

PLANNING AND PROGRAMMING OF FISHERIES DEVELOPMENT  
SUPPORT SERVICES  
WORKPLANS AND MILESTONES

U.S. AID COOPERATIVE AGREEMENT DAN 4024 A-00-2072  
FISHERY DEVELOPMENT SUPPORT SERVICES  
Project Office S&T/AGR/RNR  
PROJECT NO.: 936-4024

SOCIO-CULTURAL FACTORS  
FISHERIES MANAGEMENT AND RESOURCE UTILIZATION  
USE OF MARICULTURE IN DEVELOPING COUNTRIES  
POST-HARVEST FISHERY LOSSES



ICMRD



INTERNATIONAL CENTER FOR  
MARINE RESOURCE DEVELOPMENT

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## INTRODUCTION

Under the terms of USAID Cooperative Agreement DAN 4024 A-00-2072, "Fishery Development Support Services," the International Center for Marine Resource Development provides a range of services including technical assistance, applied research, training opportunities and information resources. These services address four principle fishery management and development problem areas identified as the following:

- Socio-Cultural Factors
- Fisheries Management and Resource Utilization
- Use of Mariculture in Developing Countries
- Post-Harvest Fishery Losses

Descriptions of these problems, problem specifications and targeting, current status and prospects, desirable linkages and expected/intended results are detailed in an October 1985 publication of ICMRD.

The purpose of the following document is to detail a program of work to take place within each of the earlier defined four problem areas. It also describes the administrative, training, information and other program support activities which will take place under the Cooperative Agreement. This workplan will be revised on an annual basis. The contact person at URI is

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The services provided by this Cooperative Agreement are available to USAID Missions, Regional Bureaus and Science and Technology/Central Bureau under various cost sharing arrangements. Requests for services under the Cooperative Agreement are to be directed to Dr. Richard Neal, S&T/AGR/RNR, USAID Washington.

1. PLANNING AND PROGRAMMING OF FISHERIES DEVELOPMENT SUPPORT SERVICES

Output 1.1: Administration of Cooperative Agreement Activities

The Planning and Programming Committee serves as the coordinating linkage for the Fisheries Development Support Services Cooperative Agreement. The major purpose of the Committee is to ensure an interdisciplinary approach to the solving of priority fisheries development problems. Review of all materials produced for the Agreement is also a Committee responsibility. In-house evaluations or reviews are conducted by the Committee. The following work areas have representation on the Committee:

Administration  
 Training Services  
 Information Services  
 Socio-Cultural Factors  
 Fisheries Management and Resource Utilization  
 Use of Mariculture in Developing Countries  
 Post-Harvest Fisheries Issues

Results to Date:

The Committee was formed in February, 1985, and has scheduled six meetings during the first eighteen months. Clerical, editing and word processing services, fiscal services, training support services, and information services are provided and administered by the International Center for Marine Resource Development (ICMRD) Office.

Task Analysis:

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
		<u>Start</u>	<u>End</u>
1. Identify four priority fisheries development problem areas	X	2/85	10/85
2. Establish and implement working committees		2/85	12/88

3.	'Prepare a composite of committees' resumes and update on an annual basis	X	2/85	10/85 10/86 10/87
4.	Prepare a report of the four priority area problem descriptions	XX	2/85	10/85
	a) Revise and distribute	XX	4/86	10/86
5.	Organize and implement a planning and programming committee; meet at least 6 times during each year		2/85	12/88
6.	Prepare Quarterly Fiscal Reports for project management purposes	X	7/85	10/85 1/86 4/86 7/86 to 12/88
7.	Develop and maintain linkages with other USAID projects at URI: Strengthening Grant Program, Coastal Resources Management Cooperative Agreement, etc.		7/85	12/88
8.	Prepare Quarterly Report of Cooperative Agreement Activities	X	7/85	10/85 1/86 4/86 7/86 to 12/88
9.	Respond to and implement technical assistance requests from USAID Missions, Regional, and Central Bureau offices		7/85	12/88
10.	Finalize and distribute trip reports of persons involved in international travel	X	7/85	12/88
11.	Supervise all support services providing input to Cooperative Agreement Activities		7/85	12/88
12.	Conduct in-house review of ongoing Cooperative Agreement activities		7/85	12/88
13.	Meet with S&T program officer on a quarterly basis		7/85	12/88

- |     |   |    |      |                                  |
|-----|---|----|------|----------------------------------|
| 14. | Meet with Regional Bureau representatives and AID Mission personnel to discuss the Fisheries Development Support Services |    | 7/85 | 12/88                            |
| 15. | Prepare a composite report of 3-year work plans and revise on an annual basis   | XX | 2/85 | 11/85<br>11/86<br>11/87<br>11/88 |
| 16. | Develop Gantt chart to depict all activities, milestones and target dates   | XX | 4/86 | 7/86                             |
| 17. | Develop 3-4 minute slide sets and scripts to depict each of the identified problem areas                                  | XX | 4/86 | 10/86                            |

Inputs:

<u>Category</u>	<u>Rate</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
<b>Staff Support:</b>				
Director	60%	29,965	31,463	33,036
Fiscal Services	50%	10,664	11,469	12,047
Clerical Service	75%/50%	16,384	11,469	12,042
Word Processing Services	50%	9,838	10,330	10,847
Student Assistants	50%	2,246	2,358	2,476
<b>Operational Support:</b>				
Office Expense	(\$50/mo)	600	630	961
Expendable Supplies	(\$434/mo)	5,212	5,040	5,180
Copying/Xeroxing, Printing, Photo	(\$400/mo)	4,800	5,040	5,592
<b>Communications:</b>				
Phone, Telex	(\$200/mo)	2,400	2,620	2,946
Postage, Freight	(\$200/mo)	2,400	2,620	2,946
<b>Yearly Subtotals:</b>		<b>84,509</b>	<b>83,039</b>	<b>88,073</b>

## ICMRD TRAINING RETROSPECTIVE

1979 - Present

<u>Country</u>	<u>Dates</u>	<u># of Trainees</u>	<u>Discipline</u>	<u>Supporting Agency</u>
Guinea Bissau	1979-81	16	Commercial Fisheries	USAID
Nigeria	1982-83	1	Fisheries Management	USDA
Philippines	1982-83	8	Project Monitoring & Evaluation	World Bank
	1984-85	8	Stock Assessment, Project Monitoring, and Project Development and Management	World Bank
	1984-85	10	Preservation & Packaging	World Bank
	1985	2	Electronics	World Bank
	1985	1	Marine Sciences and Fisheries Information Services	World Bank
Sri Lanka	1983-84	1	Commercial Fisheries	World Bank
Puerto Rico	1981	10	Small-Scale Technical Fisheries	Peace Corps
	1983	22	Small-Scale Technical Fisheries	Peace Corps
	1984	7	Small-Scale Technical Fisheries	Peace Corps
	1985	18	Small-Scale Technical Fisheries	Peace Corps
	1986	3	Small-Scale Technical Fisheries	Peace Corps
Ecuador	1986	2	Naval Engineering	ESPOL
Oman	1986-88	9	Technical Fisheries	USAID

Output 1.2: International Training Component of Fisheries Development Support Services

1.2a. Degree and Non-Degree Training

A principal component of ICMRD's comprehensive approach to providing technical marine fisheries assistance to developing countries is through an active degree and non-degree training center.

ICMRD develops and manages non-degree training programs for fisheries officials from throughout the developing world. The training is offered on an individualized request basis and is country as well as skill specific.

Students arriving for graduate-degree training are assisted with the admissions process and are closely monitored by ICMRD training staff.

ICMRD provides cross-cultural preparation and logistical support to all trainees. Training materials are developed in-house to meet the specific needs of each group, and training staff evaluate and monitor the program on an ongoing basis. After completion of the final evaluation recommendations are made to improve on future trainings.

ICMRD is a major player in the area of international marine fisheries training because of its ability to touch on virtually every marine discipline. Training programs have varied from the scientific (stock assessment) to the technical (instrumentation maintenance and repair).

Results to Date:

ICMRD has held five non-degree training programs for fisheries officials from the Philippines, Ecuador, Costa Rica and for Peace Corps volunteers destined for Sierra Leone, Dominican Republic, Jamaica, Antigua, Tonga and Morocco. The training varied with each group, but the breadth of the Center's capabilities is evidenced by the scope of the programs: small-scale technical fisheries; stock assessment; project monitoring and evaluation; project development and management; instrumentation repair and maintenance; and applications of microcomputers in marine fisheries. The number of trainees per group varied from two to eighteen, and the length of the programs varied from two weeks to sixteen weeks.

ICMRD provided support services for five graduate-degree students funded by USAID, all of whom were enrolled in marine fisheries departments. The countries represented by the students were Yemen, Ivory Coast, Senegal and Morocco.

ICMRD foresees the development and completion of two major projects. The first is the compilation of a procedural guide for all future trainings. This comprehensive training manual will

systematize all training procedures, enabling any member of the training staff to respond to the varied requests of international trainees. Guidelines for administrative and fiscal matters will be formalized, and all logistical and procedural documentation will be included, ensuring that future participants will receive consistently high-quality training.

The second training goal envisioned by ICMRD is the establishment of training programs in pre-identified need areas. The training will be open to participants from all developing countries and will be offered on a yearly basis. ICMRD foresees the standardization of training programs in the areas of stock assessment, microcomputer application, and project development and management. ICMRD strongly believes that there exists an audience in many developing countries for these training programs.

Task Analysis:

TRAINING PROGRAMS

	<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
			<u>Start</u>	<u>End</u>
1.	Peace Corps Marine Fisheries (Peace Corps Funding)*	X X	7/84 7/85 4/86 7/86 7/87	9/84 9/85 6/86 9/86 9/87
2.	Instrumentation Maintenance and Repair, Philippines (World Bank Funding)*		7/85	9/85
3.	Oman Technical Fisheries Training (AID Funding)		9/86	6/87
4.	Ecuador (ESPOL) Training in Technical Fisheries (Inter-American Bank and other Ecuador funding)*		2/86	4/86
5.	University of Costa Rica - Microcomputer uses in Fisheries Economics (University of Costa Rica - AID funds)		6/85	7/85
6.	Marine Science Information Services, Philippines (World Bank Funding)*		10/85	11/85
7.	Information from the harvest sector		4/87	5/87
8.	Microcomputer applications in the Marine Fisheries Sector (AID Funding)		5/87	5/87
9.	Fresh Fish Preservation - Minimizing Post-Harvest Losses (USAID - URI joint sponsors)		5/87	6/87

\* Outside funding

## TRAINING MATERIALS

	Activities/Tasks	Selected Milestones	Target Dates		
			Start	Draft	End
1.	Student Services and Training Operations Manual	XX	11/85	5/86	11/86
2.	The Use of Linear Programming in Bioeconomic Management of Fisheries	XX	1/85	6/86	12/86
3.	Microcomputer Applications in Tropical Fisheries	XX	9/84	4/86	10/86
4.	Fisheries Cooperatives	XX	4/84	5/86	11/86
5.	Training Program in Seafood Processing and Utilization: Preservation and Processing of Fishery Products	XX	2/84	3/86	9/86
6.	Building the FAO 6.2 Meter V-Bottom Boat with Lines and Offsets	XX	3/84	8/85	12/86

1.2b. International Visitors

The University of Rhode Island's breadth of programs in the marine fisheries field attracts scholars and government officials from throughout the world. The University has a worldwide reputation for its comprehensive approach to problems in international fisheries and sits in the forefront of new developments in this field.

As host to marine fisheries experts sponsored directly by their governments or by other international agencies, the Center offers orientation sessions and organizes seminars on marine fisheries issues relevant to each visitor. Training staff serve as translators, technical assistants, and guides throughout the course of a visit. ICMRD administrative staff assist with coordination of logistics from airline scheduling to airport pickup.

Results to Date:

Twenty-one visitors from five different countries were hosted by ICMRD training staff. The government officials and scientists represented the countries of Ecuador, Costa Rica, Brazil, Malaysia, Indonesia, China, Philippines and Mozambique.

University-to-university linkages begin with informal visits by international professors and administrators and on the basis of mutual interests are formalized by means of a Memorandum of Understanding. ICMRD was able to sign Memorandums of Understanding with ESPOL in Ecuador, University of the Philippines Visayas, The

Institut Agronomique et Veterinaire Hassan II, Morocco, Kasetsart University, Thailand, and The University of Sierra Leone/IMBO. ICMRD intends to complete the negotiations with the Shanghai Fisheries College and have a Memorandum of Understanding signed by early 1986.

ICMRD policy is to welcome all international guests and to assure that they become familiarized with the variety of marine fisheries programs offered by The University.

To more effectively communicate the assets of The University, the Center will continue to offer intensive French and Spanish courses to staff and associates. The language program will be an active offering of the Center through 1986.

#### 1.2c. Seminar Series

In order to keep the academic community abreast of current trends in international marine fisheries, ICMRD sponsors a series of seminars. The lecture series has also enabled ICMRD associates to report on an informal basis on projects undertaken with Cooperative Agreement funds.

In addition to the ten seminars presented by the Center, the International Fisheries Association, a college organization composed of undergraduate and graduate students interested in international marine fisheries, holds twelve seminars a year. The organization is hosted and assisted by ICMRD.

#### Results to Date:

ICMRD held nine seminars on the following topics:

- The Role of Small-Scale Fisheries in the Rural Economy of Sierra Leone.
- Mathematical Programming and its Utility in Solving Developing Country Programs.
- The Natural History of Preparing an RFTP - Experience from the Eastern Caribbean.
- U.S. Peace Corps Fisheries Programs - Recruitment, Training and the Experience.
- Development of In-Country Production of Brine Shrimp (Artemia) for Use as Food for Aquaculture Organisms in Indonesia.
- Demonstration by Philippines Training Group of Computer Applications in the Fishing Sector.
- Examination of Artisanal Fisheries in Morocco, Tunisia and Haiti. Potential Peace Corps Marine Fisheries Programs in those Countries.

- Consortium of Food Security in Mauritania--a Joint Effort by ICMRD and CODOT.
- Fisheries Development in Ecuador--Implementing a Memorandum of Understanding with Escuela Superior Politecnica Del Litoral (ESPOL).

The IFA presented seminars on the following topics:

- Fisheries Development in the Philippines - Aquaculture, Mariculture and Marine Fisheries
- Spanish Market for Squids
- The United States Joint Venture with Spain in Squid Fisheries
- New Zealand and its Fishing Industry
- An Experience in Fisheries Community Training in Costa Rica
- Public Relations in the Fishing Industry
- Surim~~a~~
- Small-Scale Fisheries in Southern Ecuador
- Peace Corps Marine Fisheries Training and Programming
- Population Dynamics in Coral Reefs in the Philippines
- Development in Zaire and the Philippines - Comparison of Fish Pond Development in Two Different Societies
- Fishery Co-ops of the World: Boom or Bust?

Four ICMRD seminars were scheduled for the fall semester, 1985, entitled:

- Fisheries Opportunities in the Azores.
- Maritime Human Geography Approaches to Island Communities.
- Maritime Law and Legal Aspects of International Trade.
- Coastal Zone Remote Sensing Applications in Developing Countries.

The Center is planning to hold seven seminars during the spring semester, 1986, and the IFA will hold four seminars.

ICMRD has invited international guests to lecture in order to broaden the scope of the series. Two of the four speakers, Professor Alistair Couper and Dr. Ademuni Odeke, are visitors from the United Kingdom.

The seminar series plays an important role in the dissemination of germane information in the marine fisheries sector. ICMRD will continue to sponsor the series as well as attempt to increase its current attendance.

#### 1.2d. In-Country Training

ICMRD is working on two fronts in the area of in-country training. The first is based on the philosophy that training conducted in the U.S. to be comprehensive should include an in-country component. The follow-up to the initial training is done by the original trainer after a lag period of two months, thus allowing the trainees to process their new skills. The trainer is able to gauge the effectiveness of the training and complete a thorough evaluation. Follow-up, in-country training has proven to be a highly effective method of reinforcing skills learned during the original training period.

In the second instance, especially with large groups, training conducted in-country is more cost effective. The cost of travel and per diem for each trainee is eliminated as well as the adjustment period required to acclimate oneself to a new environment. ICMRD feels that the same high standard of training performed at The University of Rhode Island can be maintained in any in-country component.

#### Results to Date:

ICMRD trained eight Filipinos in stock assessment, project monitoring and evaluation, and project development and management. The training included an in-country component that served as a follow-up and as a refresher course on the basic skills learned while at ICMRD. Other in-country training included professors from URI who travelled to ESPOL in Ecuador to work with their counterparts in small-scale technical fisheries. This technical exchange broke ground for a more comprehensive and formal approach to training of faculty and students.

Peace Corps training, conducted in Puerto Rico in conjunction with the University of Puerto Rico, graduated its fourth group of volunteers. The program has successfully utilized the facilities of the University of Puerto Rico to prepare volunteers for the difficulties they will encounter in artisanal fisheries.

ICMRD will continue to include in-country, follow-up training as an important option for all training.

In addition, Peace Corps training is to be conducted in Puerto Rico by ICMRD for the next three years. ICMRD intends to expand on the current Peace Corps program and offer country-specific, in-country training as well as mid-term, in-country training.

Task Analysis:

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
		<u>Start</u>	<u>End</u>
1. Follow-up Training in Project Monitoring and Evaluation and Project Development and Management in the Philippines (AID/World Bank Funding)	X	6/2/85	6/23/85
2. Peace Corps Training in Puerto Rico (Peace Corps Funding)	X	7/84	9/84
	X	7/85	9/85
	X	4/86	6/86
	X	7/86	9/86
	X	7/87	9/87

Inputs:

	1986		1987		1988	
	<u>Rate</u>	<u>Dollars</u>	<u>Rate</u>	<u>Dollars</u>	<u>Rate</u>	<u>Dollars</u>
Training Coordinator:	40%	11,477	25%	7,675	25%	8,212
Asst. Training Coordinator (2):						
1. Grad. Res. Asst.	50%	7,081	50%	7,381	50%	7,681
2. Grad Res. Asst.	50%	<u>7,081</u>	50%	<u>7,381</u>	50%	<u>7,681</u>
Yearly Subtotals:		25,639		22,437		23,574

Output 1.3: International Information Services Component of Fisheries Development Support Services1.3a. Information Support Services

The ICMRD Information Service provides information support services to AID on issues of small-scale fisheries development in developing countries including brackishwater aquaculture. Over a decade old, it is the only library/information service in the United States totally devoted to the problems of artisanal fisheries development.

Primary users of the Information Service include ICMRD professors at work on AID development projects and AID offices in coastal countries. Other users of the collection include ICMRD trainees, both degree and non-degree, University of Rhode Island students preparing for internationally-oriented careers, subcontractors working on AID development projects in allied fields, artisanal

fisheries researchers at other institutions, libraries and information services in developed and developing countries with research collections on artisanal fisheries, and non-governmental or United Nations agencies focusing on issues which impinge upon small-scale fisheries.

Researchers are encouraged to visit the collection which is open from 9:30 to 4:30, Monday through Friday. Other requests are filled by mail or other means of communication as appropriate. ICMRD Library materials are loaned to all users at home and in developing countries.

Due to the broad range of interests and countries included in ICMRD development programs, the Information Service's subject interests cover artisanal fishing techniques, mariculture, basic seafood processing, fisheries economics, post-harvest loss, socioeconomics of small-scale fishing, marketing of fishery products, and fisheries management issues. Emphasis is placed upon acquiring "grey" literature not available through traditional book services with special consideration for AID's most disadvantaged target countries. At present, the collection consists of over 13,000 documents and reports with an average of 1,000 items being added each year.

Through arrangement with the University of Rhode Island Library, online searching facilities, interlibrary loan and extended research facilities are made available to AID through the ICMRD Information Service.

Policy for the operations of the ICMRD Information Service is set by the ICMRD Publications/Information Services Committee.

The Information Service is continuously working to increase awareness of the collection and the availability of ICMRD Publications. Statistics of user use are reported in the quarterly and annual reports.

A user survey will be designed to gather data for future program evaluation. Current services will be evaluated in light of the survey results and the new budget guidelines.

#### Results to Date:

A guide to the use of the collection has been written to make personal access to the materials easier. A summary, subject printout of the database is available for walk-in patrons.

The librarian participated in the intensive Spanish language program ICMRD offered at the end of this reporting year. A beginner, her ability to understand letters in Spanish from developing countries improved 100 percent.

With the addition of Ms. Watkins to the staff in November 1984, total professional time available weekly to the Fisheries

Cooperative Agreement was 55 hours. When the AID Coastal Resources Management Agreement came into effect in June 1985, 45 hours of professional time weekly were allocated to the Fisheries Cooperative Agreement. For the calendar year 1986, 75 percent of library staff time will be devoted to the Fisheries Cooperative Agreement.

### 1.3b. Database Development

To increase awareness of the rich resources contained in the ICMRD Library, cataloging of the collection is proceeding using an IBM PC microcomputer on loan from the IBM Foundation.

#### Results to Date:

Results of this project will be both print and non-print bibliographic records which can be sent to AID project personnel/missions detailing information available on issues of concern to them. Increased awareness of the information resources available will increase their use and encourage enhanced project planning. Our workplan, approved in September 1985, is to gain bibliographic control over the collection within two years.

An increase in the interlibrary loan requests for out-of-print materials from our collection is anticipated as a result of the data base project.

A manual for the use of the data base has been prepared, and a first evaluation of both the manual and the data disks has been given by AID Fisheries Officer, Lamarr Trott. Suggestions have been noted and are being incorporated into project plans. Further refinement of input and editing of the data base is underway.

### 1.3c. Strengthening Developing Country Information Services

The ICMRD Information Service endeavors to help libraries in developing countries enrich their artisanal fisheries collections with the purpose of both enhancing materials available to specific AID projects and encouraging long-term development of research collections. Publications exchange agreements are maintained with over 125 libraries. Advice/research is given to librarians developing fisheries collections in AID target countries. Professional research experiences for librarians from developing countries are available at the ICMRD Information Service in coordination with the ICMRD Training Component.

#### Results to Date:

In conjunction with the ICMRD working groups, information resources on the four target issues are being researched and documented. Specific information activities for each of the working groups is contained in their reports. This is an ongoing activity of the Information Service. As specific in-country applications of the working group activities are begun or as specific publications

are developed, bibliographic support for these activities is given with appropriate transfer to developing country institutions. It is expected that, as a result of these activities, a select bibliography of publications will be developed and made available in each of the target issue areas.

### 1.3d. Dissemination of ICMRD Publications

Documents produced under the Fisheries Cooperative Agreement are disseminated free of charge world-wide to those involved in artisanal fisheries development upon request. A publications list is issued when new publications become available. Exchange institutions automatically receive copies of new publications upon publication. Through AID, additional copies are made available and publicized through NTIS ALERTEC for developing countries. ICMRD document availability is also publicized through FAO's Aquatic Science and Fisheries Abstracts.

#### Results to Date:

##### ICMRD Publications

Received for distribution during 1985:

Working Papers	6
Newsletters	3
Publications Lists	1

Total ICMRD Publications Distributed this Year: 3,998  
(Annual goal of 800 required.)

Pages photocopied to answer reference requests: 6,654  
Pages photocopied to add to the collection: 3,678

Increased awareness of the collection fostered by distribution of the data base and its print/non-print products should produce increased requests in the interlibrary loan/photocopy categories.

### 1.3e. International Visitors

International visitors come to the ICMRD Information Service to discuss methods for improving their in-country information facilities. Demonstrations are given of the data base, exchanges are established and materials on the service are disseminated. Visitors include both those on formal tours conducted by ICMRD staff and others who "pop in" because they were passing through one of the University departments and were encouraged by URI professors to visit.

#### Results to Date:

Visits of this sort generally lead to strengthening activities as described above.

### 1.3f. Training Program in Marine Science Information Management

In 1983/84, faculty of the University Library specializing in marine information designed an eight-week training program for those charged with managing a developing country marine information service.

#### Results to Date:

Candidates responded to the initial brochures about the training program, but few had money to cover costs.

The training program did not take place as planned, but in 1985, working with the United Nations' Intergovernmental Oceanographic Commission, eight of the candidates were able to participate in a training experience sponsored by IOC given at NTIS. AID information services were represented in this program by NTIS personnel working with AID Washington. However, ICMRD Information Service provided the only list of candidates used by the IOC to invite candidates. Two of them, one from Sri Lanka and one from the Philippines, were able to visit ICMRD. The former was here for four days, the latter for a one-month professional exchange experience.

A formal training program on this topic will not be possible within the current span of the Fisheries Cooperative Agreement. However, the activity so far has helped eight individuals from developing country libraries achieve professional marine science information training using resources funded in part by this Cooperative Agreement.

Individual training/professional exchange experience for a librarian from the Philippines included university library administration of circulation, reference, interlibrary loans, reserve room, and specialized marine fisheries research conducted at the ICMRD Information Service, National Sea Grant Depository, Pell Marine Science Library, Woods Hole Oceanographic Institute, NE National Marine Fisheries Service, Woods Hole Data Library, American Society of Information Science Meeting, and DIALOG online training.

#### Task Analysis:

##### DATABASE CATALOGING & BIBLIOGRAPHIES

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Start</u>	<u>Dates End</u>
1. Recent Acquisitions-Quarterly (1)	X	3/86	9/87
2. Bibliographie Selectionnee sur les Peches (2)		6/85	7/85

3.	Bibliographie Selectionnee sur les Peches Rev. 1	XX	1/86	2/86
4.	Spanish Language Marine Resources Bibliography (3)	XX	1/86	2/86
5.	Cataloging by Material Type (4)			
	a - Publications of International Organizations		2/86	6/86
	b - Serials			
	Checklist of Serials	X	6/85	7/85
	Cataloging of Serials		1/87	6/87
	c - Monographs		12/85	3/86
	d - Country Files			
	Africa			
	A-N	XX	9/85	11/85
	O-Z	XX	5/86	7/86
	*Asia			
	Sri Lanka (Printout 12/85)	XX	4/86	9/86
			7/85	12/85
	Latin America			
	Ecuador (Printout 12/85)	XX	8/86	11/86
			7/85	2/86
	Caribbean		8/86	11/86
	Pacific		12/86	2/87
	U.S.A. & Developed Countries (5)			
	High Priority	X	1/86	5/86
	Low Priority		6/87	8/87
	e - U.S. State files (6)			
	High Priority	X	6/86	8/86
	Low Priority		6/87	8/87
	f - Atlases		9/87	9/87
	g - Theses	X	12/84	1/85
6.	Subject Catalog of the ICMRD Data Base: An Interim Guide for Users	XX	1/84	1/85

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(1) This bibliography will highlight new items received in the ICMRD collection on a quarterly basis. A by-product of the cataloging project, it will provide a timely awareness service

for Center Associates, exchange institutions and AID Fisheries Officers. It will be possible to provide an IBM disk version to those who will send a blank disk to us.

(2) The first bibliography was prepared from the ICMRD data base to guide faculty in the AID language proficiency programs to resources on fisheries available in French. The first list was distributed informally through the network. Rev. 1 will be available in February.

(3) A Spanish language bibliography, prepared for the AID language proficiency program, is being prepared as a result of the data base development project. Its scope is broader than fisheries issues due to the influx of material from Ecuador related to the Coastal Resources Management Cooperative Agreement.

(4) To facilitate swift buildup of the ICMRD Data Base, cataloging is done by materials type. Priorities for cataloging are determined by the ICMRD librarians based upon their knowledge of both the collection and the basic ICMRD interest profiles. Country files are given priority based upon ICMRD projects/research.

(5,6) U.S. National and Developed Country materials have been separated into high and low priority groups based upon ICMRD interests. Materials directly bearing upon ICMRD interests or those specific to an AID target country are high priority.

Inputs:

	<u>1986</u>	<u>1987</u>	<u>1988</u>
Salaries and benefits	\$39,335	\$39,335	\$39,335
Student help	631	631	631

Operating Expenses:

Supplies, books, subscriptions, travel, printing services, photocopying, telephone, online searching, postage and freight	5,111	4,611	5,611
Indirect costs at 8%	<u>3,923</u>	<u>3,423</u>	<u>4,423</u>
Yearly Subtotals:	\$49,000.	\$47,989	\$50,000

Output 1.4: Technical Assistance

Based on the current level of funding, the Cooperative Agreement is to provide annually 11.5 person months, or 46 person weeks, of technical assistance to USAID Missions, Regional Bureaus, and S&T/AGR/RNR.

Various methods of cost sharing will be utilized to extend the budgeted amount.

Results to Date:

Based on current requests, the following technical assistance is planned during the year 1986 for the following developing USAID countries and areas of expertise:

Task Analysis:

<u>Country/Area of Expertise</u>	<u>Target Dates</u>	
	<u>Start</u>	<u>End</u>
<u>Indonesia:</u>		
Fisheries Economics (6 weeks)	1/86	3/86
Fisheries Products and Marketing (6 weeks)	1/86	3/86
Social Soundness Aquatic Resources Research Project (6 weeks)	4/86	5/86
<u>Philippines:</u>		
Project Monitoring and Evaluation Follow-up Training (1 week)	6/86	6/86
<u>Artemia</u> Quality Control (1 week)	5/86	5/86
<u>Thailand:</u>		
<u>Artemia</u> Quality Control (1 week)	5/86	5/86
<u>Ecuador:</u>		
Fisheries Cooperatives (4 weeks)	3/86	7/86
Information Services (4 weeks)	7/86	8/86
<u>Artemia</u> Production and Training (2 weeks)	4/86	10/86
Mariculture Technology (4 weeks)	7/86	8/86
<u>Caribbean:</u>		
Fisheries Development/Haiti (4 weeks)	9/86	9/87
Small-Scale Fisheries Insurance Training Program (2 weeks)	9/86	9/87
<u>Costa Rica:</u>		
Fisheries Marketing and Policy (4 weeks)	7/86	3/87

## South Pacific:

Planning Effort - Fisheries Development - uncommitted (5 weeks)	6/86	1/87
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## Central America:

Fishery Sector Study - Guatemala (2 weeks)	8/86	9/86
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SUMMARY OF INPUTSPLANNING AND PROGRAMMING OF FISHERIES SUPPORT SERVICES

	<u>1986</u>	<u>1987</u>	<u>1988</u>
Salaries:	\$19,000	\$25,000	\$28,000
Operations:	<u>19,000</u>	<u>25,000</u>	<u>28,000</u>
Yearly Total:	\$38,000	\$50,000	\$56,000

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## 2. SOCIO-CULTURAL FACTORS: WORKPLANS AND MILESTONES

### Output 2.1: Analysis of the Role of Women in Fishing Societies

Most studies of fishing societies have focused on the males who conduct the actual harvesting activities in most societies. Nevertheless, it is important to understand the role of women in fishing societies. The woman frequently participates in decision making with her husband and can affect the outcome of a technological transfer project. Further, in many societies, women play important roles in the processing and marketing of fish. In some they play the role of capitalist, financing fishing operations. It is therefore important to obtain a clearer understanding of women's roles in the fishery in order to prepare projects which will not ignore an important half of the target population and potentially result in failure.

#### Results to Date:

The division of labor by sex was examined in a worldwide cross-cultural sample of 186 societies. The analysis concentrated on a comparison of activities performed by women in fishing and non-fishing societies. The results were published as Anthropology Working Paper #44, "The division of labor by sex in fishing societies" (by R. Pollnac, 1984). A further cross-cultural sample of 143 societies that depend on fishing for more than 30 percent of their subsistence has been coded. Preliminary field work has also been completed concerning the socio-cultural and nutritional aspects of the role of women in fishing communities in Sierra Leone.

#### Activities:

Further analysis is being conducted on the same sample of 186 societies and the sample of 143 fishing societies from around the world. This time the focus is on the sociocultural correlates of the participation of women in fishing activities. Computer analysis has been for the most part completed, and the write-up is in progress. Follow-up work is planned in West Africa.

Task Analysis:

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
		<u>Start</u>	<u>End</u>
1. Review of existing literature		7/82	7/85
2. Establish minimum data set	X	7/82	7/85
3. Identify site for initial field work		-	1/85
4. Preliminary analysis of minimum data sets and preparation of report on division of labor by sex in fishing societies	XX	6/84	9/84
5. Develop extended data sets		1984	1/86
6. Field work in Sierra Leone concerning sociocultural and nutritional aspects of the role of women in fishing societies	X	6/85	7/85
7. Report on Sierra Leone field work	X	7/85	9/85
8. Analysis of extended data sets on role of women in fishing societies		1/86	4/86
9. Preparation of major report on role of women in fishing societies	XX	4/86	6/86
10. Prepare proposals for further research on role of women in fishing societies		10/86	2/87
11. Further field work on role of women in fishing societies (e.g., West Africa)		6/87	9/87
12. Final report on division of labor by sex in fishing societies	XX		12/87

Inputs:

	<u>1986</u>	<u>1987</u>
Salary	\$ 4,751	\$ 5,388
Computer time	150	
Transportation		2,600
Per Diem		<u>1,800</u>
Total:	\$ 4,901	\$ 9,788

Output 2.2: Factors Influencing Success of Fishermen's Organizations

Fishermen's organizations, such as cooperatives, are frequently included as a part of development programs among small-scale fishermen. For example, they form part of the recent AID projects in both Guinea Bissau and Djibouti. Many Peace Corps fishery projects also involve cooperatives (examples are too numerous to cite). Much research, however, has indicated that there are many more failures with respect to fishermen's cooperatives than successes (see research cited below in "Results to Date" section). The proposed work will provide information which will increase the chances of writing projects which will result in organizations which will succeed.

Results to Date:

Field studies have been conducted concerning fishermen's organizations in New England, Panama, Costa Rica, and the Azores. Results of these studies have been published in various places including (1) Panamanian Small Scale Fishermen: Society, Culture, and Change (R. Pollnac, Ed.) Marine Tech. Report No. 44. ICMRD, URI (1977); (2) Small Scale Fisheries in Central America (J. Sutinen & R. Pollnac, Eds.) ICMRD (1980); and (3) "Attitudes towards cooperation by small-scale fishermen in the Azores" (R. Pollnac & F. Carmo) in Anthropological Quarterly 53 (1980). Analyses of existing literature and research on fishermen's organizations have also been conducted and written-up in several publications including (1) Maritime Anthropology: Sociocultural analysis of small-scale fishermen's cooperatives" (J. Poggie) in Anthropological Quarterly 53 (1980); (2) Sociocultural aspects of developing small-scale fisheries (by R. Pollnac) World Bank Staff Working Paper No. 490 (1982); (3) "Social and cultural characteristics in small-scale fisheries development" (by R. Pollnac) in Putting People First: Sociological Variables in Rural Development Projects (M. Cernea, Ed.) Oxford University Press (1985); and (4) Evaluating the Potential of Fishermen's Organizations in Developing Countries (Report prepared by R. Pollnac for UNFAO - in process of being edited for publication).

Finally, as part of a consultancy concerning the potential role of ESPOL in the development of the artisanal fishery in Ecuador, a research proposal was prepared concerning factors influencing the relative success of fishermen's cooperatives in Ecuador. Elements of this proposal were based on past work of members of the human impediments group (cited above). The proposal was accepted by ESPOL staff who evidenced willingness to cooperate with the planned research.

Activities:

Research will be conducted in Ecuador (or a similar site) concerning factors which influence cooperative success or failure. Ecuador is an ideal site since there exist, on paper and in reality, a relatively large number of fishermen's cooperatives

manifesting varying levels of "success". The results of field research will be presented as a separate report, and the findings will be combined with work already completed to prepare a guide for determining the sociocultural data needs for designing projects which include fishermen's cooperatives.

Task Analysis:

Activities/Tasks	Selected Milestones	Target Dates	
		Start	End
1. Review of existing literature	X	-	9/85
2. Identify site for further field work to test models already developed		3/85	4/85
3. Develop proposal for comparing effectiveness of fishermen's cooperatives in Ecuador	X	3/85	4/85
4. Preliminary field work in Ecuador		3/85	4/85
5. Data collection concerning fishermen's cooperatives in Ecuador (ESPOL, Ecuador, is expected to obtain funds for student assistants, counterparts, and in-country transportation.)		Spring or Summer 1986	
6. Preparation of report concerning factors influencing success of fishermen's cooperatives in Ecuador	X	?/86	9/86
7. Preparation of guide for sociocultural information needs for use of fishermen's cooperatives in the small-scale fishery development cycle	XX	1/86	9/86

Inputs:

	1986
Salary	\$ 9,981
1 r/t airfare Ecuador	1,000
Per diem (Ecuador 30 days @ \$59)	1,770
Computer time	<u>150</u>
	\$12,901

Output 2.3: Analysis of Traditional Behavior Patterns in Fishing Communities

Most researchers will agree that fishing communities are somehow different from farming communities. A clear understanding of the interrelationships between aspects of both the marine environment and fishing technologies and the society and culture of fishermen will facilitate preparation of social impact statements which should accompany project proposals. This understanding will also facilitate development of fishery projects which are both socially and culturally sound.

Results to Date:

Literature was reviewed in 1976 resulting in Anthropology Working Paper #10, Continuity and Change in Marine Fishing Communities. Additionally, over the past 10 years 44 Anthropology Working papers and numerous journal articles and book chapters have been produced by members of the Human Impediments group which have dealt with this subject. Further, since 1976 (that year AWP #10 was prepared) a continuous review of the literature and accumulation of both articles and data from field work has been in process.

Activities:

Results to date have resulted in a massive source of information which can be analyzed as a means of updating AWP #10, resulting in a substantial publication which will increase our understanding of social and cultural aspects of small-scale fishing communities.

Task Analysis:

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Start</u>	<u>Target End</u>
1. Compile existing information		7/82	9/85
2. Preliminary analysis of information and coding and adding it to existing data sets	X	9/85	3/86
3. Analysis of data sets in conjunction with systematic analysis of available literature		1/86	6/86
4. Preparation of major report on traditional behavior patterns in fishing communities	XX	6/86	3/87

Inputs:

	<u>1986</u>	<u>1987</u>
Salary	\$4,751	\$7,127
Computer time	<u>150</u>	<u>200</u>
Yearly Subtotals:	\$ 4,901	\$7,327

Output 2.4: Model of Interrelationships Between Sociocultural  
Characteristics of Fishing Communities, Fishing  
Technologies and Techniques, and Aspects of the Marine  
Environment and Coastal Zone

A model will be developed which can be directly applied in the preparation of fishery development projects to insure that important social and cultural factors are taken into account. The model can also be applied to the preparation of social impact statements to accompany transfer of technology projects which directly impact fishing communities. The output will provide a "state-of-art" paper replacing the one prepared in 1976 (Continuity and Change in Marine Fishing Communities).

Results to Date:

Almost all of the Anthropology Working Papers prepared to date deal with some aspect of this output. Additionally, both "Sociocultural aspects of technological and institutional change among small scale fishermen" (in Modernization and Marine Fisheries Policy, J. Maiclo & M. Orbach, eds., 1982) and "Social and cultural characteristics in small-scale fisheries development" (in Putting People First: Sociological Variables in Rural Development Projects, M. Cernea, Ed., 1985) by R. Pollnac deal with the central issues involved with this topic.

Activities:

Literature and data sets accumulated since 1976, in addition to the State of Art paper prepared in 1976 (Anthropology Working Paper #10, "Continuity and Change in Marine Fishing Communities," by R. Pollnac), can be considered as inputs to this output. This earlier work will be analyzed to develop the model. Proposals will be prepared which will result in the field testing of the model in fishing communities in developing countries. Ideally, the application of the model will be tested in areas where research is being conducted concerning other areas of the Cooperative Agreement. Field work will be conducted and results will be used to modify the model, and a report will be prepared which can be used as a guide for its application.

Task Analysis:

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
		<u>Start</u>	<u>End</u>
1. Compile existing information		7/82	9/85
2. Preliminary analysis of information, coding, and updating of existing data sets	X	9/85	3/86
3. Revise and file African data set		8/85	9/85
4. Update AWP #43, "Sociocultural Aspects of Small-scale Fisheries Development in West Africa"	XX	8/85	11/85
5. Analysis of data sets in conjunction with review of existing literature		1/86	6/86
6. Develop model	X	6/86	12/86
7. Prepare proposals for testing aspects of the model	X	1/87	6/87
8. Field work for testing model		6/87	6/88
9. Preparation of final report on applied use of the model along with guide for its application	XX	6/88	12/88

Inputs:

	<u>1986</u>	<u>1987</u>	<u>1988</u>
Salary	\$ 7,127	\$14,253	\$29,225
Field expenses (estimates of travel and per diem for at least two developing countries)			6,000
Computer time	<u>50</u>	<u>300</u>	<u>500</u>
Yearly Subtotals:	\$ 7,177	\$14,553	\$35,725

SUMMARY OF INPUTSSOCIO-CULTURAL FACTORS

	<u>1986</u>	<u>1987</u>	<u>1988</u>
Salaries:	\$26,610	\$26,768	\$29,225
Operations:	<u>3,270</u>	<u>4,900</u>	<u>6,500</u>
Yearly Totals:	\$29,880	\$31,668	\$35,725

### 3. FISHERIES MANAGEMENT AND RESOURCE UTILIZATION: WORKPLANS AND MILESTONES

The work planned here is related to but different from the work planned under the Fisheries Stock Assessment CRSP. Only one of the eight CRSP projects involves economic analysis and modeling, whereas all of our outputs (projects) emphasize economic analysis and modelling. Our economic analysis and modelling work will be more detailed and focus on specific types of fisheries (e.g., pelagic, multispecies), while the CRSP economic work will involve less detail and be more general.

#### Output 3.1: A Bioeconomic Management Model for Small Pelagic Fisheries

Small pelagics are commonly a major part of artisanal fisheries in many coastal less developed countries. While the value of small pelagics is rarely high, their contribution to local food supplies and employment is usually relatively large. Small pelagics exhibit several peculiar characteristics that conventional bioeconomic management fails to incorporate. One such characteristic is their schooling behavior, which can result in a nearly constant catch-per-unit-effort even as the resource stock is being driven down to dangerously low levels. If exploitation expands unconstrained, the stock can collapse with little or no advance warning. This contrasts with demersal species which exhibit declining catch-per-unit-effort as exploitation increases, serving as a check on and a signal of over-exploitation. Other important characteristics include pelagics' wide migratory patterns and their high sensitivity to environmental changes. There is clearly a need to incorporate the peculiar features of pelagic fisheries into bioeconomic management models and assess alternative management strategies for these important artisanal fisheries.

Senegalese authorities have expressed an interest in the proposed modeling effort, and a good amount of data is available at CRODT (a marine research unit of the government). A fisheries economist from CRODT is studying for his M.S. in Resource Economics and will be trained in the construction and use of the bioeconomic management model.

#### Results to Date:

Most previous bioeconomic modeling work has dealt with demersal fisheries. Work to date includes identifying the salient biological and economic features peculiar to small pelagic fisheries in developing countries. A dynamic simulation model is

currently being developed which incorporates some of these features.

Activities:

The major activities to produce Output 3.1 include:

1. Field research to collect data on Senegal's small pelagic fisheries.
2. Analysis of collected data to prepare for use by computer model.
3. Develop a bioeconomic model for simulating the Senegalese small pelagic fisheries.
4. Analyze selected management scenarios for the fisheries using the simulation model.
5. Write a report explaining the construction of the model and results of the analysis.
6. Presentation of results to an International Workshop on Fisheries Management.

All five activities primarily involve research. Information services will be used to obtain general information on pelagic fisheries, and training of a graduate student in the development and use of the model will be a by-product of this project.

The external conditions necessary for successful completion of this project are (1) the availability of biological and economic data and (2) the cooperation of Senegalese authorities.

Task Analysis:

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
		<u>Start</u>	<u>End</u>
1. Field research		6/85	9/85
2. Data analysis		9/85	12/85
3. Model development	X	11/85	5/86
4. Management Analysis		5/86	8/86
5. Report on construction of the model and results of the analysis	XX	9/86	12/86

<u>Inputs:</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
Salaries:	\$16,950	\$ 3,885	
Travel: Air Fare & Per Diem to International Workshop			\$ 3,000
Telephone and Other Communications	500	200	
Publications	150	100	
Supplies	<u>150</u>	<u>100</u>	<u>          </u>
Total:	\$17,750	\$ 4,285	\$ 3,000

### Output 3.2: Mathematical Programming Algorithms

The methods of mathematical programming are widely used in economics and management science. Algorithms to solve mathematical programming problems on large (mainframe) computers have been available for several years. Such algorithms for microcomputers currently are either not available or exceedingly cumbersome to use, i.e., not user friendly. Having user friendly algorithms available to solve mathematical programming problems on microcomputers will enable fisheries researchers and decision makers in LDCs to make use of the latest technology for setting management policy in their countries.

#### Results to Date:

Several algorithms are being developed at URI which solve mathematical programming problems and are user friendly. These are based on algorithms created years ago by some URI faculty.

#### Activities:

The major activities to produce Output 3.2 include:

1. Preparation of an algorithm for solving linear programming problems on an IBM PC.
2. Preparation of a file editor program.
3. Write a user's manual.
4. Provide full documentation of the program.
5. Testing of the program.
6. Establish a means of distributing the program to potential users.

7. Demonstration of algorithm at an International Workshop on Fisheries Management.

The first five activities involve research. Few information services will be needed for any of these activities. Training of potential users of the programs will be a by-product of this project.

The external conditions necessary for successful completion of this project are (1) the existence of sufficient IBM PC equipment in the Department of Resource Economics, and (2) cooperation of a few LDC researchers in testing the program.

Task Analysis:

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
		<u>Start</u>	<u>End</u>
1. LP algorithm preparation	X	9/84	6/85
2. File editor program preparation	X	6/85	9/86
3. User's manual	X	6/85	10/86
4. Documentation		6/85	11/86
5. Testing		9/85	12/86
6. Distribution	X	1/87	8/87

Inputs:

	<u>1986</u>	<u>1987</u>
Salaries	\$10,922	
Telephone and Other Communications	100	\$ 100
Publications	100	400
Supplies	<u>100</u>	<u>400</u>
Total:	\$11,222	\$ 900

Output 3.3: Utilization of Fish Bycatch of the Shrimp Fishery

A common problem is the failure to use the incidental catches of major fisheries such as those for shrimp. This fish bycatch may amount to as much as 20 tons of finfish caught for every ton of shrimp caught. Yet, only a small fraction of the bycatch is landed and sold to consumers. Special problems also arise if the bycatch must be controlled for management purposes (as in the case where the bycatch is comprised of juveniles of valuable species which are either disposed of at sea or directed to low value industrial uses). Monitoring and control of incidental catches represents a particularly difficult problem for fisheries managers.

Results to Date:

While considerable attention has been given to the technical aspects of bycatch utilization, no significant work has been done examining the bycatch issue in the context of the whole system. Virtually no work exists on the problem of management of bycatch resources. This is an important area where a comprehensive, integrated research program is needed.

Activities:

The major activities to produce Output 3.3 include:

1. Selection of the site or fishery to be used as the case study, e.g., Ecuador.
2. Data collection on the selected fishery.
3. Development of a bycatch model.
4. Testing, refining and calibration of the bycatch model.
5. Writing of a report explaining the results of the model.
6. Presentation of results to an International Workshop on Fisheries Management.

All activities involve research. Information services will be essential for activities 1, 2 and 5. Training will be involved in activities 2 through 4.

The external conditions necessary for successful completion of this project are (1) availability of adequate data and (2) cooperation of counterparts and authorities in the selected country(-ies).

Task Analysis:

Activities/Tasks	Selected Milestones	Target Start	Dates End
1. Site selection		5/85	5/87
2. Data collection	X	6/87	8/87
3. Model development	X	9/87	6/88
4. Model testing		7/88	10/88
5. Report on model results	XX	9/88	12/88

<u>Inputs:</u>	<u>1987</u>	<u>1988</u>
Salaries	\$28,866	\$37,544
Travel:		
Air Fares (two to Ecuador and/or another country)	4,940	4,940
Per Diem (30 days each in Ecuador and/or another country)	3,360	3,360
Air Fare and Per Diem to International Workshop		3,000
Telephone and Other Communications	500	500
Publications	200	200
Supplies	<u>200</u>	<u>200</u>
Total:	\$38,066	\$49,744

Output 3.4: A Bioeconomic Management Model for Tropical Multispecies Fisheries

The need for management of fisheries resources has long been recognized in the professional community, but only recently have development authorities recognized that fisheries development without consideration of management may imperil the resources themselves. Unfortunately, most approaches to management are implicitly based on models of temperate water demersal fisheries. Tropical water demersal fisheries, however, exhibit significantly different biological and economic characteristics than their temperate water counterparts. Therefore, it is important to extend and adapt conventional management models to appropriately reflect the salient features of tropical fisheries.

Results to Date:

The most recent result is a bioeconomic management model that is both stochastic and dynamic and includes multiple species and vessels with different characteristics. The model was tested on U.S. Northwest Atlantic demersal fisheries with good results. The next step is to adapt the model to tropical demersal fisheries, which exhibit biological and economic characteristics different from temperate water, developed fisheries.

Activities:

The major activities to produce Output 3.4 include:

1. A review of the literature on tropical multispecies fisheries and stochastic dynamic fisheries models.
2. Development of a preliminary bioeconomic model to approximate the conditions of tropical multispecies fisheries.

3. Collection of biological and economic data on selected tropical fisheries (e.g., Indonesia, Ecuador).
4. Analysis and preparation of collected data for use by a bioeconomic model.
5. Development of a final bioeconomic model for a selected tropical multispecies fishery.
6. Analysis of selected management alternatives for the fishery.
7. Writing of a report explaining the model and its use.
8. Presentation of results to an International Workshop on Fisheries Management.

The first seven activities include research. Information services will be needed for the first activities, and training of a graduate student in the development and use of bioeconomic models will be a by-product of this project.

The external conditions necessary for successful completion of this project are (1) the availability of appropriate data and (2) cooperation of colleagues and authorities in the selected countries.

#### Research Program

To be proposed at a later date as funds become available.

#### SUMMARY OF INPUTS

##### FISHERIES MANAGEMENT AND RESOURCE UTILIZATION

	<u>1986</u>	<u>1987</u>	<u>1988</u>
Salaries:	\$27,872	\$32,751	\$37,544
Operations:	<u>1,100</u>	<u>10,500</u>	<u>15,200</u>
Yearly Totals:	\$28,972	\$43,251	\$52,744

#### 4. USE OF MARICULTURE IN DEVELOPING COUNTRIES

One of the major reasons for the low use of mariculture in developing countries is the difficulty in rearing larval stages of marine organisms. URI can be of significant assistance in the alleviation of this difficulty through its expertise in the nutrition of larval organisms.

Brine shrimp (Artemia) nauplii are probably the most widely used food worldwide for the culture of larval fish and crustaceans.

For the last ten years URI together with the EPA laboratory in Narragansett and the Artemia Reference Center in Gent, Belgium, have supplied the base for the research on Artemia quality. Because of this research we can predict a good Artemia and one that will not supply good nutrition to the predator. It has now been established that the survival of the post larval shrimp in the growout ponds is directly related to the Artemia that is fed to the pre-larval shrimp in the hatchery. At present there is no shortage of Artemia on the world market. The supply of good Artemia is however very short. At present the survival of the shrimp fed for a short period of time on Artemia in the hatcheries is good. Based on unpublished data we would predict that the survival of post larval shrimp in the ponds of present hatchery shrimp is much lower than sea captured post larval shrimp. This estimate is based on feeding studies of commercially available Artemia compared to "enriched" Artemia. In the short term the hatcheries will be compelled to use existing supplies of Artemia. If these are enriched their production will be higher. The other alternative is to buy good Artemia. In the latter regard we have been contracted to analyze samples of Artemia for fatty acids and pesticides for several companies before large purchases are made.

Two particular countries which URI could immediately help with Artemia quality are Ecuador and Thailand.

This project would complement the effort in Ecuador.

##### Output 4.1: Development of Artemia Production and Quality Control in Ecuador

In 1970 the shrimp industry in Ecuador was \$2.9 million. This production expanded in 1983 to a total of \$183 million. In 1984 a decline to \$154 million was experienced. In 1985 the production has been estimated to be even lower. This lowered production has taken place in spite of the fact that pond construction has

continued at a very fast pace. The simple explanation is that the shrimp farms cannot get enough post larval shrimp to stock the ponds. The long-term solution to the problem is the construction of shrimp hatcheries rather than importation of post larval shrimp or intensified activity in the collection of post larval shrimp from the sea.

The hatchery production of post larval shrimp is not without its problems. The pre-larval shrimp require a series of live foods--the last being Artemia. Evidence is now emerging that the survival of the post larval shrimp in the ponds is directly related to the quality of the Artemia fed in the hatchery. Thus, increased production of post larval shrimp by the hatcheries will not result in a proportional increase in market shrimp if the pre-larval shrimp are fed existing supplies of Artemia. ESPOL should, for a price, analyze the quality of Artemia used in the hatcheries. It is the intent of this project to give ESPOL that capacity.

In the long term, Ecuador should raise its own Artemia. The climate would appear to be suitable--Ecuasol has been making solar salt for many years. However, Ecuasol's ponds probably are not suitable for the level of Artemia production that is required; this due to the difference in pond management required for Artemia production and human salt production. ESPOL has land available for large experimental Artemia ponds.

#### Activities:

The major activities to produce Output 4.1 include:

1. Assist in the establishment of Artemia production ponds in Ecuador.
2. Establish a quality control laboratory at the ESPOL coastal laboratory.
3. Train ESPOL students at URI in quality control and URI students at ESPOL in shrimp production.
4. Conduct research on the pond survival of post larval shrimp cultured on live feed, fortified live feed and artificial diets.
5. Develop and publish an Artemia culture manual in Spanish.

#### Results to Date:

Dr. Simpson visited Ecuador from May 27 to May 31, 1985, in order to examine the ESPOL laboratory, shrimp ponds and solar salt ponds and to present a seminar on Artemia. A site visit was made to the areas where the Artemia ponds might be located. In November 1985 and April 1986 Dr. David Bengtson was invited to lecture at an ESPOL hatchery training course. The subjects of the lectures involved live food quality, including Artemia, Artemia culture and

toxicology of testing. A public lecture was given. All expenses of Dr. Bengtson were paid by ESPOL. A foundation supplemental grant has been submitted for possible funding.

Task Analysis:

4.1a. Work with Pond Systems

	<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
			<u>Start</u>	<u>End</u>
1.	Pre-feasibility examination, incl. collection of samples		5/85	6/85
2.	Identification of site for full feasibility study		5/85	6/85
3.	Full feasibility study, incl. algal culture (requires on-site ESPOL personnel)	XX	11/85	12/86
4.	Preparation of experimental design for pond studies		12/85	3/86
5.	Site visit to set up experiment		3/86	3/86
6.	Experiment with inoculation and fertilization schemes (requires on-site ESPOL or hatchery personnel)		1/87	12/87
7.	Site visit to collect and analyze experimental results	X	12/87	12/87
8.	Development of country-wide plan for <u>Artemia</u> production	XX	1/88	12/88
9.	Implementation of country-wide plan (depends on Ecuadorian government)		7/86	12/88

4.1b. Establishment of training and quality control center (ESPOL)

	<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
			<u>Start</u>	<u>End</u>
1.	Present seminars		5/85	4/86
2.	Advise on design of quality control center		6/85	4/86
3.	Advise on set-up of quality control center		12/85	6/86
4.	Produce Spanish-language <u>Artemia</u> manual	XX	1/86	12/86

5. Interlaboratory calibration (URI & ESPOL) on Artemia quality from pond studies X 4/86 12/86
6. Training in enrichment of Artemia 11/85 4/86

<u>Inputs:</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
Graduate Student (ESPOL) <sup>1</sup>	\$ 2,500	\$10,000	\$5,000
Research Associate	2,500		2,500
Travel/Per Diem	1,500	1,000	1,000
Supplies	1,000	500	1,000
	<u>\$ 7,500</u>	<u>\$11,500</u>	<u>\$9,500</u>

<sup>1</sup>May be degree or non-degree training as the situation dictates. The goal is to provide ESPOL with a quality control capability.

Output 4.2: Development of Artemia Production and Quality Control in Thailand

Artemia are not native to Thailand, yet it is an area suited to the cultivation of Artemia. Since its inoculation cyst and biomass production has increased, many small farms have been devoted to Artemia as part of poly culture. Preliminary results indicate marginal quality for the Thai cysts. The ponds are available for our inputs and are in production.

The proposed Thailand project aims at the analyses of the nutritional values and the pesticide residues of the Thai Artemia cysts, nauplii and adults as well as on their suitability as live food for tropical marine organisms. The project will also include the effects of environmental factors on the nutritional quality of Artemia. However, with the lack of personnel who specialize in nutritional quality analysis and control, the proposed project also aims at the training of a Faculty staff person who will be assigned to participate in the Artemia project in the above-mentioned aspects.

Activities:

The major activities to produce Output 4.2 include:

- Analyze the effects of environmental factors on saltfarms;
2. Analyze the nutritional quality and the pesticide residues of Artemia reared in saltfarms;
3. Conduct experiments on the suitability of Artemia as live food for larval stages of cultured sea bass (Lates cacarifer) and shrimp (P. monodon and P. merguensis).

4. Provide for the advanced studies of Mayuree Chaiyawat at URI and assist in her adaptive research in Thailand.

Task Analysis:

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
		<u>Start</u>	<u>End</u>
1. Present seminar		5/86	12/86
2. Advise on design of setup of quality control laboratory		5/86	12/86
3. Interlaboratory calibration (URI and K.U.) on <u>Artemia</u> quality from pond studies	X	5/86	12/86
4. Water quality analysis of <u>Artemia</u> ponds		5/86	1/88
5. Analysis of <u>Artemia</u> samples for fatty acids and chlorinated hydrocarbons	XX	5/86	1/88
6. Start training of Thai student at URI	X	8/86	1/88

Inputs:

	<u>1986</u>	<u>1987</u>	<u>1988</u>
Graduate Student*	\$ 5,000	\$10,000	\$10,000
Travel/Per Diem	3,000	3,000	3,000
Travel/Student	1,000	1,000	1,000
Supplies	500	500	1,000
Yearly Subtotals:	\$ 9,500	\$14,500	\$15,000

\* Mayuree Chaiyawat to come to URI 8/86.

Kasetsart University Faculty of Fisheries  
Counterpart Contribution to the Project

Description	1986 (Baht) <sup>1</sup>	1987 (Baht)	1988 (Baht)	1989 (Baht)
1. Project personnel				
1.1 salary	500,000	500,000	500,000	500,000
1.2 travel for field studies	20,000	20,000	20,000	20,000
2. Facilities and equipment for field and laboratory experiments	-	-	-	-
3. Fellowship: Ph.D. level		See above		
3.1 round-trip airfare		See above		
4. Sundry (office supplies, postal services, etc.)	1,500	1,500	1,500	1,500

Remark: <sup>1</sup>23 Baht = US \$1

Output 4.3: Fundamental Studies on Artemia Quality

One of the critical factors in Artemia quality for marine organisms is the amount of essential fatty acid. That amount is primarily a reflection of the essential fatty acid level in the diet, i.e., in the algae that the Artemia eat. Very little is known about the fatty acid profiles of the hypersaline algae that Artemia eat in their natural environment. We intend to culture several species of these algae to determine their profiles and the effects of environmental changes on them. The results obtained could then be applied to algal culture in Artemia ponds.

Artemia can theoretically be replaced someday by microencapsulated diets that are mass-produced in laboratory conditions. The development of these diets requires a more complete understanding of Artemia quality, especially with regard to lipids and enzymes.

Results to Date:

We have conducted research on microencapsulated diets for the past year, with funding from the Environmental Protection Agency. We presented three papers at the Second International Symposium on the Brine Shrimp, Artemia, in September 1985. We also have contributed to a major review paper on the nutritional quality of Artemia for marine larvae, in conjunction with our colleagues at the State University of Ghent in Belgium. The basic research is funded from other agencies. We include it here because we intend to use the research base for appropriate technology transfer.

Task Analysis:

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
		<u>Start</u>	<u>End</u>
1. Analysis of <u>Artemia</u> samples for fatty acids and chlorinated hydrocarbons		6/85	12/88
2. Research on microencapsulated diets (depends on funding from U.S. EPA)		1984	12/88
3. Research on fatty-acids of algal species in culture		1/86	12/88
4. Application of item 3 to pond conditions		1/87	1/88
5. Participation in and co-sponsorship of the 2nd International <u>Artemia</u> Symposium		done	-
6. Acceptance for publication of a paper on <u>Artemia</u> isozyme patterns	XX	7/85	2/86
7. Acceptance for publication of a paper on <u>Artemia</u> lipids in microencapsulated diets	XX	7/85	2/86
8. Acceptance for publication of a review paper on <u>Artemia</u> nutritional quality	XX	6/85	6/86
<u>Input:</u>		<u>1986</u>	<u>1987</u>
Research Associate		\$2,500	\$2,500

Output 4.4: International Study of Artemia Workshop

The idea of an International study of Artemia group came out of discussions held in Poland at an aquaculture conference in 1977. It was felt at the time that there was a need to have a comprehensive study of Artemia salina in which laboratories from various parts of the world would contribute for a complete study. Thus, laboratories from the United Kingdom, Belgium, Italy, the United States and Spain cooperated on this committee bringing in such aspects as genetics, morphology, biochemistry, aquaculture, physiology, etc. Some 40 to 45 papers have resulted from this collaboration including perhaps 15 papers out of The University of Rhode Island, some of which have been USAID cooperative efforts. In the past we have hosted, under the ISA, research workers from a number of developing countries including Indonesia, Thailand and the Philippines for specific training as well as researchers from Belgium and Spain. A Spanish student sent by the Spanish govern-

ment is presently in our laboratory learning techniques. He is at present preparing an Artemia training manual in Spanish. This group has hosted two International Conferences on Artemia, the last one being held in Antwerp, Belgium, in 1985. In addition, this group meets in informal session every year. The next conference is to be held in Rhode Island in September 1986. Under past protocol The University of Rhode Island would be the host for meals and lodging for this group. An approximate cost is included in the 1986 budget. At present our proposals for work in Ecuador and in Thailand are coordinated very closely with the Belgium initiative in Artemia and are coordinated under the ISA group. In addition, we are working on an initiative in Egypt which the Belgians have initiated. We have cooperated in significant ways with the Philippine groups in aquaculture together with the laboratories of Belgium and the United Kingdom. Thus, it is extremely important that we maintain our ties with this group, because in the past it has been shown to be a very valuable contact for coordinating activities in the brine shrimp quality and pond production areas.

<u>Inputs:</u>	<u>1986</u>	<u>1987*</u>	<u>1988*</u>
ISA Conference: (September 1986)	\$2,500	\$800	\$800
meals, lodging, local transportation and room charge			

\* Meetings to be held in Wales and Italy.

#### Output 4.5: Generalized Model of an Artemia Production System

Artemia are grown in ponds and salinas around the world under a variety of conditions and with varying techniques. Whether production is being maximized in any given system is unknown. In order to develop optimum procedures and inputs for maximization of outputs, we first need to define and model the basic elements of the system. Such a model could then be manipulated and subjected to appropriate field experiments in order to maximize production.

#### Task Analysis:

To be proposed at a later date as funds become available. Funds are being sought from foundations as well as from ESPOL and ARC.

#### SUMMARY OF INPUTS

##### USE OF MARICULTURE IN DEVELOPING COUNTRIES

	<u>1986</u>	<u>1987</u>	<u>1988</u>
Salaries:	\$12,500	\$20,000	\$20,000
Operations:	<u>9,500</u>	<u>6,800</u>	<u>7,800</u>
Yearly Totals:	\$22,000	\$26,800	\$27,800

## 5. POST-HARVEST FISHERY LOSSES: WORKPLANS AND MILESTONES

### Output 5.1: Improved Fresh Fish Preservation to Minimize Post-Harvest Fishery Losses

Considerable post-harvest losses occur in developing countries in small-scale fisheries within the entire post-harvest system. These losses range from 20 to 40 percent of the total catch. Considering the nutritional aspects, fish is one of the most important animal protein foods available in many less developed nations. Approximately 28 percent of the world fish supplies is consumed by the less developed countries (LDC's). Fish, therefore, is regarded as a main and indispensable item in the diet in many countries. Fisheries will continue to make a significant impact on food supplies in developing nations.

The basic causes of post-harvest fishery losses are improper handling, contamination, and related factors resulting in fish spoilage. Increased losses occur due to poor methods and practices for preservation, transportation, and marketing. Accordingly, the adaptation and evaluation of improved methods associated with these losses is the basis of this work plan. Specific program activities address the minimization of post-harvest losses as follows:

1. The development and implementation of an adaptive research program illustrating where losses occur during post-harvest in a small-scale fishery system.
2. The introduction of improved methods for handling fresh fish as related to pre-processing, e.g., washing, evisceration, the use of modified ice and other preservatives, and proper packaging.
3. The development of baseline data on the specific causes of post-harvest fishery losses focusing on spoilage, contamination, distribution and marketing, and socio-cultural factors.
4. The organization and presentation of an international workshop on post-harvest fishery losses addressing fresh fish preservation to minimize losses.
5. The training of ESPOL people - B.S. and graduate level program; specialized short courses focusing on topics such as fresh fish quality, sanitation and other appropriate subjects.

### The Role of Women in Fisheries Post-Harvest Losses

Women in fishing communities play an important role in providing food for both their family and the larger community. Maintaining and improving the fish catch and introducing methods to minimize losses is important for providing a needed stable protein source for the population.

Socio-cultural data on the roles of women in the processing system and the effect local policies have on these systems is important.

The goal of minimizing losses focuses on improvement in the quality of fresh fish bought at the beach and brought to the market. High losses due to already spoiled fish is evident--an integrated program in improving fish quality, preservation, processing, and packaging addresses this problem area.

#### Results to Date:

1. Preliminary proposal submitted to the Escuela Politecnica del Litoral (ESPOL) for implementation in Ecuador. This proposal is designed to determine where the post-harvest losses of fishery products occur and is followed by introduction of possible new techniques to study their feasibility to reduce the losses.
2. A survey letter has been sent to 70 agencies, institutes, and universities in 26 countries requesting information on current research in improved fish preservation. Interest in participating in an international workshop is being reviewed.

#### Agencies, Institutes, Universities/International Workshop (selected listing):

- Escuela Superior Politecnica del Litoral (ESPOL), ECUADOR
  - Universidad Catolica de Valparaiso, CHILE
  - Institute of Fishery Technology, INDONESIA
  - Direccion General de Ciencia y Tecnologia del Mar, MEXICO
  - Bureau of Fisheries and Aquatic Resources (BFAR), the PHILIPPINES
  - University of the Azores, PORTUGAL
  - Fishery Technology Laboratory, THAILAND
  - National Fisheries Institute, Washington, DC, U.S.A.
  - Central Institute of Fisheries Technology, INDIA
3. Background information was reviewed on the handling, preservation, and utilization of fish by previous URI work in Guatemala and Costa Rica. Post-harvest losses are a result of improper sanitary practice and poor handling procedures.

Activities:

1. Carry out an adaptive research program on post-harvest fishery losses with ESPOL.
2. Develop and introduce training programs in ESPOL.
3. Organize and present an international workshop on current applied research in fresh fish preservation to minimize post-harvest losses.

Task Analysis:5.1a. Adaptive Research - Post-harvest Fishery Losses - ESPOL

	<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
			<u>Start</u>	<u>End</u>
1.	Site visit to Ecuador to update and redesign research proposal and determine need for short course		8/86	8/86
2.	Development and modification of research program	X	8/86	8/86
3.	Site visit to initiate program *(final date pending on availability of fund)	X		
4.	Site visit to evaluate data and prepare reports (*See #3 above)	X		
5.	Dissemination of information - initiation of technology transfer (*See #3 above)	X		

5.1b. Short Courses and Training - ESPOL

	<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
			<u>Start</u>	<u>End</u>
1.	Two-week short course at ESPOL subject to local interest and the availability of funding and faculty	X	7/87*	7/87*
2.	Degree training at URI for 2 ESPOL students - School of Food Technology (funds will be provided by ESPOL)	X	9/86	12/87
	- Studies for B.S. and M.S. in Food Science and Technology (3 semesters)			

5.1c. International Workshop/Fresh Fish Preservation - Minimizing Post-harvest Fishery Losses

Activities/Tasks	Selected Milestones	Target Dates	
		Start	End
1. Survey of related research activities currently being conducted at international agencies, institutes and universities		7/85	11/86
2. Development and planning of workshop program		7/86	12/86
3. Planning meeting for organizing a work plan including program and budget for the International Workshop		1/87	1/87
4. Identification of funding for the International Workshop*	X	1/87	1/87
5. International Workshop convenes*		8/88	8/88
6. Preparation and distribution of Workshop proceedings	XX	9/88	10/88

\*pending on the availability of funds.

Inputs:

	<u>1986</u>	<u>1987</u>	<u>1988</u>
URI			
Research Associate (salary and fringe) (6 months)	\$15,860		
Research Associate (Salary and fringe)		\$34,892	\$38,381
1 RT ticket and per diem	1,875		
2 RT tickets		3,750	
Per diem		2,000	
Research supplies	3,000	3,000	3,000
Planning Meeting for International Workshop on post-harvest losses on fishery products (including travel cost for invited participants), estimated		2,000	
International Workshop on post-harvest losses on fishery products		16,500	
Publication of International Workshop proceeding		2,000	
Literature search, report and preparation of training manual for packaging	1,265		
Training course		to be determined	
	<u>\$22,000</u>	<u>\$64,142</u>	<u>\$41,381</u>

## TO BE FUNDED BY ESPOL:

- 2 Student Research Assistants
- In-country transportation
- Research supplies
- 4 RT tickets
- Tuition and expenses for students

Output 5.2: Processing Methods for Fishery Products

Significant post-harvest fishery losses occur due to poor methods and practices of processing the fresh fish. Improved traditional methods of processing fishery products and their use address the post-harvest processing system in relation to primary processing (product form) and secondary processing (salting, smoking, and drying). Improved processing of a properly handled and stored fish catch results in obtaining fishery products having high nutritional quality and consumer acceptability with minimum product loss. Program areas address improvement in the processing of fishery products as follows:

1. The development of an adaptive research project focusing on basic preservation methods applicable to the most popular fishery products in developing countries, e.g., salting, drying, smoking, or combinations thereof in relation to fishery product usage and the effect of processing on their nutritional quality.
2. Based upon where losses occur in the post-harvest fishery system, the development of a report outlining product models to address specific problem areas--handling, sanitation, landing, time, and temperature.
3. State of the art report for fishery products in a defined LDC or region.
4. Preparation of a training manual in seafood processing and utilization. Topic emphasis on sanitation, fresh fish quality, fish preservation, and new fishery products.

Results to Date:

1. Reports were obtained on fishery products and processes in the Philippines.
2. A training manual was prepared and is being reviewed (in progress) for publication.

Activities:

1. Complete revision of training manual in seafood processing and packaging for final publication.
2. Disseminate information on training course for other LDC's.

3. Development and presentation of a training program for LDC fishery officers in seafood processing and utilization (Bureau of Fisheries and Aquatic Resources - BFAR - the Philippines).
4. Determine the feasibility of the development and presentation of training programs (seafood processing and utilization) for other LDC's following their request.

Task Analysis:

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	<u>Start</u>	<u>End</u>
1. Identify basic fish preservation methods for fishery products as basis for adaptive research project		6/85	12/86	
2. Complete revision of seafood processing and utilization training manual for final publication	XX	7/86	12/86	
3. Publicize capability of offering training course, initiating contacts and seeking funds for presenting training programs in LDC's		12/86	12/88	

Inputs:

	<u>1987</u>	<u>1988</u>
Training Manual (250 ea.)		
English edition (1987)	\$ 4,000	\$
Spanish translation (1987)	3,000	
Spanish edition (1988)		4,000
Training Course		
Publicize our capability and initiate contact for potential users	<u>500</u>	<u>500</u>
	\$7,500	\$4,500

Output 5.3: Packaging Fishery Products

The adoption of proper packaging systems for fishery products could contribute to a) increasing product quality and shelf life, b) minimizing product losses as a result of contamination and other environmental factors, and c) increasing consumption and introducing new food products. The identification and use of applicable packaging methods for fishery products throughout the post-harvest system is a significant step towards minimizing fishery product losses. Program areas are as follows:

1. Review of literature specifically on seafood packaging for minimizing post-harvest fishery losses.

2. Conduct research on appropriate packaging methods applicable to LDC's.

Results to Date:

1. Literature search on packaging for fishery products was initiated (ICMRD Information Service).
2. A training program in the packaging of fishery products was conducted in conjunction with MSU/School of Packaging at the seafood processing training course for fishery officers from the Bureau of Fisheries and Aquatic Resources (BFAR), the Philippines. Specific information on packaging of fishery products obtained from MSU is available for incorporation into the training manual for future training course.

Activities:

1. Applied research in packaging fishery products (graduate research project at URI).
2. Continued cooperative short-course training program in fishery product packaging.

Task Analysis:

<u>Activities/Tasks</u>	<u>Selected Milestones</u>	<u>Target Dates</u>	
		<u>Start</u>	<u>End</u>
1. Literature search		1/87	6/87
2. Research project on packaging fishery products	X	1/87	12/88

Inputs:

	<u>1987</u>	<u>1988</u>
Literature search	\$ 500	\$
Research supplies	3,000	3,000
Graduate student assistantship	14,000	14,000
Report		500
	<u>\$17,500</u>	<u>\$17,500</u>

SUMMARY OF INPUTS

POST-HARVEST FISHERY LOSSES

	<u>1986</u>	<u>1987</u>	<u>1988</u>
Salaries:	\$15,860	\$48,892	\$52,381
Operations:	<u>6,140</u>	<u>40,250</u>	<u>11,000</u>
Yearly Totals:	\$22,000	\$89,142	\$63,381

SUMMARY OF TOTAL INPUTS

	<u>1986</u>	<u>1987</u>	<u>1988</u>
1.1 Administration	\$ 84,509	\$ 83,039	\$ 88,485
1.2 Training	25,639	22,437	23,574
1.3 Information Services	49,000	48,000	50,000
1.4 Technical Assistance	38,000	50,000	56,000
2.0 Socio-Cultural Factors	29,880	31,668	35,725
3.0 Fisheries Management	28,972	43,251	52,744
4.0 Use of Mariculture	22,000	26,800	27,800
5.0 Post-Harvest Fishery Losses	<u>22,000</u>	<u>89,142</u>	<u>63,381</u>
Yearly Totals:	\$300,000	\$394,337	\$397,709