



The International Center For Aquaculture

SWIN
HALL
FISHERIES



ANNUAL REPORT FOR FY 1975

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The International Center for Aquaculture — Annual Report for 1975

E. W. SHELL *

FINDINGS FROM 19 research projects, each with the objective of increasing efficiency of some phase of fish production, highlight 1975 work by the International Center for Aquaculture at Auburn University. Each of the projects received support under the grant, AID/csd 2780, under which the International Center was established at the Alabama Agricultural Experiment Station in 1970¹ under authority contained in Section 211 (d) of the Foreign Assistance Act of 1961. International service activities and technical assistance to international development projects overseas also received emphasis during the year.

BACKGROUND OF GRANT

Establishment of the International Center at Auburn University and funding of the overall project, "To Strengthen Specialized Competency in Aquaculture," reflect (1) the importance of aquaculture in developing nations of the world, and (2) Auburn University's competence and worldwide leadership in fisheries.

Aquaculture is becoming increasingly important in developing countries as a means of providing more of the protein needed for adequate diets and as an important contribution to economic growth. It utilizes infertile lands and runoff waters, along with agricultural wastes and surpluses, to intensively grow crops of high quality protein in the form of fish and other aquatic animals, thus greatly increasing the ability of each country to supply the protein needs of its own people. Aquaculture can be used to grow high quality protein locally where it is most needed, thereby reducing the cost of transportation, processing, and refrigeration. It also provides additional needed income and employment for farmers.

Auburn University has received worldwide recognition for its leadership in warmwater fisheries generally and aquaculture specifically. The University is committed to assist developing nations to increase their supplies of high quality protein and improve their economic well-being through improved methods of aquaculture. No other American university presently has such a high capability of providing this type of assistance.

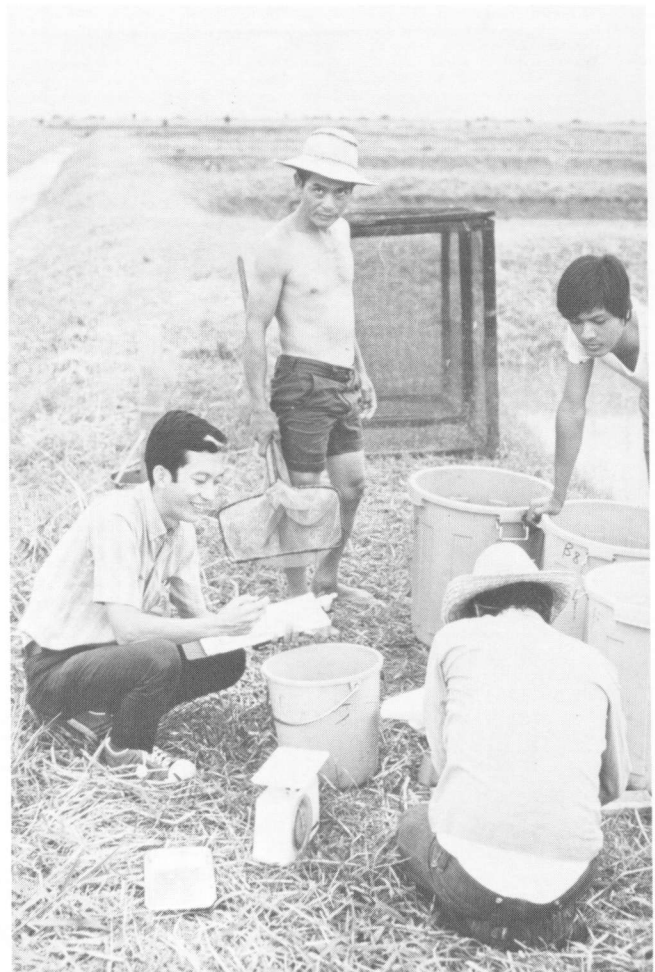
Awarding of the grant provided the resources for strengthening Auburn University's research and teaching programs in aquaculture and its service capabilities for consultation and training in the field. This increased competence will allow the International Center to be of greater service throughout the world in contributing toward aquacultural development. Receiving special attention under the grant

program is the development of methods and procedures of making the University's competence in aquaculture more readily available for those who need it.

GRANT OBJECTIVES

Auburn University proposes the following objectives as being of paramount importance in strengthening the competence of the International Center for Aquaculture.

1. To add to the faculty experts with competence in selected fields who can provide broad technical assistance in aquaculture to developing nations.
2. To develop a library containing worldwide literature on



Aquaculture research in the Philippines by Auburn trained staff.

* Head, Department of Fisheries and Allied Aquacultures, and Director, International Center for Aquaculture.

¹ Agreement signed June 25, 1970, by John H. Hannah, for AID, and President Harry M. Philpott, for Auburn University.

aquaculture and more effective methods of disseminating information on aquaculture.

3. To provide training and educational opportunities through short courses, symposia, and University courses for professional staff members of USAID, other federal agencies, and private foundations; for students interested in careers in international development; for Peace Corps Volunteers; and for foreign nationals.

4. To develop a worldwide collection of data on important food fishes and other aquatic organisms presently cultured or that appear suitable for culture.

PERSONNEL OF THE PROJECT

Personnel funded under the grant are listed below, with amount of time devoted to the grant project indicated:

Name	Position	Man-months
Dr. E. W. Shell	Director	4.2
Dr. D. D. Moss	Assistant Director	1.3
Dr. R. Allison	Associate Professor	2.8
Mr. J. R. Hubbard	Associate Professor	1.4
Dr. R. T. Lovell	Associate Professor	2.6
Dr. E. W. McCoy	Associate Professor	2.1
Dr. M. M. Pamatmat	Associate Professor	7.2
Mr. E. E. Prather	Associate Professor	0.4
Dr. R. O. Smitherman	Associate Professor	6.9
Mr. J. R. Snow	Associate Professor	8.0
Dr. W. D. Davies	Assistant Professor	0.8
Mr. R. K. Goodman	Research Associate	0.5
Ms. E. W. Scarsbrook	Research Associate	6.0
Mr. B. N. Burrow	Technical Assistant	1.5
Mr. C. D. Depoister	Technical Assistant	2.3
Mr. J. P. Pugh	Technical Assistant	0.5
Ms. C. B. Sherrer	Senior Clerk	5.3
Ms. C. B. Hawke	Typist A	1.3
Ms. E. C. Talley	Typist	9.9
Ms. P. M. Argo	Typist	0.6
Ms. L. S. Stonicher	Typist	2.3
Ms. T. N. Tilson	Typist	1.2
Ms. A. C. Tucker	Typist	5.7
Mr. D. E. Alston	Graduate Research Assistant	1.7 ¹
Mr. R. L. Busch	Graduate Research Assistant	4.0
Mr. J. A. Chappell	Graduate Research Assistant	0.7
Mr. C. Lim	Graduate Research Assistant	0.3
Mr. V. E. Mezainis	Graduate Research Assistant	3.7
Mr. P. W. Perschbacher	Graduate Research Assistant	3.0
Mr. R. P. Phelps	Graduate Research Assistant	1.0
Mr. E. H. Robinson	Graduate Research Assistant	1.0
Mr. C. S. Tucker	Graduate Research Assistant	1.0
Mr. J. L. Williamson	Graduate Research Assistant	3.1

¹ All graduate research assistants are generally expected to spend 1/3 time on activities related to their stipend and under normal circumstances do not contribute more than 4.0 man-months to a project in a year.

ACCOMPLISHMENTS DURING THE YEAR

Research Activities

Specific experiments completed in FY 1975 which received support under this grant are summarized in the following paragraphs. The pond experiments were all designed to evaluate possible techniques which would give greater or more efficient fish production. Fish pathology projects and processing and marketing studies were aimed at providing advances in these areas.

Aquaculture

One experiment, conducted in 12 aerated concrete ponds each 0.005 acre, was to monitor water quality and determine the amount of *Tilapia aurea* that could be produced

with different feed formulations and stocking rates. Treatments were stocking at 400 per pond and giving pelleted feed; 200 per pond with pelleted feed; 200 per pond with non-pelleted feed of the same formulation; and 100 per pond with pelleted feed. The experiment continued for 107 days. Feed conversion ratios (weight of feed:weight increase of fish) varied from 0.9:1 to 1.7:1. Net gains averaging in excess of 17,000 pounds per acre were achieved, with the higher stocking rates giving the highest net yields but least efficient feed utilization. Results showed no significant differences between pelleted and non-pelleted feeds. (*Allison and Smitherman*)

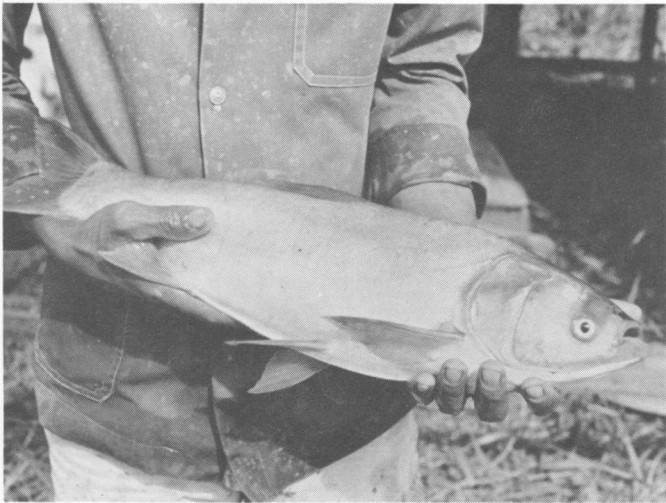
Striped bass fry were cultured in twelve 7.6-liter hatching jars and twelve 38-liter aquaria set up on recirculating water systems. Effects of diet, salinity, and container on survival and growth were tested. Data obtained from daily mortality counts and weekly growth samples showed no significant differences in survival between container shapes or levels of salinity. Fry survived and grew significantly better ($P = .01$) on the brine shrimp diet than on the dry feed diet. Growth of fry was significantly better ($P = .01$) in aquaria than in jars. There was no difference in growth rates of fry cultured in the two salinity levels. (*Shell*)

Light attraction experiments to determine the effects of wave length and intensity of light on striped bass fry behavior were conducted at night. Using a high intensity lamp, colored filters, and a voltage regulator, it was determined that fry were attracted to light of moderate intensities. Light of low intensity was not powerful enough to attract fry, while fry appeared to avoid intense light. No difference was observed in behavior of fry to light of various wave lengths. (*Shell*)

An experiment was conducted from October to December 1974 to determine if clomiphene citrate would induce gonadal development in channel catfish. Feed containing the chemical was fed to males and females in separate ponds. Five females were sacrificed at 2-week intervals and the degree of gonadal development (Gonadal Somatic Index) determined for each. Males were sacrificed only at the end of the experiment. Control fish were treated in the same manner except no chemical was incorporated in their feed. There was no difference in gonadal development of the fish fed the chemical and control fish. (*Busch*)

Disc gel electrophoresis of serum proteins of *Tilapia aurea* was used to determine if any sex-related differences existed in the electropherograms. Analysis of the number of bands, frequency, and position of these bands will be continued with greater numbers of fish in the hope that differentiation of males and females will be possible. (*Smitherman and Hardin*)

A polyculture experiment with channel catfish (3,000 per acre) as the principal species in the system and various stocking combinations with tilapia, hybrid buffalo, and Israeli carp was conducted from March to October 1974 in twenty-two, 0.1-acre earthen ponds. Fish growth, temperature, oxygen, and water hardness data were recorded periodically. All ponds were limed, and food was kept constant in all treatments. Results indicated no effective competition of tilapia with channel catfish at the lower stocking rate of tilapia (250 per acre), and tilapia represented an extra 200 pounds per acre of harvestable size fish. Larger tilapia fed on the pellets but channel catfish preyed on tilapia reproduction thereby offsetting any food loss. Hybrid buffalo



Pond-raised silver carp are regarded by some as the "miracle fish" for the developing world.

stocked both at 100 adults per acre or 1,000 fingerlings per acre decreased channel catfish yields, as did Israeli carp stocked at both 40 and 100 per acre. (Smitherman and Pretto)

Fry (9-11 millimeter) of *Tilapia aurea* were orally administered androgen (Ethynyltestosterone) or estrogen (Estrotrone). The fish were then reared in concrete tanks and earthen ponds. Sex ratio and growth rate were determined. Fish treated with androgen were 93 to 100 percent male, but estrogen-treated fish had normal sex ratios. Growth of hormone-treated fish from May to October 1974 was similar to that of control fish. (Shelton)

Food habits of channel catfish, adult and fingerling hybrid buffalofish, *Tilapia aurea*, and Israeli carp were studied in polyculture. Studies of the stomach contents of these fishes in May, July, and October revealed that supplemental feed was the primary food of the channel catfish in polyculture. Supplemental feed became increasingly more important to the tilapia, hybrid buffalofish, and Israeli carp as the total weight of fish in the ponds increased. In October, tilapia remains were found in only 1 percent of the channel catfish. This low percentage was believed to be the result of low water temperatures. (Smitherman and Williamson)

Three different aeration devices were evaluated in 0.1-acre ponds in terms of catfish and tilapia production, maintenance of water quality, and power requirements. Productivity varied from 4,998 to 4,789 pounds per acre. Conversion ratios were similar in all ponds, approximately 1.4:1. Average percentage of harvestable fish per pond varied from 65.5 to 69.6. Maximum feed was in excess of 2,300 pounds per acre, much in excess of what is possible without aeration. During the last 59 days of the experiment, a daily average of 59 pounds per acre was fed. Dissolved oxygen profiles and flow patterns showed some differences with depth and type of aerating device. Power consumption approached a cost comparable with other production costs, ranging from \$0.03 to \$0.07 per pound of fish produced. (Allison)

A comparison of the production of channel catfish and a hybrid (blue × channel) catfish was made in earthen ponds. The fish were compared for survival, food conversion, growth, size uniformity, dressout percentage, and chemical composition. Significant differences existed between the two fishes,

with the hybrid being superior in all phases except for greater fat content. (Smitherman and Yant)

Fish Nutrition

Although catfish can absorb adequate calcium from water, they must have dietary phosphorus for optimum growth rate in ponds. All-plant diets containing 0.69 percent total P or 0.22 percent available P did not allow for maximum growth by channel catfish in earthen ponds; however, when 0.3 percent phosphorus from CaHPO_4 was added to the all-plant diet to bring the available P level up to 0.52 percent, maximum growth rate by the channel catfish was obtained. Higher supplemental levels of P did not result in improved growth. (Lovell and Prather)

Vitamin C (ascorbic acid) was previously demonstrated to be essential in the diet for channel catfish grown in cages or artificial environments. During 1972-74, feeding studies were conducted to determine the necessity of vitamin C in pond feeds for channel catfish stocked at 2,000 to 10,000 per acre. Vitamin C was not necessary in practical feeds when fish were stocked up to 4,000 per acre (yield of 3,700 pounds per acre), as indicated by lack of differences in growth, incidences of deformed spinal columns, hemorrhagic tissues, alkaline phosphatase activity, blood or kidney levels of ascorbic acid, or susceptibility to bacterial infections between catfish fed vitamin C in the feed and those fed no vitamin C. However, when stocking density was increased to 10,000 per acre (in pens along the edge of large ponds) poorer growth, deformed backs, and higher mortalities from bacterial infection were found in fish not receiving vitamin C in the feed. (Lovell)

When ethylcellulose coated ascorbic acid was used in pelleted fish feeds, an average of 84 percent of the vitamin activity remained following the pelleting process; however, following extrusion, an average of 66.5 percent of the activity remained. With non-coated ascorbic acid, 49 percent of the activity remained following pelleting but none after extrusion. After 4 months' storage at ambient temperature, 23.9 percent of the vitamin was recovered from the pelleted feeds and 21.7 percent from the extruded feed. (Lovell)

Floating and sinking forms of Auburn No. 4 catfish feed formula were fed to channel catfish, stocked at 3,000 per acre, for 200 days in 3.5-acre (floating feed) and 12.5-acre (sinking feed) ponds. Feeding rates were similar to those previously used in 1/10-acre ponds when fish fed this feed in pellet form gained 0.98 pound each (2,950 pounds per acre). Average gain by the fish fed the floating feed in the large pond was 0.77 pound. Gain by fish fed the sinking feed in the large pond, estimated by seine sampling, was 0.72 pound or 93.6 percent of that by the fish fed the floating pellets. (Prather and Lovell)

Pound-size channel catfish which had previously been fed intensively for 6 months were weighed, measured, and placed back into nine 1/10-acre earthen ponds at the rate of 2,000 per acre. The fish were managed through the winter until the following March 4 on one of three feeding regimes: no feeding; feeding 1 percent of fish weight on alternate days; and feeding 1 percent of fish weight only on "warm" days or when water temperature at a 3-foot depth was above 54° F. Fish not fed lost 9 percent of their weight during the 100-day overwinter period. Those fed on alternate days received feed on 51 days and gained 23 percent, and those fed on "warm" days received feed 52 days and gained 19

percent. Condition factors increased for both groups of fed fish but decreased for the non-fed fish. Non-fed fish lost weight and also had the highest percentage of body fat, indicating that a significant amount of tissue protein was degraded for energy needs. The protein content of the fed fish was higher and the fat content was lower than that usually found in summer-fed fish. (Lovell)

Aquatic Ecology

Benthic community metabolism was studied in two earthen ponds (densely stocked with channel catfish) to better understand the problem of organic decomposition and consequent depletion of dissolved oxygen in bottom water. The role of the bottom mud and its associated biotic community in the consumption of oxygen needs to be clarified in order to better evaluate different ways of alleviating low oxygen conditions in bottom water. The bottom water below a depth of 5 feet in one of the ponds became anoxic as early as June. The benthic community may have been supplied with a small amount of oxygen through mixing of bottom water with overlying water, but this has not been assessed. In any case, metabolic activity of benthos in ponds with anoxic bottom water during the fish-growing season must be measured by methods dealing with anaerobic metabolism. (Pamatmat)

Fish Pathology

Channel catfish populations were immunized against *Ichthyophthirius* by exposure to controlled numbers of the parasite and by injections with ground trophozoites. Exposed and injected fish were challenged with 20 trophozoites per fish. Mortality in controls, 20 trophozoites exposure, 40 trophozoites exposure, and ground trophozoites was 100, 6.6, 0, and 0 percent, respectively. (Allison)

Processing and Marketing

Buffalofish and tilapia, which had been grown in combination with channel catfish in polycultures, were mechanically deboned along with channel catfish on a Bibun bone separating machine. A 7-millimeter diameter hole in the extrusion cylinder of the machine was satisfactory for separating the flesh from the bone of all three fish species. No significant amounts of bone or scale were left in the flesh. Particle size of the minced flesh was relatively large, which allowed for favorable texture when cooked. Scaling prior to deboning was not necessary. Important for high quality minced flesh were: processing soon after the fish died, pre-washing with chlorine solution, removal of black peritoneum in tilapia, and removal of skin pigment of catfish with a hot alkali prior to deboning. Yields, expressed as percentage of whole fish, were 50.5 for buffalofish, 39.7 for tilapia, and 43.7 for channel catfish. All species were highly acceptable in various consumer-type products when evaluated by a taste panel. (Lovell)

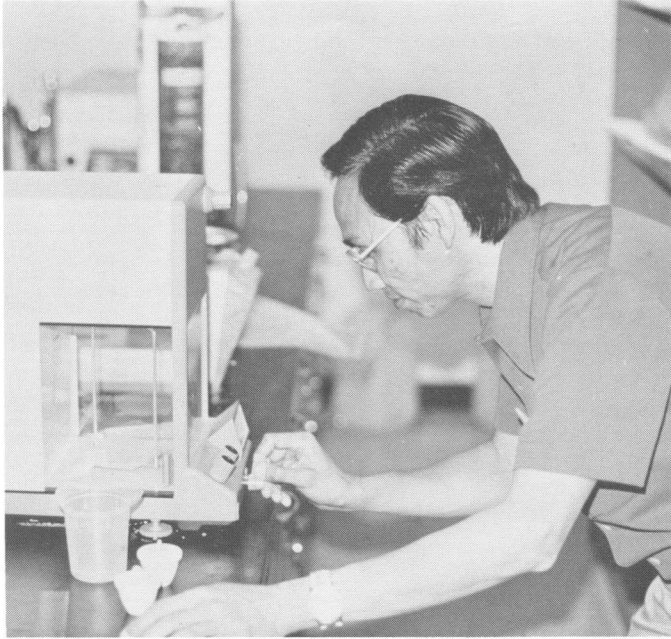
During the last 3 years, a comprehensive chemical evaluation of the nutritional composition of farm-raised catfish was made. These data are presented in tabular form following the format used in USDA Handbook No. 8, "Composition of Foods." The tables include protein, fat, energy, water, ash, Ca, P, Fe, Na, K, vitamin A, riboflavin, niacin, thiamine, cholesterol, amino acids, and fatty acids. All nutrients required by F.D.A. for nutritional labeling of consumer foods are provided. (Lovell)

Technology was developed for making a flaked aquarium fish feed that (1) contained fish processing waste, (2) floated and was stable in water, (3) was palatable to several species of aquarium fishes, (4) was nutritionally adequate for growth, and (5) produced pigmentation in ornamental aquarium fish. The following formula was equal to an expensive commercial flaked fish feed in all aspects: catfish waste (or marine fish) meal, 15 percent; shrimp meal, 15 percent; dehulled soybean meal, 45 percent; rice polishings (or rice bran), 9 percent; wheat bran, 7 percent; marine fish oil, 4 percent; marigold petal meal, 0.113 percent; and a complete vitamin supplement. (Lovell)

Research by Foreign Graduate Students

Fifteen foreign students received graduate degrees from Auburn University during the year. Each student was required to submit a thesis or dissertation based on his original research. Although none of these students was supported directly on grant funds, all utilized equipment and supplies, benefited from the availability of field labor, or received guidance and information from staff time which was purchased with grant funds. Name, country, and title of thesis or dissertation for each student follows (name of major professor follows thesis or dissertation title):

Name	Thesis or dissertation title
Almazan, Guadisa (Philippines)	Studies on Oxygen Consumption by Microbial Organisms during Decomposition of Aquatic Plants (Boyd)
Apolinario, Catherine (Philippines)	Recovery and Utilization of Boneless Flesh Mechanically Separated from Tilapia (<i>Tilapia aurea</i>), Buffalofish (<i>Ictiobus cyprinellus</i> x <i>Ictiobus niger</i>), Channel Catfish (<i>Ictalurus punctatus</i>) (Lovell)
Arce, Rodolfo (Philippines)	Effects of Applications of Agricultural Limestone on Water Chemistry, Phytoplankton Productivity, and Tilapia Production in Softwater Ponds (Boyd)
Augusto, Jose (Brazil)	Effects of Inorganic Fertilization on Phytoplankton in Fed Catfish Ponds (Boyd)
Boonyaratpalin, Mali (Thailand)	Development of Flaked Feeds for Aquarium Fish (Lovell)
Boonyaratpalin, Sitdhi (Thailand)	Movement of Largemouth Bass in Relation to a Thermally Influenced Area on the Coosa River (Shelton)
Camacho, Arsenio (Philippines)	Characterization of Thiamine Deficiencies in Channel Catfish Heated and Non-heated Catfish Processing Wastes (Lovell)
Dela Cruz, Catalino (Philippines)	The Effect of Water Circulation and Aeration on Water Quality and Productivity of Catfish in a Closed System (Allison)
Fortes, R. D. (Philippines)	Studies on Chlorophyll in Pond Waters (Boyd)
Hongpromyart, Manoj (Thailand)	Population Structure and Dynamics of a Dominant Black Crappie (<i>Pomoxis nigromaculatus</i>) Year Class in Lee County Fishing Lake, Alabama (Davies)
Koonsoongnoen, Vanida (Thailand)	Protein Efficiency Ratios of Catfish Processing Wastes for Channel Catfish Fingerlings (Lovell)
Potpitak, Kumron (Thailand)	Standing Crop of Oligochaetes Outside Culture Pens of Channel Catfish (Pamatmat)



Laboratory skills are developed by international students.

Sirikul, Boonsong
(Thailand)

Condition Changes in Harvestable Size Channel Catfish Held in Ponds Overwinter under Various Feeding Regimes (Lovell)

Tangtrongpiros, Manob
(Thailand)

Effects of Stocking Rates of Channel Catfish on Standing Crops of Oligochaetes (Annelida) (Pamatmat)

Ventura, Rudolfo
(Philippines)

A Survey of Methods in Artificial Breeding of Grass Carp (Shelton)

Publications

The following publications have resulted from research and other professional activities of the grant-funded staff:

D. D. Moss

1974. Design and Plan for an Aquaculture Research Center in Colombia.

1974. Recommendations Concerning the Development of an Aquaculture Research Center in Colombia.

AND R. O. SMITHERMAN. 1974. Evaluation of Proposed Shrimp Culture Project in Guapi, Cauca, Colombia.

AND M. C. JOHNSON AND W. D. DAVIES. 1975. Summary of Survey Trip to Colombia.

AND R. O. SMITHERMAN AND E. L. DIAZ. 1974. Observations on the Biology of *Macrobrachium americanum* Bate from a Pond Environment in Panama. Proceedings of the Fifth Annual Workshop of the World Mariculture Society, 4:29-40.

AND F. CHOLIK, SEDIATMO, S. JOYODIHARJI, SUDI BYO, E. W. MCCOY, J. R. SNOW, AND J. H. GROVER. 1975. Inland and Brackishwater Fishery Expansion Project in Indonesia.

R. Allison (with C. D. Busch and J. L. Koon)

1975. Aerating Catfish Ponds for Increased Production. *Progressive Farmer*, April 1975.

1975. Aeration, Water Quality and Catfish Production. *Trans. ASAE*, Vol. 17, No. 3:433-435.

1975. Paddlewheels for Catfish Pond Aeration. Auburn Univ. (Ala.) Agr. Exp. Sta. Highlights of Agr. Res., Vol. 22, No. 2.

R. T. Lovell

1974. Nutritional Deficiencies in Intensively-cultured Catfish. *In The Pathology of Fishes*. Ed., Ribelin, W. E. and G. Migaki. The Univ. of Wisc. Press, Madison.

AND G. R. AMMERMAN. 1974. Processing Farm-raised Catfish. Southern Coop. Series. Bull. 193 (available from Auburn Univ. (Ala.) Agr. Exp. Sta.).

1974. Effects of Diet Fiber Content on Fish Growth, Nutrient Digestibility, and Water Quality in Practical Catfish Culture. Proc. Third Fish Nutrition Workshop III, 47:14-23. Tunnison Fish Laboratory and Cornell University, Cortland, N.Y., September 1974.

1974. Factors Affecting Optimum Protein Level in Feeds for Pond Grown Channel Catfish. Proc. Third Fish Nutrition Workshop III, 82:54-62. Tunnison Fish Nutrition Laboratory and Cornell University, Cortland, N.Y. September 1974.

SNOW, J. R. AND R. T. LOVELL. 1974. Comparison of Organoleptic Quality of Largemouth Bass Fed Natural and Artificial Diets. *Prog. Fish. Cult.*; 36(4): 217.

1974. How Much Protein in Feeds for Channel Catfish? *The Commercial Fish Farmer and World Aquaculture*. 1(4):40.

AND R. O. SMITHERMAN AND E. W. SHELL. 1974. Progress and Prospects in Fish Farming. *In New Protein Foods*. Ed., Altschul, A. M. and H. Wilcke. Academic Press, Inc., New York and London. (*in press*)

PRATHER, E. E. AND R. T. LOVELL. 1974. Response of Intensively Fed Channel Catfish to Diets Containing Various Protein-energy Ratios. Proc. 27th Ann. Conf. SE Assoc. Game and Fish Comrs., 27:455.

E. W. McCoy

AND R. T. LOVELL AND G. R. AMMERMAN. 1974. "Processing Economics," Processing Farm-Raised Catfish. Southern Coop. Series Bull. 193:21-31.

AND K. W. CRAWFORD. 1974. Costs of Overwintering Catfish. Auburn Univ. (Ala.) Agr. Exp. Sta. Highlights of Agr. Res., Vol. 21, No. 4.

AND K. W. CRAWFORD. 1975. Alabama Catfish Producers, Fingerling Producers and Catfish Processors, 1974, a Directory. Mimeograph Series, Dept. of Agr. Econ. and Rur. Soc. Auburn Univ. (Ala.) Agr. Exp. Sta.

AND K. W. CRAWFORD. 1975. Catfish Are not the Only Fish in the Pond. Auburn Univ. (Ala.) Agr. Exp. Sta. Highlights of Agr. Res., Vol. 22, No. 2.

1975. "Marketing Research and Economics" Freshwater Foodfish (and Crawfish). Aquatic Food Animal Task Force R. P. 407.

Mario M. Pamatmat

AND H. R. SKJOLDAL. 1974. Dehydrogenase Activity and Adenosine Triphosphate Concentration of Marine Sediments in Lindaspollen, Norway Sarsia, 56:1-12.

E. W. Scarsbrook

BOYD, C. E. AND E. SCARSBROOK. 1974. Effects of Agricultural Limestone on Phytoplankton Communities in Ponds. *Arch. Hydrobiol.*, 74:336-349.

Teaching Activities

Six of the staff members on the grant taught a total of seven courses during the year and six supervised thesis re-

search projects for graduate students. A summary of teaching activities follows:

<i>Professor</i>	<i>Courses taught</i>	<i>No. of graduate students supervised</i>
Dr. E. W. Shell	None	3
Dr. D. D. Moss	Pond construction	0
Dr. R. Allison	None	4(4) ¹
Mr. J. R. Hubbard	Extension methods	0
Dr. R. T. Lovell	Fish nutrition Fish processing technology	16(14)
Dr. E. W. McCoy	Aquacultural economics	2(1)
Dr. M. M. Pamatmat	None	4(3)
Dr. R. O. Smitherman	Aquaculture	10(4)
Mr. R. K. Goodman	None	0
Ms. E. W. Scarsbrook	Nutrient cycles in aquaculture	0

¹ Number in parenthesis indicates number of foreign nationals.

The number of courses taught by grant-funded staff since the inception of the grant is shown in the following table.

<i>Year</i>	<i>Number of courses</i>
1970-71 (FY 1971).....	6
1971-72 (FY 1972).....	7
1972-73 (FY 1973).....	8
1973-74 (FY 1974).....	9
1974-75 (FY 1975).....	7
TOTAL.....	37

The International Center utilized grant funds to bring the following scientists to campus to present seminars and to consult with staff and graduate students.

Mr. Randy Haygood. Research scientist with the Florida Department of Natural Resources. Mr. Haygood is an expert on the culture of freshwater shrimp.

Dr. Marcel Huet. World-renowned expert in aquaculture from Belgium. Dr. Huet presented several lectures on various aspects of aquaculture while at Auburn.

Dr. Fred Lee. Dr. Lee is an expert in water quality and a member of the research staff at the University of Texas at Dallas.

Dr. S. W. Ling. Dr. Ling is an expert in tropical aquaculture. Before retiring he was FAO Regional Fish Culturist for Asia and the Far East.

Library Acquisitions

During the year 87 books were purchased with grant funds. Emphasis in selection was given to those on aquaculture, aquaculture-related subjects, and fishes found in developing countries. Fifty-five periodicals were acquired. Grant funds are used only to pay the initial year of a subscription. Other funds are used to continue the subscriptions.

IMPACT OF GRANT-SUPPORTED ACTIVITIES IN ACHIEVING GRANT PURPOSE

The purpose of the grant is to strengthen the International Center for Aquaculture for greater service to developing countries. It is evident from the information thus far

presented that reasonable progress is being made in the use of grant funds to realize the grant purpose. The International Center has been strengthened and the resulting capability for service is being maintained and enhanced. Furthermore, the increased capacity is being effectively utilized.

Grant funds were utilized during the year to purchase 12.1 man-months of personnel services. These services contributed significantly to the capability of the Center in the areas of education and training, extending the knowledge base, advisory capacity, information capacity, and linkages and networks. Funds were also used to increase library holdings, to support the activities of the Center staff, and to provide materials, supplies, and minor items of equipment utilized in graduate training.

The major contribution of the grant was to provide for the purchase of approximately 38 man-months of senior-level (assistant professor and above) staff during the year. These personnel are key elements in the strengthening of the International Center. They are primarily responsible for the training, extension of the knowledge base, advisory services, and other activities necessary for a vital program.

Virtually all of the grant-funded staff participated in the expansion of the knowledge base through research and development. Results of their activities were published as research papers in recognized scientific journals, as chapters in monographs or books, as parts of symposia, and as reports prepared for various USAID Missions and other international development agencies.

Man-months of personnel services purchased with grant funds since the beginning of the project are given in the following table:

<i>Year</i>	<i>Category of personnel</i>			
	<i>Aca- demic and research</i>	<i>Tech- nical and secr- etary</i>	<i>Grad. res. assist- ants</i>	<i>Field and student labor</i>
1970-71 (FY 1971).....	47.8	12.0	15.2	17.6
1971-72 (FY 1972).....	38.0	22.3	25.6	74.9
1972-73 (FY 1973).....	45.2	16.1	16.3	65.6
1973-74 (FY 1974).....	48.4	29.0	22.4	47.9
1974-75 (FY 1975).....	44.2	30.6	19.5	26.8

Research conducted by foreign students represents an area of special significance in contributing to expansion of the knowledge base. Not only did the students contribute new information to various fields of aquaculture and inland fisheries, but they also learned something about using the scientific method for solving practical problems. A total of 14 foreign students received graduate degrees during the year. Each student was required to submit a thesis or dissertation based on original research. Although none of these students was supported directly on grant funds, all utilized equipment and supplies, benefited from the availability of field labor, or received guidance and information from staff time which was purchased with grant funds.

Because of the availability of the staff funded from the grant, the Department has been able to attract a number of research grants and contracts that it could not otherwise have handled. In the past year the grant-funded staff was involved in a number of research projects supported by state appropriated University funds. Several of these research projects will result in information that will have direct transferability to developing countries.

Research interests, research projects, and publications of the grant-funded staff are listed below:

Name	Research interests	No. of research projects	No. of publications ¹
Dr. E. W. Shell	aquaculture	1	0
Dr. D. D. Moss	aquaculture	0	6
Dr. R. Allison	aquaculture	4	3
Dr. R. T. Lovell	fish nutrition and fish processing and technology	6	9
Dr. E. W. McCoy	aquacultural economics	3	6
Dr. M. M. Pamatmat	pond ecology	2	6
Dr. R. O. Smitherman	aquaculture	5	2
Mr. J. R. Snow	aquaculture and fish reproduction	2	7
Dr. W. D. Davies	fisheries management	5	3
Mr. R. K. Goodman	aquaculture	1	0
Ms. E. W. Scarsbrook	pond ecology	1	1
Mr. D. E. Alston	culture of fish food organisms (with Dr. J. S. Dendy)	1	1 ²
Mr. R. L. Busch	induced spawning of fish (with Dr. W. L. Shelton)	1	0
Mr. J. A. Chappel	quantitative inheritance in fish (with Dr. R. O. Smitherman)	1	0
Mr. C. Lim	nutrient requirements of fish (with Dr. R. T. Lovell)	1	0
Mr. V. E. Mezainis	oxidation of organic matter in fish culture ponds (with Dr. M. M. Pamatmat)	1	0
Mr. P. W. Perschbacher	effect of grazing by tilapia on productivity of phytoplankton (with Dr. C. E. Boyd)	1	1
Dr. R. P. Phelps	toxicity of disease control chemicals to fish (with Dr. W. A. Rogers)	1	1
Mr. E. H. Robinson	nutrient requirements of cultured fishes (with Dr. R. T. Lovell)	1	0
Mr. C. S. Tucker	prevention of oxygen depletion following plankton die-offs (with Dr. C. E. Boyd)	1	0
Mr. J. L. Williamson	competition for food in polyculture (with Dr. R. O. Smitherman)	1	1 ²

¹ Titles of publications are given in the preceding section.

² Research thesis or dissertation.

The number of publications produced by grant-funded staff since the beginning of the grant is shown in the following table:

Year	Number
1970-71 (FY 1971)	6
1971-72 (FY 1972)	8
1972-73 (FY 1973)	12
1973-74 (FY 1974)	13
1974-75 (FY 1975)	37 ¹

¹ Beginning in FY 1975, formal reports prepared as a result of USAID contracts are included in the number of publications.

Grant-funded staff taught seven courses during the year. Although the University paid most of the costs for teaching the courses, use of the grant funds made available more specialists for teaching these courses. Nine courses per 12-month academic year would be approximately a full-time teaching load for one professor if he were supported entirely by University teaching funds.

Obviously, a single individual could not adequately teach the wide variety of courses offered. By combining University teaching funds and grant funds to allow joint appointments, six different teachers (specialists in their respective fields) were available to teach the courses.

A summary of the information on courses taught and students enrolled is presented in the following table:

Quarter	No. of courses	Number of students enrolled	
		American	Foreign
Summer 1974	8	50	43
Fall 1974	10	93	47
Winter 1975	11	157	67
Spring 1975	9	85	24
TOTAL	38	385	181

The graduate training program increased dramatically during the year. The number of new graduate students admitted to the program increased from 16 in FY 1974 to 33 in FY 1975. A significant factor in the increase was enroll-



Field experience is required of all students.

ment of former Peace Corps Volunteers. The Volunteers enrolled after completing tours of duty overseas where they participated in aquaculture and inland fisheries projects. Grant-funded staff served as major professors for 14 of the new students.

Including the new students admitted during the year, an average of 60 graduate students was enrolled in the Department during each of the four quarters. Because of the program established through use of the grant funds, there have been large increases in the number of graduate students enrolled in each of the quarters since inception of the grant, as shown in the following table:

Year	Number of graduate students, by quarter			
	Summer	Fall	Winter	Spring
1970-71 (FY 1971).....	24	23	31	28
1971-72 (FY 1972).....	29	34	43	46
1972-73 (FY 1973).....	43	48	50	51
1973-74 (FY 1974).....	48	57	54	53
1974-75 (FY 1975).....	50	57	65	69

Foreign graduate student enrollment has also increased dramatically since the inception of the grant. Information on the enrollment of these students is presented in the following table:

Year	Number of graduate students, by quarter			
	Summer	Fall	Winter	Spring
1970-71 (FY 1971).....	7	5	5	7
1971-72 (FY 1972).....	5	5	13	15
1972-73 (FY 1973).....	16	16	19	22
1973-74 (FY 1974).....	22	27	26	26
1974-75 (FY 1975).....	24	22	19	21

A total of 27 advanced degrees was awarded during the year (24 M.S. and 3 Ph.D.), of which 14 were to foreign students. Information on the total number of advanced degrees awarded and the number awarded to foreign students is presented in the following table:

Year	Graduates	
	M.S.	Ph.D.
1970-71 (FY 1971).....	4(0) ¹	4(2)
1971-72 (FY 1972).....	10(4)	4(1)
1972-73 (FY 1973).....	18(8)	4(0)
1973-74 (FY 1974).....	20(9)	5(3)
1974-75 (FY 1975).....	24(12)	3(2)

¹ Number of foreign student graduates given in parenthesis.

UTILIZATION OF INSTITUTIONAL RESPONSE CAPABILITIES IN DEVELOPMENT PROGRAMS

A primary activity of the International Center for Aquaculture is international service activities. In the past year, staff of the Center participated in a total of 459 man-days of service activities overseas. Grant-funded staff and other staff supported with grant funds were involved in 262 man-days, or approximately 60 percent of these activities.

The international service activities can be roughly divided

into four categories. Man-days of time spent in each category are indicated below:

Category	Man-days
Activities by grant staff utilizing 211-d funds.....	31
Activities by other staff utilizing 211-d funds.....	37
Activities by grant staff utilizing other funds.....	194
Activities by other staff utilizing other funds.....	228

International service activities during the year are listed below by category, along with names of the staff involved and dates for each activity:

Staff member	Activities and dates
Grant staff utilizing 211-d funds	
D. D. Moss	Consultations with USAID Missions in Costa Rica and Panama on aquaculture and fisheries programs, January 5-22, 1975.
M. M. Pamatmat	Gave invited lecture on aquatic ecology at meeting on meiofauna at Bordeaux, France, September 23-29, 1974.
J. R. Snow	Attended Conference on "Fish Farming in Europe" in London, December 1-6, 1974.
Other staff utilizing 211-d funds	
M. C. Johnson	Assisted Government of Colombia and USAID Mission in Bogota in development of plans for an aquaculture research station, March 16-21, 1975.
E. E. Prather	Conducted a survey on aquaculture potential in Jamaica, June 17-29, 1974.
D. G. Hughes	Participated in FAO-sponsored Aquaculture Conference in Montevideo, Uruguay, November 23-December 10, 1974.
R. O. Smitherman	Surveyed potential for shrimp culture on West Coast of Colombia, September 29-October 11, 1974.
Grant staff utilizing other funds	
E. W. Shell	Conference with Israeli scientists on Bi-National Science Foundation project on "Fish Breeding," January 6-12, 1975. Met with FAO officials in Rome regarding program of International Center for Aquaculture, January 14, 1975.
D. D. Moss	Met with USAID and Government of Colombia officials in Bogota to discuss plans for aquaculture research station, September 29-October 4, 1974. Meeting in Colombia for further discussions of plans for research station, January 5-10, 1975. Meeting in Colombia to review progress of construction of research station, March 15-21, 1975. Planning for expansion of milkfish industry in Indonesia with Government and USAID officials, May 27-June 25, 1975.
R. T. Lovell	Participated in short course on aquaculture sponsored by Brazilian fisheries agency in Fortaleza, Brazil, March 27-April 7, 1975.
E. W. McCoy	Participated in survey of expansion of milkfish industry in Indonesia, May 27-June 28, 1975.
M. M. Pamatmat	Attended conference on aquatic ecology sponsored by NATO in Switzerland, November 3-December 12, 1974.
J. R. Snow	Participated in survey for expansion of milkfish industry in Indonesia, May 27-June 28, 1975.

Other staff utilizing other funds

- M. C. Johnson Survey of potential sites for fish farming in Mid-Western State, Nigeria, June 29-July 19, 1975.
- W. D. Davies Study of trout production potential in natural lakes in Peruvian Andes, August 24-September 22, 1974.
Study of problems relating to the development of the fishery in Lake Victoria, Tanzania, October 26-November 15, 1974.
- J. H. Grover Attended conference on brackishwater shrimp culture in South Vietnam, March 30-April 12, 1975.
Surveyed catfish culture industry in Thailand, April 12-15, 1975.
Assisted USAID Mission in Indonesia with preparation of documentation required for proposal to provide assistance to GOI in milkfish culture, June 19-July 5, 1975.
- L. L. Lovshin Participated in FAO-sponsored conference on aquaculture in Montevideo, Uruguay, November 24-December 3, 1974.
- G. E. Hall¹ Evaluation of proposed USAID project for improvement of Lake Tanganyika's fishery resources in Zaire, March 9-April 8, 1975.
- J. A. Plumb Participated in short course on aquaculture sponsored by Brazilian fisheries agency in Fortaleza, Brazil, March 27-April 7, 1974.
- H. R. Schmittou Conferred with USAID and Government of Indonesia officials on potential for expansion of milkfish industry in Indonesia, November 4-23, 1974.
- W. L. Shelton Study of trout production potential in natural lakes in Peruvian Andes, August 24-September 22, 1974.
- J. W. Jensen Attended FAO-sponsored conference on aquaculture in Montevideo, Uruguay, November 24-December 3, 1974.

In addition to the international service activities, the Center also provided 60.5 man-months of technical assistance to four international development projects overseas. Center staff were assigned to these full time. These projects were: (1) A USAID-supported freshwater aquacultural development project in Northeast Brazil T.O. 2 (ICA), (2) a USAID-supported freshwater aquacultural development project in El Salvador (AID/la 688 ICA), (3) a USAID-supported brackish and freshwater aquacultural development project in the Philippines (AID/ea 180 ICA), and (4) an aquacultural development project in Mid-Western State in Nigeria — a project supported by the Nigerian Government. Three of the Center staff receiving part of their support from the grant provided 10.9 man-months of technical backstopping for those overseas projects. Funds from the individual projects paid for their services.

Man-months of overseas activities by grant-funded staff since the inception of the grant are given in the following table:

Year	Man-months
1970-71 (FY 1971)	9.8
1971-72 (FY 1972)	8.0
1972-73 (FY 1973)	3.0
1973-74 (FY 1974)	4.5
1974-75 (FY 1975)	7.7

A major activity for Center staff during the year was the training of foreign students. They were responsible for 26 foreign graduate students during the year, carrying out such duties as serving as chairmen of graduate committees, developing plans of study, and supervising thesis or dissertation research. The close and continuing contact between student and major professor is one of the most important elements in training graduate students. This contact is especially important in the case of foreign students, and availability of the grant-funded staff offers a distinct advantage at Auburn. Because a majority of this staff has had

¹ Mr. Hall is a staff member of the Tennessee Valley Authority.



Record keeping and field observations are stressed with practical experience.

foreign service experience, they are able to relate to the foreign students much more effectively.

A total of 27 students received advanced degrees with specialization in inland fisheries and aquaculture during the past year. Fourteen of the 27 graduates were foreign students — 1 from Brazil, 6 from the Philippines, and 7 from Thailand. Thirteen of these students were provided financial support through USAID Mission programs. The fourteenth student supported himself while here.

Eleven of the graduates have returned to their respective countries and are engaged in inland fisheries and aquaculture work. One, Dr. Arsenio Camacho, has been appointed Director of the Brackishwater Aquaculture Center at Leganes, Iloilo, in the Philippines. Another, Dr. Catalino dela Cruz, is Director of the Freshwater Aquaculture Center at Central Luzon State University in the Philippines. Three of the graduates are still at Auburn and are now studying for the Ph.D. degree.

The Center provided a 4-day short course for a group of 10 Peace Corps Volunteers from Michigan State University who were training for service in the Philippines. It is anticipated that this type of training will be increased in the future.

The Center also provided approximately 2 months of training in aquaculture for Dr. Abdel Kadar Dia, from the Ivory Coast. Dr. Dia's training was sponsored by the Council for International Exchange of Scholars as Fulbright Hays Scholar.

The Center established and is maintaining a number of linkages both domestic and international that will facilitate utilization of its unique capabilities. The more important of these linkages with respect to immediate utilization of developed capability include:

- The University of Arizona
- The University of Rhode Island
- The University of Puerto Rico
- The University of the Philippines
- Kasetsart University in Thailand
- IBRD
- FAO
- USAID
- Peace Corps
- Southeast Asia Fisheries Development Council
- Hebrew University

Utilization of institutional response is expected to increase this year. New USAID Mission-funded projects involving the Center are expected to develop in Jamaica, Colombia, and Indonesia, and there is a good possibility that projects will be initiated in Honduras.

The project in the Philippines will be continued, but at a reduced level, while the one in El Salvador will be terminated. A proposal is being prepared to convert the project in Brazil to a regional one. If this conversion is carried out, additional services from the Center will probably be required.

The initial phase of the work in Nigeria will be completed early in 1976. It is anticipated that the Center will be requested to provide additional assistance on that project during the year.

Plans are being made to hold two, 3-month short courses in inland fisheries and aquaculture during the coming year. The courses will be designed primarily for technical personnel working these fields in developing countries. The courses will be publicized and applications mailed early in 1976.

Another important international service activity of the Center was providing short-term training and orientation to the large number of visitors from other countries and U.S. institutions who come during the year to obtain information on inland fisheries and aquaculture in developing countries and information on the program of the International Center. These visitors required approximately 120 man-days of specialized training and orientation by the Center staff. A list of the visitors follows:

- Toshihiko Arai, M.D.
Assistant Professor
Department of Microbiology
School of Medicine
Keo University
35 Shinanomachi, Shinjuku-ku
Tokyo, Japan
July 28-31, 1974
- Dr. Takashi Aoki
Department of Fisheries
Faculty of Agriculture
University of Tokyo
July 28-31, 1974
- Dr. S. Egusa, Professor
Department of Fisheries
Faculty of Agriculture
University of Tokyo
1-1-1 Yayoi Bunkyo-Ku
113 Tokyo, Japan
July 28-31, 1974
- Mr. and Mrs. Conrado F. Estrella
Secretary Department of Agrarian Reform
Republic of the Philippines
August 5-6, 1974
- John Obbo Okaronon
802 Monroe Street
Ann Arbor, Michigan
August 5-31, 1974
- Raul Castro Cpnde
5G C. #34-74 Zona M
Guatemala
August 9, 1974
- Harris H. Whitbeck
23 Av. 0-37 Zone 15
Guatemala City, Guatemala
C.A.
August 9, 1974
- Michael Hoeft
Box 627
Wayne, West Virginia
August 14-15, 1974
- Mark Majewski
% WMUL-TV
3rd Avenue
Huntington, West Virginia
August 14-16, 1974
- Dr. Leon Hesser
Office of Agriculture
Bureau of Technical Assistance
Agency for International Development
Washington, D.C.
August 20-21, 1974
- Dr. Colin Nash
Oceanic Institute
Makapuu Point
Waimanalo, Hawaii
August 20-21, 1974
- Guy Rothwell
Oceanic Institute
Makapuu Point
Waimanalo, Hawaii
August 20-21, 1974
- William Sellew
Oceanic Institute
Makapuu Point
Waimanalo, Hawaii
August 20-21, 1974
- Professor Marcel Huet
Avenue General Derache, 104
1050 Bruxelles
Belgium
August 26-28, 1974
- Mr. Anthony A. Neylan
International Bank for Reconstruction
and Development
Washington, D.C.
August 30, 1974

Paul Maugle % USAID Edificio Bavaria Piso 17 Bogota, Colombia	September 10-11, 1974	Dr. John Pino Director for Agriculture Rockefeller Foundation New York, New York	February 5-6, 1975
Professor Gelar Wira Atmadja Faculty of Fisheries Bogor Agricultural University Bogor, Indonesia	September 15-20, 1974	Dr. Jerry Grant Rockefeller Foundation in Colombia	February 13, 1975
James Davis Fish Culture Extension Specialist Texas A&M University	September 27, 1974	Mr. Gordon E. Hall Forestry, Fish and Wildlife Tennessee Valley Authority Norris, Tennessee	February 19, 1975
Noel C. Alon E. Litton & Associate Wack-Wack Subdivision Mandaluying, Rizal or P.O. Box 1772 Makati Commercial Center Makata, Rizal 3117	October 14-November , 4, 1974	Mr. John Hall Atlanta Bureau of Sport Fisheries and Wildlife Division of Federal AID Atlanta, Georgia	March 17-20, 1975
Alicia Cornejo Black Assistant Professor Santiago, Chile	October 15-20, 1974	Mr. John Young Michigan State University Peace Corps Intern	March 17-20, 1975
Ms. Terry Rockefeller WGBH TV Boston, Massachusetts	October 24, 1974	Mr. Joseph Trudeau Michigan State University Peace Corps Intern	March 17-20, 1975
Dr. Salvador Lopez President of the University of the Philippines Manila, Philippines	November 13, 1974	Mr. Dave Smith Michigan State University Peace Corps Intern	March 17-20, 1975
Mr. Luis A. Rivas L. Division Pesca Continental Ministerio de Agricultura y Cria Oficina Nacional de Pesca Av. Benito Juarez, Quinta Tremar Alta Florida, Caracas, Venezuela	November 14-15, 1974	Mr. Mark T. Halter Michigan State University Peace Corps Intern	March 17-20, 1975
Randy Haygood Marine Research Lab St. Petersburg, Florida	November 15, 1974	Mr. Don Palawski Michigan State University Peace Corps Intern	March 17-20, 1975
Mr. Fred Lee, Director Institute for Environmental Sciences University of Texas Dallas, Texas	November 22, 1974	Ms. Linda Parker Michigan State University Peace Corps Intern	March 17-20, 1975
Hugo Cuevas, Jr. P.O. Box 555 W.P.I. Worcester, Massachusetts	November 27, 1974	Mr. John E. Spielby Michigan State University Peace Corps Intern	March 17-20, 1975
Dr. Takeshi Nose Fish Nutritionist Freshwater Fisheries Research Laboratory Fisheries Agency, Ministry of Agriculture Hino, Tokyo, Japan	December 7, 1974	Mr. Cary Kerns Michigan State University Peace Corps Intern	March 17-20, 1975
Dr. Frank Sheppard USAID/Philippines	December 16-17, 1974	Dr. Howard E. Johnson Associate Professor Michigan State University Peace Corps Intern Advisor	March 17-20, 1975
Dr. S. W. Ling FAO Fishculturst (retired) Adjunct Professor University of Miami	January 16, 1975	John J. Castle Michigan State University Peace Corps Intern	March 17-20, 1975
Dr. Tom Niblock AID Mission Director Manila, Philippines	February 5-6, 1975	Mr. Gander New Zealand	April 24, 1975
Dr. Gerald Sicat GOP Planning Commissioner Manila, Philippines	February 5-6, 1975	Wen-Ted Chang Taiwan Fisheries Bureau 8 Sec. 1, Chan-Hsiao East Rd. Taipei, Taiwan 2-0 Republic of China	April 28-29, 1975
Dr. Erven Long Associate Assistant Administrator Bureau of Technical Assistance Agency for International Development Washington, D.C.	February 5-6, 1975	F. Brian Davy Programme Officers, IDRC 308-314 Duke Hall University of British Columbia Vancouver, B.C. V6T 1W5, Canada	April 28-29, 1975
		Mr. Philip Roedel USAID/Washington Officer of Agriculture Bureau of Technical Assistance Washington, D.C.	April 30-May 1, 1975
		Dr. Kadar Dia Fulbright Scholar Student Ivory Coast	May 10, 1975
		George Umeh Student from Nigeria University of Wisconsin Madison, Wisconsin	May 19, 1975

Mr. Dwight Steen
Rural Development Officer
American Embassy (USAID)
APO New York 09895
Colombia

May 19, 1975

U Than Sein, BA
Inspector of Schools
Department of Technical Ag and
Vocational Ed
Rangoon Burma

June 16-17, 1975

U Nyunt Shein
Principal
Tech High School
Rangoon Burma

June 16-17, 1975

Ducksoo Lee
Senior Economist
East Asia Projects Dept.
International Bank for Reconstruction
and Development
1818 H. Street N.W.
Washington, D.C.

June 17, 1975

Dr. Sam Myers
Department of Food Science
Louisiana State University
Baton Rouge, Louisiana

July 10, 1975

George Wm. Kissil
Israel Oceanographic and Limnological
Research Ltd.
Mariculture Laboratory
P.O. Box 1212
Eilat Israel

July 10, 1975

Of the 58 official visitors to the Center during the fiscal year, 24 were from 14 foreign countries and the other 34 were from 6 American agencies:

Country and/or organization	Number
Foreign	
Philippines.....	5
Guatemala.....	4
Japan.....	5
Belgium.....	1
Burma.....	2
Canada.....	1
Chile.....	1
Indonesia.....	1
Israel.....	1
Ivory Coast.....	1
New Zealand.....	1
Nigeria.....	1
Taiwan.....	1
Venezuela.....	1
American	
USAID.....	7
IBRD.....	2
Peace Corps.....	10
Rockefeller Foundation.....	2
Oceanic Foundation.....	3
Other.....	8

The number of visitors coming to the center specifically for information on international fisheries and aquaculture

development each year since the inception of the grant is shown in the following table:

Year	Number of visitors
1970-71 (FY 1971).....	1
1971-72 (FY 1972).....	41
1972-73 (FY 1973).....	30
1973-74 (FY 1974).....	58
1974-75 (FY 1975).....	58

¹ Records not kept for fiscal year 1971.

OTHER RESOURCES FOR GRANT-RELATED ACTIVITIES

All funds received by the Department and International Center strengthen and support the Center. Sources of funds are presented below:

Source of funds	Amount
State of Alabama appropriated funds	
For teaching.....	\$145,333
For research.....	124,946
Sales funds	
For sale of food fish and fingerlings.....	237,168 ¹
Federal appropriated funds for research	
USDA-Land Grant College funds.....	73,274
Research grants from other state governments.....	114,127
Research grants from federal agencies.....	69,452
Research grants from private enterprise.....	144,786
Subtotal.....	909,086
All USAID support.....	462,685
TOTAL.....	\$1,371,771

¹ Includes \$213,811 for sale of timber. This was a one-time sale and will not be repeated for 15-20 years.

As the information indicates, the Department and Center receive funds from a wide variety of sources; however, the U.S. Agency for International Development is the largest single source of funds. Appropriated funds from the State of Alabama to Auburn University for teaching and research represent the second largest source. A number of separate research and development contracts provide the third largest source.

Interpreting the term "grant-related activities" in its broadest sense, virtually all funds received contribute directly or indirectly to achieving the purpose of the grant. Even industrial research grants contribute supplies, equipment, and personnel that are used to some extent in graduate training. By having this type of work going on in the same department, foreign graduate students are able to better comprehend the complexity of problems they must face in the future when attempting to balance food and industrial production needs with the need for environmental protection.

