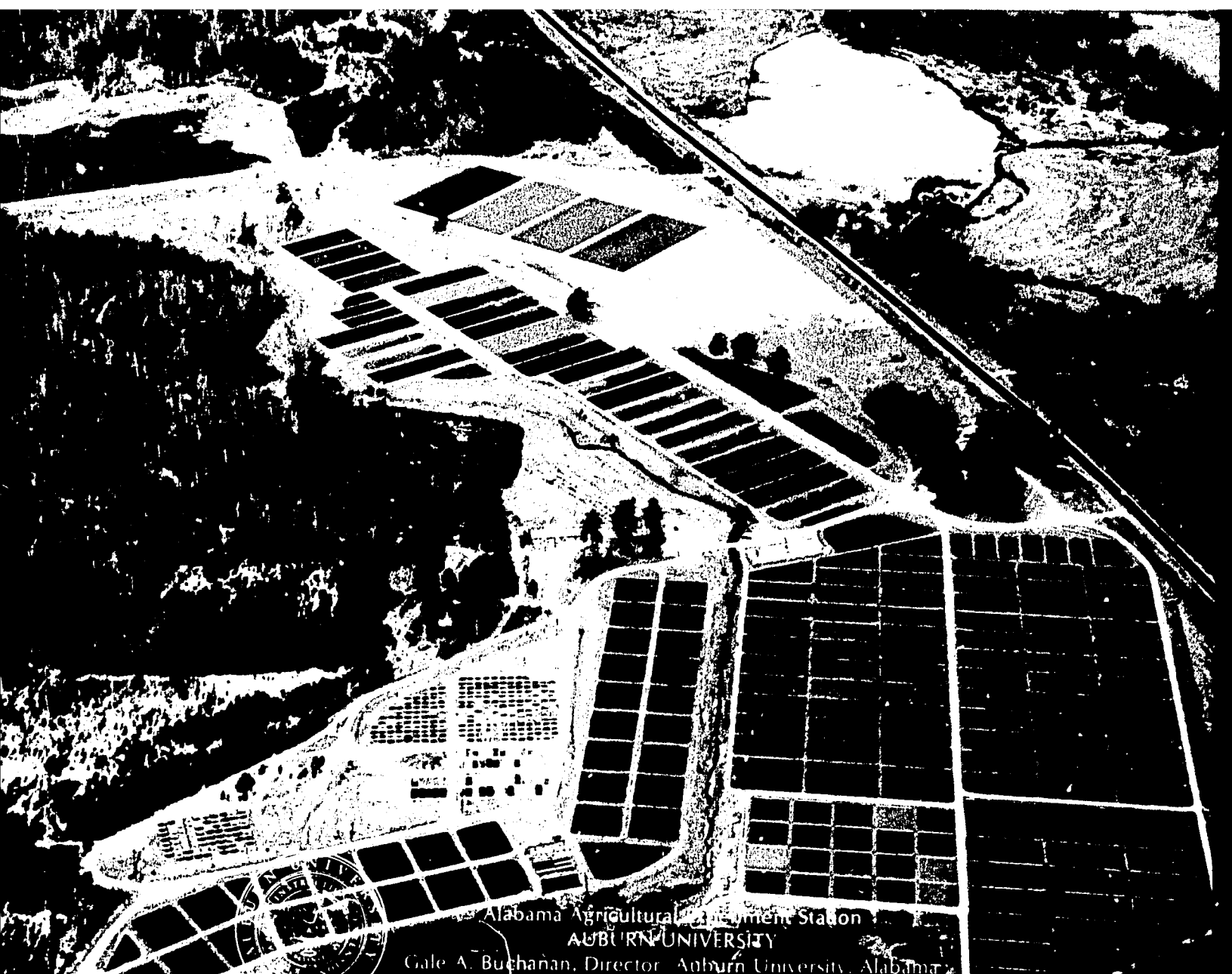


The International Center for AQUACULTURE

PD-ABA-321

64

64 331



Alabama Agricultural Experiment Station
AUBURN UNIVERSITY
Gale A. Buchanan, Director Auburn University, Alabama

POA 321

TERMINAL REPORT
COOPERATIVE AGREEMENT
AQUACULTURE TECHNOLOGY DEVELOPMENT
Auburn University, Alabama 36849

For the Period
1 January-31 December, 1987

AID Cooperative Agreement
DAN 1314-A 002500

A-00-0005-00

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY.....	1
BACKGROUND INFORMATION.....	3
INTRODUCTION.....	7
PROGRESS ACHEIVED IN WORK PLANS	
A. Continue Quality Training for Foreign Graduate Students.....	10
B. Develop Practical Recirculating Systems for Use in Larval Rearing of Aquatic Organisms.....	16
C. Develop New Production System Information.....	17
D. Improve the Information Base in Aquaculture in Developing Countries through International Aquaculture Network (IAN) and Other Initiatives.....	20
E. Provide Information on Aquaculture to Developing Countries through Service to AID Missions, Host Country Governments and Others.....	23
F. Improve the Knowledge Base in Developing Countries by Providing Short-Term, Non-Credit Training.....	27
FINANCES AND BUDGET.....	35
APPENDIX	
A. Time Chart of International Contracts and Grants	
B. Registry Information on the International Aquaculture Network, Including a List of ICA Associates	
C. Format of Current Production Practices of the Aquatic Organisms	
D. List of International Research and Development Series Publications	
E. Short-Term Work Carried Out by ICA Staff, 1982-1986	
F. A List of Participants Completing the Aquaculture Training Program, 1982-1986	

EXECUTIVE SUMMARY

The Cooperative Agreement (DAN-931-1314) became effective January 1, 1982 and initially extended over a 5-year period and subsequently was extended an additional year, terminating December 31, 1987. The CA essentially consolidated two programs previously funded by AID/Washington--a university services contract under which ICA provided technical services in aquaculture and inland fisheries to AID Missions and an aquaculture technology grant which provided on-campus core support.

Total funding as listed in the CA document was \$2,250,000 for the 5-year period, but funds received were approximately 10 percent less than the projected figure. A sum of \$260,000 was available to the CA for calendar 1987. Three "buy-in" actions were implemented during the life of the CA--1) USAID/Philippines--\$20,000 in 1983; 2) USAID/Niger--\$94,200 in 1984; and 3) USAID Egypt \$76,821 in 1986. Two other opportunities for major AID Mission buy-ins were encountered, but both actions involved long-term technical services. These were ruled by Contracts Office to be inappropriate for inclusion in the Cooperative Agreement.

Short-term technical services provided to AID Missions generally exceeded 1.5 person years annually--approximately 1.6 p/y during 1987. However, services provided to AID Missions with funding support from the CA included two country actions (Ecuador and Guatemala) involving three staff who contributed a total of 1.5 pm of technical services. Greater utilization of ICA short-term services on overseas projects was achieved in the Water Harvesting/Aquaculture project (5.3 pm) implemented jointly with Private and Voluntary Organizations; USAIDs directly (4.7 pm); Private Sector (2.7 pm); Banks (1.8 pm); and Program Support Grant (1.6 pm).

Research conducted focused upon developing new production methodology for tilapia seed for LDCs. Considerable effort was made in improving the

information base in aquaculture in developing countries through an international network initiative and publication and distribution of the ICA Communicae.

On-campus training program for international participants was conducted from March to July 1987. Major emphasis in this 16-week intensive training exercise was placed on practical training in the various techniques essential for successful hatching and culture of freshwater shrimp and fish. Eleven participants from countries in Asia, Africa and Latin America successfully completed this program.

One of the work plans involved providing quality graduate educational programs in aquaculture for students from developing countries. The Department presently has the largest number of graduate students (over 100) of any department within the University, of which 54 are from 23 different countries.

BACKGROUND INFORMATION

As this is the final report under the present Cooperative Agreement (terminated December 31, 1987), it is appropriate to include a brief historical background leading to its implementation.

Auburn University became involved in international aquaculture development in the mid-1950's with various fisheries staff carrying out short-term work programs in Asia and Latin America, under contracts with the U.N. Food and Agriculture Organization and the U.S. National Marine Fisheries Service.

In 1967, the Agency for International Development contracted with Auburn University to provide technical assistance in establishing a world-wide fisheries and aquaculture program in which surveys would be conducted to determine aquaculture potential for selected developing countries. Auburn University, based on information gained through these surveys, subsequently constructed field research facilities, provided technical assistance to get the experimental program underway and provided practical and academic training for scientists of participating developing countries. The University also assisted in the organization and implementation of fishery extension programs as follow-on to adaptive research programs.

The initial agreement, AID/csd-1581 ("Increased Fish Production through Improved Fishculture in Less Developed Countries") became effective July 1, 1967 and continued for 2 years during which detailed surveys were conducted in 20 different countries involving a total of 1,186 person days of overseas service by Auburn fisheries staff. This Contract was replaced by AID/csd-2270 (Worldwide) on July 1, 1969. This new mechanism was structured as a Basic Ordering Agreement under which specific task orders were funded. Although this B.O.A. agreement significantly altered and reduced the thrust of the original concept, long-term aquaculture projects were implemented in Brazil and Thailand.

Also long-term fishery projects were initiated in El Salvador, Panama and the Philippines through direct contracts with the USAIDs. Through these and other AID contracts, some core support was provided for on-campus activities.

The Agency for International Development, due to requests received from AID Missions, continued to contract for technical services in aquaculture and inland fisheries from Auburn University. The second Basic Ordering Agreement (B.O.A.-1152) became effective mid-year 1974, but it did not provide on-campus core support. During the 5-year life of B.O.A.-1152, short-term technical services were provided under 9 individual task orders for various countries in Africa, Asia and South America. Also, during this period, AID Missions contracted directly with Auburn University on long-term fisheries and aquaculture projects in Indonesia, Jamaica, Colombia and Honduras. In addition, one long-term program (Brazil) that was initiated under the earlier B.O.A. (2270) was continued under the new B.O.A. (1152).

The Department of Fisheries and Allied Aquacultures, due to its preeminence in the area of inland fisheries and aquacultures, received an ever-increasing number of requests for short-term and long-term specialists for overseas work. However, the Department's response capability, particularly with no on-campus core support, was limited, and great care had to be taken to coordinate assignments around on-campus teaching and research activities. To reduce this constraint, AID executed an Institutional 211-(d) Grant with Auburn University on June 25, 1970. This Grant continued over a period of 8 years and was for the express purpose of strengthening specialized competency of the newly established International Center for Aquaculture and generally expanding its capability in international development activities in inland fisheries and aquaculture. The 211-(d) Institutional Grant, terminated April 30, 1978, was superseded by another grant entitled Aquaculture Technology Development (G-0039). The latter

grant, with an effective date of May 1, 1978, extended through December 31, 1981.

Specific objectives of the Aquaculture Technology Development Grant (G-0039)

were:

- a) To maintain a quality graduate program in aquaculture
- b) To provide special training programs for students from the international community
- c) To provide support to graduate students interested in aquaculture development in developing countries
- d) To carry out an intensive aquaculture training program designed primarily for students from the international community
- e) To prepare a set of working manuals with detailed technical information on selected aquaculture topics
- f) To publish a newsletter, on a quarterly basis as an aid to communication among aquaculturists working in developing countries

The Technology Development Grant, as initially conceived, had a significant component for providing overseas advisory services to meet the needs of USAID Missions and the AID Regional Bureaus. However, this component was eliminated from the Technology Development Grant and incorporated under a new University Services Contract (AID-DSAN-C-0053). The Services Contract, which was implemented September 15, 1978, provided a mechanism to enable the ICA to respond rapidly to requests received from USAID Missions for technical assistance, program evaluation and project planning activities. It also provided support for carrying out surveys, conducting feasibility studies and short-term training programs overseas in various areas including aquacultural economics and extension. In the early 1980's two long-term USAID aquaculture projects were implemented directly with Auburn University (Panama and Rwanda) while two other long-term projects were implemented under subcontractual arrangements. The latter included the Egyptian Fishculture Project with James Montgomery, Inc. serving as the prime contractor and the Pond Dynamics CRSP with Oregon State

University serving as the management entity of this multi-university project. Under the Aquaculture CRSP Auburn posted researchers both in Panama and Honduras.

The Aquaculture Technology Grant and the University Services Contract terminated December 31, 1981 and March 30, 1982, respectively. Those two projects were superseded by a Cooperative Agreement which essentially consolidated the functions of the two former AID mechanisms. The Cooperative Agreement (DAN 1314) became effective January 1, 1982, and extended over a 5-year period. This Cooperative Agreement was extended one additional year, terminating December 31, 1987. During the mid-1980's two additional AID supported long-term aquaculture projects, each staffed with one advisor, were implemented under subcontractual arrangements with the University of Kentucky (Indonesia) and the University of Florida (Ecuador). In total, more than 14 million dollars have come to Auburn University as the result of international fisheries and aquaculture programs. A time chart depicting the various international projects and the funding amounts provided for each is presented in the Appendix.

INTRODUCTION

The Cooperative Agreement (DAN-1314-A002500) between AID and Auburn University was implemented January 1, 1982, and extended through December 31, 1986. Subsequently, it was extended one additional year, terminating December 31, 1987. Initially the Cooperative Agreement provided a strong international services component as well as a substantial on-campus element that supported training of LDC students, both academic and specialized non-credit programs, as well as modest amount of funds for research appropriate to needs of developing countries.

Regarding the technical services to Missions component, AID Missions, over time, absorbed an increasing share of the total costs for short-term assistance. Initially, USAIDs only had to request technical assistance and these services subsequently were provided by the ICA at no cost to the Missions. Later, AID Missions were requested to cost-share by absorbing the international transportation and in-country travel of Auburn specialists carrying out short-term work programs. During the last year of the Cooperative Agreement (1987), a decision was reached by the AID/W Office of Agriculture which mandated that all TDY expenses must be fully circumscribed by the Mission requesting technical services. This likely will have considerable effect in reducing the magnitude of requests received from USAIDs in the follow-on Cooperative Agreement scheduled for implementation January 1, 1988.

In 1985, a management consultant was contracted by the Department of Fisheries and Allied Aquacultures to assist in formulating a strategy for implementing work plans that would accelerate aquaculture development in the LDCs context and focusing on specific projects for which Auburn's International Center for Aquaculture had good capacity to address, given staff competence and the level of available funding. Subsequently work plans were developed and implemented during 1986.

Calendar 1987 is the second year in which project work plans were formalized and presented to the AID/W Office of Agriculture for consideration and approval. Basically, the work plans under implementation during 1987 were the continuation of those initiated in 1986. Basic work plans for 1987 and the jobs under each are indicated in the following table as are the staff contributing to each job and the funding amount set aside for that purpose.

	\$5,000 Shell	\$28,700 Moss	\$8,700 Grover	\$21,000 Lovshin	\$6,201 Malvestuto	\$24,300 Phelps	\$29,300 Rouse	(\$123,201) Total
Improve information base, develop network								
1. contact alumni		553						
2. develop & distribute questionnaire	600	553						
3. collate questionnaire	600	553				2760		
4. develop format to describe current practice	600	1580				2760		
5. review and edit: description of systems	600	2480				2780		
6. ICA commuicacae	---	2200	1000	1000		1000	3000	
7. write, print and distribute tech. articles etc.	600	3081	----	1000		1000		(\$30,300)
Provide information on aquaculture to LDC via AID/Wash. and Missions								
1. services to AID/Wash.	1340	7300	1000	2000	1000	2000	2000	
2. services to Mission	660	7300	1000	6000	3201	8000	4000	(\$46,801)
Improve knowledge base through short term training, ATP								
1. screen applicants							360	
2. prepare for course		527					2880	
3. present course		2573	700	1000		2000	6000	
4. evaluate course							200	
5. prepare brochure for next year							360	(\$16,600)
Continue quality training for foreign graduate students								
1. supervision of foreign graduate program			5000					
2. direct foreign graduate students in research methods								
a. fin fish hatchery techniques					2000			
b. crustacean production							2000	
3. direct foreign graduate students in developing management skills i.e. Masters of Aquaculture						2000		
4. Assist students in experimental design and data analysis						2000		(\$13,000)
Develop new production research on tilapia seed production								
1. effect of periodic exchange of Tilapia broodstock				4000				
2. effect of water depth on spawning success				4000				(\$8,000)
Develop practical recirculating systems for larval culture							8500	(\$8,500)

PROGRESS ACHIEVED IN WORK PLANS

For calendar year 1987, the sixth and final year of Auburn's Cooperative Agreement (DAN-1314), six work plans, each with two or more individual jobs, were submitted to AID/Washington for consideration. These work plans were approved by the AID/W Office of Agriculture and subsequently implemented.

These are listed as follows:

- A. Continue quality of training for foreign students
- B. Develop practical recirculating systems for use in larval rearing of aquatic organisms
- C. Develop new production system information through research on seed production in tilapia
- D. Improve the information base in aquaculture in developing countries through an information and research network
- E. Provide information on aquaculture to developing countries through service to AID Missions and other organizations
- F. Improve the knowledge base in aquaculture in developing countries by providing short-term, non-credit training

Some jobs listed under the various work plans were completed, while varying degrees of progress were achieved in others. In rare instances, a work plan was terminated due to funding or time constraints or as the result of inadequate progress. The progress achieved in each of the above listed work plans during calendar 1987 is discussed as follows.

A. Continue Quality Training for Foreign Graduate Students

The lack of trained man power is generally recognized as a major constraint on the development of aquaculture in third world countries. The Agency for International Development, through the Title XII Institutional Grant program and various other Grants, including the present Cooperative Agreement, provided funding support specifically to develop quality training programs appropriate to the needs of LDC students. The training of foreign graduate students in

aquaculture and inland fisheries is among the more significant development efforts in which the Agency for International Development is involved. Because of the worldwide involvement of the International Center for Aquaculture, foreign students at Auburn learn in a development atmosphere. Virtually all of the professors have had overseas experience and almost without exception, courses are taught from a development prospective. Four jobs were included under this work plan.

(1) Assist with the special counseling and advising required by international students, visitors and prospective students. The Department presently has the largest number of graduate students (over 100) of any department within the University, of which 54 are from 23 different countries. A listing of the foreign graduate students indicated degree level being sought, home country, major professor and sponsoring agency follows.

Dr. Grover carried out this responsibility with assistance, when needed, of other faculty. He functioned in such tasks as interpreting transcripts from foreign universities, advising on visa affairs, providing progress reports to sponsors, assisting in the overall orientation and academic advising of foreign students.

He updated the Departmental Guidelines for Graduate Students that includes specific information for international students and provided orientation programs for incoming students that included information about housing, cultural adaptation, and the American educational system. He also supervised the non-degree work of several international scientists, postdoctoral fellows and certificate-advanced studies participants. Dr. Grover also served as major professor for six foreign students in the Master of Aquaculture Program.

(2) Direct foreign graduate students in thesis research

It is generally recognized that the one-to-one exchange that takes place

DEPARTMENT OF FISHERIES AND ALLIED AQUACULTURES
INTERNATIONAL GRADUATE STUDENTS

NAME	CLASS	MAJ PROF	FIRST	HOME	SPONSOR	SEX
Abdelhamid, Aboulmagd	6	Dunham	F/85	Egypt	USAID/USDA	-
Ahmed, Abdulkader	10	Grover	W/87	Kuwait	KISR	-
Artiles, Rodolfo	6	Lovshin	W/87	Guatemala	OAS	-
Ashwa, Youssef Hassan	6	Rogers	F/85	Egypt	USAID/USDA	-
Awad, Mohamed	6	Brady	W/86	Egypt	USAID/USDA	-
Bukhari, Feisal	6	Rouse	W/86	Saudi Arabia	Saudi Govt.	-
Calderon, Jorge	9	Boyd	F/84	Ecuador	IASPAN and ICA	-
Celestin, Wilson	6 MAQ	Grover	F/85	Haiti	FAO	-
Constantino, Guilherme	6 MAQ	Grover	F/86	Brazil	Mustad	-
Droussi, Mohamed	6	Grover	Su/87	Morocco	USAID/USDA	-
Duarte-Cortes, Sergio	6	Lovshin	F/86	Colombia	self	-
Dureza, Lourdes	9	Rogers	F/83	Philippines	Univ. Phil/V	F
El Ghamrini, Sami A.	6	Molnar	Sp/86	Egypt	USAID/USDA	-
El Naggar, Gamal	9	Lovell	F/84	Egypt	USAID (AMIDEAST)	-
El Rashedy, Sameh	9	Plumb	W/85	Egypt	USAID (AMIDEAST)	-
El Sherbini, Ahmed	9	Dunham	Sp/86	Egypt	USAID/USDA	-
Hayat, Mohammad	9	Dunham	F/85	Pakistan	FAO/USDA	-
Ibrahim, Hamid	6	Lovshin	W/86	Egypt	USAID/USDA	-
Jantraratjai, Pattanee	9	Bayne	Sp/85	Thailand	Self & FAA	F
Jantraratjai, Wimol	9	Lovell	Sp/84	Thailand	Thai Govt.	-
Jo, Jae-Yoon	9	Smitherman	F/84	Korea	Fulbright (IIE)	-
Joshi, P. L.	6	Bayne	F/85	Nepal	FAO/NMFS	-
Kartamulia, Izuddin	9	Smitherman	F/85	Indonesia	U. Sriwijaya	-
Lasso dela Vena, Ern.	6	Brady	Su/86	Panama	Govt of Panama	-
Li, Menghe	6	Lovell	Sp/87	PRChina	GOC	-
Lieutaud, Anne O.	6	Grover	F/87	France	self	F
Liu, Pan-Rong	9	Plumb	Su/84	PeoRepChina	PRP & FAA	-
Marafi, Mohammad	6	Grizzle	W/87	Kuwait	KISR	-
Mevel, Jean-Yves	9	Boyd	Su/86	France	Self/ICA	-
Mohamed, Tahya A.	6	Lovell	Sp/86	Egypt	USAID/USDA	F
Mohsen, Al-Walid	6	Lovell	W/86	Egypt	USAID/USDA	-
Morsy, Mohamad	6	Plumb	W/86	Egypt	USAID/USDA	-
Mqolomba, T. N.	6	Grover	F/87	So Africa	Fulbright	-
Pacoli, Cecily	9	Grizzle	Sp/86	Philippines	UP/V	F
Park, Doowan	6	Grover	F/87	Korea	Govt. Korea	-
Pipoppinyo, Somsak	9	Grover	F/87	Thailand	Govt Thai	-
Radwan, Ismail A.	6	Rouse	F/85	Egypt	USAID/USDA	-
Rai, Ashkumar	6	Bayne	F/85	Nepal	FAO/NMFS	-
Ramboux, Anne	9	Dunham	F/86	Belgium	self	F
Rezk, Mahmoud	6	Dunham	F/85	Egypt	USAID/USDA	-
Rodriguez, Ivonne L.	6	Lovell	W/86	Panama	Govt. Panama	F
Saad, Che Roos	9	Lovell	F/83	Malaysia	Univ. Pert.	-
Salah El Deen, Maqdy	10	Grover	F/87	Egypt	USAID/UColo	-
Sedana, I. Putu	9	Bayne	F/82	Indonesia	USAID (U.Ky.)	-
Shrestha, Gopal B.	6	Rogers	F/85	Nepal	FAO/NMFS	-
Sihotang, Clemens	10	Grover	F/86	Indonesia	USAID(UKv)	-
Singh, Dharani M.	6	Smitherman	F/85	Nepal	FAO/NMFS	-
Siregar, Yusni	6	Lovell	Sp/87	Indonesia	USAID/UKy	-
Sukadi, M. Fatuchri	9	Smithennan	F/85	Indonesia	Winrock	-
van der Ploeg, M. P.	9	Boyd	Sp/85	Netherlands	ICA	F
Wardoyo, Supriyono E.	9	Smitherman	Su/86	Indonesia	Winrock	-
Weathers, Kenneth	6	Rain	Su/87	SC	-	-
Xu, Dehai	6	Rogers	F/86	PRChina	PRC univ	-
Yeh, Hsin-Sheng	6	Grover	F/87	Taiwan	self	-

between a professor and student during the conduct of research and preparation of the thesis or dissertation is probably the most important exchange that takes place between a major professor and his/her graduate student. It is especially important for the foreign student. It is during this exchange that they learn of the practical aspects of the scientific method, the ethics of science and the scientist, accountability, and the role of the scientist in society. It is in this time frame that the relationship between teacher and pupil is established. Because of the importance of graduate training to international development, a portion of Cooperative Agreement funds were utilized for helping with the cost of graduate research supervision.

Drs. Leonard Lovshin and David Rouse are two professors who contributed to this job. Dr. Lovshin worked with three foreign graduate students during 1987, while Dr. Rouse was directly involved with six. The names of students, title of research topic and expected date of completion are listed below.

Hamid Ibrahim. Egypt. The effects of broodstock exchange on Tilapia nilotica egg and fry production in net enclosures. Completed M.S.

Sergio Durate. Colombia. The effects of water depth on Tilapia nilotica fry production in concrete tanks. Research completed, data now being analyzed.

Rodolfo Artiles. Guatemala. Research project under development

During 1987, Dr. Rouse directed graduate research projects for six international students. Listed below is the students name, country, research topic and expected completion date.

Feisal Bukhari. Saudi Arabia. Influence of Chinese Carp on prawn monoculture and polyculture with tilapia. Expected completion date: 1988.

Innocent Forbin. Cameroons. Effects of the giant prawn Macrobrachium rosenbergii and tilapia on benthic macroinvertebrates. Completed M.S. in March 1987.

Izuddin Kartemula. Indonesia. Evaluation of the culture potential of the Australian crayfish, Cherax tenumianus. Expected graduation date 1989.

Munir Mulla. India. Culture techniques of marine shrimp in coastal rice fields of western India. Expected graduation date 1989.

Ismail Radwin. Egypt. Effect of culture media on yield and chemical composition of the free living nematode Pangaillus redivivus. Expected graduation date 1988.

Fatuchri Sukadi. Indonesia. Effects of calcium in the diet and water on prawn survival, growth and spawning. Expected graduation date 1989.

(3) Direct foreign graduate students in developing management and production skills relative to aquacultural activities. Dr. Ronald Phelps assisted with this job which involved the Master of Aquaculture degree.

This is a non-thesis degree for students seeking broad practical training leading to a career in aquacultural production, extension or development. The program is designed to provide hands-on production experience in the operation of the Department's integrated commercial fish farm as well as a sound scientific preparation in the principles of aquaculture and agro-business.

This degree is particularly appropriate for international students, allowing them to have the broadest base of education at Auburn before returning to their own country. The emphasis on management and the interrelation of activities helps break the syndrome of students returning to their country and trying to repeat their U.S. thesis research or not knowing what to do because they don't have the sophisticated equipment used in the U.S.. Students completing a Masters of Aquaculture degree are the most qualified to return to a production environment, either public or private sector. Currently over 60% of

the students in this degree program are international students or have international experience and are interested in returning overseas.

Work on this degree is supervised by a faculty committee appointed by the Department Head. Normally a Plan of Study listing the courses required to meet degree requirements is developed by the student in consultation with the committee during the second quarter in the program. The Plan of Study normally requires a minimum of 48 credits with at least 15 credits outside the Fisheries Department. A 3-6 month internship working a commercial aquacultural firm may also be incorporated into the degree program for those students wishing to pursue this option. Also the required special problem course (FAA 698A) requires the writing of a term paper in technical style on an aquaculture-related topic selected by the student and his academic advisor. A comprehensive oral examination, administered by the faculty committee, must be passed to receive this degree.

- (4) Provide guidance to international students in the experimental design and data analysis of their research.

Dr. Stephen Malvestuto, a specialist in computer applications in fisheries work, provided this service. During 1988, Dr. Malvestuto helped several foreign students with experimental designs, sampling problems, statistical analyses and interpretation of results. Primary interactions involved two Egyptian students working with aquaculture of tilapias, two Cameroonian students working on fish population dynamics in large impoundments, one Zairian studying fish population dynamics in small impoundments, one Ecuadorian interested in computer applications, and one Egyptian visiting scientist responsible for establishing management schemes for brackishwater lagoons in his country. In addition, up to 15 other foreign students were advised from time to time during the year on various matters involving quantitative treatment of data.

B. Develop Practical Recirculating Systems for Use in Larval Rearing of Aquatic Organisms

At some point in most aquacultural operations, cultured species must be held in close confinement in tanks. This may occur during larval rearing, growout or holding during the marketing process. If suitable water is available, then a flow-through system is appropriate for flushing out waste products and maintaining suitable water quality for culture. If adequate water is not available to "flush" the system, then filtration and recirculation is necessary.

In 1987 a project was started to investigate and develop simple recirculating systems that would be used in aquaculture. Numerous systems have been developed to filter and clean water for reuse. However, much of the work has produced sophisticated and often very expensive systems. The emphasis of the work at Auburn was to develop technology for a low cost system appropriate for developing countries.

Most of 1987 was spent collecting literature on different small-scale recirculating systems (job 1). By the end of 1987, enough information was available to begin preliminary testing. The first trials involved freshwater systems with tilapia and freshwater shrimp. Twelve 1000-l tanks were used as culture containers and two filter designs were used (job 2). The preliminary testing still is underway and is showing that low technology systems can be effective in maintaining adequate water quality.

The project with recirculating systems is serving two important functions. The first as discussed was to accumulate and package the information for overseas aquaculture projects. Another important function was to provide facilities for training international students studying aquaculture at Auburn (job 3). The literature search and testing in 1987 involved four students two from Indonesia; one from Nepal and one from Egypt.

Due to the fact that activities deemed to be of higher priority are being considered for implementation under the new Cooperative Agreement, this work plan, although to be continued in part with other funding, will be removed from CA support.

C. Develop New Production System Information through Research on Seed Production in Tilapia

Although native to Africa, tilapia has been widely introduced and cultured in other regions of the world, including Asia and Latin America. Limited seed production long has been a constraint to the culture of this fish species. As a result, a real need exists relative to developing more effective methodologies for producing seed for culture purposes.

Two major jobs were undertaken by Dr. L. L. Lovshin in this general area during calendar year 1987. A third job was initiated. Progress achieved in each is described as follows.

Job 1: The effects of brood stock exchange on Tilapia nilotica egg and fry production in net enclosures.

Net enclosures (hapas) frequently are used as tilapia egg and fry production units. Typically, eggs and fry are harvested and the parents remain in the hapa for another spawning cycle. However, removing spent fish after each spawning period and allowing them to recuperate may improve spawning performance. This research tested the effects of brood stock exchange on Tilapia nilotica egg and fry production in hapas. Six female and three male T. nilotica adults were randomly stocked into twelve 3.3-m² net enclosures suspended in a 0.05-ha earthen pond. Treatments tested were no brood stock exchange, female only exchange, male only exchange and male and female exchange after each 21-day spawning period. Five egg and fry harvests were completed during a 105-day period. Replacement male and female brood stock were held separately in similar hapas. Adults were fed a 32% crude protein pelletized catfish feed at 2.0% of

their body weight daily. Average egg and fry numbers produced per gram of female body weight were 2.7, 2.2, 1.7 and 2.5 for no exchange, female only exchange, male only exchange and male and female exchange, respectively. No significant difference ($P > 0.05$) was found among treatments for the number of eggs and fry produced per gram of female body weight. These results conflict with data obtained in a similar experiment performed in 1986 (USAID/Auburn University Cooperative Agreement annual report-1986). Results obtained in 1986 demonstrated that male and female exchange resulted in significantly more eggs and fry per gram of female Tilapia nilotica than female exchange or no brood stock exchange.

Job 2: The effects of water depth and exchange on the spawning performance of Tilapia nilotica females in 20-m² concrete tanks.

Nine, 20-m² concrete tanks were stocked with 9 female and 4 male T. nilotica each. Three treatments, replicated three times were tested. Treatments were: 1. water level held at 20 cm; 2. water level held at 60 cm; 3. alternating water depth of 20 cm or 60 cm regulated by the addition or release of water after each fry harvest. Brooders were fed a 32% crude protein floating catfish diet at 2% of body weight daily. Fry harvests were performed at 14-day intervals by seining each tank twice with a small mesh net. Fry were collected and preserved for enumeration at a later time. Seven harvests were carried-out during the 96-day experimental period. Afternoon water temperatures were taken daily at feeding time. Early morning water temperatures and dissolved oxygen were measured three times a week. Fry and egg enumeration and data tabulation have not been completed. Results will be reported at a later date.

Job 3: Effects of Estradiol and Progesterone on the spawning performance of female Tilapia nilotica in net enclosures.

Sex reversal of tilapia fry to yield male fingerlings for grow-out requires large numbers of same-age fry for most efficient utilization of nursery

facilities. However, tilapia spawn asynchronously resulting in continual production of small numbers of fry during the reproductive period. Synchronizing tilapia female spawning would permit the collection of large numbers of same-age fry. Tilapia spawning is regulated by sex hormones. Females produce and release eggs in accordance with the increases and decreases of several hormones. Two of the most important hormones are estradiol, responsible for oocyte production (yolk synthesis), and progesterone, responsible for final egg maturation. Raising the levels of these two hormones in female tilapia could increase the number of mature eggs ready for release when the females are stocked with the males.

Twelve, 3.3-m² net enclosures (hapas) were suspended in a 0.4-ha pond and randomly stocked with 5 female and 3 male adult Tilapia nilotica. Female brood stock were isolated from the males and treated in one of 4 ways before stocking into the spawning hapas: 1. Fed a floating catfish feed with no hormones for 20 days (control); 2. Fed a similar feed with 3 mg/l 17B-estradiol for 14 days, followed by untreated feed for 6 days; 3. Fed an untreated feed for 17 days, followed by a feed with 3 mg/l 17-hydroxy-20-dihydroprogesterone for 3 days; 4. Fed a ration containing 3 mg/l 17B-estradiol for 14 days, followed by 3 days with untreated feed and 3 days with a 17-hydroxy-20-dihydroprogesterone treated feed. Females were held in 3.3-m² net hapas while undergoing hormone treatment and were fed at 2.5% of their body weight a day. Females remained in the spawning hapas for 21 days before eggs and fry were harvested and preserved for enumeration at a later date. After harvest, spent female tilapia were exchanged for rested females that had undergone one of the above 4 treatments. Males were not exchanged after each harvest. Males and females were weighed to the nearest gram before stocking and after each harvest. Tilapia in spawning enclosures were fed a floating catfish ration daily at 2.0% of their body weight. Four

harvests were performed during the 84-day experimental period. Data are presently being analyzed and will be reported in the future.

Job 1- Lovshin and Hamid Ibrahim (Egypt), MS graduated

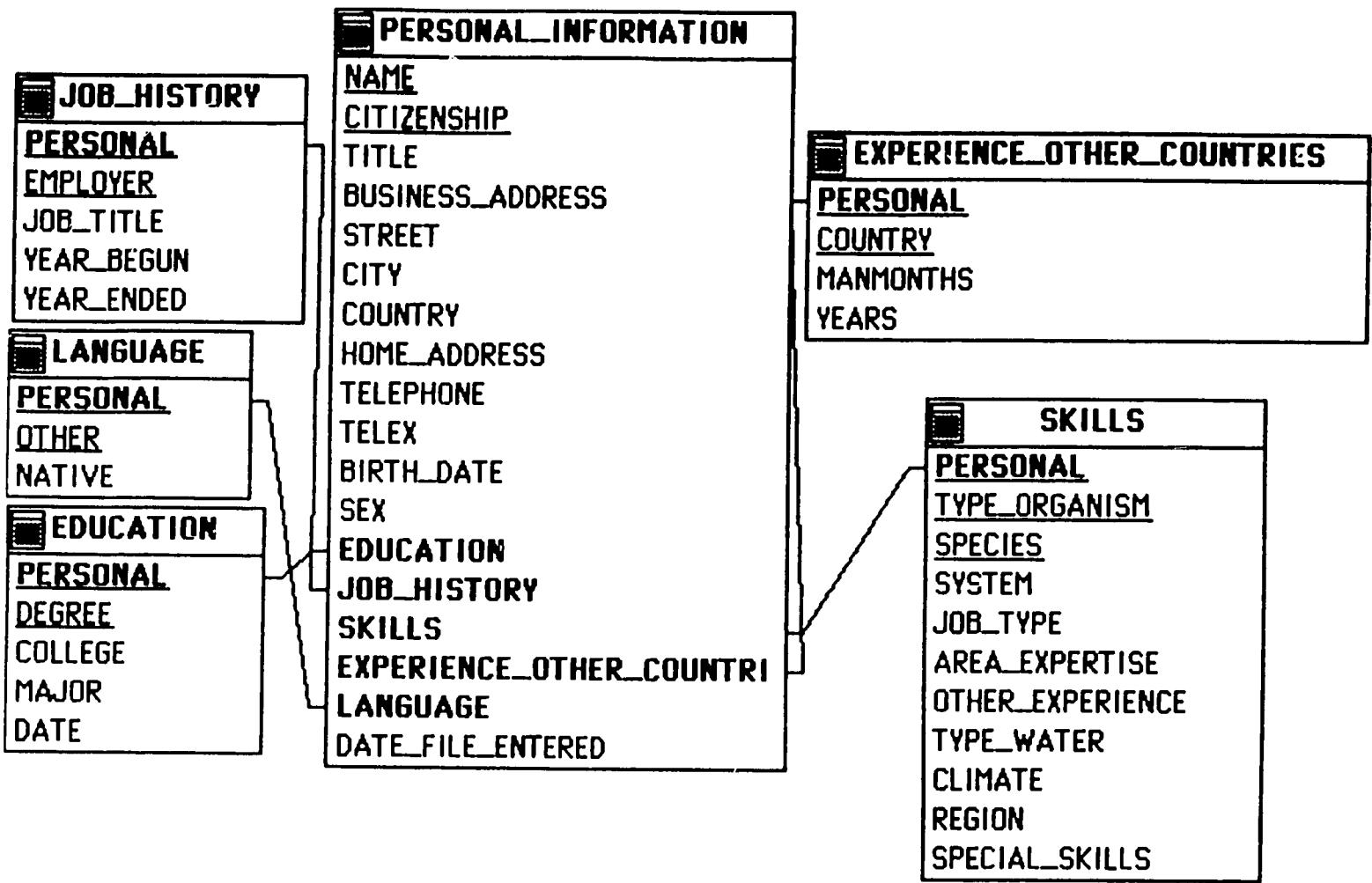
Job 2- Lovshin and Sergio Duarte (Colombia), MS in progress

Job 3- Lovshin and Rodolfo Artiles (Guatemala) MS in progress

D. Improve the Information Base in Aquaculture in Developing Countries through International Aquaculture Network (IAN) and Other Initiatives

On January 13, 1987, a letter with the Registry Information Questionnaire and code sheet was transmitted to international alumni, primarily former graduate students of the Department of Fisheries and Allied Aquacultures. The questionnaire and code sheet is included in the Appendix. Three major work categories included in the code sheet were Aquaculture, Fisheries Biology and Aquatic Ecology. Under one of the three major categories definitive information was requested of each IAN associate regarding specific areas of expertise.

Due to the relative modest number of questionnaires received following the initial mail out, a second mailing was implemented September 25, 1987. Completed questionnaires received by December, 1987, approximately 150 in number, were analyzed and relevant data entered in a computer program. Although a few questionnaires still arrive from time to time, jobs 1 (contacting alumni regarding their interest in the network), Job 2 (developing and distributing the questionnaire, and Job 3 (collecting information and entering it in the computer) essentially have been completed. A sample list of ICA associates is included in the Appendix. Job 4, which is to develop a format for describing current practices in important world aquacultures, also received considerable effort-draft is included in Appendix. Additional work is needed, however, prior to finalizing this and distributing it to ICA associates. It is felt that although current production practices could be described, it would be difficult



to keep this up to date, without providing monetary reward for those contributing. Hence, additional strategy will be developed on this job.

ICA Communicae

The ICA Communicae initially was published and distributed as a quarterly. However, with the funding decreases received in recent years, a decision was reached to convert this to a semi-annual publication. The major goal of summarizing aquacultural research of particular relevance to aquaculture development in the third world can still be achieved. Apparently for a number of recipients of the ICA, it is one of the few documents received that keeps them informed of current, practical aquacultural development and research. The demand for the ICA Communicae has increased from about 400 in 1982 to 1500 in 1987. Approximately 800 copies are distributed internationally of which about one-half are directed to Auburn fisheries alumni.

ICA Research and Development Series

The last issue of the ICA Research and Development Series was published December 1986. This is the 33rd publication in this series and is entitled Cooperatively Managed Panamanian Rural Fish Ponds- The Integrated Approach. Approximately 2000 copies of this valuable report were distributed in 1987 with the majority going to overseas addresses. The U.S. Peace Corps requested 200 copies for distribution to volunteer trainees destined for service in Africa, Asia and Latin America. This publication series, which focuses on Auburn's international programs, serves an excellent purpose in improving the awareness for aquaculture development in the third world. A complete listing the R & D Series is included in the Appendix.

Aquaculture Video

It has been demonstrated that aquaculture provides potential for generating income and generally improving quality of life for small-scale farmers in many

developing countries. However, one of the major constraints limiting aquaculture in the developing world is lack of awareness of government administrators, private enterprise groups and officials of various aid groups. As an effort to improve this awareness, a video entitled "Aquaculture, Its Time Has Come" was produced by ICA. This 20-minute video cassette now has been transmitted to about 45 USAIDs around the world. Approximately 40 additional cassettes have been distributed to various Private Volunteer Organizations involved with aquaculture programs in developing countries.

E. Provide Information on Aquaculture to Developing Countries through Service to AID Missions, Host Country Governments and Others

Providing technical services to AID Missions was a major activity during early years of the Cooperative Agreement. During recent years, however, AID/W strongly encouraged the USAIDs to absorb an increasingly greater share of the total costs incurred by ICA when providing requested technical services. A total of nearly 18 person months (pm) of short-term international services were provided by ICA staff during 1987. However, services provided to AID Missions with funding support from the Cooperative Agreement included only two country actions (Ecuador and Guatemala) involving three staff who contributed a total of 1.5 pm of technical services. Greater utilization of ICA short-term services on overseas projects was achieved in the following: Joint/Private and Voluntary Organization Water Harvesting/Aquaculture project (5.3 pm); USAIDs (4.7 pm); Private Sector (2.7 pm); Banks (1.8 pm) and Program Support Grant (1.6 pm).

USAID/Ecuador requested ICA provide an extension specialist to review the fisheries outreach program in Ecuador relative to possible establishment of an extension component in the Fisheries Service. Mr. Johnie Crance was recruited for this purpose. He spent two weeks in-country during February 1987 and submitted a report entitled "Freshwater Fish Farming Extension Services in Guayas Region of Ecuador". This report was circulated within Ecuador and to AID/Washington.

USAID/Guatemala requested ICA provide technical services to San Carlos University (Center for Marine Studies and Aquaculture-CEMA). Accordingly, Drs. Ronald Phelps and Thomas Popma were in-country December 1-15, 1987, during which time they carefully reviewed the proposed curriculum in fisheries and aquaculture for CEMA. Also, in-depth discussions were held with CEMA staff relative to assessing needs for advanced training. Limited in-country travel was accomplished to assess various sites for field facilities including experimental ponds. A detailed report was prepared in Spanish and presented to appropriate administrators of the USAID, San Carlos University and AID/Washington.

Niger River Fishery Study

The International Center for Aquaculture (ICA) at Auburn University was formally involved in a multi-agency fishery project on the Niger River in Niger from March 1983 - September 1985. This activity was a "buy-in" under the Cooperative Agreement. Although funding support for this activity was exhausted in 1986, important fishery data continued to be forwarded to Auburn where it was analyzed and results incorporated in a final report.

The ICA worked in conjunction with the Government of Niger (GON), the United States Peace Corps (PC), and the Food and Agriculture Organization of the United Nations (FAO) to conduct the project. The primary objectives of the project were to assess the viability of the fishery biologically, economically and socially. The multidisciplinary assessment was designed to provide options for instituting management strategies that would have a high probability for success given the contingencies involved in Niger.

The assessment objectives were met by conducting four independent surveys, including a catch assessment survey (CAS), a fish biology survey (FBS), a household survey (HHS) and a market survey (MS). The survey results showed the

fishery on the Niger River to be in a rapid state of decline due to the low water level conditions and poor fish community structure caused by the prolonged drought in the Sahel. The fishery was most depressed in the southern section of the river where exploitation has been high historically. The fishery in the northern part of the river was viable, but showing the initial signs of overfishing. The study documented that about 80% of the income of fishing families came from the sale of the fish bankside and that the economic viability of these households was directly linked to fishing success on the river. Also, 20% of the fish harvest was brought into households for direct consumption by family members attesting to the nutritional importance of the fishery.

The management options stemming from the surveys dictated that recommendations must be sensitive to the socioeconomic conditions existing in the fishery, but strive to protect the fish stocks under the environmental stress associated with the drought conditions. The HHS documented that traditional management strategies will likely involve co-management of the fishery where GON infrastructure is integrated with traditional management approaches at the community level to provide workable plans that are acceptable by all parties involved.

Implementation strategies was not possible under the auspices of the project summarized here. The GON and FAO are now in the process of defining a second phase that could involve implementation and evaluation of the management options recommended from the initial study.

Water Harvesting/Aquaculture Project (WHAP)

Several of the ICA staff contributing to the Water Harvesting/Aquaculture Project (WHAP) also are involved in Auburn's Cooperative Agreement. As the AID/W Office of Agriculture provides funds for the Cooperative Agreement and the Water Harvesting/Aquaculture Project, WHAP activities for 1987 are briefly described.

	UY.	MO.
J/PVO	160	5.3
USAID	140	4.7
INDUSTRY	81	2.7
BANKS	54	1.8
PSG	49	1.6
CRSP	25	0.8
OTHER	31	1.7
	<u>540</u>	<u>17.9</u>

SHORT-TERM WORK CARRIED OUT
BY THE STAFF OF THE
INTERNATIONAL CENTER FOR AQUACULTURE
AUBURN UNIVERSITY, AL 36849
January 1-December 31, 1987

DATE	COUNTRY	STAFF	PROJECT	DAYS
01/05/87-01/06/87	Kenya	K. Veverica	RWANDA PROJECT	01
01/15/87-02/05/87	Ecuador	D. B. Rouse	PROGRAM SUPPORT GRANT	22
01/15/87-01/31/87	Rwanda	B. L. Nerrie	RWANDA PROJECT	17
01/15/87-01/31/87	Rwanda	J. J. Molnar	RWANDA PROJECT	17
01/19/87-01/24/87	Ecuador	D. G. Hughes	CRSP PROJECT	06
01/19/87-01/28/87	Nepal	B. L. Duncan	PVO PROJECT	10
01/29/87-01/28/87	Nepal	H. R. Schmittou	PROGRAM SUPPORT GRANT	10
01/28/87-02/02/87	Thailand	B. L. Duncan	PVO PROJECT	05
01/28/87-02/02/87	Thailand	H. R. Schmittou	PROGRAM SUPPORT GRANT	05
02/03/87-02/14/87	Indonesia	B. L. Duncan	PVO PROJECT	12
02/03/87-02/14/87	Indonesia	H. R. Schmittou	PROGRAM SUPPORT GRANT	12
01/20/87-02/03/87	Ecuador	J. Crance	COOP AGREEMENT	15
01/22/87-02/01/87	Tunisia	J. W. Jensen	PEACE CORPS	11
02/10/87-02/21/87	Honduras	K. H. Yoo	PVO PROJECT	12
02/15/87-02/19/87	Australia	C. Bailey	FAO	05
02/20/87-02/22/87	Burundi	K. Veverica	RWANDA PROJECT	02
02/20/87-02/22/87	Burundi	J. Moehl	RWANDA PROJECT	02
02/28/87-03/19/87	Rwanda	D. D. Moss	RWANDA PROJECT	20
03/17/87-03/22/87	Sierra Leone	B. L. Duncan	PVO PROJECT	06
03/20/87-04/10/87	Thailand	C. E. Boyd	ASIA DEV BANK	27
04/11/87-04/15/87	Philippines	C. E. Boyd	ASIA DEV BANK	05
03/23/87-03/25/87	Togo	B. L. Duncan	PVO PROJECT	02
03/23/87-04/06/87	Bolivia	R. P. Phelps	PVO PROJECT	16
03/26/87-04/02/87	Senegal	B. L. Duncan	PVO PROJECT	08
03/29/87-04/11/87	India	A. Bocsek	PVO PROJECT	14
04/11/87-04/18/87	Bangladesh	A. Bocsek	PVO PROJECT	08
04/02/87-04/06/87	Ivory Coast	B. L. Duncan	PVO PROJECT	05
04/29/87-05/06/87	Panama	R. P. Phelps	CRSP & PVO	09
05/07/87-05/10/87	Honduras	R. P. Phelps	CRSP & PVO	04
05/11/87-05/13/87	Guatemala	R. P. Phelps	PVO PROJECT	03
06/03/87-06/07/87	Ivory Coast	B. L. Duncan	PVO PROJECT	05
06/05/87-06/11/87	Ecuador	C. E. Boyd	PRIVATE SECTOR	07
06/07/87-06/19/87	Senegal	B. L. Duncan	PVO PROJECT	13
06/08/87-06/19/87	Senegal	J. Y. Mevel	PVO PROJECT	12
06/08/87-06/22/87	Senegal	J. Morrison	PVO PROJECT	15
06/23/87-06/30/87	Ethiopia	J. Morrison	PVO PROJECT	08
06/24/87-06/28/87	Mexico	L. L. Lovshin	UNIV/MEXICO	04
06/26/87-06/29/87	Dominica	D. B. Rouse	PRIVATE SECTOR	04
07/05/87-07/26/87	Venezuela	L. L. Lovshin	INT AM DEV BANK	22
07/25/87-08/17/87	Indonesia	B. L. Duncan	ENGINEERING CONSULT INT	24
08/12/87-08/16/87	Costa Rica	L. L. Lovshin	AMER SOYBEAN ASSOC	04
08/16/87-08/20/87	Panama	L. L. Lovshin	AMER SOYBEAN ASSOC	04
08/20/87-08/23/87	Dominican Rep.	L. L. Lovshin	AMER SOYBEAN ASSOC	03
08/23/87-08/26/87	Jamaica	R. T. Lovell	AMER SOYBEAN ASSOC	03
08/26/87-08/30/87	Honduras	R. T. Lovell	AMER SOYBEAN ASSOC	04
09/31/87-09/01/87	El Salvador	R. T. Lovell	AMER SOYBEAN ASSOC	01
09/01/87-09/03/87	Guatemala	R. T. Lovell	AMER SOYBEAN ASSOC	02
09/13/87-10/03/87	Rwanda	J. J. Molnar	RWANDA PROJECT	21
10/12/87-10/22/87	Honduras	R. P. Phelps	CRSP	12
11/08/87-11/14/87	Ecuador	C. E. Boyd	PRIVATE SECTOR	06
11/12/87-11/21/87	Madagascar	D. B. Rouse	PRIVATE SECTOR	10
11/23/87-11/25/87	Turkey	R. T. Lovell	AMERICAN SOYBEAN ASSOC.	03
11/25/87-11/26/87	Switzerland	R. T. Lovell	HOFFMAN-LA ROCHE, INC.	02
11/13/87-12/12/87	Indonesia	M. C. Johnson	USAID/ICA	30
12/01/87-12/15/87	Guatemala	R. P. Phelps	USAID	15
12/01/87-12/15/87	Guatemala	T. J. Popina	USAID	15

Technical assistance provided by ICA staff to the WHAP included visitation of project sites to facilitate feasibility design, project monitoring, assessment and evaluation. To date, the fourth year of implementation, 497 person-days of technical assistance have been contributed on 67 country visits. In 1987 eight different PVOs in 28 countries received technical assistance, including 7 countries in Asia, 14 countries in Africa and 7 countries in Latin America.

Also, training programs were carried out for professional and technical staff of participating Private Voluntary Organizations. A total of 112 person days of training assistance were provided in five training programs for the benefit of PVO personnel working in 26 countries. The five overseas training programs, each of a duration of one week, were conducted in the Cameroons, Indonesia, Panama, Rwanda, and Senegal.

Short-term work programs carried out by staff of Auburn's International Center for Aquaculture from implementation of the Cooperative Agreement in 1982 through 1986 may be found in the Appendix.

F. Improve the Knowledge Base in Developing Countries by

Providing Short-Term, Non-Credit Training

In addition to graduate level training available for participants from developing countries, the Department annually offers a non-credit, practical course in aquaculture. Each trainee is expected to grow a crop of fish in his/her individual fish pond during the 16-week training period.

The need for such short-term training, in part, is due to several factors: 1) the high costs incurred in completing an academic degree, \$30,000 to \$50,000 for a Masters or Ph.D., respectively, and 2) the length of time required to complete degree programs (2 to 4 years). Many organizations simply cannot spare the time and money for academic programs. A third factor occasionally surfaces

in that for admission to graduate degree programs, a B.S. degree with relatively high course performance is a requirement. Finally, good comprehension of English is essential for successful completion of the degree programs. Therefore, the Aquaculture Training Program (ATP) provides good compromise to academic programs for those of limited finances and time.

Aquaculture Training Program

The 1987 Aquaculture Training Program provided the opportunity to train 11 participants from eight countries. Participants included biologists and fish culturists from governments and private organizations as well as senior level administrators, planners and extension workers. The program began in late March and continued for 16 weeks.

Major emphasis in the program was placed on practical training in the various techniques essential for the successful hatching and culture of freshwater shrimp and fish. Five different species of fish were spawned during the course by either natural or artificial means to provide experience with handling fishes in all stages of their life cycle from egg to adult. Each participant was provided with a 200-m² earthen pond to manage. The ponds were stocked with species similar to those native to the participant's home country. The species used included different species of tilapia, Asiatic and European carps, catfish and freshwater shrimp. Stocking strategies and management methods were included that allowed participants to evaluate and compare different aquaculture systems.

To provide theory in support to the practical experience, classroom lectures and discussions were also provided in the course. During classroom work, over 200 hours of instructions were provided including the following topics: principles of aquaculture, aquatic ecology, water management, pond construction, hatchery management, fish health, fish economics and extension.

To reinforce the classroom and field work, field trips were made to three government hatcheries, seven private fish farms, two processing plants and a feed mill.

A training fee of \$3500 was charged for each trainee which covered costs of books, manuals, laboratory and field supplies and local transportation. Funds from the Cooperative Agreement supported staff who contributed lectures and provided other services to this training program. Individuals successfully completing the 1987 aquaculture training course are listed in the following table. A list of participants completing the Aquaculture Training Program from 1982 through 1986 is included in the Appendix.

All jobs included under this work plan were completed and will be continued in 1988.

The jobs were as follows:

- Job 1: Screening applications for the 1988 course
- Job 2: Preparation for course
- Job 3: Preparation of course
- Job 4: Student and course evaluation
- Job 5: Prepare and distribute announcement for the follow-on course

1987 Participant's Home Addresses

1. Mr. Mazhar Ali Samo
Assistant Director Fisheries
Mohalla Ali Murad Nabi
Bux Road
Khairpur Mirs (Sind.)
Pakistan
2. Mr. Qamar H. Baloach
Director Fisheries
Hyderabad Sind.
Pakistan
Phone 27105
3. Mr. Charles O. Oduol
District Fisheries Officer
Kisumu District
P. O. Box 1084
Kisumu, Kenya
Phone 40908 KSM
4. Mr. J. P. Ojwang-Okwor
Fisheries Officer
Fisheries Experimental Station, Kajansi
P. O. Box 530
Kampala
Uganda
5. Mr. Alex Honczaryk
Manager Private Fish Farm
Rua Ten Joao Gomes DaSilva 1361
Curitiba Parana, Brasil
6. Mr. Collin Fearon
Extension Specialist
P. O. Box 415
Kingston 11
Jamaica, W.I.
Phone (Office) 984-2062
7. Michael William
District Development Officer
18 Angle Ruelle Villemenay
Ave Lamartiniere
Port-Au-Prince, Haiti W.I.
8. Mr. C. Mujtaba Wadahar
District Fisheries Officer
P. O. Bagarji
Dist: Shikarpur
Sind.
Pakistan

9. Mr. Lee Wu Chung, Fisheries Biologist
Tunkang Lab.
Taiwan Fisheries Bureau
8 Section 1 Cungh Shiao
E. Road
Taipei, Taiwan R.O.C.
Phone: (Office) (02) 3414830

10. Mr. Charles G. Smith
Manager Private Fish Farm
P. O. Box 234
Bridgeport, AL 35740
Phone: 495-3553

11. Mr. Sheng-Lung Shih (David)
Research Biologist
9-1 Shinmin Lane
Linkou Road
Kinrou, Taipei
Taiwan, R.O.C.

International Visiting Scientists and Post Doctoral Fellows, 1982-1987

Another non-credit program implemented by the Department and International Center involves visiting scientists. Although no formal recruitment program is practiced, a number of requests are received each year from visiting scientists from the international community indicating a strong desire to pursue post-graduate studies at Auburn. Through this program, visiting scientists improve their knowledge bases in areas important to their teaching and research in their home countries. Office and laboratory space and limited supplies are made available to these scientists. In addition, access to libraries is facilitated. Also senior departmental staff are available for consultation and provide advice and other inputs as appropriate. Graduate students and faculty benefit from this program through exchange of information and through formal seminars and informal discussions.

A listing of the post-doctorate and visiting scientists participating in this non-credit but very valuable training activity since the initiation date of the Cooperative Agreement follows.

Also listed are those internationals that completed special advance studies programs during 1987. Duration of these studies generally varied from three to 12 months, after which a Certificate of Achievement was awarded. The participants in this study plan generally selected a senior faculty member and worked under his direction.

Other Short-Term Training

Other short-term training was carried out on-campus and overseas during 1987. A two-week training program in Spanish was conducted in Venezuela in July. Approximately 25 biologists received training which focused upon hatchery management and spawning of fish species native to Venezuela. The Interamerican

International Visiting Scientists and
Post Doctoral Fellows 1982-1987

<u>Name</u>	<u>Dates</u>	<u>Sponsor</u>	<u>Country</u>
Devaraj, K.V.	1 Aug 82 -31 Oct 82	Univ. Ag. Sci.	India
Ozdemir, Niyazi	30 Jun 82 -28 Aug 82	First Univ.	Turkey
Tang, Hung-Chi	Jun 82 -Mar 83	Taiwan CAPD	ROC
DeQuan, Xia	Apr 82 -May 83	PRC	PRC
Miyazaki, Teru	Sept 82-Jun 83	Mie Univ.	Japan
Singh, Bansh	1 Jan 84-30 Apr 84	FAO	India
Narayanaswamy, D.	10 Jan 84-10 May 84	FAO	India
Jayaprakas, V.	Sept 85-Aug 87	ICAR	India
Zhang, Lai-Fa	16 Aug 86-30 Jan 87	IDRC	PRC
Treer, Tomislav	4 Aug 86-25 Nov 86	USDA	Yugoslavia
Sadek, Sherif	July 86-Jun 87	Peace Fellowship Program	Egypt
Chatterjee, Dhirenda	Jan 88 -present	FAO	India
Kamaly, Abolghassem	May 87-present	Home University	Iran
Li, Yue Hua	July 87-present	PRC	PRC
Wu, Ruiquan	May 87 -present	PRC	PRC

1987 Certificates - Special Advanced Studies

Celestin, Wilson	USAID	Haiti
Siregar, Syamaruddin	UK/USAID	Indonesia
Berrios, Mario	Humphrey Fellow	Honduras
Alfa, Musa T.	Self	Nigeria
Summawuthi, Suppachai	Asia Dev. Bank	Thailand
Ruttanagostrigit, Wanna	Asia Dev. Bank	Thailand

Development Bank sponsored the training while Dr. Lovshin conducted the program. It appears that as a direct result of this training program, two or three aquaculturists from the Venezuela project may enroll in academic or the Aquaculture Training Program in 1988.

A short-term training activity involving a total of 50 agriculturists from Central America was completed in 1987. This involved the CAPS program coordinated by Tuskegee Institute in which internationals from various Central American countries received several months training in agriculture and related subject matter areas. Auburn Fisheries provided two one-day training programs (25 trainees in each group), in Spanish, in the specific area of aquaculture. This is the second year that the ICA has participated in the CAPS program.

Two training programs, each of 2 days duration, were held on-campus for approximately 100 Peace Corps volunteer trainees (50 per group) destined to work in aquaculture programs in several African countries. Several ICA staff (all former PCVs) participating in this training activity received funding support under the Cooperative Agreement.

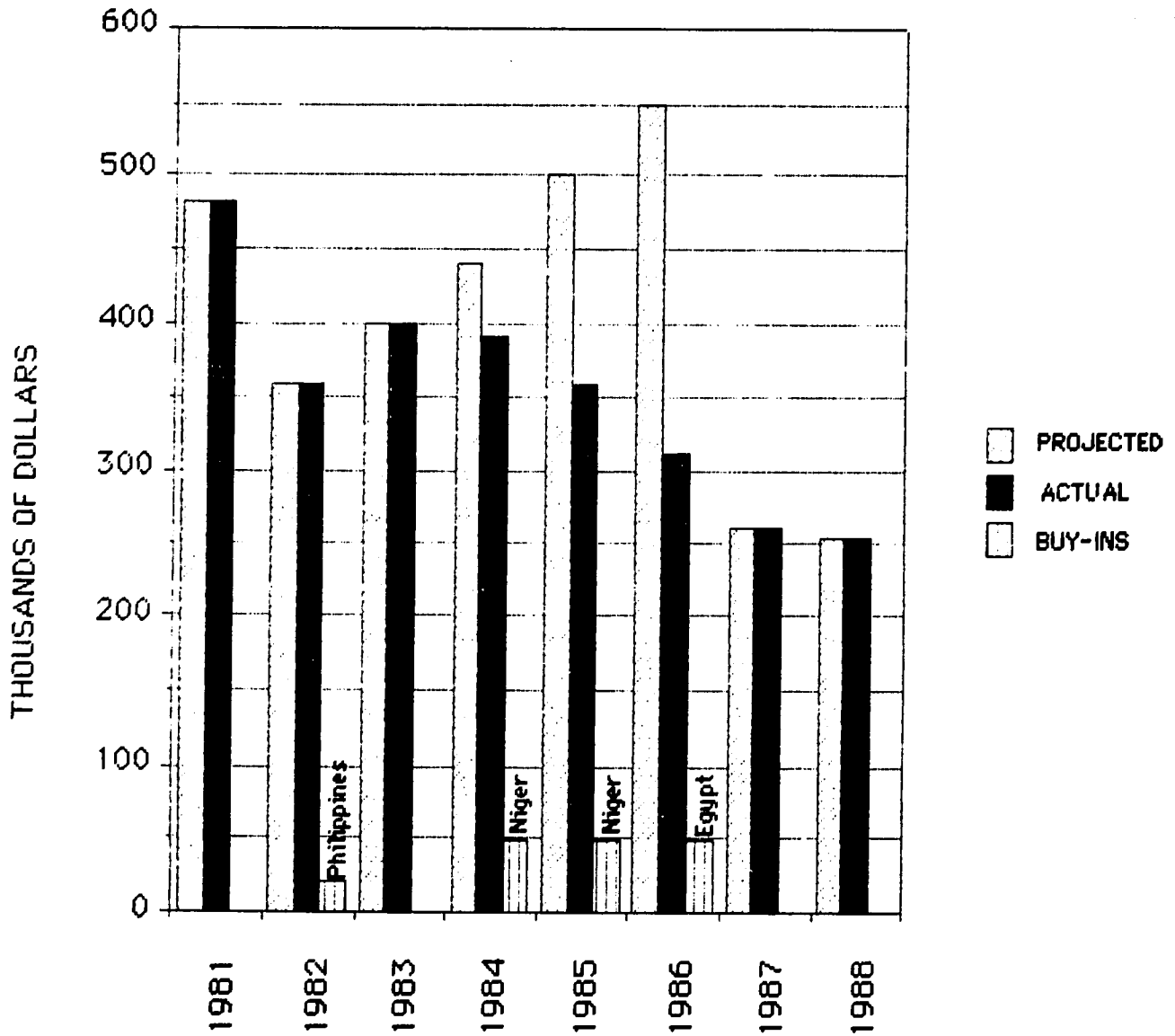
FINANCES AND BUDGET

The AID/Auburn University Cooperative Agreement (DAN 931-1314) was implemented January 1, 1982. It essentially consolidated programs previously funded under two other AID mechanisms--a university services contract under which technical services in aquaculture and inland fisheries were provided to AID Missions and an aquaculture technology grant which provided on-campus core support.

The Cooperative Agreement extended over a five-year period but subsequently was extended one additional year, terminating December 31, 1987. Total funding as listed in the CA document was indicated as 2.250 million dollars for the 5-year period. However, funds actually received were approximately 10 percent less than the projected figure.

An increase in the indirect costs rate from 24 percent at the start of the project in 1982 to the present rate of 39 percent coupled with an inflation element and increased staff salaries resulted in a severely reduced capacity to support core staff project activities. Funds received under the ICA over time are depicted in the following chart while a line-item breakdown of annual budgets from 1982 through 1987 are included in the attached table. A total sum of \$260,000 was available to the ICA for calendar 1987. This supported approximately 2.7 full time equivalents of professional staff time.

Three buy-in actions were implemented under the CA: 1) USAID/Philippines-\$20,000 in 1983; 2) USAID/Niger-\$94,200 in 1984; and 3) USAID/Egypt-\$76,821 in 1986. Two other opportunities existed for AID Missions buy-ins, but both actions involved long-term technical services which was viewed by AID contracts people to be inappropriate for implementation under the Cooperative Agreement.



PROJECTED AND ACTUAL FUNDING RECEIVED UNDER THE AID/AU COOPERATIVE AGREEMENT

Cooperative Agreement

Expenditure Report for Cooperative Agreement 01 January 1982 - 31 December 1987

	1982	1983	1984	1985	1986	1987	TO DATE
SALARIES							
Administrative	\$8,255.00	\$8,035.00	\$10,885.00	\$13,953.00	\$18,315.99	\$4,905.00	\$64,348.99
Faculty	\$133,394.83	\$142,353.16	\$153,752.98	\$146,559.18	\$88,562.42	\$108,595.06	\$773,217.63
Secretarial/Clerical	\$16,623.69	\$14,480.57	\$14,295.72	\$25,885.34	\$21,217.38	\$17,166.01	\$109,668.71
Graduate Assistants & Student Wages	\$44,218.55	\$48,384.02	\$55,129.00	\$31,987.07	\$20,249.92	\$14,315.58	\$214,284.14
Other Personnel	\$7,435.56	\$7,374.84	\$3,323.51	\$11,430.73	\$558.00	\$0.00	\$30,122.64
Total	\$209,927.63	\$220,627.59	\$237,386.21	\$229,815.32	\$148,903.71	\$144,981.65	\$1,191,642.11
FRINGE BENEFITS							
Total	\$35,367.98	\$36,257.58	\$35,786.95	\$39,487.51	\$22,401.24	\$26,030.92	\$195,332.18
TRAVEL							
In-State	\$2,574.30	\$39.88	\$36.00	\$465.00	\$42.00	\$232.00	\$3,389.18
Out-of-State	\$6,891.87	\$10,481.84	\$7,838.51	\$9,066.35	\$6,918.41	\$1,170.35	\$42,367.33
International	\$24,032.55	\$23,905.29	\$13,175.49	\$9,520.85	\$29,026.19	\$4,112.01	\$103,772.38
Total	\$33,498.72	\$34,427.01	\$21,050.00	\$19,052.20	\$35,986.60	\$5,514.36	\$149,528.89
OTHER DIRECT COSTS							
Total	\$37,410.53	\$39,487.85	\$45,149.28	\$61,480.17	\$44,886.97	\$25,671.69	\$254,086.49
EQUIPMENT							
Total	\$1,709.09	\$1,359.95	\$7,301.62	\$4,305.13	\$2,378.88	\$278.00	\$17,332.67
INDIRECT COSTS							
Total	\$74,962.75	\$79,046.36	\$100,305.48	\$94,620.45	\$76,872.10	\$62,419.92	\$488,227.06
GRAND TOTAL	\$392,876.70	\$411,206.34	\$446,979.54	\$448,760.78	\$331,429.50	\$264,896.54	\$2,296,149.40

121

APPENDIX

- A. Time Chart of International Contracts Implemented by the International Center of Aquaculture, Auburn University
- B. Registry Information on the International Aquaculture Network, Including a List of ICA Associates
- C. Format of Current Production Practices of Aquatic Species
- D. List of ICA Research and Development Series Publications
- E. Short-Term Work Carried Out by ICA Staff, 1982-1986
- F. A List of Participants Completing the Aquaculture Training Program, 1982-1986

APPENDIX A
TIME CHART OF INTERNATIONAL PROJECTS IMPLEMENTED
BY THE INTERNATIONAL CENTER FOR
AQUACULTURE

TIME CHART OF INTERNATIONAL CONTRACTS
INTERNATIONAL CENTER FOR AQUACULTURE, AUBURN UNIVERSITY

	<u><Egypt Fish Culture></u>	\$ 253,915
< <u>Tiffany Inc. Nigeria</u> >		225,728
(AID/afr-C-1429 Burundi) <__>		43,945
< <u>Honduras Aqua Dev</u> >	(Zimbabwe) <__>	16,951
< <u>AID/LA-C-1166 Colombia</u> >		328,580
(514-251 T Colombia) <__>	< <u>Rwanda Fish Culture Dev</u> >	951,590
< <u>AID/LA-C-1166 Jamaica</u> >		854,551
< <u>AID/ASIA-C-1177 Indonesia</u> >		7,500
(ta.147-438 Peru) <__>		1,142,915
(AID/LA-688 El Salvador) <__>		584,757
< <u>AID/LA-C-684 Panama</u> > (\$121,885)	< <u>AID/Panama \$405,187</u> >	7,367
< <u>AID/ea-180 Philippines</u> >		174,472
T.O.1 Worldwide Funding \$315,504	\$ 5,053	T.O.1 Tanzania
T.O.2 Thailand 23,647	287,433	T.O.2 Brazil
T.O.3 Brazil 71,928	0	T.O.3 Colombia
T.O.4 Brazil 65,451	7,855	T.O.4 Zaire
T.O.5 Peru 4,631	15,800	T.O.5 Colombia
T.O.6 Worldwide Funding 145,000	23,469	T.O.6 Indonesia
T.O.7 Thailand 16,500	9,206	T.O.7 C.A.R.
T.O.8 Brazil 177,540	5,817	T.O.8 Honduras
T.O.9 Thailand 14,400	4,959	T.O.9 Colombia
	5,048	T.O.10 Zaire
< <u>\$364,972</u> >	< <u>\$834,601</u> >	< <u>\$364,640</u> >
Basic Grant	2270 Basic Ordering Agreement	1152 B.O.A.
	< <u>2780 Institutional Grant \$1,438,000</u> >	< <u>\$348,999</u> >
		AID University Services Contract
		1,913,212
		< <u>Technology Dev Grant</u> > (\$1,101,904)
		2,539,904
		< <u>Strengthening Grant G-0150</u> >
		500,000
		< <u>Title XII Aquaculture CRSP</u> >
		830,000
		< <u>AID Cooperative Agreement</u> >
		2,250,000
1968	1969	1970
1971	1972	1973
1974	1975	1976
1977	1978	1979
1980	1981	1982
1983	1984	1985
1986	1987	1988
\$13,946,325		

4

APPENDIX B
REGISTRY INFORMATION ON THE INTERNATIONAL AQUACULTURE
NETWORK INCLUDING A LIST OF
ICA ASSOCIATES

AUBURN UNIVERSITY



AUBURN UNIVERSITY, ALABAMA 36849

School of Agriculture and
Agricultural Experiment Station System

Department of Fisheries
and Allied Aquacultures
Telephone (205) 826-4786
ACTS Number 923-4786

International Center
for Aquaculture
Telephone (205) 826-4786
ACTS Number 923-4786

January 13, 1987

Dear FAA Alum:

To help improve technology transfer to developing countries, the International Center for Aquaculture is developing the International Aquaculture Network (IAN). The IAN will consist of foreign (non-U.S. citizens) aquaculturists and fisheries biologists who are working overseas. Eventually, the IAN may include all interested aquaculturists and fisheries biologists, but initially it is limited to foreign Auburn FAA Alumni who were here as students, either on long-term or short-term programs.

As the first step in the development of the IAN, we are developing the IAN expertise file. This file will enable us to locate aquaculturists and fishery biologists who can provide expert assistance throughout the world.

To help us develop this file, please fill out the enclosed Registry Information Questionnaire and return it in the pre-addressed envelope. You do not need to return the code sheet. Feel free to use additional pages if necessary.

Please print or type your responses.

With your help, we can make the IAN a reality and an important tool in technology transfer and international development.

Sincerely,

A handwritten signature in cursive script that reads "E.W. Shell".

E.W. Shell
Professor and Head

Auburn University

Auburn University, Alabama 36849-5419

College of Agriculture

Department of Fisheries
and Allied Aquacultures

International Center
for Aquaculture

Telephone: (205) 826-4786
Telex: 5106002392

Unites States of America

September 25, 1987

■

Dear ■:

Our International Aquaculture Network is soon to be completed and I am hoping you will participate. In an earlier letter I responded to your expression of interest in participating in the network and included a questionnaire to be filled out.

In case my letter with the questionnaire did not reach you or your reply was not received here, I am enclosing another questionnaire. Please fill it out and return it as soon as possible.

I look forward to hearing from you soon.

Sincerely,

E. W. Shell, Department Head
Department of Fisheries and
Allied Aquacultures

EWS/bmj

Enclosure

-43'

REGISTRY INFORMATION

International Aquaculture Network



Department of Fisheries and Allied Aquacultures
International Center for Aquaculture
Auburn University
Alabama, 36849, U.S.A.

44-

INTERNATIONAL AQUACULTURE NETWORK QUESTIONNAIRE



please type or print

I. PERSONAL INFORMATION

A. Name: _____
(underline family name)

Position/Title: _____

Business Address: _____

Home address: _____

Telephone: _____

Telex: _____

Citizenship: _____

Optional information: Sex: M ____ F ____ Year of Birth ____

II. EDUCATION

College/Institution	Degree	Major	Date
---------------------	--------	-------	------

45

Special skills

List your special skills not covered by the code sheet (e.g., computer programming, statistical analysis, genetic engineering):

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____

Species

List the species with which you have experience, listing first the one with which you are most qualified. Include only those species for which you could provide information on the culture or biology. Please include the scientific name. Do not use abbreviations (attach additional page if necessary):

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____

V. EXPERIENCE IN COUNTRIES OTHER THAN THE U.S. (use additional pages if necessary)

Country	No. of months	Year(s)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

VI. LANGUAGES

List the languages which you can speak and write well enough to provide technical information to professional audiences. List your native language first. List others in descending order of fluency.

Native: _____

CODE SHEET

AQUACULTURE

JOB TYPE

- 001 teaching
- 002 research
- 003 extension
- 004 administration
- 005 private enterprise

EXPERTISE/SPECIALTY

- 006 design and construction of facilities
- 007 engineering
- 008 soils
- 009 hydrology
- 010 seed (fingerling) production
- 011 reproduction/spawning
- 012 pond management
- 013 nutrition
- 014 diseases—viral
- 015 diseases—bacterial
- 016 diseases—parasitic
- 017 diseases—environmental
- 018 pathology
- 019 water quality
- 020 breeding/genetics
- 021 weed control
- 022 harvesting
- 023 marketing
- 024 processing
- 025 economics
- 026 physiology
- 027 socio-economics/anthropology

ORGANISM

- 028 food fish
- 029 bait fish
- 030 ornamental fish
- 031 molluscs
- 032 crustaceans
- 033 plants

SYSTEM

- 034 ponds—monoculture
- 035 ponds—polyculture
- 036 integrated agriculture-aquaculture
- 037 raceways
- 038 cages
- 039 closed systems

WATER

- 040 freshwater
- 041 marine
- 042 brackish water

CLIMATE

- 043 tropical—arid
- 044 tropical—humid
- 045 temperate

REGION

- 046 Africa
- 047 Asia
- 048 South America
- 049 North America
- 050 Central America
- 051 Caribbean
- 052 Europe
- 053 Middle East

FISHERIES BIOLOGY

JOB TYPE

- 054 teaching
- 055 research
- 056 management
- 057 extension
- 058 administration
- 059 private enterprise

EXPERTISE/SPECIALTY

- 060 biology of fishes
- 061 fish systematics/taxonomy
- 062 population dynamics
- 063 catch assessment surveys
- 064 commercial fishing projects—fish in lakes/reservoirs
- 065 commercial fishing projects—fish in rivers/streams
- 066 commercial fishing projects—fish in oceans
- 067 commercial fishing projects—crustaceans in freshwater
- 068 commercial fishing projects—crustaceans in marine waters
- 069 commercial fishing projects—molluscs
- 070 artisanal fishing projects
- 071 cooperative fishing projects
- 072 socio-economics/anthropology
- 073 gear design
- 074 economics
- 075 evolution
- 076 genetics
- 077 toxicology
- 078 physiology
- 079 behavior

ORGANISM

- 080 fish—food
- 081 fish—meal and oil
- 082 molluscs
- 083 crustaceans

SYSTEM

- 084 ponds
- 085 lakes/reservoirs
- 086 rivers/streams
- 087 oceans

WATER

- 088 freshwater
- 089 marine
- 090 brackish

CLIMATE

- 091 tropical—arid
- 092 tropical—humid
- 093 temperate

REGION

- 094 Africa
- 095 Asia
- 096 South America
- 097 North America
- 098 Caribbean
- 099 Central America
- 100 Europe
- 101 Middle East

AQUATIC ECOLOGY

JOB TYPE

- 102 teaching
- 103 research
- 104 extension
- 105 administration
- 106 private enterprise

EXPERTISE/SPECIALTY

- 107 limnology
- 108 primary productivity
- 109 weed control
- 110 hydrology
- 111 water pollution
- 112 water quality
- 113 food chains

ORGANISM

- 114 algae—phytoplankton
- 115 algae—filamentous/benthic
- 116 macrophytes
- 117 zooplankton
- 118 benthic organisms
- 119 molluscs
- 120 crustaceans
- 121 fish

SYSTEM

- 122 ponds
- 123 lakes/reservoirs
- 124 rivers/streams
- 125 oceans

WATER

- 126 freshwater
- 127 marine
- 128 brackish water

CLIMATE

- 129 tropical—arid
- 130 tropical—humid
- 131 temperate

REGION

- 132 Africa
- 133 Asia
- 134 South America
- 135 North America
- 136 Caribbean
- 137 Central America
- 138 Europe
- 139 Middle East

INTRODUCING

the

U. A. N.

ABDELGHANY, ALI EZZELDIN
GENERAL AUTH. FOR FISH RESOURCES
(AQUA. RES. CENTER) 4 TYARAN ST.
NASR CITY, CAIRO
EGYPT
CAIRO UNIV.
B.S. 1966
AUBURN UNIV.
M.S. 1982
UNIV. IDAHO
PH.D. 1986

AL-AHMAD, THANI A.
MARICULTURE AND FISHERIES DEPT. ,
P.O. BOX 1638
22017-SALMIYA
KUWAIT
UNIV. OF OREGON
B.S. 1974
AUBURN UNIV.
M.S. 1978
AUBURN UNIV.
PH.D. 1983

ALAPAN, APOLONIO A.
DA-AQUA. DEV. PROJ., PROJ. MAN.
M.H. DEL PILAR STREET
MOLO, ILOILO CITY
PHILIPPINES
UNIV. OF THE PHILIPPINES
ASSOCIATE 1966
WESTERN COLLEGES
B.S.E. 1971
APARRI COLLEGE OF FISHERIES
SECONDARY 1962

ALI, AHYAUDIN B.
SCHOOL OF BIOLOGICAL SCIENCES
UNIVERSITI SAINS MALAYSIA, 1180,
PENANG
MALAYSIA
OREGON STATE UNIV.
B.S. 1978
AUBURN UNIV.

M.S. 1981
AUBURN UNIV.
PH.D. 1984
ALSAGOFF, SYED A. L.
FACULTY, FISH. & MAR. SCI.
UNIV. OF AGRICULTURE
43000-SERDANG
MALAYSIA
CORNELL UNIV
B.A. 1978
AUBURN UNIV.
M.S. 1981
AUBURN UNIV.
PH.D. 1985
UNIV. TEXAS/ARLINGTON
POST-DOC. 1986
ALVAREZ, GALVEZ MARCO
V.M.RENDON #920 Y STA. ELENA
APARTADO 11397
GUAYAQUIL
ECUADOR
AUBURN UNIV.
ATP-CERTIFICATE 1981
GUAYAQUIL UNIV.
B.S. 1975
ARCE, RODOLFO G.
FAC
COLLEGE OF INLAND FISHERIES
MUNOZ, NUEVA ECIJA 2320
PHILIPPINES
CLSU
B.S. 1967
KANSAS STATE/USDA COURSE
CERTIFICATE 1980
AUBURN UNIV.
M.S. 1974
AUBURN UNIV.
PH.D. 1980
AREECHON, NONTAWITH
DEPT. AQUACULTURE, FAC. OF
KASETSART UNIV.

FLORIDA ATLANTIC UNIV.		WALES, U.K.	
M.S.	1976	I.A.P.H., BELGIUM	
CORRE, VALERIANO L., JR.		INGENIEUR	1975
COLLEGE OF FISHERIES		AUBURN UNIV.	
UNIV. OF PHIL. IN THE VISAYSA		M.S.	1985
ILOILO CITY		UNIV. NORTH WALES, U.K.	
PHILIPPINES		PH.D.	1990
UNIV. PHILIPPINES (DILIMAN)		DEVARAJ, K.V.	
B.S.	1976	UNIV. OF AGRICULTURAL SCIENCES	
UNIV. PHILIPPINES (VISAYAS)		HEBBAL CAMPUS	
M.S.	1981	BANGALORE-560 024	
CORREDOR, JORGE EDUARDO		INDIA	
AV 4N *18-60		CENTRAL COLLEGE, UNIV.	
		B.S.	1959
CALI		CENTRAL INST. OF FISHERIES,	
COLOMBIA		D.F.SC.	1967
UNIV. WISCONSIN		CENTRAL COLLEGE, UNIV.	
B.S.	1979	M.S.	1961
CRUZ, EMMANUEL M.		AUBURN UNIV.	
MARICULTURE AND FISHERIES DEPT.		PH.D.	1970
KUWAIT INST. FOR SCI. RES., BOX		DHITAL, RESHAM RAJ	
SALMIYAH 22017		C/O CHIEF. FISHERIES DEVELOPMENT	
KUWAIT		HARIHAR BHAWAN	
C.L.S.U.		KATHMANDU	
B.S.A..	1963	NEPAL	
ARANETA UNIV.		AUBURN UNIV.	
M.S.A.	1968	CERT. OF	1984
AUBURN UNIV.		KANPUR UNIV.	
PH.D.	1975	M.S.	1974
DE LA TORRE, RAFAEL		DROUSSI, MOHAMMED	
ACUICOLA LOS DESMONTES		NATIONAL CENTER FOR FISHERIES	
LOPEZ MATEOS 166-104		P.O. BOX 11	
TECOMAN, COLIMA 28100		AZROU	
MEXICO		MOROCCO	
UNIV. AUTONOMA DE		AUBURN UNIVERSITY	
	1980	ATP CERTIFICATE	1985
AUBURN UNIV.		NATIONAL SCHOOL OF WATER	
M.AQ.	1984	ENGINEER	1982
DERU, JACQUES		DUARA, HITENDRA	
MARINE SCIENCE LABORATORIES		OFFICE OF SUBDIV FISH DEV OFFICER	
UNIV. COLLEGE OF NORTH WALES		UZANBAZAR	
MENAI BRIDGE LL595EH			

52

GUWAHATI-781 007 ASSAM INDIA GUWAHATI UNIV. M.S. 1975	EL SHIBLY, ABDEL FATTAH ABDEL MANZALA FISH FARM MANZALA DAKAHLIA EGYPT AG. COLLEGE, CAIRO UNIV. B.S. 1972
DUMADA-UG, EDGARDO B. PNAAC-RIGT TINIGUIBAN HTS. PUERTO PRINCESA CITY PHILIPPINES ILOILO STATE COLLEGE OF BFS 1979	ELLA, MICHAEL OWAN FISHERIES HEADQUARTERS P.M.B. 1168 CALABAR, CROSS RIVER STATE NIGERIA UNIV. OF IFE B.S. 1975 AUBURN UNIV. M.S. 1984
DUTTA, OMEO K. JOINT DIR. OF FISHERIES GOVERNMENT OF ASSAM GAUHATI 781001 INDIA DIBRUGARH UNIV. B.S. 1969 GAUHATI UNIV. M.S. 1971 AUBURN UNIV. PH.D. 1979	ESIN, O. JONATHAN JONE ESIN AQUACULTUREAL P.O. BOX 1573 BENIN CITY, BENDEL STATE NIGERIA AUBURN UNIV. ATP-CERTIFICATE 1982 AHMADU BELLO UNIV., ZARIA B.S. 1972
EISENMANN, ANA CAROLINA AGROMARINA P.O. BOX 6-4600 EL DORADO, PANAMA REP. OF PANAMA UNIV. DE PANAMA B.S. 1982 AUBURN UNIV. M.S. 1985	ESTEVEZ, MARIO CALLE 35 #6-13 BOGOTA COLOMBIA JORGE TADEO LOZANO UNIV. BACHELLOR 1972 AUBURN UNIV. M.S. 1979
EKINGEN, GURKAN FIRAT UNIVERSITESI SU URUNLERI YUKSEKOKULU ELAZIG - TURKEY ANKARA DR. 1973 ANKARA UNIV. DVM 1962 AUBURN UNIV. M.S. 1970	EYESON, KODWO NDZIBAH DEPT. ZOOLOGY UNIV. OF CAPE COAST CAPE COAST GHANA UNIV. GHANA B.S. 1962 UNIV. LEEDS (U.K.)

PH.D. 1968
FATUROTU, EMMANUEL OLUJIMI
DEPT. WILDLIFE & FISHERIES
UNIV. OF IBADAN
IBADAN
NIGERIA
UNIV. OF IFE, NIGERIA
B.S. 1973
AUBURN UNIV.
CERTIFICATE 1982
UNIV. COLLEGE OF NORTH
M.S. 1987
UNIV. OF IBADAN, NIGERIA
PH.D. 1980

FONG, SUN-CHIO
INSTITUTE OF MARINE BIOLOGY
NATIONAL SUN YAT-SEN UNIV.
KAOHSIUNG
TAIWAN 80424 ROC
NATIONAL TAIWAN UNIV.
B.S. 1969
NATIONAL TAIWAN UNIV.
M.S. 1971
AUBURN UNIV.
PH.D. 1979

FONSECA-ESERSKI, CARLOS
BOULEVARD EL HIPODROMO #548
COL. SAN BENITO
SAN SALVADOR
EL SALVADOR
UNIV. OF MIAMI
B.S. 1984
AUBURN UNIV.
M.AQ. 1986

GARLAND, JIM
RT.6
BOX 945
HILLSBORO, NC 27278
U.S.
AUBURN UNIV.
1981
UTAH STATE UNIV.

B.A. 1970
UTAH STATE UNIV.
B.S. 1974
GERALDES, FRANCISCO X.
SECRETARIA DE ESTADO DE

SANTO DOMINGO
DOMINICAN REPUBLIC
UNIV. AUTO. DE SANTO
LIC. BIO. 1976
AUBURN UNIV.
M.S. 1978

GUERRERO III, RAFAEL D.
AQUATIC BIOSYSTEMS

BAY, LAGUNA
PHILIPPINES
UNIV. OF THE PHILIPPINES
B.S. 1964
UNIV. OF THE PHILIPPINES
M.S. 1970
AUBURN UNIV.
PH.D. 1974

HABSBURGO-LORENA, ANDRES S.
CANG, S.A.
ARROYO FRESNO 19
E-28035 MADRID
SPAIN
ESCUELA SUP. DE COMERCIO
PROF. MERCANTIL 1961

HERRERA, ALFREDO MENA
PLAYA VENTANAS S/N
APARTADO POSTAL 591
MANZANILLO 28200 COLIMA
MEXICO
UNIV. NACIONAL AUTONOMA
B.S. 1972

KAMARUDIN, MOHD. SALLEH BIN
FAC. OF FISHERIES & MAR. SCI.
UNIVERSITI PERTANIAN MALAYSIA
43400 UPM SERDANG, SELANGOR
MALAYSIA

UNIV. OF WASHINGTON		T AEYON-DONG, NAM-GU	
B.S.	1982	PUSAN 608	
UNIV. PERTANIAN MALAYSIA		KOREA	
DIPLOMA	1980	AUBURN UNIV.	
AUBURN UNIVERSITY		CERTIFICATE	1960
M.S.	1984	NATIONAL FISH. UNIV. OF	
KEREMAH, KODU REGINALD		DIPLOMA	1949
FISHERIES SECTION		PUSAN NATIONAL UNIV.	
NIGER DELTA BASIN DEV. AUTH.		M.S.	1963
P.M.B. 5676, PORTHARCOURT		SEOUL NATIONAL UNIV.	
NIGERIA		PH.D.	1968
UNIV. OF IBADAN		KOSSOWSKI, CHRISTOPHE ANDRE	
B.SC.	1977	UNIV. CENTRO OCCIDENTAL "LISANDRO	
AUBURN UNIV.		P.O. BOX 400	
M.S.	1983	BARQUISIMETO, EDO. LARA	
KHATOO, PETER		VENEZUELA	
REGIONAL OFFICE, REGION 3		UNIV. CENTRO OCCIDENTAL	
WEST COAST			1970
DEMERARA		AUBURN UNIV.	
GUYANA		M.A.Q.	1983
AUBURN UNIV.		KOULAGNA	
ATP-CERTIFICATE	1980	DEPT. FORESTRY	
GUYANA SCHOOL OF AG.		UNIV. CENTER OF DSCHANG, P.O. BO:	
DIP. AG.	1979	DSCHANG	
MUSLIM TRUST COLLEGE		CAMEROON	
G.C.E. "O" LEVEL	1973	E.N.S.A. YAOUNDE	
KHODARI, MOHAMMED		INGENIEUR	1983
CENTRE NATIONAL DE LA RECHERCHE		AUBURN UNIV.	
ET PISCICULTURE, BP 11		M.S.	1986
AZROU		LANDESMAN, LOUIS	
MOROCCO		C/O M.SIAHAYA, WORLD VISION INT	
AUBURN UNIV.		JALAN WAHID HASYIM 33	
INSTITUT AGRONOMIQUE		JAKARTA PUSAT	
DIP. GEN.	1981	INDONESIA	
IST. AGRONOMIQUE		S.U.N.Y. GENESEO, N.Y.	
MASTERS	1983	B.S.	1975
MARINE SCIENCE CENTER,		B.I.T.S. PILANI, INDIA	
STUDIES	1982	B.SC.	1973
KIM, IN-BAE		AUBURN UNIV.	
NATIONAL FISHERIES UNIV. OF PUSAN		M.S.	1978
		NATIONAL UNIV. SINGAPORE	
		PH.D.	

55'

LAWAL, LATEEF ABAYOM
LAGOS STATE UNIV., OJO, FAC. OF
DEPT. BIO. & CHEM. SCI., PMB 1087
APAPA, LAGOS
NIGERIA
KENT STATE UNIV.
B.S. 1980
AUBURN UNIV.
M.AQ. 1982

LAWAL, LATEEF ABAYOMI
LAGOS STATE UNIV., OJO
FAC. OF SCIENCE, DEPT. OF BIO. &
PMB 1087, APAPA, LAGOS
NIGERIA
KENT STATE UNIV.
B.S. 1980
AUBURN UNIV.
M.AQ. 1982

LEE, JEN-CHYUAN
FISHERIES DEPT., COUNCIL OF
37 NANHAI ROAD
TAIPEI
REP. OF CHINA
NATIONAL TAIWAN NORMAL
B.S. 1967
NATIONAL TAIWAN UNIV.
M.S. 1972
AUBURN UNIV.
PH.D. 1979

LEGADOS, JULIETO A.
CEBU STATE COLLEGE OF SCIENCE &
COLLEGE OF FISHERIES TECHNOLOGY
CARMEN, CEBU CAMPUS
PHILIPPINES
ILOILO REGIONAL SCHOOL OF
B.S.F.ED. 1976
STERLING, AUBURN
M.S. 1981

LIQUIGAN, ANTONIO A.
CSU-RIFT

APARRI, CAGAYAN

PHILIPPINES
LYCEUM OF APARRI
A.B. BSE 1972
UNIV. OF THE PHIL. IN THE
M.S. 1987

MANGALIK, ARTHUR
AQUACULTURE DEPT., FAC. OF
LAMBUNG MANGKURAT UNIV.
BANJARBARU, S. KALIMANTAN
INDONESIA 70713
AUBURN UNIV.
M.S. 1979
AUBURN UNIV.
PH.D. 1986
BOGOR AGRIC. UNIV.
SARJANA 1966

MEYER, DANIEL E.
PANAMERICAN AGRICULTURE SCHOOL
BOX 93
TEGUCIGALPA
HONDURAS
CLEMSON UNIV.
B.S. 1969
CLEMSON UNIV.
M.S. 1973
AUBURN UNIV.
PH.D. CANDIDATE 1987

MGBENKA, BERNARD OBIALO
DEPT. OF ZOOLOGY
UNIV. OF NIGERIA
NSUKKA, ANAMBRA STATE
NIGERIA
UNIV. OF NIGERIA, NSUKKA
B.S. 1975
AUBURN UNIV.
M.S. 1980
AUBURN UNIV.
PH.D. 1983

MOHAMADI, MAJEED B.
37 AVERY DR.

96

ATLANTA, GA 30309	BENIN CITY
U.S.A.	NIGERIA
BAGDAD STATE UNIV.	UNIV. WASHINGTON, SEATTLE
B.S. 1970	B.S. 1976
GEORGIA STATE UNIV.	L.S.U.
CERTIFICATE 1987	M.S. 1978
AUBURN UNIV.	AUBURN UNIV.
M.S. 1982	PH.D. 1982
MSISKA, ORTON V.	ODUOL, CHARLES OKUTHE
MIN. OF FORESTRY AND NATURAL	DISTRICT FISHERIES OFFICER
FISHERIES DEPT., P.O. BOX 44	P.O. BOX 4031
DOMASI	KISUMU
MALAWI	KENYA
UNIV. STERLING	MAKERERE UNIV., KAMPALA,
ADV. TILAPIA 1985	B.S. 1975
UNIV. OF MALAWI	UNIV. NAIROBI
B.S. 1973	M.S. 1986
AUBURN UNIV.	ODURO-BOATENG, FRANCIS
CERTIFICATE 1980	TECHNOLOGY CONSULTANCY CENTER
UNIV. OF MALAWI	UNIV. OF SCIENCE AND TECHNOLOGY
M.S. 1982	KUMASI
MULUK, CHAIRUL	GHANA
DEPT. AQUA., FAC. FISHERIES	UNIV. OF SCI. & TECH. KUMASI
BOGOR AG. UNIV. (IPB)	B.S. 1979
KAMPUS IPB-DARMAGA	ORAJAKA, BONIFACE IFEANYI
INDONESIA	P.O. BOX 480
AUBURN UNIV.	C/O 138 PORTHARCOURT ROAD
B.S. 1966	ONITSHA, ANAMBRA STATE
AUBURN UNIV.	NIGERIA
M.S. 1967	UNIV. OF NIGERIA, NSUKKA
NYIRAHABIMANA, PELAGIE	B.S.C. 1978
FISHCULTURE PROJECT	AUBURN UNIVERSITY
B.P. 132	CERTIFICATE 1982
BUTARE	OZDEMIR, NIYAZI
RWANDA	FIRAT UNIVERSITESI FEN-EDEBIYAT
AUBURN UNIV.	BOLUMU
CERTIFICATE - 1986	OGRETIM UYESI
NATIONAL UNIV. OF RWANDA	ELAZIG/TURKEY
ENGINEER OF AG. 1984	ANKARA UNIV. AG.
OBI, AKOLISA	ASSOC. PROF. 1977
DEPT. OF FISHEREIS	ANKARA UNIV. AG.
UNIV. OF BENIN, PMB 1154	ENGIN. 1959

ANKARA UNIV. AG.		PTD 178,179 SEDILIDECIL 81910
M.S.	1965	KOTA TINGGI, JOHOR
ANKARA UNIV. AG.		MALAYSIA
PH.D.	1971	UNIV. OF WISCONSIN
PARK, KYU SEOK		B.S.
FISHERIES RES. & DEV. AGENCY		1984
2-16, NAMHANG-DONG, YOUNGDO KU		AUBURN UNIV.
PUSAN 606		M.S.
KOREA		1986
NATIONAL FISHERIES UNIV. OF		RASHEED, VICTORIA
B.S.	1971	KISR, FISHERIES AND MARICULTURE
AUBURN UNIV.		P.O. BOX 24885
M.S.	1982	13109 SAFAT
		KUWAIT
		KUWAIT UNIV.
		B.S.
		1973
		AUBURN UNIV.
		M.S.
		1978
		AUBURN UNIV.
		PH.D.
		1983
		REIS, LIDIA MAASS
		RVA DESEMBARGADOR SANTOS NEVES
		CENTRO
		VITORIA 29000
		BRASIL
		UNIV. DE BRASILIA
		B.S.
		1980
		AUBURN UNIV.
		M.S.
		1987
		REY, FERNANDO
		LABORATORIO CARTAGENERA DE
		PLAYA DE LA ARTILLERIA NO 33-36
		CARTAGENA-BOLIVAR
		COLOMBIA
		JICA
		EXP.
		1985
		UNIV. JORGE TADEO LOZANO
		EXPERTO
		1984
		UNIV. JORGE TADEO LOZANO
		EXPERTO,
		1978
		AUBURN UNIV.
		M.AQ.
		1981
		RODRIGUEZ-BUSTOS, FERNANDO
ANKARA UNIV. AG.		
M.S.	1965	
ANKARA UNIV. AG.		
PH.D.	1971	
PARK, KYU SEOK		
FISHERIES RES. & DEV. AGENCY		
2-16, NAMHANG-DONG, YOUNGDO KU		
PUSAN 606		
KOREA		
NATIONAL FISHERIES UNIV. OF		
B.S.	1971	
AUBURN UNIV.		
M.S.	1982	
PEREZ, HUGO		
MINISTERIO DE DESARROLLO		
CHITRE-HERRERA		
REPUBLIC DE PANAMA		
UNIV. NACIONAL		
B.S.	1975	
AUBURN UNIV.		
M.S.	1986	
PRETTO MALCA, RICHARD		
NATIONAL DIRECTORATE OF		
MINISTRY OF AGRICULTURE &		
SANTIAGO, VERAAGUAS		
PANAMA		
ITESM		
B.S.	1967	
ITESM		
M.S.	1967	
AUBURN UNIV.		
PH.D.	1976	
RABEE, AHMED ABDEL MONEM		
MASAKEN ZENHOM, BLOCK 39		
ENT. 4, FLAT 3		
EL SAYDA ZENB, CAIRO		
EGYPT		
CAIRO UNIV.		
B.S.	1973	
RAHIM, ABDULLAH ABD.		
EAST ASIAN MARINE FARMS SDN. BHD.		

- 50

DIAGONAL 127A No. 29-43 OF. 203
P.O. BOX 90811, TRUCHAS DE LOS
BOGOTA D.E.
COLOMBIA

UNIV. JORGE TADEO LOZANO
1971

UNIV. JORGE TADEO LOZANO
EXPERT 1975

AUBURN UNIV.
M.S. 1978

SAEED, MOHAMED O.
FACULTY OF MARINE SCIENCE, KING
P.O. BOX 1540

JEDDAH 21441
SAUDI ARABIA
UNIV. KHARTOUM
B.S. 1976

UNIV. ARIZONA
M.S. 1979

AUBURN UNIV.
PH.D. 1983

SAKAMOTO, TAKASHI
FISHERIES TRAINING CENTER
5-25-1 NAGAI, YOKOSUKA-CITY
KANAGAWA-PREF. 238-03
JAPAN

TOKYO UNIV. OF FISHERIES
B.S. 1976

AUBURN UNIV.
M.S. 1984

SAMO, MAZHAR ALI
ASSISTANT DIR. OF FISHERIES

ONE UNIT BUILDING
KHAIRPURMIR'S (SIND)
PAKISTAN

MUMTAZ COLLEGE KHAIRPUR
B.S. 1965

INTER COLLEGE KHAIRPUR
F.SC. 1963

SANCHEZ, DAVID F.
UNIVERSIDAD DEL ZULIA, FAC.
DEPARTAMENTO DE BIOLOGIA. MODULO

MARACAIBO
VENEZUELA
UNIV. ZULIA STATE
B.S. 1971
AUBURN UNIV.
M.S. 1981

SANTIAGO, CORAZON B.
SEAFDEC AQUA. DEPT.
BINANGONAN RES. STA.
BINANGONAN, RIZAL
PHILIPPINES
MINDINAO STATE UNIV.
B.S. 1971
AUBURN UNIV.
M.S. 1978
AUBURN UNIV.
PH.D. 1985

SARR, ABDOU
CHURCH WORLD SERVICE
B.P. 300
LONGA
SENEGAL, WEST AFRICA
COLLEGE OF WOOSTER
B.A. 1981
EXPERIMENT IN
CERTIFICATE 1978
AUBURN UNIV.
CERTIFICATE-ATP 1985

SCOTT, PHILIP CONRAD
C.P. 82621
BARRA DO PIRAT
R5 27.100
BRAZIL
UNIVERSIDADE SANT URSULA
B.S. 1979

SEVELLEJA, RUBEN C.

C.I.S.U.
B.S. 1973

AUBURN UNIV.		SIRIKUL, BOONSONG	
M.S.	1978	THACHAALAB, MUANG	
SHIMANG, GOOVIM NOYA		CHANTHABURI 22000	
FED. MIN. OF AGRIC., WATER RES. &		THAILAND	
FED. DEPT. FISH., FMB 12329		KASETSART UNIV.	
VICTORIA ISLAND, LAGOS		B.S.	1968
NIGERIA		AUBURN UNIV.	
AUBURN UNIV.		M.S.	1974
ATP-CERTIFICATE 1981		SITASIT, PRASERT	
AHMADU BELLO UNIV.		NATIONAL INLAND FISHERIES INST.	
B.S.	1970		
UNIV. IBADAN		BANGKOK	
DIP. ED.	1971	THAILAND	
GRIMSBY COLLEGE OF HIGHER		KASETSART UNIV.	
DIPLOMA	1976	B.S.	1966
SINGH, BANSH NARAIN		AUBURN UNIV.	
CENTRAL INST. FRESHWATER		M.S.	1973
P.O. KAUSALYAGANG, BHUBANESWAR		SRIMUKDA, PICHIT	
751002 ORISSA		RAYONG BRACKIDHWATER FISHERIES	
INDIA		RAYONG PROVINCE	
U.P. COLLEGE, VARANASI		BAN PHE 21160	
B.S.	1961	THAILAND	
AUBURN UNIV.		KASETSART UNIV.	
CERTIFICATE	1984	B.S.	1966
BANARAS HINDU UNIV.		AUBURN UNIV.	
M.S.	1963	M.S.	1973
BANARAS HINDU UNIV.		SUAREZ, JOSE	
PH.D.	1966	ITESM CAMPUS OBREGON	
SIRAJ, SITI SHAPO		APDO. 662	
		CD. OBREGON, SONORA 85,000	
		MEXICO	
		AUBURN UNIV.	
		ATP -	1985
SIRAJ, SITI SHAPOR		ITESM-CAMPUS GUAYMAS	
FAC. FISHERIES & MARINE SCIENCES		B.S.	1978
UNIV. OF AGRICULTURE		UNIV. ALABAMA	
43400 SERDANG		M.A.	1982
MALAYSIA		SUN, PETER LIN	
UNIV. OF MALAYA		DEPT. OF AQUA., NATIONAL PINGTUN	
B.A.	1979	NEI PU	
AUBURN UNIV.		PINGTUNG 91207	
M.S.	1983		

TAIWAN, R.O.C.
 AUBURN UNIV.
 M.S. 1976
 CHINESE CULTURE UNIV.
 PH.D. 1987

TISSERA, VINDHYA
 FRESHWATER FISH BREEDING & EXPER.
 BAMBARAKELLE
 NUWARAELIYA
 SRI LANKA
 ASTRAKHAN TECH. INST. OF
 M.S. 1981

TRIPATHI, SATYENDRA DATT
 CENTRAL INST. OF FRESHWATER
 P.O. KAUSALYAGANG 731002
 ORISSA
 INDIA
 VICTORIA COLLEGE, GWALIOR
 B.S. 1954
 VICTORIA COLLEGE, GWALIOR
 M.A. 1956
 MLB COLLEGE, GWALIOR
 M.S. 1958
 MEERUT UNIV.
 PH.D. 1987

UYEH, EMMANUEL WAYA
 PUBLIC AND GOVERNMENT AFFAIRS
 SHELL P.O. BOX 230
 YARRI
 NIGERIA
 AUBURN UNIV.
 ATP-CERTIFICATE 1982
 COLLEGE OF AGRICULTURE,
 NATIONAL 1965

VALQUEZ, OLGA ELENA
 UNIV. OF PANAMA
 B.S. 1982

VARELA, ZOEL

MONTEVIDEO
 URUGUAY
 UNIV. DE LA REPUBLICA
 DR. 1978

VARIKUL, VANICH
 DEPT. OF FISHERIES
 RAJANMERN AVE.
 BANGKOK
 THAILAND
 KASETSART UNIV.
 B.S. 1955
 AUBURN UNIV.
 M.S. 1965

VASQUEZ CH., FRANCISCO E.
 "TUNARI" BOTTLING COMPANY
 P.O. BOX 557
 COCHABAMBA
 BOLIVIA
 AUBURN UNIV.
 ATP CERTIFICATE

VASQUEZ, OLGA ELENA
 AUBURN UNIVERSITY
 M.S. 1984

VASQUEZ, OLGA ELENA
 LABORATORIA DE DIAGNOSTICO
 GERARDINO MEDIAN, MIDA
 APDO. 5390, ZONA 5
 PANAMA
 UNIV. PANAMA
 B.S. 1982
 AUBURN UNIV.
 M.S. 1984

WADAHAR, G. MUJTABA
 DIRECTORATE OF FISHERIES,
 BLOCK-50, PAK SECRETARIATE
 SADAR KARACHI
 PAKISTAN

61

APPENDIX C
FORMAT OF CURRENT PRODUCTION
PRACTICES OF AQUATIC SPECIES

Auburn University

Auburn University, Alabama 36849-5419

College of Agriculture

Department of Fisheries
and Allied Aquacultures

August 12, 1987

Telephone: (205) 826-4786
Telex: 5106002392

International Center
for Aquaculture

United States of America

Dear _____

In our earlier correspondence we have discussed your participation in helping to describe Current Production Practices for a number of aquatic organisms. We would like you to describe the production of _____ in your area.

Enclosed are the following outlines to assist you in describing the production practices. Please try and cover the details described in the outlines when appropriate. The outlines are:

1. General Information
2. Broodstock Management
3. Reproduction
4. Artificial Incubation
5. Nursery Phase
6. Growout (Market) phase

To help standardize descriptions, I am enclosing definitions of the terms used in the outline. Please review this outline as to whether it will adequately describe your conditions and correspond with me before beginning the narrative.

Yours Truly,

Ronald P. Phelps
Associate Professor

RPP/aja

Current Production Practices

General information

Species

common name (es)

Total yearly production for the region being described

Number of producers for region being described

Nature of the market for the product being produced

What percent of the production of this organism in the region is produced by the method being described

What characteristics of the region (physical, social, economic) make the production method being described suitable for the region

Reproduction

Spawning

Indicate the type of spawning most descriptive for your circumstance

Natural (natural release of egg and sperm)

Free spawn, collect seed as partial harvests
Stock broodstock, harvest seed and broodstock together
Stock broodstock, remove broodstock, culture reproduction in site
Stock broodstock, remove reproduction as eggs or larvae, harvest broodstock

Stimulus given to induce reproduction hormones

type, total dosage
mode of application
frequency of application

environmental modification
type of modification
dimensions of modification

Artificial (eggs and sperm removed by humans from broodstock and mixed)

Stimulus given to induce reproduction hormones

type, total dosage
mode of application
frequency of application

environmental modification
type of modification
dimensions of modification
time between first exposure to stimulus and ovulation

Facilities and management practices associated with reproduction

Spawning/nursery (describe separately if appropriate, spawning vs nursery facilities and their use)
facility characteristics

(pond, pen, cage, raceway, rack, raft)
material (earthen, concrete etc)
size
depth
number/unit area (i.e. no. ponds/___ ha farm)
/m³ water

Water supply
quality

weight broodstock recovered

no. seed recovered

weight of seed recovered

Labor requirement

Pond preparation Stocking Fertilizing/Feeding Other mgt Harvesting Marketin

Number of individuals

Total No. man hours

Broodstock Management

Broodstock Characteristics

Age, size and weight at maturity (by sex)
Frequency of spawning per broodstock
Spawning season
Percent broodstock used each spawning period
Average weight of fish used (give mean,
minimum and maximum)
Number of spawns per broodstock during
its life as broodstock
Quantity of eggs/kg of broodstock/spawn
Mortality of broodstock/spawning period

Maturation Process

Source of broodstock

Nature of holding conditions
facility (ponds, tanks, cages etc)
no. used, average size
construction material

Density at which broodstock are held
in a given facility

Time period broodstock are held in a
given facility

Source of broodstock

Captured directly from the wild
Purchased for each season (source wild or
cultured)
Production ponds
Broodstock ponds
Other (describe)

Water management associated with the facility

frequency of water exchange
water quality (O₂, temperature,
hardness, salinity)

Nutrient Input

feed
form (meal, pellets, etc)
% protein
 % animal
 % vegetable
quantity
frequency of application
presentation/application

fertilizer
inorganic
chemical composition

quantity applied
frequency of application
mode of application

Water quality or disease management
type management
frequency

Selection of Broodstock for spawning
Collected in mass from holding
facility, no selection by sex,
degree of maturity, or other characteristics

Selected individually based on
sex
degree of maturity
other characteristics (describe)

sex ratio

Nutrient and Input

Feed

form (meal, pellet, etc)

% protein

% animal

% vegetable

quantity

frequency of application

presentation-application

Fertilizer

inorganic

organic

chemical composition

quantity applied

frequency of application

mode of application

Water quality or disease management

type management

frequency

Harvest procedure

type (partial-complete)

equipment

length of time between stocking & harvesting

transportation

Production

no. broodstock recovered

Nursery

Spawning-nursery phase

Culture facility characteristics

(pond, pen, cage, raceway, rack, raft)

nature (earthen, concrete etc)

size

depth

number/unit area

/m³ water

Water supply

quality

chemistry

temperature

quantity used per crop

frequency of exchange

Preparation of facilities before

stocking

activity

time between activity and

stocking

materials used

quantity

quality

Stocking

broodfish aver. length by sex

weight " "

density

chemistry
temperature
quantity used per crop
frequency of exchange

Preparation of facilities before stocking
activity
time between activity and stocking
materials used
quantity
quality

Stocking
broodstock aver. length by sex
weight by " "

density
sex ratio

Nutrient and Input
Feed
form (meal, pellet, etc)
% protein
% animal
% vegetable
quantity
frequency of application
presentation-application

Fertilizer
inorganic
organic
chemical composition
quantity applied
frequency of application
mode of application

Water quality or disease management
type management
frequency

Harvest procedure
type (partial-complete)
equipment
length of time between stocking & harvesting
transportation

Production
no. broodstock recovered
weight broodstock recovered
no. seed recovered
weight of seed recovered

Labor requirement

Pond preparation Stocking Fertilizing/Feeding Other mgt Harvesting Marketing

Number of individuals
Total No. man hours

Foodfish Production

grow-out phase

Culture facility characteristics

facility (pond, pen, cage, raceway, rack, raft)

nature (earthen, concrete)

size

depth

number/unit area

/ m³ water

other

Water supply

quality

chemistry

temperature

quantity used for crop

frequency of exchange

Stocking

initial size (length, weight)

density

other characteristics

Nutrient Input

feed

form (meal, pellets, etc)

% protein (feeds)

% animal

% vegetable

quantity

frequency of application

presentation/application

Fertilizer

inorganic

organic

chemical composition

quantity applied

frequency of application

mode of application

Water quality or disease management

type management

frequency

Harvest procedure

type (partial, complete)

culture period

frequency

equipment

Production

mean final size

mean final weight

yield (total biomass)

net production

% survival

final density/unit area

other biomass produced

% yield marketable

Marketing

location (on-farm, off-farm, etc)

form (live, processed, etc)

volume marketed per transaction

equipment

Labor requirements (for all of the above activities)

Stocking Fertilizing/Feeding Other mgt Harvesting Marketing

Number of individuals

Total no. manhours

APPENDIX D
LIST OF ICA RESEARCH AND DEVELOPMENT
SERIES PUBLICATIONS

RESEARCH AND DEVELOPMENT SERIES

Auburn University
International Center for Aquaculture

NUMBER	DATE	AUTHOR AND TITLE
1	September 1972	Jeffrey, N. B., Progress Report on Fisheries Development in Northeastern Brazil I, 10p.
2	November 1972	Davies, W. D., Progress Report on Fisheries Development in Northeastern Brazil II., 14p.
3	February 1973	Sidthimunka, A., Length-Weight Relationships of Freshwater Fishes of Thailand, 25p.
4	March 1973	Schmittou, H. R., Artificial Spawning of Mullet and Culture of Mullet and Milkfish in Taiwan, 8p.
5	March 1973	Schmittou, H. R., Aquacultural Survey in Japan, 18p.
6	February 1974	McCoy, E. W., Economic Analysis of the Inland Fisheries Project in El Salvador, 15p.
7	April 1974	Bayne, D. R., Progress Report on Fisheries Development in El Salvador, 11p.
8	December 1974	Jensen, J. W., Progress Report on Fisheries Development in Brazil, 10p.
9	April 1975	Lovshin, L. L., Progress Report on Fisheries Development in Northeast Brazil, 11p.
10	January 1976	Jensen, J. W., Progress Report on Fisheries Development in Northeast Brazil, 7p.
11	November 1976	Hopkins, M. L., and E. W. McCoy, Marketing of Fisheries Products by Municipal Fishermen in Panguil Bay, Philippines, 12p.
12	January 1977	Parkman, R. W., and E. W. McCoy, Fish Marketing in El Salvador, 19p.
13	February 1977	Parkman, R. W., and E. W. McCoy, Marketing as a Factor in Fish Culture Development in El Salvador. 11p.
14	July 1977	Lovshin, L. L., Progress Report on Fisheries Development in Northeast Brazil, 11p.
15	October 1977	Hughes, D. G., Progress Report on Fisheries Development in El Salvador, 16p.

NUMBER	DATE	AUTHOR AND TITLE
16	November 1977	Lovell, R. T., Fish Culture in Poland. 7p.
17	February 1978	Street, D. R., The Socio-Economic Impact of Fisheries Programs in El Salvador. 14p.
18	March 1978	Dourado, O. F., and W. D. Davies, Length-Weight Relationships and Condition Indices of Fishes from Reservoirs of Ceara, Brazil. 7p.
19	August 1978	Street, D. R., An Economic Assessment of Jamaica's Fish Culture Program. 8p.
20	December 1978	Street, D. R., An Economic Assessment of Fisheries Development in Colombia. 10p.
21	March 1979	Sevilleja, R. C., and E. W. McCoy, Fish Marketing in Central Luzon, Philippines. 23p.
22	April 1979	Boyd, C. E., and F. R. Lichtkoppler, Water Quality Management in Pond Fish Culture. 30p.
23	April 1979	Cremer, M. C., and B. L. Duncan, Brackishwater Aquaculture Development in Northern Sumatra, Indonesia. 11p.
24	May 1979	McCoy, E. W., and M. L. Hopkins, Method of Conducting a Marketing Study. 19p.
25	November 1979	Crance, J. H., and D. F. Leary, The Philippine Inland Fisheries Project and Aquaculture Production Project-Completion Report. 23p.
26	February 1980	Lovshin, L. L., Progress Report on Fisheries Development in Northeast Brazil. 15p.
27	September 1980	Malvestuto, S. P., R. J. Scully and F. Garzon F., Catch Assessment Survey Design for Monitoring of the Upper Meta River Fishery, Colombia, South America. 15p. also published in Spanish.
28	November 1980	Grover, J. H., D. R. Street and P. D. Starr, Review of Aquaculture Development Activities in Central and West Africa. 31p.
29	November 1982	Duncan, B. L., The Indonesia Brackishwater Aquaculture Production Project - Completion Report. 18p.
30	May 1983	Johnson, M. C., Commercial Fish Farming in Nigeria. 24p.

NUMBER	DATE	AUTHOR AND TITLE
31	October 84	T. J. Popma, F. E. Ross, B. L. Nerrie and J. R. Bowman, The Development of Commercial Farming of Tilapia in Jamaica 1979-1983. 18p.
32	November 1985	H. R. Schmittou, J. H. Grover, S. B. Peterson, A. R. Rabanal, A. A. Portugal, and M. Adriano, Development of Aquaculture in the Philipppnes. 31p.
33	December 1986	L. L. Lovshin, N. B. Schwartz, V. C. de Castillo, C. R. Engle, U. L. Hatch, Cooperative Managed Rural Panamanian Fish Ponds: The Integrated Approach. 47p.

71'

APPENDIX E

SHORT-TERM WORK CARRIED OUT BY ICA STAFF, 1982-1986

INTERNATIONAL CENTER FOR AQUACULTURE
SHORT-TERM ASSIGNMENTS 1982

DATE	COUNTRY	STAFF	PROJECT	DAYS
01/02/82-01/16/82	Panama	N. P. Schwartz	PANAMA AQUA DEV	15
01/03/82-01/15/82	Philippines	J. O. Avault	AID/DSAN-C-0053	13
01/06/82-01/19/82	Philippines	J. P. Snow	AID/DSAN-C-0053	18
01/11/82-02/18/82	Suriname	C. E. Eoyd	GOVERNMENT OF SURINAME	08
02/01/82-02/15/82	Egypt	D. D. Moss	JMM/KNBS EGYPT	15
02/10/82-03/25/82	Philippines	H. R. Schmittou	AID/DSAN-C-0053 & COOP AGREE	44
02/12/82-03/19/82	Philippines	J. H. Grover	AID/DSAN-C-0053 & COOP AGREE	36
02/13/82-03/16/82	Philippines	S. Peterson	AID/DSAN-C-0053 & COOP AGREE	32
03/07/82-03/20/82	Panama	R. J. Scully	GOVERNMENT OF PANAMA	14
04/11/82-04/24/82	Dominican Republic	R. P. Phelps	COOPERATIVE AGREEMENT	14
04/14/82-05/31/82	Jamaica	R. Manning	AID/LA-C-1166 CA	48
05/02/82-05/06/82	Israel	R. O. Smitherman	CMT/ME	05
05/06/82-05/17/82	France	J. H. Plumb	FAA	12
05/07/82-05/15/82	Egypt	R. O. Smitherman	CMT/ME	08
05/04/82-05/25/82	Egypt	A. A. Khater	CMT/ME	22
05/01/82-05/07/82	Taiwan	R. T. Lovell	AMERICAN SOYBEAN ASSOCIATION	07
05/08/82-05/14/82	Philippines	R. T. Lovell	AMERICAN SOYBEAN ASSOCIATION	07
05/26/82-05/29/82	Israel	A. A. Khater	CMT/ME	04
05/30/82-06/04/82	Egypt	A. A. Khater	CMT/ME	06
06/04/82-05/15/82	Israel	W. L. Shelton	CMT/ME	11
06/13/82-06/16/82	Finland	R. T. Lovell	USDA	04
06/16/82-06/22/82	Egypt	W. L. Shelton	CMT/ME	07
06/30/82-08/02/82	Niger	S. P. Malvestuto	COOP AGREE	34
07/04/82-08/03/82	Panama	N. P. Schwartz	PANAMA AQUA DEV	30
07/10/82-09/22/82	Ecuador	D. G. Hughes	PEACE CORPS	73
08/01/82-08/07/82	Netherlands	W. L. Shelton	WATER RESOURCES	07
08/08/82-08/21/82	Dominican Republic	R. P. Phelps	COOP AGREE	14
09/19/82-09/26/82	Panama	E. W. Shell	PANAMA AQUA DEV	08
10/17/82-11/14/82	Peru	R. P. Phelps	COOP AGREE	27
10/26/82-11/24/82	Jamaica	M. C. Cremer	JAMAICA AQUA DEV	30
11/18/82-12/19/82	Burundi	R. J. Scully	COOP AGREE	32
11/18/82-12/19/82	Burundi	J. F. Moehl	COOP AGREE	32
11/21/82-12/10/82	Egypt	D. R. Rouse	JMM/KNBS EGYPT	20
11/24/82-12/11/82	Panama	D. G. Hughes	COOP AGREE	18
11/24/82-12/11/82	Panama	R. P. Phelps	COOP AGREE	18
11/29/82-12/03/82	Honduras	D. D. Moss	CRSP	05
12/05/82-12/11/82	Jamaica	E. W. Shell	JAMAICA AQUA DEV	07
12/05/82-12/20/82	Niger	S. P. Malvestuto	COOP AGREE	16
12/05/82-12/20/82	Niger	J. M. Sullivan	COOP AGREE	16

737 days
2.02 person year

CHRONOLOGICAL LIST OF SHORT-TERM FOREIGN WORK
CARRIED OUT BY THE STAFF OF
THE INTERNATIONAL CENTER FOR AQUACULTURE

Department of Fisheries and Allied Aquacultures
Auburn University, Alabama 36830
December 1983

DATE	COUNTRY	STAFF	PROJECT	PERSON DAYS
01/02/83-01/15/83	Panama	N. B. Shwartz	PANAMA AQUA DEV	14
01/03/83-01/21/83	Jamaica	M. C. Cremer	AID/LA-C-1166	18
01/15/83-02/26/83	Zimbabwe	S. P. Malvestuto	SECID	30
01/16/83-01/30/83	Dominican Republic	R. P. Phelps	COOPERATIVE AGREEMENT	15
01/31/83-03/07/83	Brazil	L. L. Lovshin	PANAMA AQUA DEV	07
01/29/83-02/07/83	Taiwan	J. A. Plumb	UN GARR 211-028	10
01/29/83-02/07/83	Taiwan	W. A. Rogers	UN GARR 211-028	10
02/08/83-02/11/83	Thailand	J. A. Plumb	COOPERATIVE AGREEMENT	03
02/08/83-02/11/83	Thailand	W. A. Rogers	COOPERATIVE AGREEMENT	03
04/04/83-04/24/83	Cameroon	S. P. Malvestuto	PEACE CORPS	19
04/21/83-05/15/83	Jamaica	J. McAllister	AID/LA-C-1166	25
04/25/83-05/03/83	Morocco	S. P. Malvestuto	PEACE CORPS	08
04/24/83-05/15/83	Dominican Republic	R. P. Phelps	COOPERATIVE AGREEMENT	21
04/24/83-05/15/83	Dominican Republic	L. U. Hatch	COOPERATIVE AGREEMENT	21
05/01/83-05/07/83	Italy (FAO)	K. L. Veberica	RWANDA AQUA DEV	07
05/01/83-05/07/83	Italy (FAO)	J. F. Moehl	RWANDA AQUA DEV	07
05/07/83-05/15/83	Israel	R. O. Smitherman	NUMSC-298-0160	09
05/07/83-05/15/83	Israel	T. J. Popma	AID/LA-C-1166	09
05/07/83-05/15/83	Israel	B. L. Nerrie	AID/LA-C-1166	09
05/07/83-05/15/83	Israel	J. R. Bowman	AID/LA-C-1166	09
05/07/83-05/15/83	Israel	J. R. Snow	COOPERATIVE AGREEMENT	09
05/07/83-05/15/83	Israel	G. L. Jensen	COOPERATIVE AGREEMENT*	09
05/07/83-05/15/83	Israel	M. C. Johnson	COOPERATIVE AGREEMENT*	09
05/07/83-05/15/83	Israel	L. L. Lovshin	PANAMA AQUA DEV	09
05/16/83-06/18/83	Egypt	R. O. Smitherman	NUMSC-298-0160	03
05/26/83-06/09/83	Sudan	R. P. Phelps	COOPERATIVE AGREEMENT	15
05/26/83-06/08/83	Sudan	W. D. Davies	COOPERATIVE AGREEMENT	14
06/05/83-06/25/83	Jamaica	G. M. Sullivan	AID/LA-C-1166	21
06/06/83-06/10/83	Jamaica	J. A. Plumb	AID/LA-C-1166	05
06/09/83-06/10/83	Egypt	W. D. Davies	COOPERATIVE AGREEMENT	02
06/19/83-06/26/83	Panama	R. O. Smitherman	PANAMA AQUA DEV	07
08/01/83-10/29/83	Panama	N. B. Schwartz	PANAMA AQUA DEV	91
08/02/83-08/16/83	Rwanda	E. A. Malek	RWANDA AQUA DEV	15
08/26/83-09/09/83	Niger	S. P. Malvestuto	PEACE CORPS	14
08/29/83-09/27/83	People's Republic China	M. C. Johnson	WORLD BANK	30
09/13/83-09/18/83	Panama	R. P. Phelps	PANAMA CRSP	05
09/18/83-09/21/83	Costa Rica	R. P. Phelps	TRAINING PROGRAM	03
09/21/83-09/23/83	Honduras	R. P. Phelps	HONDURAS CRSP	03
08/28/83-09/03/83	Honduras	L. L. Lovshin	FAO	07
10/15/83-10/28/83	Panama	L. U. Hatch	STRENGTHENING GRANT	07
10/16/83-10/22/83	Dominican Republic	R. P. Phelps	COOPERATIVE AGREEMENT	07
11/01/83-11/21/83	Philippines	J. R. Snow	COOPERATIVE AGREEMENT	21
10/31/83-11/21/83	Philippines	J. W. Avault	COOPERATIVE AGREEMENT	22
11/22/83-12/05/83	Gabon	S. P. Malvestuto	PEACE CORPS	10

* Travel costs only supported through the Cooperative Agreement

<u>Under Coop. Agreement</u>	<u>Total Short-Term</u>
171 days short-term	592 days
5.70 person months	19.73 person months
or 0.48 person years	1.62 person years

CHRONOLOGICAL LIST OF SHORT-TERM FOREIGN WORK
CARRIED OUT BY STAFF OF
THE INTERNATIONAL CENTER FOR AQUACULTURE

Department of Fisheries and Allied Aquacultures
Auburn University, Alabama 36830

December, 1984

DATE	COUNTRY	STAFF	PROJECT	PERSON DAYS
01/22/84-02/07/84	Dominican Republic	R. P. Phelps	COOPERATIVE AGREEMENT	16
02/18/84-02/23/84	France	J. A. Plumb	OFFICE OF INT. EPITIZOOLOGY	09
02/19/84-03/11/84	Rwanda	D. D. Moss	RWANDA PROJECT	21
02/25/84-03/01/84	Panama	G. Buchanan	STRENGTHENING GRANT	04
03/05/84-03/19/84	Costa Rica	L. L. Lovshin	COOPERATIVE AGREEMENT	14
03/05/84-03/19/84	Costa Rica	T. J. Popma	COOPERATIVE AGREEMENT	14
03/13/84-03/24/83	Niger	S. P. Malvestuto	COOPERATIVE AGREEMENT	10
04/01/84-04/14/84	Panama	L. U. Hatch	PANAMA AQUA DEV	14
04/06/84-04/16/84	Tunisia	W. D. Davies	PEACE CORPS	10
05/21/84-06/13/84	Cameroon	B. L. Duncan	COOPERATIVE AGREEMENT	23
06/02/84-06/16/84	Panama	J. Molnar	STRENGTHENING GRANT	14
06/02/84-06/16/84	Panama	N. B. Schwartz	PANAMA AQUA DEV	15
06/13/84-06/19/84	Togo	B. L. Duncan	COOPERATIVE AGREEMENT	07
06/16/84-06/18/84	Jamaica	R. O. Smitherman	REGIONAL PROJECT	03
06/26/84-06/28/84	Costa Rica	D. G. Hughes	COSTA RICA	03
07/04/84-07/10/84	Ecuador	T. J. Popma	UNIVERSITY OF FLORIDA	06
07/05/84-07/09/84	Ivory Coast	J. F. Moehl	RWANDA PROJECT	04
07/08/84-07/12/84	Puerto Rico	S. P. Malvestuto	USFWS	05
07/15/84-07/28/84	Dominican Republic	R. P. Phelps	COOPERATIVE AGREEMENT	14
08/21/84-09/03/84	Niger	S. P. Malvestuto	COOPERATIVE AGREEMENT	25
09/02/84-09/07/84	Honduras	R. P. Phelps	AQUA CRSP	05
09/08/84-09/13/84	Panama	R. P. Phelps	AQUA CRSP	05
09/19/84-09/25/84	Rome	B. L. Duncan	UN-FAO	06
09/09/84-09/14/84	Israel	A. Khater	MARINE TECH PROG. MID EAST	05
09/23/84-09/30/84	Yugoslavia	W. D. Davies	USDA-OICD	07
10/07/84-10/24/84	Rwanda	R. P. Phelps	RWANDA PROJECT	18
10/09/84-11/29/84	People's Republic China	M. C. Johnson	WORLD BANK	24
10/25/84-11/12/84	Cameroon	S. P. Malvestuto	PEACE CORPS	19
10/26/84-12/10/84	Indonesia	G. M. Sullivan	RDA/AID	46
11/03/84-11/17/84	Dominican Republic	R. P. Phelps	COOPERATIVE AGREEMENT	14
11/03/84-11/10/84	Dominican Republic	T. J. Popma	COOPERATIVE AGREEMENT	07
11/09/84-12/01/84	Indonesia	H. R. Schmittou	IADS/WORLD BANK	23
11/11/84-11/16/84	Dominican Republic	L. L. Lovshin	COOPERATIVE AGREEMENT	05
11/29/84-12/19/84	India	C. E. Boyd	UN/FAO	20
12/03/84-12/09/84	Philippines	R. T. Lovell	SEAFDEC	06
12/11/84-12/23/84	Philippines	J. Molnar	AGRICULTURE EXPERIMENT STAT	12

Under Coop. Agreement

124 days short-term
4.13 person months
or 0.34 person years

Total Short-term

453 days
14.9 person months
or 1.24 person years

SHORT-TERM WORK CARRIED OUT
BY STAFF OF THE
INTERNATIONAL CENTER FOR AQUACULTURE
AUBURN UNIVERSITY, AL 36849
1985

DATE	COUNTRY	STAFF	PROJECT	DAYS
01/23/85-01/30/85	Honduras	D. G. Hughes	USAID HONDURAS	
01/19/85-01/22/85	Rome	B. L. Duncan	UN/FAO	03
01/22/85-02/08/85	Honduras	D. B. Rouse	COOP AGREE/USAID	16
01/22/85-01/25/85	Malaysia	B. L. Duncan	UN/FAO	03
01/25/85-01/29/85	Rome	B. L. Duncan	UN/FAO	04
01/27/85-02/02/85	Indonesia	E. W. Shell	COOPERATIVE AGREE	06
01/27/85-02/08/85	Rwanda	D. D. Moss	RWANDA PROJECT	12
02/02/85-02/07/85	Thailand	E. W. Shell	AQUACULTURE CRSP	05
02/14/85-02/22/85	Peru	R. P. Phelps	JOINT-PVO	08
02/16/85-02/22/85	Rwanda	E. W. Shell	AQUACULTURE CRSP	12
02/21/85-03/01/85	Panama	R. O. Smitherman	JOINT-PVO	09
02/21/85-03/01/85	Panama	B. L. Duncan	JOINT-PVO	09
02/21/85-03/03/85	Niger	S. P. Malvestuto	COOPERATIVE AGREE	10
02/22/85-03/01/85	Bolivia	R. P. Phelps	JOINT-PVO	08
03/02/85-03/10/85	Guatemala	R. O. Smitherman	JOINT-PVO	08
03/02/85-03/10/85	Guatemala	B. L. Duncan	JOINT-PVO	08
04/08/85-04/26/85	Mexico	J. H. Grover	GOV'T OF MEXICO	19
04/08/85-04/26/85	Mexico	R. P. Phelps	GOV'T OF MEXICO	19
04/08/85-05/04/85	Indonesia	B. L. Duncan	JOINT-PVO	28
04/21/85-05/08/85	Honduras, Mexico, Guatemala, Panama, Costa Rica	R. O. Smitherman	AM. SOYBEAN ASSOC	18
04/22/85-05/04/85	Indonesia	T. J. Popma	JOINT-PVO	13
05/04/85-05/08/85	Thailand	B. L. Duncan	JOINT-PVO	04
05/04/85-05/17/85	New Guinea	T. J. Popma	JOINT-PVO	14
05/17/85-05/24/85	Thailand	J. F. Moehl	RWANDA PROJECT	08
06/16/85-06/29/85	Dominican Republic	R. P. Phelps	JOINT-PVO	14
07/01/85-07/13/85	Rwanda	M. C. Cremer	JOINT-PVO	13
07/14/85-07/27/85	Egypt	M. C. Cremer	JOINT-PVO	14
07/14/85-07/17/85	Peru	R. P. Phelps	JOINT-PVO	14
07/27/85-08/05/85	Bolivia	R. P. Phelps	JOINT-PVO	10
07/01/85-07/12/85	Rwanda	B. L. Duncan	JOINT-PVO	12
07/13/85-07/19/85	Tanzania	B. L. Duncan	JOINT-PVO	07
08/13/85-08/28/85	Jordan	B. L. Duncan	NEAR EAST FOUND.	16
08/04/85-9/01/85	Ecuador	P. W. Taylor	COOP AGREE/USAID ECUADOR	29
08/16/85-08/22/85	Dominica	D. B. Rouse	USAID/DOMINICA	07
08/22/85-08/30/85	Costa Rica	S. P. Malvestuto	PEACE CORPS	08
08/26/85-09/04/85	Spain	L. U. Hatch	AL. AG. EXP. STA., AMER. AG. ECON., ASSOC.	10
09/01/85-09/10/85	France	C. E. Boyd	COOPERATIVE AGREE	10
09/16/85-09/27/85	Honduras	D. B. Rouse	COOP AGREE/USAID	12
09/23/85-09/27/85	Spain	R. T. Lovell	AM. SOYBEAN ASSOC	04

DATES	COUNTRY	STAFF	PROJECT	DAYS
09/15/85-09/20/85	Panama	R. P. Phelps	CRSP	05
09/20/85-09/26/85	Honduras	R. P. Phelps	CRSP	06
10/11/85-11/09/85	Egypt	C. D. Busch	COOPERATIVE AGREE	30
10/09/85-10/14/85	Honduras	L. L. Lovshin	U.S. PEACE CORPS	05
10/20/85-10/26/85	Argentina	L. L. Lovshin	GOA	07
10/26/85-10/30/85	Brazil	L. L. Lovshin	FAA	04
11/19/85-12/07/85	Nepal	J. R. Snow	JOINT-PVO	19
11/12/85-11/29/85	Ecuador	D. G. Hughes	INTER AMERICAN DEVELOPMENT BANK	17
12/14/85-12/20/85	Dominica	D. B. Rouse	USAID/DOMINICA	06
12/15/85-12/20/85	Panama	R. T. Lovell	STRENGTHENING GRANT	05

			DY	MO.
		J/PVO	217	7.2
SHORT-TERM WORK CARRIED OUT		CA	147	4.9
BY STAFF OF THE		PC	30	1.0
INTERNATIONAL CENTER FOR AQUACULTURE		PSG	38	1.3
AUBURN UNIVERSITY, AL 36849		USAID	34	1.1
1986		CRSP	12	0.4
		OTHER	87	2.9
			565	=18.8= 1.5 yr.

DATE	COUNTRY	STAFF	PROJECT	DAYS
01/06/86-01/19/86	Indonesia	B. L. Duncan	JOINT/PVO	13
01/20/86-01/24/86	Thailand	B. L. Duncan	JOINT/PVO	04
01/21/86-02/02/86	Bolivia	R. P. Phelps	JOINT/PVO	13
01/25/86-01/31/86	Sri Lanka	B. L. Duncan	JOINT/PVO	06
02/06/86-02/28/86	Rwanda	D. D. Moss	RWANDA PROJECT	22
03/01/86-03/19/86	India	D. B. Rouse	USDA/OICD	19
03/04/86-03/18/86	Cameroon	B. L. Duncan	JOINT/PVO	14
03/04/86-03/18/86	Cameroon	F. H. Meriwether	JOINT/PVO	14
03/19/86	Kenya	B. L. Duncan	JOINT/PVO	01
03/19/86	Kenya	F. H. Meriwether	JOINT/PVO	01
03/20/86-03/25/86	Sudan	B. L. Duncan	JOINT/PVO	05
03/20/86-03/25/86	Sudan	F. H. Meriwether	JOINT/PVO	05
04/10/86-04/18/86	Egypt	J. H. Grover	COOPERATIVE AGREE	09
04/14/86-04/18/86	Antigua	D. B. Rouse	USAID/PRIVATE SECTOR	05
04/25/86-05/11/86	Niger	S. P. Malvestuto	COOPERATIVE AGREE	17
05/12/86-05/28/86	Senegal	B. L. Duncan	JOINT/PVO	17
05/11/86-05/17/86	El Salvador	R. P. Phelps	COOPERATIVE AGREE	07
05/26/86-06/03/86	Bolivia	R. P. Phelps	JOINT/PVO	09
06/01/86-06/30/86	Ecuador	S. P. Malvestuto	PEACE CORPS	30
06/15/86-06/21/86	Dominican Republic	L. L. Lovshin	AID/MOOREHOUSE COLLEGE	07
07/01/86-08/02/86	Kenya & Zimbabwe Uganda, Congo	R. E. Brummett	JOINT/PVO	33
07/17/86-07/24/86	Jamaica	B. L. Nerrie	RWANDA PROJECT	07
07/21/86-08/04/86	Panama	C. E. Boyd	STRENGTHENING GRANT	05
07/22/86-08/04/86	Egypt	J. H. Grover	COOPERATIVE AGREE	14
07/26/86-07/31/86	Honduras	C. E. Boyd	STRENGTHENING GRANT	06
07/27/86-08/02/86	Egypt	L. L. Lovshin	JOINT/PVO	06
07/24/86-08/08/86	Egypt	R. P. Phelps	COOPERATIVE AGREE	16
08/02/86-08/10/86	Thailand	J. A. Plumb	FAO	08
08/03/86-08/15/86	Egypt	L. L. Lovshin	COOPERATIVE AGREE	13
08/07/86-08/22/86	Egypt	D. B. Rouse	COOPERATIVE AGREE	16
08/11/86-08/25/86	Somalia	K. H. Yoo	JOINT/PVO	14
08/14/86-08/24/86	Egypt	D. D. Moss	COOPERATIVE AGREE	11
08/15/86-08/25/86	Bangladesh	J. H. Grover	JOINT/PVO	11
08/25/86-09/13/86	Sri Lanka	J. H. Grover	JOINT/PVO	20
09/01/86-09/14/86	Indonesia	B. L. Duncan	JOINT/PVO	14
10/18/86-11/01/86	Honduras	R. P. Phelps	CRSP POND DYNAMICS	06
09/07/86-09/27/86	Guatemala	L. L. Lovshin	USAID/COOPERATIVE AGREE	20
09/07/86-09/20/86	Guatemala	W. L. Shelton	USAID/COOPERATIVE AGREE	13
09/07/86-09/12/86	Panama	R. P. Phelps	CRSP POND DYNAMICS	06
09/14/86-09/19/86	Thailand	B. L. Duncan	JOINT/PVO	07
09/14/86-10/02/86	Panama	D. B. Rouse	PROGRAM SUPPORT GRANT	14
09/23/86-09/26/86	Jamaica	J. A. Plumb	AQUALPIA LIMITED	03
09/28/86-10/02/86	Brazil	R. T. Lovell	BRAZILIAN COLLEGE OF ANIMAL NUTRITION	09
11/16/86-11/20/86	Mexico	R. P. Phelps	AU/AG. EXP. STA.	04
11/19/86-11/29/86	Guatemala	L. U. Hatch	COOPERATIVE AGREE	11
11/20/86-11/29/86	Guatemala	R. P. Phelps	JOINT/PVO	09
11/30/86-12/16/86	Guatemala, Panama, Costa Rica, El Salvador, Belize, Honduras	D. D. Moss M. E. Marvel	AU INT. PROG. AU INT. PROG.	18 18
12/07/86-12/20/86	Ecuador	C. E. Boyd	PROGRAM SUPPORT GRANT	13
12/02/86	Ecuador	T. J. Popma	JOINT/PVO	01

APPENDIX F
A LIST OF PARTICIPANTS COMPLETING THE AQUACULTURE TRAINING
PROGRAM, 1982-1986

NAME	COUNTRY	TITLE/POSITION OF EMPLOYMENT
March - September 1982		
Aremu, Fasola	Nigeria	Senior Fisheries Officer, Oyo State
Barah, John-Bosco	Cameroon	Chief of Ku-Bome Fish Station
Bukhair, Feisal	Saudi Arabia	Fisheries Biologist, Fisheries Research Center
Chuah, Toh Thye	Malaysia	Fisheries Officer, Fisheries Research Center
DiNapoli, Paola	Italy	Researcher, Government Lab.
Dlamini, James	Swaziland	Fisheries Extension Office, Government of Swaziland
Esin, Joe	Nigeria	Farm Manager, Bendel Tiffany Farm
Faturoti, Emmanuel	Nigeria	Prof., University of Ibaden Nigeria
Msibi, Johannes	Swaziland	Fisheries Extension Officer, Government of Swaziland
Nolla, Rene	Cameroon	Fisheries Extension Officer, Government of Cameroon
Olatubonsun, Olatude	Nigeria	Senior Fisheries Officer, Oyo State Government
Orajaka, Boniface	Nigeria	Fisheries Officer, Anabra Dev. Authority
Orin, Rollins	Guyana	Aquaculture Supervisor, Guayana Sugar Corp.
Soto, Gilberto	Mexico	Aquaculturist, Government of Mexico
Tangie, Peters	Cameroon	Chief of Bamessing Fish Station
Texier, Christian	France	Aquaculturist, Private Consultant
Uyeh, Emmanuel	Nigeria	Senior Fisheries Extension Officer
Walters, Guillermo	Panama	Vice Director, Ministry of Agriculture

NAME	COUNTRY	TITLE/POSITION OF EMPLOYMENT
March - July 1983		
Acosta-Rivera, Bienvenido	Dominican Republic	Aquaculturist, Church Development
Atiatullah, Abdulrahman	Saudi Arabia	Loan Officer, Saudi Arabian Agriculture Bank
Bouloud Abderrahmane	Morocco	Fisheries Officer, Government Laboratory
Chishti, Mohammad A.	Pakistan	Deputy Director of Fisheries Ministry of Fisheries
Gueye, Lamine	Senegal	Extension Officer, Government of Senegal
Khan, Shamine A.	Pakistan	Assistant Director, Ministry of Fisheries
Muluh, John T.	Cameroon	Chief of Station, Government of Cameroon
Qureshi, Mohammad	Pakistan	Deputy Director, Ministry of Fisheries
Tissera, Vindhya	Sri Lanka	Aquaculturist, Government Fish Station
Wahyudi. Novenny A.	Indonesia	Assitant Director, of Government Station
Wannigama, Nimal	Sri Lanka	Chief of Government Fish Station
Vaseuquez, Fransico	Bolivia	Aquaculturist, Private Fish Farm

NAME	COUNTRY	TITLE/POSITION OF EMPLOYMENT
March - July 1984		
Amin, Choudhary M.	Pakistan	Assistant Director, Ministry of Fisheries
Cifuentes, William A.	Colombia	Biologist, Government Research Station
Corredor, Jorge E.	Colombia	Manager, Private Fish Farm
Duara, Hitendra	India	Fisheries Officer, Government of India
El-Kafrawy, Mahmoud	Egypt	Appraisal Officer, Agricultural Bank
El-Sharkawy, Mabrouk	Egypt	Appraisal Officer, Agricultural Bank
Faiz-ur-Rehman, Qazi	Pakistan	Fish Station Manager, Ministry of Fisheries
Jaffri, Akhtar A.	Pakistan	Assistant Director of Fisheries
Khan, Mohammad A.	Pakistan	Assistant Director of Fisheries
Klusey, Sylvanus	Ghana	Project Officer, Fisheries National Service
Pillai, V. K.	India	Research Officer, Central Marine Fisheries
Sakr, Ahmed A.	Egypt	Appraisal Officer, Agricultural Bank

NAME	COUNTRY	TITLE/POSITION OF EMPLOYMENT
March - July 1985		
Chumacero, Ali	Mexico	Station Director, Ministry of Fisheries
Droussi, Mohammed	Morocco	Station Manager, Government of Morocco
Ortega, Oscar	Panama	Aquaculturist, Ministry of Fisheries
Rodriguez, Jaime	Venezuelan	Director, Church Development Project
Sarhan, Mohammed	Saudi Arabia	Aquaculturist, Government Fisheries
Sarr, Abdou	Senegal	Project Director, Church World Services
Scott, Philip C	Brazil	Manager, Private Fish Farm
Sheriff, Mohammed	Sierra Leone	Aquaculturist, Ministry of Fisheries
Suarez, Jose	Mexico	Researcher, Institute Tech. and Superior Studies
Sukadi, Fatuchri	Indonesia	Aquaculturist, Government Research Laboratory
Velazquez, Francisco	Nicaragua	Aquaculturist, private company

1986 ATP TRAINEES ADDRESSES

- | | |
|--|---|
| <p>1 Lic. Joaquin E. Nadal
 CALLE F #1
 URB. NORDESA III
 SANTO DOMINGO, D.N.
 REPUBLICA DOMINICANA
 (USAID)*</p> | <p>Professor
 UNIVERSIDAD CENTRAL DEL ESTE
 AVE. DE CIRVALACION
 SAN PEDRO DE MACORIS
 REPUBLICA DOMINICA</p> |
| <p>2 Lic. Walter A. Gill Morils A.
 CALLE 92 Y CHACO BOREAL NO 4038
 ASUNCION - PARAGUAY
 SOUTH AMERICA
 (LASPAU)*</p> | <p>Assistant Professor
 INSTITUTO DE CIENCIAS BASICAS
 U.N.A.
 SAN LORENZO- PARAGUAY</p> |
| <p>3 Al-Kattan A.
 ARAMCO
 ABGAIG
 P. O. BOX 428
 SAUDI ARABIA (ARAMCO-Houston, TX)*</p> | <p>Agriculturist, Supervisor Fish Farm</p> |
| <p>4 Pelagie Nyrahabimana
 PROJECT PISICULTURE NATIONALE
 B.P. 132 BUTARE
 RWANDA (EAST CENTRAL AFRICA)
 (USAID)*</p> | <p>Extension Training Program</p> |
| <p>5 Nathanael Hishamunda
 PROJECT PISICULTURE NATIONALE
 B.P. 132 BUTARE
 RWANDA (EAST CENTRAL AFRICA)
 (USAID)*</p> | <p>Fishculture Extension Program</p> |
| <p>6 Anani Ketoglo
 B. P. 2715
 LOME
 TOGO (West Africa)
 (PRIVATE/USAID)*</p> | <p>Leader Private Project
 (Parasatol) B. P. 7070
 LOME TOGO -West Africa</p> |
| <p>7 Francis Oduro-Boateng
 Technology Consultancy Centre (T.C.C.)
 University of Science and Technology (UST)
 KUMASI-ASHANTI
 (USAID)*</p> | <p>Research Officer; Teaching
 Assistant, Aquacultural Extension
 Consultant</p> |
| <p>8 TECN. Luis Campodonico
 ESPOL
 Guayaquil-Ecuador
 (ORGANIZATION OF AMERICAN STATES (OAS)</p> | <p>Investigator, Instructor
 PROYETO PISICOCTL
 FACULTAD ING. MARTIMA Y
 CIENCIAS DEL MAR</p> |

*Indicates sponsoring agency or organization.