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9. ABSTRACT
This Auburn University report on aid to the development of a fisheries program in Colombia discusses four major areas: construction of the Repelon Aquaculture Station, Research Station site selection in the Alto Magdalena, development of an aquacultural research plan, and the establishment of a fisheries training program. Substantial progress has been made on the earth work at Repelon. Construction methods, drainage systems, pond layouts, filters, drain canals, and construction of the fish hatchery building are discussed. The objective of the trip to the Alto Magdalena Area was to evaluate the physical attributes of three potential sites for the construction of a fresh water aquaculture research and fingerling distribution station. Three sites were visited and observations were made of the approximate slope of land, area available for station facilities including ponds and buildings, soil profile, water supply proximity, temperature, alkalinity, physical color, volume of flow, occurrence of large granite outcroppings, description of site in relation to access roads, local municipality, ownership, availability of electricity and telephone and local agriculture practiced. It is suggested that the primary importance in a developing aquaculture research program is the determination of the best species for culture. Researchers must decide whether native or exotic species will best meet the country's needs. It is also important to determine maximum yields. A short term in-country training program should emphasize the present state of Colombian fish culture, the basic biology of fish, aquaculture principles and application, experimental design, analysis of data, water chemistry, fish nutrition, fish diseases.

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ASPECTS OF THE COLOMBIAN FISHERIES DEVELOPMENT LOAN

by

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Date of Project - August 3-17, 1975
Work Supported by: USAID/Colombia
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Introduction

At the request of the Rural Development Office, USAID/Colombia, a team from Auburn University arrived in Colombia to aid in the development of a fisheries program which would be funded by a Fisheries development Loan from USAID to INDERENA (Natural Resources Institute) of Colombia. Professors Don D. Moss, Jack Snow, David Hughes and Ron P. Phelps arrived in Colombia August 3, 1975 with the last of the team leaving the country August 17, 1975.

Four major areas were discussed with the staffs of INDERENA and USAID: construction of the Repelon Aquaculture Station, Research Station site selection in the Alto Magdalena, development of an aquacultural research plan, and the establishment of a fisheries training program. These discussions took place in Bogota, Repelon, San Cristobal, Cartagena and the sites in the Alto Magdalena. Participating in one or more of these discussions, from INDERENA were Srs. Luis Ernesto Ruiz, Eduardo del Real, Edgar Ortunduaga, Luis Alberto Acuna, Ramiro Munoz, Bernando Herazo, Luis Martiniz, Guilleromo Quinonez, Gorge Mercordo and others. Representing the Ministry of Agriculture was Sr. Armando Hernandez while Sr. Alfredo Sanchez represented the National Planning Board. USAID representatives included Dwight Steen, Agapito Olea and Hector Sarmiento.

Report on the Construction at
Repelon Aquaculture Center

The Repelon Fish Culture Station was visited on August 5, 1975 to observe the pond construction work and to respond to questions regarding construction details of various buildings planned for the facility. Included in the party were officials of INDERENA, USAID and the Auburn Team.

The party arrived at Repelon about 12:30 pm and spent about three hours at the site inspecting the work in progress and discussing relevant aspects of the job. It was found that substantial progress had been made on the earth work. The ponds scheduled for completion in Phase I were roughed out and the work of shaping the dikes and bottoms was in progress.

The construction method originally recommended by Moss during an earlier visit was not followed. The result is an earthen pond complex constructed by excavation of soil from the pond area proper and dikes without clay cores. Unfortunately layers of coarse gravel mixed with clay were encountered in the excavation of several of the ponds. Since the core wall is designed to prevent the lateral seepage of water through dams, lack of a core wall may result in excessive seepage between ponds. To offset as much of this as possible, it was recommended that a layer of good quality clay be deposited on the slopes of the dikes after shaping, followed by compaction. Hopefully this will serve as a partial substitute for the core wall. If excessive seepage develops when the ponds are filled, it may be necessary to do remedial work to correct this problem.

In addition to shaping the slopes of the dikes, the bottoms of the ponds were being shaped to finish grade. Reportedly, a machine grader

would be brought to the job to smooth and slope the pond bottoms. The need to properly slope the pond bottoms from shallow to deep end, and from the toe of the dike to the center of the pond was emphasized. A minimum slope of 1.0% from the toe of the dike at the shallow end to the drain is desired. The slope from the toe of the side dikes to the center should be at least 0.5%. All depressions and high points should be dressed smooth with the lowest bottom elevation being at the monk.

Work on the drainage system had not yet begun although delivery of two back-hoes to excavate for drainlines and drainage canals was scheduled for mid-August. It was pointed out that much excavation could have been avoided if the trenches for drainlines had been dug before the dikes were completed. Generally one meter of earth over the drain pipe is adequate to support the weight of earth moving machines over the line so that no damage to the pipe would occur.

Some changes in the pond layout were discussed and agreed upon. Presence of an underground irrigation line in two ponds in the northwest corner of the station necessitated a modification of these two ponds. The combining of the two ponds into one was suggested.

The only material noted on the job site was some 10-inch asbestos-cement (transite) pipe. One stack of this pipe was used pipe and the other was new. Some of the used pipe had broken ends and other damage. Care should be taken to avoid installing faulty drain pipe or it could be a cause of drain malfunction.

It was agreed to combine the filters for the water intake from the reservoir pond into one structure giving the same amount of screening but at one location. It was suggested that the screen slots be installed with care to assure a tight fit of the filter screen frames. The principle of the design is to progress from coarse (1.27 cm) mesh galvanized wire

cloth to fine Saran (0.50 mm) mesh. Wooden frames for the filter screens is recommended with a cover over the screen box of 1.27 cm wire cloth to exclude snakes, frogs and similar animals which could enter the supply lines causing water stoppage.

Although it was not measured, visual inspection of the dike along the lower side of the reservoir pond appeared too steep for a 2:1 slope. Since this is a high dike, sloughing of the fill can be anticipated when heavy rains occur. It is imperative that vegetative cover be established at the earliest time possible and that use of a covering mulch of straw or similar material be placed to reduce erosion until vegetation can become established.

The Phase 2 pond layout was changed to relocate the small ponds in close proximity to the fish holding house and hatching shed. Also, the size of these ponds was increased by reducing the number. The question of reducing the depth of these small ponds also came up. It is felt that a desirable depth should be 60 cm at the shallow end (toe of dike) sloping evenly to 120 cm at the drain. Less freeboard will be required however as 35 cm should be adequate here. A previous design change to incorporate an open drainage canal between the tiers of the smallest ponds would result in a loss of potentially valuable pond space and also would increase maintenance requirements for the drainage system. Hence, it was recommended that a drainline be installed in lieu of an open drainage canal.

Work on excavation of the drain canals on the perimeter of the pond area was scheduled to begin in the near future. Since the ditch will be one meter wide at the bottom with a 1.5 to 1 side slope and will be several hundred meters long, this will take some time. Considering the

completion of ponds, construction of drainage and water supply systems and stabilizing the fill dirt of the dikes, a substantial amount of work remains to be completed. A completion time of 5-6 months would be optimistic, considering the amount of work yet to be completed.

The canal at the irrigation pumping plant was also inspected. The pumping station was not in operation when visited. Aquatic vegetation causing weed problems in fish production ponds was noted growing profusely in the canal. Included was cattail (Typha sp.), water hyacinth (Eichornia sp.) and a submerged vascular plant tentatively identified as Najas sp. When the pond system is placed in operation, efforts should be made to prevent these and other unwanted species from becoming established in ponds and drainage canals.

Design and construction of the fish hatchery building, (Phase 2) was discussed at a conference later in the day at San Cristobal. A detailed review of the features of this facility was made with the following points of agreement:

1). Hatchery building designed for tanks, incubator stands and work tables to be portable allowing for diversified use.

2). Nursery tanks of two designs. Two tanks were to be modeled after the bocachico starting tanks developed in Brazil. The remainder were to be of conventional design.

3). Water supply to be from two sources, untreated from the reservoir pond and filtered water from the treatment plant.

4). The hatching area and at least part of the nursery tanks should be supplied with both untreated and treated water.

5). A main line size of 6 inches is desirable with a 4-inch line for the hatching area and 4-inch line to the nursery tanks. The aquarium bench should have a 2-inch supply line.

6). Electric wiring should be overhead with adequate overhead fluorescent lighting. Receptacles for electric agitators should be provided for each group of four collecting-nursery tanks and each pair of larger nursery tanks. Receptacles should be located to be accessible to an 8-foot agitator cord when the equipment is located in the center of the tank. Wall receptacles at several convenient locations also should be provided. All receptacles should be of the waterproof outdoor type. For safety each should have an off-on switch. Wiring and circuit breakers (fuses) should be adequate to permit operation of aeration devices in all rearing tanks simultaneously.

Plans for the fish holding building were also reviewed. The building should provide ample tank space for full station operation. The following modifications were discussed and agreed upon:

1). Extend building to accommodate an additional pair of tanks.

2). Omit a central pair of tanks on one side of driveway to provide a work area for fish sorting.

3). Provide for equipment and net storage at end of building on both sides of driveway.

4). Reduce size of tanks to 76 cm wide, 81 cm deep with, 76 cm water depth.

5). Main water supply line 8-inch diameter, 6-inch to each tier of tanks, 4-inch riser w/2-inch molasses gate to individual tanks.

6). Each tank provided 3-level drain and fitted screen.

7). Overhead fluorescent lighting over each pair of tanks. Waterproof electrical receptacle for each pair of tanks for agitator plug-in.

8). Although not provided for in the design or discussed, it is recommended that a water supply be provided to fill tanks used for hauling fish. A two-inch pump with 3 meters of two-inch discharge hose should be adequate. Mount pump overhead near the fish holding sorting area.

It should be emphasized that concrete work for the holding tanks be of high quality. Straight lines, exact dimensions and adherence to specifications minimizes difficulty in use of tools (tank nets, graders etc.) and enables screens and other fittings to be interchanged. A smooth finish on both inside and outside walls should be provided.

Site Evaluation Trip to Alto
Magdalena Area, 7 & 8 August 1975

During a two-day trip to the area designated Alto Magdalena, the four Auburn University representatives, Dr. D. D. Moss, Dr. Ron Phelps, Mr. Jack Snow and Mr. David Hughes, were accompanied by Lewis Ernesto Ruiz, Inland Fisheries Division representative of INDERENA, and Hector Sarmiento, Agricultural representative of USAID Colombia. The objective of the trip was to evaluate the physical attributes of three potential sites for the construction of a fresh-water aquaculture research and fingerling distribution station. This station will be built under the Colombia-USAID Fisheries Development Loan to serve the greater Alto Magdalena area in the development of aquaculture.

The sites, in the order they were visited, were:

1) Finca Las Cruces, Garzon,

2) Puesto de Monta, Gigante,

3) Finca Palestro, Gigante, Huila.

At each site the following observations were made: approximate slope of land; area available for station facilities including ponds and buildings; soil profile at representative locations (using a 9 ft soil auger, at 1 ft intervals up to 8.5 ft); water supply proximity, temperature, alkalinity, physical color, volume of flow; occurrence of very large granite outcroppings; description of site in relation to access roads, local municipality, ownership, availability of electricity and telephone; local agriculture practiced.

The following is a description of each site:

I. Finca Las Cruces, Garzon

This site is located approximately 8 km from Garzon, and is accessible by an all-weather dirt road. Elevation is 1200 m. Water is supplied to the site from an nearby river via a canal, the supply can be expanded greatly but

would require enlarging the present canal. The site is characterized by many large granite outeroppings distributed throughout the site. Area available for site construction is about 5 ha.

Slope is acceptable for construction but reaching the maximum for economy. The rock substrate just beneath the surface would make this site unacceptable for pond construction.

The canal traverses the upper elevation of the site. The following analysis of the canal water was made by INDERENA:

Dissolved oxygen	6.0 ppm
pH	7.4
Alkalinity	30 ppm
Total hardness	30 ppm
Temperature	22° C

Soil samples were taken at 5 locations, and were as follows:

Sample #1: at 6", solid rock, no clay above rock.

Sample #2: at 18", solid rock; above rock found sandy, sandy-loam, sandy clay.

Sample #3: at 13" solid rock; above rock found sandy, then sandy clay.

Sample #1-3: taken about 100 m downhill from canal.

Sample #4: at 27", solid rock; above rock found sandy, sandy-clay, clay-sand-gravel, clay-gravel-decomposed granite.

Sample #5 & 6: at 6", solid rock.

Sample #4-6: taken about 125 m downhill from canal.

Rainfall in this area, based on the meterological station at Garzon, is about 1100 mm per year. The ownership of the land is private. Purchase of this site would necessarily be negotiated between INDERENA and the owner.

II. Puesta de Monta, Gigante

This site is located on an all-weather gravel road about 9 km from the town of Gigante and is in the muncipality of Gigante. Elevation is about 1500 m. The site is approximately 300 m higher in altitude than Gigante. The site has several concrete-brick-bamboo dwellings at the top of its uppermost altitude and has water supplied to an outside concrete tank by a small pipe which runs an unknown distance from the La Honda River, a fast-flowing, clear stream. Temperature of the tank water at mid-morning with light sun was 67° F (19.4° C). Analysis of water at La Honda River indicated a temperature of 64° F (17.7° C) and a total hardness of 44 ppm. A new canal from the river source to the site would be required for the operation of a fish culture facility here.

Two soil samples were taken and are as follows:

Sample #1: about 10 m diagonally to the right of bamboo utility shed (with back facing the shed). Surface: sandy loam, then clay and sandy loam.

1' level: mottled yellow-brown clay; very good quality;

2' level: mottled yellow-brown clay; mixed with some sand and quartz-sand particles; very good quality;

4' level: Basically same as 2' level; very good quality;

5' level: mottled reddish-brown clay; slightly more quartz particles than 4' level; very good quality;

6' level: basically same as 5' level, except no quartz particles; very good quality;

7' level: yellow-brown clay, no quartz particles; very good quality;

8' level: reddish-brown clay, no quartz particles; very good quality;

8.5' level: reddish-brown clay, some quartz particles; very good quality.

Sample #2: about 85 m directly down hill from soil site #1.

Surface: sandy loam, after which clay and sandy loam.

1' level: brown sandy loam and clay.

2' level: yellow-brown clay; very good quality.

3' level: yellow-brown clay, with some quartz particles; very good quality.

4' level: yellow-brown clay, with some mica-like particles; very good quality.

5' level: red-brown clay; very good quality.

6' level: yellow-brown clay; very good quality.

7' level: red-brown clay; very good quality.

8' level: yellow-brown clay; very good quality.

8.5' level: yellow-brown clay; very good quality.

Total area available for construction is about 3.0 ($\pm$ 0.5) ha of possibly acceptable slopes.

The surrounding area is very hilly. Agriculture is mainly small coffee plots.

Electricity does not pass by site but runs about 1 km from site. Telephone is not located near site.

About 5 small ponds were seen in area farms. All were less than 100 m^2 in surface area.

A local agricultural school, Escuela de Cafeteros, is located a few kms from this site. It has a small pond (about 100 m^2) whose water comes from the La Honda River. Water entering the pond was 63° F (17.2° C) and at the opposite side of the pond (pond edge, 3" below surface) was 74° F (23.3° C), at about

1100 hours, with no sun. Wind was blowing about 4-6 km per ha. About one half of the volume of water entering the pond was leaving the pond at its drain end. Owner of site is the muncipality of Gigante.

The soil was of fine quality at this site but the area for construction is limited. A 3 ha research station would be restricted in its contributions to the area and a larger site would be desired.

III. Finca Palestro

This site, part of a 450 ha school (Escuela Normal), is located 4 km from Gigante on an all-weather dirt road. It has an elevation of 1130 m. An adequate quantity of water is supplied by a canal from the nearby Rio Juandinosa, a distance of about 1.5 km. Color of the canal water was slightly stained (brown). No pollution problems are said to affect the river. An analysis of the canal water indicated a temperature of 65.3° F (18.5° C) and total hardness of 58 ppm. Air temperature at mid-afternoon was 86° F (30° C).

The site designated as a potential fish culture station is a single area of about 6 ha, divided into two pastures. The upper pasture has about 2 ha, the lower pasture about 4 ha. Both have similar grades which are considered toward the maximum that is considered acceptable for pond construction. Soil samples were attempted on the lower pasture only because of the appearance of numerous large granite boulders or outcroppings on the upper pasture and the probability of better soil conditions in the lower pasture. Four soil samples were attempted, and are as follows:

Sample #1: Surface: sandy loam, then rock, not possible to sample further than 6".

Sample #2: Surface: sandy loam, gravel particles.

1' level: sandy loam with mixed rock.

2' level: brown clay mixed with small gravel and some organic

matter, weathered rock; then rock prevented boring further.

Sample #3: Surface: sandy loam.

1' level: decayed rock, little clay.

2' level: brown clay mixed with decayed rock compacts well.

2.5' level: decayed rock, then solid rock, preventing futher boring.

Sample #4: Surface: sandy loam with small gravel particles.

1' level: decayed rock; solid rock prevented further penetration.

The owner of the 450 ha area on which this site is located is the Ministry of Education.

Two small ponds are located at edge of school buildings. One has fish in it (Mojarra, plus other species), area of about 800 m^2. Color of water was greenish. Temperature of water at pond edge, 3" deep, was 82° F (27.8° C).

Electricity and telephone are furnished to the school facilities.

The Alcalde of Gigante accompanied us. He would like to see the Escuela Normal be modified into a Technical Agriculture School. He appeared very eager to have the fish culture station established here.

Meteorlogical data for the muncipality of Gigante are as follows:

Annual rainfall	=	1250 mm
Median annual temperature	=	19.3° C
Median relative humidity	=	76%
Maximum absolute temperature	=	27° C
Minimum absolute temperature	=	12° C
Median maximum temperature	=	23° C
Median minimum temperature	=	16.1° C

Source: Meteorlogical Station, Gigante, Huila.

The occurence of boulders and the gravelly texture of the soil would make this site of questionable value for pond construction. Numerous boulders would increase construction cost, while excessive gravel in pond dams could result in seepage problems.

As none of the sites examined by the Auburn Team appeared to be adequate for construction of an aquaculture facility. It was recommended that additional potential sites be located.

	Location	Accessibility	Altitude Water Temperature	Land Soil	Land Slope	Land Size	Water to Site
I. Finca Las Cruces, Garzon	Good, close (less than 8 km) to large town	Good, all-weather dirt road	1220 m, 22°C probably too cold for warm-water species	Rocky, protruding boulders; rejected	Very steep, nearing point of rejection	4-5 ha, not enough for both research & fingerling dist'n	Canal expansion required, river source, 22° C, running in canal 30 ppm hardness.
II. Puesta de Monta Gigante	Good, close to large town. Electricity near town	Good, all-weather dirt road	1500 m, 23.3°C probably too cold for warm-water species	Clay, excellent for pond construction	Steep, barely acceptable	3.0 (±0,3) ha too small for either research or fingerling dist'n. to be carried out adequately	Expensive canal construction required over long distance river source; 19.4°C, tank at site. 44 ppm hardness at river
III. Finca Palestro, Gigante	Good, close (4 km) to large town. Electricity & telephone on site	Good, all-weather dirt road	1180 m, 30°C good for warm-water species	Rocky, protruding boulders; requires further excavation for final verfication of soil nature	Steep but acceptable	9.1 ha, good for research & fingerling production	Adequate water at site via canal from river; 18.5° C running in canal; 58 ppm hardness.

Research Program

Colombia has a number of institutions capable of carrying out aquacultural research. A meaningful program in this field can be developed through the coordinated use of INDERENA's facilities and by the contracting of specific research programs to other institutions.

To carry out a research program which will produce usable information in the shortest period of time, a research and review program should be established. Such a program should be coordinated by a committee which would have the responsibility for evaluating proposed plans and selecting those which meet the main priorities. In addition the committee should periodically review ongoing research to see that the work is being carried out according to plan and critically review and analyze each research program upon its completion.

This committee should include representatives of each group conducting fisheries research funded in part by the Fisheries Development Loan, an individual responsible for allocation of funds, and a representive of USAID.

Areas of Research

In a developing aquaculture program the determination of the best species for culture is of primary importance. Researchers must decide whether native or exotic species will best meet the country's needs.

The evaluation of native species is time-consuming and often unrewarding if not conducted properly. Several questions related to a fish's ability to be cultured should be answered. Information on the reproductive habits need to be obtained. This includes information on a species ability to reproduce naturally in ponds and if so how often, how many young are produced per spawn, what is the minimum mature size, and whether it can be induced to spawn artifically. Other questions to be answered are, at what degree of culture will the fish best respond? How does the fish respond to handling? What is

the fish's minimum oxygen requirements? What is the fish's feeding habits? Is the fish resistant to disease? Will it grow rapidly?

Colombia has a variety of fish species of which several may have good potential for culture. These include bocachico Prochilodus reticulatus, mojarra Petenia sp, and the various species of catfish and mullet. Considerable interest has been expressed in the culture of bocachico and this species should receive attention early in an aquaculture program.

It is of particular importance to determine maximum yields. To do this a statistically valid experiment (experiment A) should be conducted to determine yields at given stocking rates under conditions of: 1. no fertilization, 2. fertilization only, 3. fertilization plus feeding. Such an experiment should be conducted for approximately 6 months. The fish should be sampled for growth at 2 or 4 week intervals. At the end of 6 months, the experiment should be evaluated in terms of percent survival, number and weight of fish in each size class, growth rate and percent of a usable size for food.

Based on these results several options should be explored.

I. If the greatest yield of harvestable (usable size) fish is in the fertilization and feed treatment (A_3) and this yield is 50% greater than other treatments then the optimum stocking rate for treatment A_3 should be determined.

   a. If the growth rate of A_3 has begun to decrease severely towards the end of the experiment but the majority of the fish were harvestable then A_3 should be repeated and a stocking rate less than and greater than A_3 should also be tested.

   b. If the growth rate of A_3 had begun to decrease severely towards the end of the experiment and the majority of the fish were not harvestable then other options develop.

1. The same treatment can be repeated but for a longer period of time.
2. The same treatment can be repeated along with testing two lower stocking rates.
3. Work with this species can be discontinued because at this higher degree of culture (fertilization and feeding) insufficient harvestable size fish were produced.

c. If the growth rate of treatment A_3 did not decrease to any notable extent, then A_3 should be repeated and two higher stocking rates should be tested.

II. If A_3 did not have a 50% greater number of harvestable fish than A_2 but the majority of the fish from A_2 were harvestable, then treatment A_2 should be tested at different stocking rates. Stocking rates should be tested based on procedures similar to those in Ia, b and c.

III. If A_1, A_2, and A_3 did not differ by 50% then this species shows no potential for intensive culture.

IV. If A_2 and A_3 produced fish in which the majority were harvestable and A_3 produced a 50% greater weight of fish than A_2 then optimum stocking densities should be determined for A_2 and A_3.

Once the optimum stocking rate and the best level of production have been determined, then research to determine the best type of feed and fertilizer to be used should be conducted.

Exotic Fishes

In addition to work with native species emphasis should also be given to exotic species already present in the country e.g. Tilapia rendalli. Tilapia have proved to be a good species for culture in other areas of the world. Several areas of research should be investigated using Tilapia. One aspect which

has shown promise is the production of male tilapia by the use of hormones to reverse the sex of young females. Such an approach overcomes the major limitation of tilapia, that of excessive reproduction. Another technique for the production of monosex tilapia would be the production of the 100% male, hybrid cross between male Tilapia hornorum and female Tilapia nilotica. This hybrid has recently shown a great deal of potential in Brazil.

The development of a predator-prey combination using tilapia as the forage fish is another area which should be investigated. In such a system a predator, when stocked in proper numbers, will control tilapia population by feeding on the small fish. Such a program has been shown to be effective in El Salvador using a combination of Tilapia aurea and the guapote tigre Cichlasoma managuense. A similar program may be developed using T. rendalli and Cichala ocellaris in Colombia.

Evaluation of past stocking programs

Fish have been stocked into ponds for culture in many areas of Colombia but the production from such ponds is not fully known. The evaluation of these stockings can supply information which will aid in the rapid development of a fish culture program. Such a program should include a survey of the ponds near each fisheries research station. This survey should include a description of each pond in the area giving the size, water supply, type of construction etc. A biological sampling of at least ten ponds in each area should also be conducted to determine the standing crop of fish in each pond. The information would be collected in terms of species of fish present, the total number of individuals in each species, and the number and weight of fish by species in each major size group. Pertinent information related to water quality such as temperature, total hardness and pH should be collected. This information will point out areas where more research is needed.

Training Programs

In Country Training

Through conferences with INDERENA staff and personnel of the Rural Development Office of USAID/Colombia, the need for a short term in-country training program was emphasized. Such a program should cover various subjects such as the present state of Colombian fish culture, the basic biology of fish, aquaculture principles and application, experimental design, analysis of data, water chemistry, fish nutrition, fish diseases and other material. These subjects would be covered during several training programs each approximately 10 days in duration. Assuming that a contract for this program is concluded between INDERENA and Auburn University, the first of these training programs can be conducted during February of 1976. Faculty for this program would include representives of Auburn University and staff members of various Columbian institutions.

The site selected for the short course training program should be able to comfortably accommodate 20 persons. There also should be in the vicinity a number of ponds with fish available for field demonstrations.

A firm date for this program should be established as soon as possible to allow interested participants to adjust their schedule accordingly. This early confirmation would allow for a more complete program planning, the arranging of instructors, and the translation of the necessary instructional material. A firm date for this program should be reached by November 31, 1975.

Special Study Tours

It would be advisable for several of the administrative personnel of INDERENA and other agencies to visit active fish culture programs to become familiar with well established fisheries programs. Such visits might include the Pentecoste Aquaculture Research Center in Brazil, the Santa Cruz Fisheries

Station in El Salvador, and Auburn University in the U.S.A. These visits would aid the staff of INDERENA and other agencies in making management decisions when dealing with fisheries programs.

Out of Country Training

There are provisions under the Fisheries Development Loan for the training of 17 individuals at Master of Science level in several areas of fisheries. It will be necessary to begin this program as soon as possible to obtain full benefits of the loan.

A major stumbling block for students planning to study U.S. universities is having adequate use of the English language. Language training can be begun in Colombia and intensified through a 6-10 week training program at Georgetown University in Washington D.C.

School terms in U.S. institutions having the quarter system typically begin in January, March, June and September. School terms having a semester system have terms generally beginning in September and late January. Sufficient lead time should be planned so that a student may complete his English training and enter a university program soon there after.