



An Economic Assessment of Fisheries Development in
COLOMBIA

Research and Development Series No. 20
International Center for Aquaculture
Agricultural Experiment Station

December 1978
R. Dennis Rouse, Director

AID/1a-C/1176 CL
Auburn University
Auburn, Alabama

CONTENTS

	<i>Page</i>
INTRODUCTION.....	3
DESCRIPTION OF STUDY.....	3
RESULTS.....	4
The General Situation.....	4
Repelon.....	5
Gigante.....	5
Los Llanos.....	6
OTHER ASPECTS OF THE COLOMBIAN FISHERIES PROGRAM.....	7
Use of Economists.....	8
CONCLUSIONS AND RECOMMENDATIONS.....	9
APPENDIX A.....	10
A Market Monitoring Program for Gigante.....	10
APPENDIX B.....	10
Itinerary of Donald R. Street.....	10

PUBLISHED 12/78—1M

COVER PHOTO. Sampling fish population
at Repelon Experiment Station.

Information contained herein is available to all without
regard to race, color, or national origin.

An Economic Assessment of Fisheries Development in Colombia

DONALD R. STREET*

INTRODUCTION

THE PRINCIPAL GOAL of the Auburn University-USAID fisheries project with INDERENA is to devise means of increasing protein in the diets of Colombians, especially the poorer segments of the population. An implicit secondary goal is to increase the well-being of the rural population through improved income. These two goals are not necessarily in conflict, and both seem to fit well in the National Development Plan of Colombia which was to be made available around the latter part of March 1978.

Colombia has several advantages over some countries with respect to the creation of a fish culture program and development of an improved program of inland fisheries in continental waters. First, Colombia has a fishery tradition in a large part of the country, largely because of the effect of the expansive Magdalena River and its tributaries. Second, Colombia has a large amount of complementary resources which are amenable to the creation of aquaculture and other inland fisheries programs. Third, the country has a well-developed technical base in its overall economy, which aids the implementation of new technology in fisheries. Fourth, the country has several universities with capacity to continue research and supplement biological training for ultimate extension services to the potential users of new information on fisheries. Fifth, Colombia has well developed market and transportation infrastructures on which new programs can be built.

DESCRIPTION OF STUDY

The purpose of the study summarized in this report was to give a preliminary socio-economic appraisal of the Auburn-USAID project and its potential. Special emphasis was given to changes needed to elicit favorable economic impacts and to assess such impacts. Primary attention was given to the Repelon Station in the northern part of the country, the Gigante Station in the southern part, and the Llanos area (with emphasis on the Meta River watershed, which drains into the

Orinoco Basin). The study entailed examination of research techniques presently in use, data availability for answering specific questions relevant to the programs, and additional survey information which should be obtained to more fully satisfy project needs. The latter phase of the study was coordinated through the INDERENA fisheries economist.

Both microeconomic and macroeconomic problems are encountered in the programs which Auburn-USAID and INDERENA are carrying out in Colombia. At the micro-level are the costs and returns problems of business firms and the problem of potential pond owners in attempting to allocate their limited resources in an optimum manner. At the macro-level are such problems as determining total income impacts for the country, improving the nation's productivity through improved diets for the populace, and public investment needs for maintaining potential development programs.

The efficacy of actions at both levels depends on the proper balance of public and private inputs to programs. Without a proper market infrastructure and complementary transportation available, private investments in fishculture at the farm level will not be feasible. Production of large volumes of fish will not be warranted unless the populace is made aware of the new products for consumption. Extension work is necessary ultimately for carrying new methods to potential fish farmers to enable them to supply a high-quality product which the populace can utilize. Consumption patterns in areas which presently buy fish in sizable quantities need to be determined to aid in planning for distribution in similar areas.

The principle of using all natural resources wisely must be followed in planning for development of a country such as Colombia. Fish culture projects must be considered along with the development of inland waterways for fish production, and along with coastal waters, brackish waters, and other marine water fisheries as a complete package of development in which each component is properly related to all other components.

In the total economic picture, fisheries must be considered as a competitor for resources with all other enterprises within an alternative cost context. Fisheries should compete for resources only to the extent that they put the country's factors of production to their "highest and best" use.

* The author is Associate Professor of Economics at Auburn University. He was on loan to the Department of Fisheries and Allied Aquacultures during winter quarter 1978.



Fisherman survey on the Meta River.

RESULTS

The General Situation

Three major concerns related to the project goals are (1) the production of fish by pond culture, (2) the management and harvesting of food fish from inland waters, and (3) the importance, economic impact, and potential of ornamental fish in the economy of Colombia. The first step in assessing the various fishery programs is to determine the availability of data relevant to the subject. Many different organizations are involved in the various aspects of fisheries and there has been little effort to pool information. A fisheries bibliography is in preparation and should be available in 1978.

One problem is the lack of sufficient copies of reports of some of the studies related to fisheries. In some studies entailing many thousands of dollars only a few copies of the final report are made. These often go to heads of bureaus and never get in the hands of the scientists who can use them. A large study by outside agencies at a cost of many thousands of dollars purportedly had only around 20 copies made. Often studies put out by these agencies are labeled "preliminary" and/or "for internal use only." A worthy goal seems to be publication of sufficient copies of study reports in "final" form and to express any caveats or data limitations overtly. A third problem closely related to the previous one is the long lag from the time data are collected to the time they are published. Any information on fisheries should be analyzed as soon as possible to be of use in current decision making on fishery policy.

River fisheries are essentially a flow resource in the economic sense. A certain level of harvest may be obtained without damaging the fish population. The work in the Meta watershed in the Llanos is designed to determine optimum management and harvest decisions with respect to food for

human consumption. Both the Gigante and Repelon projects are designed to show costs and returns, and to demonstrate preferred methods of growing fish in the Colombian waters.

The ornamental fisheries are of interest as a means to increase income from their capture areas. Surveys currently being carried out will aid in the determination of income received at the first levels, species captured, and opportunities to improve the system to the benefit of the populace.

The following sections give a general appraisal of the programs at Repelon, Gigante, and the Llanos of Colombia. These sections are followed by recommendations for needed changes in policy to improve the efficiency of inputs to the programs.



Fishing boat with part of the day's catch near San Miguel.

Repelon

The construction program was proceeding at the Repelon Station. Several of the ponds are now in production with experiments in progress. Other ponds were under construction at the time of the author's visit. The Repelon Station will afford opportunities for significant experimentation and production in one of the warmer climatic regions of the country. After sufficient research to assure confidence in data on production, costs, and probable returns, the results gained can be extended to a wide area of the country with large markets established to fill the needs of the populace.

Cities such as Cartagena, Barranquilla, and many smaller towns are in the sphere of influence of the Repelon Station. Colombia already has a fishery tradition with about 60 percent of the fish sold coming from inland waters. Aquacultural fish are likely to be only a small part of the total fish production and should not be expected to affect the markets appreciably. For determining economic feasibility, cost of production data should be complemented by market monitoring in the areas of influence of new ponds coming into production. This monitoring could include prices of competitive fish similar to those to be harvested from aquacultural operations as well as prices of the fish from the aquacultural operations themselves. The services of the INDERENA economist should be used in this program.

The Repelon Station is in the basin of the Magdalena River, which has a highly seasonal fluctuation of fish quantities and corresponding high fluctuations of prices according to quantities received in the markets. Fish culture operations can be adjusted to take advantage of these fluctuations. Harvesting can be timed for the most profitable exploitation of the market and to level out the quantities supplied per unit of time dur-

ing the different seasons of the year. The fish culture operations also have the flexibility for furnishing the product at special festive and holiday times when the demand is expected to increase greatly.

In all projects undertaken, every effort should be made to assess such economic factors as costs of different size operations in terms of construction, life of the facility, the operator's alternative opportunities for his labor, and alternative cost of using his own capital. This type of data will be valuable, not only to INDERENA but also to other countries with similar characteristics to those in Colombia's production and experimental areas.

Other work presently in progress in this part of the lower Magdalena area includes data collection and analysis for artisanal fisheries including certain socioeconomic characteristics of the fisherman, equipment descriptions, equipment costs, work patterns, and other characteristics. Price and value of fish by different species are also included in these studies. These data will be important in the overall planning of total resource development for the Government of Colombia in future years.

Gigante

The Gigante area had the good fortune to have about 40 local ponds either in experimental projects or in production of fish for home use and for sale at the time of the author's visit. It was expected that the contract for construction of experimental facilities would be signed within a few days. Several interesting experiments were in progress including feeding a local plant, bore, to tilapia. When this plant was used as the only nutrient and fed to maximum consumption, fish yield was 4,000 kilograms per hectare.



Experimental plot of bore used for feeding fish.



Leaf stems remaining after fish have consumed bore plants.

It will take considerable time to build the experimental production unit at Gigante and to bring it into use. During this time it is suggested that a system of market monitoring be set up in Gigante to obtain price and quantity baseline data. These data would include prices and quantities of fish currently marketed which are competitive with the aquacultural products, the prices and quantities of the new aquacultural products, and prices and quantities of competitive animal protein products such as beef, pork, and chicken. The size of the city of Gigante and the possibility of flooding the market, which includes only one fish stall, justifies this approach to the study. Some farmers may begin pond culture operations as the experimental facility is being built. Market monitoring will allow contingency planning to prevent failures in the efficient movement of fish to enhance the protein in diets

of the area's populace. If the area of ponds established is such that production is greater than the local market can handle, plans can be made to ship fish to outlying areas such as Neiva, Garzon, and Compoalegre. Marketing outlets and transportation means should be explored well ahead of time to prevent losses to producers and potential consumers. Details of the proposed market monitoring program are given in the Appendix. A questionnaire was designed for setting up the market monitoring system.

Additional surveys considered were house-to-house interviews to determine the preferred sizes of fish by consumers, and the segregation of fish by size in the markets to observe customer preferences. Producers have some leeway in regulating the size of fish marketed by adjusting the time of harvest. This type of action must be considered in conjunction with the price of fish of different sizes and with the per unit cost of production.

It may be difficult to create a tradition of eating fish in an area where fish has not been a popular food. Gigante seems to be in such an area. Sufficient advertising of fish should be done before large quantities of the new fish culture products are marketed. In areas where incomes are sufficiently high, such as in El Salvador, fish have moved well on the market. Questions remain on the response of both fish farmers in building facilities and supplying the product and of consumers to the availability of the product.

In addition to Tom Popma, from Auburn University, the Gigante Station is staffed by Alberto Villaneda, acting head, Jorge Trujillo, biologist, an administrative analyst, a secretary, watchmen, and a cleaning woman. All of the ponds serviced by the Gigante Station are within a 40-minute drive from the Station and are between 900 and 1,600 meters above sea level.

Los Llanos

The biological work in the Llanos area of the country was making substantial progress. Several workers were participating in river surveys on the Meta Basin and in data collection at the various shipping points, such as the ones at Puerto Lopez, Puerto Gaitan, and San Miguel. Work was in progress



Private fish pond used for experimental work in southern Colombia.



LEFT—Dried fish sales in market at Puerto Lopez in the llanos; **RIGHT**—typical catch from the Meta and Manacacias rivers at Puerto Gaitan.

for ornamental fish as well as for food fish. Ornamental fish afford a sizable opportunity for economic gain for the area and needs to be studied more from the standpoint of economic exploitation and optimum development. Socioeconomic data related to the fisherman, equipment, and methods are being collected in the area.

First-price data are being collected at buying-collection points, but data are lacking for intermediate levels of the market. Further work is needed to trace the costs of marketing and transportation at points between the first-buyer level and the retail level.

Sampling methods being used in the Meta River system are intended to determine the value of the fishery to the country, in similar fashion to the study by Chapman on the Magdalena system. Chapman used an interest rate of 12 percent in his discounting, which seems to be severely low in terms of early 1978 conditions (a prime interest rate in the 28 to 30 percent range and actual rates in the 30 to 45 percent range for business loans with some risk). A current inflation rate in the range of 30 percent may indicate some moderating, but it is unlikely to reach low levels soon.

In a situation with a 20 percent inflation rate, a 20 percent nominal interest rate is actually a real rate of interest of zero. An interest rate in excess of the inflation rate must be charged, therefore, to provide a positive return on money loaned. Risk must also be responded to by a higher rate to cover the possibility of losses on the loan. Use of a rate of discount equal to one-third the proper rate will yield an expected value of three times the one which would be proper.

There needs to be an integration of the economic data from the food fish procurement areas to the five-city consumer survey which was to be published by the Ministry of Agriculture. A description of this study is given in a later section. The differences in the original costs of the fish at the river banks and the prices to the consumer are essentially the costs of marketing and transportation. Intermediate level sampling to determine prices at the various wholesale steps will facilitate

decision making on where to market fish produced in aquacultural ponds. Whether it is more profitable for farmers to market fish at the pond bank or to transport them to outside areas will depend on the fish farmer's alternative opportunities for his time and his equipment availability. The same type of decision making will apply to the Repelon and Gigante experiment pond production.

OTHER ASPECTS OF THE COLOMBIAN FISHERIES PROGRAM

In talking with the many officials related to fisheries resources in Colombia, the idea that the country needed better and more extensive economic analyses was brought up repeatedly. The Programming Officer of INDERENA was concerned about the lack of good socioeconomic studies on the food fishery operations and on the ornamental fisheries which export products to the United States and other parts of the world. He was interested in the collection operations, the wholesale trade at different levels, and final destinations of the ornamental fish in such places as the United States. He also expressed concern about the lack of economists in the different areas of the fishery operations of Colombia, noting that many agencies were completely lost on economic matters related to their management. The Programming Officer also expressed an interest in knowing tradeoffs of resources between artisan fisheries and pond culture. There is a sizable slack period in the Magdalena River because of the "subienda" by different seasons of the year. Alternative employment opportunities are, therefore, sought for fishermen who are affected.

A very extensive socioeconomic study was being carried out in the Ministry of Agriculture under the direction of their economist. This study was related to fish marketing and consumer habits by socioeconomic levels in Bogotá, Barranquilla, Bucaramanga, Medellín, and Cali. These cities are of great significance in size, containing an important fraction of the total population of the country. The results of this study, which were to be made available about 1½ months after the



Ice house and holding facilities for fish on the Meta River at San Miguel.

author's visit, may be useful for extension to other cities on a small sample basis for determining differences in consumption patterns in different areas. Yielding income and price elasticity coefficients from the areas with highly developed markets, this study should be helpful for future planning in other areas.

The Director of Inland Fisheries reported on some of the projects of the overall fisheries program of the country. Work is in progress in the Pacific area on various shrimp fisheries research. Studies are underway in the Cartagena area relating to mercury pollution. Coral mortality studies are also in progress, in addition to fisheries, in the Atlantic Ocean. CIDA, the Economic Development agency from Canada, is also doing research in the Caribbean area of Colombia. Various shrimp experiments are in progress in the Pacific area of Colombia in which pond culture is used. Macrobrachium, mojarra, and other finfish were involved in the research. Four scientists from Taiwan and six Colombians were involved in the program. CIDA's involvement in Colombia's Pacific and Caribbean areas amounts to \$3.455 million (Canadian) over a 5-year period. This investment entails equipment such as ice plants, electric plants, preservation equipment, and a large fishing vessel. Colombia will build the vessel and Canada will donate the engines.

The combined group of USAID, CIDA, FAO, and the Chinese mission involved in the above research in marine and inland waters includes 70 biologists. No economists were mentioned in relation to these investigations. The above descriptions were not meant to be exhaustive but were given to illustrate that actions are being taken. Some good results are likely to come of this sizable commitment of the Government of Canada and its cooperating countries. Also, a sound infrastructure is in the process of development in the country.

In a debriefing meeting at the Ministry of Agriculture at the end of the visit, the Colombian officials suggested that the baseline market monitoring study developed for Gigante be extended to other outlying cities for comparative purposes. Data procurement could be included for the cities of Garzon, Compoalegre, and Neiva in the Department of Huila of the upper Magdalena Basin. It was also suggested that the same kind of baseline data be procured from Cartagena and Barranquilla so future marketing studies might have consumption and price data according to species and origin of the products.

The objectives of the market baseline study in the Gigante area and any outlying cities were to establish price and quantity data for fish. Such data would then be used to determine seasonal patterns, to establish similar patterns for competitive meats, and to establish marketing plans for the future.

Extension of the market monitoring work would require another economist to set up and supervise the work. This new resource requirement should be given a high priority by the Government of Colombia.

The educational aspect of the INDERENA program has been growing rapidly. Nine Colombian students are presently studying fisheries at Auburn University and two more are in Washington, D.C., for language training in preparation for entering Auburn University. Other students are planning to enter next year and have significant research in progress. The educational complement of the INDERENA-USAID-Auburn project is a means to increase the human capital infrastructure of the country and add to the future productive capacity.

Use of Economists

INDERENA can benefit from the use of their own economist and from others on a consulting basis. The INDERENA economist should contribute to the development and appraisal

of projects in general by converting price and cost data to constant or real terms, by correctly portraying opportunity costs for the other researchers, and by acting as a general advisor on business analysis related to fisheries. He should be able to aid in the formation and execution of sampling survey matters, some of which are listed. The INDERENA economists should also act as a go-between in coordinating economic matters from the biological scientists to policy forming personnel with the Government of Colombia.

Specifically, the economist will collect data related to agriculture from the Census of Agriculture in Colombia. He will procure seasonal patterns from crops, harvest times, yields of crops per area unit, and other data relevant to agriculture as an alternative to fish culture. He will procure labor cost information from the Ministry of Labor and working capital and investment funding information from the Caja Agraria and other sources. The economist may also aid in gathering diet information from Bienestar Familiar and from the USAID Health Group. He may contribute to background data procurement by working with the Ministry of Agriculture study related to fish consumption in five cities in Colombia as mentioned above. He will also conduct studies on marketing and transportation costs and on prices of fish at intermediate levels of marketing.

The work envisioned by INDERENA and the Ministry of Agriculture is too much for one economist to complete alone. It is advisable to employ another in the Repelon area to assume a part of the work load.

CONCLUSIONS AND RECOMMENDATIONS

The Auburn University-USAID-INDERENA Fisheries Project has made significant progress to date and will vitally affect future opportunities of the populace through improved information. The Repelon and Gigante projects have begun to accomplish parts of the work envisioned for them despite delays in construction and procurement of certain equipment and vehicles. Surveys in the Lower Magdalena and in the Llanos, which are bringing in much needed data on biological-productivity phases of the fisheries, also are useful in supplementing the socio-economic phases of the study.

There has been a scarcity of serious economic studies in Colombia in the past, with economic content being given consideration largely as an afterthought. Thus, the present study of consumer patterns in five cities, which seems to have a valuable content, will be welcomed by scientists interested in building on the data for future plans. The fishery bibliography in preparation at the Ministry of Agriculture should be a tremendous help to persons needing orientation on previous work. The recently-hired INDERENA economist will fill a vacancy from a previous resignation and should be able to aid in bringing economic information to potential users.

The training element in the fisheries project is designed to get the most out of the economy's most valuable resource, its

people. The nine persons presently in the program and the two in language training will add greatly to the human capital growth of the country. Several more plan to enter advanced degree programs later.

Construction delays (for whatever reasons) are costly in view of the high inflation rates in Colombia at present. A fixed sum of money appropriated deteriorates rapidly in terms of buying power for buildings and equipment.

Other development agencies, such as CIDA, the Chinese delegation from Taiwan, FAO, and similar agencies, complement the Auburn-USAID work in favor of a balanced effort to develop the country's natural resources. Mutual information exchanges of these groups will make improved results available to all parties concerned.

Specific recommendations for the project are given as follows:

1. Another full time economist should be hired by INDERENA. He should have at least a masters degree with special training in econometrics. This economist would be used in upgrading demand studies and would aid in opportunity cost and resource allocation problems as well as in macroeconomic matters.

2. Market monitoring should be started immediately in the Gigante area to make better plans on pricing, shipping products, and preparing for contingencies. This plan should be carried out according to the details in the Appendix and by the survey questionnaire developed for use by the INDERENA economist. A simpler market monitoring plan is recommended for the Repelon area of influence only to trace price patterns for competitive fish to aquaculture production and to examine prices of the aquacultural fish. These data can be used to plan shipping patterns of aquacultural fish.

3. The pricing structure of river fish between the first buyers and retail levels needs to be studied to learn at what levels aquacultural fish can most economically break into the market and to determine costs of marketing and transportation between important marketing points.

4. An in-city survey of ornamental fish needs to be set up to complement data which are presently being collected on the rivers at first-buyer collection points. This phase of the work would be carried out by the INDERENA economist.

5. Market monitoring similar to the program recommended for Gigante should be extended as suggested by the officials at the Ministry of Agriculture to the extent of personnel available. The hiring of an additional economist would aid in attaining this goal.

6. Plans should be made for extension personnel to carry research findings directly to potential fish farmers in Colombia. The proper allocation of the country's resources cannot be made without adequate information to the public.

APPENDIX A

A Market Monitoring Program for Gigante

The Gigante market is open for 2 days per week with the opportunity to sell fish. New fish from aquaculture may be competitive with fish which are presently sold in the market and with other animal protein products. Market monitoring will allow at least a rough approximation of economic effects elicited by changes in quantities of fish. Gigante is located on the headwaters of the Magdalena River and is not affected by seasonal fish harvests from the rising and falling of the river as are other areas of the system. Gigante is affected by seasonal demands for fish induced by holidays and such nature-oriented patterns as the coffee harvest, which elicits large inflows of migrant workers.

It is proposed that the market base monitoring for Gigante be set up as follows:

1. The first phase of the study will entail the aggregation of known data on prices, consumption, and socio-economic characteristics of consumers of fish. These data may be in the form of bulletins and unpublished data of various government organizations in Colombia.

2. The second phase of the study will entail collection of base line data at the Gigante market itself. These data will include prices and quantities sold for fish, beef, pork, chicken, and any other animal protein available. The consumption data will allow seasonal patterns to be determined. These data may be supplemented by past sales records of suppliers in the markets. As new supplies of fish enter the market, the monitoring system will be able to note changes in prices and quantities of fish from the river system, prices and quantities of fish from aquacultural developments, changes in the quantity of beef and pork sold (local governments control retail prices of beef and pork), and changes in the price and quantity of chicken.

3. The third phase of the study will be to prepare alternative contingency plans based on the flow of data from the market monitoring. Efforts may be necessary to even out the flow of the quantity of fish to prevent market disruptions in the Gigante area. As a part of the contingency planning, if excess quantities tend to flow into the Gigante area, other markets in Neiva, Garzon, Compoalegre, and other cities may be checked for the possibility of making shipments there. This

alternative would entail studying the availability of transportation, ice, and holding facilities for storing fish before shipment. An additional alternative is to market fish in Gigante more than the 2 days in which the market is usually open. These phases of the study could be supervised by the INDERENA economist with data collection by the personnel at the Gigante Station.

This study will have the limitations of a short time allowed for seasonal analysis and a lack of secular trend data to form a sophisticated econometric model. Cross elasticities and other devices useful in market analysis will not be available, but the new information should allow an improvement in decision making for production planning.

APPENDIX B

Itinerary of Donald R. Street

February 25	Arrival in Cartagena.
February 26	Project review.
February 27	Visit to Repelon and North Coast area.
February 28	Interview with project economist, interviews at Ministry of Agriculture, interviews at INDERENA to discuss National Program.
March 1	Interviews with INDERENA to discuss fish marketing studies, afternoon trip to Gigante.
March 2	Study of the Gigante area.
March 3	Study of the Gigante area.
March 4	Return to Bogotá.
March 6	Trip to Villavicencio.
March 7	Study of the Los Llanos area.
March 8	Study of the Los Llanos area.
March 9	Return to Bogotá via Villavicencio.
March 10	Interviews with agricultural and economic agencies.
March 13	Interviews with agricultural and economic agencies.
March 14	Work at AID offices.
March 15	Work at AID offices.
March 16	Review of observations.
March 17	Return to United States.

