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9. ABSTRACT

Describes the progress to date and plans for the future concerning the development of fisheries in Colombia. USAID's Fisheries Development Loan aided the development of fish culture stations at Repelon, a site in the Alto Magdalena and at Llanos. Other projects will survey fisheries resources in the Magdalena River basin and in the Llanos. This report discusses technical assistance, estimated costs, contractual arrangements, commodity purchases, and training. The accomplishments at Alto Magdalena and Repelon are described, and the report gives suggestions for the stations at Buga and Llanos. The Auburn University (A.U.) consultants think that technical assistance should be provided in three or four major areas including: an A.U. team leader to establish a country wide fisheries management program, a technical advisor in fisheries biology, a technical advisor in aquaculture, and an aquaculture advisor at Repelon aquaculture center. Short term consultants may be necessary in: fisheries economics and marketing, fish nutrition, fish diseases, induced breeding, hatchery management, fisheries biology, ichthyology and pond construction.

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PROGRESS IN COLOMBIAN FISHERIES DEVELOPMENT, 1976

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May 6, 1976

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PROGRESS IN COLOMBIAN FISHERIES DEVELOPMENT 1976¹

by

R. P. Phelps and D. D. Moss

May 6, 1976

During the period of April 21 to 30, 1976, Drs. D. D. Moss and R. P. Phelps were in Colombia at the request of the USAID Mission. Discussions were held with representatives of INDERENA, other government agencies and the AID Mission concerning the continued development of fisheries in Colombia. Major topics discussed included the needs for technical assistance, advanced training for Colombian biologists, fisheries development in the Llanos, station site selection in the Alto Magdalena, fisheries program of CVC, and matters relevant to the operation and continued development of the fisheries station at Repelon. Field trips were made to Repelon to inspect the aquaculture research center, to the Alto Magdalena for the purpose of examining a potential fish culture station site, and to Buga to review the fisheries research program carried out by the CVC.

TECHNICAL ASSISTANCE

The USAID Fisheries Development Loan amounting to US \$2.2 million was formalized December 24, 1975. Objectives of the loan included development of fish culture stations at Repelon, a site in the Alto Magdalena and another in the Llanos. In addition other projects are to include surveys of fisheries resources in the Magdalena River basin in the north-central portion of the country and in selected rivers in the Llanos in the

¹This work was financially supported by the Agency for International Development, Basic Ordering Agreement 1152, Task Order 9.

eastern region of the country.

To achieve these objectives it will be necessary to upgrade the training of INDERENA biologists and to provide technical assistance to the Colombian Government.

Training for a number of Colombian biologists at the Master of Science degree level is imperative, and should be initiated as rapidly as participants with adequate English can be selected. Additional in-country training for INDERENA biologists should be provided through short-term training programs scheduled at appropriate periods throughout the loan period.

Technical assistance in selected fisheries disciplines will be required to enable INDERENA to achieve the objectives specified in the loan.

The Auburn University consultants feel that technical assistance should be provided in three or four major program areas. These include:

I - A.U. Team Leader-(to be stationed in Bogota) - will work closely with INDERENA to establish a country-wide fisheries management program.

1. The A.U. Team Leader, working as the principal counterpart to the INDERENA Loan Manager, would assist in developing strategy and establishing priorities of work programs. He also would assist in developing research plans, overseeing their implementation, and evaluating the results.

2. Would participate in selecting qualified participants for advanced studies abroad.

3. Would coordinate and participate in short-term in-country training programs held periodically for INDERENA biologists.

4. Would supervise the activities of other technical advisors as may be included in the technical assistance component.

5. Would serve as principal liaison between INDERENA, USAID and contractor institution.

II - Technical Advisor in Fisheries Biology - to concentrate his efforts, with appropriate counterparts, in investigating the fisheries resources of the Llanos. Specific duties would include:

1. Conduct a preliminary study of the region to determine the magnitude of the work program to be carried out.

2. Prepare detailed plans for and conduct fish population studies at representative sites in the region.

3. Analyze results and formulate recommendations for the proper utilization of the fishery resource.

4. Identify fishes of the region which appear to have potential for aquaculture.

5. Determine the need for a permanent biological station in the region to deal with riverine fisheries and to locate a suitable site if appropriate.

6. Assess, with the assistance from the Team Leader, the potential and need for aquaculture in this region of Colombia.

7. Assist, as time permits, in development of management programs in other river systems of the country.

III - Technical Advisor in Aquaculture - to be responsible for aquaculture development in the Alto Magdalena and Cauca Valley.

1. Oversee the construction and management of the fisheries station in the Alto Magdalena. Due to the less than optimal character-

istics of the selected site it will be necessary that the advisor direct all aspects of construction.

2. Review and evaluate present aquaculture extension programs in the Cauca Valley.

3. Assist biologists at Buga in developing induced spawning techniques for native species.

4. Conduct field trials, with the cooperation of local farmers, using proven fish cultural practices.

5. Develop aquaculture extension programs in the Alto Magdalena.

IV - Aquaculture Advisor Repelon Aquaculture Center

The services of the present FAO aquaculture advisor are available to INDERENA and the Repelon Aquaculture Station through December, 1976. If FAO does not extend the present aquaculture position, it will be necessary for an aquaculture advisor to be provided for the northern region under the technical assistance component of the USAID Fisheries Development Loan. The Repelon Station when completed will require the full-time services of at least three experienced INDERENA biologists. These men will initially need a technical advisor who by spending a considerable amount of time at the Station can assist these INDERENA biologists in planning, implementing and evaluating a research and hatchery management program.

The INDERENA biologist currently directing the fish culture program at the Repelon Station had limited previous training in aquacultures prior to becoming manager of the Station a few months ago. Fish culture is a very specialized type of animal husbandry, and one

trained in the traditional fishery biology area would not be expected to effectively carry out a meaningful research program in aquaculture without the assistance from an experienced aquaculturist almost on a daily basis. It would not be possible for the aquaculture advisor working at the upper Magdalena Valley fishculture station near Gigante to serve the Repelon Center as the two stations are located at opposite ends of the country.

Should FAO continue to supply INDERENA with the present FAO aquaculturist, or a suitable replacement, it is not recommended that an aquaculturist be recruited for the northern region of the country under the fisheries development loan.

Short-Term Technical Assistance

It is envisioned that consultants may be required for short periods to deal with particular problems in fisheries development as well as to conduct in-country training programs. Consultants may be required in the fields of: fisheries economics and marketing, fish nutrition, fish diseases, induced breeding, hatchery management, fisheries biology, ichthyology and pond construction.

Provisions should be made for 4 man-months of consulting services annually. If possible, the consulting services should be arranged in such a way to permit the consultants with appropriate Colombian staff to carry out a 2 week in-country training program for fisheries staff of INDERENA on an annual basis.

Estimated Costs for Technical Assistance

Salary for staff vary depending on level of training and experience.

Auburn University's International Center for Aquaculture has active projects in several countries which are financially supported by USAID. Current charges of supporting a technical advisor in the field, including salary, transportation of household effects and personal automobile with appropriate allowances range from \$50,000 to \$60,000 annually. Thus a technical assistance component consisting of 3 resident advisors plus 4 man months of short-term consultants annually plus campus coordination would be expected to amount to approximately \$200,000 annually.

Contractual Arrangements for Technical Assistance

Auburn's International Center for Aquaculture has been participating in cooperative fisheries programs under USAID sponsorship for a period of ten years. Our University is familiar with the contracting procedures followed by the Agency for International Development. It is recommended, therefore, that if technical assistance is to be provided by Auburn University, that AID/Washington be designated as the agent to negotiate a technical services contract with Auburn University.

Commodity Purchases to be Included with the Technical Services Contract

In view of the 3-year loan period of which nearly 6 months have already passed, and perhaps an additional period of 6 months will be required to negotiate a technical assistance contract, it is imperative that a sizeable commodity budget be included as a part of the technical services contract.

There would be no point in recruiting a 3-man team and sending it to Colombia only to have the staff sit idly by awaiting equipment and

supplies to be ordered and received before getting into their respective work programs. Transportation will have to be provided for each advisor and it is recommended that 4-wheel drive (Jeep-type) vehicles be purchased under the technical assistance contract.

In addition, certain other equipment funds should be included for purchase of items needed to carry out fish sampling studies and an aquaculture research program. Probably a total sum of US \$50,000 would be adequate with the balance of the equipment being purchased through the Fisheries Loan equipment budget.

TRAINING

The importance of both short and long term training was emphasized. There are provisions in the Fisheries Development Loan for advanced degree training of 17 individuals. Without well-trained personnel INDERENA will not be able to fully utilize the facilities now available or to be constructed under the Loan.

The major difficulty in selecting candidates for advanced degree study overseas is the candidates lack of proficiency in English. It would be of benefit to INDERENA to select certain biologist and have them undergo intensive English training.

LLANOS

The subject of fisheries development in the Llanos was discussed on several occasions with INDERENA personnel. In these discussions it was pointed out that there is little information on the fisheries in this area and that a well-conceived plan of study will be necessary to collect useable information.

A preliminary investigation should be made to determine what information is currently available, how accessible the major rivers in the area are and what type of sampling program can be most effectively carried out. Based on this information a detailed plan should be made and implemented to study the fisheries resources of the region in a systematic and organized manner. Attention should be given during this study to identifying fish of the region which appear to have potential for aquaculture.

As this study is being conducted the need of a permanent biological station in the region should be decided. Consideration should be given when selecting sites for this station as to whether the station will concern itself with the river fisheries only, aquaculture or both.

ALTO MAGDALENA

A site of Finca Palestro, Gigante, Huila, was again visited to determine its suitability to become an aquaculture research station. In a previous visit (August 8, 1975) attempts at taking soil samples were thwarted due to encountering rock near the soil surface. At that time it was not possible to assess the extent of the rock, which prevented the Auburn team from making a definite recommendation on the site at that time.

Several weeks previous to the site visit of April 24 and 26, 1976, bulldozers were used to excavate 1 meter cuts in three areas of the site. The Auburn team examined these cuts and also studied the results of soil analysis. Based on these findings and observations, it was concluded that the site was of marginal value for pond construction due to the abundance of rocks and the relatively low percentage of clay in the soil.

Ponds that will hold water may be built at this site, but careful planning and construction will be necessary to prevent excessive seepage of water from the earthen ponds. It may be necessary to bring in additional clay to be used in construction of the earthen ponds, thus greatly increasing the cost of construction.

Another factor contributing to the marginal value of the site was its limited size. The most suitable portion of the site was only 1.6 ha and a larger tract of land would be desirable. Realizing the need for a larger site, INDERENA biologist Edgar Ortunduaga made enquiries about the availability of a field adjacent to the site. It was determined that this field of over 2 ha probably could be purchased from the owner.

Soil samples from the private plot of land could not be taken below a depth of 2 feet due to the soil auger encountering rock. This problem was also encountered when soil samples were taken earlier from the primary site but the bulldozer cuts revealed that the soil was of adequate quality for construction. It was suggested that additional soil samples be taken from the private owner's field using a posthole digger before purchase arrangements are considered.

Careful consideration should be given to the water supply of this site. The present source of water is from a canal approximately 2 km in length with a flow of 190 l/sec. The origin of the canal, at a small river, needs to be given additional protection to ensure a continuous water supply. Presently there is a danger of the entrance becoming blocked by rock and sand. There are numerous sections of canal that may need to be reinforced with concrete. Also careful consideration should be given as to whether this canal will have the capability in the

future to supply sufficient water for operating the aquaculture station and the other users.

CVC PROGRAM

The fisheries program of CVC was discussed with its fisheries biologist Joel Norena. The CVC is involved in fisheries biology and aquacultural research as well as having a small aquaculture extension program. The fisheries program is too understaffed to effectively carry out the program outlined. It is suggested that an additional biologist be added to the program so one individual can concentrate on the extension program and one on the research program.

Although the station at Buga is small, it can contribute significantly to the development of aquaculture in Colombia. Because of its present limited size with no opportunity for acquiring additional land, this station can be best used in developing techniques for spawning locally available species. To do so, additional facilities will need to be constructed. However, additional facilities including hatchery buildings as well as several small earthen ponds to hold broodstock can be constructed.

It would be in the interest of fisheries development in Colombia that INDERENA provide monetary support to this station for construction and the hiring of additional personnel. It also would be beneficial for INDERENA personnel to work at Buga to gain experience in hatchery management and aquaculture extension. Once construction of the station in the Alto Magdalena has begun the INDERENA personnel could then be transferred there.

REPELON

1. Station Construction

The first phase of construction at Repelon has been completed and 14 ponds and the reservoir pond are filled with water. In discussions with Daniel Rodriguez, INDERENA biologist responsible for the station management, it was found that the ponds had little seepage problems. Grass has been planted on the dams and was well-established on the inside slopes. In several areas grass had not become well-established on the outside slopes and erosion of the dams had begun. Continued emphasis should be given to obtaining a grass cover on all dams.

More care is required to prevent the introduction of undesirable fish into the ponds via the water supply system. The present filter system of coarse screens has allowed undesirable fish into the research ponds. It is suggested that saran filters be added at the intake and outflow structures of the reservoir. Also, saran socks should be used on the water inlets to each ponds.

The concern expressed to the consultants on the suitability of the water quality appears to be unfounded. The high total hardness of 131 ppm is a very desirable characteristic for fish culture waters, and is the primary reason for the high conductivity of the water. All other water quality factors also appear suitable for fish culture.

2. Pesticide danger

In the area of Repelon cotton and other crops are being grown that receive aerial applications of pesticides. The misuse of these pesticides poses a danger to both fish and higher animals in the area. If proper precautions are taken, intensive fish farming and agriculture can go hand-

in-hand without danger from pesticides.

In northeastern Brazil, irrigation projects have been developed below several large reservoirs with each farmer being given 5 ha to establish a diverse agriculture including crops, livestock and fish. has been shown that the incorporation of fish culture into these projects would increase the farmers income considerably.

In Asia rice and fish are often grown together in the same ponds. With the development of disease resistant varieties of rice such as IR-26, this practice will become more widespread. Recent work in the Philippines using this rice variety with no applications of pesticides produced 1735 kg/ha of rice. In addition approximately 90 kg/ha of fish were produced.

In the flat lands of the Mississippi Delta of the southeastern U.S. there is intensive farming of cotton, soybeans and rice. This area is also the center of fish culture in the U.S. having over 30,000 acres in fish production. Often one farmer may raise cotton, soybeans or rice in close vicinity to his fish and is able to apply pesticides to the crops without endangering the fish.

A major problem with pesticide application is drift of the pesticide over other areas not sprayed. This is particularly a problem where pesticides are applied aially. Such drift can be fatal to all forms of animal life. Drift will leave pesticides on pastures and feed crops and these residues can be passed on up the food chain to man.

Factors effecting drift include the method of application, the droplet size when the pesticide is sprayed, wind velocity, and air temperature. To reduce drift several precautions should be taken:

1. Release pesticides as near as possible to the plants and other areas being treated.
2. Use spray rather than dust formulations.
3. Apply pesticides when the wind velocity is at a minimum.
4. Use nozzles and sprayer pressure which will produce medium to coarse sprays.
5. When spraying by air be sure that cutoff valves and all connections are in proper condition to prevent contamination to adjoining areas during turns and approaches.

At Repelon definite steps will be needed to prevent pesticide contamination of the aquacultural research station. There are many possible solutions to prevent this contamination. They include:

1. Establish a 1000 m buffer zone with
 - a. no aerial spraying in this zone but allow spraying to be done with ground equipment within the zone.
 - b. Prohibit cotton from being grown in this zone but allow other crops such as bananas, sorghum, tomatoes etc, to be grown within the zone.
2. Plant a tree barrier around the station.
3. Do not allow any spray planes to fly over the research station.
4. Prohibit the use of toxephene and endrin within 1000 m of the station but allow the use of methyl parathion, EPN, or DDT within 800 m of the station.
5. Prohibit all aerial spraying in the area when winds are greater than 7 mph.
6. Establish a 1000 m buffer zone initially, and as a tree barrier becomes established around the station and the farmers become more aware of the dangers of pesticides, reduce the buffer zone to 800 m.
7. Allow no drainage from cotton land to enter the lake within 1000 m of the irrigation canal entrance.

Although stern measures may be required to prevent pesticide contamination the resultant benefits from this aquaculture research station will far outweigh the loss of a few hectares in cotton production.