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ANNUAL REPORT FOR FY 1972

THE INTERNATIONAL CENTER FOR AQUACULTURE

Auburn University Agricultural Experiment Station
Auburn, Alabama 36830

H. S. Swingle, Director
Project: AID/csd 2780

August 3, 1972

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211 (d) Annual Report
Date: August 3, 1972

TITLE: AUBURN UNIVERSITY INTERNATIONAL CENTER FOR AQUACULTURE

GRANTEE: AID

DIRECTOR: H. S. Swingle

A. STATISTICAL SUMMARY

PERIOD OF GRANT: June 25, 1970-June 30, 1975 Amount Grant $800,000

EXPENDITURES FOR REPORT YEAR. $171,688 Accumulated: $290,985.

Anticipated for next year: $162,478

B. NARRATIVE SUMMARY

Six staff members receive salaries in part from the project. Fifteen additional staff members that are supported on other funds add to capabilities of the Center. Six graduate research assistantships were also supported, and cost of research training projects were supported to the extent of approximately 50% for 4 participant AID trainees from Philippines, 8 from Thailand and 2 from Panama; an additional research project by a graduate student from Taiwan was also supported.

The International Center Library was increased by 160 books and 4 periodicals. Several private collections including 60 books and 1,000 issues of periodicals were donated to the library.

Abstracting of papers dealing with various phases of aquacultures was continued, and sent abroad to AID Missions, to personnel in host countries where AID Missions have fisheries projects, and to other selected officials and biologists.

A survey was made to identify commercial species of fishes in Ecuador and those potentially promising for aquaculture. A report was published on recent developments in aquacultures in Japan.

Six staff members participated in surveys abroad, two in international seminars, and 6 staff members began 2-year tours assigned to fisheries projects in Panama, El Salvador, Philippines and Brazil. One staff member returned from a 2-year tour in Brazil.

Research included continuation of feeding and testing to develop superior breeds of channel catfish; determination that ascorbic acid was an essential vitamin and must be included in artificial diets for catfish; development of concentrated fish feeds at Auburn and abroad in the Philippines, Thailand and Brazil; continuing research on biological methods for reducing organic wastes in waters from cultures; cage cultures of tilapia with and without feeding; intensive fish culture in pens located in the marginal waters of reservoirs conducted at Auburn and in Thailand; biological weed control using herbivorous fish; studies on causes of plankton blooms and die-offs that cause fish mortality in pond cultures; and studies on the causes and correction of bad flavors in cultured fish.

1.0 INTRODUCTION

The International Center for Aquaculture was established June 25, 1970, at the Auburn University Agricultural Experiment Station, under authority contained in Section 211 (d) of the Foreign Assistance Act of 1961. The grant (AID/csd 2780) was for the purpose of implementing the project "To Strengthen Specialized Competency in Aquaculture," under the agreement signed June 25, 1970 by Dr. John H. Hannah for USAID and President Harry M. Philpott for Auburn University.

The following objectives were considered of primary importance in strengthening the competence of the Center.

1. To add experts in selected fields to the faculty.
2. To develop a library of world-wide literature on aquaculture and more effective methods for dissemination of this information.
3. To provide educational opportunities in aquaculture for personnel of AID and other governmental agencies and private foundations, for students interested in international development, and for foreign participant training.
4. To develop a worldwide collection of data on food fishes and other aquatic organisms that appear suitable for culture.

2.0 ACCOMPLISHMENTS DURING THE YEAR

2.1 Personnel on the Project

The staff, percentage of time paid under AID/csd-2780 funds, together with their fields of specialization were as follows:

2.11 Technical Staff

2.111 Supported wholly or partially on 211-d funds

H. S. Swingle, Director, 57%

Specialties: Pond Construction; Aquacultures; Fish Population Dynamics

E. W. Shell, Professor, 30%

Specialties: Fish Population Dynamics; Fish Physiology and Nutrition

C. E. Boyd, Associate Professor, 100%

Specialties: Aquatic Ecology; Aquatic Plants

R. T. Lovell, Associate Professor, 30%

Specialties: Fish Feeds and Fish Technology

R. O. Smitherman, Associate Professor, 50% (served full time until January, 1972. Subsequently assigned to a 2-year tour in Panama under AID/la-684 beginning January 1, 1972). Specialty: Aquacultures

N. B. Jeffrey, Assistant Professor, 50% (upon return from 2-year tour in Brazil under AID/csd-2270, T.O. 3 on January 1, 1972)

Specialties: Aquacultures

2.112 Staff members adding to the capability of the Center, supported entirely by other funds

Dr. D. D. Moss, 100% Foreign AID/csd-2270 Programs

Specialties: Aquacultures, Pond Construction

Dr. Ray Allison, 100%

Specialties: Fish Parasites and Circulating Water Cultures

Dr. David R. Bayne, 100% Abroad on Fisheries Project in El Salvador

Specialties: Aquacultures, Aquatic Plants

Dr. W. D. Davies, 100% Abroad on Fisheries Project in Brazil

Specialties: Fish Populations, Reservoir Management

Dr. J. S. Dendy, 60%

Specialty: Limnology

Dr. John H. Grover, 100% Abroad on Fisheries Project in Philippines

Specialties: Aquacultures, Limnology

Mr. John W. Jensen, 100% Abroad on Fisheries Project in Brazil

Specialty: Fisheries Extension

Dr. J. M. Lawrence, 100%

Specialties: Aquatic Plant Control, Nutrient and Heavy Metal Relationships in Rivers and Impoundments

Dr. Leonard L. Lovshin, 100% Abroad on Fisheries Project in Brazil

Specialty: Aquacultures

Dr. John A. Plumb, 100%

Specialty: Fish Diseases

Mr. E. E. Prather, 100%

Specialties: Fish Cultures, Hatchery Management

Dr. J. S. Ramsey, 100% Leader, Alabama Cooperative Fishery Unit

Specialty: Fish Taxonomy

Dr. W. A. Rogers, 100%

Specialties: Fish Parasites and Fish Taxonomy

Dr. H. R. Schmittou, 100% Abroad on Fisheries Project in Philippines

Specialties: Aquacultures, Pond Construction

Dr. William Shelton, 100% Assistant Leader, Alabama Cooperative Fishery Unit

Specialty: Reservoir and Streams, Fish Populations

2.12 Technicians

1 Laboratory Technologist

2.13 Graduate Research Assistants and Trainees

The following graduate research assistants were supported on AID/csd-2780.

Their names, percent of time, and areas of research were:

R. K. Goodman, 33% Fish Genetics

J. D. Grogan, 33% Filters to remove fish wastes from water

W. L. Lane, 33% Digestive Physiology

D. F. Leary, 30%	Fish Nutrition and Fish Feeds
L. L. Lovshin, 60%	Aquaculture (Use of Plants to Remove Wastes)
J. W. Miller, 33%	Aquaculture (Pen Culture)

Cost of research projects of AID participant trainees from developing countries was also supported in part by AID/csd-2780. These students and their field of research were:

Philippines

Arsenio Camacho	Use of Fish Offal in Fish Feeds
Catalino De La Cruz	Aquaculture in Recirculated Water
Romeo Fortes	Relationship of Chlorophyl to Aquatic Productivity
Rafael Guerrero	Sex Reversal in Tilapia

Thailand

Kamonporn Tonguthai	Fish Parasites
Sopa Areerat	Fish Parasites
Tawan Chookajarn	River Fisheries
Vanida Koonsoongnoen	Fish Parasites
Sompong Hiranvat	River Fisheries
Prasert Sitasit	Use of Plant Proteins in Fish Feeds
Charoen Phanil	Effect of Water Hyacinths on Plankton Production
Chaliang Chaitamvong	Use of Common Carp to Clean Pond Waters

Oopatham Pawaputanon	Circulating Water Fish Culture
Somsuk Singholka	Cage Culture of Common Carp
Pichit Srimudka	Effect of Pen Culture on Water Quality
Pramot Suwanasar	Cage Culture of Tilapia

Taiwan

Charng-Jyi Chiou	Effect of Soil Phosphorus on Algae Production

Panama

Remberto Rosas	Fish Processing Technology
Rene Sanchez	Fish Nutrition

India

Dilip Mathur	Feeding Dynamics of Stream Fishes

Ghana

Lewis Sackey	Algal-induced Off-tastes in Fish

2.2 Library of World-Wide Literature on Aquacultures

Progress was continued in enlarging the library on aquacultures. Periodicals from H. S. Swingle, E. W. Shell personal collections were added to the library of the International Center for Aquaculture. Sets of publications were sent free of charge from Fisheries Departments of Thailand, Peru, Mexico, and to lesser extents by those in other countries.

Additional books and periodicals were purchased for the library, including 160 books and subscriptions to 4 periodicals.

2.3 Abstracting Service on Publications Dealing with Aquacultures and Inland Fisheries

This service to fisheries divisions and AID Missions in developing countries was continued. Publications and reprints coming to Auburn from all parts of the world are examined and information pertinent to development of aquacultures and inland and coastal fisheries is copied, indexed, and sent abroad every 4 to 6 weeks as sufficient material is accumulated. This service is effective in keeping fisheries officials, the Auburn staff abroad in AID projects, and the Agricultural Officers in AID Missions abreast of recent developments.

When requested, entire articles are xeroxed and made available.

Cross-reference files are being prepared of published information dealing with aquacultures, so that information will be readily available. No progress has been made on computerizing this information, partly because several institutions have already done this for various biological subjects or are in the process of doing so. To what extent this will serve aquacultures remains to be seen. Adequate indexing of aquacultural subjects must usually be prepared by personnel intimately involved in aquacultures, as only they would know the importance of the contents of publications in this field.

2.4 Survey of Aquacultural Developments Abroad

Following the survey of aquacultural developments in Japan and Taiwan in May-June, 1971, by Dr. H. R. Schmittou of our staff, a report was prepared and published February, 1972, entitled, "Aquaculture Survey in Japan", Project AID/csd-2780.

A similar report on Taiwan was written and is in press.

2.5 Survey of Commercial Fish Species and Fishes of Potential Value for Culture in Ecuador

One of the unsolved problems in development of aquacultures in Central and South America is that little is known about the suitability of native species for culture. The river systems of South America and especially the Amazon River system contain hundreds of species that are of potential value, but only in the last few years has any attempt been made to evaluate their usefulness for culture. Research on this problem is being conducted in a few experimental ponds in Colombia and Ecuador, with more extensive testing going on in Brazil under a USAID-Auburn University-DNOCS project at the new Fortaleza Fisheries Research Station. Many Central and South American countrie have imported fish from other countries, including the common carp, tilapias, largemouth bass, and trout. In a few countries imported species are not wanted or allowed by law. Development of aquacultures will be slow in Latin America until satisfactory local species are found. What is needed is a coordinated effort in all these countries to evaluate local species for cultures on the basis of their efficiency in utilization of natural and formulated feeds, diversity of feeding habits, maximum production per acre, acceptability on local and export markets, and costs of production under intensive culture.

Similar information is needed on the adaptability of various species to conditions in reservoirs that are being constructed for irrigation, water supply and power in the underdeveloped countries.

Following an initial survey in Ecuador under AID/csd-2270 by the Auburn University staff in 1969*, a second trip was made in 1971 to prepare a "Proposed Cooperative Fishery Program**. Because of the urgent desirability of identifying species for intensive culture and for use in reservoirs, we proposed a coordinated program between the host country, AID, and FAO. We considered a better knowledge of the commercial species of fishes, and species of fishes and shrimps potentially useful for culture of such general importance to development of fisheries in Latin America, that a survey of these species under our project AID/csd-2780 should be carried out. This was done during the period October 18, to December 4, 1971, and a report of the work is in press. The survey was made by R. Gilbert, a graduate assistant at Auburn and a consultant, Dr. Tyson Roberts of the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts. A reference collection of commercial species was prepared for the Ecuador Departamento de Piscicultura, a collection of commercial species and species considered potentially useful for Aquacultures was retained at Auburn, and a more extensive collection deposited at the Harvard Museum for identification and classification. A report is being prepared.

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*Fishculture Survey Report for Ecuador, by H. S. Swingle and F. A. Pagan, Project AID/csd-2270, December 20, 1969.

**Proposed Cooperative Fishery Program for Ecuador, by H. S. Swingle, Project AID/csd-2270, May 25, 1971.

2.6 Participation of Staff in International Activities

2.61 Surveys, Seminars and International Publications

Six staff members took part in fisheries surveys in El Salvador, Brazil, Nicaragua, Peru, and Thailand.

Dr. H. S. Swingle took part in the February, 1972, Mekong Development Panel Seminar sponsored by the Southeast Asia Development Advisory Group (SEADAG) held in California, and prepared a report entitled, "Relationship of the Thai Fish Culture Program to Production of Fish in the Lower Mekong Area."

Dr. C. E. Boyd took part by invitation in a Canadian symposium on Aquatic Communities June, 1972, and presented results of research conducted at the Auburn University International Center for Aquaculture.

Dr. E. W. Shell served as editor for preparation of an FAO Manual for Fishculture Research.

2.62 Foreign Assignments

Dr. R. O. Smitherman began, January 1, 1972, a 2-year assignment on AID/la-684 project to develop aquacultures in Panama.

Dr. H. R. Schmittou and Dr. J. H. Grover are currently serving a 2-year assignment to the Philippines under AID/ea-180 project to develop aquacultures for both freshwater and brackishwater.

Dr. David R. Bayne began a 2-year tour in El Salvador to develop aquacultures under AID/la-688 project.

Dr. W. D. Davies will return to Auburn August, 1972, from assignment in Brazil under AID/csd-2270, T. O. 4 for a 2-year period.

Dr. N. B. Jeffrey returned October, 1972, after a 2-year tour in Brazil under AID/csd-2270, T.O. 3. He was replaced by a new member of our staff, Dr. L. L. Lovshin who arrived in Brazil May, 1972. Another member of our staff, Mr. J. W. Jensen, began a tour of duty in Brazil to develop a fisheries extension program for the Northeast, both under AID/csd-2270, T.O. 8 project.

3.0 RESEARCH REPORTS

A summary of the research conducted during FY 72 by staff, graduate research assistants, and graduate students follows:

3.1 Fish Breeding and Genetics

This is a long-term project which is proceeding at a satisfactory pace and is designed to develop improved strains of channel catfish for culture and to develop methods of testing to identify genetic differences. F-2 hybrids and selected strains are currently under tests for rapidity of growth, efficiency in feed conversion, and resistance to a virus disease.

3.2 Fish Feeds and Feeding

Ascorbic acid was found to be necessary in the diet of channel catfish. Deficiency in this vitamin resulted in deformed spinal columns, reduced resistance to disease, slower growth and increased mortality. Humped back in front of the dorsal fin was the most frequent deformity.

Assistance was given in development of fish feeds from locally available materials in Brazil, Thailand, and the Philippines.

Use of "demand" feeders that are operated by the fish themselves gave slightly higher production (1,799 pounds/acre) than that obtained by hand feeding (1,599 pounds/acre), but the latter gave more efficient feed conversion (1.29 pounds to produce 1-pound catfish).

3.3 Concentrated Fish Feeds

Lowest feed to fish conversions were obtained with feeds containing 35 and 40 per cent protein. If protein is of good quality, 35 per cent is sufficient. Concentrated feeds are being tested to reduce water pollution.

3.4 Increasing Fish Production

Means for increasing fish production undergoing tests are the use of aeration, biological filtration, and methods of waste control by use of aquatic plants and animals.

3.41 Aeration

Methods of aeration include use of air blowers, water pumps spraying water into the air, water circulation, venturi-pump systems and paddlewheels. Efficiency of these methods and costs of fish production under these systems are being evaluated.

3.42 Biological Filtration

Under this method water from the culture is pumped and sprayed on the to of a tower filled with fine gravel that is open to the air. Organisms grow upon th stones and remove particulate matter and nutrients as the water passes over the gravel and returns to the culture pond. Costs for water circulation and other

costs of fish production under this method of management are being evaluated. This method of water purification has not proved entirely satisfactory because heavy plankton growth appears in the filtered water. It has produced an eight-fold increase in production over check ponds with no filtration.

3.43 Waste Control by Use of Aquatic Plants and Animals

3.431 Water Hyacinths

Water hyacinths proved very effective in absorption of nutrients from eutrophic waters. Their presence covering 0.1 to 0.05 of the pond surface prevented development of heavy plankton blooms. However, the presence of water hyacinths alone resulted in lower fish production because their presence decreased surface of water available for gaseous interchange with the air. It is evident that methods of water aeration must be added.

3.432 Use of the Plankton-feeding Tilapia

Use of the plankton-feeding tilapia, T. aurea, along with channel catfish resulted in 85 per cent increase in yield of catfish (up to 4,485 pounds per acre) plus 525 pounds harvestable tilapia, or a total of 5,010 pounds per acre harvestable fish (108 per cent increase over catfish alone). Where this combination of fishes was used in commercial production ponds, total production of harvestable channel catfish produced was 4,588.6 pounds per acre plus 1,382 pounds of harvestable tilapia, a total of 5,971 pounds harvestable fish per acre in 236 days. The S feed conversion value was 1.19 pounds feed per pound harvestable fish produced.

These experiments demonstrated that mixed cultures of channel catfish and T. aurea yielded higher production at less cost per pound than can be obtained by the culture of channel catfish alone.

3.433 The Mussel

The mussel, Corbicula, is native to Asia, but has established itself widely through the United States. It is currently in tests for the reduction of excessive algal blooms in aquacultures.

3.5 Cage Culture of Fishes

Culture of Tilapia aurea in cages suspended in ponds, where plankton was abundant as a result of commercial production of channel catfish, yielded 131 pounds/m^3 of cage in 80 days without feeding the tilapia. They utilized plankton present in water that passed through the cage as a result of wind action. There was no reproduction by the tilapia under these conditions and this may be a usable method of growing tilapia in eutrophic waters.

When fine-mesh screen was placed in the bottom of the cage, tilapia deposited eggs on the screen, and subsequently incubated the eggs in their mouths. Apparently use of screens too coarse to retain the eggs in the bottom of the cage is necessary to prevent reproduction by these fish:

Feeding the tilapia in cages yielded 317 to 443 pounds tilapia per m^3 in 80 days. The S feed conversion of tilapia in cages varied from 0.95 to 1.35 for floating pellets and 1.86 for sinking pellets.

3.6 Pen Culture

This research was continued at Auburn and in Thailand to develop methods for intensive culture of fish in fenced-in areas along the margin of reservoirs. The pens were placed in water extending from the shoreline to water depths of 5 feet. Tests are in progress to determine the life expectancy of bamboo and plastic net fences in coordinated experiments at Auburn and in Thailand. Production in pens stocked with Tilapia aurea and channel catfish was 12,660 to 15,688 pounds fish per acre of pen when feeding was used. Feed conversions ranged from 1.38 to 1.57.

In pens without feeding, production was 2,250 pounds per acre of the plankton-feeding tilapia and only 106 pounds of the insect-feeding catfish. Outside the pens, the standing crop of fish was approximately 400 pounds/acre of catfish-tilapia-bluegill-largemouth bass. This indicated that tilapia in pens were utilizing fish-food organisms that were not being adequately harvested by the fish population free in the pond.

Research is continuing to determine optimum stocking rates and most suitable species for pen culture. This method of culture appears promising for use in developing countries when reservoirs have been constructed for irrigation, or local water supplies.

3.7 Use of the White Amur for Control of Aquatic Weeds

This fish when stocked at rates of 10 to 20 per acre in ponds controlled weeds effectively over a 4-year period without interference with the growth of

bluegill-bass or channel catfish. This species should be especially useful in areas where schistosomiasis occurs. The alternate host of this parasite is snails. It has been found that snails are principally abundant when marginal waters are filled with aquatic weeds, and that most of the snails disappear after the weeds are eliminated. Removal of the weed cover makes snails vulnerable to predation by many species of fishes.

For stocking into established fish populations in reservoirs, this fish must be 6 to 8 inches in total length to survive predation by fish-eating species.

3.8 Studies on Algal Blooms

One of the problems in aquacultures worldwide is that of fish kills caused by overabundant blooms of algae and their subsequent die-offs. Blue-green algae are the principal causes of these fish kills. Research demonstrated that the blue-green algae excrete wastes which prevent growth of the more desirable green algae, with the result that there is often a monoculture of blue-green algae. These algae are objectionable because they rise to the surface in hot still days and these scums prevent photosynthesis in deeper waters. Companion research on this problem is being conducted in Israel.

3.9 Off-Flavors in Fish

Off-flavors occur in fish and other aquatic products both in nature and where under culture. Anabaena, a bluegreen algae, and Actinomycetes were found to cause musty off-flavors in fish; they also cause similar odors and taste in city water supplies coming from impoundments. Methods for their control are being studied.

4.0 PUBLICATIONS

A list of publications from the International Center for Aquaculture and the Department of Fisheries and Allied Aquacultures follows. Personnel on research supported wholly or in part by this project are marked by asterisks

*BOYD, CLAUDE

Leaf protein from aquatic plants. N. W. Pirie (Ed.) Leaf protein: Agronomy quality, and use. IBP Handbook, No. 22, Blackwell Sci. Pub., Oxford p. 44-49.

Limnological role of aquatic macrophytes and their relation to reservoir management. G. E. Hall (Ed.) Reservoir Fisheries and Limnology. Special Publ. No. 8, Amer. Fish. Soc., Washington, D.C. p. 153-166.

Nutritive quality of food in ecological system. Archiv. Hydrobiol. 68:156-172. (with C. Philip Goodyear).

The expression of net primary production in terms of dry matter, organic matter, carbon, or energy converts all units of plant production to an equivalent basis. However, net production differs in chemical composition and nutritive value depending upon species, plant age, and habitat. The nutritive quality of net primary production is very important in determining the efficiency of food utilization by herbivores. Nutrient content is equally important in determining the rate of decomposition of organic residues. Carnivores consume food of high nutrient content, especially with respect to protein, and adequate nutrition for these animals is likely determined by the amount of food consumption rather than by nutritive quality. Omnivores and detritivores fall somewhere between carnivores and herbivores with respect to the importance of food quality in regulating their growth and numbers in natural systems.

The use of energy flow or transfer in ecosystem analysis is a gross oversimplification of the relationships between organisms and their food. Energy utilization by consumers is regulated by nutritive quality of the food and all other factors regulating population sizes.

CHIEN, SHIH MING

Dactylogyrids from North American cyprinids of the genus Nocomis. The Reciprocus species group. Jour. of Parasit. 57(6):1211-1214.

DENDY, J. S.

Disposable planchets for weighing Macrobenthos. Progressive Fish-Culturist, 33(3):184. (with G. B. Pardue, and L. R. Aggus).

Phenology of midges in experimental ponds. Proc. of the 4th International Symp. on Chironomidae, the Canadian Entomologist, 103(3):376-380.

GREENE. GEORGE N.

An experiment on the effect of pond soil on calcium in pond water. Trans. Am. Fish. Soc. 100(3):580-582.

It appears that the soil absorbed added calcium until the calcium level in the water was reduced to about 20 to 30 ppm. This means that unless sufficient lime is added to satisfy the lime requirement of the soil, any increase in hardness from liming will be only temporary. When the lime requirement of the soil was satisfied with calcium carbonate, the calcium level in the water was higher (about 40 ppm). This is approximately the level reached with added calcium carbonate in the absence of soil. Equilibrium had probably not been reached in Treatment 6 since a downward trend in the calcium level was still evident at the end of the experiment.

JOHNSON, STERLING K.

North American distribution record for Paraergasilus Markewitsch, 1937 (Copepoda: Cyclopoidea: Ergaislidae). Jour. of Parasit. 57(5):1051

*KILGEN, R. H. AND R. O. SMITHERMAN

Food habits of the white amur stocked in ponds alone and in combination with other species. Progressive Fish-Culturist, 33(3): 123-127.

White amur, when stocked alone at rates of 40 (or more) per acre, effectively eliminated Chara spp., Potamogeton diversifolius, and Eurasian milfoil in less than 99 days, and caused a decrease in the amount of water hyacinths in 0.1-acre earthen ponds. Under these

conditions, their diet consisted mainly of macrophytes and algae (75 to 95 per cent by volume) and only a small amount of mature insects (0 to 18 per cent).

When stocked in combination with channel catfish, Israeli carp, and three basses (largemouth, redeye, and spotted) their diet consisted of 84 per cent macrophytes and only 9 per cent insects (larvae). In this case, with virtually no aquatic plants in the pond, white amur resorted to nibbling grass roots and stolons at the pond edge.

These findings point out the benefits of using white amur in situations where biological methods of weed control are preferable to chemical methods. They also indicate that white amur do not pose a threat as a competitor for food organisms eaten by game fish. They also provide an excellent food source and game fish since they can be taken by angling using worms as bait.

*LIANG, J. K. and R. T. LOVELL

Nutritional value of water hyacinth in channel catfish feeds. Hyacinth Control Jour. 9(1):40-43.

A series of feeding trials were conducted for the purpose of biologically evaluating aquatic plants, primarily water hyacinth, as feedstuffs for channel catfish. By conditioning the fish and gradually increasing the level of plant meal, 40% of the meal in the diet was consumed, but with reluctance. Water willow was most palatable followed by water hyacinth, then, alligatorweed. The protein efficiency ratio of a protein concentrate from water hyacinth was 0.34 which was much lower than 4.87 for casein.

The most feasible nutritional contribution of the water hyacinth appears to be when the plant meal is fed as a low percentage in vitamin-poor diets as a source of growth factors. The addition of small quantities 5 to 10%, of hyacinth meal in vitamin-free diets increased growth and reduced mortality of channel catfish fingerlings. Water hyacinth meal provided significantly higher weight gains and lower mortality than did commercial alfalfa meal when fed in a vitamin-free diet. It may be feasible to substitute the alfalfa meal with water hyacinth meal in feeds for catfish, assuming that alfalfa has nutritional value in these feeds

* LOVELL, RICHARD T.

The off-flavor problem in commercially cultured catfish. Proc. Assoc. Southern Ag. Workers, Inc. 68th Ann. Convention p. 139.

Significant aspects of feed preparation for feeding catfish. Proc. Ga. Nutritional Conf. (Univ. of Ga.) p. 101.

Stability in water is the most important physical aspect of pellet quality. The pellet should be resistant to water penetration and subsequent disintegration, to erosion, and to leaching of nutrients. Pellets which degrade quickly in water are not consumed efficiently by the fish. This not only results in poor feed conversion but also in poor water quality. Uneaten organic matter increases the oxygen demand in the water, and inorganic material not absorbed by the fish contributes to more profuse growth of algae in the pond. The pellet should remain relatively intact in the water for at least 10 minutes. Catfish are rapid feeders and, usually consume all they want within 15 minutes.

The fiber in the pellet provides mechanical strength and surface area upon which the bonding agents can adhere. Excessive fiber in the formulation may reduce the quality of the pellet as was demonstrated in a feeding experiment at the Auburn Fisheries Laboratory. Several precautions should be taken to insure good pellet quality. Too much moisture added in the manufacturing process can cause plugging of equipment and excessive drying time. Not enough moisture will reduce the quality of the pellet. Insufficient drying may result in moldy pellets. Frequently moldy fish feeds are found. This may be the fault of the feeder due to improper storage. Since fish feeds are often stored near water where the relative humidity is high, the use of bags with polyethylene liners to reduce moisture penetration would be advantageous. Moldy feeds could contain mycotoxins (mold poisons) which are toxic to catfish.

The advantages of the non-sinking or slow-sinking pellet are: feed consumption can be observed easier, particularly by the untrained feeder, which will help prevent over-or underfeeding; off-feed or disease can be detected easier when fish feed on the surface of the water; and some fish culturists claim that fish feeding on the surface may be less likely to contact diseases than bottom feeders.

As the industry becomes more competitive and profit margins narrow and feeds costs become more critical, it is doubtful that a feeder can afford to pay this magnitude of difference in price for the benefit of an expanded pellet.

The heat stability of the various vitamins during the expanded pelleting process has not been investigated. Generally, fat soluble vitamins are not destroyed to a great degree by heat, providing the exposure to oxygen in minimized. Several of the water-soluble vitamins used in catfish feeds are heat sensitive, thiamine being the most sensitive. On the average approximately 50 per cent of the thiamine is lost in thermally processed foods receiving intensive heat treatment. Perhaps thiamine activity could be used as an index of vitamin stability in fish feeds receiving high heat treatment in their manufacture.

PLUMB, JOHN

Channel catfish virus research at Auburn University. Ag. Exp. Sta., Auburn U., Prog. Rep. Series No. 95, 3 pp.

Channel catfish virus (CCV) research at Auburn University Agricultural Experiment Station primarily involves development of methods of detecting the disease in carrier populations. Data collected to date indicate that methods used in detection of infectious pancreatic necrosis (IPN) virus and viral hemorrhagic septicemia (VHS) of trout are not applicable to CCV. High CCV neutralization indices were found in 52 channel catfish broodstock suspected of being virus carriers but no viable virus was isolated. The principal organs involved in fingerling channel catfish infected with CCV are kidney, liver and intestine although the muscle and brain yielded detectable virus.

Fish cell growth rates: Quantitative comparison of RTG-2 cell growth at 5 to 25 C. In Vitro, 7(1):42-45. (with K. E. Wolf).

Tissue distributions of channel catfish virus. Jour. Wildl. Dis. 7:213-216.

The kidney, liver, intestine, brain, and muscle of live infected channel catfish were assayed for channel catfish virus in channel catfish gonad cell cultures. Sampling was done at 24-hour intervals for 120 hours. The virus was first detected in the kidneys of channel catfish 24 hours after inoculation. Channel catfish virus was also isolated at sequential time intervals from the intestine, liver, brain, and muscle. Virus was detected in the kidney, liver, and intestine but not the brain of the fish that died 70 hours after infection.

RAWSON, MAC, JR.

A redescription of Anchoradiscus trigangularis (Summers, 1937) Mizelle, 1941 (Tremotoda:monogenea) from the bluegill Lepomis macrochirus Rafinesque. Proc. of Helminthological Soc. of Wash. 38(2):264-266. (with W. A. Rogers).

ROGERS, WILMER A.

Principal diseases of catfish. Fish Farming Industries, 1971. 2(1):20-26.

Discussion of parasites and diseases affecting channel catfish with drawings and descriptions of causal organisms and methods for their control.

ROGERS, (cont.)

Sebekia oxycephala (Pentastomida) in Largemouth Bass from Lake St. John, Concordia Parish, Louisiana. Jour. Parasit., 57(5):1028. (with George H. Dukes, Jr., Robert M. Shealy).

WILLIAMS, E. H.

Two new species of Gyrodactylus (Trematoda:monogenea) and a redescription and new host record for G. prolongis Hargis, 1955. Jour. of Parasit. 57(4):845-847.

*SWINGLE, H.

Relationship of the Thai fish culture program to production of fish in the lower Mekong Area. Mekong Development Panel Seminar, Feb. International Center for Aquaculture, 1972. 15 pages.

Research by the Thailand Department of Fisheries Stations and Research Units has developed cultures for use in hatcheries, rice fields, ponds, cages, pens and irrigation ditches that can be utilized in rapid expansion of fish production as irrigation water is made widely available from Mekong impoundments. They have also determined the feeding habits of many indigenous species to facilitate selection of species capable of utilizing the various types of natural fish-food organisms in various habitats.

IN PRESS (1972)

*BOYD, CLAUDE

Studies on the biogeochemistry of boron. I. Concentrations in surface waters, rainfall and aquatic plants. Amer. Midl. Nat. (with W.W. Walley).

A bibliography of interest in the utilization of vascular aquatic plants. Econ. Bot. 25.

Phosphorus dynamics in ponds. Proc. 25th Ann. Conf. S.E. Game and Fish Commrs.

CHIEN, SHIH MING

Dactylogyrids from North American cyprinids of the genus Nocomis. The Bellicae species group. Jour. of Parasit.

PLUMB, JOHN

Channel catfish virus disease in Southern United States. Proc. 25th Ann. Conf. S.E. Assoc. Game and Fish Commrs.

A virus-caused epizootic of rainbow trout (Salmo gairdneri) in Minnesota. Trans. Am. Fish. Soc. 101(1).

* PRATHER, E. E.

Effect of vitamin fortification in Auburn No. 2 fish feed. 25th Ann. Conf. Southeast. Assoc. Game and Fish Commrs. (1971). (with R. T. Lovell)

Vitamin fortification of the Auburn No. 2 pelleted fish feed increased net production of channel catfish an average of 19.3 per cent in feeding tests conducted in replicated earthen ponds between April 13 and November 9, 1970. A stocking density of 4,000 fingerlings acre was used and the fish were fed 6 days per week. In comparison to a second commercial catfish feed containing identical vitamin fortification, the fortified Auburn No. 2 feed produced an increase in net production of 39.5 per cent.

Feed conversion, gain per day and average weight of fish at harvest were all superior with the fortified Auburn No. 2 feed when compared to the other two rations.

*RAMSEY, J. S.

Development of color pattern in pond-reared young of five Micropterus species of Southeastern U.S. Proceedings 25th Ann. Conf. Southeastern Assoc. of Game and Fish Commrs. (with R. O. Smitherman).*

REEVES, WILLIAM C.

Effects of increased water hardness, source of fry and age at stocking on survival of striped bass fry in earthen ponds. Proc. 25th Ann. Conf. S.E. Assoc. of Game and Fish Commrs. (with Jerome F. Germann).

*SMITHERMAN, R. O.

Observations on spawning and growth of four species of basses (Micropterus) in ponds. Proc. 25th Ann. Conf. S.E. Assoc. of Game and Fish Commrs.

Research on exotic fish species. Proc. Primer Seminario Sobre Piscicultura En Colombia. Presented at Universidad de Caldas, Manizales, Colombia, Jan. 12-16.

*SWINGLE, H. S.

Developments of systems of Aquaculture for India. Indian Journal of Fisheries.

Aquaculture: Raising food crops in water. World Farming Magazine.

5.0 TRAINING CONDUCTED AND DEGREES AWARDED

5.1 Seminars

Seminars were conducted at Auburn for training participants under AID fellowships and for students specializing in aquacultures. Following is a list of gue:

October 1, 1971

Dr. William Shelton, Assistant Leader, Alabama Cooperative Fishery Unit, Auburn University. "The Comparative Reproduction Biology of Gizzard Shad and Threadfin Shad in Lake Texoma, Oklahoma."

October 8, 1971

Dr. John H. Grover, Assistant Professor, Deparment of Fisheries and Allied Aquacultures, Auburn University (now serving 2-year assignment in the Philippines.) "Fish and Fishing in North Africa".

October 15, 1971

Dr. Fred Meyer, Chief, Fish Farming Experimental Station, Stuttgart, Arkansas. "Role of Disease and Parasites in Fish Kills."

January 7, 1972

Dr. F. Eugene Hester, Chief, Division of Fishery Research, BSFW, Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C. "The Role of the Division of Fishery Research".

January 14, 1972

Dr. Roger Lee Herman, Libby-Owens Truck and Trout Farms, Owens, Illinois. "Fish Pathology in Trout Culture".

January 21, 1972

Mr. Alex Montgomery, Regional Supervisor, Fishery Services, BSFS, U.S. Fish and Wildlife Service, U.S. Department of the Interior, Atlanta, Georgia. "Southeastern Fisheries Program of the Service."

January 28, 1972

Mr. R. J. Gilbert, Graduate Research Assistant, Department of Fisheries and Allied Aquacultures, Auburn University. "Fishes of Ecuador".

February 11, 1972

Dr. Mitsutake Miyamura, Vice President, Marifarms, Inc., Panama City, Florida. "Marifarms Efforts in Shrimp Culture".

Mr. David Bowman, Peace Corps Volunteer, U.S. Peace Corps, Santa Porillo Fisheries Station, Santa Porillo, El Salvador. "Fishculture in El Salvador".

February 18, 1972

Mr. Wayne E. Swingle, Chief Biologist, Seafoods Division, Alabama Department of Conservation, Marine Resources Laboratory, Dauphin Island, Alabama. "Cultures of oysters and trout; research conducted by the Seafoods Division."

February 25, 1972

Mr. Philip C. Pierce, AID/W (Formerly Aquatic Plant Specialist for AID/Ghana). "The Lake Volta Project".

5.2 Students in Academic Fisheries Courses

5.21 Undergraduate Students (U.S. and Foreign)

During the 1971-72 academic year there were an average of 35 undergraduate students enrolled in the Fisheries Curriculum each quarter.

5.22 Graduate Students

In the 1971-72 academic year there were 48 graduate students enrolled in the Department.

5.23 Number of Students in Courses

A total of 365 students registered in the 23 courses offered during the 1971-72 academic year. The total student credit hours produced was approximately 1500.

5.24 Degrees Awarded

M.S. in Fisheries Management

J. H. Addison - U.S.

W. Reeves - U.S.

J. H. Schachte - U.S.

W. H. Tucker - U.S.

Kamonporn Tonguthai - Thailand

Ph.D. Degree (Fisheries)

J. L. Gaines

J. A. Plumb

H. Wahlquist

5.3 Special Training for Biologists and Officials from Foreign Countries

Short-time training and instruction was given, including the following subjects as required:

Reservoir construction
Experimental pond construction
Fish feeds and feeding
Limnology
Fish cultural methods
Aquatic plant utilization and control
Fish parasite and diseases
Water quality criteria and anaylses
Fish processing technology
Research methods and records
Circulating water cultures and waste removal

Staff from the International Center for Aquaculture participated in the training and instruction at Auburn of biologists and officials from the following countries:

Mr. Wittington Kakdna Sikalumbi, Minister of State, Lands and Natural Resources Zambia. Mr. John Large, State Department, was Mr. Sikalumbi's escort. September 3, 1971.

Sr. Gustavo Casas A., C.I.F.S.A., Consultores en Ingenieria, Fluvio Maritima S.A., Mexico D.F., Mexico. September 27 and 28, 1971.

Sr. Absalom Lara Vargas, C.I.F.S.A., Consultores en Ingenieria, Fluvio Mariti S.A., Mexico D.F., Mexico. September 27 and 28, 1971.

Sr. Yunuen Rabadan G., C.I.F.S.A., Consultores en Ingenieria, Fluvio Maritima S.A., Mexico D.F., Mexico. September 27 and 28, 1971.

Mrs. Indu Mehta, FAO Fellow, Assistant Plant Physiologist with the United Nation Development Program (Special Fund) Chambal Land and Water Use Management Project, Rajasthan, India. October 4.-October 15, 1971.

Sr. Rudolfo Parades Perez, Technical Advisor, Fresh Water Fish, Division de Promocion, Lord Cockrane 351, Miraflores, Lima, Peru. October 9-16, 1971.

Dr. Reynaldo Lantin, Assistant Professor, Power and Machinery Division, Department of Agricultural Engineering, University of the Philippines, Laguna, Philippines. October 12, 1971.

Mr. Felix Gonzales, Deputy Commissioner, Philippines Fisheries Commission, Intramuros, Manila, Philippines. October 20, 1971.

Mr. Dan Tibbs, III, Area Manager, Recruiting Action, Peace Corps/Vista, Atlanta, Georgia. October 20, 1971.

Dr. F. A. Pagan, Department of Marine Sciences, University of Puerto Rico, Mayaquez, Puerto Rico. October 31 -November 7, 1971.

Sr. Jose Gonzales, Department of Marine Sciences, University of Puerto Rico, Mayaquez, Puerto Rico. October 31-November 7, 1971.

Mr. S. B. Singh, Central Inland Fisheries Research Sub-Station, Cuttack, Orissa, India. November 2-5, 1971.

Sr. Jorge Carranza, Senior Researcher and Professor, Institute of Biology, University of Mexico, Mexico 20, D. F., Mexico. November 19 - 22, 1971.

Sr. Jose A. Fernandes, Agronomist, DNOCS, Ceara, Brazil. November 18-November 24, 1971.

Sr. Jose W. Bezerra e Silva, Chief of Section, DNOCS, Ceara, Brazil. November 18 - November 24, 1971.

Sr. F. H. Nepomuceno, Agronomist. DNOCS, Ceara, Brazil. November 18-24, 1971.

Sr. Edmundo de A. Duarte, Researcher, Fishculture Biology, DNOCS, Ceara, Brazil. November 18-24, 1971.

Mr. Paul Sundheimer, AID Mission, Bogota, Columbia. November 22-24, 1971.

Mauro E. Amutan, Chief, Fisheries Program, National Food and Agricultural Council, Diliman, Quezon City, Philippines. January 30-February 3, 1972.

David Bowman, U.S. Peach Corps, Santa Cruz, Porrillo Fisheries Station, El Salvador. February 9-12, 1972.

Dr. Elvira Tan, National Science Developmental Board, Philippines. April 1-8.

Pres. Mauyag M. Tamano, Mindanao State University, Marair, Philippines. April 27, 1972.

Mr. Ernesto Herrera, Chief of Fisheries, Northern Zone, Ministry of Fisheries, Lima, Peru. May 7-27, 1972.

Mahmoud Mohammed Kashid, FAO Fellow, Department of Fisheries, Cairo, Egypt. May 18-19, 1972.

Dr. Frank Sheppard, Chief Agricultural Officer, USAID/Philippines. June 5-6, 1972.

Mr. Shimon Tal, Division of Fisheries, Tel Aviv, Israel. June 9-10, 1972.

5.4 Other Visitors to the International Center

An estimated additional 200 visitors came to the Center for advice on problems relating to catfish culture, and for identification of parasites and disease, or to become familiar with research results.

These were principally fish farmers, sportsmen, and personnel from other Universities or fisheries divisions.

Groups and professional visitors are listed below.

June 26, 27	Dr. Lloyd Lamouria, Head-Agriculture Engineering Department California Tech State University, San Luis Obispo, California.
July 21	Bob Ingram, "South Magazine", Montgomery, Alabama.
July 28	Wayne McLendon and J. W. Kinsey, Georgia Game and Fish Commissioners, Calhoun, Georgia.
August 2	I. B. Byrd, U.S.D.I.-BCF , St. Petersburg, Florida.
August 3	H. E. Bray, Pompano Beach, Florida.
August 4	Fernando Wong Davila, Lima, Peru.
August 10	John W. Andrews, ARS, Conecuh, Co.
August 23	Claude Kelley, Charles Kelley, and Archie Hooper, Alabama Department of Conservation.
August 25	A. G. Duke, St. Regis Paper Company, Pensacola, Florida.
Aug. 31-Sept. 3	S.C.S. Group from U.S. for Aquaculture Shortcourse.
October 4	H. J. Bowen, The Franklin Institute, Philadelphia, Pennsylvania.
October 5	O. E. Sell, Georgia Experiment Station, Griffin, Georgia.
November 16	Dr. W. R. Willard, Kentucky Medical School, Lexington, Kentucky.

December 1	Tony Calabrese, U. S. Bureau of Commercial Fisheries, Shellfish Laboratory.
December 16	E. T. Burkholder, International Basic Economic Corporation,
January 5	Lee Scrivner, Georgia-Alabama Bass Club.
January 12	Michael F. Schaible A. E. O. Systems, Inc., Laritano, Florida.
February 11	Dr. Mitsutoke Miyamura, V. P. Mari-Farms, Inc., Panama City, Florida.
February 15	Dr. Damon C. Shelton, Ralston Purina Fish Food Research Division, St. Louis, Missouri.
February 21	Harry Knipp, Motion Picture Producer, Int. Harv. Co., Sheridons, Illinois.
March 3	University of Florida Agriculture Engineering (5 persons).
March 22	Mario Pamatmat - University of Washington, Department of Fisheries.
March 27	Dr. Albert Hasler - University Wisconsin.
March 30	Rotary International
April 27	Charles Madewell and Barry Gass - TVA - Rural Development.
May 18	Dr. R. B. Wagner and L. R. Sherman, Hercules, Inc. Wilmington, Delaware.
May 23	Ken Riding and 2 other movie men from International Harvester C(
June 8	R. Mansfield-Jones, AID advisor, Guatemala.

6.0 ADDITIONAL SUPPORT FROM AUBURN UNIVERSITY

The University will have completed one wing of a planned four-wing building to house the International Center for Aquaculture and the Department of Fisheries and Allied Aquacultures. The completed wing has a total of 19,000 square feet of space, at a cost of $1,050,000.

Additional space was allotted to the Department in the form of four brick laboratory buildings with 6,480 square feet of space, with an estimated value of $750,000. This will insure adequate space for training of participants and graduate students in research as well as their academic training. It will make available some space for expansion of activities in fisheries and water management.

Additional land (60.4 acres) was purchased at a cost of $26,000 to provide a site for a new water reservoir pond to supply extra water to the experimental pond area.

Additional funds ($12,000) were allotted to the Department by the Agricultura Experiment Station to cover increased costs of current research, and to initiate new research on commercial fish production.

7.0 OTHER ADDITIONAL PROJECTS AND FUNDS FOR RESEARCH ADDED IN FY 72

7.1 Ecological Factors Associated with Dense Blooms and Die-Offs of Blue-Green Algae.

This was proposed as an international cooperative project with Israel to be supported by National Science Foundation. However, funds did not become available in Israel for international research. The project is being carried on by joint Auburn University Agricultural Experiment Station ($10,000) and AID 2780 funds because dense blooms of blue-green algae are the cause of fish kills in cultures throughout the world.

7.2 Fish Parasites and Diseases

. . Additional funds ($20,000) were made available by two southeastern states (Tennessee and Missouri) for research on fish diseases.

7.3 Survey of River at Proposed Nuclear Power Site

Supported by Alabama Power Company -$30,000

7.4 Weed Control in Reservoirs (U.S. Corps of Engineers-$6,000)

8.0 ADDITIONAL AID PROJECTS FINANCED BY USAID MISSIONS

The following AID projects were initiated in FY 72:

AID/csd-2270, T.O. 5 - Fishery Survey in Peru - $4,631

AID/csd-2270, T. O. 7 - Fisheries in Thailand - $16,500

AID/csd-2270, T.O. 8 - Fisheries Research, Training, and Extension in Brazil - $91,285

AID/ea-180 - Fisheries Research and Training in the Philippines-$77,95

AID/la-684 - Fisheries Research and Training in Panama - $119,881

AID/la-688 - Fisheries Research and Training in El Salvador-$80,003

9.0 EXPENDITURES FOR VARIOUS ACTIVITIES FROM 211(d) AND OTHER FUNDS

Total funds expended for teaching, research and other items on 211(d) and Departmental funds in FY 72 are itemized below for the various activities of the Center and of the Department of Fisheries and Allied Aquacultures.

Estimated Expenditures per Each Activity	Funds 211(d)	Other Funds*
Administrative	$ 21,000	$ 88,071
Library, acquisition, indexing. abstracting, xeroxing, and distribution	11,900	3,000
Foreign surveys	8,000	-
Publications and distribution	3,600	8,233
Teaching and supervision of graduate research	18,900	73,000
Special programs for short-time visitors to the Center	3,000	8,000
Graduate Research Assistants	22,200	30,303
Research Expenditures For:		
AID Participant Trainees	8,000	8,000
Other graduate students	12,000	25,000
Staff	63,090	240,203
Total	$ 171,690	$ 436,810

10.0 EXPENDITURES
ACTUAL AND PROJECTED
UNDER THE 211(d) GRANT AID/CSD--(GRANT #)

			Expenditures to Date		Projected Expenditures Note: List by Separate Columns the Estimated Yearly Expenditures for Remaining Years of Grant				Projected 5 year Total
			For Period Under Review	Cumulative Total	1973	1974	1975	197	
Salaries	:	Academic	60,298.01	124,244.00	73,560	80,000	84,000		361,804.00
		Library							
		Secretarial	5,019.76	9,659.76	4,140	4,380	4,620.		22,799.76
		Other (List)	27,120.70	27,120.70	20,000	20,000	20,000		87,120.70
Fringe Benefits	:		7,129.13	12,414.18	10,878	11,813	12,407		47,512.18
Student Fellowship	:	Stipends	22,177.50	38,182.50	12,000	15,000	15,000		80,182.50
		Tuition							
Consultants (a)	:		2,980.00	2,980.00	1,000	1,000	1,000		5,980.00
Guest Lecturers (b)	:		140.00	140.00	500	500	500		1,640.00
Travel Expenses	:	U.S.	1,583.00	2,281.00	1,000	1,000	1,000		5,281.00
		Foreign	4,960.00	5,747.00	2,400	2,500	2,500		13,147.00
Equipment (c)	:		7,026.00	9,600.00	4,000	4,000	4,000		21,600.00
Library Acquisitions (Books, etc.) (d)	:		2,561.00	2,886.00	3,000	3,000	3,000		11,886.00
Other (Telephone, Postage, Supplies) (e)	:		30,694.00	55,729.82	30,000	30,000	25,317.04		141,046.86
TOTAL			171,688.10	290,984.96	162,478	173,193	173,344.04		800,000.00

Footnotes

For the 12 month period of the report explain here in one or two sentences the following;

(a) Number of consultants used. Two on Ecuador survey
(b) Number of guest lecturers. One paid, others no charge
(c) Items of equipment purchased (over $100) etc.
(d) Number of books, periodicals, etc., purchased.
(e) List the type of expenditures covered under this heading.

Salaries (other): Wages for student and day labor used in pond research, abstracting, filing, laboratory research.

(c) Major Equipment Purchased

Shaker	$446
Water bath	281
Oxygen meter	197
Incubator	974
Light meter	681
Transcriber	305
Feed chopper	250

(e) Other

Office-Lab Supplies
Fish Feed
Gas-Oil
Photo and Duplication
Postage
Telephone
Chemicals and glassware
Leaflets-publications; reports

11.0 SALARIES AND FRINGE BENEFITS

NAME AND POSITION LIST BY NAME AND POSITION THE AMOUNT OF SALARY SUPPOI AND FRINGE BENEFITS PROVIDED TO PROFESSIONAL AND NON-PROFESSIONAL EMPLOYEES FROM 211(d) FUNDS	SALARY	BENEFITS
Boyd, Claude E.	$ 16,500.00	$ 2,174.71
Lovell, R. T.	5,340.00	682.00
Shell, E. W.	5,044.00	657.34
Smitherman, R. O.	8,046.67	835.97
Swingle, H. S.	12,349.00	1,397.75
Jeffrey, N. B.	6,100.50	843.33
Jensen, John	1,607.67	240.83
Plumb, J. A.	1,916.67	287.11
Lovshin		9.89
Tillery, Lynda	3,393.51	
Cobb, Evelyn	184.17	
Schryer, Margaret P.	2,957.67	
Vandiver, Terri T.	1,877.92	
	$ 65,317.77	

12.0 GRADUATE RESEARCH ASSISTANTSHIPS

NAME AND AREA OF WORK	NATIONALITY	TUITION (211(d)	STIPENDS (211(d)
Busch, R. L.	American		$ 2,160.00
Gilbert, Ronnie J.	American		1,250.00
Goodman, Randall K.	American		2,160.00
Grogan, John D.	American		2,160.00
Lane, William L.	American		2,160.00
Leary, D. F.	American		2,366.67
Lovshin, L. L.	American		4,745.83
Miller, James W.	American		2,160.00
Smith, Paul L.	American		2,750.00
Wahlquist, Harold	American		265.00
TOTAL			$22,177.50

13.0 FOREIGN TRAVEL

DESCRIPTION	DOLLAR AMOUNT PER TRIP
A BRIEF NARRATIVE STATEMENT LISTING THE NAME AND TITLE OF THE INDIVIDUAL, PURPOSE AND RESULTS OF THE TRIP, DURATION AND THE TOTAL AMOUNT CHARGED TO THE GRANT. IF PARTIAL FUNDING WAS CHARGED TO THE GRANT, THIS SHOULD BE INDICATED----------	
H. R. Schmittou, Asst. Prof. - to study recent development of fish culture in Taiwan and Japan. Duration from May 12 until June 15.	$1,638.37
Ronnie Gilbert, Grad. Res. Asst. -Survey of commercial species of fish in Ecuador and species suitable for cultures. Duration of trip from Oct. 16 -Dec. 4.	$3,321.15
	$4,959.52

14.0 OBJECTIVES

14.1 To Add Experts in Selected Fields to the Faculty

This has been done to the extent made possible by 211(d) funds. However, we have in FY 72, 6 experienced staff members beginning 2-year tours abroad under our contracts with AID Missions in Brazil, Philippines, Panama and El Salvador, while one returned from Brazil. Consequently, we find it necessary to recruit new staff members, two on 211(d), one on teaching funds and one on state funds for research. At the same time, we expect the overseas staff to return to research-teaching jobs at Auburn on completion of their assignments. Their experience will add to the competence of the Center, while their absence detracts from it. In order for work abroad to be done by experienced personnel trained specifically in the work to which they are assigned, funds are needed for a rotating staff. Provision for 7 man-years, with a minimum of 4, are contained in our world-wide project, AID/csd 2270, but Task Order 6, presently funding the project provides funds for only 1.0 full-time staff member plus 0.35 man-year for short term services. Man-power for servicing short time or long time technical services therefore must come largely from staff on 211(d) or those on University funds.

14.2 To Develop a Library of World-Wide Literature on Aquaculture and More Effective Methods for Dissemination of This Information

Development of the library is progressing satisfactorily and will be continued.

Abstracting and making recent developments in Aquaculture available to key personnel in host countries and to Agricultural Officers in other Missions has continued. As soon as sufficient important abstracts are accumulated (6 to 9 weeks), they are indexed and sent abroad by air mail. Copies are sent to key personnel in host country fisheries divisions, with the hope that they are made available to all of their interested biologists. In some cases, copies are sent directly also to heads of local stations working on aquaculture.

We have considered a formal newsletter, but feel that the FAO periodic publication entitled "Fish Culture Bulletin" serves this purpose.

The problem with published material is to get it cross-referenced so that pertinent material is readily available. We have considered entering the data on computer cards, but find that several organizations are already doing this to some extent. We are examining these to see if it allows retrieval of the detailed information needed by research and extension personnel working on aquacultures.

At present we prepare card files by country, by species and by subjects of interest to workers in the field.

14.3 To Provide Educational Opportunities in Aquaculture For Governmental Agencies, Participant Trainees for AID, FAO and Foundation and Students Wishing to Specialize in this Field.

This objective we feel we are especially qualified to attain because of our staff, long-experienced in research and teaching of various fields related to aquacultures, plus the extensive laboratory and field facilities developed at Auburn for research. The experimental pond system of over 240 earthen ponds, supplemented

by concrete and plastic-lined ponds on a 1,360-acre fisheries research unit is the largest and best in the world. The ponds and their populations of fish, other aquatic animals and plants are available for laboratory courses in dealing with all phases of aquaculture, and graduate students and participant trainees are assigned laboratory and research space for realistic training for the work in which they will engage.

Our greatest problem is that more and more participant trainees are coming each year, which increases the cost of their research and extension training, and funds for this purpose are not made available by either AID Missions or FAO. The average cost of the research problem conducted by trainees is between $500 to $1,000 per person per year, including the cost of staff supervision and pond-laboratory operation. These costs therefore came from research funds under 211(d) or University Experiment Station funds. We feel that we could do a better job of training if we had more staff. Training of participants from other countries requires approximately 3 times as much staff time as American students, principally because of the short-time trainees are here, and to some extent by language difficulties arising from need of precise writing of English required by science.

14.4 To Develop a Worldwide Collection of Data on Species Suitable for Aquacultures

This is being done by search of world literature, by Auburn personnel abroad, and by Developing Country personnel when fisheries projects have developed.

The survey of suitable species in Ecuador, as previously mentioned was for this purpose. It is especially important to identify suitable species in South America, where little is known about utility of native species and use of exotics is often not permissable. Identification of fish sold on local markets, those that became abundant in new reservoirs constructed on rivers and those in natural lakes would indicate many species of potential value for culture. These must be species that do well in quiet waters such as ponds or reservoirs, and that have different feeding habits. They must then be placed in experiments to determine their efficiency, production and acceptibility.