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**REPORT OF  
FISHCULTURAL INVESTIGATIONS  
IN SOUTH VIETNAM**

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**Project: AID/csd-1581**

**Title: Increasing Fish Production  
by Improved Fishcultures**

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REPORT ON FISHCULTURAL INVESTIGATIONS<sup>1</sup>  
IN SOUTH VIETNAM

USAID-Auburn University Project (AID/csd-1581) Increasing  
Fish Production by Improved Fishcultures - Phase I

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February 15, 1968

Introduction

South Vietnam has an area of approximately 42 million acres with a population of 16 million people. Total catch of fish is 375,000 metric tons annually.<sup>2</sup> This is equivalent to 52 pounds fish per capita per year or about one-half of the average protein requirements from animal sources. Of the total annual catch of 375,000 metric tons, 57,000 metric tons are taken from freshwaters with the remaining coming from approximately 900 miles of coastal areas present in the country. The marine catch is consumed principally by populations centered along coastal areas as transport of fishery products to inland areas is severely limited by lack of good roads, inadequate facilities for preservation and subsequent distribution of fish, and general lack of security in some areas. Therefore, the availability of protein of high quality for consumption by inhabitants of cities and villages located inland is extremely low. The need for protein derived from animal sources will increase

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<sup>1</sup>This report is based on a preliminary survey made October 23 to October 29, 1967.

<sup>2</sup>Yearbook of Fishery Statistics 1965, Food and Agriculture Organization of the United Nations.

to an even greater degree in the future as the population continues to expand at the present rate of 2 to 3 percent annually.

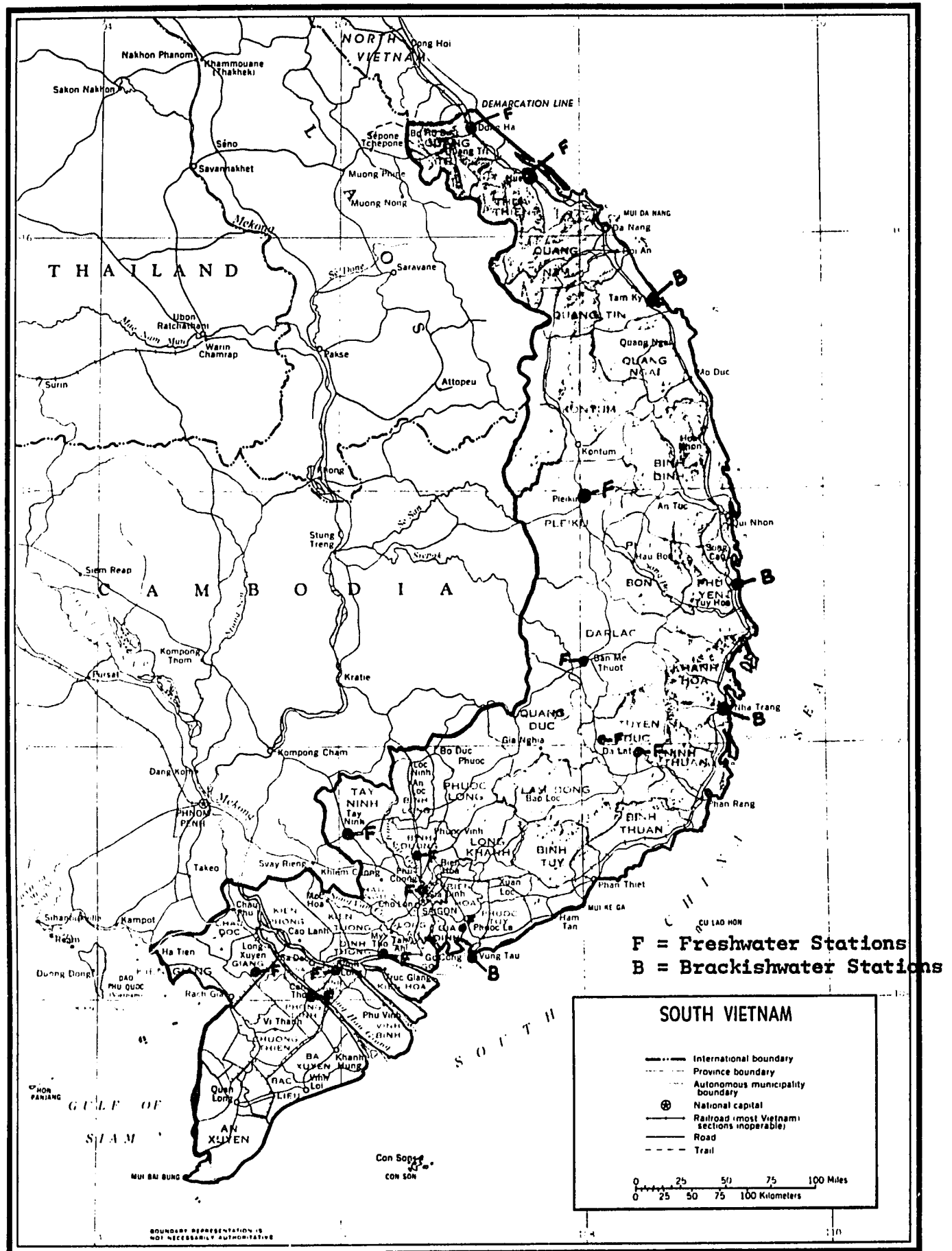
A means of increasing availability of high quality protein in inland areas is by increasing fish production in existing ponds and lakes. With improved methods of fishculture, productions of 2,000 to 5,000 pounds fish per acre per year can be achieved. However, to attain such productions with materials available locally, will require intensive experimentation and testing. After improved management procedures have been developed, a good program of demonstration and extension will be required to place these practices into general use by the farmer.

#### South Vietnam Directorate of Fisheries

The Fisheries Directorate is under the Department of Agriculture. Administrative officials, including Director and Deputy Director of Fisheries and Chiefs of the Marine and Inland Fisheries Divisions, have offices in Saigon. Each of the 44 provinces has a Chief of Fishery Service with various field personnel. The total number of employees is 200 with approximately 60 in Inland Fisheries. Of the latter, not over 10 can be classified as fishery managers or technicians.

#### Fisheries Stations

At present 17 stations, which are primarily operated as fish hatcheries, are located throughout the country (Figure 1). A list of these with production figures is given in Table 1.



Map 14741 9 66

Figure 1. Map showing location of Fish Hatcheries in South Vietnam.

Table 1. Fish Hatcheries in South Vietnam

<u>Name of Hatchery</u>	<u>Province</u>	<u>Area (Ha.)</u>	<u>Temperature (°C)</u>		<u>No. of Staff</u>	<u>Annual Production</u>
			<u>Average</u>	<u>Minimum</u>		
<u>FRESHWATER</u>						
Ban Me Thuot	Darlac	2	22	17	4	200,000
Bung	Binh Duong	0.5	27	15	1	25,000
Can Tho	Phong Dinh	--	--	--	--	----
Cu Chanh	Thua Thien	4	26	8	4	250,000
Dong Ha	Quang Tri	1	26	8	1	50,000
Duc Trong	Tuyen Duc	1	20	5	2	50,000
Lam Son	Tuyen Duc	2	18	2	3	100,000
My Tho	Dinh Tuong	0.6	27	19	2	20,000
My Thoi	An Giang	2	27	20	2	50,000
Phuoc Tho	Vinh Long	1	28	20	2	30,000
Tay Ninh	Tay Ninh	5	27	15	4	541,000
Thang Tam	Vung Tau	1	26	18	1	50,000
Thanh Binh	Pleiku	7	21	15	6	350,000
Thu Duc	Gia Dinh	4	26	14	8	500,000
<u>BRACKISHWATER</u>						
Cua Ge	Nha Trang	2	26	23	3	50,000
Vung Tau	Phuoc Tuy	1.6	26	18	4	50,000
Xuan Tho	Phu-Yen	2	26	23	2	50,000

The Hatcheries at Can Tho and Pleiku are two of the best. Pleiku is largest with 40 ponds and 10 hectares of water. Annual operating cost for this hatchery is 150,000 piastres (\$1,271). Two marine stations are planned for the southwestern section of the country.

In 5 days it was possible only to visit fish hatcheries at Thu Duc, Tay Ninh and Vung Tau. A trip scheduled to the hatchery at Ban Me Thuot was canceled when return transportation became doubtful. A brief description of the facilities and suggestions for improved operation is given for each Station visited followed by general observations on research needs in freshwater fisheries for the country.

#### THU DUC STATION

This Station is located 10 miles north of Saigon. It serves multiple purposes of production of fingerling fish for distribution to farmers and training of field staff of the Inland Fisheries Division for research in pond fishculture. It also is utilized in teaching basic fisheries to cadres prior to their relocation to various villages. This Station has a total land area of 4 hectares with 31 ponds and 2 hectares of water. Unfortunately, the Station probably has reached its limit for expansion due to limitations in land and water supplies. It now has good buildings for research and facilities for training extension and hatchery personnel.

The waters in the ponds seldom reach a pH above 6.5 and this may decrease to 4.5 during the rainy season. This low pH frequently results in death of fish. The acidity apparently is due to seepage water coming in through the bottom and sides of the ponds. Analyses of the pond waters and bottom muds are needed during wet and dry periods to determine the amount of lining needed. At present, lime is placed on the pond banks to be washed in by rains. In addition, the pond bottoms should receive heavy applications of lime as ground limestone or calcium carbonate. The amount required probably will be in excess of 5 tons per hectare per year. The pond edges should be lined with concrete blocks, both to maintain the pond banks and to supply a reserve of alkaline materials in the pond. The cement in the blocks continually gives off alkaline materials in solution. The height of dams around the ponds needs to be increased by 50 centimeters (20 inches) to keep out flood waters.

At present, this Station is severely understaffed. The only technical worker is a woman. Additional trained personnel should be provided as soon as possible.

#### TAY NINH STATION

There are 27 ponds with a total water area of 2 hectares at the Tay Ninh Hatchery. Three additional hectares of station land could be utilized for ponds. Production of fingerlings for



1966 was as follows:

<u>Species</u>	<u>Number Produced</u>
Common carp	430,000
Kissing gourami	80,000
Tilapia	30,000
Silver carp	1,000
Giant gourami	Some
Total	<u>541,000</u>

Tay Ninh Hatchery has the highest production of any station in South Vietnam. The ponds are relatively good ones. The pH of pond waters fluctuates between 6.5 and 7.0. Water for the hatchery comes from a canal that has insufficient flow of water during the driest period extending from February to April. An 8-inch artesian well was drilled to a depth of 160 feet. The natural flow, however, is too small to supply the hatchery. A deep-well pump is needed and has been ordered. The flow was tested with a pump when it was drilled and was reported to have the capacity of yielding 80 cubic meters of water per hour. The pH of water from the well is 5.5, somewhat below the optimum required for good growth of fish. The Station is near the border of Cambodia and areas adjacent to it are controlled by the Viet Cong. The usefulness of the hatchery, therefore, is limited. With gradual increase in demand for fish, the hatchery should be expanded. There is need also for additional staff as there is presently only one person with technical training at the hatchery.

VUNG TAU STATION

This Station was constructed in 1965 at a cost of 390,000 piastres (\$3,305) under the Revolutionary Development Program. It has 10 ponds with 1.2 hectares of water. Ponds get water by seepage and cannot be drained by gravity. Several of the dams are flooded during the rainy season; but in dry periods, the pond levels go down 30 centimeters (12 inches). Although this Station has a low annual production of fingerlings, 50,000 in 1966, it could serve a very useful purpose in training cadres of the Revolutionary Development Program. After training, the cadres could be supplied with fish for production ponds in the hamlets. For the program to be effective, the various cadres will need additional training in the provinces when they are at work. Such training is already being provided in part by the Directorate of Fisheries and AID Fishery Specialists. More intensive training and more frequent contacts are needed.

A survey is needed to determine if a suitable system of water supply and drainage could be devised. The Station also would need to be expanded. It was thought that land could be made available for this purpose. Water should be analyzed for hardness, alkalinity, pH and salinity. The pH and lime requirements of the bottom muds should be determined also.

Revolutionary Development Training Center

This Center, also located near Vung Tau, is where cadres are being trained to move in and serve as stabilizing elements following expulsion of the Viet Cong. The cadres normally go out in 59-men groups to various hamlets where each has a specific job to perform in an effort to win over the village. In October, 1967, 7,000 to 8,000 young men and women 17 years of age or older were being trained either in the basic or advanced leadership courses. Lasting 13 weeks, these courses cover a wide range of subjects, including agriculture and fisheries.

Cadre trainees have constructed approximately 20 ponds on the training area in villages in which they live. In addition, they have one area in combined rice and fishculture. Some ponds were dug through sand to a depth extending below the water table, requiring a total excavation of at least 3 to 4 meters. Other ponds were constructed in swamp areas and across what appeared to be parts of tidal streams. The principal fish raised were tilapia and common carp. Very few of the ponds appeared to be well fertilized and managed for relatively high fish production.

At the present time, apparently nothing is known about the water quality in the ponds. Samples of the water should be analyzed for hardness, alkalinity, pH, salinity and the bottom

soils for pH. Liming should be used to bring waters into the proper pH range for good fish production. In certain of the ponds, the water comes from seepage from swampland areas and probably is too acid for good fish growth. Several of the ponds should be managed for highest possible fish production by using fish feeds. This will allow trainees to see what actually can be done when good methods of management are applied. Some of the ponds could be maintained at lower levels of production for purposes of comparison. If trainees are then shown what has been done and the amount of fish present by seining or when the ponds are drained, this will be a lesson long remembered. Because of the large number of people passing through the Training Center, this is an excellent place to provide demonstrations of what fisheries management can do. This area certainly appears to be an ideal opportunity for closer supervision and cooperation from the Directorate of Fisheries and USAID Fishery Specialists.

#### USAID Assistance in Fisheries

At present, USAID direct-hire personnel in fisheries include Mr. George Napier, Chief of the Fisheries Branch under the Agriculture Division, a specialist in marine fisheries, and Mr. Charles P. Carlson and Mr. James C. Hudson. The latter two

individuals are former employees of the U. S. Fish and Wildlife Service having considerable experience in production of warm-water fish species in National Hatcheries. These men, by working with counterparts in the Marine and Inland Fisheries Divisions, are making a commendable effort to increase production of fingerlings in hatcheries and develop better methods of fishculture in ponds. Emphasis also is on increasing the catch of marine fishes in coastal areas by providing more efficient gear and more adequate facilities to handle the catch. The AID Mission has plans to employ 2 additional advisors in fisheries in the near future, providing local conditions will permit effective use of their services.

#### General Recommendations

Species of fish most frequently cultured in this country are common carp, kissing gourami and Tilapia mossambica. In addition, the chinese carps, consisting of the silver carp, bighead carp and grass carp, have been introduced and are now present at several hatcheries. The silver carp was spawned by pituitary injection but few fingerlings were produced. The usefulness of silver carp in Vietnam is still unknown, but it would give higher production in most ponds as it is a plankton feeder.

However, it was thought that the Vietnamese may not like the fish as well as the common carp. The kissing gourami is raised in many ponds and is reported to tolerate low pH in pond waters. A catfish of the genus Pangasius is cultured in floating boxes in the rivers. If methods can be worked out to spawn this fish, it may be used with considerable success in ponds.

Tests should be conducted to evaluate these fish for use in ponds so that the most efficient species and best rates of stocking, both with and without feeding, will be known. At present, it is not known exactly how many of each species should be supplied to fish farmers. The grass carp and probably Tilapia melanopleura should be evaluated for their ability to utilize grasses and plant wastes when stocked in combination with the carps or with Tilapia mossambica.

The snakehead should also be evaluated as a predator to prevent overcrowding by tilapias. The kissing gourami should be evaluated for its ability to survive and grow in waters too acid for other fish species. Pond waters in Vietnam seldom have a pH higher than 6.5 even with a heavy plankton bloom. The high acidity appears to come from layers of humus over which the water flows and also from certain types of soils that contain a large amount of sulfur, a portion of which is converted to sulfuric acid.

No analyses have been made on hardness or alkalinity or on the calcium requirements of the bottom soils. Such analyses are necessary to determine the corrective measures necessary, and to locate problem areas with respect to fisheries management. Of the various analyses, that for water hardness (the content of calcium and magnesium salts) is probably the most informative. If hardness is above 15 ppm as calcium carbonate, no corrective measures for acidity are necessary. However, lining is usually necessary if hardness is below 12 ppm for high production of fish food organisms. If below 5 ppm, waters do not contain enough calcium for satisfactory growth of fish. At each Fisheries Station samples of water should be analyzed for total hardness, alkalinity and pH. Where hardness is very low, samples of bottom soil should be analyzed for pH and their lime requirements determined. Salinity of pond waters for those Stations located near the coast also should be determined. During dry weather, it appears quite probable that salinity may become too high for certain species of fish. Minimum water temperatures in all areas are also necessary for intelligent selection of species most suitable for culture. Tilapia grow very slowly at temperatures below 16°C and die at 10°C to 12°C. The minimum temperatures ranging from 2°C to 8°C for Hatcheries at Cu Chanh, Dong Ha, Lam Son and Duc Trong would appear too low for good growth of warm-water fishes (Table 1). Minimum temperatures can be misleading, however, and what is needed are the average monthly maximum and minimum

temperatures to accurately evaluate the period of the year during which warm-water fishes will make satisfactory growth. When this is obtained, it will then be possible to make more intelligent selections of the fish species to be cultured in various areas.

### Participation by Auburn University

#### Training of Vietnamese Personnel at Auburn

The principal problem regarding fisheries development was considered by the Directorate of Fisheries and the AID Fisheries Branch as being lack of trained personnel. Both training and staffing are extremely difficult problems because all young men must serve time in the army. The length of time in military service is very indefinite. Young women are being used in some of these positions, but availability of trained women is very low also. The Directorate of Fisheries has been asked to furnish Auburn with a list of young men whom they consider best qualified for training abroad. When these individuals are chosen, fellowships should be made available to them to come to Auburn for a 1- to 2-year training period.

#### Training of Fishery Personnel in Vietnam

The Chief of Inland Fisheries, Mr. Le Van Dang, suggested that it would be desirable to have staff members from Auburn



University give lectures to his staff for approximately 2 to 4 weeks at the Thu Duc Fisheries Station near Saigon. Dormitory facilities at the Station are available for training such personnel. This training would be on water chemistry in ponds, limnology of ponds, hatchery management and principals of fishculture. This would appear to be quite desirable and should be arranged. Most suitable months for the training program would be February, March or April. Training, as much as possible, will be done by demonstration, visual aids and color slides in order to make understanding by the participants easier.

#### Consolidation of Fishculture Information

Over a period of years many fishery specialists have been employed by USAID to assist in advancing fishculture in Vietnam. Voluminous reports presently are on file in the Mission. It is suggested that Auburn University take over the task of reading through these materials, picking out the parts that appear valuable, evaluating them, and putting the information in a form which might be usable by fishery specialists as they come into the country in the future. If this is not done, a large part of each person's time is wasted going over the same materials as his predecessor.

#### Fisheries Research Urgently Needed in South Vietnam

The principal areas requiring research in Vietnam are the

following:

- A. Better use of present waters through greater knowledge of the chemistry of waters and the bottom soils of ponds.
- B. The fish species best adapted to the waters and temperatures in upland and lowland areas.
- C. The production rates to be expected from various species without fertilization, with fertilization and with feeding so that the most effective rates of stocking will be known.
- D. Methods of management of acid waters. This will require experiments upon methods of liming, fertilization, and feeding under these conditions.
- E. Availability of local materials which might be used for fish feeds.

It would be necessary to expand pond areas in a number of hatcheries scattered throughout the country in order to carry out the research suggested above. Recommendations regarding expansion of specific Stations cannot be made at this time. This would have to be decided at a later time following a visit to as many of the Stations as is possible under existing conditions of travel and security.

At the present time, it is not considered desirable to build a large research station in Vietnam. The differences in waters and temperatures can best be studied by using ponds at existing fish hatcheries.

To carry on such research, it would be necessary to work closely with the Freshwater Division of the Fisheries Directorate and with the technicians in charge of the various hatcheries. Additional trained personnel would be necessary at each Station in order to carry on the research.

The personnel required to make this program effective would depend upon the number of people USAID maintains in the Fisheries Branch as specialists in freshwater fisheries. If the present number is maintained, then Auburn University should send periodically 2 or 3 men to assist in research and training programs. Should AID discontinue the freshwater part of the Fisheries Branch, then additional personnel would have to be made available from Auburn. It would be contemplated that Phase II (Research) and Phase III (Extension and Demonstration) would be carried on simultaneously. The personnel, equipment and space for Phase III will be decided at a later date.

A budget of necessary expenditures at Auburn University and within the host country will be prepared following consultations with Mission officials and administrative personnel of the Directorate of Fisheries relative to future interest and emphasis on development of freshwater fisheries in South Vietnam. A trip to the area to finalize plans for initiating such a program under the USAID-Auburn University Fisheries Project can be made when local conditions permit.