and Development

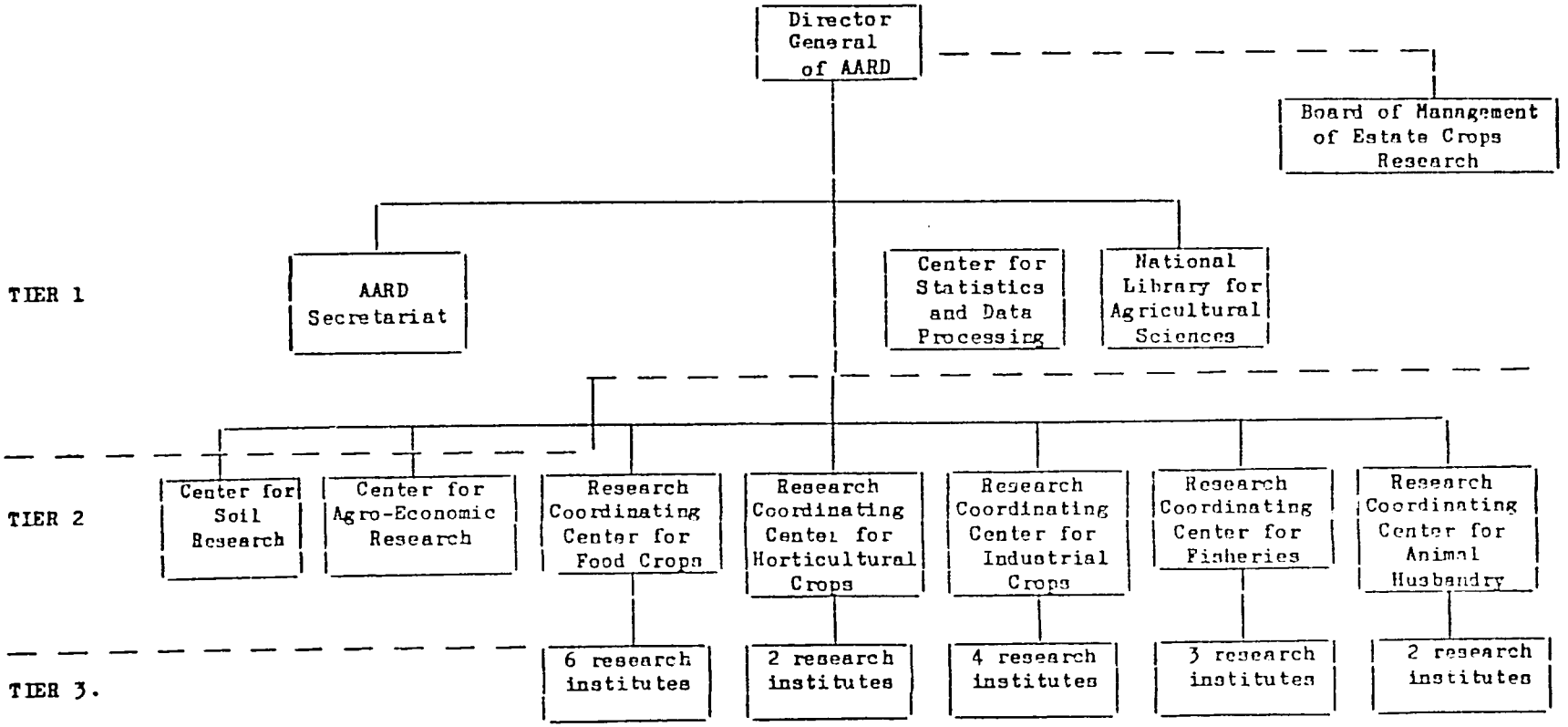
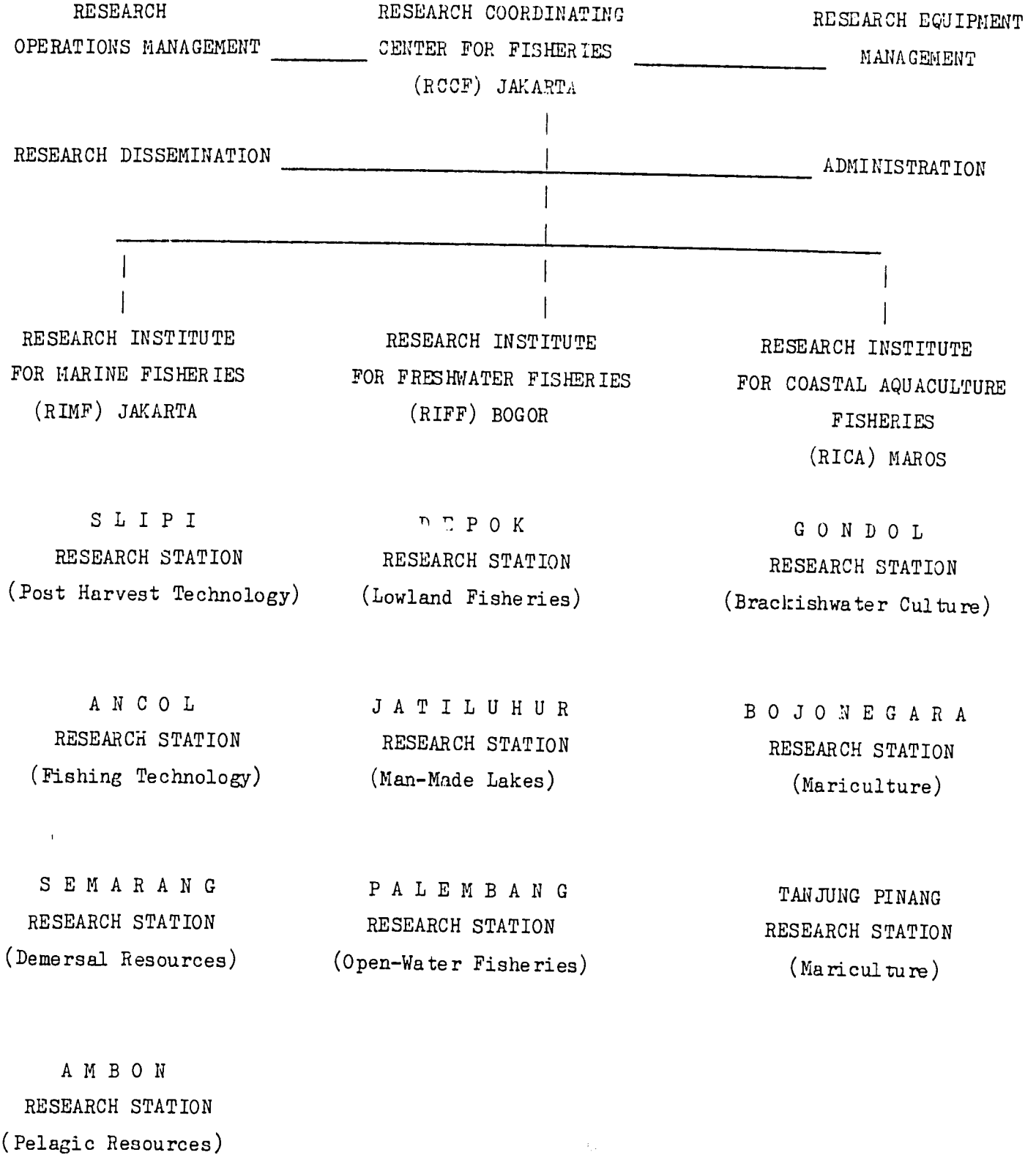


Figure 2. Organizational Structure of the Research Coordinating Center for Fisheries



The Fisheries Research Institutes prepare research proposals; manage, conduct, and evaluate research; and report and disseminate research results. However, broad research priorities and decisions on research issues are made at higher organizational levels.

Each Fisheries Research Institute is assigned specific research areas. For example, the Research Institute for Freshwater Fisheries at Bogor has specific responsibility for lowland fisheries, man-made lakes and open-water (river) fisheries. Work is carried out at three locations in Java and Sumatra. The Research Institute for Coastal Aquaculture Fisheries, located in South Sulawesi, has the national mandate for brackishwater culture and mariculture. The Research Institute for Marine Fisheries undertakes work in fishing technology and post harvest technology in Jakarta, research on demersal species in Semarang in Central Java, and research on pelagic resource management in Ambon. These institutes attempt to identify fishing systems that will maximize and sustain productivity within different ecological zones and subsectors.

Financial Support of Fisheries Research. AARD has adopted a four-pronged focus for the development of fisheries research: 1) development of a manpower base that is adequate to conduct quality research, 2) provision of effective research facilities, 3) development of a sound research strategy, and 4) establishment of efficient mechanisms to disseminate research results.

AARD budget commitments reflect strong Agency support for systematically achieving these objectives. For example, in 1984/85 AARD allocated $1.3 million of its development budget in support of fisheries. This represented 15 percent of the Agency's total development budget, a level 7 percent above the sector's contributions to Gross Domestic Product.

Constraints

Financial. AARD's efforts to support research on new technologies are plagued by recent budget cuts and RCCF's focus on facilities and manpower development. As Table 1 suggests, recent budget cuts resulting from declining oil revenues, and a strong emphasis on human capital and facilities development (AARD's first two development objectives) have limited support for research. Projected budget commitments for 1986/87 in support of fisheries are $2.0 million, approximately 82 percent of average annual commitments during the previous four years. AARD has attempted to maintain staff benefits and has absorbed major budget cuts in its development budget, the major source for field research support. For example, during the four years prior to 1986/87, the annual development budget averaged $1.6 million. In 1986/87 this was reduced by 50 percent to $.85 million.

An analysis of RCCF's 1985/86 budget suggests that only a third of its development budget, or 21 percent of it total budget, was available for research. If this rate were maintained through the 1986/87 fiscal year, operational research support of $386,000 or $1,775 per professional researcher, would be available. Such support levels are one tenth those provided for research scientists involved in rice research.

While research support levels are largely outside the control of RCCF in the short term, they do effect the productivity of investments already made in infrastructure and human resource development. For example, in 1985/86, RCCF committed 31 percent of its total budget to capital expansion. Although facilities at RCCF have expanded five fold since 1978, maintenance budgets continue to account for only 6 percent of the Center's total budget. Such budget levels are insufficient to maintain existing facilities, or facilities scheduled for completion over the next four years.

Limited operational research support also affects the research staff performance and constrains the development of a coordinated research program and dissemination of research results, RCCF's third and fourth development objectives. Although current levels of research

TABLE 1. RCCF BUDGET 1982/1983 - 1986/1987

(Rupiah 000)

| | 1982/1983 | | 1983/1984 | | 1984/1985 | | 1985/1986 | | 1986/1987 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R | D | R | D | R | D | R | D | R | D | R | D |
| RCCF | 47.943 | 114.962 | 54.023 | 99.120 | 75.925 | 84.550 | 91.727 | 93.005 | 112.587 | - | 382.205 | 391.637 |
| RIMF | | | | | | | | | | | | |
| Jakarta | 186.007 | 886.217 | 220.059 | 733.697 | 216.772 | 459.974 | 219.750 | 507.406 | 235.800 | 321.000 | 1.078.388 | 2.908.294 |
| Ancol | 21.010 | - | 21.650 | - | 21.595 | - | 42.136 | - | 51.830 | - | 158.221 | - |
| Slipi | 96.193 | 216.818 | 125.949 | 183.995 | 174.255 | 154.690 | 182.285 | 170.159 | 199.235 | 91.000 | 777.917 | 816.662 |
| Semarang | 20.100 | - | 20.700 | - | 23.745 | - | 38.563 | - | 42.043 | - | 145.151 | - |
| Ambon | 22.084 | 72.220 | 21.962 | 64.300 | 21.705 | 61.838 | 48.305 | 67.430 | 50.305 | 38.000 | 164.361 | 303.788 |
| RIFF | | | | | | | | | | | | |
| Bogor | 152.458 | 499.273 | 162.680 | 438.975 | 171.930 | 350.123 | 198.965 | 343.240 | 225.875 | 156.206 | 911.908 | 1.787.817 |
| Depok | 55.253 | - | 53.985 | - | 59.207 | - | 64.171 | - | 70.671 | - | 303.287 | - |
| Jatiluhur | 20.381 | - | 18.791 | - | 19.726 | - | 24.800 | - | 26.800 | - | 110.498 | - |
| Palembang | 24.174 | 93.827 | 26.054 | 62.730 | 30.109 | 36.236 | 36.236 | 61.760 | 39.736 | 43.794 | 156.309 | 323.699 |
| RICA | | | | | | | | | | | | |
| Maros | 24.546 | 80.000 | 24.933 | 57.960 | 30.933 | 56.562 | 41.440 | 89.958 | 47.355 | 64.451 | 169.207 | 348.931 |
| Gondol | 12.946 | - | 12.796 | - | 7.639 | 52.370 | 18.471 | 52.042 | 22.011 | 56.549 | 73.863 | 160.961 |
| Tanjung Pinang | 36.941 | - | 36.175 | - | 39.682 | 26.405 | 43.607 | 28.000 | 45.699 | 61.000 | 202.104 | 115.405 |
| Bononegara | 16.250 | - | 17.050 | - | 15.997 | 123.663 | 31.199 | 125.000 | 46.357 | 18.000 | 126.853 | 266.663 |
| Total | 736.286 | 1.964.117 | 816.807 | 1.640.777 | 912.220 | 1.431.763 | 1.081.595 | 1.538.000 | 1.216.287 | 850.000 | 4.762.195 | 7.423.857 |

RCCF = Research Coordinating Center for Fisheries

RIMF = Research Institute for Marine Fisheries

RIFF = Research Institute for Freshwater Fisheries

RICA = Research Institute for Coastal Aquaculture

Routine (R)

Development (D)

operational support are of serious concern to both AARD and AID, additional funds may become available as RCCF nears completion of its capital expansion phase. With 75 percent of facilities development completed, large commitments of capital investment funds will not be required. If it is conservatively assumed that current budget levels are maintained through 1992, an additional $730,000 currently committed to capital expansion would be available for research support. However, the ability to retain and effectively reallocate these resouces between centers and within programs will rely heavily on the quality of the centers' administrative and analytical capabilities, two areas of present concern.

Staffing. An analysis of RCCF's manpower development needs, recently completed by the International Service to National Agricultural Research (ISNAR), found that only 20 of RCCF's staff of 217 have post-graduate degrees (2 PhD and 18 MSc). While an additional 30 staff are now undergoing or are scheduled for advanced training (11 PhD and 19 MSc candidates), ISNAR estimates that this represents only 45 and 37 percent, respectively, of the PhD and MSc manpower required to support an effective fisheries research program. Only 9 of these staff will receive training in the brackishwater and freshwater subsectors, while 21 will receive training in the marine subsector. RCCF's limited operational research support budget will not be sufficient to put this limited manpower base to effective use.

Also, the limited availability of operational research support funds is affecting RCCF's ability to assign professional staff to research institutes outside Jakarta. With limited support, staff are hesitant to forego the amenities provided in Jakarta and accept transfers to research facilities in Sumatra, South Sulawesi and Ambon. This has resulted in a skewed distribution of professional staff, with 54 percent of PhDs and 44 percent of MScs located at the Research Institute for Marine Fisheries in Jakarta. The Marine Institute in Ambon, on the other hand, currently has no PhDs or MScs on site and only one MSc is scheduled for training. Given the mandate and need for field research and investigation for all subsectors, this represents a critical understaffing of field scientists with post-graduate training.

ISNAR's analysis clearly shows that RCCF's strategy has focused primarily on two major constraints to increased export sales by developing staff capabilities in fish processing and improving post harvest technology. When current staff complete their training, 38 percent of RCCF's PhD, and 28 percent of its MSc trained staff will be located at the Slipi Food Technology Research Station in Jakarta. While this strategy is consistent with national goals of increased fish exports, it has left other disciplines critically understaffed (see Table 2).

As the data indicate, major staff shortfalls exist in a number of critical areas, including marine biology, marine harvesting and post harvest technology, freshwater aquaculture production, coastal aquaculture production and management, and hatchery management. Supporting disciplines such as freshwater fish biology, genetics and limnology; and brackishwater breeding, nutrition, disease, pond engineering and fry production are also weak. Currently there are no economists on RCCF's staff and only one MSc economist is scheduled for training. Given the importance of economic analysis in selecting alternative technologies and developing products that can compete effectively in international markets, the absence of strong economic analytical capacity in RCCF will continue to be a major constraint to increased production.

The technology outputs from the project's upgrading of institutions (see Section 4) will require an upgraded extension service that can fully transfer the project's benefits to producers. As neither the AARD nor the universities are structured to provide extension services, the transfer of technology outputs will have to take place through the MOA's Agency for Agriculture Education, Training and Extension (AAETE) and DGF fisheries extension staff. Although an adequate number of DGF fisheries extension staff are located on the more populated islands, the effectiveness of such staff is impeded due to a lack of training, equipment, and transportation.

TABLE 2. MANPOWER DEFICIENCIES:

RESEARCH COORDINATING CENTER FOR FISHERIES

| | Trained or In-training | | 1990 Targets | | Staff Shortfalls | |
|---|---|---|---|---|---|---|
| | PhD | MSc | PhD | MSc | PhD | MSc |
| **Research Institute for Marine Fisheries** | | | | | | |
| Fish Biology | 3 | 1 | 5 | 8 | -2 | -7 |
| Post Harvest and Harvesting Technology | 5 | 12 | 8 | 20 | -3 | -8 |
| Environmental Studies | 0 | 4 | 0 | 4 | - | 0 |
| Economics - marketing | 0 | 1 | 0 | 4 | - | -3 |
| Sub total | 8 | 18 | 13 | 36 | -5 | -18 |
| **Research Institute for Freshwater Fisheries** | | | | | | |
| Fish Biology | 2 | 1 | 3 | 3 | -1 | -2 |
| Fish Genetics | 1 | 1 | 1 | 5 | 0 | -4 |
| Fish Disease | 1 | 1 | 2 | 4 | -1 | -3 |
| Nutrition | 0 | 0 | 0 | 2 | 0 | -2 |
| Limnology | 0 | 0 | 1 | 2 | -1 | -2 |
| Economics - marketing | 0 | 0 | 0 | 1 | 0 | -1 |
| Fish Technology | 0 | 0 | 0 | 1 | 0 | -1 |
| Fish Production | 0 | 1 | 1 | 6 | -1 | -5 |
| Sub total | 4 | 4 | 8 | 24 | -4 | -20 |
| **Research Institute for Coastal Aquaculture** | | | | | | |
| Fish Breeding | 0 | 0 | 2 | 3 | -2 | -3 |
| Nutrition | 1 | 1 | 2 | 5 | -1 | -4 |
| Fish Disease | 0 | 0 | 2 | 3 | -2 | -3 |
| Fish Production and Management | 1 | 4 | 2 | 10 | -1 | -6 |
| Pond Engineering | 0 | 0 | 0 | 2 | 0 | -2 |
| Economics - marketing | 0 | 0 | 0 | 1 | 0 | -1 |
| Hatchery Management | 0 | 0 | 1 | 6 | -1 | -6 |
| Environmental Studies | 0 | 6 | 0 | 9 | - | -3 |
| Fry Production | 1 | 1 | 1 | 3 | - | -2 |
| Sub total | 3 | 12 | 10 | 42 | -7 | -30 |
| Total 1990 Target Shortfall | | | 31 | 102 | -16 | -68 |

### 3.3.2 Institutions of Higher Education

Background

Higher education in Indonesia is composed of over 575 private and publicly-supported institutions, with a 1985 enrollment of 800,000 students. The system is increasingly oriented to providing the human resource capital necessary to manage Indonesian business, industry, and its rapidly expanding primary and secondary school system. Under the Ministry of Education and Culture, efforts to increase capacity and staff within the university system, increase the effective use of university facilities, improve the integration between public and private universities, and expand the supply of trained manpower for commerce, industry and primary and secondary education have been given priority.

Of the 45 publicly-supported institutions of higher education in Indonesia, 10 have formal fisheries programs. In the process of project development, USAID staff reviewed the programs at these universities and selected four institutions, the Institute of Pertanian Bogor (IPB), and the universities at Riau (UNRI), Ujung Pandang (UNHAS) and Ambon (UNPATTI) for support under the project. Selection was based on proximity to major AARD research facilities to be supported under the project, the subject matter focus of the universities' fisheries program, the degree to which fisheries faculties are already informally cooperating with AARD, and the universities' commitment to continue their fisheries program development.

Of the four universities selected for support, IPB (located in Bogor near RCCF) is the largest and best developed in Indonesia. With 115 faculty members, divided into five departments, the fisheries faculty graduates approximately 80 students per year. With 71 faculty members holding advanced degrees from foreign universities, the faculty has initiated a graduate program with many of its graduates returning to provincial universities to take up research and teaching positions. Situated on a new campus opened in 1985, the faculty has adequate teaching facilities but limited research facilities, which include a 2 hectare field research site adjacent to the campus, a 4 hectare undeveloped field research site, and a marine research facility at

Ancol. With modest additional support and access to RCCF research facilities, the IPB program could provide the majority of trained manpower required for long-term professional staff development in the fisheries sector.

The fisheries program at UNHAS is in the Department of Fisheries within the Faculty of Animal Husbandry. The Department currently has a faculty of 33, with 9 staff holding advanced degrees and an additional 4 in graduate training. Due to the rapid expansion of brackishwater fisheries production and processing in South Sulawesi, student enrollment has increased significantly in the last few years and currently totals 406.

The Department offers specialized training in four areas: Aquaculture, Management of Aquatic Biological Systems, Fisheries Management, and Fisheries Economics. It is located on a new campus built and equipped by the Asian Development Bank, with 300 hectares of undeveloped land available for research facilities and is close to the Research Institute for Coastal Aquaculture. With limited supplemental support, the Department could develop, over the short-term, strong MSc level training and a field-oriented research program to complement brackishwater fisheries production in Indonesia.

The fisheries program at UNPATTI has recently been upgraded to a Faculty of Fisheries and 10 BSc staff have been added. The faculty currently has 45 faculty members, four of whom have MSc degrees. The faculty will graduate about 16 BSc students in 1986, but has admitted approximately 100 students in the past three years.

At UNPATTI, fisheries training focuses on two areas of academic specialization: Management of Aquatic Resources and Fish Processing Technology. Facilities are modest and include an aquaculture laboratory equipped by USAID for research and advanced training, a general biology and food processing laboratory refurbished with UNPATTI funds but poorly equipped, and a new fish processing laboratory built by UNPATTI, which has not been equipped. In addition, advanced students from UNPATTI have

access to facilities at the National Institute of Oceanology (LON) laboratory for their thesis studies. Although UNPATTI currently has a small program, its recent emphasis on staff and facilities development, and plans to use a percentage of enrollment fees for research indicate that UNPATTI is committed to developing a strengthened fisheries training and research program for Eastern Indonesia.

UNRI, with the only fisheries faculty in Sumatra, constitutes an important resource for the advancement of fisheries production in Western Indonesia. The faculty of 38 provides BSc degrees in the areas of aquatic resource management, fishery socio-economics, aquaculture, and fish processing.

In anticipation of a move to a new campus in 1986, the faculty is undergoing an extensive staff development program. Six faculty members have recently completed graduate level training: four in Masters-level programs in the United States and two in PhD-level programs in Japan and Indonesia. An additional 12 candidates (9 MSc and 3 PhD) are currently enrolled in degree programs in the United States, Japan, Europe and at IPB. U.S. Masters-level training at UNRI is being supported by USAID's Western Universities Agricultural Education Project, which will continue for another four years. With only limited additional support for research, the Fisheries Faculty and students at UNRI could develop a field research capability to strengthen classroom instruction, complement RCCF freshwater research efforts at Palembang, and play a major role in the development of fisheries resources in Western Indonesia.

Constraints

While these universities are advancing well in their development of effective faculties and facilities to support undergraduate teaching, a number of factors seriously inhibit their ability to conduct the graduate level training and research required for sound fisheries development. Similar to counterpart agencies in the MOA, these universities have undergone major budget cuts during the current fiscal year.

Financial. As Table 3 indicates, while routine budget allocations in support of staff salaries and benefits have increased, development budget support has been reduced by 27 percent in 1986/87. Development budget cuts have reduced the capacity to undertake research, with cuts ranging from 9 percent at IPB to 48 percent at UNRI. Discussions with fishery faculty Deans during the development of this Project Paper indicate that GOI research funds are not available this fiscal year, and, during the next three to four years, will be significantly below the low levels previously provided. This will severely constrain efforts to improve field-level research, a critical component in graduate training; limit the productivity of investments in university staff trained in research methods; and forestall the utilization of expertise now in the universities.

Staffing. Table 4 indicates that with the exception of IPB, fishery faculties have very few PhD staff qualified to design and manage large research programs. In addition, the data suggest a significant difference in staff development levels at each institute. For example, by 1990 IPB and UNHAS will have a sufficient cadre trained to the PhD level, and thus will be able to undertake PhD training. UNPATTI and UNRI, on the other hand, will continue to face significant staff constraints with shortages of MSc and PhD staff. At that point, external support should continue to focus on staff development at UNPATTI and UNRI, but concentrate on research at IPB and UNHAS.

## 3.4 Summary of Constraints

In addition to funding problems (discussed further in Section 4), a fundamental constraint to the further development of fisheries and aquaculture resources in Indonesia is the lack of the human resources and institutional capacity required to plan and implement aquaculture and fisheries research and production programs. This constraint has led to the limited availability of proven technologies required to increase the productivity and incomes of Indonesia's 2.9 million small-scale fishermen. The solution to this problem will not be found in the short term, but will require concentrated effort for at least a decade to establish the organizational and human resource base needed to manage research and production in the fisheries sector.

TABLE 3. FISHERIES FACULTY BUDGETS 1981/82 - 1985/86

(Rupiah 000)

| | 1982/1983 | | 1983/1984 | | 1984/1985 | | 1985/1986 | | 1986/1987 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R | D | R | D | R | D | R | D | R | D | R | D |
| IPB | 2,848,110 | 4,785,276 | 3,088,303 | 3,903,401 | 3,420,202 | 7,110,500* | 4,055,954 | 3,340,950 | 5,290,828 | 3,043,003 | 18,703,397 | 22,183,130 |
| UNHAS | 2,454,509 | 6,570,615* | 2,251,027 | 6,560,615* | 3,011,940 | 6,960,610* | 3,575,275 | 7,199,727* | 5,058,177 | 4,752,071 | 16,350,928 | 32,043,638 |
| UNPATTI | 884,460 | 1,700,748 | 1,025,455 | 1,540,748 | 1,100,485 | 1,633,190 | 1,156,956 | 2,131,750 | 1,884,772 | 1,333,301 | 6,052,128 | 8,339,737 |
| UNRI | 763,106 | 857,552 | 881,119 | 957,552 | 1,001,376 | 1,024,580 | 1,294,053 | 1,161,200 | 1,816,795 | 482,200 | 5,756,449 | 4,483,084 |
| Total | 6,950,185 | 13,914,191 | 7,245,904 | 12,962,316 | 8,534,003 | 16,728,880 | 10,082,238 | 13,833,627 | 14,050,572 | 9,610,575 | 46,862,902 | 67,049,584 |

Routine (R)
Development (D)
* Represents construction of new facilities

TABLE 4. TOTAL FISHERIES FACULTY STAFF,
CURRENT AND IN TRAINING, BY DEGREE AND DISCIPLINE

| | Current | | Now Training | | 1990 Target | | Faculty Shortfalls* | |
|---|---|---|---|---|---|---|---|---|
| | PhD | MSc | PhD | MSc | PhD | MSc | PhD | MSc |
| IPB | | | | | | | | |
| Aqua.Res.Mgmt. | 14 | 8 | 5 | 4 | 31 | 4 | -12 | 0 |
| Aquaculture | 2 | 6 | 2 | 3 | 13 | 4 | - 9 | 0 |
| Fish.Res.Exploit. | 3 | 7 | 4 | 2 | 15 | 3 | - 9 | 0 |
| Fish.Econ.Mgmt. | 0 | 5 | 0 | 1 | 6 | 4 | - 6 | 0 |
| Post Harvest Tech. | 0 | 1 | 0 | 3 | 4 | 5 | - 4 | - 1 |
| Sub-Total | 19 | 27 | 11 | 13 | 70 | 20 | -40 | - 1 |
| UNHAS | | | | | | | | |
| Aquaculture | 1 | 4 | 2 | 0 | 3 | 4 | - 1 | 0 |
| Fish. Mgmt. | 1 | 0 | 1 | 0 | 3 | 4 | - 1 | - 4 |
| Fish. Econ. | 1 | 0 | 0 | 0 | 2 | 2 | 0 | - 2 |
| Aquatic Biology | 0 | 2 | 0 | 1 | 2 | 2 | - 2 | 0 |
| Sub-Total | 3 | 6 | 3 | 1 | 10 | 12 | - 4 | - 6 |
| UNPATTI | | | | | | | | |
| Aqua.Res.Mgmt. | 0 | 2 | 0 | 1 | 1 | 36 | - 1 | -33 |
| Fish Processing | 0 | 2 | 0 | 0 | 1 | 9 | - 1 | - 7 |
| Sub Total | 0 | 4 | 0 | 1 | 2 | 47 | - 2 | -40 |
| UNRI | | | | | | | | |
| Fish. Mgmt. | 2 | 7 | 3 | 9 | 8 | 22 | - 3 | - 6 |
| Sub-Total | 2 | 7 | 3 | 9 | 8 | 22 | - 3 | - 6 |
| TOTAL 1990 TARGET | | | | | 90 | 101 | | |
| SHORTFALL | | | | | | | -49 | -53 |

* MSc projections have been adjusted to reflect the fact that some of the MSc faculty will advance to the PhD level.

Staff constraints also exacerbate problems of research coordination. To date, a comprehensive national fisheries research agenda to guide the research efforts of both AARD and the universities has yet to be developed. The scattering of research facilities, staff and responsibilities results in limited research output. For example, several local universities have (or plan to have) fisheries programs in all sectors. Although applied fisheries research responsibilities were transferred from the Directorate General of Fisheries (DGF) to AARD in 1978, important research stations such as Sukabumi and Jepara were retained by the DGF. This has resulted in scattered research efforts, which reduce potential research impact on major fisheries development.

There is a serious lack of professional talent to assess the comparative advantages of alternative technologies. In addition, the adoption of new technology is often constrained by marketing and lack of socio-economic skills. Although western aquaculture technology was introduced in the 1970s, research needed to adapt it to Indonesia has not yet taken place.

### 3.4.1 Recommended Actions

To address the need for increased manpower and quality research in fisheries, AARD and the universities will have to overcome major obstacles in five areas:

First, fisheries research should refocus on more achievable goals. AARD should concentrate resources and objectives on a smaller number of high quality and implementable activities. Due to shortages of staff, facilities and research funding, there is a greater need for collaboration in planning, training and conducting research between research institutes and universities. Basic and production-oriented research on proven species should be emphasized rather than the introduction of exotic species and high-technology production methods.

Second, both AARD and the universities will have to compete more aggressively with a number of other government agencies for scarce research support. Declining oil revenues limit GOI investment funds for research and support. GOI emphasis on industrial research for import substitution has directed budget support to the Ministry of Science and Technology.

Third, even though AARD and the universities have indicated their intent to reallocate existing budgets to include more fisheries research, the level of potential research operating funds will not be sufficient to support quality research. Consequently, many of the most qualified staff may be left with inadequate support to finance active field research programs. In the medium to long-term, this austere situation will likely change as non-oil exports increase, domestic resources are taxed more effectively, and the construction of new research facilities is completed. In the interim, however, effective means will have to be found to tap existing GOI funds to meet research needs.

Fourth, while AARD's evolving management structure has proven adequate to support intensive research on food crops, new forms of organization will be required to manage, monitor and review the multi-ecosystem focus that the Agency is attempting to implement in the fisheries sector. Critical to this process will be a management system that effectively supports AARD senior policy decisions on the allocation of scarce human and financial resources between competing research programs, facilitates and assists in the development of a national fisheries research agenda, provides timely feedback on progress, and links research outputs to the complex applied field testing efforts necessitated by Indonesia's diverse agro-ecological systems.

Fifth, to augment AARD's professional staff, effective mechanisms must be identified to tap human resources in Indonesian universities and the private sector. Informal linkages with these groups exist, but dissolve after specific research efforts are completed. It is essential that AARD, the private sector, and universities develop and present well-documented cases to support increased fisheries research.

## 3.5 Progress to Date

Indonesian efforts to overcome the production constraints in fisheries have met with some success. With 90 percent of the fisheries sector controlled by private enterprise, donor and government investments have focused on improving public services and the financing of large quasi-private initiatives in support of hatchery development, fish processing, marine fish capture and transportation. The emphasis has consistently been on improving production for export, rather than domestic markets. This has been the case even though 95 percent of the sector's production is consumed domestically. Major investments have been made in the purchase of vessels and equipment, ice making and refrigeration facilities, on-shore factory landing, processing, repairs, housing facilities, and refrigerated transportation. Skipjack tuna and shrimp production for export have been emphasized.

At an average annual rate of growth of 4.2 percent, Indonesia's total fish production has doubled during the past ten years, from a base of 1.23 million metric tons (mmt) in 1970 to 2.26 mmt in 1984. During this period, marine fish landings have grown by 5.2 percent annually and aquaculture production by 5.7 percent per year, while inland capture fisheries have declined by about 0.6 percent annually.

Fisheries research, though limited, has had an impact on production and policy formulation, especially in the marine sector. For example, a by-catch escape device (BED) originally developed in the USA, has been adapted to Indonesian conditions. The adaptation of this new technology was an important factor in the government's decision to continue to allow shrimp harvesting in Eastern Indonesia, a major source of regional income and employment. Application of this technology, however, continues to face problems and the Ministry of Agriculture is playing a crucial role in further research to improve efficiency.

AARD's work on stock assessment has clearly demonstrated that prior to 1980, the majority of Javanese inshore fisheries resources were fully, or in some cases, over exploited. This information has been instrumental in shifting fisheries development programs away from Java. Also, AARD's research has clearly demonstrated the need to develop different policies to regulate fishing activities in divergent ecological zones off the coast of Java. This research led to the promulgation of regulations prohibiting large trawlers from operating close to shore and thus disrupting traditional fish production.

## 3.6 USAID Experience in the Fisheries Sector

USAID has been involved to a limited degree with Indonesian fisheries development over the past two decades. USAID support, through Auburn University, to improve the construction and supply of freshwater and brackishwater ponds in North Sumatra led to a 100 percent increase in production and a 50 percent increase in pond area. These pilot activities have served to attract another donor (ADB)* to support GOI efforts to expand aquaculture production in North Sumatra, and initiate such activities in Central Java and South Sulawesi.

More recently, the Science and Technology Project assisted in upgrading the existing university and ministry fisheries programs in Ambon. Activities supported by USAID and the University of Washington under this project have led to the development of a fledging Fisheries Faculty at the University of Pattimura. Also, current development activities under the Small Scale Fisheries Development Project with the Directorate General of Fisheries, and the Pond Dynamics Collaborative Research Project with the Institute of Pertanian-Bogor, have provided the Mission with considerable knowledge and experience related to the primary fisheries issues in Indonesia, as well as the ministries, agencies, and institutions associated with the resolution of these issues. Although both the Science and Technology and the Small Scale Fisheries Development Projects have met with moderate success during

* ASIAN DEVELOPMENT BANK

recent years through efforts to directly introduce new technologies for fisheries production/capture, it can now be seen that production efforts cannot be sustained or increased without a long-term commitment to research and manpower development. Key farmers, DGF personnel and extension agents lack experience in management, and the universities and research stations lack the fisheries scholars and scientists to train the fisheries managers and adapt or develop the technology appropriate for Indonesian fisheries.

In addition, there are serious aquaculture production input constraints. Across the board, there are fingerling shortages for food fish production, a lack of effective and least cost fish diets, and water quality problems. Rice-cum-fish, cage and pond culture cannot be sustained or increased without increased hatchery production and the development of broodstocks. Freshwater prawn grow-out operations indicate that operating costs exceed present produce price. Although it may be possible to reduce these costs (through better facility design, management, inputs, etc.) and improve production (through polyculture with other species), it will require a series of scientific investigations to develop the appropriate technology and inputs. In the marine fisheries sector, the abundance of fish stocks in Eastern Indonesia offers a potential solution for the problem of overfishing in the inner islands area over the short to intermediate term, if marketing and fish processing constraints can be resolved. The lack of research and training capabilities presents a bottleneck for both short and long term development needs in the marine fisheries sector as well as in the freshwater and brackishwater sectors.

Thus, the lessons learned through these past project activities and the completion of two comprehensive aquatic resource surveys have been drawn on for the design of this project. The assignment of a fisheries development specialist to the Mission has also strengthened USAID/ Indonesia's position to design and implement fisheries projects.

Although the Mission has not yet worked with the lead agency for this project - the Research Coordinating Center for Fisheries (RCCF), it

has worked closely with the parent agency, AARD, on a number of successful agricultural projects.* Significant USAID investments in AARD over the past 10 years have contributed to rice production self-sufficiency. Given AARD's excellent past research performance and the high level of Indonesian fisheries potential to more fully realize production, income, employment and nutritional gains from its existing aquatic resources, this project is expected to make a significant contribution to Indonesia's economic growth and development.

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* The linkages among universities, research, and the private sector established in the Applied Agricultural Research Project (AARP) can be used effectively to achieve the objectives of this project. Opportunities exist to tap into some of the AARP mechanisms that would appropriately lend themselves to specific proposed fisheries activities, e.g., special studies, and commodity research groups. This type of integration and coordination would reinforce and accelerate some of the fisheries activities by providing an ongoing mechanism and framework for effectively employing educational systems and public and private resources. The Secondary Food Crops Production Project's demonstration farms and experience in uniting researchers and extension workers on areas of mutual concern will also be made available to assist whenever appropriate. Additional possibilities exist for establishing cost-effective fish production systems in collaboration with the Small Scale Irrigation Management Project.

# 4. PROJECT DESCRIPTION

## 4.1 Sector Goal and Purpose

The fishery sector's contribution to GDP in 1984 was _ percent and accounted for 5 percent of the national labor force. Fish provides 62 percent of the Indonesian people's daily animal protein supply. Although the exploitation of Indonesia's marine resources is estimated to be less than 50 percent of MSY,* 0.6 percent of the country's domestically-consumed fish was imported (ADB/IBRD).

The GOI Fourth Five-Year Development Plan (Repelita IV) notes that the optimal level of per-capita fish consumption is 22.5 kg. per year. Per-capita supply in 1982 was only 12.9 kg., only 57 percent of optimum, and supplies varied greatly across Indonesia. While annual per-capita supply was only 6.3 kg. on Java, it was 56.0 kg. in Maluku Province, more than double the optimum.

In light of these facts, Repelita IV established the following set of general fishery development objectives: 1) increase fish production to improve the nutrition of the people; 2) increase exports and minimize imports of fishery products to develop the domestic industry and minimize the spending of foreign exchange; 3) improve the standard of living of fishermen and fish farmers through increased income; 4) expand labor opportunities in the fishery sector; 5) intensify efforts aimed at sustainable utilization of fishery resources; and 6) equally distribute fishery development and its results throughout Indonesia.

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* 23.5 percent of MSY for pelagics, 11 percent demersal, and 61.8 percent for large panaeid shrimp, as estimated by DGF for 1981.

It is expected that a five-year average annual increase in fish production of 6.2 percent will contribute to achieving these goals. This increased production is expected to result in an annual growth rate of 3.4 percent in per-capita consumption and 18.9 percent in export income, along with an average annual decrease of 8.9 percent in food fish imports (Repelita IV).

## 4.2 Project Goal and Purpose

The goal of the Fisheries Research and Development Project is to improve the technological and management resources available to public and private entities involved in Indonesia's fisheries sector. Both these resources are essential to Indonesia's efforts to increase production, employment, per capita income and efficiency. The purpose of the project is to install viable fisheries research programs in the various fisheries subsectors at the AARD in the MOA and in key universities that will address significant regional fisheries production and marketing constraints.

The project consists of four components (discussed in Section 4.3)

- Upgrading the staff, facilities, academic training, and research programs of selected universities and MOA research institutes needed to resolve priority production, marketing, and policy/management problems (see Table 5).

- Assisting the MOA and MOE to establish a national coordinated fisheries research agenda, with special emphasis on common fish production/marketing constraints.

- Assisting the MOA in evaluating the need and mechanisms to improve fisheries policy and planning to ensure the optimal utilization and management of Indonesia's aquatic resources.

TABLE 5. PROPOSED FISHERIES RESEARCH ACTIVITIES

| A. Freshwater Production | | | Research | | |
|---|---|---|---|---|---|
| Location | System | Fish | Production | Marketing | Policy |
| 1. Bogor | -Rice-cum-fish<br>-Pond-cum-fish<br>-Cage culture | -Carp<br>-Catfish<br>-Milkfish<br>-Tilapia<br>-Gourami | -Nutrition requirements for brood and grow-out fish<br>-Development of least-cost rations<br>-Improved broodstock and brood-stock production | | |
| 2. Palembang | -Pond production<br>-Cage culture<br>-Polyculture | -Catfish<br>-Carp<br>-Gourami<br>-Belida * | -Culture systems, water quality<br>-Production methods<br>-Propagation, fingerling production<br>-Polyculture<br>-Diet testing, feeding practices<br>-Parasites and diseases | - Markets<br>- Harvesting and transportation<br>- Processing<br>- Fish farming economics | |
| 3. IPB | -Pond production<br>-Cage culture<br>-Polyculture | As above | -As above through post-graduate/ faculty research | - As above through post-graduate/faculty research | - National Fisheries Research Planning |
| B. Brackishwater | | | Research | | |
| 1. Maros | -Pond production<br>-Polyculture | -Milkfish<br>-Shrimp | - Management practices<br>- Water quality | - Bacterial contamination in fish processing | -Studies on environmental impacts on coastal and off-shore ecosystems |
| 2. UNHAS | As above | As above | As above through post-graduate/ training and faculty research | As above through post-graduate/faculty research<br>Fish farming economics | -As above through post-graduate/faculty research<br>-Aquaculture development planning<br>-National Fisheries Research Planning |
| C. Marine | | | Research | | |
| 1. Ambon | Marine Fisheries | -tuna, mackerels and minor products | Bait fish mariculture<br>Sustained yield management<br>Data base<br>Fish migratory studies | -Improve shelf live of traditional processed products<br>-Improve processing for under-utilized species<br>-Market research on Eastern Indonesian fisheries products<br>-Research on seasonal production with demand markets<br>-Export market diversification | -Economic analysis of state fishing co. in E. Indonesia<br>-Research on domestic shipping rates |
| 2. UNPATTI | As above | As above | As above | As above through post-graduate/faculty research | -As above through post-graduate training<br>-National Fisheries Research Planning |

* Notopterus

- o Improving technologies for the production and marketing of commercially important fish products.

## 4.3 Project Components

Project support will be focused on human resources development and research at the Research Coordinating Center for Fisheries, and the three institutes under its direction (the Research Institute for Freshwater Fisheries, the Research Institute for Coastal Aquaculture and the Research Institute for Marine Fisheries). In addition, to strengthen fisheries training and link university research more closely with government research efforts, four universities have been selected for project support. The Institute of Pertanian in Bogor and the University of Riau in Pekanbaru will work with the Research Institute for Freshwater Fisheries in Bogor and Palembang, respectively. The University of Hasanuddin in Ujung Pandang will work with the Research Institute for Coastal Aquaculture in Maros, and Pattimura University in Ambon will work with the Research Institute for Marine Fisheries in Ambon (see Figure 3).

USAID reviews have determined that limited, but high quality, post-graduate training and coordinated applied research programs at these institutions would be the most effective mechanism for using project resources, and developing the human and institutional resources required to increase fisheries production. The geographic selections facilitate collaboration between potentially strong university programs and new RCCF research facilities in geographical areas that are already major producers of freshwater, brackishwater, and marine fish products.

### 4.3.1 Freshwater Aquaculture

The first project component will develop technologies appropriate for improving freshwater fish culture. It will seek to mitigate declines in the production of important freshwater fish species by (1) developing and testing new production technologies, and (2) strengthening the linkages between university and AARD research programs.

Figure 3. Project Sites


LEGEND

1. RIFF Bogor - IPB
2. RIFF Palembang - (UNRI)
3. RICA Maros - UNHAS
4. RIMF Ambon - UNPATTI

The design of research activities supported under this component is based on the experience gained by USAID during the implementation of the Small Scale Fisheries Development Project which will be ending on September 30, 1986. Evaluations of this project and the 1985 fishery sector feasibility study have identified problems in fish nutrition, brood stock quality, fry production and extension as major constraints to increased production. Field research activities will address the constraints in reference to production intensification and expansion for the important commercial freshwater fish species in Indonesia as identified under the fishery sector feasibility study (See Table 5).

Project activities will be limited to the involvement of two government agencies: the Agency for Agricultural Research and Development and the Directorate General of Higher Education. In support of freshwater fish development activities, project funds will finance research institute and university development, technical assistance, training and equipment.

To assure long-term sustained development of freshwater fisheries, professional programs at selected Indonesian universities will be strengthened. At present, the Fisheries Faculty of the Institute Pertanian Bogor (IPB) has an adequate program in freshwater fisheries to begin to link their efforts with the field research activities at AARD's Bogor facilities. The University of Riau (UNRI) also has the potential for such linkages. Although some support is already in place for UNRI under the Western Universities Agriculture Education Project, there is little, if any, collaboration with RCCF. The project will focus on establishing such collaboration through national fisheries research agenda development activities and research studies at RIFF-Palembang.

### 4.3.2 Brackishwater Aquaculture

Both the GOI and donor agencies have placed significant emphasis on brackishwater shrimp production in an effort to improve farm employment,

income and foreign exchange earnings. Economic returns to semi-intensive production are favorable, with one hectare generating Rp 1.4 million net revenue per year. Major investments are underway to improve the construction and management of brackishwater ponds; to relax input supply constraints through the provision of credit, large-scale hatcheries and ice plants; and to improve the capacity of government extension services.

Project activities in this component will be focused in South Sulawesi, one of Indonesia's major milkfish-shrimp production areas and the recipient of the majority of government and donor shrimp-related investments. The objective of this component is similar to that of the freshwater component. A brackishwater fisheries research program will be established at the AARD Research Institute for Coastal Aquaculture (RICA) at Maros, through collaboration with Hasanuddin University (UNHAS). Existing university research capability will be combined with AARD research facilities to initiate a research-training program that will lead to the development of a strong research program at RICA Maros. This program will address priority constraints to brackishwater fisheries subsector development and will set the stage for UNHAS to embark on a post-graduate MSc training and research program in brackishwater aquaculture.

Priority will be assigned to solving constraints limiting milkfish-shrimp production, specifically, issues of production management, water quality and bacterial contamination of fish products. The research will be complementary to major GOI and other donor investments underway to improve the construction and management of brackishwater ponds.

Project funds will support short-term technical assistance, training, research studies and equipment. It is expected that the World Bank will provide the funding to complete and equip the Maros research laboratory and pond facilities and to initiate some foreign post-graduate training of current RICA staff by the end of the first year of this project.

### 4.3.3 Eastern Indonesia Fisheries Development

This project component will initially address the technology constraints and facilities needed to decrease the costs of processing and marketing domestically-consumed fish products. However, once overseas trainees have returned, it is expected that the project will test economical techniques for, and initiate the establishment of, a data base to develop a sustained yield management policy for Eastern Indonesian marine fishery resources; and play an important role in enhancing the government's ability to develop and manage these resources.

Project activities will be based in Ambon because it is a focal point for the development of the marine fisheries program in Eastern Indonesia. A staff development program at the University of Pattimura (UNPATTI) will allow the new Fisheries Faculty to strengthen its collaboration with AARD in the area of marine fisheries. The project will also strengthen the capacity for the academic and/or specialty training of DGF provincial staff in Maluku and Irian Jaya.

### 4.3.4 Fishery Research Management, Policy and Planning

Training, short-term technical assistance and special studies will be used within this project component to improve staff, data and management capabilities in the MOA to establish national fishery policies. Two major foci are planned: (a) the development of a comprehensive national fisheries research agenda and policies to address key fisheries production and marketing issues, and (b) assistance to st engthen the planning, analysis, implementation and management capabilities of the MOA in conducting its fisheries research.

## 4.4 Project Strategy

Strengthening human resources and institutional capacity to plan and implement aquaculture and fisheries research and production programs is a key element of this project. The project will coordinate the human

resources and facilities of key research institutes and universities in each of the three fisheries areas for expanding research studies on the priority constraints to fisheries production. In Project year 4, the program will be expanded and intensified by bringing together the components initiated in the early life of the project; i.e., returning post-graduate participants, rehabilitated and expanded research facilities, and the development of a national research agenda managed by the AARD-DGHE Communication Forum composed of representatives from the Ministry of Agriculture, the Ministry of Education and Culture, the Indonesian Institute of Sciences (LIPI), the Ministry of State for Research and Techology, BAPPENAS, the Department of Finance, and the private sector. The upgraded and expanded university system will provide the "hands-on" trained fisheries scientists and scholars needed to develop the fisheries sector. The special studies component will assist in developing policies to support sector development.

The solution to the problems facing Indonesia will not be found in the short-term but will require concentrated effort for at least a decade to establish the organizational and human resources needed to manage research and production in the fisheries sector. This project represents a short phase in the long-term development of the human capital required to sustain growth in Indonesia's fisheries sector.

## 4.5 Coordination with Other Donors

The design of this project takes into consideration ongoing and planned development activities of other donors. Extensive discussions were held with other major donors, i.e., World Bank, Asian Development Bank and United Nations Development Program, and site activities of other donor projects were reviewed. As discussed in Annex G, this project complements other donor support in the sector. For example, initial project design supported freshwater fisheries extension activities in North and South Sumatra. This element has been dropped because the World Bank has plans to improve fisheries extension through a major project which is now under design. The AID-supported project will complement this effort by upgrading the capability of key universities to provide

post-graduate fisheries training for extension specialists assigned to train DGF field extension staff.

In addition, overseas post-graduate training supported under the project will complement the World Bank's program to train 30 RCCF staff abroad. Combined donor-financed training will still not meet the minimum number of trained scientists required by RCCF to effectively develop the fisheries sector.

## 4.6 Project Inputs

USAID funds totaling $7.105 million* ($3.785 million in loan funds and $3.320 million in grant funds) will provide technical assistance, training, facility rehabilitation-expansion and equipment purchases for research activities, as follows:

- o 6.0 person-years of long-term technical assistance in fisheries research planning and policy;**
- o 68 person-months of short-term technical assistance to assist in establishing AARD and university fisheries research programs and for project evaluations;
- o funding to carry out special studies to upgrade marketing and policy planning capabilities in the MOA;
- o upgraded and expanded research and training facilities at selected RCCF research institutes and universities;
- o vehicles for project activities; and
- o equipment and supplies to support research and training.

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* All currency figures in this project paper are in U.S. dollars unless otherwise stated. The exchange rate used to convert Indonesian currency to U.S. currency is US $1 = Rp 1,123.

** Illustrative technical assistance requirements for this project are given in Annex H.

The Government of Indonesia will invest an additional $1.507 million equivalent in cash, and will provide an in-kind contribution of $2.7 million equivalent to support the following:

- o Salaries, per diem and travel costs of GOI counterparts to the technical advisors;
- o land and buildings for the expansion of fisheries research facilities;
- o operational and maintenance costs of expanded fisheries research facilities and project vehicles;
- o in-country travel and per diem costs for 200 person months of in-country short-term training;
- o research and special studies support; and
- o in-country commodity procurement.

All overseas training costs and related in-country English language training costs will be loan financed. However, all pre-departure and in-country short-term training costs will be GOI financed. Costs for expanding applied research programs will be financed under GOI counterpart funding. All facility rehabilitation-development will be loan financed. Operation and maintenance costs of project facilities will be GOI financed.

The special studies component will be grant funded. However, the GOI will share the costs (with a matching contribution) of the functions of the AARD-DGHE Communication Forum and the development of a National Fisheries Research Agenda.*

The technical assistance component will be grant financed. It is expected that the long-term technical assistance component will be limited to competitive bids from U.S. universities and that most of the

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* The Communication Forum includes representatives of the Indonesian Institutes of Sciences (LIPI), Ministry of State for Research and Technology, BAPPENAS, Planning Bureau of the Ministries of Agriculture, Education and Finance.

short-term technical assistance arrangements, including the special studies component, would be provided through a university contract. However, to the extent possible, Indonesian university and institute staff will be considered as consultants for short-term assignments related to special studies and in-country training assignments.

Upon mutual agreement of the AARD-DGHE Communication Forum and AID, some of the grant contingency funds may be used for in-country research studies. In addition to the universities mentioned in Section 4.3 above and after further analysis of their institutional capacities, research activities may also involve other universities, including the University of Padjadjaran.

## 4.7 Project Outputs

The project will have both management and physical outputs that will have a direct impact on fisheries production and management. The project will also produce a substantial number of other management and production outputs that will assist in achieving the goal of the project by complementing other programs or activities such as the World Bank Agriculture Extension Training Project. The major outputs of this project will include:

1. The development of a National Fishery Research Agenda and a mechanism to focus research in critical areas and coordinate research activities between AARD and Indonesia's university system. In addition, support will result in more efficient planning of AARD's fishery research program and support of field research.

2. Established centers for graduate training and applied fisheries research at three MOE fisheries universities and four MOA fisheries research institutes. Target universities will have strengthened instructional and research programs and be able to produce professional fisheries scientists and scholars with "hands-on" experience. These universities will have upgraded

faculty training, fisheries curricula, and research programs and improved laboratories, computer facilities and pond research facilities. Target research institutes will have a critical mass of scientists with quality research facilities to develop and/or adapt required technologies.

Project investments in the freshwater fisheries area under the RCCF's Research Institute for Freshwater Fisheries (RIFF) in Bogor and Palembang, and the Institute of Pertanian Bogor (IPB) and the University of Riau (UNRI) will specifically result in: a) the development of a fish feed nutrition research laboratory at RIFF-Bogor in collaboration with commercial feed processors in Java (Cargill) and Sumatra for the development of least-cost commercial fish feed formulas for important fresh and brackishwater fish species; b) the development and distribution of a new line of carp broodstock (ikan mas); c) the development of broodstock for fresnwater catfish and carp of Sumatra; d) the development of a 10 hectare freshwater fisheries research station at RIFF-Palembang; e) established feeding rates for the new diets, and the development of breeding technology and commercial fingerling production for catfish and carp; and f) established commercial production technology for these species in ponds and cages.

Support to the RCCF's Research Institute for Coastal Aquaculture (RICA) in Maros and the University of Hasanuddin (UNHAS) will yield similar outputs but in the area of brackishwater fisheries: a) established feeding rates of new diets for shrimp and milkfish; b) established techniques for water quality management in tambaks and; c) 20 hectares of brackishwater research ponds developed at UNHAS.

Inputs to the RCCF's Research Institute of Marine Fisheries (RIMF) in Ambon and the University of Pattimura (UNPATTI) will establish the following outputs : a) an upgraded BSc marine fisheries training program at UNPATTI; b) the initiation of a research program in fisheries marketing and fish processing aimed at developing locally processed marine fish products with longer shelf life and better storage characteristics; and, c) the initiation of collaborative research with the National Institute of Oceanology (LON) and the National Space Agency (LAPAN) to identify the locations and migratory patterns of commercially important fish species.

3. The completion of several special studies that will result in the development of a policy planning and analysis capacity within the MOA, and the field testing of a fishery market information system in Eastern Indonesia in order to improve the flow of fish products, reduce transportation costs and improve the market power of small scale fishermen.

4. The overseas training of 15 MSc and 5 PhD staff.

5. Upgraded aquaculture/fisheries research facilities at the project institutes and universities.

## 4.8 End of Project Status

To achieve the Project's purpose of installing viable fisheries research programs at the MOA that will address significant regional fisheries production and marketing constraints, the following will be in place by the end of the project:

1. Improved capacity of AARD Fisheries Research Institutes to conduct research in support of the national research agenda.

2. Improved capacity of key universities to teach and conduct research in support of the national research agenda.

3. Improved analytical capacity within the government to identify and act on constraints to production, processing and marketing.

4. Increased GOI support for a coordinated national fisheries research program.

5. Technological packages for fish culture developed, tested and evaluated and systems for disseminating technologies established.

The presence of these indicators will be verified through field inspections, the passage of GOI laws and decrees, project monitoring reports, project reports, private sector investments, and project evaluations.

# 5. SUMMARIES OF THE TECHNICAL, SOCIAL SOUNDNESS, ADMINISTRATIVE, ECONOMIC AND FINANCIAL, AND ENVIRONMENTAL ANALYSES

## 5.1 Technical Analysis

Indonesia has significant potential for expanding its aquatic resources, both intensively and extensively. The basic technologies for aquaculture and capture fisheries are in place; fish stocks include several commercially proven species; production inputs of fertilizer, feeds, chemicals and harvest equipment are available; and both the short- and long-term demand for fisheries products appear to be good. An in-depth examination of this potential is provided in Annex I.

### 5.1.1 Aquaculture

Freshwater aquaculture of some fish species on Java and North Sumatra, notably carp and tilapia, approaches the intensive levels found in developed countries. However, over 225,000 ha of brackishwater aquaculture activities with shrimp and milkfish produce only 10 to 20 percent of the potential output, primarily due to the lack of appropriate technology for the development of economically feasible spawning/fry production programs and commercial diets. Carp inbreeding in hatcheries, and poor water quality, diets and diseases also represent critical limiting factors.

Tilapia, as prolific spawners, mature at three to five months and overpopulate the culture system unless males and females are stocked separately or sex reversal is used to produce all-male fry. Reproduction techniques for possible important new freshwater species, such as catfish (Pangasius and Clarias), Belida (Notopterus) and Jelawat carp (Leptobarbus) have not yet been refined to fit Indonesia's specific needs.

Other production constraints for both fresh and brackishwater species include lack of specific and least-cost fish diets/commercial feed for specific species; poor surface water quality; the lack of groundwater systems, specifically for hatchery operation and fry production; fish diseases and parasites; pollution and/or bacterial contamination of fish; poor production facility design; fish farmers' low management capabilities; weak fisheries extension service; few post-graduate trained fisheries educators and researchers; the low level of proven techniques and technologies to extend to the producer; and low availability of efficient credit and market systems.

### 5.1.2 Marine Fisheries

Approximately 90 percent of the 1.3 million marine fishermen contributed 70 percent of the total landings of 1.71 million mt in 1984*. Marine landings more than doubled between 1970 and 1984 while production increases in other fisheries sectors remain modest. Over the past 14 years, the marine sector has grown considerably in importance.

As a result of the diverse characteristics of the Indonesian archipelago, the country's marine fisheries are complex. Diverse fishing techniques are needed and range from simple hand lines and gill nets to modern trawlers. The majority of marine landings are produced by a wide range of traditional fishing activities. Of Indonesia's total fishing fleet of 313,640 vessels in 1984, approximately 70 percent were non-motorized and 20 percent were powered only by outboard motors. Ten percent of marine fishing establishments do not use boats, and therefore are confined to shallow coastal areas.

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* Fisheries Statistics of Indonesia 1984 (DGF 1986)

The DGF estimates a maximum sustainable yield (MSY) of 4.5 million mt from Indonesia's 3.1 million km2 of archipelagic territorial waters, and a further 2.1 million mt from the 2.5 million km2 within the 200 nautical mile EEZ (Exclusive Economic Zone). These estimates suggest that current levels of resource exploitation are only about 25 percent of MSY. However, Indonesia's marine fisheries resources are unevenly exploited. The western areas are under heavy pressure, with levels of fishing efforts greater than necessary to achieve maximum sustainable yields. In the eastern areas, stocks are underexploited and would support expanded fishing and larger harvests. Generally, shallow inshore fisheries are heavily exploited and, with the exception of coastal waters surrounding some sparsely populated islands, offer limited potential for expanded production. This is particularly true for the Maluku Straits, the north coast of Java, and South Sulawesi, which accounted for 54 percent of total landings and 49 percent of all marine fishermen in 1984.

Modernization in the marine fisheries subsector, without strengthened research capability and management training to produce a continuous stream of new technologies, will quickly lead to the over-exploitation of marine stocks in Western Indonesia. The DGF estimates that the marine stocks offtake in Eastern Indonesia is currently 20 percent of the potential. Although capture technology is generally adequate, the remoteness of the area, the high costs and nature of processing and transportation, and marketing requirements for inner island distribution, reduce the competitiveness of marine products relative to fresh fish.

### 5.1.3 Fisheries Extension System

Fisheries extension activities are provided through the MOA's Agency for Agriculture Education, Training and Extension (AAETE) and through provincial fisheries offices of the Directorate General of Fisheries (DGF). Universities and research stations work with provincial fisheries staff to provide limited technical assistance to fish farmers and

fishermen. As a general rule the fisheries extension system ranges from good to poor. In the immediate areas where there are universities and fisheries research stations backstopping the provincial fisheries services such as in Java, extension servies are good and technology and services flow through the fisheries extension services to the producer. However, in the outlying areas, services are generally not readily available and fisheries extension staff are inadequately trained, limited in number and are not well supported with critical extension tools (survey, soil, water testing equipment and laboratory backup facilities) or transportation. Moreover, the existing extension services in general need to be strengthened - backed by improvements in the availability and delivery of production and credit inputs - in order to fully capitalize on the existing technology and for the extension of new technology needed to increase the productivity in the three fisheries areas.

This project will link into and support the upgrading of fisheries extension services by establishing "hands on" training programs at key universities to better train extension specialists to transfer the improved and/or new technology coming from the project's upgraded fisheries research programs.

5.1.4 Prospects

Policy problems will focus primarily on supply/demand concerns. The uneven distribution of Indonesia's population is reflected in the unevenness with which fisheries resources are exploited. Productive and easily accessible fishing grounds located near major population centers are already at or near maximum levels of exploitation. In the eastern half of the archipelago, however, the relative sparseness of the population limits local demand. Available resource assessment data suggest that fishing grounds in the eastern half of the archipelago offer the greatest scope for expanded harvests, contingent on improved processing, marketing and distribution channels.

Export-oriented state fisheries enterprises in North Sulawesi, the Malukus, and Irian Jaya have been established, complete with shore-based

facilities for handling the catch and carrier boats to transport frozen fish and shrimp to foreign markets. However, a parallel infrastructure does not yet exist to support domestic inter-island fish trade.

The processing, distribution, and marketing of fish in Indonesia is complex and no one system dominates. Low value fish products originating from small-scale fishermen are handled by several middlemen before the product reaches the consumer. Shorter marketing chains characterize high value products such as shrimp. Processing techniques also vary. Approximately half of the 1.7 million tons of the 1984 marine capture was sold as fresh products. The other half was preserved by drying and salting, boiling, fermenting, smoking, freezing, canning, and conversion into fishmeal. The percent distribution of marine products using these preservation techniques can be found in Table 2 in Annex I.

This project is technically sound because it addresses major fisheries development constraints by providing the type of technical assistance, training, special studies and support for research and education facilities to effectively complement public and private resources, and develop a national research agenda that will integrate GOI and donor efforts within this sector.

### 5.1.5 Future Private Sector Participation

Recognizing that the private sector currently produces the bulk of marine and inland fish, provides a large share of required credit through informal arrangements, and furnishes nearly all distribution and marketing services, future Government efforts should emphasize the provision of basic support facilities and services for the private sector. Public sector investment can be directed to the provision of key fishing ports, landing facilities, manpower training, credit, research, resource management and technical assistance. If the Government's targeted production levels are to be attained, Government policies should be designed to encourage private sector confidence, initiative and

investment. It is the private entrepreneurs, fishermen and fish farmers who have been largely responsible for the past growth of the sector. Their efforts require continued strong Government support in terms of improved infrastructure, research, training, extension and credit.

In order to overcome some of the constraints to private sector investment in fisheries, consideration should be given to the following:

a. The provision of more effective support services to commercial producers, i.e., small to large industrial level fish farmers and fishermen, market operators and processors including:

   - the basic infrastructure: fishing ports, landing sites, marketing facilities, training facilities and research centers;
   - increased manpower planning and development, expanded applied research, timely dissemination of market information, and simplified consolidated licensing procedures; and
   - expanded commercial credit lines.

b. The expansion of business opportunities, with emphasis on new areas for development; and

c. The involvement of the private sector in fisheries development planning at the different levels of decision making.

## 5.2 Social Soundness Analysis

In its early years, the project's primary focus will be to strengthen Indonesian universities and research centers to conduct applied research in the fisheries sector. Three levels of impact can be identified for social soundness analysis in relation to this project. These levels are: the institutions whose research capacity will be enhanced, the producers who will benefit in terms of increased income from improved fishery production techniques, and the people of Indonesia,

who will have the opportunity to improve their nutrition through increased availability of fisheries products and increased foreign exchange earnings obtained from the export of high-value fisheries products (e.g., shrimp). The ultimate evaluation of beneficiary impacts will involve the second and third levels (to be identified in the future). It will depend on complex interactions and cooperation between the involved institutions, a system to deliver the results of research to the producers, and an infrastructure to manage increased production. At each level, social and cultural variables can potentially influence the impact of project inputs.

Several factors influence the social soundness of the project at the institutional level. These include: relationships between the institutions whose cooperation forms an integral part of the project, factors influencing the willingness and ability of staff to participate in training and research activities, attitudes of key staff towards proposed project activities, and impact on women. Each of these factors is discussed in the following subsections and is examined in more detail in Annex J.

### 5.2.1 Inter-Institutional Relationships

One of the basic assumptions of the institution-building component of the project is that there will be cooperation between involved fisheries research institutes and fisheries faculties at the universities. This assumption is basically sound. Staff at both types of institutions note that many of the people working at the research institutes were trained at the nearby universities with whom they are expected to cooperate. In addition, staff at the research institutes are frequently requested to lecture at the universities, serve on their committees, and cooperate with university staff on research projects for the DGF. Research institutes request university staff assistance on design of research studies and frequently send staff to the university for advanced degrees. Most of this cooperation is informal, but several of the universities are in the process of formalizing relationships with the research institutes.

In addition, the research institutes already have a tradition of sharing facilities with university staff and advanced students. Advanced students usually gain access to research institute facilities by requesting research institute staff to be on their thesis committee. It was noted, however, that as the number of students continues to climb, present facilities may not be adequate. Additionally, some university staff suggest that it is inconvenient to have students and staff conducting research at facilities remote from the university. None, however, say it is impossible. Understandably, each type of institution expresses a desire to have its own facilities improved, but there appear to be no barriers to sharing facilities.

### 5.2.2 Staff Willingness and Ability to Participate in Training and Research

Staff interviewed expressed an interest and willingness to be involved in advanced training. However, the fact that time spent away at school impedes progress through the university promotion cycle must be addressed as a possible constraint to the success of the training program. While staff do not lose their functional position while they are away for training, they can lose their structural position (e.g., director, dean). However, most noted that this would not greatly influence their willingness to participate, despite a marginal loss in income. Thus, the project must demonstrate clear benefits to be gained by training that will outweigh other losses to these staff members.

All staff interviewed feel that increased research capacity is a positive factor. In the universities, published research papers contribute to academic status and ability to obtain contracts and grants. It was noted, however, that while contract research conducted for the DGF does not improve academic status, it does increase income while involved in the research.

### 5.2.3 Attitudes of Key Staff Towards Proposed Project Activities

In general, the attitudes of staff in both the research institutes and the universities are positive towards the project. They note that they had been continuously consulted as the project developed and felt they were a part of the development process. Concern, however, is expressed with respect to several issues that can be addressed during project implementation. These concerns are detailed below.

Concerns about In-Country Training: Some staff express concerns about in-country training. They note that individuals studying for advanced degrees at in-country universities usually do not finish on time, in contrast to those going abroad for training. University staff note that this is due to the fact that the students frequently have to wait for inputs (e.g., research equipment and supplies) that are often delayed in delivery.

Another concern involves advanced training in marine sciences. Staff suggest that IPB cannot give adequate advanced training without a well equipped marine research station. This observation is supported by staff at IPB who note that their training is "literature training" as opposed to hands-on research.

Concerns about Technical Assistance: Key staff at the universities note that outside experts who are brought in are usually young and "fresh out of school." They feel that the technical assistance consists of competent researchers, but without the depth and understanding needed by deans and rectors. It is suggested that some technical experts brought in be "mature scholars" with the type of experiences to provide direction for multidisciplinary program development in fisheries science.

### 5.2.4 Impact on Women

Women are represented in responsible positions in fishery departments in the universities and the research institutes. They range from a low of 12 percent of the fishery staff at UNHAS to 29 percent at UNPATTI. In the fishery research institutes women also make up between 20 and 30 percent of the research staff. This percentage is similar to their percentage representation in the fishery student body at the universities. The project will provide training to women commensurate to their representation among professionals in this sector.

### 5.2.5 Production and Nutrition Impacts

The project will be socially sound provided certain socio-cultural variables are considered during the research dissemination process. It is anticipated that there is sufficient lead time before this occurs to allow any potential negative impacts to be investigated and alleviated. Analysis of the increased nutrition earnings impact of the project is premature at the present time. However, the project is expected to have positive impact on this level also.

## 5.3 Administrative Analysis

### 5.3.1 Implications for Administration

The Ministry of Agriculture (MOA), as the implementing agent, will be responsible through its Agency for Agricultural Research and Development (AARD), for the overall administrative and policy direction of the project. This responsibility will include close coordination with the Ministry of Education and Culture (MOE), through its Directorate General of Higher Education (DGHE), for the assignment of personnel, development of annual work plans and research strategy, and monitoring and evaluation.

Liaison between the MOA and the MOE will be maintained through the AARD-DGHE Communication Forum, composed of members from both ministries, representatives of universities and the private sector, and other organizations as appropriate. The Forum will meet on an annual basis for planning and monitoring purposes. All MOE grant and loan inputs will be disbursed through the Ministry of Agriculture's Agency for Agricultural and Research Development. The disbursement of GOI support to project activities will occur as an expansion of the existing budgeting activities under each Ministry's DIK/DIP funding procedures. The Loan Agreement will contain covenants to ensure adequate and timely budget allocations by each Ministry.

### 5.3.2 Ministry of Agriculture

#### Agency for Agricultural Research and Development

The Agency for Agricultural Research and Development (AARD) was established in 1974 to carry out applied research activities. These activities are intended to facilitate increases in agricultural production to offset import requirements for basic human foods and to improve the agriculture sector's role as a foreign exchange earner.

The AARD is directly responsible for administering the GOI's agriculture research program, which includes research programs in soils, agro-economics, food and horticultural crops, industrial crops, and fisheries and animal husbandry, as well as various major international donor programs such as the AID Applied Agriculture Research Project, the World Bank National Agriculture Research Projects (I, II) and the Government of Australia Animal Production Project. The AARD is composed of a multi-tier management structure composed of a Secretariat with various supporting Centers, a system of five Research Coordinating Centers, and a network of Research Institutes. AARD has the administrative flexibility to act promptly, and it has a semi-autonomous administrative status which enables it to execute policy defined by the Ministry as effectively as possible.

Research Coordinating Center for Fisheries

RCCF is composed of a multi-disciplinary staff in the three fisheries subsectors, and has the fundamental capacity to carry out the project. Most of the facilities currently being used by the RCCF are adequately sited and distributed throughout Indonesia to provide sufficient exposure to and involvement in the development needs of the fisheries sector.

RCCF facilities consist of laboratory and office space and over 100 ha of research ponds. Two of the institutes - the brackishwater fisheries institute in Maros and the marine fisheries substation in Ambon - occupy modern facilities recently completed under World Bank funding. Most of the research institutes have from 15 to 20 professional staff assigned to each research unit, although most of the staff have the equivalent of BSc degree training.

Many of the RCCF research institutes are located in close proximity to a major university, and liaison between the technical and administrative staffs of the institutes and univerities is excellent. The institutes also have a good liaison with the provincial fisheries service of the Directorate General of Fisheries. Based on these linkages and the administrative capability and infrastructure of RCCF, there are no problems anticipated which would impede project implementation.

5.3.3 Ministry of Education

The university system has the administrative capability and flexibility to carry out the training needs of Indonesia extremely well at the BSc level, but the lack of a critical mass of post-graduate trained staff, research facilities/equipment and research funding has handicapped the development of good post-graduate training and research programs.

These public universities are under the Directorate General of Higher Education. The Directorate General is assisted by four directors: a Director of Academic Affairs, Student Affairs, Research and Community Affairs, and of Private Universities. Within each university, there is a rector, or chief executive officer, who is assisted by three vice-rectors: a vice-rector for Curriculum, Administration and Finance, and Student Affairs. Also reporting to the rector are the deans of each of the faculties in the university. Each dean is served by three assistant deans. The last level is composed of the departments in the faculties. Each department has a department head, professional staff, a secretary, and where appropriate, a laboratory director. (Details on the fisheries faculties of the project universities are provided in Annex K.)

In summary, the three universities have the infrastructure and administrative capability to carry out the activities planned under this project. The technical assistance inputs will serve to join the scattered resources of both ministries for the development of sound research and training programs. The close proximity and existing linkages of the institutions at each geographic site will facilitate meeting the objectives of the project. The geographic sites represent opportunities to address "on-site" fisheries development constraints. The proposed inputs of equipment and commodities and facility development will ensure that training participants receive "hands on" training. And finally, the emphasis on training will significantly contribute to the development of a sufficient number of fisheries scientists and scholars to meet Indonesia's needs for the development and management of its living aquatic resources.

## 5.4 Economic and Financial Analysis

The Fisheries Research and Development Project proposes investments to support training, technical assistance, research, policy analysis and limited commodity procurement to improve domestic research training and capability in freshwater, brackishwater and marine fisheries. Project

funding will focus on improving the human capital and research resources required to develop technologies and management systems that are financially viable, technically sound and ecologically sustainable (see Annex L).

The project's focus on capacity-building efforts instead of field-level production systems poses problems for an economic and financial analysis. The causal linkages among investments in human capital development, the research outputs they produce, and the increases in income streams generated when farmers apply new technologies is long and complex. While pre-project analyses of human capital investments are at best difficult, post-project evaluations of such investments have indicated that they generate significant social benefits ranging from 30 to 200 percent.

The analysis, summarized here, relies on a number of assumptions regarding the performance of the research and academic institutions involved in the project. In the case of carp and shrimp production, the analysis assumes that new capacity developed in participating institutions will be able to modify simple fishery production technologies developed elsewhere in Southeast Asia to Indonesian conditions and that these technologies will be extended and adopted by a limited member of farmers in North Sumatra and South Sulawesi. In the case of marine fisheries, limited data on the economic structure of fish processing and transport firms have restricted the assessment of potential project impacts further. In this case, the analysis focuses on identifying the direction of change in major performance variables, such as fishermen's income, supply, and demand which could result from the application of improved technologies in Eastern Indonesia and Java.

Different analytical approaches applied in the analysis of carp and shrimp culture systems and the marine fishery system resulted in two sets of analytical results. In the first case, simple techniques were used to determine the financial viability of various components within carp and shrimp production systems: carp hatchery production, paddy carp production, carp pond production and tambak production are examined. This analysis suggests the following general conclusions:

1. Annual financial rates of return associated with improvements in these production systems are favorable, ranging from 21 to 67 percent after provision is made for family labor.

2. Returns on invested capital occur in an acceptable period of time in each system. For example, payback periods on investments range from 3.4 to 5.0 years.

3. Favorable financial rates of return are maintained over a wide range of output prices and quantities. In the most sensitive system, carp pond production, net returns fall to zero only after output prices decline by 28 percent and/or yields drop by 18 percent. Other enterprises could effectively sustain declines of 30 to 40 percent in prices and yields, and still maintain net profitability.

4. Potential employment gains from technological adoption could be significant if only 10 percent of the potential area of carp and shrimp available for expansion is converted and uses the new production technology. In this case, 7400 man years of new employment, valued at US $2.65 million per year, would be generated.

5. Finally, employing the above conservative assumptions, annual economic returns from expanded production could generate US $78.1 million in net economic benefits per year, or seven times the total project investment costs.

To achieve these returns it is critical that the GOI improve its extension capabilities and the supply of credit to producers. Although not a specific objective of this project, sizeable Asian Development Bank and World Bank loans are now focusing on these problems.

A different set of analytical methods was used to assess the potential impacts of improved processing on marine fish captured in Eastern Indonesia. A review of supply and demand trends on Java suggests that project investments to improve processing and decrease the transportation costs of dried fish shipped from Eastern Indonesia are viable and compatible with current demand trends. By 1990 Java will require 128,000 additional metric tons of fish to meet increases in domestic demand. Traditional suppliers of fish to this market (the Maluku Straits, the North and South coasts of Java, and the South coasts of Sulawesi and Kalimantan) will not be able to supply this increase on a sustained yield basis. Eastern Indonesia, with low exploitation rates, offers a potential long-term source of increased supply. Assuming 23 percent of incremental Javanese demand will be in the form of dried fish (the national average) and 20 percent of this is supplied by Malukuan fishermen, this would result in increases in gross income to Malukuan processors and fishermen of Rp 21.8 billion or US $19.5 million per year and generate 73,000 man days of additional employment annually.

## 5.5 Environmental Analysis

The construction activities planned under the project will be limited to the development of small research facilities in scattered locations, which will be used for manpower training and research related to the improvement in the production and management of Indonesia's aquatic resources. Thus, because the primary focus of the project is on manpower training and institutional development, with limited construction of research facilities, there will be no negative physical impact on the environment. (The recommendation of the initial environmental examination is provided in Annex M.)

# 6. IMPLEMENTATION PLAN

## 6.1 Phasing of Project Activities

Project activities will be implemented over a six-year period (1986-1992). In order for project activities to be initiated in the latter part of the first project year, close attention to the planning and coordination of inputs in the early stages of the project will be necessary. Of particular importance is the contracting of long-term technical assistance, the development of preliminary procurement plans, initial commodity procurement, and the initiation of training activities.

### 6.1.1 The First 12 Months

1986

Aug. : - Project agreement signed.

Oct. : - USAID issues PIL No. 1.
- Technical assistance contracting initiated.

Dec. : - Initial conditions precedent met.
- FY 87-88 GOI project budget developed.
- MOA names project manager.
- MOE names university coordinators.
- AARD-DGHE Communication Forum, PIU, and Working Groups established
- RFP for technical assistance contract completed.

Jan. : - First overseas training candidates selected and English language training initiated.

1987

Apr. : - Negotiate and award TA contract.

Sept.: - Project management specialist arrives.
- Research facility design specialist arrives.
- First vehicles procured.
- Short-term TAs for IPB, UNHAS, UNPATTI and RCCF research institutes arrive for initial assignment.

Oct. : - Research plan drafted for each project institute/institution.

6.1.2 Major Events During the Life of the Project

The major events occurring over the life of project are summarized below.

Year 1 - AARD-DGHE Communication Forum, Project Implementation Unit, and Working Groups established.
- First group of overseas long-term training participants in English language training.
- Long-term consultants on board.
- Training and research plans drafted for each project institute/institution.

Year 2 - Long-term training participants depart for training.
- Fisheries research facilities at IPB, UNHAS and RIFF - Palembang designed and construction initiated.
- Research plan developed for each project institution.
- National Fisheries Research Agenda drafted in conjunction with DGF and fisheries universities.
- Project monitoring system initiated.
- Special studies: Assessment of Fisheries Policy and Planning; Strategies for National Fisheries Research Policy.
- Detailed list of commodities developed by short-term consultants and project managers for each component.

Year 3 - Construction on fisheries research facilities completed.
- Project commodities arrive.
- Special studies: Assessment of Foreign and Domestic Fisheries Marketing Opportunities; Strategies for Establishing Pilot Market Price and Reporting System.

Year 4 - Fish nutrition and fish processing researchers complete diet development and fish processing objectives. Diets developed for carp, catfish and shrimp, fish processing training and research program underway at UNPATTI.
- Overseas MSc training participants return to Indonesia.
- Mid-term evaluation of project.
- Upgraded fisheries training and research programs initiated at project universities and research institutes.
- In-country short-term training initiated.

Year 5 - Overseas PhD training participants complete degree training and return to their institutions to initiate training and/or research programs.
- Freshwater fisheries programs at IPB, Bogor and Palembang expanded.
- Brackishwater and marine fisheries research programs expanded at Maros and Ambon.

Year 6 - Broodstock and fingerling development programs for carp and catfish in place. Fish production technology for commercially-important fish developed. Marine fish marketing and processing training programs in place.
- All institutions with critical mass of scientists and/or scholars to sustain upgraded research and training programs.
- End of project objectives met.
- Final evaluation.

## 6.2 GOI Implementation Arrangements

Project implementation and coordination responsibilities will rest with the Agency for Agricultural Research and Development (AARD), Ministry of Agriculture (MOA), in collaboration with the Directorate General of Higher Education (DGHE) in the Ministry of Education and Culture (MOE) using the already established AARD-DGHE Communication Forum and procedures for joint research/educational activities. Budget requests and financial management for the project will be the overall responsibility of AARD. There are three existing levels of AARD-DGHE coordinating units in implementation and management of the project.

### 6.2.1 AARD-DGHE Communication Forum

The Communication Forum headed by the Director General of AARD will have the responsibility for overall coordination of policy and program activities. The Communication Forum includes representatives of the Indonesian Institutes of Sciences (LIPI), Ministry of State for Research and Technology, BAPPENAS, Planning Bureau of MOA, DGHE, AARD, and Department of Finance. Various donor agencies' representatives may be commissioned as ad-hoc members. Development of a National Fisheries Research Agenda and reviews of project activities and issues will be the responsibility of the Communication Forum. Annual meetings will be held in conjunction with the annual Fisheries Research and Development Project meeting.

### 6.2.2 Project Implementation Unit (PIU)

The Project Implementation Unit (PIU), headed by the Director General of the Research Coordinating Center for Fisheries (RCCF), will be established within the AARD, for conducting day-to-day operations of the project. The PIU will coordinate the activities of the three Working Groups in terms of technical and financial reporting, monitoring, and evaluation.

### 6.2.3 Working Groups

Three Working Groups will be established to address the three project areas of freshwater aquaculture, brackishwater aquaculture, and marine fisheries. These Working Groups will be located at the respective project sites of Bogor-Palembang, Maros and Ambon. The respective Working Groups will have the following representation:

- Working Group on Freshwater Aquaculture Research
  - Bogor Agriculture University (IPB)
  - RCCF Institute in Bogor
  - University of Riau
  - RCCF Station in Palembang
  - Provincial Fisheries Service (West Java, South Sumatra and Riau)
  - Private Sector

- Working Group on Brackishwater Aquaculture Research
  - University of Hassanuddin
  - RCCF Institute at Maros
  - Provincial Fisheries Service (South Sulawesi)
  - Private Sector

- Working Group on Marine Fisheries
  - University of Pattimura
  - RCCF Station in Ambon
  - Provincial Fisheries Service (Maluku)
  - Private Sector

The Working Groups will be responsible for the implementation of project activities related to their respective area, including monitoring all activities and submission of all technical and financial reports to the PIU. In addition, the Working Groups will submit research proposals through the PIU for consideration by the Communication Forum.

## 6.3 AID Implementation Arrangements

### 6.3.1 Project Management Responsibilities

Within the Agriculture Research Division, Office of Agriculture and Rural Development, the Division's Fisheries Development Officer will be the designated Project Officer with overall management and implementation responsibilities for the project. The Project Officer will maintain liaison with the PIU and the technical assistance contractor and will coordinate mission project backstopping. The Project Officer will be assisted by an FSN fisheries development specialist who has extensive experience with USAID and the GOI in the areas of fisheries and agriculture development.

During the life of the project, the technical research assistance required by the project components will be supplied through a long-term direct USAID technical assistance contract. Long-term consultants will be backstopped by a number of short-term consultants who will return periodically over the life of the project. These short-term advisors will share in the implementation of the project by developing procurement lists, training and research plans, and monitoring plans. Key short-term advisors will assist in project planning and monitoring activities in addition to research program backstopping. Linkages between USAID/Indonesia's Agriculture and Education offices will serve to strengthen the planning and monitoring activities at the project universities.

### 6.3.2 Procurement of Goods and Services

Loan funded procurement of goods and services under the project will be solicited from firms or individuals in Code 941 countries, Indonesia and the United States. Grant funded procurement of goods and services will be solicited from firms or individuals in Indonesia and the United States. Goods and services funded by the project budget will be procured on a competitive basis, and will be advertised both in Indonesia and the United States.

### 6.3.3 Technical Assistance Procurement

The technical assistance proposed for this project reflects the diversity of technical support needed to address fisheries development needs that vary across the three fisheries subsectors. However, the technical assistance component has projected short-term consultants at universities and research institutes where limited Indonesian post-graduate faculty or staff are already assigned or will be assigned early in the life of the project. It is anticipated that an AID direct contract, using educational institution selection procedures, will be used to procure the long-term technical assistance through a lead university with sub-contracts with other universities or private firms, or through a university consortium for the short-term technical assistance. However, some of the short-term assignments to the RCCF research institutes may be provided through a PASA with the Division of Research, U.S. Fish and Wildlife Service, Department of the Interior. Detailed job descriptions for the proposed technical consultants are provided in Annex H.

#### Long-term Technical Assistance

Long-term technical assistance will be provided for a total period of 6.0 years. The long-term technical assistance will support Fisheries research policy and planning related to freshwater aquaculture, brackishwater aquaculture and marine fisheries. A team leader will have his office at the RCCF headquarters in Jakarta and will assist the

Director of RCCF in the management of the project, and in planning and implementing research, training, and policy activities.

Short-Term Technical Assistance

Sixty-eight person months of short-term technical assistance will be provided at the project universities, the AARD fisheries research institutes, and for special studies and project evaluation. Assignments will include specialists in the areas of fry production, genetics, water quality, nutrition and management. As described in Annex H, short-term consultants will play a key role in the planning and implementation of research programs for each of the project components and provide backstopping to participants returning from training and for the expansion of research activities.

Special Studies

In order to address critical policy questions related to the continued development of Indonesia's fishery resources, several special studies are planned. These studies may include the evaluation of priority issues such as the identification of factors affecting high ocean freight rates, the role of public vs. private investment in fisheries development, fish market structure and its effects on consumption and welfare, and the impact of foreign investment on export fish production, and the effects of improved management and conservation of coral reef on fish production. In addition, assistance may be provided to develop a market data system for policy analysis and improved information flows among fishermen, processors and major retailers.

This project component will establish pilot market price and supply collection and reporting systems in Sulawesi, Sumatra, Ambon and Java. If successful, these pilot projects could be expanded to encompass other major consumer and producer areas and eventually lead to the time series data required to support major policy analyses. Additional special studies related to the expansion of business opportunities for the private sector are anticipated.

### 6.3.4 Training

#### Long-Term Training Abroad

The project will provide post-graduate training for a total of 20 participants, 10 at key fisheries research institutes and 10 at universities. It is anticipated that this will include 15 MSc and 5 PhD staff members at RCCF, IPB, UNHAS and UNPATTI to develop a critical mass of research scientists at RCCF institutes in Bogor, Palembang, Maros and Ambon, and the upgrading and expansion of post-graduate training and research programs in aquaculture at IPB and UNHAS, as outlined in Table 6. In addition, staff in the newly-formed fisheries faculty at UNPATTI will be trained to the MSc level in various marine fisheries disciplines to support fisheries development-production in Eastern Indonesia. Every effort will be made to maximize the participation of female staff from both the institutes and universities components for post-graduate training. In addition, both the AARD and the DGHE will select trainees who will return to assignments appropriate to their training (e.g., trainees for the activities in Ambon would be current residents of that area and would return there after training to apply their newly acquired skills in research activities).

#### Short-Term Training In-Country

Two types of short-term training will be utilized to assist in the development of project objectives: 1) two to three week training courses that will be provided under the specialties of the various short-term technical advisors assigned to the research institutes, universities and the MOA extension service, and 2) a four to six week management training course that will be provided in years 4 and 6 of the project by a short-term management specialist.

TABLE 6. TRAINING ACTIVITIES ABROAD (MOA AND MOE)

| Long-term Training | 86 | 87 | 88 | 89 | 90 | 91 | 92 |
|---|---|---|---|---|---|---|---|
| RIFF - Bogor Staff I (Fish Nutrition) | | | ——— | ——— | ——— | | |
| RIFF - Bogor Staff II (Fish Genetics) | | | ——— | ——— | ——— | | |
| RIFF - Palembang Staff I (Fish Prod.) | | | ——— | ——— | ——— | | |
| RIFF - Palembang Staff II (Fish Prod.) | | | ——— | ——— | ——— | | |
| RICA - Maros Staff I (Fish Prod.) | | | ——— | ——— | ——— | | |
| RICA - Maros Staff II (Fish Diseases) | | | ——— | ——— | ——— | | |
| RIMF - Ambon Staff I (Fish Marketing) | | | ——— | ——— | ——— | | |
| RIMF - Ambon Staff II (Marine Biology) | | | ——— | ——— | ——— | | |
| RIMF - Ambon Staff III (Post Harvest Loss) | | | ——— | ——— | ——— | | |
| RIMF - Ambon Staff IV (Mariculture) | | | ——— | ——— | ——— | | |
| IPB Faculty Member I (Aquaculture) | | | ——— | ——— | ——— | * | |
| IPB Faculty Member II (Aquaculture) | | | ——— | ——— | ——— | * | |
| IPB Faculty Member III (Fish Economics) | | | ——— | ——— | ——— | * | |
| IPB Faculty Member IV (Post Harvest Loss) | | | ——— | ——— | ——— | * | |
| UNHAS Faculty Member I (Fish Economics) | | | ——— | ——— | ——— | * | |
| UNHAS Faculty Member II(Aquaculture) | | | ——— | ——— | ——— | | |
| UNPATTI Faculty Member I (Fish Economics) | | | ——— | ——— | ——— | | |
| UNPATTI Faculty Member II(Fish Processing) | | | ——— | ——— | ——— | | |
| UNPATTI Faculty Member III(Fish Marketing) | | | ——— | ——— | ——— | | |
| UNPATTI Faculty Member IV (Mariculture) | | | ——— | ——— | ——— | | |
| | | | | | | | |
| Short-term Training | | | | | | | |
| RCCF Staff | | - - - | - - - | - - - | - - - | - - - | - - - |
| University Staff | | - - - | - - - | - - - | - - - | - - - | - - - |
| | | | | | | | |

* PhD Degrees

Short-term training provided by the project technical advisors during years 4 to 6 will be used to upgrade the research, production and technical capabilities of the project research institute and university staff, and to help train MOA fisheries extension staff and serve to introduce the latest technology to project activities and producers. Short-term management training will be used to assist project component managers in upgrading their management skills and initially (year 4) be related to the development of expanded research activities under the project. The follow-on course scheduled for year 6 will emphasize the management and planning skills of the project managers to more fully utilize the project resources in place. The upgraded research institute and university programs are expected to play an important role in providing the institutional capability to assist AAETE in fisheries extension training.

### 6.3.5 Renovation/Expansion of Facilities

The Fisheries Research and Development Project will provide loan funds to renovate and expand research facilities at RIFF-Palembang, IPB and UNHAS. The upgraded research facilities will provide the basic infrastructure for the universities to conduct research and training, and for RCCF to conduct integrated research and demonstration activities. The anticipated shift of the RIFF-Palembang research activities from a 2 ha site in the city of Palembang to a 50 ha site located on the large MOA Patra Tani Experiment Station will provide a potential opportunity to commercialize the important freshwater fish in Sumatra and to develop speciality training programs in applied research-management for university and MOA extension staff.

The main inputs into the development of the new RIFF site will include the renovation of the existing ponds, office, and staff buildings and the development of an additional 10 ha of research ponds and a wet laboratory. Pond construction costs are expected to be moderate because the project will use GOI construction equipment assigned to the Patra Tani Experiment Station to carry out the pond renovation and the construction of new ponds.

Upgrading the research facility at IPB by constructing additional ponds will provide IPB with the capacity to expand its capability to conduct practical research on feeding and stocking rates, polyculture and reproduction, and to improve its aquaculture training program.

The development of a small research facility at UNHAS will provide facilities for hands-on aquaculture management training for BSc students and limited opportunities for some post-graduate participant and faculty research. The development of the RCCF research facilities at Maros and Ambon is in progress under the World Bank-GOI National Agriculture Research Project II. The majority of the post-graduate participant and faculty research studies planned for the brackishwater fisheries component will be conducted in the RICA-Maros research facility.

### 6.3.6 Commodities

Due to the types and sources of commodities to be purchased under the project, a variety of procurement methods will be used. Table 7 lists the types of commodities, the projected year of procurement, and the commodity source. It is anticipated that the vehicles to be procured will be locally assembled vans of predominantly Japanese-manufactured parts. This procurement will require a source/origin waiver which the Mission expects will be covered in the Agency-wide annual blanket vehicle waiver. The equipment procurement will be grant and loan-financed. The GOI will finance the costs of locally-available fish production commodities. It is anticipated that a US minority-owned procurement service contractor will be used to procure the loan-financed Code 941 source commodities.

All loan-financed in-country procurement will be performed by AARD. USAID will procure the vehicles and farm research station equipment using AID direct procurement procedures. The Mission has adequate direct hire support staff to undertake direct in-country procurement effectively. In-country procurement by the AARD will follow the guidelines in Chapter 3 of USAID Handbook 11.

TABLE 7. PROPOSED COMMODITY PROCUREMENT PLAN

| Loan Financed | Procurement Schedule | Source/Origin |
|---|---|---|
| Fish Farming - Research Equipment (100% L) | year 3-4 | US |
| Reference Materials Journals (100% L) | year 1-6 | US |
| SSB Radios (100% L) | year 3 | US-Indonesia |
| Feed Mill (100% L) | year 3 | US-Indonesia |
| Computers, Photocopiers (100% L) | year 2-3 | Indonesia |
| **Grant Financed** | | |
| Vehicles (100% G) | year 1-3 | Indonesia-Japan |
| Miscellaneous (100% G) For equipment/material required for special studies program and emergency parts replacement | year 2-6 | US-Indonesia |
| **GOI Financed** | | |
| Brood Fish (100% GOI) | year 3 | Indonesia |
| Fish Production Inputs (100% GOI) | year 4-6 | Indonesia |

### 6.3.7 Gray Amendment Considerations

The participation to the maximum extent possible of small business concerns, small disadvantaged business concerns, and women-owned small business concerns as contractors or sub-contractors is encouraged in accordance with Part 19 of the Federal Acquisition Regulation. Thus, the request for technical proposals for the competitively-bid long-term technical assistance team will include language to this effect and will indicate that, if at the time of evaluation, ratings against other selection criteria are found equal, the participation of such firms or other Gray Amendment entities may become a determining factor for selection with direct AID contracting. If host country contracting takes place, bidding procedures will be the same as above so long as they do not conflict with Indonesian regulations.

It is anticipated that a direct AID contract using the educational institution selection procedure will be utilized to procure the technical assistance. The request for technical proposals (RFTP) will encourage offerers to subcontract with any qualified Historically Black College or University (HBCU) for short-term technical assistance and will also include the requirement to submit small and small minority business sub-contracting plans. In addition, it is anticipated that a minority procurement service company will be used to procure the U.S. source commodities under this project.

In executing the Project Paper Facesheet the Mission Director certifies that use of Gray Amendment entities in the implementation of this project has been considered to the maximum possible extent.

# 7. COST ESTIMATES AND FINANCIAL PLAN

Recent GOI budget cuts, mandated by declining oil revenues, have severely limited the counterpart funds that GOI agencies can pledge in support of foreign-assisted development projects. In developing this project AID staff have discussed this issue with GOI officials and have designed the project in such a way as to minimize risk. First, AID's support of training early on in the project and the delayed support of research, an area of major AARD fiscal involvement, will provide AARD with sufficient time to secure additional funding, complete heavy capital investment commitments, and shift funds from infrastructre to operational research support. Also as a result of these discussions AID has agreed to loan fund all international travel associated with long-term training abroad. An approval waiver is included in Annex N.

While these steps will not ensure the required reallocation of funds in support of fisheries research, they will facilitate budgetary change and increase the probability that counterpart funds are available when needed.

## 7.1 Summary Cost Estimates

Total project costs are estimated at $11.312 million to support technical asistance, training, research, and minor facilities development and equipment purchases. The AID contribution includes $3.785 million in loan funds and $3.320 million in grant funds. The Government of Indonesia (GOI) will invest an additional rupiah equivalent of $1.507 million and will provide in-kind contributions of $2.700 million in support of the activities.* The rate used to convert Indonesian currency to U.S. currency is $1.00 = Rp 1,123. Total project costs are summarized

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* In-kind contributions of $2.7 million include salaries of 39 counterpart staff at the 7 project components and the 20 participants for the life of the project; land contributions (4 ha @ $50,000/ha at IPB, 20 ha @ $30,000/ha at UNHAS and 50 ha @ $20,000/ha at Palembang); and building contributions at Palembang ($100,000) and UNPATTI ($300,000).

in Table 8, with back-up tables by component, provided in Annex 0. Of the $7.105 million contribution from AID, approximately 71 percent represents foreign exchange costs and 29 percent represents local currency costs. Tables 1 and 2 in Annex 0 provide a breakdown of costs by project year and Ministry.

TABLE 8. BUDGET SUMMARY ESTIMATION
($ 000)

| | AID | | | |
|---|---|---|---|---|
| | Grant | Loan | GOI | Total |
| Technical Assistance | | | | |
| Long - Term 1/ (6 py) | 1,437 | | | 1,437 |
| Short - Term (68 pm) 2/ | 1,130 | | | 1,130 |
| Construction | | 500 | | 500 |
| Equipment | 240 | 1,270 | 482 | 1,992 |
| Training | | | | |
| Long-term Abroad (55 py) 3/ | | 1,671 | | 1,671 |
| Short-term In-Country (100 pm) | | | 140 | 140 |
| Special Studies | 220 | | 100 | 320 |
| Project Administration/Research | | | 648 | 648 |
| SUB-TOTAL | 3,027 | 3,441 | 1,370 | 7,838 |
| Contingency and Inflation (10% Subtotal) | 293 | 344 | 137 | 774 |
| In-Kind Contribution | | | 2,700 | 2,700 |
| T O T A L | 3,320 | 3,785 | 4,207 | 11,312 |

1/ Includes funds for in-country support (housing, utilities, furnishings, appliances and travel for long-term consultants and job-related operation and maintenance costs of vehicles for the consultants) and for miscellaneous equipment items.

2/ Includes $110,000 for additional round-trip air fares/annum for the 7 senior short-term consultants assigned to the universities and research institutes to participate in the annual project reviews and National Fisheries Research Planning activities.

3/ Loan funds include in-country English language training and overseas degree training for 5 Phd and 15 MSc Degrees; GOI funds include all pre-departure and in-country travel for overseas training.

4/ This figure is not exactly 10% due to the requirement to make a last minute budget change after receipt of budget allocation from AID/Washington. Upon mutual agreement of the AARD-DGHE Communication Forum and AID, some of the grant contingency funds may be used for in-country research studies.

7.1.1 Loan Budget

The upgrading and/or expansion of project research facilities (AARD facilities at Palembang and university research facilities at IPB and UNHAS) will require an estimated $0.5 million, which will be provided under loan financing. In addition to construction, the AID loan will support a variety of equipment procurements ($1.5 million) and provide $1.7 million for overseas training (see Tables 3 and 4, Annex O). The GOI will contribute to the procurement of commodities to be purchased in-country, namely fish production inputs ($0.5 million), and to training costs ($0.1 million). A key component of support from the GOI is for the expanded research activities to be implemented in project years 4 through 6. Activities will include an expanded use of existing laboratory facilities and fish production in 46 new hectares of research ponds. The GOI will contribute $0.6 million for support to the research program under administrative costs in addition to the production inputs under commodities.

A contingency and inflation cost of 10 percent has been calculated by funding component and project year (Table 1, Annex O).

7.1.2 Grant Budget

AID grant funds of $2.6 million are provided for 11.7 person years of long-term and short-term technical assistance in fisheries research, production and management (Table 5, Annex O). The contract will be a AID direct contract with direct payment and normal audit coverage. Approximately $0.3 million of the technical assistance funding is provided for in-country support to the technical advisors and $0.2 million is provided for the special studies component, which includes support for the development of national fisheries research plans. GOI will provide $0.1 million to support the special studies component. Approximately $0.2 million is provided for vehicle and research station equipment procurement. Table 6 of Annex O contains the illustrative list of special studies and budgets. AID funds for special studies support

related to the development of a national fisheries research agenda will be committed via a PIL, and payment documentation will be subject to the USAID Controller's Office program of voucher verification.

## 7.2 Disbursement Procedures

### 7.2.1 Loan Funds for Construction

The renovation/expansion of the research facilities under the project will be designed and supervised by a long-term technical specialist. Construction activities will be limited to the completion of construction tasks designed by the facility development specialist and GOI counterparts. It is anticipated that funds for these minor construction activities will be disbursed through the technical assistance contract.

### 7.2.2 Loan Funds for Other Components

Equipment and commodities procured offshore and overseas training will be committed via PIOs and financed through direct AID payment to the suppliers. AID financed local equipment and commodities and in-country training support, such as research funding and English language training, will be financed under PIL procedures with direct payment to suppliers. It is anticipated that there will be a university contract and that this contract will include training. The university contract may also include a limited amount of funding for equipment and commodity procurement.

### 7.2.3 Grant Funds Disbursement

The major use of the grant funds is for technical assistance. Disbursements will be by direct payment to the Contractor(s). Grant funds for special studies will be disbursed by direct payment to suppliers for the short-term contract special studies and by

reimbursement to GOI for the activities related to the development of a national fisheries research agenda. Grant funds for vehicles and research station equipment will be disbursed by direct payment to suppliers.

## 7.3 Audit Procedures

Technical assistance financed by AID direct contracts is subject to audit. In order to minimize vulnerability, the Mission Controller will conduct periodic examination of records, and as part of its voucher examination program, will review GOI accounting procedures and documentation relating to their direct procurement financed under the project. Project funding is also available for audit of host country contracts should they be employed, following guidelines from the USAID Inspector General's Office. This audit coverage will be performed by auditors through local representatives of U.S. certified public accountant firms, the selection of which will be made by AID/Washington with assistance from the Regional Inspector General-Audit Division in Manila. These services will be procured by AID direct contract following direct payment procedures.

# 8. MONITORING AND EVALUATION

The monitoring and evaluation system proposed for the Fisheries Research and Development Project is structured to address three sets of information needs. The first is the need to monitor the formulation and coordination of a national fisheries research agenda. The second information need concerns the institutional development of AARD and participating universities with regard to their capacity to undertake fisheries research. The third information need concerns assessment of overall project performance. This is a periodic rather than continuous information need which will be addressed in mid-term and final evaluations. The first two needs, in contrast, are continuous and will be addressed in the establishment of a routine monitoring system. (Details of specific indicators to be monitored and mechanisms to undertake monitoring activities are contained in Section 1 of Annex P.)

## 8.1 Project Monitoring

### 8.1.1 Research Agenda

The principal mechanism for monitoring the formulation and coordination of research activities will be annual reviews sponsored by the AARD-DGHE Communication Forum. The purpose of the review will be to bring together scientists from AARD fisheries programs and university researchers to discuss national research priorities in the three subsectors supported through the project. Research undertaken to date will be discussed and plans formulated for overall sectoral research activities in the coming year. Included in these reviews will be discussions of such issues as whether or not the current research programs are addressing the priority needs of the country and the allocation of budgets based on the identification of these priorities. The extent to which research findings are being successfully disseminated and the role of the private sector in research and extension would also be included in these discussions.

On the basis of these annual meetings, recommendations will be made regarding changes in the national fisheries research agenda and the resources required to carry out the revised program. To assist with the annual reviews, the project will provide a special studies fund for visits by eminent fisheries researchers to assist AARD and the universities in analyzing the direction and performance of the research program.

### 8.1.2 Institutional Development

The monitoring of institutional development will be accomplished through the preparation of annual workplans for each institution involved in the project. This plan will be expected to conform to the priorities outlined at the annual reviews of the national research agenda and specify areas of activity for the coming year (staff assigned to the activities, technical assistance requirements, budget, and a description of the specific outputs of the project). A principal function of the technical assistance team will be to assist with the preparation of these plans.

Institutional development monitoring will also track progress in the development of improved linkages among the participating institutions. The focus of this component of the monitoring system will be the degree to which the participating institutions share facilities and information, and cooperate with one another in other ways.

Finally, the monitoring of institutional development will involve tracking improvements in research capacity. Areas of focus will, for the monitoring system, be primarily related to the management system developed to support research. Specific issues include the establishment of procedures for preparing and submitting proposals, the review of proposals, and tracking the progress of research in process.

## 8.2 Project Evaluation

Two project funded evaluations involving non-project personnel are planned. The mid-term evaluation will occur in year 4 of the project and will focus on overall progress towards increasing the capability within AARD and participating institutions to plan and carry out aquaculture research in the three subsectors supported under the project. The following questions will be addressed as part of the mid-term evaluation:

- Has the project resulted in improving the quality and quantity of research proposed and conducted at the involved institutions, have adequate financial and human resources been provided, and is the research proceeding in the directions outlined by the project and is it applicable to the needs of Indonesia?

- Has the manpower development program been effectively implemented, as evidenced by attention to national fisheries research requirements and the specific project training needs of each institution?

- Are mechanisms being developed to improve the quality and quantity of interactions between the involved institutions?

- If problems have developed in the process of project implementation, has management learned lessons from these problems and taken steps to apply these lessons to improve the implementation process?

The team for this evaluation should include expertise in the areas of freshwater aquaculture, brackishwater aquaculture, and marine fisheries. At least one of the team members should have extensive experience in the management of institution-building projects.

The final evaluation will focus on the achievement of the specific objectives of the project. The following questions will be asked:

- Has institutional capability improved to the extent that involved institutions are able to both produce capable researchers, and plan and conduct high quality research on their own?

- Is there evidence that the institutions involved are working together to solve problems in aquatic research and development?

- Has the project resulted in an increase in the quality and quantity of appropriate aquatic research which can be applied in a socially-sound manner to the solution of fishery development problems in Indonesia, as outlined in the project paper?

The team for the final evaluation should consist of experts in the areas of freshwater and brackishwater aquaculture, marine fisheries, fisheries economics, fisheries anthropology/rural sociology, and the management of institution-building projects. In addition to these outside consultants, Indonesians with expertise in similar areas will participate in the evaluation.

# 9. CONDITIONS AND COVENANTS

## 9.1 Conditions

### Additional Disbursement: Construction Activities

Prior to disbursement under the Loan, or to the issuance by A.I.D of documentation pursuant to which disbursement will be made for construction activities, the Borrower will, except as the parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) evidence that sufficient land and/or buildings for the facilities to be constructed have been acquired;

(b) evidence that a comprehensive survey of the proposed pond sites has been completed to ensure that the soil and water conditions are suitable for the culture of fish; and

(c) a detailed plan and budget for pond construction, facility renovation or construction, and operation and maintenance of facilities constructed.

### Short-Term Technical Assistance

Prior to disbursement of funds for short-term consultancies, the Contractor shall submit to A.I.D. for approval an Annual Short-term Technical Assistance Work Plan and supporting Financial Plan to include Terms of Reference, specific dates and identification of counterparts and contact institutions.

## 9.2 Covenants

Except as A.I.D. may otherwise agree:

(a) Within three months from the signing of the Agreement, the Borrower/Grantee will appoint the Director of the Project and Project Implementation Unit Committee members.

(b) The Borrower/Grantee will ensure that adequate budget allocations for project implementation, including funds for the procurement of commodities, research studies, and research facility and vehicle operation and maintenance, GOI project counterpart travel and per diem will be provided in a timely manner consistent with implementation schedules developed by the Project Committee.

(c) the Borrower/Grantee will furnish to A.I.D., in form and substance satisfactory to A.I.D., time-phased implementation schedules for the project years commencing on September 1, 1987, 1988, 1989, 1990, and 1991, each based upon the results of a review of the Project during the previous twelve-month period.

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

# INDONESIA
# FISHERIES RESEARCH AND DEVELOPMENT PROJECT

## PROJECT PAPER

497-0352

## VOLUME II - ANNEXES

August 1986

## ANNEXES

A. Project Logical Framework

B. Project Checklist

C. Section 611 (e) Certification: Fisheries Research and Development Project

D. Project Identification Document Facesheet (PID)

E. GOI Request for Assistance

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H. Technical Assistance Requirements

I. Technical Analysis

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K. Administrative Analysis

L. Economic and Financial Analysis

M. Initial Environmental Examination

N. Approval Waiver: International Travel Costs for Long-Term Participants

O. Cost Estimate Tables

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## ANNEX A. PROJECT LOGICAL FRAMEWORK



Evaluation for Period: _____ to _____

Project Title: Fisheries Research and Development Project

Date Prepared: _____

| NARRATIVE SUMMARY | OBJECTIVELY VERIFIABLE INDICATORS | ASSUMPTIONS | MEANS OF VERIFICATION |
|---|---|---|---|
| A. Program or Sector Goal | Measures of Goal Achievement | Assumptions for Achieving Goal | |
| Improve public and private sector management systems which provide key inputs to Indonesia's fisheries sector and thus improve sector employment, per capita income and efficiency. | Increased flow of services-research, human capital, technology transfer-available to fish farmers and fishermen and an increase in production accompanied by declining unit costs. | Improved government/private sector services will lead to increased employment/income/efficiency. | 1. Local production/price statistics<br>2. Project monitoring system |
| B. Project Purpose | End of Project Status | Assumptions for Achieving Purpose | |
| To install viable fisheries research programs at MOA and key universities that will address significant regional fisheries production and marketing constraints. | 1. Improved capacity of AARD Fisheries Research Institutes to conduct research in support of the national research agenda.<br>2. Improved capacity of key universities to teach and conduct research in support of the national research agenda.<br>3. Improved analytical capacity within government to identify and act on constraints to production, processing and marketing.<br>4. Increased GOI support for a coordinated national fisheries research program.<br>5. Technological packages for fish culture developed, tested and evaluated and system for disseminating technologies established. | 1. Availability of improved technologies to fish producers removes constraints to increased productivity and employment.<br>2. GOI interested and willing to alter current policy to encourage private sector involvement in input supply market development and extension.<br>3. Private sector interested in expanded role.<br>4. Technology can be generated that is economically viable and acceptable to producers. | 1. Field inspection<br>2. GOI laws, decrees<br>3. Project monitoring reports<br>4. Project reports<br>5. Private sector investment<br>6. Evaluation |

| C. Outputs | Magnitude of Outputs | Assumptions for Achieving Outputs | |
|---|---|---|---|
| 1. Improved AARD and university programs in fisheries research and training. Staff trained in new/ improved fisheries research and management systems. | 1. Upgraded research and training programs at RCCF, IPB, UNHAS, and UNPATTI. Overseas training of 15 MSc and 5 PhD staff/faculty. 100 pm of ST in-country fisheries/ management training for RCCF and university staff. | 1. Complimentary budget available for AARD and universities to operate facilities and conduct research studies; and staff/ faculty acceptable for overseas training. | 1. Project reports, copies of documents produced. |
| 2. Upgraded aquaculture/fisheries research facilities at selected project institutes and universities. | 2. 16 laboratories equipped. 34 new ha of research ponds (10 ha RCCF-Palembang, 4 ha IPB, 20 ha UNHAS). | 2. Water and soil quality adequate for pond construction and fish production at all sites. | 2. Field inspection, Project reports. |
| 3. Development of a national fisheries research agenda to be implemented by AARD and Indonesian universities. | 3. Development and support of a national research program, adoption of a cooperative agreement between the MOA and DGHE in support of research program. | 3. GOI willing to support research implementation. | 3. Field inspection, Project reports. |

| D. Inputs | Implementation Targets | | | | Assumptions | |
|---|---|---|---|---|---|---|
| | GOI | AID(L) | AID(G) | ($000) | 1. GOI and AID funds will be available. | GOI budgets, project reports and financial data. |
| Technical Assistance | - | - | 2,567 | 2,567 | | |
| Construction | - | 500 | - | 500 | | |
| Equipment | 482 | 1,270 | 240 | 1,992 | | |
| Training | 140 | 1,671 | - | 1,811 | | |
| Special Studies | 100 | - | 220 | 320 | | |
| Administration/Research | 648 | - | - | 648 | | |
| Contingency/Inflation | 137 | 344 | 293 | 774 | | |
| In-Kind Contribution | 2,700 | | | 2,700 | | |
| T o t a l s | 4,207 | 3,785 | 3,320 | 11,312 | | |

ANNEX B. STATUTORY CHECKLIST

5C(2) PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B. applies to projects funded from specific sources only: B.1. applies to all projects funded with Development Assistance loans, and B.2. applies to projects funded from ESF.

| | |
|---|---|
| CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT? | YES. SEE GPT II PP AMENDMENT 2, ANNEX F.<br>YES. SEE ATTACHED 5C(3). |

A. GENERAL CRITERIA FOR PROJECT

| | |
|---|---|
| 1. FY 1986 Continuing Resolution Sec. 524; FAA Sec. 634A. Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project. | A CN has been prepared. Obligation will occur upon expiration of the notification period without Congressional objection. |
| 2. FAA Sec. 611(a)(1). Prior to obligation in excess of $500,000, will there be (a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimte of the cost to the U.S. of the assistance? | (a) Yes.<br>(b) Yes. |
| 3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance? | No further legislative action is required. |

| | | |
|---|---|---|
| 4. | FAA Sec. 611(b); FY 1986 Continuing Resolution Sec. 501. If for water or water-related land resource construction, has project met the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See AID Handbook 3 for new guidelines.) | N/A. |
| 5. | FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project? | Yes. See Annex C. |
| 6. | FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. | No, but based upon AID's previously assistance in this area, multilateral financing may follow for activities initiated by AID under this project. |
| 7. | FAA Sec. 601(a). Information and conclusions whether projects will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions. | This project should directly encourage (b), (c), and (d). |

| | |
|---|---|
| 8. FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise). | Private U.S. Contractors will supply substantial amounts of technical assistance and U.S. manufactured commodities under the project. |
| 9. FAA Sec. 612(b), 636(h); FY 1986 Continuing Resolution Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars. | The GOI contribution is approximately 37% of the total costs of the project, in Rupiah or "in-kind." |
| 10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release? | No. |
| 11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? | Yes. |
| 12. FY 1986 Continuing Resolution Sec. 522. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity? | N/A. |

| | |
|---|---|
| 13. FAA 118(c) and (d). Does the project comply with the environomental procedures set forth in AID Regulation 16. Does the project or program take into consideration the problem of the destruction of tropical forests? | Yes. An IEE has been prepared as an Attachment to this PP.<br><br>N/A. |
| 14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate sysem for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)? | N/A. |
| 15. FY 1986 Continuing Resolution Sec. 533. Is disbursement of the assistance conditioned solely on the basis of the policies of any multilateral institution? | No. |
| 16. ISDCA of 1985 Sec. 310. For development assistance projects, how much of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)? | No set amount will be only so available, but the RFTP for the TA contract will highlight the opportunities for Gray Amendment entities to participate, particularly as subcontractors for short term TA. In addition, a minority PSA will be used furnish U.S. source commodities. |

## B. FUNDING CRITERIA FOR PROJECT

### 1. Development Assistance Project Criteria

a. FAA Sec. 102(a), 111, 113, 281(a). Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status, (e) utilize and encourage regional cooperation by developing countries?

The project will contribute to (a),(b),(c), and (d). It will develop technology to improve the production, processing, transport and marketing of fisheries products which will favorably impact on the majority of small scale fishermen and fish farmers. Emphasis on the processing and marketing of fish products will promote an increased level of participation of women. Twenty percent of the training inputs for the project will be for training of women staff in the project institutes and universities.

| | |
|---|---|
| b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used? | Yes. The project meets fully the criteria under Section 103 of the FAA. |
| c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)? | Yes. The project will emphasize a range of appropriate fish production technologies to maximize fish production and management capabilities found at the small farm and small business levels. |
| d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed country)? | Yes. The GOI will contribute approximately 37%, in cash or "in-kind". |
| e. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth? | Yes. |

| | |
|---|---|
| f. FAA Sec. 128(b). If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority? | Yes. |
| g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government. | The project supports established GOI policy to increase food production through the expansion of research and development of fisheries production and management technology at a national level. There is a strong institutional development and training component to the project. Project R&D will key on the priority constraints to fish production, i.e., the major problems of the producers of fisheries products. |

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information an conclusion on capacity of the country to repay the loan, at a reasonable rate of interest.

The GOI has an excellent history of loan repayments.

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

N/A.

3. Economic Support Fund Project Criteria

Not ESF-Funded

a. FAA Sec. 531(a). Will this assistance promote economic and political stability? To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of part I of the FAA?

N/A.

b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities?

N/A.

c. ISDCA of 1985 Sec. 207. Will ESF funds be used to finance the construction of, or the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified

N/A.

that such country is a party to the Treaty on the Non-Proliferation of Nuclear Weapons or the Treaty for the Prohibition of Nuclear Weapons in Latin America (the "Treaty of Tlatelolco"), cooperates fully with the IAEA, and pursues nonproliferation policies consistent with those of the United States?

d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made? N/A.

## 5C(3) - STANDARD ITEM CHECKLIST

Listed below are the statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

A. Procurement

| | | |
|---|---|---|
| 1. | FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed? | Yes. |
| 2. | FAA Sec. 604(a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him?? | Yes. |
| 3. | FAA Sec. 604(d). If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company? | Indonesia does not so discriminate. |
| 4. | FAA Sec. 604(e); ISDCA of 1980 Sec. 705(a). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.) | N/A. |

| | | |
|---|---|---|
| 5. | FAA Sec. 604(c). Will construction or engineering services be procured from firms of countries which receive direct economic assistance under the FAA and which are otherwise eligible under Code 941, but which have attained a competitive capability in international markets in one of these areas? Do these countries permit United States firms to compete for construction or engineering services financed from assistance programs of these countries? | No. Local cost financing under the TA Contract will be undertaken for construction activities. |
| 6. | FAA Sec. 603. Is the shipping excluded from compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent such vessels are available at fair and reasonable rates? | No. |
| 7. | FAA Sec. 621. If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs? | Yes.<br><br>Yes. Project PASA actvities will not be competitive with U.S. private enterprise and will not interfere with domestic programs. |

| | | |
|---|---|---|
| 8. | International Air Transportation Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available? | Yes. |
| 9. | FY 1986 Continuing Resolution Sec. 504. If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States? | Any direct AID contract under the project will so provide. |

B. Construction

| | | |
|---|---|---|
| 1. | FAA Sec. 601(d). If capital (e.g., construction) project, will U.S. engineering and professional services be used? | No. The construction planned will be designed and contracted with locally established firms. |
| 2. | FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? | Yes. |
| 3. | FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million (except for productive enterprises in Egypt that were described in the CP)? | N/A. |

C. Other Restrictions

| | |
|---|---|
| 1. FAA Sec. 122(b). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter? | Yes. |
| 2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? | N/A. |
| 3. FAA Sec. 620(h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? | Yes. |
| 4. Will arrangements preclude use of financing: | |
| a. FAA Sec. 104(f); FY 1986 Continuing Resolution Sec. 526. (1) To pay for performance of abortions as a method of family planning or to motivate or coerce persons to practice abortions; (2) to pay for performance of involuntary sterilization as method of family planning, or to coerce or provide financial incentive to any person to undergo | (1) Yes.<br>(2) Yes. |

| | | |
|---|---|---|
| | sterilization; (3) to pay for any biomedical research which relates, in whole or part, to methods or the performance of abortions or involuntary sterilizations as a means of family planning; (4) to lobby for abortion? | (3) Yes.<br><br>(4) Yes. |
| b. | FAA Sec. 488. To reimburse persons, in the form of cash payments, whose illicit drug crops are eradicated? | Yes. |
| c. | FAA Sec. 620(g). To compensate owners for expropriated nationalized property? | Yes. |
| d. | FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? | Yes. |
| e. | FAA Sec. 662. For CIA activities? | Yes. |
| f. | FAA Sec. 636(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained? | Yes. |

| | | |
|---|---|---|
| g. | FY 1986 Continuing Resolution, Sec. 503. To pay pensions, annuities, retirement pay, or adjusted service compensation for military personnel? | Yes. |
| h. | FY 1986 Continuing Resolution, Sec. 505. To pay U.N. assessments, arrearages or dues? | Yes. |
| i. | FY 1986 Continuing Resolution, Sec. 506. To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multilateral organizations for lending)? | Yes. |
| j. | FY 1986 Continuing Resolution, Sec. 510. To finance the export of nuclear equipment, fuel, or technology? | Yes. |
| k. | FY 1986 Continuing Resolution, Sec. 511. For the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights? | Yes. |
| l. | FY 1986 Continuing Resolution, Sec. 516. To be used for publicity or propaganda purposes within U.S. not authorized by Congress? | Yes. |

ANNEX C:

SECTION 611 (e) CERTIFICATION
FISHERIES RESEARCH AND DEVELOPMENT PROJECT

This project will loan-finance approved design and construction costs of research facilities at key project sites and related commodities for approximately $1,770,000. The project will develop a collaborative fisheries research institute-university research program in three fisheries subsectors in four key geographic locations within Indonesia.

I, William P. Fuller, Principal Officer of the U.S. Agency for International Development in Indonesia, do hereby certify that in my judgment the Government of Indonesia has the financial capacity and the resources to effectively carry out, maintain and utilize the capital resources financed by this project. This judgment is based upon the analyses contained in the Project Paper, as well as upon the successful maintenance and utilization of projects in Indonesia previously financed or assisted by the United States.

William P. Fuller
Director
USAID/Indonesia

cc: G. Bisson

ANNEX D

AGENCY FOR INTERNATIONAL DEVELOPMENT
# PROJECT IDENTIFICATION DOCUMENT FACESHEET (PID)

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) Revision No. — DOCUMENT CODE: 1

2. COUNTRY/ENTITY: Indonesia

3. PROJECT NUMBER: 497-0352

4. BUREAU/OFFICE: A. Symbol: ASIA; B. Code: 04

5. PROJECT TITLE (maximum 40 characters): Aquaculture Research and Development Project

6. ESTIMATED FY OF AUTHORIZATION/OBLIGATION/COMPLETION:
A. Initial FY: 86
B. Final FY: 88
C. PACD: 914

7. ESTIMATED COSTS ($000 OR EQUIVALENT, $1 =)

| FUNDING SOURCE | LIFE OF PROJECT |
|---|---|
| A. AID | 14,000 |
| B. Other U.S. 1. | |
| B. Other U.S. 2. | |
| C. Host Country | 6,900 |
| D. Other Donor(s) | |
| TOTAL | 20,900 |

8. PROPOSED BUDGET AID FUNDS ($000)

| A. APPROPRIATION | B. PRIMARY PURPOSE CODE | C. PRIMARY TECH. CODE 1. Grant | C. PRIMARY TECH. CODE 2. Loan | D. 1ST FY 1. Grant | D. 1ST FY 2. Loan | E. LIFE OF PROJECT 1. Grant | E. LIFE OF PROJECT 2. Loan |
|---|---|---|---|---|---|---|---|
| (1) FN | 100B | 077 | 077 | 2,400 | 2,000 | 8,800 | 5,200 |
| (2) | | | | | | | |
| (3) | | | | | | | |
| (4) | | | | | | | |
| TOTALS | | | | 2,400 | 2,000 | 8,800 | 5,200 |

9. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 966

10. SECONDARY PURPOSE CODE:

11. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A. Code | BR | RGEN | TECH | | | | |
| B. Amount | | | | | | | |

12. PROJECT PURPOSE (maximum 480 characters)

To install viable fisheries research programs at Ministry of Agriculture that will address significant regional fishery production and capture constraints.

13. RESOURCES REQUIRED FOR PROJECT DEVELOPMENT

Staff: 2 mm for one sociologist

Funds: $15,000 PDS for preparation of PP.

14. ORIGINATING OFFICE CLEARANCE
Signature: Richard Cobb
Title: Chief, ARD/USAID/Indonesia
Date Signed: MM 03 DD 21 YY 86

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

16. PROJECT DOCUMENT ACTION TAKEN: A (S = Suspended, A = Approved, D = Disapproved, CA = Conditionally Approved, DD = Decision Deferred)

17. COMMENTS: Project Committee Clearance:
EHR: DFoster-Gross (Draft) PRO: RRedman (Draft)
EED: TMyers (Draft) FIN: RMcClure (Draft)

18. ACTION APPROVED BY
Signature: William P. Fuller
Title: Mission Director

19. ACTION REFERENCE

20. ACTION DATE: MM DD YY

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ANNEX E.
GOI REQUEST FOR ASSISTANCE

REPUBLIC OF INDONESIA
NATIONAL DEVELOPMENT PLANNING AGENCY
JAKARTA, INDONESIA

No. : 2786 /D.I/8/1986 Jakarta, August 27, 1986

Mr. William P. Fuller
Director
USAID/Mission
c/o American Embassy
Jakarta

Re : Fisheries Research and Development Project

Dear Mr. Fuller,

Having discussed the Fisheries Research and Development Project with the Ministry of Agriculture and the Ministry of Education and Culture, we herewith request a loan of up to 3.785 million United States Dollars (US$ 3.785 million) and a grant of up to 3.32 million United States Dollars (US$ 3.32 million). The Government of Indonesia will provide the Rupiah equivalent of US$ 1.507 million in cash and US$ 2.7 million in kind to support this project over its six-year life.

The purposes of the project are as follows :

A. To support research programs at the Ministry of Agriculture (MOA) and at key universities to improve the technological and management resources available to the public and private entities involved in Indonesia's fisheries sector.

B. To support the establishment of a national coordinated fisheries research agenda to identify and prioritize the fisheries production constraints and research needs on a national scale.

C. To strengthen the capability of key fisheries research institutes and universities staff to adopt or develop new or improved fisheries production technologies and management systems appropriate to the needs of the fishermen and fish farmers in the three fisheries sub-sectors.

D. To strengthen the post-graduate fisheries training capability of key universities to produce post-graduate fisheries scientists and managers with "hands-on" experience.

.../2

REPUBLIC OF INDONESIA
NATIONAL DEVELOPMENT PLANNING AGENCY
JAKARTA, INDONESIA



E. To assist in the assessment of fisheries policy and planning issues, fisheries marketing opportunities and in developing strategies for fisheries research policy and marketing systems through collaborative studies and research efforts with the Directorate General of Fisheries (DGF) and the Agency for Agriculture Education, Training and Extension (AAETE).

The project will be implemented by the Ministry of Agriculture.

We look forward to your favorable consideration.

Sincerely yours,

Muchtarudin Siregar
Deputy Chairman of BAPPENAS

cc. : 1. Head, AARD
Dept. of Agriculture
2. Director General of Higher Education
Department of Education & Culture

## ANNEX F. PROJECT DESIGN ISSUES

The Project Identification Document identified the following issues for additional analysis during Project Paper preparation:

### 1. GOI Financial Support for Research

In spite of the economic and budgetary constraints facing Indonesia, the GOI has maintained a strong commitment to agriculture sector research and development. The results of this commitment are highlighted by the success in rice production. Despite some shortfalls and delays in Ministry of Agriculture (MOA) counterpart budgets to the USAID-supported Applied Agriculture Research Project (AARP) prior to IFY 84/85, GOI contributions have been accelerated over the past two years. Construction activities are being completed on schedule.

As discussed more fully in Section 3.2, "Institutional Setting," the AARD Fisheries Centers' consolidated routine and development budgets over the last five years have ranged from a high of Rp. 2.69 billion in FY82/83 to the current low of Rp. 2.07 billion in FY86/87 with some fluctuation in the interim years. This has represented about 10% of the overall AARD budget annually. The FY86/87 development budget for Fisheries was cut by approximately 45% from the prior year's level, while the routine budget was increased by some 13%. While the reduction in the development budget necessitated across-the-board cuts, one third of the reduction was taken by cutting the number of operating research vessels from three to one.

Under the Fisheries Project the cost of research activities will peak and level off in year four at an estimated additional cost of Rp. 0.50 billion. In essence, the anticipated post-project research and development budget would need to be restored to the IFY 1985/86 levels to sustain the level of research activity achieved under project auspices. This is not an unreasonable proposition. However, in light of GOI budget stringencies in the short to medium term, this expectation may be overly optimistic. In implementing the

project, the research element will be focused on short-term, high impact studies. As important, however, the project will identify and establish priorities for a research agenda in the fisheries subsectors to provide both AARD institutes and the universities a reasonable basis for allocation of scarce human and financial resources.

2. Coordination Between Ministries of Agriculture and Education

The proposed coordination between AARD and the universities builds on existing agreements. Formal agreements already exist between a number of the AARD institutes and universities for collaborative research and training. In addition, although formal collaborative mechanisms are new and not yet well developed, faculties and research institute staff have a long history of sharing facilities and exchanging information on an informal basis. A similar collaborative program between AARD and MOE under the Applied Agriculture Research Project has been made final and procedural questions of management and control resolved. Both ministries have agreed to follow existing arrangements in this project, i.e., the AARD will serve as the implementing agency through a project committee chaired by AARD's Director of the Research Coordinating Center for Fisheries (RCCF) and composed of members from each of the AARD fisheries research institutes and university faculties involved in the project.

3. Institutional Capability of IPB, UNHAS and UNPATTI

The 1985 AID Aquatic Resource Sector Review did not identify serious institutional problems at IPB, UNHAS or UNPATTI. A follow-up review by USAID staff in early 1986 confirmed this conclusion. The review team found the fisheries curricula and staff at IPB and UNHAS generally adequate for under-graduate studies, and post-graduate studies in some departments. New fisheries faculties at both institutions should be adequate for expanded research and training.

In addition, institutional problems at UNPATTI encountered during the implementation of the AID-funded Science and Technology Project, completed in 1983, appear to be resolved. A new Rector has been appointed, the Department of Fisheries has been upgraded to a Faculty of Fisheries, and plans for long-term development of the faculty are being formulated. Staff appointments have increased from 15 to a current total of 45 with five staff having MSc post-graduate fisheries degrees and twenty-five Sarjana level degrees from IPB. Finally, a fish technology laboratory has been constructed and a research program in post-harvest handling and fish processing is being planned. These changes indicate that UNPATTI has both the capability and commitment to develop a strong BSc training program in marine fisheries technology and economics with support from this project.

d. Overall Level of Technical Assistance

The task of molding scattered manpower resources and facilities of two ministries in the three fisheries subsectors into a national fisheries research and development program requires substantial technical assistance input. Six person-years of long-term technical assistance will be provided. Short-term technical assistance, 68 person-months, will assist the four research institutes and three universities to develop, implement, manage, and evaluate research programs over the life of the project.

5. Coordination with Other Donors

The design of this project takes into consideration ongoing and planned development activities of other donors. Extensive discussions were held with other major donors i.e., World Bank, Asian Development Bank and United Nations Development Program, and site activities of other donor projects were reviewed

wherever possible. Rather than overlap with other donor activities, the project complements other donor support in the sector. For example, an initial project design supported freshwater fisheries extension activities in North and South Sumatra. This element has been dropped and activities restructured to support a major World Bank effort to improve fisheries extension beginning in 1987. The AID-supported project will compliment this effort by upgrading the capability of key universities to provide post-graduate fisheries training for extension specialists assigned to train DGF field extension staff.

In addition, overseas post-graduate training supported under the project will complement the World Bank's program to train thirty RCCF staff abroad. As pointed out in the World Bank review of the Research Coordinating Center for Fisheries (RCCF) in 1985, the outputs of the combined training will not provide more than the minimum number of scientists that RCCF needs to develop the vast Indonesian fisheries sector.

6. Technical Clarification

a. Freshwater Fisheries Subsector Activities in Sumatra

The USAID-funded aquatic resource survey in 1985 included a broad sector analysis of the aquatic resources sector of Indonesia. It is an exceptionally good review of the constraints to developing the freshwater subsector and has offered sound recommendations for increasing production over the short-term through the adoption of modern technology. However, previous attempts to introduce modern fisheries production and management have not worked very well in Indonesia because of the extremely weak base of technically-trained manpower. Thus, this project will emphasize post-graduate training for Indonesian staff to develop programs that will adapt or develop the technology and management systems that Indonesia needs to better utilize and manage its freshwater fisheries subsector.

b. Brackishwater Fisheries Subsector Activities in South Sulawesi

The design for the brackishwater fisheries subsector has addressed priority constraints to improved milkfish and shrimp production and the quality of brackishwater fish products. Thus, activities to be implemented under this component will focus on aspects not being addressed by other donors, namely manpower development and research on selected environmental issues. The potential for upgraded training and research in brackishwater fisheries under UNHAS and RICA is significant; and the support for conducting research to improve management, water quality and the quality of fish products addresses priority constraints across the three fisheries subsectors.

## ANNEX G. OTHER DONOR ASSISTANCE

### 1. Asian Development Bank Assistance

ADB is the largest donor involved in development of Indonesia's fishery sector. Total funding provided by the Bank since 1972 has been approximately $94.6 million. ADB has financed six projects, four of which have focused exclusively on marine fisheries. Two current projects, the Sumatra Fisheries Development Project located in Padang, and the Brackishwater Aquaculture Development Project located on several islands, are involved with aquaculture. A second brackishwater project, currently in the planning phase, is expected to begin in 1986. It will focus on increased production of both marine fish from the eastern region and expansion of shrimp and milkfish from tambaks. The ADB projects are listed in Table 1.

These ADB projects have traditionally been capital development projects: 37 percent for fishing vessels, 31 percent for contingencies and working capital, 22 percent for shore facilities, 7 percent for carrier vessels and 3 percent for consultants and training (ADB, 1984). The Bank's emphasis on production-oriented projects does not address the underlying marketing constraints that USAID intends to address through manpower development in key institutions.

TABLE 1. ASIAN DEVELOPMENT BANK PROJECTS IN FISHERIES AND AQUACULTURE

| Projects | Date | Description |
|---|---|---|
| Riau I* | 12/72-07/77 | Production of fish and prawns in Sumatra for export to Singapore |
| Irian Jaya I* | 03/74-01/82 | Pole and line (P&L) fishing and export of skipjack from Sorong, Irian Jaya |
| Java I* | 07/75-12/84 | Purse seining for small pelagic fish in the Java Sea and storage and distribution of fish in Java |
| Sumatra I* | 05/81-12/86 | Production of demersal and pelagic fish in Sumatra for local market and export |
| Irian Jaya II* | 09/82-03/88 | Production of tuna and skipjack for export and local marketing. Development of an artisanal fishing village in Sorong, Irian Jaya |
| First Brackishwater Aquaculture* | 05/83-03/89 | Production of shrimp and milkfish for export and local marketing |
| Second Brackishwater Aquaculture Project** | Proposed | Production programs in East Kalimantan, South Sulawesi, West Nusa Tenggara, South Kalimantan, West Kalimantan, West part of Sumatra |
| Marketing Study** | Proposed | Detailed study of the production, distribution and marketing of fish for domestic consumption and export. |

* ADB Report No. INO: APR-91
** Information from Directorate General of Fisheries

ADB has been involved with two quasi-state enterprises, P.T. Tirta Raya Mina (TRM) and P.T. Usaha Mina, both of which are operating in marine fisheries in the same areas of Eastern Indonesia. Closer coordination between these two enterprises could alleviate the private sector's distributional problems through access to these carrier services.

The ADB has also conducted a short-term study entitled "Fish and Fishery Products Marketing Study." The study's field work was conducted in 1985 and the report examines all aspects of marine and brackishwater marketing systems.

## 2. World Bank Activities

The World Bank has a major loan program in the fishery sector (see Table 2). The Bank's loans include investments in commercial fishing, tambak development, training and market facilities. The majority of their loans are for outer island development. Production loans are site specific, and marketing is not included. In addition, two Bank projects planned to begin in 1987 (NAEP III and NAR III) will train approximately 200 fisheries extension workers and a limited number of other professionals, and 30 RCCF staff members, respectively.

## 3. Japanese Investment

The Japanese Government continues to make investments in Indonesia's fishery sector, most recently funding a new port in Jakarta. New loans are being proposed to develop that facility further. The Japanese Government is also involved in improving other port facilities in the archipelago. Construction on these sites will be conducted during 1985-1986.

TABLE 2. WORLD BANK AND GOVERNMENT OF JAPAN LOANS TO THE GOVERNMENT OF INDONESIA FOR FISHERY PROJECTS

| Agency/Country | Description | Location | Amount of Project | Time Period |
|---|---|---|---|---|
| 1. BECF/Japan Japan | Jakarta fishing port | Jakarta | US $50 Million | Finished |
| 2. BECF/Japan | Engineering service | 6 distribution centers | US $1 Million | 1985-1986 |
| 3. World Bank Fisheries Development | Strengthening tambak development | Semarang | US $4 Million | 1986-1989 |
| 4. World Bank Fisheries Development | Strengthening fishery extension | Sorong, Ambon, Medan, Singaradja, East Nusa Tenggara | Proposed | |
| 5. World Bank Fisheries Development | Develoment of skipjack fisheries | East Nusa Tenggara | Proposed | |
| 6. World Bank Fisheries Development | Shore facilities | Halmahera, Maluku, Tomini Bay (Ampana and Tilamutu), North Sulawesi | Proposed | |
| 7. World Bank Fisheries | Brackishwater | Aceh, Riau, Jambi, Central Sulawesi and South Sulawesi | Proposed | |
| 8. World Bank NAEP | Training | National | US $70 Million | 1987-1992 |
| 9. World Bank NAR III | Training | National | Proposed | |



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TABLE 3. TECHNICAL ASSISTANCE GRANT PROGRAMS TO THE GOVERNMENT OF INDONESIA

| Agency/Country | Description | Location | Amount of Project | Time Period |
|---|---|---|---|---|
| 1. FAO | Sea farming | Lampung | US $1.3 Million | 1984-1988 |
| 2. FAO | Support to extension services on outer islands | North, Southeast, and Central Sulawesi, Maluku, East Nusa Tenggara | US $1.2 Million | 1984-1988 |
| 3. Indonesia Fish Development Project (INFIDEP) Second Phase FAO/Canada | Description not available | Not known | US $250,000 | 1984-1985 |
| 4. USAID | Small-scale fisheries | Several | US $3.4 Million | 1980-1985 |
| 5. West Germany/GTZ Second Phase | Small-scale fisheries<br>- production<br>- marketing<br>- processing | West Nusa Tenggara | D.M. 3 Million | 1980-1987 |
| 6. European Economic Community (EEC) | Fresh fish marketing and production | Prigi and Bulu Central Java | US $.8 Million | 1984-1988 |
| 7. Belgium | Artemia culture | Jepara, Java | B.F. 19 Million | 1982-1985 |
| 8. Denmark | Study of fisheries | Ujung Pandang | US $300,000 | |
| 9. Italy | Study on brackishwater irrigation | Aceh Province North Sumatra | US $1.2 Million | 1985-1986 |
| 10. Denmark | Development of fisheries-fishing | Pelabuhan Ratu West Java | Proposed | |
| 11. Nordic Group | Shore facilities and expansion | West Nusa Tenggara (Lombok) | Proposed | |

## 4. Technical Assistance Grant Programs

Most of the technical assistance projects shown in Table 3 are production oriented. The EEC project in Prigi and Bulu will market fresh fish in the interior of East Java. Fishing boats, shore facilities and transport trucks are all planned for the project. There are no projects to assist private sector export marketing firms. Furthermore, no projects address key constraints to improving the distributional problems of moving fish from surplus areas to deficit consumption areas.

# ANNEX H. TECHNICAL ASSISTANCE REQUIREMENTS
# (ILLUSTRATIVE ONLY)

## 1. Long-Term Technical Assistance

### Senior Fisheries Management Specialist (Team Leader)

The person selected to fill this position will play a key role in the implementation and management of the project. The individual should have wide experience in tropical fisheries development, management and research. Training and/or experience in administrative management is essential. The ability to coordinate (and manage) various research institute and university freshwater, brackishwater and marine fisheries research programs into a national fisheries research program will be necessary. This person should have a general knowledge of pond design and construction, fish farming-culture, hatchery management, processing and marketing, and agriculture credit and extension. Some knowledge of fisheries capture would be most helpful. This individual should have a minimum of five years of fisheries development experience in developing countries. This experience should include a minimum of three years of administrative experience dealing with people of different cultures.

In addition to fisheries development and administrative experience, the senior fisheries management specialist must have a minimum of seven years teaching/research experience in a warm-water fisheries program in one or more U.S. university fisheries departments. An achieved minimum rank of associate professor and publication in major fisheries journals are a must. A PhD in warm-water fisheries production and/or management, with a speciality in either freshwater or brackishwater fisheries is required. Leadership capability will be extremely important.

The person in the position of team leader will work directly with the project director. He will report directly to the Fisheries Development Officer of USAID/I and keep him fully informed of the project. The team leader will also work directly with the various

universities of the Directorate General of Higher Education, involved in the project. He will be responsible for the activities of all the members of the technical assistance team and for project monitoring activities. The team leader will be responsible for quarterly and annual progress reports, and the implementation and control of any record-keeping system required by USAID. He will also help identify and schedule short-term assistance and special studies as required under the technical assistance contract. This specialist will be needed for five years.

Aquaculture Facility Design Specialist

This specialist should have practical knowledge of tropical aquaculture or fish farming and a minimum of five years of commercial aquaculture experience. Experience in the design and construction of fish ponds and hatcheries is a must as the assignment will require the design and construction supervision of research facilities at three of the project component sites.

The facility design specialist will work directly with the director of the Research Institute of Freshwater Fisheries in reference to the development of a freshwater fisheries research facility at Palembang. He will report directly to the project director and the team leader and keep them fully informed on his activities.

The facility design specialist will also work directly with the Institute of Pertanian and the University of Hasanuddin in reference to the design/rehabilitation of aquaculture research facilities at the two institutions. This individual will be responsible for quarterly and annual progress reports and the implementation, monitoring and control of any management system assigned by the team leader, to include the design of the three facilities to be constructed by the project. This position will be for one year (project year 2).

B. Short-Term Assistance

Under the technical assistance portion of the project, a total of 68 person months of short-term assistance will be required during the life of the project. This will include, but not be limited to, the following disciplines: fish nutrition/genetics, aquaculture, marine fisheries, research management, fish economics, post harvest, water quality, and fish marketing and processing, special studies, and project evaluation. The disbursement of funds for short-term consultants will be contingent on submission by the contractor for USAID's approval annual short-term technical assistance work plans and associated financial plans, to include terms of reference, dates, identification of counterparts, and institutes involved.

Short-term Specialists

The short-term specialists should have a minimum of ten years teaching and/or research experience and a PhD in their speciality. An achieved rank of professor or senior scientist (if assigned to an experimental station) with a minimum of two years of administrative experience is desirable. Publication in major journals is a must. Leadership capability will be extremely important.

Short-term specialists will work directly with the institute director or faculty dean of their assignment. They will report directly to the project director/team leader. They will be responsible for progress and/or trip reports for each annual assignment. The short-term specialists will be responsible for the development and implementation of any record-keeping and monitoring system required by USAID. They will also assist in short-term studies, seminars or assignments as required under the technical assistance contract. It is recommended that specific annual assignments be carried out by the same individual for the life of the project.

3. Reporting

Quarterly reports to USAID (in English) and the GOI (in Bahasa Indonesia) will be required to provide data and information on the progress of the project and where appropriate, recommendations and decisions or actions which are required in the view of the consultant. Annual implementation reports will be prepared by the TA team assigned to each component and combined, detailing project implementation plans and recommendations for future action. Reports to USAID should be sent to the USAID office in Jakarta (3 copies). Reports to the GOI should be sent to: Kepala Research Coordinating Center for Fisheries (1 copy); Direktorat, Agency for Agriculture Research and Development (1 copy); and the Director General of Higher Education (1 copy).

4. Implementation

An important aspect of project management will involve monitoring activities. Technical reports from the short-term consultants should complement the monitoring and reporting activities for their components. The team leader, however, should visit component sites at least once every quarter to personally review activities. The technical assistance contract will provide funds for this travel and the cost of preparing quarterly and annual reports.

## ANNEX I. TECHNICAL ANALYSIS

### 1. Fisheries Conditions and Implications for Development

The archipelago of Indonesia consists of over 13,600 islands dispersed over an area of 2.7 million km2. As a result of this dispersed land mass, development has been uneven. At present two-thirds of the population are concentrated on the inner islands of Java, Bali, Madura and Lombok where development and utilization of resources and infrastructure are reasonably modern. On the other hand, most of Indonesia's undeveloped resources, and in this case, potential for fisheries development, are located in the sparsely populated islands, which include the larger islands of Sumatra, Kalimantan and Sulawesi for fresh and brackishwater fisheries and the Malukus for marine fisheries.

Fisheries technology varies greatly across Indonesia. Modernization in the marine fisheries subsector - without the research capability and fisheries management training to adapt and manage new technologies - has led to the over exploitation of the marine stocks in Western Indonesia. Freshwater aquaculture of some species on Java and in North Sumatra, notably carp and tilapia, approaches the intensive levels found in developed countries. However, over 225,000 ha of brackishwater aquaculture activities with shrimp and milkfish only produce from 10 to 20% of the potential output, primarily due to lack of technology to develop sound and economic spawning/fry production programs and a satisfactory commercial feed. With the exception of carp and tilapia, the availability of fry is probably the most serious constraint for the intensification of production with most fresh and brackishwater species; however, fry production with carp in many hatcheries has been decreasing due to inbreeding. Water quality, diets, and diseases are factors which have less of an impact, but limit production with all of the species.

The DGF estimates that the marine fish offtake in Eastern Indonesia is currently 20 percent of the potential. Although capture technology is generally adequate, the remoteness of the area, higher capture costs and the processing and transportation requirements for marketing in the inner islands reduce the competitiveness of the product within existing fresh fish markets.

Thus, Indonesia has significant potential for expanding its living aquatic resources, both intensively and extensively. The basic technologies for aquaculture and capture fisheries are in place; fish stocks include several commercially proven species; the potential for production inputs of fertilizer, feeds, chemicals and harvest equipment is adequate; and both the short- and long-term demand for fisheries products appear to be good. However, based on GOI and donor investments to date, efforts to adapt modern technology and management to Indonesia's fisheries sector have not significantly increased production. Therefore, faced with the need to develop a critical mass of researchers and scholars to address this problem in the three fisheries subsectors, this project has selected four geographic sites: Java (Bogor) and Sumatra (Palembang) for freshwater fisheries, Sulawesi (Ujung Pandang) for brackishwater fisheries and Maluku (Ambon) for marine fisheries (Table 1). These sites represent key areas for development in each of the subsectors, and provide for the collaboration of research institutes and university programs to develop manpower training and research capability under programs that will address the priority constraints to fisheries development in each subsector.

The following sections answer questions about: a) the availability of the proper technology and inputs to support a viable fisheries production program in each of the subsectors; b) the existence of the proper resources inputs and fish stocks; c) the ability of the GOI agencies to develop and extend the various production systems to the producers; and d) the ability

TABLE 1. PROJECT STRUCTURE
FISHERIES RESEARCH AND DEVELOPMENT PROJECT

| Agency | Project Activity |
|---|---|
| Ministry of Agriculture | |
| Agency for Agricultural Research and Development | |
| Research Coordination Center for Fisheries | Fisheries research management |
| Research Institute for Freshwater Fisheries (Bogor and Palembang) | Fish production/nutrition/broodstock aquaculture research, and staff development |
| Research Institute for Coastal Aquaculture (Maros) | Staff development |
| Research Institute for Marine Fisheries (Ambon) | Staff development |
| Ministry of Education and Culture | |
| Directorate General of Higher Education | |
| Institute Pertanian Bogor (and possibly Riau Univ.) | Freshwater fish research/faculty development |
| Hasanuddin University | Aquatic ecology research/faculty development |
| Pattimura University | Marine fisn economics, processing and marketing/ faculty development. |

and willingness of the producer to adopt the improved technology. The importance of marketing, credit and extension are also addressed.

2. Aquaculture Methods

Aquaculture was introduced to Javanese fish farmers in the colonial era, when it was found that the freshwater native carp was suitable for pond rearing. Tilapia, a fish that grows well in both fresh and brackishwater and which is a prolific breeder, was introduced from Central Africa during the late 1930s. More recently, additional native species such as catfish(s), milkfish and tiger shrimp have been successfully cultured by fish farmers in Indonesia, on a limited basis.

The aquaculture methods used in Indonesia are similar to those found elsewhere in Asia. Basically, there are three aquaculture systems: a) pond or tambak culture, b) cage culture, and c) rice-cum-fish culture. Each system varies somewhat but includes directly, or indirectly, several distinct activities: brood fish development and spawning or the alternative of fry collection from the wilds, fingerling production, food fish production, harvesting and marketing. Depending on the species and the production system being used by the farmer, production inputs may include only fertilizer (organic and/or inorganic), agriculture wastes as feed and/or a commercial fish feed. The more progressive tambak farmers generally use fertilizer, feed, chemicals for disease and parasite control, and water exchange to maintain the water quality, for maximum production and profit.

Rice-cum-fish culture with carp or tilapia is also well established on the more populated islands and in North Sumatra. However, production in this system is usually limited to extensive production techniques, with little or no production inputs. Brood stock development, fry production and food fish production are usually combined in the same system with tilapia. However, with carp, some farmers specialize in fry production and most farmers purchase fry to carry out rice-cum-fish to produce fingerlings for paddy food fish production during the two-month period between rice crops.

Cage culture is relatively new to Indonesia. Fry inputs usually come from pond production systems or from fry collected in the wild and reared through a succession of stocking densities in cages. Unlike pond and rice-cum-fish culture systems, fish in cage culture systems require a full ration of feed inputs.

The assistance for planning, implementing and managing aquaculture systems in Indonesia varies greatly. Overall, MOA fisheries extension officers are poorly trained in modern fisheries technology, limited in number and often not adequately equipped with extension support equipment (survey equipment, soil and water testing equipment, etc.) or a mode of transport. However, in certain areas such as West Java and North Sumatra, the limited extension service does provide good assistance to fish farmers, which includes assistance in calculating production cost/return, for obtaining credit, and in the procurement of fingerlings from a government or private hatchery. However, such extension support is generally limited to the culture of carp and is only found in areas where previous fisheries development/intensification activities have taken place such as in Java, North Sumatra and South Sulawesi.

Although there are some fisheries which are capable of utilizing modern aquaculture techniques and technology, on the whole aquaculture production in Indonesia is at the extensive level, with a production output of less than 20 percent of the potential. The unavailability of fry is probably the most important immediate production constraint to most aquaculture programs. This is especially true for the 225,000 ha of tambaks in the brackishwater subsector, where the availability of fry is a priority production constraint for both milkfish and shrimp production. In carp fisheries, the inbreeding of brood stock has resulted in low survival rates and a loss of growth vigor. Although tilapia are prolific spawners, they mature at three to five months and in effect overpopulate the culture system unless males and females are stocked seperately or sex reversal is used to produce all-male fry. On the other hand, the reproduction techniques for possible important new species such as catfish (Pangasius and Clarias),

Belida (Notopterus) and Jelawat carp (Leptobarbus) have not been adequately developed for commercial production; thus, the priority production constraint for these species is also the availability of fry. Attempts to promote the culture of freshwater shrimp have also not been very successful.

Other production constraints, across the board for both fresh and brackishwater species, are the lack of specific and least cost fish diets/commercial feed for specific species; poor surface water quality; the lack of groundwater systems (specifically for hatchery operation and fry production); fish diseases and parasites; pollution and/or bacterial contamination of fish; poor production facility design; the lack of management capability for fish farmers; an overall weak fisheries extension service; the lack of post-graduate trained fisheries educators and researchers; and consequently the lack of tried and proven techniques and technology to extend to the producer. The availability of credit and markets are factors that will have to be addressed in most expansion/intensification programs.

Freshwater Fisheries

This project will combine the programs at IPB and RIFF-Bogor and UNRI-IPB-RIFF Palembang to directly address most of the above constraints in order to intensify production through a combined post-graduate training and research program. Other constraints such as weak extension capabilities will be addressed indirectly by the training of fisheries extension specialists for AAETE and DGF fisheries extension training programs.

At RIFF-Bogor and IPB, and in collaboration with RIFF-Palembang, a number of studies will be initiated to upgrade and develop broodstocks, and to develop specific and least-cost diets for carp (ikan mas) Jelawat carp (Leptobarbus) and catfish (Pangasius). At RIFF-Palembang the main emphasis will be directed toward developing commercial production systems for fingerling and food fish production for the above species that can be transferred to the private sector. Fingerlings produced at the

RIFF-Palembang should be sold at cost to the private sector to stimulate fish production. Although research activities at RIFF-Palembang will concentrate on intensive pond production systems, some research should be directed to improve rice-cum-fish and cage culture systems.

The project will assist in the transfer of fisheries technology by providing hands-on production training for post-graduate extension specialists to be trained in collaboration with the World Bank Extension Training Program. The upgraded technology and extension service will assist key farmers in designing and establishing successful fish production facilities. Such programs will serve both to reduce existing credit availability bottlenecks and stimulate new credit sources. Upgraded university-research institute programs coming out of the project will be capable of developing or adopting new technology in aquaculture to Indonesian conditions and this new technology can be transferred to the producers through an upgraded extension service. The technology of fish culture is evolving rapidly and this research and extension capability is essential if obsolescence is to be avoided and new techniques are to be made available to farmers. During the life of the project key farmers and extension specialists will also be encouraged to attend short seminars at RIFF-Bogor and Palembang to learn new production techniques.

Brackishwater Fisheries

Brackishwater aquaculture activities are well established in Java and South Sulawesi. Production methods are generally based on the adaption of intensive commercial aquaculture techniques and technology but much of the existing brackishwater system generally lacks the design, production and management inputs to produce at the intensive level; hence, increases in production are principally due to the extensification of tambak areas, rather than the intensification of production in existing tambaks under commercial aquaculture methods.

The principal brackishwater culture species are shrimps and milkfish. The lack of fry inputs and the low availability of an adequate commercial feed generally limit production to less than 20 percent of the potential. However, production facilities have increased at the rate of approximately 9,000 ha per year, from 172,000 ha in 1978 to 225,000 ha in 1984, primarily due to the high price of shrimp and facility development support from the GOI and donors such as the World Bank and Asian Development Bank. Due to the importance of shrimp production as a foreign exchange earner and milkfish as a protein source for in-country consumption, the DGF plans to develop an additional 175,000 - 200,000 ha on the larger but less populated islands of Sulawesi, Kalimantan and Sumatra. However, in South Sulawesi there is probably more than adequate production infrastucture already in place to support short-term production needs through the adoption of new technologies and management. In addition to the high failure rate of shrimp and milkfish hatcheries, there is a decreasing supply of fry from the wild apparently due to a combination of water pollution (siltation and bacterial contamination) and over exploitation. Thus, a continued expansion of facilities for extensive production - pending the breakthrough on the technology for commercial fry production - does not look promising.

The RICA research institute and UNHAS in South Sulawesi need to develop a training and research program with a critical mass of researchers and scholars to address the priority constraints for increasing brackishwater fisheries production in Indonesia. Taking into consideration the ongoing and planned activities of the other donor programs, USAID activities should primarily address water quality and bacterial contamination constraints to production and fish quality. This research will help ensure the continued availability of fry from nature - and production in the natural system - and improve the production and quality of fisheries in tambaks. Support for this research and research to overcome other production constraints could lead to improved production methods and significant increases in production over the life of this project. The linkage of project activities under this subsector to extension programs would be similar to that described under the freshwater aquaculture subsector.

## 3. Marine Fisheries Methods

Indonesia's marine fisheries sector is dominated by the small-scale subsector, which accounts for approximately 90 percent of the 1,295,000 people directly employed as marine fishermen and who contributed roughly 70 percent of the total landings of 1.71 million mt in 1984 [1/]. Marine landings more than doubled between 1970 and 1984 while production increases in other fisheries sectors have been modest. Marine fisheries thus not only contribute the bulk of total supply, but also, over the past 14 years, this sector has grown in overall importance.

As a result of the diverse characteristics of the Indonesian archipelago, the country's marine fisheries are complex. Fishing techniques are also diverse and range from simple hand lines and gill nets to modern trawlers. However, the majority of marine fish landings are still produced by a wide range of traditional fishing activities carried out by a large number of small vessels. Of Indonesia's total fishing fleet of 313,640 vessels (1984) approximately 70 percent were non-motorized and 20 percent were powered only by outboard motors. Ten percent of marine fishing establishments used no boat, fishing close to shore in the shallows.

The DGF estimates a maximum sustainable yield (MSY) of 4.5 million mt from Indonesia's 3.1 million km2 of archipelagic territorial waters, and a further 2.1 million mt from the 2.5 million km2 within the 200 nautical mile EEZ (Exclusive Economic Zone). These estimates suggest that current levels of resource expolitation are only about one-third of MSY. This, however, is misleading because Indonesia's marine fisheries resources are unevenly exploited. Some fishing grounds, particularly the western areas, are under heavy pressure, with levels of fishing effort greater than necessary to achieve maximum sustainable yields. In eastern areas, stocks are underexploited and would support expanded fishing effort and larger harvests. Generally, shallow inshore fisheries are heavily exploited and,

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1/ Fisheries Statistics of Indonesia 1984 (DGF, 1986)

with the exception of coastal waters surrounding some of the more sparsely populated islands, offer limited potential for expanded production. This is particularly true for the Maluku Straits, the north coast of Java, and South Sulawesi Province, which combined, accounted for 54 percent of total landings and 49 percent of all marine fishermen in 1984.

A key problem facing Indonesia's fisheries policy makers is how to match supply with demand for fisheries products. The uneven distribution of Indonesia's population is paralleled by unevenness in the degree to which fisheries resources are exploited. In broad terms, productive and easily accessible fishing grounds located near major population centers, where demand for fish is strong, are already at or near maximum levels of exploitation. In the eastern half of the archipelago, however, the relative sparseness of the population limits local demand and thereby constrains expanded fishing effort.

Available resource assessment data suggest that fishing grounds in the eastern half of the archipelago offer the greatest scope for expanded harvests. Increased exploitation of fisheries resources in the eastern islands of Indonesia would be economically feasible only if improved processing, marketing and distribution channels to domestic and international markets were established. Export-oriented state fisheries enterprises in North Sulawesi, the Malukus, and Irian Jaya have been established, complete with shore-based facilities for handling the catch and carrier boats to transport frozen fish and shrimp to foreign markets. No parallel infrastructure exists to support domestic inter-islands fish trade from these islands at a level that would significantly increase the supply of fish on Java and encourage expanded fishing efforts in these areas.

4. Marketing and Processing of Principal Fish Types

The processing, distribution, and marketing of fish in Indonesia parallel that in many Asian fisheries in terms of their complexity.

There is no one system that is dominant throughout country. For lower valued fish products originating from small-scale fishermen, several agents handle the products before they reach the consumer. Shorter marketing chains characterize high value products such as shrimp. In general, the smaller the producer the larger the number of middlemen.

Processing techniques are also varied. Only 49.9 percent of the 1.7 million tons of marine fish capture in 1984 was sold fresh (either iced or uniced). Fifty and one tenth percent was preserved in some manner, including drying and salting, boiling, fermenting (terasi, peda, or kecap ikan), smoking, freezing, canning, and conversion into fishmeal. The percentage distribution of marine fish products across these various preservation techniques can be found in Table 2.

Table 2. PERCENT DISTRIBUTION OF MARINE FISH DISPOSITION AND PRODUCTS

| Type of preservation | Disposition (%) | Products (%) |
|---|---|---|
| Dried, Salted | 65 | 61 |
| Boiled | 14 | 18 |
| Fermented (terasi) | 4 | 3 |
| Fermented (peda) | 1 | 1 |
| Fermented (kecap ikan) | 1 | 1 |
| Smoked | 5 | 5 |
| Other | 2 | 2 |
| Frozen | 5 | 5 |
| Canned | 2 | 2 |
| Fishmeal | 1 | 1 |
| Total Processed (MT) | 859,157 | 549,229 |

Source: Fisheries Statistics of Indonesia 1984 (DGF, 1986)

## Fresh Fish

The domestic marketing and processing of fresh fish is generally done relatively close to landing areas or in cities not overly far from coastal areas. Some inter-island trade exists but is limited for the most part to production areas close to Java such as South Kalimantan. There are frequently several middlemen between the producer and retailers in the marketplace. In some coastal areas where there is a large population concentration, fishermen land their fish at the market and sell directly to retailers. In less populated areas, they sell their fish to middlemen who transport the product to the market and resell it to retailers. In rural areas, especially in Maluku, fishermen's wives retail the catch. Where ice is available it is frequently used during transport, but is little used in the retail market. In general, distribution and marketing of fresh fish suffer from the relatively high cost, in relation to retail prices, of transporting fish from surplus areas to shortage areas (e.g., from East Indonesia to Java) as well as from an inadequate number of ice plants and cold storage.

## Dried and Salted and Boiled Fish

Dried and salted fish can be found in all areas of Indonesia, representing a significant source of protein as well as product traditionally preferred among some groups. The trade of dried and salted fish has evolved over a long period of time, and long-distance trade in this product is reported to be concentrated in the hands of a relatively small group of traders.

The level of quality of dried and salted fish is generally low, with relatively high levels of deterioration due to inadequate procedures used in processing. Also, insecticides are sometimes used directly on the product, creating a health hazard to consumers. Boiled fish suffer from a relatively short shelf life.

## Frozen Fish

Domestic marketing and processing of frozen fish are practiced substantially by only one state-owned company. No private enterprises are involved in the inter-island trade due to high transportation costs and limited demand, which has a negative impact on profitability.

## Distribution and Processing of Exported Fish

Most exported fish, including tuna, shrimp and other crustaceans, and jellyfish, are usually frozen. The value of shrimp exceeds all other fishery commodity exports. Processing is usually accomplished close to production areas due to high transportation costs. Collection agents purchase shrimp from producers and hold them until sufficient quantities have accumulated to justify shipment. Shipment to processors is accomplished by truck, boat, or aircraft depending on production areas.

Exported shrimp suffer from being closed out of some markets (e.g., U.S.A.) due to high levels of contamination. This quality control problem is especially severe with tambak produced shrimp.

## Inter-Island Trade in Fish and Fish Products

The major components of Indonesian inter-island trade involve the "export" of fish and fish products from South Sumatra, Kalimantan, South Sulawesi and Bali-Nusa Tenggara to Java. These "flows" have developed due to the demand on Java and the costs of transporting fish, which make it commercially impossible for Java to "import" fish from provinces further away. Most inter-island trade flows are controlled by middlemen on Java.

Most dried fish trade enters Java via trading vessels (primarily sailing ships) through the ports of Jakarta, Semarang and Surabaya. Further study is required to fully understand the volume and value of inter-island trade.

All Fishery Products

All fishery products suffer from a lack of adequate market information that could be used by both middlemen and producers to govern the production and movement of fish. The lack of information concerning markets results in periodic shortages in some areas and surpluses in others, sometimes resulting in losses of product and price instabilities which have negative economic effects on producers, middlemen and consumers.

These processing and marketing constraints have a strong negative impact on the movement of fish from Eastern Indonesia to the more populated areas; hence, such constraints will be the focus of one component of the project.

The Eastern Indonesia Fisheries development component of this project should facilitate product development research aimed at extending the shelf life of traditional products such as pindang (fish steamed with salt and sugar) and peda (dried and salted fish) through the application of new technologies, i.e., vacuum packing and solvent extraction as well as improved traditional processing methods for minor products (shark skin, jelly fish, etc.). In addition, research should include the investigation of appropriate storage and improve appropriate technologies for traditional processed products, especially salted skipjack tuna.

This component of the project should also explore the development of marketing activities to enhance policy analysis and improve information flows among fishermen, processors and major retailers of fish products. This project component could establish pilot market price and supply collection and reporting systems in areas affected by the project.

## ANNEX J. SOCIAL SOUNDNESS AT THE PRODUCER LEVEL

The three major components of the project--freshwater fisheries development, brackishwater fisheries development, and Eastern Indonesian fisheries development--have potential impacts at the producer level. These impacts will not occur until institutional development begins to provide research outputs that can be used to increase small-scale producers' production and incomes. Potential social impacts are briefly reviewed here to ensure the future social soundness of proposed areas of institutional research.

### 1. Social Soundness of Brackishwater Fisheries Development

#### Socio-Economic Setting

Initial project activities are to be focused in South Sulawesi which is inhabited primarily by Muslim Buginese and Makasarese. Producers who will be directly effected are small-scale farmers living sufficiently close to the seashore to maintain brackishwater ponds. 1982 statistics put the number of brackishwater pond (tambak) operators in South Sulawesi at 16,515 (RDA 1985). It is difficult to determine accurate numbers of producers at the present time, but DGF statistics indicate a 15 percent increase in production between 1982 and 1984. In addition, today's falling rice prices are reported to influence coastal farmers to shift rice fields to tambak production. Thus, the number of tambak operators in South Sulawesi at the present time is estimated to be as high as 20,000.

Tambak operators usually practice fish farming and paddy rice production in separate fields. All operators interviewed devote some of their production to rice, and many also keep domestic animals such as ducks, chickens, goats, and water buffalo.

Another category of small-scale operator who will be affected is the middleman who buys tambak production and sells it to the processors. These middlemen also function as suppliers between post-larval shrimp collectors and tambak operators and frequently provide credit and loans to tambak operators. Interviews at the village level suggest that there

is one middleman for approximately every ten tambak operators; hence, about 2000 middlemen will be affected by the project in South Sulawesi.

The final small-scale group to be affected is the post-larval shrimp collector. No figures are available concerning their numbers, but they are estimated to be in the many thousands. Their activity is highly seasonal; hence, the collectors are all part-time. Interviews indicate that when post-larval shrimp collection is at its peak, almost all categories of people become involved. School teachers collect in the afternoons; children skip school to be involved; and farmers and fish sellers take off time to collect the post-larval shrimp. Males, females, and children are involved in the activity. For some collectors, the activity contributes significantly to their income, and they note it would hurt them severely if curtailed.

Sociocultural Feasibility

Cultural Appropriateness: Brackishwater aquaculture has a long history in Indonesia, probably starting with milkfish culture in conjunction with salt production on the north coast of Java. In 1982 almost 70,000 households operated brackishwater ponds. Development of traditional (extensive) tambak operations has been spreading in the coastal zone of South Sulawesi for many years; hence, small-scale farmers' attitudes towards the practice in general are positive, and they see it as a way to increase their income. Intensive tambak operations, as improved by research stimulated by the project, would have a traditional base upon which to build.

Income Effects: Financial analyses of traditional and improved tambak management indicate a 650 percent increase in wages to labor and a 700 to 900 percent increase in income to management (Aquatic Resources Development Feasibility Study 1985:287). Field interviews with tambak operators support these findings. Hence, tambak operators able to use intensive techniques would clearly benefit. Middlemen and post-larval suppliers, handing more production, would also be likely to benefit.

Nutrition Effects: At present most tambak production is a high value export product (i.e., shrimp) and milkfish. Improved production will thus provide locally consumed fish as well as increased income which can be used for food purchases.

Spread Effects: Distribution of tambak area, although clearly not equal, indicates that a wide range of producers could benefit, including a large number with relatively small holdings. According to DGF (1985), 45 percent of the tambak operators in South Sulawesi manage less than 2 hectares, 34 percent from 2 to 5 hectares, 15 percent from 5 to 10 hectares, and only 6 percent manage more than 10 hectares of tambak. It should be noted that the distribution of tambak holdings exceeding 10 hectares varies widely across the 19 districts of South Sulawesi. Tambak holdings greater than 10 hectares make up less than 5 percent of the productive units in 12 of the districts, but in 3 districts, they make up 10 percent or more of the holdings. In one district, Wajo, fully 25.4 percent of tambak are larger than 10 hectares. Although it is reported that, in general, the holdings of those with more than 10 hectares are between 10 and 20 hectares, there appears to be some excessive accumulation of tambak area in a few localties. For example, an extension agent reports that in one village 108 families operate 907 hectares of tambak. Of this 907 hectares, nine families hold 306 hectares, or about one-third of the tambak area. This type of accumulation is made possible by the distribution of land ownership certificates throughout the extended family. However, it is not clear if such accumulation of tambak area benefits one nuclear family or if the benefits are distributed equitably to the entire extended family which could include the nuclear families of brothers and sisters. Although this is an extreme example, it indicates a potential for reducing opportunities for the targeted small producer.

Opportunity to take advantage of fish production intensification techniques in tambaks requires both capital and skills. Capital is required to improve existing tambak areas and provide inputs such as fertilizer, feed, pesticide, and increased quantities of post-larval shrimp for stocking. Knowledge is needed to manage the ponds and inputs

effectively. Although the existing shrimp production intensification program, "INTAM," had a goal of 4000 hectares in South Sulawesi for 1985-1986, it has only achieved 100 hectares operated by 69 families. This failure to reach the target is attributed to several factors: 1) too few trained extension agents to supply the knowledge to a larger number of operators; and 2) the inability of target tambak operators to obtain capital. To obtain capital from the bank under the INTAM Program farmers have to meet criteria which include 1) appropriate tambak environment, 2) good credit record, 3) uncontested land certificate, and 4) recommendation by extension agent. It is estimated that only 30 percent of tambak operators have land certificates; some farmers had defaulted on earlier loans (in fisheries 40 percent of loans were in arrears in 1980 and 32 percent in 1981); and the limited number of extension officers makes it difficult for them to train and certify tambak operators for the program. Hence, although some improved technologies are already available, delivery to the producer is impeded by extension and credit difficulties.

Potentially Negative Effects: Potentially negative social consequences may occur to the post-larval shrimp collectors if nursery production, which is clearly needed for a major intensification program, becomes so efficient that it puts post-larval shrimp collectors out of business. Although post-larval shrimp collection is not a full-time occupation for anyone, it is reported to be an important supplement to income for many. This potentially negative effect is many years in the future, it it ever occurs. By that time remedial action such as the development of alternative employment opportunities may be implemented.

Changes in post-harvest handling, which may affect middlemen, must also be handled with care. Middlemen provide services other than the buying and selling of tambak production and are frequently of considerable social standing in the community as well as connected by ties of kinship to some of the tambak operators. Project outputs that might involve post-harvest handling between the tambak and processor must account for the social and economic roles of middlemen if they are to be acceptable to the target population.

Effects on Women: Women are not involved in tambak operation on any of the farms visited. Nor are they involved as middlemen. In one processing plant visited, 100 percent of the casual labor is provided by women, so increased production will provide additional employment opportunities in that sector. In general, however, increased income will positively affect both men and women in farm families which will benefit from the by results of the research generated by the project.

## 2. Social Soundness of Freshwater Fisheries Development

### Socio-Economic Setting

The results of freshwater aquaculture research activities stimulated by the project will initially be applied in North and South Sumatra. Populations of the two regions are approximately 9.5 million and 5.5 million respectively. The socio-cultural characteristics of potential producer beneficiaries in the two areas are different. Most paddy rice farmers in the target areas of North Sumatra are either Batak or long-time Javanese residents who migrated to the area as plantation labor during the colonial period. Many of both groups are Christian. The percentage distribution of the two groups in individual communities varies widely, ranging from almost exclusively one or the other, to an almost equal distribution. In South Sumatra native residents along the rivers refer to themselves as orang plus the name of their community. The same name is applied to the local dialect or language. Transmigrants from Java also inhabit some areas along the rivers.

In North Sumatra the target population consists of paddy rice farmers with potential for rice-cum-fish culture. There are some 17,000 producers involved in rice-cum-fish culture at the present time (DGF 1984). DGF estimates that production could spread to 96,000 hectares.

Given that an average family would operate at maximum .5 hectare of rice-cum-fish, the minimum potential target population is some 180,000 producers. In addition to rice production these farmers currently grow some vegetables and fruits and keep domestic animals such as ducks, chickens, goats, sheep, and water buffalo. Women are generally involved in all phases of rice production, but this varies from community to community, reportedly according to ethnic group. Women are more involved in rice production among the Batak than the Javanese. Some Javanese farmers report that their wives do no work in the fields, while others said they do about 50 percent of the work. Observations of workers in the paddy fields of North Sumatra support the reported wide range of variability.

In South Sumatra the type of cage culture proposed requires access to a river, its tributaries, or the oxbow lakes associated with the rivers. At present most cage culturists practice both farming and fishing. Where potential for paddy rice farming exists, the fisherman usually operates some paddy. Women do most of the work in the paddy and men fish. Although fishing is reported as strictly a male occupation, 75 percent of the individuals observed operating very small lift nets were females and children.

At present, most of the freshwater fishermen in South Sumatra live along the river, its tributaries, or the oxbow lakes. This is especially true in the non-urban areas where fishermen's houses are strung-out along the river bank, giving each family water frontage adequate for cage culture. Urban congestion along the river results in some fishermen without water frontage. Given this information, if we assume that the target population consists of only 50 percent of the present freshwater fishermen of South Sumatra, the target population is approximately 11 thousand families, but potentially larger, especially if non-fishing farmers with river frontage are included.

Several types of land tenure operate in the target area of North Sumatra. Some lands are traditional lands owned by Batak clans (marga), and clan members obtain permission to use portions of the land. Other land was obtained by individuals (either Batak or Javanese) who settled and cultivated an unoccupied area, thus gaining rights to the land. Many of the latter do not have land certificates (titles), but their village tax receipts give them rights to continue to use the land. Some farmers have bought land and have purchase receipts signed by the sub-district chief, and finally, some have certificates (titles) issued by the DGA, district level. In South Sumatra, clan land ownership was not reported among the fishermen. The only types of ownership encountered involve use, as evidenced by a tax receipt, sales receipt, and certificates.

## Sociocultural Feasibility

Cultural Appropriateness: Freshwater fish culture has been practiced in Indonesia for generations. In the early 1980s some 360,000 Indonesian families were involved in the activity. These freshwater pond operators are for the most part small-scale, with three-quarters of them working ponds of .1 hectare or less and only about 4 percent with ponds over .5 hectare. In South Sumatra freshwater fishermen have been using cages to hold fish for sale during low-catch periods for years. The applied results of the proposed research development activities will thus be improvements to traditional practices; hence, they will most likely be culturally acceptable, if costs of the proposed changes are kept within the means of the target populations. This conclusion is supported by the fact that USAID-sponsored freshwater aquaculture improvement projects in these two areas have been well received, but limited in impact and spread effect due to unavailability of inputs and inadequate extension support.

Income Effects: Financial analyses indicate that the fish-cum-rice systems are economically attractive because of relatively low initial investment costs as well as fish production being an add-on to income already generated by the paddy culture of rice. Interviews with fishermen practicing the system indicate additional income, after costs, of from 50 to 100 percent for a given area of paddy production. Some report that the additional fertilizer used for the fish even increases rice yields. As rice prices fall, the system will become even more attractive.

Analyses of the cage culture systems to be improved for South Sumatra suggest that the system does not yet provide adequate returns (RDA, 1985). However, interviews with several fishermen using the system indicate that it has been adding anywhere from 10 to 30 percent onto their incomes from fish capture and farming activities. They feel it has potential and plan to continue to try and improve the system and would be very receptive to trying out new technologies to improve the system.

Nutrition Effects: The fish cultured in both North and South Sumatra are luxury items. Producers do not normally consume the cultured fish themselves, but sell them and use the proceeds to purchase other food. For example, a farmer in North Sumatra said that if he consumed one of the carp (ikan mas) he produced, it would feed his family for one day. If he sells the carp, with the proceeds he can buy two to three kg. of dried small fish and eat them for a week. Hence, the culturing of the relatively expensive fish has an effect on nutrition through increased income.

This is not to say that the fish are not eaten by the local population--they are. In North Sumatra the ikan mas plays a significant part in many Batak ceremonies. At feasts given at the time of the ceremony, matrilateral relatives provide fish while the patrilateral relatives provide red meat. Traditionally the fish used was ikan batak (lysochillus sp.) coming from Lake Toba, but the capture of this fish is so small today that the ikan mas is being used as a substitute.

Ikan mas now plays a role in birth ceremonies (makkaroani), name giving ceremonies (mambaen goar), festivities marking the seventh month of the first pregnancy (mangalean deke ni boru), house warmings (mamasuki ruma), weddings (pangolihon anak; mangalap boru), ceremonies surrounding the death of the old (marujung ngolu), and the reburial of bones (pananko simin or mamestahon holi). At these ceremonies ikan mas is a ritual necessity which incidentally provides high quality protein to participants. Its consumption is also reported to rise in December in conjunction with Christmas and the New Year. Hence, although ikan mas is relatively expensive in North Sumatra, too expensive to be a regular part of the diet of rural people, its role in ceremonies creates a demand which exceeds current supply.

In South Sumatra the species targeted for cage culture are also relatively expensive but in demand. There the species (Leptobarbus hovenii and Pangasius pangasius) are reported to give status to the person who serves them.

Spread Effects: Access to land suitable for fish production is not overly unequal among paddy rice farmers in North Sumatra. Most could practice some form of fish-cum-rice production in part of their holdings; hence, project impacts could be widespread among all levels of landholders. In a sample village where the earlier USAID-sponsored rice-cum-fish project had successful impacts, some 18 percent of the land

with potential for this fish culturing activity is being used. Grow out of ikan mas (in rice fields) during fallow periods is practiced by all farmers with suitable irrigation potential. Seventy-one percent of the rice farmers in the village have water suitable for fish culture. With respect to the distribution of paddy, 78 percent had less than .5 hectare, 12 percent between .5 and 1 hectare, 6 percent between 1 and 1.5 hectare, 3 percent 1.5 to 2 hectare, and only 1 percent had over 2 hectare. Distributions differ from village to village, but for North Sumatra as a whole, most of the farmers have less than 1 hectare while only a few have more than 2 hectares of paddy rice field.

Access to water for cage culture among fishermen/farmers in South Sumatra appears to be relatively equal in rural areas where households are strung out along the river banks. In urban areas, such as Palembang, not all fishermen/farmers have access to oxbow lakes or riverbanks, but many do. If a fisherman/farmer does not have water frontage from his residence, access and security for the cages would present a problem.

Overall, the opportunity to take advantage of both rice-cum-fish and cage culture appears to be relatively high. Investment costs for both are minimal, and although some rice-cum-fish farmers say credit for inputs is a problem, the gradual building up of an area devoted to the practice through partial reinvestment of profits could result in the desired impact. Some problems with credit are attributed to a lack of land certificates which can be a problem. The low availability of inputs (fingerlings and feeds) also hampers some farmers. The final barrier to the spread of both fish culturing techniques is a lack of extension agents who are trained and provided with transportation sufficient to reach a significant number of key farmers to stimulate the spread of the technology.

Potentially Negative Effects: Potential for increased production is high, and at present, prices of cultured species are relatively high. Unless care is taken to improve the marketing and distribution infrastructure, oversupply and falling prices may result. Interviews at retail markets in North Sumatra found that given present marketing conditions (e.g., holding facilities) most fish sellers interviewed stated that they can handle only double the present levels of production. If prices plummet along with increased input costs on the part of farmers, the resultant failures could have a negative impact on the future of small-scale fish farming activities in the region for many years.

Effects on Women: In North Sumatra effects on women will probably be proportional to the present level of effort they now provide for paddy rice culture. As noted above, there is a great deal of variation among villages, but in general the Batak women work more in the fields than the Javanese in North Sumatra. In some cases men do the additional fish culture work, and in others, the women. The distribution of fish culture work seems to depend on existing workload rather than a belief that it is either a woman's or a man's work.

In South Sumatra both sexes tend the cages. In cases where the man spends a great deal of time capture fishing, the women tend the caged fish. A woman and several men interviewed felt that cage culture would provide women with additional opportunity for productive activity while the man was out fishing. In most cases where a family member collects plant feed for herbivorous fish culture, it is a woman.

In North Sumatra women are also involved in fish marketing. In one market visited, 20 percent of the fish sellers are women. The RDA team visited a market where all sellers were women. Increases in production would have positive effects for these women. In South Sumatra no women fish sellers were observed.

In general, however, the increased income generated by fish culture will have a positive impact on the quality of life of women in fish farming families.

## 3. Social Soundness of Eastern Indonesian Fisheries Development

### Socio-Economic Setting

The institution building and resulting research to be developed by this component of the project addresses techniques and facilities needed to decrease the costs of processing and marketing domestically-consumed fish products as well as to initiate establishment of a data base to develop a sustained yield management policy for East Indonesia's marine fish resources. Producers potentially affected by the research are the individuals involved in small-scale fish processing and distribution. Also affected will be the fishermen served by the processing and marketing sector.

Throughout Indonesia there are some 1.17 million people directly employed as marine fishermen, approximately 90 percent of whom can be classified as small-scale. Overall incomes among full-time small-scale fishermen are among the lowest in Indonesia. Somewhat over 50 percent of marine small-scale fishermen, however, are only part-time, gaining income from other sources as well. Impacts of research developed by the project will first occur in Maluku where DGF statistics report approximately 70 thousand fishermen--40 percent full-time, 42 percent part-time with major emphasis on fishing, and 18 percent with a minor portion of their employment being fishing. No figures are available concerning the most directly affected group--the small-scale processing and marketing specialists--but observation and informants indicate that a great deal of the processing and initial distribution and marketing is carried out by fishermen's wives in the rural areas. In more urban areas, much of the

capture is sold fresh in the market where male sellers predominate. Cottage industries of smoking and drying of fish are operated by women in the urban areas. If the ratio of small-scale fishermen to small-scale processors, middlemen, and retailers is similar to that in other sectors, it is estimated that there are some 20,000 individuals involved in small-scale processing and marketing; hence, results of improved processing and marketing research could affect some 90,000 producers (fishermen, processors, distributors, and fish sellers) and their families in Maluku.

Sociocultural Feasibility

Cultural Appropriateness: There is a long tradition of fish processing and marketing in Eastern Indonesia. If researchers are careful to build upon traditional knowledge and techniques, the results will most likely be culturally appropriate. With the respect to the development of information for management, fishing communities in Maluku use a traditional system of local law (sasi) to manage their inshore fishery. To be culturally appropriate, development of management schemes in the region must take this traditional system as a starting point for the development of information gathering and management.

Income Effects: There is no way to estimate income effects at the present time because specific research directions have not been defined. Nevertheless, decreasing post-harvest losses and increasing markets usually result in better prices to both fishermen and other fishery workers.

Nutrition Effects: The resulting higher quality fish and potentially increased incomes will enhance nutrition in areas affected by the research.

Spread Effects: The small-scale fishermen, fish processors, and fish wholesalers and retailers are spread-out over some 1000 remote islands in Maluku. Each district within Maluku province has only one fishery extension officer who must cover many islands with inadequate transportation and funds as well as limited communication with the head office. Thus, the spread of new technologies will be severely hampered by this inadequate extension ability. However, by the time new methods are developed by improved research capacity, it is anticipated that the extension situation will be improved.

Potential Negative Effects: Since specifics concerning the directions of research are not yet determined, it is difficult to identify negative effects. If the research builds on the traditional methods of the small-scale fishery, keeping in mind effects on employment from the level of the fishermen to the retailers, potentially negative effects will be least likely to occur.

Effects on Women: In rural areas and to some extent in urban areas, women are intensively involved in the processing and marketing of fish. Improvements made in this area should improve their well-being as long as labor-saving techniques do not displace workers without consideration of alternative employment opportunities.

# ANNEX K. ADMINISTRATIVE ANALYSIS

## 1. Implications for Administration

The Ministry of Agriculture (MOA), as the implementing agent, will be responsible, through its Agency for Agricultural Research and Development (AARD), for the overall administrative and policy direction of the project. This responsibility will include close coordination with the Ministry of Education and Culture (MOE), through its Directorate General of Higher Education (DGHE), for the assignment of personnel, development of annual work plans and research strategy, and monitoring and evaluation.

Liaison between the MOA and the MOE will be maintained through a AARD-DGHE Communication Forum composed of members from both ministries that will meet on a annual basis for planning and monitoring purposes. All MOE grant and loan inputs will be disbursed through the MOA's Agency for Agricultural and Research Development. However, the directors of the fisheries faculties of the project universities may be required to co-authorize disbursements. The disbursement of GOI support to project activities will occur as an expansion of the existing budgeting activities under each Ministry's DIK/DIP funding procedures. The Loan Agreement will contain covenants which will ensure adequate and timely budget allocations by each Ministry.

## 2. Ministry of Agriculture

### Agency for Agricultural Research and Development

The Agency for Agricultural Research and Development (AARD) was established in 1974 to carry out applied research activities. These activities are intended to facilitate increases in agriculture production to offset import requirements for basic human foods and to improve the agriculture sector's role as a foreign exchange earner.

The AARD is directly responsible for administering the GOI's agriculture research program, which includes research programs in soils, agro-economics, food and horticultural crops, industrial crops, and fisheries and animal husbandry, as well as various major international donor programs such as the USAID Applied Agriculture Research Project, the World Bank National Agriculture Research Project (I, II) and the Government of Australia Animal Production Project. The AARD is composed of a multi-tier management structure composed of a Secretariat with various supporting Centers, a system of five Research Coordinating Centers, and a network of Research Institutes (Figure 1, Section 3). By the end of this decade AARD will complete the development of its physical infrastructure which will include 23 research institutes and approximately 200 stations, sub-stations and experimental sites throughout the nation's 27 provinces. Over 100 PhD and 300 MSc scientists are now in place and the professional staff is projected to grow to 1100 post-graduate research scientists by 1990. AARD has the administrative flexibility to act promptly, and it has a semi-autonomous administrative status which enables it to execute policy defined by the Ministry as effectively as possible.

Research Coordinating Center for Fisheries

The Research Coordinating Center for Fisheries (RCCF), in collaboration with the three project universities, will manage the day-to-day operation of the project from its headquarters in Jakarta. The organizational structure of RCCF is shown in Figure 2, Section 3.

RCCF is composed of a multi-disciplinary team of staff in the three fisheries subsectors, and has the fundamental capacity to carry out the project. Most of the facilities currently being used by the RCCF are adequately sited and distributed throughout Indonesia to provide a good exposure to the development needs of the fisheries sector. In addition, many of the facilities are located near major universities.

RCCF facilities consist of laboratory and office space and over 100 ha of research ponds. Two of the institutes - the brackishwater fisheries institute in Maros and the marine fisheries substation in Ambon - occupy modern facilities recently completed under World Bank funding. Most of the research institutes have from 15 to 20 professional staff assigned to each research unit, although most of the staff have the equivalent of BSc degree training.

To further support the development of the fisheries sector, the GOI is currently improving infrastructure and staffing through various donor activities. The GOI has recently transferred 50 ha of land to RCCF for the development of a major freshwater fisheries research station in Sumatra. The proposed project budget includes funds for the development and operation of this site.

The RCCF headquarters center in Jakarta will directly control all project activities at the selected institute sites in Java, Sumatra, Sulawesi and Ambon. The headquarters center has the administrative capability to implement and manage the proposed project activities. In addition, it has access to the services and support of other AARD centers, i.e., statistics and data processing and library services.

The additional inputs of the proposed project (technical assistance, training, commodities and construction) will allow the RCCF to upgrade and expand its activities without diluting the effectiveness and efficiency with which the unit now operates.

The AARD has recently authorized each of its Research Institutes to assume greater responsibility in the dissemination of the results of its research programs. Twenty AARD staff are now participating in agriculture communication training at the Institute Pertanian at Bogor.

Many of the RCCF research institutes are located in close proximity to a major university, and liaison between the technical and administrative staffs of the institutes and univerities is excellent. The institutes also have a good liaison with the provincial fisheries service of the Directorate General of Fisheries. Based on these linkages and the administrative capability and infrastructure of RCCF, there are no problems anticipated which would impede project implementation.

3. Ministry of Education

The university system consists of 45 public institutions of which 10 are devoted primarily to the training of teachers and 4 are specialized technical institutes. Nine institutions are authorized to grant master's degrees and doctorates: University of Indonesia (UI), Institute of Agriculture at Bogor (IPB), University of Padjadjaran at Bandung (UNPAD), University of Gajah Mada at Jogyakarta (UGM), University of Airlangga at Surabaya (UNAIR), and the teacher training institutes of Jakarta, Bandung and Malang. These are the most prestigious institutions of higher education in Indonesia and each is at least 21 years old. The rest of the institutions are rated class B or C in regard to their reputation and number of faculty with advanced degrees.

These public universities are under the Directorate General of Higher Education. The Directorate General is assisted by four directors: a director of Academic Affairs, Student Affairs, Research and Community Affairs, and of Private Universities. Within each university, there is a rector, or chief executive officer, who is assisted by three vice-rectors: a vice-rector for Curriculum, Administration and Finance, and Student Affairs. Also reporting to the rector are the deans of each of the faculties in the university. Each dean is served by three assistant deans. The last level is composed of the departments in the faculties. Each department has a department head, professional staff, a secretary, and where appropriate, a laboratory director.

The university system has the administrative capability and flexibility to carry out the training needs of Indonesia extremely well at the BSc level, but the lack of a critical mass of post-graduate trained staff, research facilities/equipment and research funding has handicapped the development of good post-graduate training and research programs.

The commitment to improved formal fisheries training programs is obvious in the expansion and upgrading of programs at many of the universities and the active support of regional governments for these activities. Once the infrastructure is in place, the universities will need to increase their emphasis on post-graduate training and research. However, the inputs of this project will allow the IPB and the Universities of Hasanuddin and Pattimura, each of which represents one of the fisheries subsectors and has a key geographic siting, to bridge the gap for developing such post-graduate training and research programs.

Institute of Pertanian Bogor

The Institute of Pertanian (Agriculture) Bogor (IPB) is located in Bogor, Java near the capital city of Jakarta. It is the premier agriculture university in Indonesia and the principal source of fisheries scientists and managers.

At the present, IPB offers fisheries training and MSc and PhD degrees in five basic areas in its Faculty of Fisheries. About 36 percent of its 106 staff members have post-graduate degrees and an additional 4 percent are abroad for post-graduate degrees. However, with the exception of the Aquatic Resource Management Department (12 PhD and 6 MSc staff), the faculty lacks sufficient post-graduate staff to offer sound graduate training programs in the other departments.

To support the proposed project, IPB is currently improving its infrastructure and staffing through various activities. A recent move to

a new campus has solved the problem of lecture and laboratory space, but the new facility is poorly equipped and some laboratories have no equipment. Field stations include the Darmaga Fisheries Station in Bogor and a Marine Science Center at Ancol near Jakarta. Pond research facilities are limited to a 2 ha facility; however, the faculty has the university's permission to expand the existing pond facility and/or to develop a new 4 ha facility at a new site near the campus. The proposed project budget includes funds for the development and operations of the new pond facilities.

In addition to serving as the principal institution for the in-country fisheries training, IPB has a "credit-earning activities" agreement with UNHAS that allows UNHAS students to have the opportunity to conduct MSc level studies and degree research in brackishwater and marine fisheries at UNHAS with the degrees actually granted by IPB. It is expected that a similar agreement will be established between IPB and UNPATTI.

University of Hasanuddin

The University of Hasanuddin (UNHAS) is the lead university in the Eastern Indonesian University Association. It is located in Ujung Pandang, Sulawesi, which is the fifth largest city in Indonesia and serves as the hub for East Indonesia.

In any overall ranking of universities in Indonesia based on status, reputation, and number of faculty with advanced degrees UNHAS would be ranked below the major universities in Java but above all the other universities in East Indonesia. UNHAS was established in 1948 and now is composed of 13 faculties. Although its current fisheries program is a department in the Faculty of Animal Husbandry, it is approaching the critical mass of post-graduate fisheries staff for a good MSc program in fisheries (25% of the fisheries staff have or are obtaining post-graduate degrees). As a result, the department may soon be elevated to faculty

status. The university has recently moved to a new campus, however, the fisheries laboratories are not yet adequately equipped and the department does not have much field equipment or a developed field station. At present, fisheries study is limited to a BSc program in fisheries and an MSc program under the "credit-earning activities agreement" with IPB.

University of Pattimura

The University of Pattimura (UNPATTI) is located in Ambon on the island of Ambon in far Eastern Indonesia. Ambon - as a result of the ban on marine fish trawling in Western Indonesia in 1980 and the subsequent transfer of the marine fisheries capture industry to Eastern Indonesia - has become the center for an important and expanding marine fisheries industry. At the present, most of the Indonesian trawler fleet is based in Ambon and this has stimulated the development of a significant amount of landing and processing infrastructure in Ambon to support the industry.

Established in 1962, UNPATTI is a young university. However, it is already a respected institution with widespread impact in Eastern Indonesia. At present, the university has 13 faculties. Its Fisheries Faculty is the most recent, having been upgraded from a department in 1985. The facilities are modern and adequate for the present needs and student levels. The Faculty of Fisheries has reasonably equipped wet and biology laboratories and a library which was completed in 1983 as a result of the AID Science and Technology Project. A new fish processing laboratory has just been completed and the faculty has increased its staff level to 45 in preparation to support the proposed project activities. The UNPATTI campus is sited adjacent to the new Research Coordinating Center for Fisheries marine fisheries research institute and is about 4 kilometers away from the National Institute of Oceanology (LON) laboratory.

UNPATTI offers a BSc program in marine biology and is prepared, with the inputs planned under the project, to upgrade the program to offer graduate training and research in the specific areas of marine fisheries marketing and processing. It would thus provide the nucleus for the expansion of the program into other areas.

In summary, the three universities have the infrastructure and administrative capability to carry out the activities planned under this project. The technical assistance inputs will serve to join the scattered resources of ~~both~~ ministries for the development of sound research and training programs. The close proximity and existing linkages of the universities with the research institutes at each geographic site will facilitate meeting the objectives of the project. The geographic sites represent opportunities to address "on-site" fisheries development constraints. The proposed inputs of equipment and commodities and facility development will ensure that training participants received "hands on" training. And finally, the emphasis on training will significantly contribute to the development of a sufficient number of fisheries scientists and scholars to meet Indonesia's needs for the wise development and management of its living aquatic resources.

# ANNEX L. ECONOMIC AND FINANCIAL ANALYSIS

## 1. Introduction

The Fisheries Research and Development Project is proposing the investment of $8.6 million in support of training, technical assistance, research, policy analysis and limited commodity procurement to improve domestic research and training capability in the freshwater, brackishwater and marine fisheries subsectors. Project funding will focus on improving domestic capacity to develop technologies and management systems that are financially viable, technically sound and ecologically sustainable.

The selection of specific project activities is premised on four basic assumptions: 1) a strong university system is an essential prerequisite to preparing the number of young professionals needed to define and implement sustainable fishery development programs in the future; 2) a dynamic research capacity in both the university and the national agricultural research systems is needed to provide a continuous stream of new technologies for dissemination by the extension service to farmers; 3) a consistent and well-articulated set of government plans and policies and information about them and other basic sector-wide performance variables are necessary if private sector investment is to be encouraged and increased; and 4) building upon past relationships and programs, AID's comparative advantage lies in the support of longer-term institutional and human capital resource activities. The application of these basic assumptions to improving research capabilities--especially in fish nutrition and breeding, technology development and testing, and research management and coordination--within the Agency of Agricultural Research and Development; and the strengthening of staff, research and curricula at selected universities will be the main focus of the project.

## 2. Analytical Approach

Emphasis on support of capacity building efforts within the university and agricultural research systems poses problems for an economic analysis. Post-project analyses of investments to strenghten agricultural research systems have demonstrated substantial returns - usually in the neighborhood of 25 to 300 percent. However, due to the length of time required to generate returns and the complex array of variables that affect returns, pre-project economic estimates of economic benefits are often misleading. In the case of investments for improving analytical capacity or information systems, similar problems exist. While historical evidence suggests that such investments are productive, the absence of basic information about system performance hinders the detailed definition of system constraints and the economic returns likely to be generated by improving information and analysis.

The following analysis attempts to address these problems by adopting a three-step approach. First, where the input/output structure of a production enterprise is known, such as for rice-cum-fish and tambak production systems, estimates of annual financial rates of return are presented. These estimates use data compiled from production sites in Indonesia which are currently using selected advanced management techniques and field data from other Southeast Asian countries where complete improved management and technological packages have been introduced. This step in the analysis provides rough estimates of the financial viability of semi-intensive systems that are likely to emerge with the adoption and spread of new production techniques. Second, financial rates of return are converted into economic rates of return

using a series of standard assumptions about border prices and marginal value of labor and the value of foreign exchange. Finally, where the potential impacts of investments are difficult to quantify, as is the case with improved processing techniques and fish marketing systems, the direction of changes in major performance variables such as fishermen's income, commodity prices, and demand is calculated.

Data used in the analysis are from feasibility studies commissioned by USAID/Indonesia and conducted by Resources Development Associates in January and October 1985, and from secondary sources (World Bank, Asian Development Bank and FAO).

Given the complex nature of the production relationships under analysis, this report begins with a description of known technologies and management systems used in rice-cum-fish and brackishwater systems, and changes which would occur with semi-intensification. This is followed by a discussion of assumptions used in the analysis and a summary of analytical results. A separate section at the close of the analysis explores the potential impact of investment in fish processing and marketing in Eastern Indonesia.

## 3. Rice-cum-Fish and Tambak Production Systems

### Current Production Practices

Unlike agricultural field crops, aquaculture production systems use multiple facilities for the rearing of fish species. For example, rice-cum-fish production employs hatchery ponds, rice paddies and ponds in the production of carp. Tambak systems rely on hatchery production and wild capture of shrimp and milkfish fry, nursery and brackishwater pond production. The production techniques currently used in each of these systems are described below.

Rice-cum-Fish Production System: A typical carp hatchery uses a hectare of land divided into broodstock, spawning and nursery ponds. The farmer usually maintains a broodstock population of approximately 60 females of 2 kg. each and an equal number of smaller males. Each female is spawned three or four times per year and produces 70,000 to 80,000 eggs per kg. of body weight per spawning. Eggs are produced in a spawning pond and hatched and reared in nursery ponds for a period of 15 to 18 days. Nursery ponds are fertilized with urea and $P_{205}$ and fry are fed on a diet of 30 kg. of fish feed, and/or rice bran per 50,000 fry. Survival rates tend to below, averaging 12 percent. Production is approximately 31,500, two centimeter fry per kilogram of brood stock or 6.6 million fry per year.

Following maturity, fry are sold and stocked into a specially prepared rice paddy. Farmers prepare the paddy by digging a ditch around the perimeter, then flood the field, plant rice, and apply 22 to 24 kg. of fertilizer (urea, $P_{205}$ and ammonia sulfate). Stocking rates are low, averaging 15 fry per square meter of paddy and two harvests are common during a growing season. Fry remain in the paddy from 40 to 45 days. Survival rates are typically low, averaging 50 percent during the first harvest and 40 percent during the second due to limited food supply and a shorter second growing season. Typically, one hectare of paddy produces from 14 to 18 thousand fingerlings per year of approximately 4 centimenters in length.

In Northern Sumatra, fingerlings are typically transfered from paddies to shallow ponds 40 cm deep for grow out to food fish size. Stocking rates average 1500 fingerlings per hectare. Fish remain in these ponds approximately three months and average 300 grams at harvest. The majority of farmers provide supplemental feeding, usually after the first one and a half months, but feed quality tends to be poor. Yields vary widely from 200 to 600 kg. of carp per hectare depending on soil fertility and food availability. Due to the age of the carp during this phase in production, mortality is low.

Tambak Systems: In South Sulawesi brackishwater ponds are used in the production of both shrimp and milkfish. The majority of farmers employ traditional methods of tambak culture which rely on the capture of fry from natural waters, as well as the purchase of hatchery seed stock. Food fish production is based on the enhancement of the natural pond productivity through water management, fertilization and pest control. This system is composed of a number of separate activities. Two to four weeks before shrimp and milkfish fry are introduced, pond soil is dried and fertilized. Tambaks are usually divided into at least two sections, a nursery and a grow-out area. Prior to stocking, generally in October and March, ponds are flooded with sea water, and banana and metapenaeus shrimp are introduced. Giant tiger shrimp milkfish fry are purchased commercially and added to the tambak. Stocking rates for giant tiger shrimp are low, averaging 10,000 fry per hectare. Typically, fry supplies are limited with only 30 percent of demand currently supplied by hatcheries and the remainder from the wild. Milkfish fry, which are also captured from coastal, areas are stocked at a rate of 1500 fingerlings per hectare.

Both shrimp and milkfish remain in the tambak for approximately 100 to 140 days. Some farmers use chicken manure, peletized fish feed and pesticides, but yields from this intensively managed system tend to be low. Tiger prawn production averages 160 kilograms per hectare per year while milkfish production averages 308 kilograms.

## Assumed Changes in Production Patterns and Yields

Applied research and field experience in Indonesia and other Southeast Asian countries suggests that significant increases in the efficiency of existing rice-cum-fish and tambak production systems can be achieved through the introduction of improved technologies and management

systems. For example, better management, improved genetic material and better feeds and feeding regimes could make a significant difference in mortality rates and rates of growth of carp. The analysis assumes that improved brood stock and the use of more appropriate feeds would decrease mortality in carp hatcheries from the current levels of 80 to 90 percent. Better design and more intensive management would result in a significantly smaller area required for hatchery construction (.44 ha), smaller brood stock requirements (30 brooders) and more rapid turnover (37 days per spawning cycle).

In the paddy production stage, an improved package of management techniques, including better field construction, control of aquatic weeds, supplemental feeding, fertilization, and better harvesting techniques, could reduce the growing period from 45 to 30 days and would increase survival rates by 5 percent for the first harvest and 10 percent for the second harvest. Finally, improved feed quality in the grow-out period would increase yield by approximately 20 percent per fish.

A number of improvements are also possible in tambak production. Currently, tiger shrimp mortality rates tend to vary between 15 to 25 percent during nursery operation and could be reduced to 10 percent with improved diet and nutrition. With improved tambak management, it is reasonable to assume that yields comparable to other semi-intensive systems in Southeast Asia could be approached. In the Philippines, tiger prawn yields are averaging 300 to 400 kg. per hectare per crop with stocking rates of 20,000 fry per hectare. Milkfish yields are 500 kg per hectare more per crop using the same stocking levels currently used in Indonesia.

## Cost and Return Estimates

Cost and return estimates used in the analysis are those experienced by aquaculture producers in North Sumatra (rice-cum-fish), South Sulawesi

(brackishwater) and other similar areas of Southeast Asia. Individual estimates of capital costs appear as amortized annual costs, constructed using straight line depreciation. All costs and returns are expressed in 1985 prices. Cost and return estimates are taken from field data prepared by Resource Development Associates on contract to AID and field staff working in North Sumatra under USAID's Small Scale Fisheries Development Project.

Farmer Adoption

A basic assumption of this analysis is that as technologies and management systems are developed by a strenghtened research and university program, they will be extended and adopted by farmers. However, as the Project Paper suggests, current fisheries extension capacity is weak. In the future, extension capabilities are likely to improve with the implementation of the World Bank's $65 million extension development project. However, for the purposes of this analysis, conservative estimates of farmer adoption are used to reflect constraints currently faced by the development and/or adoption of appropriate technology and limited capability of the extension service. In North Sumatra and South Sulawesi it is assumed that only 10 percent of the area potentially available for carp and shrimp expansion is converted and adopts improved technologies and management systems.

Financial and Economic Prices

Economic and financial prices for major aquaculture inputs and outputs used in the analysis are presented in Appendix 1. Economic prices for fertilizer and pesticides are based on 1990 market prices projected by the World Bank's Commodity Division, and adjusted for transportation, processing and handling costs. Shrimp prices are those estimated by the World Bank and FAO in their joint 1982 fisheries sector

analysis and projected to 1990. The remaining inputs and outputs that are not traded in the international market have been expressed in terms of actual farm gate prices. The level of subsidy or implicit taxation experienced by farmers is indicated by the differential between financial and economic prices. For example, the economic price for shrimp is about 7 percent higher than the financial price and the subsidized price for fertilizer is approximately half of the economic farm gate price. The financial cost of construction and farm labor have been converted to economic costs using a conversion factor of .75. In the economic analysis, inputs such as labor are costed at the income they would produce in their next-best use. Because aquaculture operations generally use unskilled labor for which alternative employment opportunities are limited, agricultural labor has been priced at 75 percent of its actual price.

Foreign Exchange

In March 1983 the GOI devalued the rupiah by 28 percent, from Rp 703 to Rp 970 per US $1.00. Since that period, the government has followed a floating rate exchange policy which has resulted in a further 34 percent erosion in the value of the Rupiah vis-a-vis the dollar by early 1986. A standard conversion factor of 1.125 has been used to convert rupiahs to dollars. This assumes the present exchange rate reflects the value to the economy of the foreign exchange earned via exports or saved through increased aquaculture production.

4. Financial Analysis

On farm adoption of improved technologies and management systems could generate substantial returns to adopters. Each separate enterprise - carp hatchery production, paddy carp production, carp pond production and tambak production--show favorable returns on investments. Results of

the financial analysis including annual net revenue, rates of return, capital requirements and payback periods are provided in Table 1.

TABLE 1. KEY INDICATORS OF FINANCIAL VIABILITY a/

| ENTERPRISE | NET REVENUE (Rp 1000) | FINANCIAL RATE OF (%) | CAPITAL REQUIREMENTS (Rp 1000) | PAY BACK PERIOD (Year) |
|---|---|---|---|---|
| Carp Hatchery Production Systems | | | | |
| without family labor | 922.2 | 75 | 2369.8 | 2.6 |
| with family labor | 622.6 | 44 | 2962.6 | 4.8 |
| Paddy Carp Production Systems | | | | |
| without family labor | 859.6 | 78 | 2571.0 | 3.0 |
| with family labor | 786.1 | 67 | 2638.5 | 3.4 |
| Carp Pond Production Systems | | | | |
| without family labor | 358.1 | 38 | 987.1 | 2.8 b/ |
| with family labor | 225.1 | 21 | 1117.1 | 5.0 b/ |
| Tambak Production Systems | | | | |
| without family labor | 1576.9 | 59 | 5209.1 | 3.3 |
| with family labor | 1366.9 | 47 | 5389.1 | 3.9 |

NOTES:

a/ Based on financial analysis in Appendices 2 to 5.

b/ Assumes land is already owned by farmer and formally used in rice cultivation. If purchased, the payback period would be 11.1 years without family labor and 18.3 years with family labor.

All estimates have been calculated before and after providing for family labor. As the data indicate, annual financial rates of return range from a low of 38 percent to a high of 78 percent before providing for wage payments to family labor and 21 to 67 percent when provision is made for family labor. The highest rates of return, 78 and 67 percent respectively, are associated with paddy carp production systems.

Favorable financial rates of return are also reflected in estimates of the payback period for each type of enterprise investment. These range from 2.6 to 3.3 years before providing for wage payments for family labor and to 3.4 to 5.0 years with family wage payments.

There is one exception. The analysis assumes that farmers who enter carp pond production take land out of rice production for a period of four years for use as grow-out ponds. The only structural change which occurs to the paddy is the heightening of dikes. This transfer in land use is incorporated into the financial analysis by treating the annual net income from rice production as a cost of production in pond operation. If farmers were to purchase new land for their pond, this would increase his capital requirements and extend the payback period. Assuming land costs Rp 30,000,- per $m^2$ capital investment costs would increase to Rp 4,111,710,- in the case where family wage labor is paid. This would extend the payback period from 5 to 18 years.

These favorable rates of return are maintained over a wide range of output prices and quantities.

TABLE 2. BREAKEVEN PRICES AND YIELDS a/

| ENTERPRISES | OUTPUT UNITS | USED IN ANALYSIS | | BREAKEVEN | | ALLOWABLE PERCENTAGE DECLINE | |
|---|---|---|---|---|---|---|---|
| | | YIELD (Per Ha) | PRICE (Rp) | YIELD (Per Ha) | PRICE (Rp) | YIELD (Per Ha) | PRICE |
| Carp Hatchery Production Systems | | | | | | | |
| without family labor | 1000 fry | 1080.0 | 2.0 | 618.9 | 1.2 | 43 | 40 |
| with family labor | 1000 fry | 1080.0 | 2.0 | 748.9 | 1.4 | 31 | 30 |
| Paddy Carp Production Systems | | | | | | | |
| without family labor | 1000fingerlings | 115.0 | 17 | 64.4 | 9.5 | 44 | 44 |
| with family labor | 1000fingerlings | 115.0 | 17 | 68.4 | 10.1 | 31 | 31 |
| Carp Pond Production Systems | | | | | | | |
| without family labor | kg | 864 | 1500 | 625.3 | 1086.0 | 28 | 28 |
| with family labor | kg | 864 | 1500 | 712.0 | 1236.0 | 18 | 18 |
| Tambak Production Systems b/ | | | | | | | |
| without family labor | kg | 536 | 6440 | 291.1 | 3498.0 | 46 | 46 |
| with family labor | kg | 536 | 6440 | 319.1 | 3833.8 | 40 | 40 |

NOTES :

a/ Calculated from data appearing in Appendices 2 to 4.

b/ Assumes milkfish yields and prices constant.

As the data in Table 2 indicate, the financial viability of carp pond production is relatively sensitive to changes in yield and prices. In this case, net returns per year would be zero if yield declined by 28 percent or prices by 18 percent. While of some concern, these reductions are unlikely given the strong demand for carp in North Sumatra, estimated to be growing at 9 percent per year, and the low mortality rates associated with pond production. All other declines are in acceptable ranges from approximately 30 to 40 percent.

Employment and underemployment would be affected by the expansion of aquaculture activities. While estimates of individual enterprise employment generation are base on field data, estimates of the over-all impact on provincial employment must rely on estimates of new area brought under aquaculture production. Illustrative estimates are provided in Table 3 below. Because of limited data on area available for further expansion in North Sumatra and South Sulawesi, the results should be viewed as indicative and may contain significant error margins.

TABLE 3 EMPLOYMENT GENERATION DUE TO EXPANDED AQUACULTURE OPERATIONS

| ENTERPRISE | LABOR INPUTS PER UNIT | | | AREA AVAILABLE FOR EXPANSION a/ | EMPLOYMENT GENERATION |
|---|---|---|---|---|---|
| | FAMILY | HIRED | TOTAL | | |
| | (md) | (md) | (md) | | (1000 md) |
| Carp Hatchery Production System | 170 | 150 | 330 | 156 b/ | 51.5 |
| Paddy Carp Production System | 49 | 71 | 120 | 687 b/ | 82.4 |
| Carp Pond Production System | 82 | 68 | 150 | 8772 b/ | 1315.8 |
| Tambak Production System | 140 | 132 | 272 | 1980 b/ | 538.6 |
| Total man days | | | | | 1988.3 |
| Total man years c/ | | | | | 7.4 |

NOTES:

a/ The GOI estimates that there are an additional 87,700 ha available for expansion of carp ponds in N. Sumatra and 9,336 ha of mangrove suitable for the expansion of tambak in South Sulawesi. The analysis assumes 10 percent of this area is converted to aquaculture production using improved technologies and management systems.

b/ Paddy carp production and carp pond production estimates are in hectares, and hatchery production in number of hatcheries. Estimates are calculated using fry and fingerling input requirements, some of which appear in Appendices 2 to 4, and mortality rates of 24 percent between hatchery and rice paddies and 20 percent between paddies and ponds.

c/ Assumes 270 work days per year.

Estimates of workdays generated are based on employment generation due to expansion of currect hectarage not intensification on existing hectarage. The analysis assumes a conservative estimate of expanded hectarage equal to 10 percent of available hectarage.

The analysis indicates that approximately 2 million additional days or 7400 man years of employment would be generated by expansion of current hectarage using improved technologies and management systems. Assuming a wage rate of Rp 1500 per day (US$1.33) this would generate Rp 2,982 million (US $2.65 million) per year in additional wages.

5. Economic Analysis

Available information regarding current production systems and the focus of project investments limit the scope of the economic analysis. Annual rates of economic return for the four production systems, assuming the adoption of improved technologies and management, are calculated in Appendices 2 to 5 and summarized in Table 4.

TABLE 4. ANNUAL ECONOMIC RATES OF RETURN

| ENTERPRISE | ANNUAL ECONOMIC COST (Rp1000) | ANNUAL ECONOMIC RETURNS (Rp1000) | RATES OF RETURN % |
|---|---|---|---|
| Carp Hatchery Production System | 1364.7 | 2760.0 | 58 |
| Paddy Carp Production System | 1523.3 | 1955.0 | 28 |
| Carp Pond Production System | 897.8 | 1296.0 | 44 |
| Tambak Production System | 1917.3 | 4381.3 | 229 |

All systems exibit favorable rates of return, ranging from 28 percent per year for paddy carp production to 229 percent per year for tambak

production. Returns associated with the latter depend heavily on the supply of hatchery shrimp fry and the availability of credit both for construction and operation of tambaks. An Asian Development Bank loan is currently being negotiated to improve credit for both hatchery and tambak operation.

Employing assumptions adopted in the financial analysis (Table 3) suggests significant returns could be generated if new technologies and management systems were adopted on expanded hectarage. Assuming the adoption of new technologies on 10 percent of potentially available hectarage, annual economic returns of Rp 87.9 billion (US $78.1 million) per year, or approximately 5 times the total project investment budget, would result.

## 6. Potential Impacts of Investments in Eastern Indonesia

A variety of marine processing systems are current in use in Indonesia depending on location, species, and types of facilities available. They range from the more traditional drying to modern freeze drying systems. In part, project investments will focus on improving processing techniques currently used by small-scale processors in the production of salted/dried fish and decreasing collection and transport costs associated with the transport of dry fish to major Javanese markets.

Very little information is available about the structure and financial viability of small-scale processors in the Malukus. Thus standard financial and economics analysis was not attempted. Instead, assumptions regarding increased demand for fish to meet the needs of growing Javanese demand and the impact this could have on Eastern Indonesia are explored. Analysis of specific firm-related costs and

returns and the economic implications to processors, transporters and middlemen in the Maluku, Java, and South Sulawesi-a transshipment point, require further field work which will be undertaken as part of the project.

The Eastern Islands have the highest per capita consumption of fresh fish in Indonesia. The abundance of fish, low prices and limited supplies of other animal protein have result in fish consumption levels of 48 kg per person per year. Wide price fluctuations caused by the seasonal nature of the fisheries resource are common and it is not unusual for skipjack tuna prices to vary from Rp 600 to Rp 200 per kg within a year.

Although fresh fish is the preferred protein source in Eastern Indonesia, excess supplies and low prices have encouraged the growth of a traditional fish processing sector. Currently, the majority of fish is smoked; however, a limited amount (approximately 17,000 tons) is dried and salted. Dried fish which has a shelf life of approximately 30 to 45 days, depending on salt and water content, are collected and shipped to Ambon for sale or transshipment to South Sulawesi or Java. The principal supplier for the Javanese market is Banda Island.

Dried fish from Ambon enter the Javanese market via Surabaya, Semarang and Cirebon. Typically, fish are transported by Bugies sailing vessels which take 12 to 15 days to reach Java. Fish are shipped in burlap bags in mixed lots, containing upwards of ten different species. Upon arrival they are separated by species, graded and transshipped to retailers in coastal and interior cities.

Given current limited availabilities of salt in the Malukus, primitative handling techniques, and the need to resort and package upon arrival, processing and handling costs are high and losses in the system are thought to range from 20 to 25 percent. However, marketing margins ranging from Rp 131 kg for Sead to Rp 334 kg for dried Eastern Little Tuna landed in Eastern Java remain attractive and encourage imports.

Technical assessments of this marketing chain suggest that simple improvements in processing and transportation techniques would lead to increased market volumes, improved quality and lower consumer prices. Improved information systems which link processors with transporters would encourage increased market volumes by decreasing sailing time in search of dried fish supplies and assuring full loads on return trips to Java. The introduction of grading and sorting systems would improve the value of cargoes, increase transport margins and decreased handling costs. Finally, improved processing techniques such as vacuum packing would increase the shelf life of dried fish, decrease losses, and improve transport and wholesale margins.

Technological innovations in fish processing, combined with Eastern Indonesia's comparative advantage due to abundant marine resources and relatively cheap labor, could result in increased market volumes and a reduction in the recent real price increase of 1.3 percent per year for fish on Java.

In 1984, demand for fish on Java was estimated at 627,000 metric tons or 6.3 kg per capita per year. Government investment programs are attempting to increase per capita supplies nationally to 15.2 kg per

person per year. If achieved, this would require an additional 840 thousand metric tons of fish per year on Java. With the coastal area close to Java already over fished, the majority of new supplies will have to come from Eastern Indonesia.

Javanese demand for fish will also support increased market volumes. Expenditure elasticity for fish on Java is currently estimated at 1.11. Assuming population and incomes rise at trends consistent with the past decade, 1.7 and 2.0 percent respectively, this will result in per capita increases in demand of 19.4 percent or 1.22 kg per person by 1990. To meet this demand, an additional 126 thousand tons, equal to a 3.7 percent annual increase, will be required to supply the Javanese market by 1990.

A significant portion of this demand will be generated by the urban poor. Currently, poor urban household members consume 9.4 kg of fish per year. However, they exhibit a significant expenditure elasticity of demand for fish of 1.80. Assuming a per capita income rise of 1.7 percent per year for this group, this would result in increased consumption of 1.8 kg by 1990.

Increased demand for fish on Java will have a significant impact on Eastern Indonesia. Traditional areas of fish supplies for the Javanese market, the Malacca Straits, the North and South coasts of Java, and the South coasts of Sulawesi and Kalimantan, are currently over exploited; thus, new supplies of fish will not be available from these areas on a sustained yield basis. Eastern Indonesia, with exploitation rate of 4.1 percent of potential landings, offers a long-term source of supply.

Increased demand for fish from this area would have a significant impact on Moluccan fishermen and processors. With limited land for cultivation, 17 percent of the Moluccan male population between the ages of 15 and 50 are employed in full- or part-time fishing. On a full-time basis, this equals approximately 45,000 fishermen. Only a small proportion of these fishermen, approximately 5 percent, are employed in the modern fish sector. On the average, fishermen employed in the traditional sector make 150 days fishing trips per year and average 200 kg of fresh fish per trip. Approximately 21 percent of the traditionally-harvested fish is dried and salted and sold at a weighted average of Rp 167 per kg. Accounting for weight losses during processing, this suggests that the annual catch from each small scale fisherman generates Rp 1.5 million in gross income per year, shared by fishermen and processors.

Estimates of per capita consumption of dried fish on Java are not available. However, if it is assumed that 23 percent of all fish sold on Java is dried and salted (the national average), annual demand for dried fish would rise by 48,000 metric tons by 1990. If only 20 percent of this demand were met by Malukuan fishermen and processors, this would result in an increase in annual gross revenues of Rp. 21.8 billion or US $ 19.5 million per year. Finally, an additional 73,000 man days of labor per year would be required to provide the volume of fresh fish to meet this demand.

## Appendix 1. Financial and Economic Prices

| COMMODITY | 1990 PRICES FINANCIAL | 1990 PRICES ECONOMIC[a] |
|---|---|---|
| **UREA** | | |
| Export price, FOB Europe, US $/ton[b] | | 270 |
| Ex-factory price, Jakarta | | 285 |
| Transport handling to retail level | | + 16 |
| Storage and transfer to farm level | | + 4 |
| Farm gate price, US $/ton | | = 305 |
| Farm gate price, Rp/kg[c] | | = 343 |
| Financial farm-gate price, Rp/kg[f] | 150 | |
| **TSP** | | |
| Export, FOB US Gulf post, US $/ton | | 188 |
| Freight and insurance to Jakarta | | + 34 |
| Ex-factory price Jakarta | | = 222 |
| Transport/handling to retail level | | + 16 |
| Storage and transfer to farm level | | + 4 |
| Farm gate price, US $/ton | | 242 |
| Farm gate price, Rp/kg[c] | | 272 |
| Financial farm gate price, Rp/kg[f] | 150 | |
| **Pesticides** | | |
| Farm gate price, US $/liter | | 10 |
| Farm gate price, Rp/liter[c] | | 11250 |
| Financial farm gate price, Rp/liter[g] | 4140 | |
| **Maize** | | |
| Export price, FOB Gulf port, US $/ton | | 113 |
| Adjusted export price, FOB outer islands[d] | | + 15 |
| Port handling | | - 10 |
| Transfer, farm to port[e] | | - 22 |
| Farm gate price, US $/ton | | 96 |
| Farm gate price, Rp/kg[c] | | 108 |
| Financial farm gate price, Rp/kg. | 95 | |
| **Soybean meal** | | |
| Export price, FOB Gulf port, US $/ton | | 208 |
| Freight and insurance to Jakarta | | + 38 |
| CIF, Jakarta | | = 246 |
| Port handling and storage | | + 15 |
| Bagging | | + 10 |
| Transfer, port to wholesaler | | - 4 |
| Transfer, wholesaler to farmer | | - 27 |
| Farm gate price, US $/ton | | 240 |
| Farm gate price, Rp/kg[c] | | 270 |
| Financial farm-gate price, Rp/kg | | 307 |

| | | |
|---|---|---|
| Shrimp | | |
| FOB price, Tokyo, US $/kg | | 1888 |
| Freight and insurance to Ujung Pandang[h/] | | - 283 |
| CIF price, Ujung Pandang | | = 1605 |
| Port handling and transportation | | - .20 |
| Processing costs[i/] | | - 3.58 |
| Processing losses[j/] | | - 4.82 |
| Transport/handling, farm to processor[k/] | | - 1.51 |
| Farm gate price, US $/kg | | 5.94 |
| Farm gate price, Rp/kg[c/] | | 6683 |
| Financial farm gate price, Rp/kg | 6440 | |

Notes:

a/ Based on World Bank projections, January 1986.
b/ Urea valued ex-factory, Jakarta. Price projections for bagged urea, FOB Europe, are adjusted to the Indonesian market by adding a transport.
premium of US $15/ton.
c/ Conversion rate Rp.1125 = US $1.00.
d/ Assumes Indonesia net exports of maize, the export price (FOB Ujung Pandang) is estimated using the 1990 world market price plus a US $15 transport premium.
e/ Includes physical losses, storage and packaging
f/ Assumes a 36 percent increase in GOI controlled market prices by 1990.
g/ Assumes a 50 percent increase in GOI controlled market prices by 1990.
h/ Assumes 15 percent of CIF price, Tokyo.
i/ Includes factory rental ($0.01), cold storage costs ($0.16), processing labor ($0.12), water ($0.01), packing materials ($0.10).
j/ Assumes 30 percent loss in volume during processing.
k/ Includes transport costs, losses and return to collectors.

## Appendix 2. Per Hectare Annual Financial and Economic Returns: Carp Hatchery Production System

| ITEM | | UNIT | QUANTITY | PRICE FINANCIAL | PRICE ECONOMIC | COST FINANCIAL | COST ECONOMIC |
|---|---|---|---|---|---|---|---|
| **OUTFLOWS** | | | | | | | |
| **Brood Stock** | | | | | | | |
| Hatchery construction | | | 1 | 42210 | 42210 | 4221 | 4327 |
| Storehouse[a/] | | m2 | 540 | 1875 | 1594 | 101250 | 86076 |
| Ponds[b/] | | pairs | 30 | 10000 | 10000 | 75000 | 75000 |
| Brood stock[c/] | | | | | | | |
| Feed | | kg | 1100 | 95 | 105 | 104500 | 115500 |
| Corn | | kg | 370 | 50 | 50 | 18500 | 18500 |
| Cassava chips | | kg | 1100 | 15 | 15 | 16500 | 16500 |
| Feed preparation | | m2 | 10 | 100 | 100 | 1000 | 1000 |
| Hatch medium | | | | | | | |
| Labor | | | | | | | |
| Maintenance | hired | man days | 10 | | | | |
| | total | man days | 10 | 1500 | 1125 | 15000 | 11250 |
| Pond supervision | hired | man days | 30 | | | | |
| | total | man days | 90 | 1500 | 1125 | 45000 | 101250 |
| Culling/stocking | hired | man days | - | | | - | |
| | total | man days | 5 | 2000 | 1500 | | 7500 |
| Sorting/moving | hired | man days | 10 | | | | |
| | total | man days | 10 | 2000 | 1500 | 20000 | 15000 |
| Debt servicing[d/] | | | | | | 195633 | |
| Sub Total | | | | | | 586604 | 451993 |
| **Fry Production** | | | | | | | |
| Harvest containers | | bucket | 5 | 3000 | 3000 | 15000 | 15000 |
| Inlet/outlet structures | | gates | 2 | 1500 | 1500 | 3000 | 3000 |
| Fertilizer | | | | | | | |
| Urea | | kg | 750 | 150 | 343 | 112500 | 257250 |
| TSP | | kg | 390 | 150 | 272 | 58500 | 106080 |
| Chicken manure | | kg | 1150 | 60 | 60 | 69000 | 69000 |
| Lime | | kg | 10 | 120 | 120 | 1200 | 1200 |
| Soybean meal | | kg | 250 | 307 | 270 | 76750 | 67500 |
| Pesticides | | liter | 2 | 4140 | 11250 | 8280 | 22500 |
| Labor | | | | | | | |
| Pond supervision | hired | man days | 80 | | | | |
| | total | man days | 180 | 1500 | 1125 | 120000 | 202500 |
| Feeding | hired | man days | 40 | | | | |
| | total | man days | 100 | 1500 | 1125 | 60000 | 112500 |
| Pond maintenance | hired | man days | 10 | | | | |
| | total | man days | 10 | 1500 | 1125 | 15000 | 11250 |
| Harvesting/stocking | hired | man days | 20 | | | | |
| | total | man days | 30 | 2000 | 1500 | 40000 | 45000 |
| Debt servicing[e/] | | | | | | 71976 | |
| Sub Total | | | | | | 651206 | 912780 |
| Total outflows | | | | | | 1237810 | 1364693 |

| | | | | | |
|---|---|---|---|---|---|
| INFLOWS | | | | | |
| Fry production | 1,080,000 | 2 | 2 | 2160000 | 2160000 |
| Net returns - without family labor | | | | 922130 | 725317 |
| - with family labor | | | | 662130 | |

Notes:

a/ Assumes 10 percent of construction materials are imported and storehouse has a life of 10 years.
b/ Assumes 60 percent of construction cost is unskilled labor valued at 75 percent of daily wage rate and ponds have a life of 10 years.
c/ Assumes 25 percent per year replacement rate due to mortality and genetic improvement.
d/ Assumes 70 percent of capital investment costs are borrowed at 18 percent per year over a 10 year loan period.
e/ Assumes 50 percent of operating capital borrowed at 18 percent for one year.

## Appendix 3. Annual Financial and Economic Returns: Paddy Carp Production System (one hectare)

| ITEM | | UNIT | QUANTITY | PRICE FINANCIAL | PRICE ECONOMIC | COST FINANCIAL | COST ECONOMIC |
|---|---|---|---|---|---|---|---|
| OUTFLOWS | | | | | | | |
| Construction a/ | | | | | | | |
| Dike and bund | | m | 1500 | 80 | 60 | 24000 | 18000 |
| Inlet/outlet | | | 2 | 1000 | 750 | 400 | 300 |
| Equipment b/ | | | | | | | |
| Screens/nets | | | 1 | 2250 | 2250 | 2250 | 2250 |
| Harvest container | | | 1 | 750 | 750 | 150 | 150 |
| Stocking | | fry | 200000 | 2.5 | 2.5 | 500000 | 500000 |
| Feed : | | | | | | | |
| Chicken feed | | kg | 600 | 40 | 40 | 24000 | 24000 |
| Rice bran | | kg | 600 | 16 | 16 | 9600 | 9600 |
| Feed preperation | | kg | 1200 | 10 | 10 | 12000 | 12000 |
| Feeticides | | liter | 72 | 4140 | 11250 | 298080 | 810000 |
| Labor | | | | | | | |
| Trench construction | hired | man days | 20 | | | | |
| | total | man days | 20 | 2000 | 1500 | 40000 | 30000 |
| Stocking | hired | man days | | | | | |
| | total | man days | 4 | 1500 | 1125 | - | 4500 |
| Field supervision | hired | man days | 15 | | | | |
| feeding | total | man days | 60 | 1500 | 1125 | 22500 | 67500 |
| Spraying | hired | man days | 20 | | | | |
| | total | man days | 20 | 2000 | 1500 | 40000 | 30000 |
| Harvesting | hired | man days | 16 | | | | |
| | total | man days | 16 | 2000 | 1500 | 32000 | 24000 |
| Debt servicing c/ | | | | | | 90448 | - |
| Total outflows | | | | | | 1095428 | 1532500 |
| INFLOWS | | | | | | | |
| Fry production d/ | | | | | | | |
| First harvest | | fingerlings | 65000 | 17 | 17 | 1105000 | 1105000 |
| Second harvest | | fingerlings | 50000 | 17 | 17 | 850000 | 850000 |
| Total inflows | | | | | | 1955000 | 1955000 |
| Net returns - without family labor | | | | | | 859572 | 422700 |
| - with family labor | | | | | | 786072 | |

Notes:

a/ Assumes dikes, bunds and inlet/outlet structures have a life of five years. The economic cost of construction is composed of the cost of hired labor and valued a 75 percent financial cost estimate.

b/ Screens and nets assumed to have a one year life, harvest containers a five year life.

c/ Assumes producers borrow 50 percent of the variable cost of production at 18 percent for six months (stocking, feeds, pesticides and hired labor).

d/ Assumes four crops per year with survival rates of 65 percent for the first and third crop and 50 percent for the second and fourth crop and yields of 65,000 and 50,000 of five to eight centimeter fingerlings.

## Appendix 4. Annual Financial and Economic Returns: Pond Carp Production System (one hectare)

| ITEM | | UNIT | QUANTITY | PRICE FINANCIAL | PRICE ECONOMIC | COST FINANCIAL | COST ECONOMIC |
|---|---|---|---|---|---|---|---|
| OUTFLOWS | | | | | | | |
| Construction a/ | | | | | | | |
| Dike and bund | | m | 3000 | 80 | 60 | 48000 | 36000 |
| Inlet/Outlet | | gate | 6 | 1000 | 750 | 1200 | 900 |
| Equipment b/ | | | | | | | |
| Screens/nets | | | 5 | 1500 | 1500 | 7500 | 7500 |
| Harvest container | | | 2 | 1500 | 1500 | 3000 | 3000 |
| Stocking | | fingerlings | 3000 | 50 | 50 | 150000 | 150000 |
| Feed : | | | | | | | |
| Chicken manure | | kg | 4000 | 50 | 50 | 200000 | 200000 |
| Chicken feed | | kg | 320 | 150 | 150 | 48000 | 48000 |
| Corn | | kg | 320 | 95 | 108 | 30400 | 34560 |
| Feed preparation | | kg | 640 | 15 | 15 | 9600 | 9600 |
| Labor : | | | | | | | |
| Land preparation | hired | man days | 20 | | | | |
| | total | man days | 28 | 2000 | 1500 | 40000 | 42000 |
| Stocking | hired | man days | | | | | |
| | total | man days | 2 | 1500 | 1125 | - | 2250 |
| Pond supervision | hired | man days | 36 | | | | |
| feeding | total | man days | 96 | 1500 | 1125 | 54000 | 108000 |
| Harvesting | hired | man days | 12 | | | | |
| | total | man days | 24 | 2000 | 1500 | 24000 | 36000 |
| Land taxes c/ | | | | | | 97200 | |
| Debt servicing d/ | | | | | | 25020 | |
| Opportunity cost of land e/ | | | | | | 200000 | 220000 |
| Total outflows | | | | | | | |
| INFLOWS | | | | | | | |
| Crop production f/ | | kg | 864 | 1500 | 1500 | 1296000 | 1296000 |
| Total Inflows | | | | | | | |
| Net returns | - without family labor | | | | | 350080 | 338180 |
| | - with family labor | | | | | 225080 | |

Notes:

a/ Assumes ponds and inlet/outlet structures have a life of five years. The economic cost of construction is composed of hired labor costs valued at 75 percent of financial costs.

b/ Screens and nets assumed to have a one year life, harvest containers a five year life.

c/ Assumed to be 7.5 percent of gross receipts.

d/ Assumes 50 percent of variable costs (stocking, feed and hired labor) are borrowed at 18 percent for six months.

e/ Assumes ponds are taken out of local rice production and that fields generated Rp 200,000 and Rp 210,000 per hectare in financial and economic returns respectively.

f/ Assumes two crops per year of 1200 fish, each weighing 36 grams.

## Appendix 5. Per Hectare Annual Financial and Economic Returns: Tambak Production System

| ITEM | | UNIT | QUANTITY | PRICE FINANCIAL | PRICE ECONOMIC | COST FINANCIAL | COST ECONOMIC |
|---|---|---|---|---|---|---|---|
| OUTFLOWS | | | | | | | |
| Construction a/ | | | | | | | |
| Ponds | | ha | 1 | 3000000 | 2250000 | 300000 | 275000 |
| Dikes | | m | 100 | 1500 | 1125 | 150000 | 112500 |
| Gates | | gate | 3 | 10000 | 10000 | 15000 | 15000 |
| Equipment b/ | | | | | | | |
| Nets | | | 3 | 700 | 700 | 2100 | 2100 |
| Harvest containers | | | 1 | 1500 | 1500 | 300 | 300 |
| Stocking | | | | | | | |
| Shrimp | | fry | 20000 | 35 | 35 | 700000 | 700000 |
| Whitefish | | fingerlings | 2960 | 50 | 50 | 148000 | 148000 |
| Fertilizer | | | | | | | |
| Urea | | kg | 150 | 150 | 343 | 22500 | 51450 |
| TSP | | kg | 72 | 150 | 272 | 10800 | 19584 |
| Chicken manure | | kg | 1480 | 30 | 30 | 44400 | 44400 |
| 30% protein pellets | | kg | 180 | 1200 | 1200 | 216000 | 216000 |
| Pesticides | | | | | | | |
| Bretan 60 | | kg | .8 | 22500 | 22500 | 18000 | 18000 |
| Thesban | | kg | .8 | 8000 | 11250 | 6400 | 9000 |
| Labor : | | | | | | | |
| Stocking/feeding | hired | man days | 40 | | | | |
| | total | man days | 180 | 1500 | 1125 | 60000 | 202500 |
| Water control | hired | man days | 80 | | | | |
| | total | man days | 80 | 1500 | 1125 | 120000 | 90000 |
| Milkfish harvest | hired | man days | 6 | | | | |
| | total | man days | 6 | 1500 | 1125 | 9000 | 6750 |
| Shrimp harvest | hired | man days | 6 | | | | |
| | total | man days | 6 | 1500 | 1125 | 9000 | 6750 |
| Land tax c/ | | | | | | 319829 | |
| Sales tax d/ | | | 15000 | 2.25 | | 33750 | |
| Debt servicing e/ | | | | | | | |
| Capital costs | | | | | | 438900 | |
| Variable costs | | | | | | 51154 | |
| Total outflows | | | | | | 2674132 | 1917334 |
| INFLOWS | | | | | | | |
| Shrimp production f/ | | kg | 536 | 6440 | 6683 | 3451840 | 3582088 |
| Milkfish production g/ | | kg | 888 | 900 | 900 | 799200 | 799200 |
| Total inflows | | | | | | 4251040 | 4381288 |
| Net revenue - without family labor | | | | | | 1576908 | 2463954 |
| - with family labor | | | | | | 1364908 | |

Notes:

a/ Assumes purchase and excavation costs of ponds at Rp 20,000 and Rp 10,000 respectively, and a pond life of 10 years. Dikes are repaired each year and gates replaced every two years.

b/ Assumes nets have a life of one year and harvest containers five years.

c/ Assumes a land tax of 75 percent on gross revenues.

d/ Sales tax: Rp 2.25 per shrimp tail and 2.5 per milkfish.

e/ Assumes 70 percent of capital costs borrowed at 18 percent per year over 10 years and 50 percent of operating costs borrowed at 1% percent for five months.

f/ Assumes mortality rates of 25 percent, annual production of 15,000 tails, and 28 tails per kilogram

g/ Assumes mortality rates of 90 percent, annual production of 2664 fish, and 3 fish per kilogram.

# ANNEX M. INITIAL ENVIRONMENTAL EXAMINATION

Project No. : 497-0352
Project Title : Aquaculture Research and Development

## I. Examination of Nature, Scope and Magnitude of Project

### A. Project Description

The goal of the project is to develop a viable fisheries research program in the Ministry of Agriculture. To achieve this interventions are planned in the three major fisheries subsectors: freshwater aquaculture, brackish water research and Eastern Indonesian pelagic fisheries. The interventions encompass training for research, in several universities; research, in universities and in the Agency for Agricultural Research and Development (AARD) and extension in AARD and DGF (the Directorate General of Fisheries).

Because of the acute shortage of human resources with sufficient training and experience, the project concentrates almost totally on technical assistance, training, extension support and support for research and special studies. Of the total funds $500,000 is allocated to construction and $1,050,000 to equipment. The equipment allocation is primarily to raise the standards of university and regional laboratories to a level which will support substantive research. Construction funding will be used to improve existing hatcheries and ponds especially the raceways, water sources and ponds at the Kerasaan Hatchery in North Sumatra.

### B. Identification and Evaluation of Environmental Impacts

The project concentrates on technical assistance training and extension which have no physical impact on the environment. Construction activities are limited to small areas in scattered locations. The primary purpose of the construction is to improve the water quality in the Kerasaan fish hatchery by designing race ways, a deep well and improving overall system operation to offset heavy silting and potential disease from irrigation water. Fish ponds will also be constructed to offset suspended silt and provide an environment supportive of the development of healthy fish stock for breeding and marketing.
All construction will be designed with environmental concern as a major factor.

## II. Recommendation for Environmental Action

A decision for a negative determination is recommended.

INITIAL ENVIRONMENTAL EXAMINATION

Project Location : Indonesia

Project Title : Aquaculture Research and Development

Funding : LOP $13,975,000 (G $8,775,000 + L $5,200,000)

Life of Project : 1987 - 1994

IEE Prepared by : Desmond O'Riordan - Environmental Officer USAID/I

Environmental Action
Recommended : Negative Determination

Mission Director's
Concurrence : _____ Date: 9/4/85
William P. Fuller

Assistant Administrator's
Decision

Delegated to Mission Director
per 85 State 137444

Approved : _____

Disapproved : _____

DATE : 05/06/85

ANNEX N

Waiver Control No. IND/86/53

ACTION MEMORANDUM FOR THE DIRECTOR

DATE : August 28, 1986

FROM : Ron Redman, PRO
Ken Randolph, ARD

SUBJECT: AID Project 497-0352, Fisheries Research and Development Project; International Travel Costs for Long-Term Participants

Issue: A waiver is required to authorize AID funding of approximately $90,000 in international travel costs for long-term participants under the subject project.

Pertinent Data:

a. Cooperating Country: Indonesia
b. Project: Fisheries Research and Development Project No. 497-0352
c. Funding Source: Loan
d. Description of Services: International Travel Costs to U.S. and possibly other Code 941 countries
e. Approximate Cost: $90,000 (for life of project)

Justification:

AID Handbook 10, Chapter 15 requires that the host country pay the cost of international travel associated with participant training. The Mission Director has the authority to waive this requirement under Handbook 10, Part 15B, with notification to DS/IT in AID/W.

Background: During the recent negotiations with the GOI on the project budget, the GOI requested that AID loan-fund the international travel costs of the long-term participants under the project. Their request was based on the GOI budget constraints at the present time and for the foreseeable future. GOI officials explained that funds for travel are extremely tight and that allocation priority for travel funds is low and is expected to remain low for some time. USAID personnel explained that AID's agreement to fund international travel costs in this project does not mean a change in AID's overall policy on international travel and that if the GOI budgetary situation improves during the life of the project the GOI would be expected to pick up these costs, through a revision to the Project's Financial Plan in the Amplified Project Description of the Project Agreements.

It is anticipated that the project will finance long-term training for 20 participants. Of the 20 long-term participants, 5 will be PhD candidates. It is planned that the 5 PhD candidates will have a total of two-round trips. One would be to return to Indonesia to attend the national fisheries research

planning meeting in year four of the project. Therefore, the total planned round trips is 25, including 10 for the PhD candidates, and 15 for the MSc candidates. Based on an average estimated international travel cost per participant of $3,600, the total estimated cost would be $90,000. Training of these participants is critical to the success of the project since these trainees will contribute greatly to the important research in their respective areas of expertise. USAID believes that approving AID's financing of these costs is in the best interest of the project.

Recommendation: That you waive the requirement that the host country bear the costs of international travel for long-term participants and authorize the use of approximately $90,000 of loan funds under the project for this travel.

Approved: _____
William P. Fuller
Director

Disapproved: _____
William P. Fuller
Director

Date: _____

cc: DS/IT

Drafted:PRO:RKedman:pl

Clearances: AP.D:JHale _____
LO:GBisson (in draft) _____
EHR/T:DFoster-Gross _____
DD:JAnderson _____

## ANNEX O. COST ESTIMATE TABLES

### TABLE 1. AID/GOI PROJECT COSTS BY U.S. FISCAL YEAR
($ 000)

| AID Contribution | FY1987 | FY1988 | FY1989 | FY1990 | FY1991 | FY1992 | TOTAL |
|---|---|---|---|---|---|---|---|
| **Grant:** | | | | | | | |
| Technical Assistance | | | | | | | |
| Long-Term (6 py) | 190 | 405 | 224 | 224 | 224 | 170 | 1,437 |
| Short-Term ( 68 pm) | 145 | 167 | 167 | 242 | 167 | 242 | 1,130 |
| Vehicles/Farm Equipment | 22 | 70 | | 128 | 20 | | 240 |
| Special Studies | | 50 | 50 | 50 | 50 | 20 | 220 |
| SUB-TOTAL | 357 | 692 | 441 | 644 | 461 | 432 | 3,027 |
| Contingency and Inflation (10%)* | 28 | 68 | 44 | 64 | 46 | 43 | 293 |
| TOTAL | 385 | 760 | 485 | 708 | 507 | 475 | 3,220 |
| **Loan** | | | | | | | |
| Construction | | 200 | 300 | | | | 500 |
| Training | | | | | | | |
| Long-Term | 213 | 482 | 482 | 392 | 102 | | 1,671 |
| Equipment | | | | | | | |
| Fish Equipment | | 76 | 833 | 54 | 54 | 47 | 1,064 |
| Shipping-Insurance | | 14 | 162 | 12 | 12 | 6 | 206 |
| SUB-TOTAL | 213 | 772 | 1,777 | 458 | 168 | 53 | 3,441 |
| Contingency and Inflation (10%) | 21 | 77 | 178 | 46 | 17 | 5 | 344 |
| TOTAL | 234 | 849 | 1,955 | 504 | 185 | 58 | 3,785 |

* This figure is not exactly 10% due to the requirement to make a last minute budget change after receipt of budget allocation from Washington.

Table 1 Cont.

| GOI Contribution | FY1987 | FY1988 | FY1989 | FY1990 | FY1991 | FY1992 | TOTAL |
|---|---|---|---|---|---|---|---|
| Equipment | | | | | | | |
| Feed, Fertilizer & Broodstock | | | 7 | 163 | 156 | 156 | 482 |
| Training | | | | | | | |
| Short-Term In-Country (100 pm) | | | 35 | 35 | 35 | 35 | 140 |
| Special Studies | | 20 | 20 | 20 | 20 | 20 | 100 |
| Administration | 22 | 22 | 22 | 194 | 194 | 194 | 648 |
| SUB-TOTAL | 22 | 42 | 84 | 412 | 405 | 405 | 1,370 |
| Contingency and Inflation (10%) | 2 | 4 | 8 | 41 | 41 | 41 | 137 |
| TOTAL | 24 | 46 | 92 | 453 | 446 | 446 | 1,507 |

TABLE 2. ESTIMATED BREAKDOWN OF COSTS BY MINISTRY
($ 000)

| | AID | | GOI | | |
|---|---|---|---|---|---|
| | MOA | MOE | MOA | MOE | TOTAL |
| Technical Assistance | | | | | |
| Long-Term 1/ (6 py) | 1,437 | | | | 1,437 |
| Short-Term 2/ (68 pm) | 633 | 497 | | | 1,130 |
| Construction | 200 | 300 | | | 500 |
| Equipment 3/ | 927 | 583 | 280 | 202 | 1,992 |
| Training | | | | | |
| Long-term Abroad (55 py) 4/ | 765 | 906 | | | 1,671 |
| Short-term In-Country (100 pm) | | | 70 | 70 | 140 |
| Special Studies | 140 | 80 | 50 | 50 | 320 |
| Project Administration 5/ | ——— | ——— | 432 | 216 | 648 |
| SUB-TOTAL | 4,102 | 2,366 | 832 | 538 | 7,838 |
| Contingency and Inflation 6/ (10% Sub Total) | 405 | 232 | 83 | 54 | 774 |
| In-Kind Contribution | | | 1,300 | 1,400 | 2,700 |
| T O T A L | 4,507 | 2,598 | 2,215 | 1,992 | 11,312 |

1/ Includes $288,000 for in-country support and $100,000 in miscellaneous and equipment items.

2/ Includes $110,000 for additional round trip fares/annum for 7 ST Specialists.

3/ A specific equipment list will be developed for each component unit in the second year of the project.

4/ 5 PhD and 15 MSc Degrees.

5/ Project administration costs based on 3 years of expanded research program operation and maintenance (O&M) costs for 16 departments in the 7 project units at a monthly cost of $100/month; 20 project vehicles (17 vehicles and 3 pumps) for an average of 4 years at an average annual unit cost of $4,410; and 76 hectares of research ponds at a monthly hectare cost of $100 (feed, fertilizer, etc. inputs are included in equipment/commodities funding). As this project does not add additional staff or programs, etc. to the project components, administrative costs are limited to the expanded operation and maintenance of research facilities.

6/ Contingency and inflation figures on the AID funds are assigned to MOA and MOE based on the respective percentages of Grant and Loan funds assigned to each Ministry. However, the AID figures are not exactly 10% due to the requirement to make a last minute budget change after receipt of budget allocation from AID/Washington.

TABLE 3. EQUIPMENT AND COMMODITY COST ESTIMATES 1/
($ 000)

| Item | AID | GOI | | TOTAL |
|---|---|---|---|---|
| | | MOA | MOE | |
| LOAN FINANCED | | | | |
| Fish Farming-Research Equipment Tools and Supplies | 630 | | | 630 |
| Feed Mill Equipment and Suppliers/ Miscellaneous-Replacement Equipment | 230 | | | 230 |
| Office Equipment and Supplies (Computers, Photocopiers) | 128 | | | 128 |
| Reference Materials | 56 | | | 56 |
| SSB Radio @ $5,000 | 20 | | | 20 |
| Fish Feed, Fertilizers, Broodstock | | 280 | 202 | 482 |
| Vehicles, Boats and Pumps | 240 | | | 240 |
| SUBTOTAL | 1,304 | 280 | 202 | 1,786 |
| Freight and Insurance 2/ | 206 | | | 206 |
| TOTAL | 1,510 | 482 | | 1,992 |

1/ Costs reflect equipment and commodities for 7 project components, plus RCCF headquarters. Fish production input costs are based on 76 hectares of research ponds (10 - Palembang, 40 - Maros, 6 - IPB and 20 - UNHAS) at a production rate of 5,500 kg/ha/annum using a combination of feed and fertilizer. Cost for some line items have been averaged on a per-unit basis for the purpose of general budgeting. Short-term TA will be used to develop specific equipment lists for each component.

2/ Estimate based on 30 percent of $686,000 worth of commodities to be procured offshore.

TABLE 4. TRAINING COST ESTIMATES
($ 000)

| | AID Loan | GOI MOA | GOI MOE | TOTAL |
|---|---|---|---|---|
| 1. Long - Term Training | | | | |
| US Institution | | | | |
| a. 5 PhD Participants, 42 Months | | | | |
| 3 Aquaculture | | | | |
| 1 Fisheries Economics | | | | |
| 1 Post - Harvest Technology | | | | |
| Tuition - Living Expenses @ $87.5 | 438 | | | 438 |
| English Language Training @ $10.0 1/ | 50 | | | 50 |
| Travel - Per Diem @ $7.0 2/ | 35 | | | 35 |
| a. 15 MSc Participants, 30 Months | | | | |
| 7 Aquaculture | | | | |
| 4 Fisheries | | | | |
| 3 Fisheries Economics | | | | |
| 1 Post - Harvest Technology | | | | |
| Tuition - Living Expenses @ $62.5 | 938 | | | 938 |
| English Language Training @ $10.0 | 150 | | | 150 |
| Travel - Per Diem @ $4.0 | 60 | | | 60 |
| SUBTOTAL | 1,671 | 0 | 0 | 1,671 |
| 2. Short - Term Training and Seminars | | | | |
| a. In - Country | | | | |
| 10 2-week Technical Course | | | | |
| 20 Participants/Course | | | | |
| Travel @ $0.4 | | 80 | | 80 |
| Per Diem $0.3 | | 60 | | 60 |
| T O T A L | 1,671 | 140 | 0 | 1,811 |

1/ $6.8 tuition, $3.25 travel and per diem.

2/ Includes two round trip air fares for PhD participants to return to Indonesia to attend fisheries research planning under the national research planning meeting in year 4 of the project.

TABLE 5. TECHNICAL ASSISTANCE COSTS
($ 000)

| Technical Assistance | Man Months | | Total Cost (AID Grant) | |
|---|---|---|---|---|
| | MOA | MOE | MOA | MOE |
| Long-Term Specialists | 72 | | 1,050 | |
| Long-Term In-Country Costs | | | | |
| Housing | | | 225 | |
| Vehicles (2) | | | 30 | |
| Equipment Purchases | | | 100 | |
| Travel | | | | |
| In-Country | | | 26 | |
| International | | | 6 | |
| SUBTOTAL | 72 | | 1,437 | |
| Short-Term Specialists 1/ | 38 | 30 | 570 | 450 |
| (e.g., Fish Nutritionist/ Geneticist, Aquaculture Development, Marine Fisheries, Research Management, Fish Economics, Post Harvest, Water Quality, Marketing, and Processing) | | | | |
| Additional Air Fare 2/ | | | 63 | 47 |
| PERSON MONTHS-COSTS, SUBTOTAL | 110 | 30 | 2,070 | 474 |
| PERSON MONTHS-COSTS, TOTAL | 140 | | 2,567 | |

Cost Factors: LT: $175,000/Year, ST: $15,000/Month

1/ Disbursement of funds for short-term consultancies will be contingent on submission by the contractor, for USAID approval, short-term annual technical assistance work plans and associated financial plans, to include terms of reference dates, identification of counterparts, and contact institutes involved.

2/ Includes $110,000 for additional round trip fares/annum for 7 ST Specialists.

TABLE 6. SPECIAL STUDIES AND RESEARCH COST ESTIMATES
($ 000)

| STUDY ACTIVITY 1/ | ESTIMATED COST AID Grant | AID Loan | GOI |
|---|---|---|---|
| A. Policy and Management | | | |
| - Assessment of Fisheries Policy and Planning | 30,000 | | |
| - Assessment of Foreign and Domestic Fisheries Marketing Opportunities | 30,000 | | |
| - Strategies for National Fisheries Research Policy | 30,000 | | |
| - Strategies for Establishing Pilot Market Price and Reporting System | 30,000 | | |
| - Establishment of National Fisheries Research Group | 100,000 | | 100,000 |
| TOTAL | 220,000 | | 100,000 |

1/ Inputs for Monitoring and Evaluation studies/activities will be provided under the project component for short-term technical assistance.

TABLE 7. METHODS OF IMPLEMENTATION AND DISBURSEMENT
($000)

| Method of Implementation | Method of Financing | Amount Grant | Amount Loan |
|---|---|---|---|
| 1. Technical Assistance | Direct payment to TA Contractor | 2,567 | |
| 2. Construction | Direct payment to TA Contractor | | 500 |
| 3. Equipment and Commodities | Direct payment to suppliers | 240 | 1,270 |
| 4. Training Long-Term Abroad (and in-country ELT) | Direct payment to suppliers | | 1,671 |
| 5. Special Studies | Direct payment to suppliers | 220 | |
| Sub-Total | | 3,027 | 3,441 |
| 6. Contingency and Inflation (10%) | - | 293 1/ | 344 |
| TOTAL | | 3,320 | 3,785 |

1/ Due to the requirement to make a last minute budget change after receipt of budget allocation from Washington this figure is not exactly 10%.

# ANNEX P. MONITORING AND EVALUATION SYSTEM

## 1. Monitoring Institutional Development, Inter-Institutional Linkages, and Research Capacity

### Characteristics of the Monitoring System

The monitoring system is expected to provide appropriate and timely information to the mission project committee concerning the status of project implementation. The monitoring system is a specific sub-objective of the project and is to be institutionalized. The institutionalization of the monitoring system as a management tool for the involved institutions will ensure that its use will be continued after the life of the project.

As a first step in monitoring project implementation, the long-term technical assistance Team Leader will prepare, in coordination with counterparts and involved institutions, a set of monitoring forms or logs concerning institutional development, inter-institutional linkages, and research capacity. The forms and/or logs will outline key indicators to facilitate the consolidation of information at each level of reporting responsibility in a manner which will provide summaries for decision makers as well as back-up data files.

A second step in developing the monitoring system will involve the identification of staff responsible for reporting on various activities, defining responsibilities for summarizing and monitoring the information, and providing feedback to the project implementors. Structures such as these will facilitate the timely distribution of relevant information and provide sources of data and information for two interim evaluations and a final project evaluation.

VOD

Project monitoring systems will focus only on key indicators relevant to project objectives. The key indicators for defined information needs concerning institutional development, inter-institutional linkages, and research capacity are listed in the three following subsections.

Key Indicators for Monitoring the Formulation and Coordination of a National Fisheries Research Agenda

The focus of this aspect of monitoring is an examination of fisheries research in involved research institutes and universities in the context of research being conducted by other institutions, the needs of Indonesia, the dissemination and application of research results, and budget allocations.

The questions to be addressed include:

- o Are current fishery research programs addressing the needs of Indonesia?
- o Are research findings being disseminated to all potential users?
- o Are results of research being applied to national needs?
- o What is the relationship between private sector and government sponsored research?

Indicators that will form part of the data and information used to respond to these questions include the following:

- o Indicators of involved institutions' research capacity, listed below under the monitoring of institutional development.
- o Abstracts of ongoing and proposed fisheries research at other institutions, both GOI and private sector.
- o Descriptions of procedures used to disseminate research findings (e.g., mailing lists, seminars).
- o Descriptions of users responses to research findings.

## Key Indicators for Monitoring Institutional Development

Although two types of institutions are involved, there is a great deal of overlap between the type of information to be monitored; hence, they will be considered together. In cases where key indicators apply to only one type of institution, the indicator will be annotated. Indicators for the management of inputs, fisheries staff development, and facility development are detailed in the following subsections.

Indicators for the Management of Inputs: Basic to the area of institutional development is the establishment of systems to manage inputs. In part this involves establishing monitoring systems to answer questions such as the following:

- Have adequate mechanisms been established to select staff for advanced training?
- Have adequate mechanisms been established to identify areas of training and training centers?
- Are the logistics for paying salary to staff undergoing training and paying training costs adequately developed?
- Is there an adequate system for monitoring the progress of staff training?
- Is there an adequate mechanism for relating facility development to training/research needs?
- Are mechanisms for accounting for project expenditures adequate?
- Have mechanisms been established to provide feedback on monitoring information as a means of adjusting project implementation strategies and tactics?

Indicators of Fishery Staff Development: A major project objective is staff development. Staff here are defined as research and teaching staff. Key indicators of staff development include:

- o Numbers of staff, their degrees, rank, and duties.
- o Numbers of staff currently nominated for training and the type of training.
- o Numbers of staff currently involved in training and the type of training (e.g. subject area, beginning date, expected duration, degree level, source of support).
- o Numbers of staff completing training during the reporting period and type of training (defined above).

Data inputs for indicators of staff development will be a form listing all staff with the above required information. These forms will be summarized into a report answering the first four questions above under "Indicators for Management of Inputs."

Indicators of Fishery Program Structure Development: Program structure refers to the intra-institutional division of labor in the involved institutions. The key indicators concerning program structure are the following:

- o Baseline and amended organizational charts of each institution. For the RCCF this will involve complete organizational charts. For universities, the location of fisheries faculties/departments within the university structure should be identified, and complete organizational charts should be developed for the fishery faculty. Charts should be amended as changes in structure occur.
- o Duties of each structural position in the organizational chart (e.g., dean of fisheries, director, coordinator of research) including information concerning percent of time spent on research, teaching, and administration.

Data for the preparation of organizational structure information include lists of staff annotated according to structural position and duties. These data can be collected and updated in conjunction with data concerning staff development.

Indicators of Training Capacity Development (Universities): Another major objective of the project is to improve the university training program. Key indicators for training programs include the following:

- o Fishery subject areas within which degrees or short-term training are offered.
- o Degrees and certificates offered in fisheries for each subject area.
- o Staffing and program outline for each subject area (e.g., required courses, credits, time).
- o Frequency of course offerings for each course.
- o Number of students in each training level (e.g., short course, Bsc, Msc, PhD) in each subject area.
- o Number of graduates of each training level in each subject area.

The above information will be kept up to date, and the dates of all changes will be noted.

Indicators of Institutional Facility Development: Facilities are an important aspect of institutional development. Although this project is providing minimal hardware input, the viability of scientific research and teaching institutions is heavily dependent on facilities. Indicators concerning facilities are the following:

- o Laboratories (space, equipment, capacity for operation and maintenance).
- o Field research facilities (size, equipment, capacity for operation and maintenance).
- o Library (space, staffing, and holdings).
- o Offices (space).

Logs will be kept concerning changes in any of the above categories. The logs will begin with a baseline and contain proposals for changes, and sources for funding where applicable.

Monitoring Institutional Linkages

The focus of this area of monitoring involves the degree to which the two types of involved institutions share facilities, information, and cooperate in other ways with one another. This type of interaction provides not only a cost-effective way to spread research funds but also pools knowledge, resulting in a greater probability of significant advances without duplication of effort. The primary method for monitoring the evolution of linkages between the two types of institutions involved in the project as well as linkages with other GOI fisheries-related institutions is to set up a logging system. In this system, selected types of inter-institutional interactions will be recorded. The types of information to be logged are the following:

- o Requests to use facilities to/from other institutions (description and follow-up).
- o Requests for information (phone, letter, visit) to/from other institutions (description and follow-up).
- o Talks, lectures, or seminars provided by speakers from/for other institutions (description).
- o Training sessions or workshops provided by/for other institutions (description).
- o Cooperative research performed with other institutions (description).

The key indicators listed above will be recorded on logs which will provide data to be summarized at regular intervals, providing information for those monitoring inter-institutional linkages. The logs themselves will provide back-up data.

Monitoring the Development of Research Capacity

Monitoring the development of research capacity will involve several types of information. One type will be related to the management of research activities and the other will quantify and evaluate research activities.

Indicators for Management of Research: Mechanisms must be established to manage research in the involved institutions. Without such mechanisms, research could become undirected and redundant. In part this involves the establishment of a monitoring system which will respond to the following questions:

- o Have adequate mechanisms been established to stimulate the preparation and submission of research proposals?
- o Have adequate mechanisms been developed to evaluate research proposals?
- o Has management established adequate procedures to manage research projects in terms of keeping financial records, formal reporting, etc.?
- o Has management established an information system which will inform researchers of potential areas of funding of research as well as areas of ongoing and proposed research?

Indicators of Research Capacity: The major objective of the project is increasing the research capacity of involved institutions. Logs will be kept concerning key indicators which can be used to measure both the quantity and quality of research. They will include the following indicators:

- o Numbers of research proposals prepared (topics, funds requested, duration).

- o Numbers of research proposals submitted for external funding (to where, topics, funds requested, duration).
- o Numbers of research proposals funded and sources of funds.
- o Numbers of research projects initiated, ongoing, and completed (source of funding, amounts, topics, and duration).
- o Other research-related grants or contracts (purpose, source of funding, amount, duration).

Logs containing the above information will be summarized into information forming part of an annual report submitted to the Team Leader along with copies of proposals and project reports. The logs will provide data back-up for the report.

Research proposals and project reports will be evaluated by the mission project committee and selected university and MOA personnel. Each reviewer will receive a package of material appropriate to his/her area of specialization. At this meeting reports, proposals, and project reports will be evaluated in terms of overall progress, scientific adequacy, and appropriateness to the needs of Indonesia.

## 2. Characteristics of the Evaluation System

In contrast to the monitoring system which is continuous, the evaluation system will be periodic. Two evaluations are scheduled: One at the end of year four of the project and a final evaluation. Both evaluations will rely heavily on data and information accumulated through the monitoring system described above; hence, evaluation of the monitoring system will be an important aspect of interim evaluations. The monitoring system will provide much of the impact data needed for the final evaluation.

The interim evaluations will examine the efficacy of the monitoring systems, use of its outputs in project management, and progress toward project objectives. In sum, it will respond to the following questions:

- o To what extent has the proposed monitoring system been implemented? Are its reports timely and accurate?
- o How is project management using the outputs of the monitoring system? Are they learning from factors that are impeding project progress?
- o Does management appear to be abreast of issues that are cited in the monitoring reports?
- o Has the training program been effectively implemented, as evidenced by attention to specific project training needs, numbers involved in training, and student progress reports?
- o Has the quantity and quality of interactions between institutions increased? Are mechanisms being developed to enhance this interaction and ensure its continuation after project completion?