PD-ABA-460

Project Paper Outline

Aquaculture Technology Development and Assistance

PROJECT PAPER

FOR

A COOPERATIVE AGREEMENT

WITH

THE INTERNATIONAL CENTER FOR AQUACULTURE

AT

AUBURN UNIVERSITY

Renewable Natural Resources Division
Office of Agriculture
Bureau for Development Support

PROJECT PAPER OUTLINE

AQUACULTURE TECHNOLOGY DEVELOPMENT AND ASSISTANCE

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PART I SUMMARY AND RECOMMENDATION

A. RECOMMENDATION

It is recommended that a $2,100,000 project be approved for a 5-year period to transfer existing aquaculture technology available at Auburn University to LDCs. The project will facilitate the continuity of the University's education program for LDC students in aquaculture and will make technical assistance available to USAID missions and host government institutions for fisheries outreach programs. A Cooperative Agreement mode is proposed. The project would be initially funded at rates of $200,000 for the last 2 quarters of FY81 and $450,000 for FY82. Funding levels for FY83, FY84, and FY85 will be $450,000, $500,000 and $500,000 respectively.

B. SUMMARY DESCRIPTION

The project will insure the continuation of a high quality university educational program oriented toward the application of aquaculture in LDCs. It would make this program available to graduate and special students and other participants from LDCs, and would provide for the utilization of capabilities developed at Auburn for transferring existing aquaculture technology.

The graduate educational programs for LDC students will be provided core support to enable continuation of specialized research, academic and practical training programs at Auburn. The project will maintain positions for at least 35 LDC graduate students at Auburn. A high level of faculty involvement in graduate student education will be maintained and adequate research ponds, equipment and related facilities will be made available for LDC students. Special training for LDC students will be arranged between quarters and during vacations to provide opportunities for these students to observe and study elements of aquaculture programs in other regions which will complement their training at

Auburn. Opportunities will be provided for international participants to receive the specific academic or applied training program that will best serve their needs in their home countries. Short courses of an applied nature, including practical instruction and experience with fish farming operations, will be offered both in the US and in LDCs. Working manuals in selected areas of aquaculture will be prepared for use in LDCs and a quarterly information letter will be published and distributed as an extension tool. These activities will be supported by AID financed inputs of 40 person-months of senior professional staff time and 36 person-months of graduate or research assistant time per year, as well as administrative, library, publication and travel costs.

In addition to the program outlined above, a technical advisory service will be funded under the project consisting of 8 person-months in FY 1981 and 16 person-months in FY 1982 and each year of project implementation thereafter. This will facilitiate effective and rapid responses to Mission and Regional Bureau requests. Short courses in various subject matter areas of aquaculture, technical services in conducting surveys, assessing potential for aquaculture, project planning activities and program evaluation will be included in the services component of this Cooperative Agreement. These activities are a logical follow-on to the grant funded capability building which AID supported at Auburn University during the past 11 years. Through Auburn's experience and current on-going activities, many of the costs associated with these activities can be accurately estimated.

It is expected that core support for this project will be required on a long-term basis which, it is believed, can best be provided under the Cooperative Agreement mechanism. The Advisory Services Activity, formerly funded under Contract AID/DSAN-C-0053 will be allowed to terminate along with Grant AID/DSAN-G-0039 on April 30, 1981. Subsequently, the Cooperative Agreement,

with components for merging support under the two former funding agreements, will be implemented May 1, 1981, as a single funding entity.

PART II PROJECT BACKGROUND AND DETAILED DESCRIPTION

A. BACKGROUND

Aquatic food production differs from that of other commodities in that a majority of the total supply presently comes from wild stocks. The realization of the potential contribution of aquaculture to total supplies of fish and other aquatic foods is just beginning to materialize. Aquaculture production, which presently provides about 10% of the world supply of aquatic food, increased from one million metric tons in 1966 to 6.1 million tons in 1975. Aquaculture development plans prepared by 34 developing countries in Africa, Asia and Latin America plus production increases occuring in other countries are expected to result in a total production of 12 million tons by the end of 1985. Experts agree that potential for much greater production exists, and that aquaculture can be complementary to traditional agriculture by utilizing land resources of low value, water resources stored for irrigation, power, or flood control, and agricultural labor whose regular employment is seasonal.

Basic technology for labor intensive aquaculture production already exists. This technology has been used successfully in a variety of circumstances. The efficiency of fish production in ponds makes aquaculture well suited for use in LDCs, and the utilization of organic wastes as fertilizers and agricultural by-products as supplemental feeds greatly reduces the costs of inputs. Energy requirements for such systems are relatively low and the financial rates of return are generally attractive. These characteristics make aquaculture well suited for developing countries. The key needs for utilizing this technology in LDCs are education, information exchange, extension, demonstration and administrative capabilities to organize and carry out programs which involve these

functions. The proposed Cooperative Agreement addresses these problem areas with respect to the transfer of technology required to promote increased production of fish through aquaculture.

To accomplish this technology transfer AID will utilize the specialized capabilities in aquaculture which have been developed at Auburn University during 11 years of 211(d) and other grant assistance. It is proposed that AID provide long-term core support to maintain and promote agency access to these capabilities. With AID grant support Auburn has already been involved in a number of technology transfer projects. Although these activities have frequently involved contract support from USAID missions, they have been dependent upon the training, research and extension capabilities developed under the 211(d) grant. Outstanding examples of technology transfer are referred to under Part III, Project Analysis.

The International Center for Aquaculture at Auburn in 1980 had 95 graduate students enrolled in the fisheries curriculum of which 35 were of foreign nationality. In addition 18 foreign nationals were enrolled in the 4-month intensive aquaculture training program. The majority of foreign graduate students are sponsored by various international organizations, including FAO, USAIDs, World Bank, Rockefeller Foundation and IDRC (Canada). Other international students are sponsored by research organizations of their home country, i.e. MARDI (Malaysia), KISR (Kuwait) and INDERENA (Colombia). US universities and consortia, MUCIA (Wisconsin), SECID (Southeastern Consortium for International Development) and Kansas State University, financially support several of Auburn's international students.

Auburn has joined the Latin American Scholarship Program (LASPAU) in sponsoring graduate students drawn from staffs of Latin American universities. In 1980 three LASPAU students (one each from Venezuela, Peru and Colombia) were

enrolled in the fisheries graduate program, with tuition paid by Auburn's fisheries department.

Auburn personnel have assisted in long-term aquaculture development projects in the Philippines, Jamaica, Indonesia, Honduras, Colombia, Brazil, El Salvador, Panama and Nigeria. Auburn staff have contributed a total of 65 person-years of long-term advisory services to those projects. From September 1978 to June 1980, Auburn staff members responded to 66 requests for short-term assistance and provided 840 man-days of services to 33 LDC and middle income countries. A list of short-term services provided by Auburn's International Center in 1979-80 is attached to this paper.

The significant contribution of Auburn to LDC aquacultural development has been possible because of the core support provided through previous AID grant funding. Without this form of support an extremely heavy financial burden would be placed on Auburn University, as a large proportion of the staff is involved with international aquacultural development. Core support from AID, supplemental to that provided by the State of Alabama, is needed to maintain existing capabilities and to fully utilize the expertise developed for foreign assistance.

An AID review team carried out a review of the Auburn project February 11-13, 1980. This review team was complimentary regarding Auburn's overall performance and pointed to the need for long-term core support to provide for effective utilization of the expertise developed.

The Cooperative Agreement will extend over a 5-year period; however, it is anticipated that the need for core support to maintain and utilize Auburn's capabilities will continue beyond the present 5-year proposal. Some state and federal funds are available to support Auburn University in its work related to the US aquaculture and sport fisheries industries, but for the most part these

services are not available for development assistance to LDCs, nor should that be expected.

B. DETAILED DESCRIPTION

1. Introduction

The Cooperative Agreement is contemplated to be an extension of the assistance which AID has provided for the development and maintenance of the International Center for Aquaculture (ICA) at Auburn University over the past 11 years. From June 1970 until May 1978 financial assistance was provided by means of the 211(d) mode, Grant AID/DSB-2780. When it was realized that it would not be possible to sustain Auburn's international response capability without continued AID contribution to the core budget of the ICA, it was first proposed to extend the AID support by means of an additional 211(d) grant. This, however, was considered to be inappropriate by the Office of the AID General Counsel, the reason being that the 211(d) mode was for developing a foreign assistance capability, not for core support. It was pointed out that at Auburn University such a response capability already existed. The counselors also questioned the propriety of providing technical assistance to LDCs under an AID grant. For those reasons two separate projects were approved in 1980 for continuing support of the program at Auburn University. These were grant AID/DSAN-G-0039, which provides core funding for the education and outreach activities of the ICA on the Auburn campus, and Contract AID/DSAN-C-0053, under which technical assistance is made available to LDCs at the request of the USAID missions. Since 1978, the Cooperative Agreement has been made use of under similar circumstances to combine core support and short-term technical assistance to LDCs. The Cooperative Agreement, then, is the mode that we recommend when the present projects terminate on April 30, 1981.

2. Project Design Summary: Logical Framework.

3. Sector Goal

The sector goal is increased production of high protein food in LDCs through the farming of fish and the controlled stocking of inland water bodies.

The success of aquaculture programs in producing an economic source of animal protein through pond culture has already been demonstrated in a number of LDCs and as a consequence interest in fish farming has steadily increased. That there is a need for short- and long-term technical services in this field is evidenced by the large demand for Auburn's services at Mission request. Auburn aquaculture technicians have been provided under seven USAID Mission and three host-country contracts, comprising a total of 65 person-years of long-term advisory services. Short-term technical services were provided by 62 individual ICA staff who contributed a total of 6,025 person-days of overseas work in which 343 country visits were made in 72 different countries during the period 1967-1980. There is every reason to assume, as a result of continued outreach made possible with AID/W central funding, that fish farming can become a profitable enterprise for large numbers of small farmers in many LDCs.

4. Project Purpose

AID's continued support of the core budget of the International Center for Aquaculture is expected to maintain the facility which has been developed at Auburn over the past 11 years. The project purpose is to utilize this facility to continue strong educational programs in aquaculture for students from LDCs, to more effectively utilize the capabilities available at Auburn in programs which will backstop aquacultural development in the LDCs and to provide technical assistance at the request of AID Missions and host country governments.

The strong influence which Auburn University has exerted in the development of aquaculture in LDCs is to a great extent the result of the students it has trained. It is noteworthy how many have returned to their home countries to

occupy key positions in their agricultural and fisheries departments. The training is oriented towards tropical aquaculture. The teaching staff has had many years of experience working in LDCs and this has created an intimacy between the foreign student body and the faculty which is unique. Due to the unusually high number of professional staff which have participated in international development programs ties are formed with the foreign students which remain long after the students have returned to their home countries. Auburn has been effective in drawing on these ties to establish a network for implementing aquaculture activities in the LDCs. The network adapts the utilization of appropriate technologies developed in the US by the university community and state and federal agencies. This Auburn network also provides an institutional set-up for a post-consultation "follow-through" and information exchange. Finally by making use of its network contacts the Auburn staff has been able to achieve, during short periods of consultation, project success that would require most contractors considerable time to achieve.

5. Project inputs

The cost of this activity over a 5-year period will be approximately $2,100,000. As the project is scheduled to start on May 1, 1981, an initial funding of $200,000 is anticipated for the remaining 5 months in FY 1981. Thereafter annual increments of $450,000 for FY 1982 and FY83 and $500,000 for FY84 and FY85 are proposed. In-depth project reviews will be scheduled on the second and fourth anniversaries of project implementation. The reviews will serve two functions: first as a vehicle through which to audit the rate of project expenditures; and second, to consider any internal adjustments that should be made in the project operations. At the fourth year evaluation it will also be determined if adequate developmental benefit has been derived from the AID funding support to merit extension of the Cooperative Agreement beyond the fifth year.

Inputs of a specific nature for core support will be:

(a) 40 person-months of professional time per year for maintenance and execution of graduate courses and for additional time required to supervise LDC graduate student studies and research.

(b) 36 person-months of graduate student assistantships, and graduate student teaching and research per year.

(c) administrative, secretarial and communications costs and equipment and supplies as required to accomplish objectives.

(d) travel support for professional staff to study relevant LDC problems and training needs and to participate in meetings and conferences which help to maintain communication links and professional competence necessary to this program.

(e) special library acquisitions required to keep abreast of international literature in the field.

(f) costs of printing and distribution of the information letter, reports, technical manuals and other publications.

Inputs of a specific nature to advisory services will be:

(a) release time for professional staff to provide advisory services, conduct short courses, evaluate past programs, and provide technical inputs as requested by AID Regional Bureaus and Missions: 8-pm in FY 81, 16-pm each in FY82 and FY83 and 16-pm each in FY84 and FY85.

(b) travel costs for services in (a) above are estimated as follows: 8 trips in FY81, 16 in FY82 and FY83, and 18 in FY84 and FY85.

(c) administrative costs related to short courses in LDCs and other advisory services.

6. Project Outputs

Up to 35 LDC graduate students will be enrolled in formal courses in aquaculture and fisheries at Auburn each year and prepared for leadership roles as teachers, researchers or administrators in LDCs. Individual farmers, extension personnel, and aquaculture workers will recieve practical training in aquaculture through short-courses or extension programs. Technical assistance will be provided to LDC government and mission personnel as well as to fish farmers as a part of the technology transfer process. A developing international network of universities, research institutions, and agencies working together in the field of aquaculture will be strengthened through project activities. Specific identifiable outputs will be:

(a) Basic educational program. A strong graduate educational program will be maintained at Auburn with orientation toward application of aquaculture in the LDCs. Positions for up to 35 graduate students from LDCs will be maintained each year.

(b) Special training and graduate student assistantships. Special training for foreign students, including visits to fish farms and other fisheries institutions, will be provided between quarters and during holidays to broaden their experience and knowledge in aquaculture. Each year selected graduate students from LDCs will be awarded assistantships which will enable them to complete academic research and thesis programs that constitute important parts of their education.

(c) Short-courses. A 4-month intensive aquaculture training program will be offered annually for LDC participants. This training will include practical experience and instruction in the most important aspects of aquaculture including pond construction, hatchery management, fish

production, pond management, nutrition, disease control, water quality and product processing.

(d) Publications and manuals. Each year two working manuals for use in LDCs will be prepared on topics such as aquaculture research, hatchery management, and extension methods. A quarterly information letter will be published and distributed to former students and to other interested persons. A variety of reports will be published describing the progress made in the development of aquaculture by Auburn personnel working in LDCs. Initially all publications will be in English and will be written for research biologists, extension leaders, students and instructors. Translations to Spanish, French and other languages will be made as appropriate, especially of materials used by extension workers.

(e) Short-courses and seminars in LDCs. As part of the continuing education program, Auburn will provide short-courses and seminars to fish farmers and to university and government personnel on applied aspects of aquaculture and inland fisheries. Under this project one course will be presented in a LDC in FY 1981, two in FY 1982, and at least two each year thereafter. Among the proposed sites for these initial short-courses are Colombia, Egypt, El Salvador, Guatemala, Indonesia, Jamaica, Philippines, Thailand and selected countries of West Africa. Final site selection will be made on the basis of interest and needs of the host-country fisheries department or agencies.

(f) Evaluations of LDC aquaculture development programs and short-term advisory services in LDCs will be funded under this program which will allow Auburn to respond to requests from USAID Missions or the

Regional Bureaus for technical assistance in aquaculture and inland fisheries.

PART III PROJECT ANALYSIS

A. TECHNICAL ANALYSIS

For many years it has been popular to note the potential of aquaculture to provide food in developing countries. Advantages of aquaculture in the production of food with underutilized labor and land resources, with waste products as fish food, and with water being stored for other uses have been emphasized. It is now possible to point to substantial production of high quality protein from aquaculture and to a series of examples of economically viable, efficient, and practical fish production systems operating in developing countries.

Mainland China is the leader in both aquacultural production and in the recycling of wastes through aquaculture. Multiple uses of water and the use of multispecies, ecologically balanced systems with efficient, herbivorous fishes are widespread. A recent FAO study team observed a major commitment to the storage of water for conservation and irrigation, and for concurrent use of stored water for fish culture. Spawning, hatchery and rearing methods are some of the most developed in the world, and are being practiced at the community level with outstanding success. China's success in aquaculture, with an annual production of 2.5 million tons, is a convincing demonstration that methods of fish husbandry can be practiced in rural areas without highly sophisticated equipment or complicated techniques.

In India a long-term program for improving hatchery production, spawning techniques and pond production with polyculture of native Indian and Chinese carp species is now resulting in the production of substantial new sources of high protein food at relatively low economic inputs. Yields of 8,500 kg/ha/yr have been obtained at research stations with modest supplemental feed. India's

fish farming harvest is now 500,000 tons per year and is increasing rapidly. Aquaculture practices in Indonesia are yielding 144,000 tons of fish per year. Thailand is harvesting 106,000 tons of pond raised fish a year and in Bangladesh the harvest is 76,000 tons a year.

Outstanding examples of aquaculture successes have also been achieved with Auburn University assistance under AID's auspices.

In a Brazilian project farmers cultivating 10 hectares of ponds are consistantly producing 60 tons of hybrid tilapia annually and farmers are able to recover all construction costs from the first year's profits. Only the lack of adequate numbers of fingerlings is blocking a large-scale expansion of these production methods.

In Panama rural development activity is being widely expanded. It includes fish culture combined with pig production and vegetable crops. In this system the swine wastes and unutilized feeds are washed into fish ponds, thereby greatly increasing the nutrient content of pond water, which in turn results in an abundant production of phytoplankton. Tilapia feed and grow rapidly on the phytoplankton. Also some of the nutrient rich water is utilized to irrigate home gardens. Thus both fresh vegetables and animal protein are available to such communities at low cost even during the dry season.

In the Philippines total production from aquaculture has increased 32% during the last 3 years reaching a present level of 125,000 tons per year. There Auburn played an important role in increasing milkfish production from 350 kg/ha/yr to over one ton/ha/yr. The project affected more than 1000 small farmers who manage an aggregate of 15,000 ha of ponds and can be extended to 400,000 ha of similar land.

In Jamaica, Auburn is participating in an AID funded fish production project in which a significant quantity of fish has been produced and placed in

markets for low income families. During the three years since its implementation 240 tons of fish were produced in government operated ponds and another 60 tons were produced by a group of predominantly small farm operators.

AID and Auburn have cooperated similarly in programs in El Salvador, Colombia, Thailand and Indonesia. Large numbers of the aquaculture technicians in these countries have been trained in Auburn and no doubt much of the fish farming there is a result of that training.

On a worldwide basis 36 countries presently have substantial production of fisheries products through aquaculture contributing to a total annual production of 6 million metric tons. Eleven countries each produce more than 100,000 tons of fisheries products annually through aquaculture, and it is predicted that world production will double in the next 10 years.

These successes substantiate that aquaculture can contribute toward improved nutrition and employment for the rural poor in LDCs. Such development can be accelerated with the help of improved extension, effective demonstration and continuing education activities since the existing technology is known, functional and well-suited for transfer to LDCs. Approximately 18% of present aquaculture production is in the LDCs; however, the distribution of underutilized land and water resources suitable for aquaculture, the availability of labor in the LDCs and the high level of profitability of aquaculture there, all indicate these countries could increase their production enormously.

The AID grants which have been used to support the development of Auburn's capabilities and to provide a variety of services will expire April 30, 1981. Demand for technical services of this type will continue to increase as more successful examples of aquaculture emerge and as the technology is effectively transferred to additional LDCs.

The number of graduate students from LDCs enrolled in Auburn's fisheries program has increased from 7 in 1971 to 48 in 1980, and is expected to hold at about 38 for the duration of this agreement. The number of requests for technical assistance has increased steadily since inception of the Auburn project.

Although it is impossible to accurately estimate the number of future requests for assistance in aquaculture, an increasing number of such requests are being received and further increases are anticipated during future years in response to the successful application of fish farming methodology in LDCs. The following list represents countries which have asked Auburn or AID for assistance or countries for which preliminary discussions have indicated formal requests may be forthcoming within the next year. Auburn may not be able to provide the services needed in every instance; however, the ICA will be considered as the most likely source of assistance to these countries.

	Country	Anticipated Service
1.	Guatemala	Aquaculture training program
2.	Peru	Aquaculture short-course
3.	Panama	Technical assistance
4.	Egypt	Technical assistance
5.	Morocco	Aquaculture program evaluation
6.	Thailand	Technical assistance
7.	Turkey	Technical assistance
8.	Philippines	Aquaculture project development
9.	Indonesia	Aquaculture technical assistance
10.	Central African Republic	Technical Assistance

It is almost certain that additional requests will come from countries not included in this list as plans develop for new activities and as problems are encountered in ongoing aquaculture activities.

Two criticisms have been raised repeatedly about the Auburn activity. The first is that Auburn's linkages with other US institutions have failed to develop to the extent which AID had anticipated. Considerable effort has been expended to overcome this. Auburn is actively cooperating and collaborating with a large number of institutions and organizations in both domestic and international aquaculture and inland fisheries programs.

Auburn University and the University of Washington are in their fourth year of a staff exchange program. An exchange of seminars for students and staff has helped Auburn personnel to acquire more personal knowledge of cool-water fisheries and aquaculture while University of Washington staff acquire experience in warm-water fisheries and aquaculture.

Auburn staff has participated during the past 4 years in a series of reviews and evaluations of departmental fisheries and aquaculture programs at Louisiana State, Texas A & M and Oregon State Universities. The staff have provided advisory services in fisheries and aquaculture to: the University of Florida, University of Kentucky, University of Tennessee, University of Rhode Island, Purdue University and Southern Illinois University.

A watershed management and fish pond development project was jointly developed by the University of Arizona and Auburn, though not implemented due to AID funding constraints, the two universities cooperated closely in the project development.

In the past 3 years, Auburn has provided professional services on long-term assignments to the US Department of Agriculture and the National Marine Fisheries

Service under the federal Interagency Personnel Act. By the same token, Auburn has benefited from short-term and long-term professional services acquired through the US Fish and Wildlife Service, various universities as well as private industry groups.

Auburn's International Center for Aquaculture with University of Rhode Island's International Center for Marine Resource Development at USAID's request jointly provided technical services to various African countries.

Auburn has developed two continuing regional education programs. The first is a Southeastern Cooperative Fishery Education Project with fisheries agencies of seven states participating: Alabama, Arkansas, Florida, Georgia, Mississippi, Tennessee and West Virginia; a 1-1/2 day shortcourse carried out annually on a topic that is selected by each of the state fishery agencies. In addition, a 1-1/2 day workshop is conducted annually at Auburn for administrators of state fishery agencies on a topic selected by the Steering Committee of this program.

The second is the Southeastern Regional Fish Parasite and Disease Control Project. A clinical and diagnostic disease service is available to each cooperating state. A 1-week workshop on fish health is also held on the Auburn campus annually with about 20 fisheries biologists from member states participating.

The selection of Auburn as one of three agencies in a pond dynamics CRSP, along with the University of California at Davis and an Oregon State University consortium will allow Auburn to establish close ties with additional institutions. The CRSP is slated for FY 1980 funding. The demand for advisory services in aquaculture may increase at a rate greater than Auburn can handle, and the implementation of an aquaculture CRSP should result in a greater number of personnel qualified in this area. This increasing demand will encourage closer cooperation among all the participating groups in the future.

The second criticism frequently heard regarding Auburn's program is that: "Auburn has not made adequate efforts to develop an interdisciplinary approach to fish farming including the fields of social science, economics, marketing and storage." Auburn has recently involved both sociologists and economists in their program. It offers formal graduate level courses in aquacultural economics and technology transfer. Also a major effort is being placed on improving Auburn's capacity in aquaculture economics and fish marketing through its recently implemented AID Strengthening Grant. While continuing progress is expected toward development of interdisciplinary skills at Auburn, in some cases other institutions will be looked to for expertise in fields such as marketing and the social sciences. The aquaculture CRSP and the associations it will foster should lead to that end.

A question also has been raised regarding Auburn's relationships with LDC universities, institutions and government agencies. Their record is good on this topic. Auburn has worked well with LDC groups and has involved them in AID activities to the extent that is reasonable, is compatible with the LDC institution's capabilities, and is possible with the funding available.

B. ENVIRONMENTAL ASSESSMENT

No adverse environmental effects will result from the activities supported under this grant. Generally aquaculture has beneficial environmental effects since storage of water provides supplies for other uses such as irrigation and helps maintain ground water levels. Products such as agricultural by-products, food industry wastes and animal manures are used as organic fertilizers in aquaculture, thereby eliminating disposal problems. Construction of small dams and impoundments high in the watersheds captures runoff waters and contributes to the control of erosion and flooding.

The environmental changes resulting from aquaculture are summarized as follows:

-Some land changes will occur; however, land used for fish farming is normally unsuitable or poorly suited for agriculture.

-The bilogical and chemical state of water will, be changed as ponds are filled from streams, intermittent runoff water or natural water bodies. Slight chemical and biological changes in existing watercourses will occur when ponds are periodically drained because nitrates, phosphates and other nutrients will be introduced into the streams. In most cases, however, partial harvesting or cropping of fish is employed, with infrequent draining to conserve water and nutrients and to maximize fish yields. In other cases where ponds are completely drained and water is not utilized for irrigation, the draining schedule coincides with the start of the rainy season. Thus, rains dilute pond water releases until such time that ponds are refilled.

-Some beneficial economic changes are anticipated in the local communities where fish farming is initiated. Increased employment will result, especially during periods of slack agricultural labor demand. Water supplies for domestic and irrigation uses will be increased.

-Slight changes in the natural environment will occur with the construction of ponds. Mosquitoes that breed in the ponds will be controlled by fish before emerging as adults. The risk of schistosomiasis will be minimized by 1) building ponds deep enough to minimize growth of macrophytes which are required by the snail host, 2) maintaining a high density of plankton algae which reduces light necessary for growth of aquatic vegetation, and 3) utilizing herbivorous fish species to consume plant species that may still occur in small quantities in ponds.

C. FINANCIAL ANALYSES

The funds provided for this project can be grouped into two distinct components. The first is for core support of the Auburn International Center for Aquaculture and the second is a fund for specific advisory services as requested by USAIDs or the Regional Bureaus and as approved by DS/AGR/F. The disbursement period for the grant will be May 1, 1981-April 30, 1986.

Work for a 5-year period is outlined which will require support of approximately $2,100,000. Approval of this project for the 5-year period is recommended and funding for the first 18 months ($650,000) is requested prior to an initial review in FY 1982. Thereafter expenditures are expected to proceed at the rate of $450,000 in FY 1983 and $500,000 each in FY 1984 and 85. It is expected that the services of Auburn University will be required beyond the 5-year period.

This project will not supply direct support for research at Auburn, however, it is anticipated that support for aquaculture research will be implemented by the Joint Research Committee of BIFAD under the Aquaculture CRSP. Short-term technical assistance provided to LDCs and USAIDs under this project normally will be limited to 30 person-days on any one assignment. It is recognized, however, that in special circumstances, it may be necessary to exceed the 30-day limitation, and that some requests may require a team effort rather than an individual specialist.

1. Input Budget:

a. Core Support ($K)

	1981	1982	1983
On-Campus Services:			
Professional	46.76	105.21	105.21
Non-professional support personnel	5.21	11.72	11.72
Graduate Assistantships	16.80	37.80	37.80
Administrative Costs:			
Equipment and Supplies	3.32	7.47	7.47
Travel	4.15	9.34	9.34
Library Acquisitions	.83	1.87	1.87
Publication and Printing	8.30	18.68	18.68
Subtotals	85.37	192.09	292.09
b. Advisory Services ($K)			
Release Time for Professional Staff Services	24.00	54.00	54.00
Travel	32.00	72.00	72.00
Adminsitrative Costs: Supplies travel documents, medical exams, communications	1.60	3.60	3.60
Subtotals	57.60	129.60	129.60
c. Overhead ($K)			
(41% of Salaries)	38.04	85.58	85.58
d. Fringe benefits			
(25% of salaries excluding graduate assistantships)	18.99	42.73	42.73
Subtotals	57.03	128.31	128.31
	$ 200.00	$ 450.00	$ 450.0

2. Output Budget:

a. Core Support ($K)

	1981	1982	1983
Basic educational program	34.00	76.50	76.50
Special training and graduate student assistantships	8.5	15.10	15.10
Short-courses (4 months/yr)	17.00	36.30	36.30
Publications and manuals	25.50	57.40	57.40
Subtotals	85.00	185.30	185.30

b. Advisory Services ($K)

Short courses and seminars in LDCs	14.40	38.40	38.40
Evaluation of aquaculture development programs	8.60	19.40	19.40
Short-term advisory services in LDCs	34.60	77.80	77.80
Subtotals	57.60	135.60	135.60
c. Overhead	38.10	85.70	85.70
d. Fringe benefits	18.90	43.40	43.40
Subtotals	57.00	129.10	129.10
Totals	$ 200.00	$ 450.00	$ 450.00

D. SOCIAL ANALYSIS

No aspect of this project has undesirable social consequences. In most LDCs, as in the developed world, fish is accepted as a desirable food. Where malnutrition is manifest it is a superior source of low-cost animal protein. In many parts of the world fishponds are part of the rural environment, and where they are not, the introduction of pond culture has been readily accepted. It is generally considered an attractive activity from the community viewpoint. The educational, extension, research and organizational aspects of this project therefore pose no social problems.

E. ECONOMIC ANALYSIS

The pond culture of fish generally is not adversely affected when implemented on the poor land to which the small farmers of the LDCs are frequently relegated. Salted lands, marsh lands, coastal flats, mangrove swamps and other lands not suitable for traditional agriculture have all proven satisfactory for fish farming. Aquaculture has been found well suited for use by small farmers. It provides farmers the opportunity to make use of relatively unproductive land and to utilize off-season family labor to improve their incomes and also increase the availability of high protein food for themselves and their community. This project is designed to emphasize small-scale, low technology aquaculture operations with species such as tilapia or milkfish. These species are economical to culture as they feed low on the food chain, primarily on algae rather than on more costly fish feeds. Although larger, commercial operations using labor saving methods may develop simultaneously in some countries, these are not likely to be competitive with small-scale systems. Demand for protein in the LDCs is generally so great that both small-scale and large-scale specialty fish production are needed for the rural areas as well as for the urban market.

PART IV IMPLEMENTATION ARRANGEMENTS

A. ANALYSIS OF ADMINISTRATIVE ARRANGEMENTS

It is essential that the implementing institution have considerable knowledge, experience and a broad background in aquaculture and fish farming disciplines as well as international recognition in these fields as evidenced by experience and service with international organizations concerned in aquaculture and inland fisheries. Such background and experience is considered essential to the establishment of linkages between project activities and personnel and institutions in the LDCs.

During the last 11 years AID has assisted in the development of a specialized capability in the field of tropical freshwater aquaculture at Auburn University through 7 years of 211(d) grant assistance and more recently by means of a 3-year special support grant. The capability that now exists at Auburn is unique among US institutions. No other US insitution has an aquaculture program of comparable size and magnitude, or an aquaculture curriculum as diverse and complete. More importantly, Auburn's program is unique in that it is oriented toward fish production in developing countries as opposed to production of higher priced species in the US. During the period of grant support, Auburn personnel gained an impressive base of experience working on a large number of short- and long-term projects in LDCs. Many LDC students have been educated at Auburn and Auburn experience includes a wide variety of research, training and extension applications overseas. For these reasons, no other US institution has a comparative competence which qualifies them to undertake the project described herein.

B. IMPLEMENTATION PLAN

This PP has been developed jointly by DS/AGR/RNR and Auburn University based on their assessment of what Auburn can contribute and on the needs for

project activities as seen by DS/AGR/RNR. Effort has been made to be responsive to needs expressed by Regional Bureau representatives contacted during preparation of the paper. Cost estimates may need to be revised somewhat during contract negotiations. The on-campus support portion of the budget is to be used by the implementing agency at their discretion within the categories specified, except that responsibilities itemized in the attached scope of work are considered essential components of the project. A Cooperative Agreement seems to be an appropriate mechanism for this project, as under that mode both the on-campus activities and the technical services component can be jointly funded. It will be desirable for DS/AGR/RNR to exercise control over the use of funds designated for technical services. For example, DS/AGR/RNR approval of each service activity will be required prior to Auburn responding to technical service requests overseas.

C. EVALUATION PLAN

The project will be managed by the AID direct-hire fisheries specialist within the Renewable Natural Resources Division of DS/AGR. The Fisheries Subcommittee of the Technical Program Committee for Agriculture (TPCA) will serve in an advisory-evaluation role for AID.

The project implementing agency will appoint a Project Director who will be directly responsible for project operations and project supervision on a day-to-day basis. He will serve as the implementing agency's immediate contact with the AID Project Manager. The Project Manager and the Project Director will maintain communications as appropriate and necessary for effective project management. Ad hoc meetings between the AID Project Manager and the implementing agency Project Director will be facilitated as necessary, taking advantage of possible visits to Washington by the Project Director in connection with project and nonproject related activities.

Four evaluations are contemplated during the 5-year project activity. In mid-FY 1982 an initial project review will be undertaken to determine whether the project implementation is proceeding on course as desired by AID. As part of that evaluation a recommendation will be prepared regarding a plan of subsequent funding increments by which AID might effectively finance the activity. The possibility of Regional Bureau participation in project funding will be investigated. At the end of the third and fourth years of project activity, routine evaluations will be performed with the Project Director presenting a program report to the fisheries subcommittee of the TPCA. A principal function of the first three evaluations will be to discuss project activities for the following year. The fourth project evaluation will take place no later than 4 months prior to the termination of the fifth year of project activity and as a primary objective it will decide whether the project should be further extended.

D. PROJECT REPORTING

1. An annual report of project activities will be required within 30 days of the anniversary date. A fiscal report showing actual expenditures during each year will be included in the annual report. Twenty-five (25) copies of the annual report will be submitted to the AID project manager.

2. Twenty-five (25) copies of formal reports, manuals and publications will be supplied to DS/AGR, while two (2) copies of all trip reports will be supplied to the AID Project Manager.

3. Ten (10) copies of each quarterly information letter will also be sent to the AID Project Manager.

E. RELATED ACTIVITIES OF OTHER DONORS

The FAO, UNDP, World Bank and several donor nations are supporting aquaculture research and development activities oriented toward encouraging the efficient production of high quality protein in LDCs.

The AID Project Manager in association with the implementing agency Project Director will have the responsibility for ascertaining that the Auburn project 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 OF PROJECT

To achieve the project objectives in the US the implementing agency shall carry out the following activities with funds provided for this activity.

1. Maintain a strong graduate program in aquaculture at Auburn University with positions for at least thirty-five (35) students from LDCs annually.

2. Provide special training programs for LDC students between quarters and during holiday periods to strengthen the students academic experience and broaden their knowledge in aquaculture. Special assistance will be provided to LDC students experiencing difficulty in specialized courses. Auburn will be expected to maintain appropriate records of the special training programs offered.

3. Provide up to thirty-six (36) man-months of graduate and research assistantships annually to promising students and to study and carry out investigations in aquaculture development activities having direct application to LDCs.

4. Offer annually an intensive aquaculture training program consisting of a four (4) month comprehensive but practical course in aquaculture. The program shall be designed primarily for LDC students and will provide training on applied aspects of aquaculture. Openings for a minimum of fifteen (15) LDC participants each year will be maintained.

5. Two working manuals with detailed technical information in various specialty areas important to aquaculture development will be prepared each year. These will be comprehensive manuals designed for use in LDCs.

6. A quarterly information letter will be published to disseminate relevant information on appropriate aquaculture technology, information and news to aquaculturists working in LDCs and among those working on problems related to aquaculture in LDCs. The letter will be used to up-date information on a variety of aquacultural topics including research results, project activities, project plans and specific activities of aquaculture personnel. At least 500 copies will be distributed to aquaculture students, international aquaculturists, AID personnel, cooperating domestic and foreign institutions, and other interested persons.

7. Publish and distribute reports of surveys, studies and evaluations which are directly attributable to the project activities.

8. Provide short-term technical assistance overseas as approved in advance by the AID Project Manager, in such matters as:

1. The presentation of LDC short-courses and seminars.
2. The evaluation of aquaculture development programs.
3. Surveys of aquaculture potential.
4. Assistance in project design.
5. Improvement of pond culture methods.
6. Identification of special problems and potential means of resolving these problems as they relate to LDC fish farming.