

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

L. TRANSACTION CODE

A = Add
 C = Change
 D = Delete

A. Amendment Number

DOCUMENT CODE

3

COUNTRY/ENTITY

Interregional

5. PROJECT NUMBER

936-4161

4. BUREAU/OFFICE

S&T/AGR/RNR

0

6. PROJECT TITLE (maximum 40 characters)

Reproductive Studies On Milkfish

6. PROJECT ASSISTANCE COMPLETION DATE (FACD)

MM DD YY
016 310 816

7. ESTIMATED DATE OF OBLIGATION

(Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 814 B. Quarter 4 C. Final FY 814

8. COSTS / \$000 OR EQUIVALENT \$1 =

A. FUNDING SOURCE --	FIRST FY 84			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total	1,250		1,250		300	1,250
(Grant)	(1,250)	()	(1,250)	()	()	(1,250)
Other						
U.S.						
Host Country						
Other Donors)						
TOTALS	1,250		1,250		300	1,250

9. SCHEDULE OF AID FUNDING (\$000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH CODE	D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED * THIS ACTION		F. LIFE OF PROJECT	
			1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) AIDW	121	075	-0-		1,250		1,250	
(2)								
(3)								
(4)								
TOTALS			-0-		1,250		1,250	

10. SECONDARY TECHNICAL CODES (maximum 5 codes of 3 positions each)

079 | 099 | 064 | 876 | 319 | 874

11. SECONDARY PURPOSE CODE

141

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

A. Code | BS | R/AG | DEL | TNG
B. Amount | 300 | 400 | 250 | 300

13. PROJECT PURPOSE (maximum 420 characters)

To develop means of raising milkfish to sexual maturity in captivity, including maturation and increasing viability of larvae. It will also assist in training and technology transfer for LDCs.

14. SCHEDULED EVALUATIONS

Location MM YY | MM YY | Final MM YY
011 815 | 017 815 | 017 816

15. SOURCE/ORIGIN OF GOODS AND SERVICES

000 941 Local Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of 8 page PP Amendment)

* NOTE: This is a Cooperative Agreement.

17. APPROVED BY

S&T/AGR, Ansoo R. Bertrand

Title

Date Signed MM DD YY

18. DATE DOCUMENT RECEIVED IN AIDW, OR FOR AIDW DOCUMENTS, DATE OF DISTRIBUTION

MM DD YY

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS
PART II

Entity: Bureau for Science and Technology

Project: Reproductive Studies on Milkfish

Project Number: 936-4161

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961 as amended, I hereby authorize the centrally funded project, entitled: "Reproductive Studies on Milkfish." The project involves planned FY 1984 obligation not to exceed \$1,250,000, subject to availability of funds, in accordance with the A.I.D./OYB allotment process, to help in financing foreign exchange and local currency costs for the project.
2. The project funding is an increase of \$250,000 over the minimum level of \$1,000,000 indicated on page 19 of the project paper (P.P.). This increase will permit expansion of the LDCs collaborative program and activation of a Technical Advisory Group to guide the project.
3. The purpose of this project is to develop means of raising milkfish to sexual maturity in captivity, inducing maturation, and increasing viability of larvae. It will also assist in training and technology transfer for LDCs.
4. Each developing country where training or other assistance takes place under this project shall be deemed to be a cooperating country for the purposes of permitting local cost financing.
5. Goods and services, except for ocean shipping, financed by A.I.D. under the project shall have their source and origin in the cooperating country or in the United States, except as A.I.D. may otherwise agree in writing.
6. 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.

John W. Wang
J. S. Robinson
Agency Director for Food and Agriculture
Bureau for Science and Technology

Date 6-15-84

Clearance:

S&T/AGR: TGill [Signature] Date 6/14/84
S&T/AGR: JRoyer [Signature] Date 6/14/84
S&T/AGR: ABertrand [Signature] Date 6/14/84
S&T/PO: GEaton [Signature] Date 6/14/84

Drafter: LTrott:lt:Wang 0263j:06/11/84

JUN 14 1984

ACTION MEMORANDUM FOR THE AGENCY DIRECTOR FOR FOOD AND AGRICULTURE,
BUREAU FOR SCIENCE AND TECHNOLOGY

FROM: S&T/AGR, Anson Bertrand

SUBJECT: Authorization for S&T/AGR's Milkfish Project

Problem: Your approval is required to implement a new two year project entitled "Reproductive Studies on Milkfish" (936-4161) requiring obligation of AID funds not to exceed \$1,250,000 in fiscal year 1984 and 1985. This is the first phase of a possible two phase program.

Discussion: The project was submitted as an unsolicited proposal from the Oceanic Institute, Makapuu, Hawaii in January 1984. It was reviewed internally by S&T/AGR and five external scientists or administrators in March 1984. The Office of Agriculture has worked with the Oceanic Institute to strengthen the proposal to include especially training and technology transfer. A Project Paper was developed by S&T/AGR. The Subcommittee for Fisheries and Aquaculture reviewed the project in May, and the Agriculture Sector Council discussed it in June 1984.

Research advances in milkfish culture have been sufficient to expect breakthroughs in maturation and larval viability, which are the major problems in milkfish culture. This project will address these issues, will coordinate research with other institutions presently working with milkfish in LDCs, and will provide training and technology transfer to appropriate LDCs. In that manner, it addresses the AID philosophy of not only developing technology which will enhance food productivity, but also will provide for transferring this technology to LDCs and training their nationals in proper utilization of such new techniques.

The Office of Agriculture endorses the first phase of a possible two phase program with the Oceanic Institute and will guide the research and training at the Institute through a Technical Advisory Group, which will be composed of scientists knowledgeable in the culture of milkfish. This will include individuals from the Philippines, Indonesia, and Taiwan. The project funding is an increase of \$250,000 over the minimum level of \$1,000,000 indicated on page 19 of the project paper (P.P.). This increase will permit expansion of the LDCs collaborative program and activation of the Technical Advisory Group to guide the project. The first six to nine months will be particularly critical, as the ability of the Institute to obtain proper specimens, determine their suitability for experimentation, and establish working relationships with LDC institutions doing milkfish research will be tested. If the Institute cannot produce satisfactory results on these issues, there will be no reason to continue, and the project will be terminated.

B

Advice of Program change has been submitted and PPC will transfer funds to the S&T/AGR FY 1984 OYB for this activity.

Recommendations: That you indicate your approval of this new two year project by signing the attached PAF and Non-Competitive Procurement Memo to the Contract Office.

Attachments:

- PAF
- Justification for Recipient Selection
- Environmental Threshold Determination
- Justification for Non-Competitive Procurement
- Project Paper

Clearances:

S&T/AGR: TGill *T. Gill* Date 6/14/84
S&T/AGR: JRoyer *J. Royer* Date 6/14/84
S&T/PO: GEaton *G. Eaton* Date 6/15/84

Drafter: LTrott:lt:Wang 0246j:06/08/84

JUN 14 1984

MEMORANDUM

TO: S&T/FA, J. S. Robins
FROM: S&T/AGR, *Amison Bertband*
SUBJECT: Environmental Threshold Determination for:

Project Title: Reproductive Studies on Milkfish
Project Number: 936-4161
Specific Activity: Cooperative Agreement
Reference: Initial Environmental Examination (IEE) contained in PP for subject project.

On the basis of the Initial Environmental Examination referenced above and attached to this memorandum, I recommend that you make the following determination:

- 1. The proposed Agency action is not a major Federal action which will have significant effect on the human environment.
- 2. The proposed Agency action is a major Federal action which will have a significant effect on the human environment, and:
 - a. An Environmental Assessment is required; or
 - b. An Environmental Impact Statement is required.

The cost of and schedule for this requirement is fully described in the referenced document.

- 3. Our environmental examination is not complete. We will submit the analysis no later than _____ with our recommendation for an environmental threshold decision.

Approved *Roual Wadley*
Disapproved _____
Date *6-15-84*

Clearances:
S&T/AGR: TGill *TGill* Date *6/14/84*
S&T/AGR: JRoyer *JRoyer* Date *6/14/84*
S&T/PC: GEaton *GEaton* Date *6/15/84*

Drafter: LTrott:lt:Wang 0247j:06/08/84

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MEMORANDUM

TO: SER/CM/COD, Phillip Casteel

FROM: S&T/FA, ^{for} Jack Robins

SUBJECT: Justification for Non-Competitive Procurement of Unsolicited Proposal "Reproductive Studies on Milkfish" (936-4161), submitted by the Oceanic Institute, Hawaii.

Based on the attached memorandum, I am requesting that you award a Cooperative Agreement to the Oceanic Institute of Hawaii, without considering other sources.

I have determined that the substance of the proposal is not available to the Government without restrictions from another source, nor does it resemble any pending competitive solicitation, and is sufficiently unique to warrant exception from competing procurement procedures.

Below is the Project Officer's certification that is required by AID PR Notice 78-4.

I certify that neither I, nor to the best of my knowledge and belief, any other AID employee solicited the proposal from the offeror or had other prior contact with the offeror regarding the subject matter of the proposal other than to convey to the offeror an understanding of AID's mission and needs relative to the type of effort contemplated in the offer.


Lamarr B. Trott
Senior Fisheries Advisor, S&T/AGR

Drafter:LTrott:lt:Wang 0264j:06/11/84

MEMORANDUM

TO: SER/CM, Phillip Casteel

FROM: S&T/FA, ^{ATL}J. S. Robins
_{for}

SUBJECT: Justification for Recipient Selection of the Oceanic Institute for the Project of "Reproductive Studies on Milkfish" (936-4161).

The Oceanic Institute of Hawaii submitted an unsolicited proposal for research on milkfish in January 1984. This fish has been cultured for centuries in southeast Asia. However, it has not been successfully reared in captivity. The young fish are collected in the wild, and suffer greater than 90% mortality before reaching a harvestable age and size. By funding the proposed project, the Agency for International Development will be properly following its mandate to develop means of increasing food production in the developing world. The research proposed will address the primary problems of sexual maturation of milkfish in captivity, and larval survival. The state of the art in milkfish culture has progressed sufficiently in the last decade so that AID can expect results from this project that will immediately be of benefit to LDCs, particularly in southeast Asia. Not only will the technology be transferred, but the Cooperative Agreement will provide for training of LDC nationals at the Oceanic Institute.

The Bureau for Science and Technology plans to initiate during FY 1984 a Cooperative Agreement for two years, for a first phase study of a possible two phase program with Oceanic Institute that has recognized capability in culture of marine and brackish water fish and shellfish species. This Institute is the only U.S. entity which conducts research on milkfish. It also has worked on such species as mullet, marine shrimp, and dolphin fish. It has capabilities for training of LDC nationals, as well. The institution selected must have these capabilities.

Equally important, the institution selected to conduct this project must have an in-house staff with a background in marine fish culture, for conducting research as well as for training purposes. The institution must also have strong professional linkages with LDC scientists and technical specialists currently working on milkfish culture in LDCs. The Bureau for Science and Technology finds this unique blend of talents at the Oceanic Institute, and requests non-competitive approval of the Oceanic Institute on the basis of predominant capability. There are no other U.S. institutions which could undertake such a program, with the exception of Auburn University, which has no on-site mariculture capability, and the University of Hawaii, which does not have specialists in milkfish culture on the staff.

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The Oceanic Institute began its milkfish research in 1973, with assistance from A.I.D. It had received recognition for success in the culture of mullet, and planned to pattern research on milkfish after this success. This approach was not successful, however advances in methodology have been developed by the Oceanic Institute and other institutions in LDCs working on milkfish sufficient to expect success in this present project.

In consideration of the above, the Bureau for Science and Technology requests that the Contract Management Office proceed to award a Cooperative Agreement with the Oceanic Institute.

Clearances:

S&T/AGR:TGill	<u>[Signature]</u>	Date	<u>6/14/84</u>
S&T/AGR:JRoyer	<u>[Signature]</u>	Date	<u>6/14/84</u>
S&T/AGR:ABertrand	<u>[Signature]</u>	Date	<u>6/14/84</u>
S&T/PO:GEaton	<u>[Signature]</u>	Date	<u>6/14/84</u>

Drafter:LTrott:lt:Wang 0254j:06/08/84

PROJECT PAPER

STUDIES ON MATURATION AND SPAWNING OF
MILKFISH IN CAPTIVITY

A Cooperative Agreement with
The Oceanic Institute

Renewable Natural Resources Division
Office of Agriculture
Bureau for Science and Technology
Agency for International Development

June 1984

STUDIES ON MATURATION AND SPAWNING OF MILKFISH IN CAPTIVITY

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Part a

Statistical

Title: Studies on Maturation and Spawning of Milkfish in Captivity

Type of Agreement: Cooperative

Status: New

Collaborating Institution: The Oceanic Institute (O.I.)
Makapuu Point
Waimanalo, Hawaii 96795

Approval Period: Four Years

Approval Funding Level: \$3,800.000
(Including Buy-ins)

Funding Distribution:

Period	Research and Technology Transfer	Technical Advisory Committee	Buy-ins Mission
1st Year - 6 months	320	10	30
6 months	410	10	170
2nd Year	730	20	200
3rd Year	730	20	200
4th Year	730	20	200
	<u>2,920</u>	<u>80</u>	<u>800</u>

Minimum Commitment: \$250,000 for the first 6 months, and \$750,000 for the next 18 months, subject to satisfactory progress

Level of Agency Involvement: Considerable and Continuing

Monitoring Office: AID/ST/AGR/RNR

Part I

Recommendations and Summary

A. Recommendations:

It is recommended that \$3,800,000 project be approved for a four-year activity, to develop productive techniques of maturation and spawning of captive milkfish, to expand this technology, and to transfer this technology to LDCs. This would be achieved through a Cooperative Agreement between Agency for International Development (A.I.D.) and the Oceanic Institute (O.I.) of Waimanalo, Hawaii. The project is subject to satisfactory progress and good collaboration with less developed countries (LDCs) as determined by periodic reviews and discussions between A.I.D. and O.I.

The project funding would be scheduled as follows: for the first six months -- \$225,000 for research and logistics for O.I, and \$105,000 for research, training and technology transfer in LDCs, feed research in the U.S.A. and the A.I.D. oversight Technical Advisory Committee; for the second six months -- \$225,000 for research and logistics for O.I and \$195,000 for research, training and technical transfer in LDCs, feed research in the U.S.A and the A.I.D. oversight Technical Advisory Committee. Total second year funding for various components would be at the same level as that of the first year. Initiation of activities during the third and fourth year would depend on whether satisfactory progress was made during the first two years.

At least \$1,000,000 will be available for a minimum program for the first two years. Funds for an expanded, collaborative program and funds for the second two years, will be dependent on availability of additional A.I.D. funds, including Mission "buy-ins." A.I.D. and O.I. will work together to allocate available funds to various on-going or planned activities during any given period.

B. Summary Description

Background

The Oceanic Institute is a private, non-profit research institution incorporated in 1960. The corporation has demonstrated capabilities in research and developed education and training in the area of aquaculture.

The Institute was originally founded as the Oceanic Foundation, and was part of a member complex including Sea Life Park, a public oceanarium, and Makai Range, an engineering facility. In 1973 the Foundation was reorganized, resulting in the present structure of the Oceanic Institute.

Since its inception, the Oceanic Institute has contributed in the research of mariculture systems design, nutritional requirements of stock, and education/training programs for instruction in mariculture technique. The mariculture programs of the Oceanic Institute have been focused on food production, and aquaculture business development, using mullet and milkfish (Chanos chanos).

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A significant market for milkfish exists in the Philippines, Taiwan, and Indonesia, where for centuries traditional techniques have overseen the development of brackish pond fish farming. The milkfish industry is currently dependent upon the capture of fry from the wild and stocking in production ponds.

In 1973, a five year contract was awarded to the Oceanic Institute by A.I.D. amounting to \$1,262,799, for research intended to develop techniques for artificially stimulating milkfish propagation in order to eliminate the need for capture of fry. This study increased the knowledge of the natural history of the milkfish production, but did not achieve the techniques for the inducement of spawning or larval survival.

The Oceanic Institute has submitted an unsolicited proposal to A.I.D. for funding of continued milkfish research. The objectives of this proposal are similar to earlier studies but are more specific in light of recent progress in milkfish research both at the Oceanic Institute and other institutions.

After extensive review and interaction with the Oceanic Institute, it has been determined by A.I.D. this research will be funded under a Cooperative Agreement. This Agreement will provide for a continued process of evaluation and determination of direction for research and technology transfer programs.

The proposed Cooperative Agreement will help develop the existing technology of milkfish culture, and make the resultant levels of technology available to LDCs where milkfish culturing is presently being explored and utilized.

The Oceanic Institute is qualified and prepared to conduct these activities, given their established research direction in milkfish culture, and their past research under A.I.D. sponsorship. The Oceanic Institute will continue to collaborate with other research institutions currently sharing research activities in milkfish, and exchange information on their mutual progress. A formal affiliation agreement exists between the Oceanic Institute and the Aquaculture Department of the Southeast Asia Fisheries Development Center (SEAFDEC) in the Philippines, and with other significant research institutions. Milkfish research within the Pacific community is extensive. A continuous effort of mutual communication is critical for utilizing the results of this work.

The milkfish culture industry is limited by the level of fry recruitment from open water. This proposal intends to develop means of controlling the gonad maturation and spawning of captive adult milkfish. Once this goal is achieved (Phase I), subsequent research will be directed toward successful larval rearing (Phase II).

The Project

The project will consist of two components: (1) Research Activities, (2) Training, and Technology Transfer.

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1. Research Activities

The primary purpose of these experiments is to better understand maturation and reproductive processes of milkfish. The Oceanic Institute will hold and artificially expedite maturation by controlling nutritional and environmental factors, and using hormonal treatments. A maturation experiment has been designed to test the effect of three hormone levels, two water quality strategies, and two diets on the maturation of adult milkfish in captivity. Preliminary studies on the drug-induced spawning of mature milkfish and the quality of any resulting spawn will be implemented. Additional supporting work will assess basic nutritional parameters and general indices of health in natural and captive milkfish in different stages of maturation.

Once procedures for maturing milkfish have been tentatively established, then hormonally induced spawning can be investigated in greater detail, and problems associated with the rearing of milkfish fry can be addressed. Given the ability to obtain viable eggs consistently, experiments will be performed to define the most appropriate techniques for raising the fry to fingerling size. Larval-rearing techniques for several other species have been successfully discussed in the past by researchers at the Oceanic Institute.

2. Research, Training and Technology Transfer

The Oceanic Institute will establish a collaborative research and training program with LDCs which are currently utilizing milkfish and/or are interested in acquiring milkfish culturing technology. This collaboration will take the form of exchange of scientists and students and/or training workshops and visitations by scientists and students, as well as on-site research. The Oceanic Institute will initiate collaborative efforts with other research institutions and offer technology and information resources to representatives of the LDCs' milkfish industry.

Summation

This two component project will be funded by A.I.D. to support the research, technology transfer, training, and staffing of these elements. Transportation costs for all elements of the project are included and it is recognized that specific goals and directions may change during the four year term of this Agreement. A Cooperative Agreement is most appropriate for this project, and shall accommodate any changes in project priorities or research direction. A.I.D. will establish a Technical Advisory committee consisting of experienced milkfish researchers from the Philippines, Indonesia, Taiwan, and other members as appropriate. This advisory committee will review details of this research project and plan the collaboration that will embrace the technical skills and institutional capabilities of the participants.

Part II

Project Background and Detailed Description

A. BACKGROUND

Milkfish (Chanos chanos) has been cultivated for centuries throughout southeast Asia, and remains a staple of the diet for millions of Indo-Pacific people. The productive effort of this industry is from brackish-water culturing ponds rather than capture in open water. Milkfish are widely distributed throughout the tropical and sub-tropical Pacific and Indian oceans and tolerate a wide range of salinities. Rapid growth and an algal diet make them an efficient source of fast growing low cost protein.

Milkfish culture started in Indonesia 600 years ago and soon reached Taiwan and the Philippines. It is in these three countries that culture activity is most active oday. In the Philippines and Indonesia, an average of 300 to 700 kg/ha (267 to 625 pounds per acre) are harvested, and Taiwan produces 1800 to 2000 kg/ha (1600 to 1780 pounds per acre). The Taiwanese production is higher due the continuous stocking and harvesting efforts and deeper culture ponds. Leading the milkfish industry, Taiwan produces about 35,000 metric tons on nearly 20,000 ha (49,000 acres). While this productivity is significant, the techniques of this fishery have not changed significantly through its 600 year history, and remains a very labor intensive industry. The factor most limiting to increased production is the reliability of the supply of milkfish fry.

The natural history of milkfish is not fully understood. It is believed that spawning occurs once or twice a year. Fecundity is high with adult females releasing one to six million eggs hatching within 24 hours if fertilized.

Young larvae are carried as plankton to inshore waters. In several days the yolk sac is depleted and the fry begin feeding on phytoplankton and rotifers. Growth continues for approximately one year as the animal reaches a length of 15 to 20 cm (6 to 8 inches) and then moves into deeper water to join the adult stock. Difficult to capture, milkfish are far less productive as a pelagic fishery than the pond reared production cited above. There is no fishery for the adult milkfish, and only in the Philippines do regulations exist governing adult harvests.

Culture efforts begin by securing a source of fry which will be pond raised. Capture methods are diverse. Various dip nets and hand-held lock seine nets (Fang Liao type and Taishi type) are used to sweep coastal inshore waters by wading fishermen. The hand-held fork net, pushed by one man expanded into the seine which is pulled by two wading men. The hand pulled net is about 12 inches long with bouyant floats guiding the upper edge and weights for the lower. These larger two man nets are towed by bamboo raft, either hand poled or motorized, enabling fry collection far from shore.

A fry industry has developed, staffed largely by part-time men, women, and children. An intricate series of dealers and middle men make this an income generating industry for many. Fry capture varies seasonably and from year to year. Meteorological and oceanic events may effect adult spawning and planktonic distribution of eggs and fry. In the Philippines, fry are found coastally in May-June, Indonesia from March-May and September-December, and Taiwan in April-May.

Once captured, fry are sold to nurseries where they are raised to fingerling length of 5 to 6 cm (2 inches). Fingerlings are sold to the culture farms or as baitfish for the longline tuna industry.

More than 200 years ago, Hawaii was active in milkfish farming producing an estimated 1000 metric tons. Presently, no commercial harvesting effort exists on these islands. Many LDCs have milkfish fry available in their coastal waters. Among them, India, Sri Lanka, Malaysia, and Thailand have begun to establish milkfish farms, yet not all areas have sufficient quantities of this fish to create the market demand as found in Indonesia, Taiwan and the Philippines.

Factors limiting milkfish farm productivity are coastal pollution, natural environmental conditions, and fry availability. Research efforts are needed to successfully induce spawning and fertilization in tank held animals. Development of reproductive technology will increase farm productivity by removing dependence on fry capture.

A major focus of A.I.D. concern is increasing the nutritional quality and food availability in LDCs. Milkfish reproduction in captivity should encourage the expansion of this industry to areas in need of high protein food sources. The tolerance of this species to variances in salinity make it a highly adaptive creature suitable for pond culture and production. Further efforts in this direction may increase production through the introduction of recently developed technologies. Oceanic Institute staff have demonstrated their willingness to proceed with this research through their unsolicited proposal and recent findings.

Presently, under proper conditions, tank-held animals can be induced to spawn. Investigations at Oceanic Institute and other facilities support or duplicate this evidence. A significant effort of this Agreement will be to spread this newly acquired technology to LDC technicians who can initiate these laboratory generated techniques in their own farming environments. A.I.D. objectives will be achieved through this work, by increasing a significant food source in LDCs currently impacted by a protein deficient diet.

B. DETAILED DESCRIPTION

1. Introduction

This Cooperative Agreement is contemplated as an extension and expansion of the work previously conducted by the Oceanic Institute under A.I.D. financing from 1973 to 1978. That work resulted in the

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increased knowledge of milkfish natural history and preliminary steps toward captive maturation and spawning. The proposed research is intended to further the objectives of the original work. This proposal includes the development of technology under controlled conditions, and the adaptation and implementation of the same in LDC facilities of milkfish mariculture.

Through this proposal, A.I.D. will provide the resources to initiate research and newly acquired scientific technology transfer to activate milkfish farming in LDCs.

2. Sector Goal

The program or sector goal is to increase the production of a high protein food source in LDCs through research on milkfish. The research will generate and refine techniques developed under controlled conditions, and provide an operational method for field use in LDCs. Additionally, an extension of this goal is to increase the awareness of LDC scientists and technicians of recent developments in milkfish culture which provide for an increased productivity.

3. Project Purpose

A.I.D. support is directed toward developing field applicable techniques for inducing gonad maturation, spawning of milkfish and the successful rearing of milkfish fry. Collaboration of LDC members is intended to offer instruction in technique and participation in the research efforts in the LDCs. These training and collaborative services are to be provided for the LDCs in the culture, breeding, and ultimate increase in productivity of milkfish. This purpose relates fully to the sector goal by increasing milkfish productivity to achieve greater yields of protein in LDCs. A.I.D. has given high priority to improving the nutritional status of low income groups in LDCs. The agency has focused on developing the aquacultural capabilities of these nations using personnel and techniques from the United States. Presently, milkfish culture is limited to regions with a ready access to fry. The development of methods to produce fry in captivity will not only stabilize the industry in nations presently involved in milkfish aquaculture, but may also open opportunities for expansion into nations without local stocks of fry. The expected nutritional bonus will also be a result of a unique collaborative training and technology transfer program between a U.S. institution and several LDCs.

4. Project Inputs

The total cost of this activity over a four year period would be approximately \$3,800,000. Funding will be provided under a Cooperative Agreement between A.I.D. and O.I. During the first six months of the Agreement \$225,000 will be provided for research and logistics for O.I. and \$105,000 for research, training and technology transfer in LDCs, feed research in the U.S. and for the oversight technical Advisory Committee for A.I.D. Corresponding funding for

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the next six months will be \$225,000 and \$195,000. Second years funding will be at the same level as that of the first year. Initiation of activities during the third and fourth year would depend a great deal on whether satisfactory progress was made during the first two years. There is no guarantee that more than \$1,000,000 will be available for the first two years, or that any funding at all will be available for the second two years. A.I.D. and O.I. will work together to allocate available funds to various ongoing and planned activities during any given period.

An important consideration in influencing the response of LDCs to the proposed available training is the provision of sponsorship funding, or "buy-in" for training. Thus, LDCs and Missions will be encouraged to contribute or assume the funding required to provide the additional training of LDC personnel described in this project.

Inputs of a specific nature for core support will be:

- a) Administrative, secretarial, and communications costs and, equipment and supplies as required to accomplish objectives.
- b) Costs of printing, translation, and distribution of information bulletins, newsletters, or field technique publications.
- c) Full time efforts or as required to maintain, project efforts for research to determine:
 1. hormonal (thyroxim) regulation of gonad maturation and spawning in milkfish,
 2. environmental factors and water turnover rate governing milkfish maturation,
 3. successful feed and rearing of cultured fry,
 4. Intra-specific biochemical variation between milkfish indigenous to Hawaii, the Philippines, and Christmas Island,
 5. benefits of brine shrimp and other additives to commercial feed effecting milkfish maturation in captivity,
 6. evaluation of alternative hormonal treatments in field culture applications on maturation and spawning,
 7. benefits of methyl-testosterone in maturation of captive male adult milkfish,
 8. Oocyte development and hydration related to administration of various drugs,
 9. biochemical and physical parameters effecting standard measurements of egg quality,

10. baseline levels of health related parameters in milkfish as related to captive specimens and individual age, location of capture, and diet.

h. feed research for milkfish in the U.S.

i. funding for the technical Advisory Committee.

5. Project Outputs

The Oceanic Institute will make technical assistance available to LDCs interested in milkfish culture as part of the technology transfer process. Publications, manuals, and reports resulting from this project will be sent to A.I.D. and LDCs. LDC students and scientists will obtain formal and personalized training programs in various aspects of milkfish culture. The existing international network of universities and institutions working together on milkfish culture will be strengthened through the project's activities.

Specific, identifiable outputs will be:

A. First six months: 1 July 84 - 31 December 84

1. A comprehensive, detailed state-of-the-art paper on milkfish culture will be completed.
2. Successful collection and survival of sufficient broodstock to complete all experiments will be accomplished.
3. Biochemical analyses of Hawaiian, Christmas Island, and Indonesian populations of milkfish to determine the degree of genetic similarity will be completed.
4. Expansion of specialized handling facilities completed.
5. Initiation of experimentation dealing with broodstock maturation and health assessment.
6. Preliminary results on effects of testosterone on male reproductive performance completed.
7. Exchange visits by LDC scientists in milkfish culture begun, and outline and timetable of future collaboration completed.
8. Submission of fiscal report.
9. Memorandum of understanding for collaborative research with institutions in LDCs.

- B) Second Six Months: 1 January 85 - 30 June 85
1. Continuation of maturation studies which examine the influence of environment, nutrition, and hormones in reproductive development.
 2. Continue collaborative arrangements with institutions in LDCs.
 3. Second series of trials in effects of testosterone completed.
 4. Annual report of project activities.
 5. Fiscal report.
- C) Second Program Year: 1 July 85 - 30 June 86
1. Analyses of first year results will prompt changes which will be instituted.
 2. Continue collaborative arrangements with institutions in LDC.
 3. Begin planning technology transfer to LDCs.
 4. Submit annual report of project activities.
 5. Submit fiscal report every six months.
- D) Third and Fourth Program Years: 1 July 86 - 1 July 88.
1. Results of the studies from years 1 and 2 will be used to refine the experimental programs for maturation and hormone-induced spawning.
 2. Technology transfer component will convey the results of years 1 and 2 to LDC institutions.
 3. Continue collaborative arrangement with LDC institutions
 4. Submit annual report of project activities
 5. Submit fiscal report every six months.

**PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK**

Life of Project: _____
 From FY _____ to FY _____
 Total U.S. Funding _____
 Date Prepared: _____

Project Title & Number: Milkfish Fishery: Captive Maturation and Spawning Technology

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS																
<p>Program or Sector Goal: The broader objective to which this project contributes:</p> <p>Increase production of high protein food source in LDCs through research and increased awareness in Milkfish farming.</p>	<p>Measures of Goal Achievement:</p> <ol style="list-style-type: none"> 1. Representative LDCs report successful rearing of on-site hatched fry stock. 2. Increase in reported metric tons of milkfish produced in LDC culture ponds. 	<ol style="list-style-type: none"> 1. Report by LDC liaisons to project. 2. National reports and statistics. 	<p>Assumptions for achieving goal targets:</p> <ol style="list-style-type: none"> 1. Technology will be used and new hatcheries will be started with full support of LDCs and donor agencies. 2. Expand milkfish production in other nations. 																
<p>Project Purpose:</p> <ol style="list-style-type: none"> 1. Develop field technique for maturation and spawning, and fry rearing of Milkfish. 2. LDC Participant training. 3. Training and Consultant Services for LDCs in Milkfish breeding and culturing. 	<p>Conditions that will indicate purpose has been achieved: End of project status.</p> <ol style="list-style-type: none"> 1. Publication of field technique for adult maturation and spawning, and fry culture. 2. 20 LDC locations of experimental technique application. 3. 10 LDC scientists and technicians receive training in techniques. 4. Bi-monthly report of liaison and collaboration with other institutions conducting similar work. 	<ol style="list-style-type: none"> 1. Receipt of Publication. 2. In-house Review 3. In-house Review 4. Dialogue or Report received documenting current literature and collaborative efforts. 	<p>Assumptions for achieving purpose:</p> <ol style="list-style-type: none"> 1. Potential exists for artificial induction of maturation and spawning in open culture ponds. 2. Laboratory technique can be implemented in LDC's field applications. 3. On-site spawning and fry rearing will increase productivity of milkfish ponds in LDCs. 																
<p>Outputs:</p> <ol style="list-style-type: none"> 1. Research activities; state-of-the-art publication, seminars, workshops, and reports. 2. Technical assistance for LDCs at request of A.I.D. missions. 3. Scientists and technicians receive training. 	<p>Magnitude of Outputs:</p> <ol style="list-style-type: none"> 1. Full time research of four staff persons. 2. 2 workshops or seminars per yr. and updated publication of laboratory generated-field applied technique. 3. 3 person mos. (per yr.) TA to LDC's. 4. 10 LDC scientists and technicians receive training. 5. 20 LDC locations established to implement and field test technique. 	<ol style="list-style-type: none"> 1. In-house review 2. In-house review 3. In-house review 4. In-house review 5. In-house review 	<p>Assumptions for achieving outputs:</p> <ol style="list-style-type: none"> 1. Host countries express interest and support of projects. 2. Mission demands for TA meet expectations. 3. USAID missions and host governments make use of available technology. 4. USAID missions and other international donors might augment support with participant training funds. 																
<p>Inputs:</p> <ol style="list-style-type: none"> 1. O.I., LDC, and A.I.D. professional support. 2. Guidance of Technical Advisory Committee. 3. Equipment, supplies and facilities at O.I. and LDCs. 4. Travel and transportation and communication. 5. Collaborative Program. 6. Buy-in (services) by AID missions. 	<p>Implementation Target (Type and Quantity)</p> <table border="1"> <thead> <tr> <th></th> <th>Two Years (minimum funding)</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>485,000</td> </tr> <tr> <td>2.</td> <td>40,000</td> </tr> <tr> <td>3.</td> <td>205,000</td> </tr> <tr> <td>4.</td> <td>100,000</td> </tr> <tr> <td>5.</td> <td>170,000</td> </tr> <tr> <td></td> <td>1,000,000</td> </tr> <tr> <td>6.</td> <td>400,000</td> </tr> </tbody> </table>		Two Years (minimum funding)	1.	485,000	2.	40,000	3.	205,000	4.	100,000	5.	170,000		1,000,000	6.	400,000	<p>AID Budget and fiscal review</p>	<p>Assumptions for providing inputs:</p> <p>AID funding will be available for the purposes herein subscribed.</p>
	Two Years (minimum funding)																		
1.	485,000																		
2.	40,000																		
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4.	100,000																		
5.	170,000																		
	1,000,000																		
6.	400,000																		

Part III

Project Analysis

A. Technical Analysis

Milkfish is a popular and important source of protein in Southeast Asia. It is hardy, fast-growing, widely distributed species, and an efficient food converter. Although this species has been cultured for centuries in brackish water ponds, milkfish farmers are still dependent on the natural fry fishery. Fry are collected along the coasts during the spawning season in large numbers, but the supply is unstable due to seasonal environmental conditions and natural fluctuations in yearly recruitment. Indonesia, Taiwan, and the Philippines have a strong and active interest in breeding and producing milkfish in captivity; the annual production of milkfish in these three countries was 230 thousand metric tons from 1975 through 1978. If problems associated with breeding and fry collection can be resolved, milkfish aquaculture may be expanded to other LDCs such as Kiribati and Tahiti.

The Oceanic Institute in Hawaii received A.I.D. funding from 1973 to 1978 to engage in basic research on milkfish aquaculture. Because of their familiarity with the subject and due to the importance with milkfish aquaculture to nations in the western Pacific, the Oceanic Institute is a worthy candidate to continue receiving A.I.D. support in refining milkfish-growing technology. Because there are several LDC research facilities investigating different aspects of milkfish culture, it is essential that the Oceanic Institute collaborate and exchange expertise and information in order to avoid duplication of effort. Additionally, the Oceanic Institute can serve as a training center for LDC students to insure technology transfer. Investigating the potential for developing collaborative research between the Oceanic Institute and scientists in regions where milkfish research is important has already begun. During September and October 1983, Dr. Robert Shleser of the Oceanic Institute visited research centers in Indonesia and Thailand. During October and November 1983, Dr. Cheng-Sheng Lee of the Oceanic Institute attended the International Milkfish Conference in the Philippines to solicit opinions from LDC scientists as to current and future milkfish research goals and objectives. It is evident there remains a great potential for future progress in milkfish aquaculture if research can overcome some of the technical difficulties.

A successful milkfish industry depends on a stable supply of broodstock, but there is, as yet, no consistent method of maturing milkfish in captivity. Today no method of maintaining or manipulating broodstock has produced consistent results in spawning or fry production. In previous experimental programs, broodstock have been captured from the wild and maintained in large ponds (Taiwan, Hawaii), floating sea cages (Philippines), and tanks (Taiwan, Hawaii). The future of the industry depends on the ability to develop new broodstock by using animals taken from production ponds, and transferring them to defined environments in

which they can grow to sexual maturity. At the 2nd International Milkfish Conference which was held during October 1983 in the Philippines, it was concluded that if propagation of milkfish in captivity is to be achieved, research must be conducted on problems of stock development, maturation, and spawning. Such research is necessary in order to improve vital production levels of this important aquacultural product.

During the past decade, studies of milkfish propagation have addressed different components of maturation and spawning with varying degrees of success. For example, Marte et al (1983) reported that milkfish held in cages floating in the sea completed their life cycle and spawned. The reliability of this approach will be dependent on finding similar conditions in other regions and the reproducibility of the environmental conditions. Use of the cage method of culture presents several problems in the areas of: 1) effective methods of egg collection; 2) predicting spawning times; and 3) identifying and controlling the environmental factors of maturation and spawning.

The basis of successful aquaculture is dependent on routine control of maturation and spawning in enclosed culture systems. Milkfish were matured in tanks or ponds in Taiwan (Tseng and Hsiao, 1979; Liao and Chen, 1979, 1983; Lin, 1982). However, only a low percentage of fish matured or spawned in captivity. In studies conducted at the Oceanic Institute, milkfish which were held in tanks of different size and shape demonstrated a high percentage of gonad maturation (Lee and Weber, 1983); however, lack of replicate studies limited conclusions about the most appropriate management methods. The work is proposed to establish the most appropriate methods to manage maturation.

Hormone-Induced Spawning

Milkfish have been induced to spawn with administration of hormones (Vanstone et al, 1977; Liao et al, 1979; Tseng and Hsiao, 1979; Lee and Weber, 1983; Juario et al, 1984). In these studies, fertilization and survival have been relatively poor. Success in egg fertilization and hatching, using fish which have been induced to spawn through the introduction of hormones, depends on their preconditioning, nutrition, and growth history prior to hormone administration. Successful use of hormones to induce spawning also depends on identifying the most effective hormone and/or the optimal dosage. This information can only be obtained in controlled studies with adequate supplies of mature fish; heretofore these conditions have not been met.

Larval Rearing

Larval rearing of milkfish has been reported in detail by Liao et al (1979) and Juario et al (1984). It has been suggested that such rearing is relatively straightforward for milkfish, in comparison to other species of finfish. Techniques of larval rearing can only be improved if the control over milkfish maturation and spawning allows for a dependable supply of larvae. For experimentation the ability to reliably mature and spawn milkfish in captivity is the key to profitable and productive milkfish culture, and represents the cornerstone for work on virtually all other aspects of milkfish propagation.

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B. Environmental Assessment

No adverse environmental effects are anticipated resulting from the activities supported under this agreement. Slight chemical and biological changes in surrounding waterways will result when holding tanks are periodically drained because nitrates, phosphates, and other dissolved nutrients will be released. These dissolved nutrients should only temporarily increase the nutrient load in nearby water systems.

C. Financial Analysis

Work for a four-year period is outlined which will require support of approximately \$3,800,000. Approval of this project for the four-year period is recommended although funding for the first six months, at a minimum level will require \$250,000, prior to an initial review in December 1984. Expenditures are expected to proceed at a rate of \$500,000 per year for FY 85-89, at minimum level.

This project will provide support for research and travel, and collaborative exchanges both of scientists and students. Support is provided for the adaptation of technology and methodology which as proven successful under the conditions of a research institution in one country to that of another.

For efficient performance of the project which would include components of collaborative research and technology transfer activities in and for the LDCs, as well as feed research in U.S.A., it would require \$80,000 during the first six months and \$170,000 during the second six months, and the same yearly level (\$250,000) thereafter.

An oversight project technical Advisory Committee for A.I.D. will require about \$20,000 on yearly basis to perform its duties. The sum is included in the minimum levels stated above.

D. Social Analysis

In many LDCs, small-scale fisheries comprise a large part of the rural environment and constitute a large percentage of the rural employment.

A very large number of subsistence coastal farmers and fishermen make a basic living by collecting milkfish fry from the wild. If milkfish fry hatcheries were to be developed as a result of this agreement, it could conceivably greatly decrease the need for large numbers of "fry collectors." Consequently, the social impacts at the community level could be significant.

E. Economic Analysis

The economic impacts on the existing milkfish fry collecting industry could be major and significant. This agreement is designed to enhance milkfish culturing techniques presently being used in Southeast Asia. If successful, the possibility exists that future expansion of the industry may occur in areas that do not now practice milkfish culture. What this

agreement will hopefully provide is a constant and consistent supply of fry in order to insure availability of an economical and popular protein source, thereby, enhancing nutritional levels.

F. Women in Development

Women play a significant role in the collection of milkfish fry. Revenue accrued by such activity will be decreased if large scale, laboratory production of fry is achieved through successful research efforts and becomes standard practice in LDCs. Long-term impacts of such a scenario are difficult to assess at this time.

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Part IV

Implementational Arrangements

A. Analysis of Administrative Arrangements

It is essential that the implementing institution have considerable knowledge, experience, and a disciplinary background in fisheries and mariculture. Additionally, an international reputation in these fields should be evidenced by experience and service with international organizations, institutions, and professional societies. Such background and experience is considered to be essential to link the project activities with the personnel and institutions of the LDCs.

A.I.D. has assisted in the development of a specialized capability in fisheries and mariculture of the Oceanic Institute with a five years of project funding through an earlier study from 1973 to 1978. The capability which now exists at Oceanic Institute is unique among U. S. institutions. Currently, the Oceanic Institute is the only professional facility in the U. S. conducting milkfish research. Additionally, this institution has developed the resources and means to conduct such research, and has demonstrated an interest in collaborating with LDCs representatives on milkfish research and mariculture operations. Staff researchers have met with other scientists in the field to discuss current status of research, and have made written statements of affiliation with the Aquaculture Department of SEAFDEC and Tufts University. For these reasons, no other U. S. institution has a comparative competence with which to qualify them to undertake the project described herein.

B. Implementation Plan

This PP has been developed by S&T/AGR based on their assessment of what the Oceanic Institute can do and on the needs for project activities as seen by S&T/AGR. Cost estimates and the scope of activities may need to be revised during negotiations. A Cooperative Agreement seems to be an appropriate mechanism for this project as it is expected that S&T/AGR will maintain a considerable involvement in the project activities.

C. Evaluation Plan

The project will be managed within the Renewable Natural Resources Management Division of S&T/AGR.

The Oceanic Institute will appoint a Project Director who will be directly responsible for project operations and project supervisions on a day to day basis. This person will serve as the Oceanic Institute's immediate contact with the A.I.D. Project Manager. The A.I.D. Project Manager and Oceanic Institute's Project Director will maintain communications with one another on a routine basis in order to insure effective project management. Ad Hoc meetings between the A.I.D. Project Manager and the Oceanic

Institute Project Director will take place as necessary, taking advantage of the Oceanic Institute's Project Director's visits to Washington in connection with project and non-project related activities.

Several evaluations are envisioned during the four year project activity. After the first six months of project implementation an in-depth team review will be undertaken to determine whether the project is proceeding on the course as agreed upon by Oceanic Institute and A.I.D. Two more site evaluations will be conducted by ST/AGR, one after 15 months and another after 36 months of project initiation. During the first six months A.I.D. will appoint a Technical Advisory Committee which will meet to review the project, as required, and at the request of S&T/AGR.

D. Project Reporting

1. An annual report of project activities will be submitted (50 copies) to the A.I.D. Project Manager by April 30 each year.
2. A fiscal report will be prepared every six months from the date of project initiation showing actual expenditures and projected expenditures for the following six months. This report will be submitted in six copies to SER/CM.
3. Three copies of all trip reports involving international travel in support of this project will be sent to the A.I.D. Project Manager.
4. Ten copies of all reports, manuals, and publications resulting from this activity will be sent to the A.I.D. Project Manager.

E. Related Activities of Other Donors

Canada and Japan are supporting similar milkfish research and development activities at SEAFDEC.

The A.I.D. Project Manager in cooperation with the Oceanic Institute Project Director will have the responsibility for assuring that these cooperative agreement activities do not compete with or duplicate work being supported by other donors. Cooperation and information exchange among donors is generally good and complementary activities are planned whenever possible. Because the needs are large and the assistance activities are relatively small, cooperation among groups has been effective.

F. Scope of Work

To achieve the objectives of this project, the implementing institution shall carry out the following activities in each of the two following project components. There will be a continuing dialogue between A.I.D. and O.I. regarding the progress, relevance, scope and direction of the project activities.

1. Research Activities

- a) Maturation Experiment - To define the environmental tank conditions, nutritional parameters, and hormonal treatments which will allow adult milkfish of both sexes to become reproductively mature in captivity.
- b) Hormone Experiment - To identify the level of thyroxin hormone which will most effectively induce maturation in male and female milkfish.
- c) Environmental Component - To test and compare two environmental management strategies on ability to promote the maturation of milkfish in captivity.
- d) Nutritional Component - To develop a diet which will provide sufficient nutrients to promote milkfish maturation.
- e) Testosterone Experiment - To identify a method for attaining mature ripe male milkfish in captivity.
- f) Hormone Induction of Spawning Experiments - To determine the effectiveness of CPH, LH-RH-A, HCG, and SPH as spawn inducing drugs for milkfish.
- g) Egg Quality Assessment - To define the physical attributes and biochemical composition of fully developed ova in order to better predict the health and survival of the resulting larvae
- h) General Health Assessment - To develop criteria to assess the health of milkfish.
- i) Nutritional Research - To define dietary regimes under which milkfish became reproductively mature. Develop suitable feed.
- j) Intraspecific Variation - To assess by means of electrophoresis the degree of genetic similarity between Hawaiian populations of milkfish with those of other regions.

2) Training and Technology Transfer

- a) Initiate collaborative agreements with research institutions in LDCs which are concerned with milkfish culture.
- b) Plan training programs for students and trainees from LDCs in various aspects of milkfish culture
- c) Coordinate technology transfer of project results through exchange visits by working scientists in various areas of milkfish propagation.

- d) Prepare publications, manuals, and reports of project activities for dissemination to interested institutions.
- e) Host seminars for interested scientists, students, and trainees on aspects of on-going project research.

Both of these components are illustrated in Appendix A.

Part V

Budget: The project has two major components - 1) research and 2) technology transfer activities for LDCs. The research will be done at O.I. and the institutions in the LDCs, with O.I. doing the major part of it. Because of the difficult nature of this research and severity of the funding constraints, budget commitments are time phased and are subject to the satisfactory progress of the project as well as availability of funds. There is also a potential of buy-ins (services) from the missions.

1. Minimum Commitment and Needs (\$1,000,000)

Year 1: First six months: \$250,000 (1)

Second six months: \$250,000 (2)

Year 2: \$500,000 (3)

Stage (2) and (3) funding will follow an intensive review, dialogue and planning, regarding design and scope-of-work, for these stages as stage (1) progresses.

The funding level under this commitment does not provide satisfactory resources for collaborative research and technology transfer for LDCs.

Line Items For Minimum Funding

(,000)

<u>Items</u>	<u>1st 6 Months</u>	<u>2nd 6 Months</u>	<u>2nd Year</u>	<u>Total</u>
Salaries	44	55	104	203
Benefits (25%)	11	14	26	51
Indirect Cost (90%)	50	63	118	231
Travel	38	22	60	120
Facilities & Supplies	102	41	62	205
Publications	5	5	10	20
Collaborative Program*		50	120	170
Total	250	250	500	1000

* Includes research, training, technology, transfer in LDCs

2. The project outputs and utilization of technology will be far greater and the resources expended far more cost effective if the project funding were to be increased by about fifty percent...from \$1,000,000 to \$1,500,000 for the first two years and from \$2,000,000 to \$3,000,000 for a possible four year agreement.

Funding for Reasonable Collaboration
Subject to Satisfactory Project Progress:
(,000)

<u>Year</u>	<u>Research</u>		<u>Training & Tech Transfer</u>		<u>Tech</u>	<u>Total</u>
	<u>O.I.</u>	<u>Sub-Contract</u> *	<u>LDCs</u>	<u>LDCs</u>	<u>Adv.Com.</u> **	
One	450	70	80	130	20	750
Two	450	70	80	130	20	750
Three	450	70	80	130	20	750
Four	<u>450</u>	<u>70</u>	<u>80</u>	<u>130</u>	<u>20</u>	<u>750</u>
TOTAL	1,800	280	320	520	80	3,000

* Feed formulation for milkfish

** Advises A.I.D., (Appointed by A.I.D.)

Line Items for Reasonable Collaboration
(,000)

<u>Item</u>	<u>1st Year</u>	<u>2nd Year</u>	<u>3rd Year</u>	<u>4th Year</u>	<u>Total</u>
Salaries	142	150	158	168	618
Benefits (25%)	36	38	39	42	155
Indirect Cost (90%)	160	170	177	190	697
Travel	60	60	60	60	240
Facilities and Supplies	192	92	126	100	510
Publications	35	35	35	35	140
Collaborative Program*	<u>125</u>	<u>205</u>	<u>155</u>	<u>155</u>	<u>640</u>
TOTAL	750	750	750	750	3,000

* Includes research, training, technology transfer in LDCs.

3. Buy-in of Services from A.I.D. missions

If the project received increased funding, as suggested in the previous section, O.I. will have an improved capacity to provide buy-in services from the missions. Request for most of these services, perhaps at level of about \$200,000 a year, are expected to come initially from S. East Asia (mainly Philippines, Indonesia, Thailand, Sri Lanka, and India). Later requests for assistance will also start from African region as well.

Appendix A: Milkfish Project Flow Chart

<u>Activity</u>	<u>First Year</u>	<u>Second Year</u>	<u>Third Year</u>	<u>Fourth Year</u>
Coordination	X	X	X	X
Technical Advisory Committee	X	X	X	X
Facility Preparation	X			
State-of-the-Art Paper	X			
Experimental Design	X		X	
Animal Collection	X			
Collaborative Studies Agreement	X			
Nutrition Studies	X	X	X	X
Health Studies	X	X	X	X
Testosterone Experiments	X	X	X	X
Maturation Studies	X	X	X	X
Training Workshops	X	X	X	X
Collaborative Research	X	X	X	X
Technical Assistance	X	X	X	X
Publications/Newsletters	X	X	X	X
Training/Exchange of Expertise	X	X	X	X
Stock Transfer		X		
Genetic Study	X			

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