

An Economic Assessment of Jamaica's Fish Culture

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COVER PHOTO. Fish vendor in Western Jamaica

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

AN ECONOMIC ASSESSMENT OF JAMAICA'S FISH CULTURE PROGRAM

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INTRODUCTION

FISH CULTURE HAS BEEN CHOSEN as a tool for economic development by the national government of Jamaica. Its potential as a development mechanism depends on its ability to fit into the overall development plan of the country and on other constraints imposed externally. Reasons for considering fish culture as a development mechanism include nutrition, foreign exchange, income generation, employment considerations, resource utilization, and the indirect effects of an improved socio-political climate.

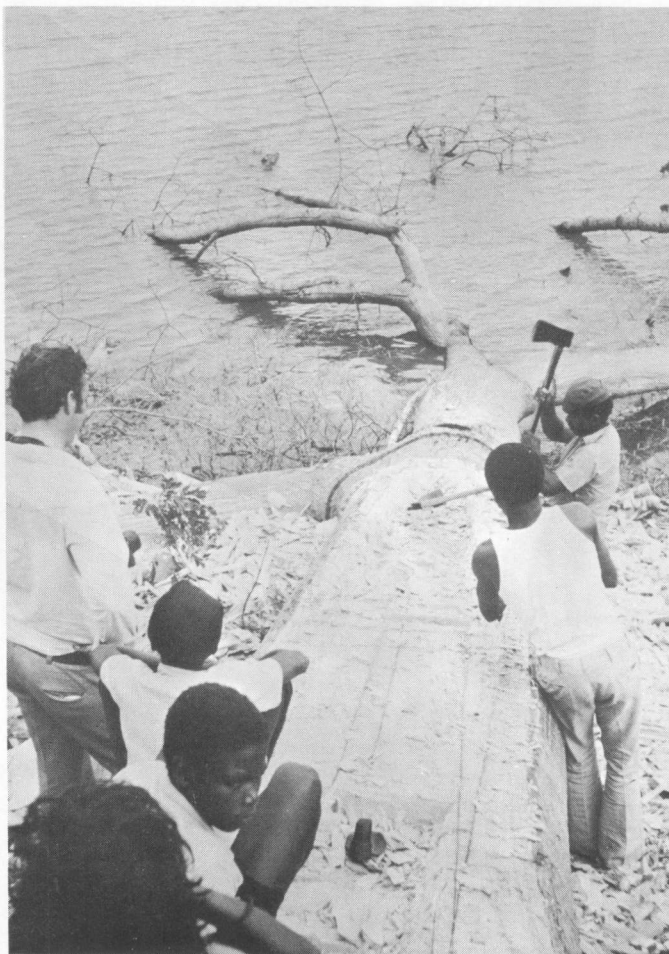
Nutritional deficiencies related to protein requirements have been well-documented and will not be discussed here. Quantitative requirements to fill probable deficiencies are also known at present. Foreign exchange problems, import problems, and balance of payments difficulties have been recognized by the government and have elicited external constraints on financial activities by international lending agencies. World lending institutions have predicated part of their credit on proper internal corrections and measures to improve overall economic and financial stability of the country. The International Monetary Fund was in negotiation with the Jamaican government at the time of this study in an effort to set the economy on a more sound financial footing.

The family income in Jamaica is low and has an adverse distribution in terms of societal goals. Unemployment is high and is closely related to income levels. At a time when greater internal production is needed to enhance food for humans and feed for animals, the country has natural resources which could be mobilized for improving diets of the populace and furnishing added employment of complementary human resources. The allocation of resources needs to be known to determine if a reallocation is needed for optimum productivity.

Spillovers from fish culture development may improve the economy in a secondary fashion through greater productivity of the labor force and through diet improvement. Attainment of a well-fed populace could lead to improved efficiencies of educational inputs and other elements of the economy. Such improvements could lead to more stable social elements within the institutions of the government. Lower costs related to law enforcement and lower crime rates could result as a secondary reaction to an improved quality of life.

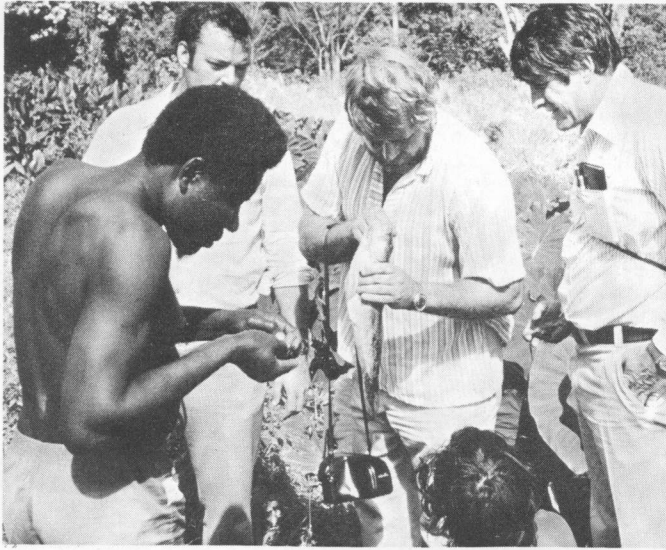
The above reasons justify a further look at fish culture as a potential development method. Ultimate application of such methods depends on the availability of alternatives and many other factors, such as attitudes of the populace and the government and external and internal financial considerations.

The present study was conducted between January 16 and February 8, 1978. Visits were made to fish pond sites, marketing establishments, agricultural offices, and related



Dugout canoe construction by local fishermen.

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Examination of local fish catch in Western Jamaica.

development and aid offices in attempting to assess the fish culture prospects of Jamaica.¹

ALTERNATIVES TO FISH CULTURE

Several possible alternatives to fish culture exist, and these must be considered to establish the feasibility of any given fishery development. Among the alternatives are capture fisheries, animal husbandry, agricultural crops, and imports. The local tropical marine waters are considered to have a low carrying capacity due to nutrient deficiencies and are probably over-exploited at present. Future increases in fuel costs may radically change the economic feasibility of using motorized equipment. Fuel costs have been subsidized to fishermen so they pay less than the J\$2.25 per imperial gallon price of gasoline available for automobiles (U.S. \$1.00 equals approximately J\$1.27). The amount of subsidy for such fuels must be weighed against the social value of the funds if used for other purposes.

Various types of animal husbandry are available for furnishing protein to the diet, but these are highly dependent on importation of feeds. Pork, broiler, and egg operations fit into this pattern. Sheep have not been satisfactory due to climate and disease factors. Goats afford a more viable opportunity for expanded production of animal protein than do the other alternatives listed. Goat meat is valuable and commands a good price in the market.² The animals can use marginal areas and land resources with little alternative value. An additional advantage is that they have little if any direct linkages to imports.

Beef cattle operations are limited by available forage from lands not adaptable to more intensive types of agriculture. According to one FAO study, "The amount of imported frozen meat (mostly boneless beef) is substantial (about 50 percent of consumption) because of current un-

¹The author benefitted from discussions with H. R. Schmittou, Kenneth Randolph, and Vernon Minton during this study.

²FAO/IDB Cooperative Programme, Jamaica Agricultural Research, Vol. I, Final Project Preparation Synthesis Report, #4/76, Washington, December 1976, p.16.

TABLE 1. CONSUMER PRICES IN JAMAICA BY MONTH, 1976 AND 1977 (JANUARY 1975 = 100)

Month	Consumer price index	
	1976	1977
January	111.4	120.6
February	112.3	121.5
March	113.5	125.1
April	115.0	125.6
May	115.2	126.6
June	117.0	130.0
July	118.4	131.0
August	119.6	132.8
September	120.1	135.6
October	120.9	137.4
November	120.8	
December	120.9	

Source: Research Department, Bank of Jamaica, *Statistical Digest*, December 1977, Table 46.

derproduction in the domestic beef industry."³ Prices of meats competitive with fish are extremely high and expected to increase. Chicken necks and backs were selling at J\$0.50 per pound, while whole chickens were priced at J\$0.88 per pound. Swine production, poultry production, and dairying are highly dependent on imports at present and must be considered within the context of the overall import-export question and the balance of payments problem.

Agricultural crops make a valuable contribution to the domestic food and protein requirement as indicated by their high prices in the market. These high prices help to pave the way for fish which may, in some cases, be cheaper per pound and furnish certain protein components that are unavailable from plant sources. In the high-protein food group, the Agricultural Marketing Corporation (AMC) pays farmers J\$95.00 per hundred pounds for African red peas, J\$46.00 per hundred pounds for Congo peas, J\$90.00 per hundred for cowpeas, J\$55.00 per hundred pounds for peanuts, and J\$15.00 per hundred pounds for yellow corn. Retail prices may range from 50 percent to 100 percent above these values. Cowpeas were observed at J\$1.40 per pound in one AMC retail store. Red peas (kidney beans) were selling for J\$2.00 per pound by individuals at street markets.

The Jamaican consumer price index began to increase rapidly in late 1977. The September "All Items" index increased 2.1 percent, to 135.6, on a January 1975 base, table 1. This increment amounts to a 25 percent annual rate of increase. "For the nine-month period January to September, the composite 'All Items' index rose by 12.2 percent compared with 7.1 percent in the comparable 1976 period."⁴ Price movements in the food and drink category accounted for more than two-thirds of the increase in consumer prices and are expected to increase further in the near future. These movements tend to favor fish production, pending their productivity, lack of import dependence, and availability of factor supplies.

Importation of fish as an alternative to aquaculture must be weighed carefully in view of the balance of payments problems encountered in recent years. The overall balance of payments deficit in 1976 was J\$234 million. Improvements were made to the extent that a deficit of

³FAO/IDB Cooperative Programme, Jamaica: *Preparation of Agricultural Marketing Project*, Vol. I Main Report, Washington, 1977, p.38.

⁴Research Department, Bank of Jamaica, *Monthly Review*, November 1977, p.50.

TABLE 2. PERCENT CHANGE IN IMPORT CATEGORIES DURING JANUARY - SEPTEMBER, 1976 AND 1977, WITH PERCENTAGE COMPONENT DISTRIBUTION FOR THE TWO YEARS

Category	Percent change Jan.-Sept. 1976 to 1977	Percent distribution of imports Jan.-Sept.	
		1976	1977
O. Food	-16.6	19.4	18.1
1. Beverage and tobacco ..	+ 1.4	0.8	0.9
2. Crude materials	+49.1	3.5	5.8
3. Mineral fuels	+13.7	22.6	28.7
4. Animal and vegetable oils and fats	- 4.3	1.4	1.5
5. Chemicals	+ 5.4	9.5	11.2
6. Manufactured goods ...	+13.0	18.3	17.8
7. Machinery and trans- portation equipment ...	-41.9	18.2	11.8
8. Miscellaneous manufactured goods ...	-40.6	5.7	3.8
9. Miscellaneous commodities	-27.0	0.6	0.4
TOTAL	-10.4	100.0	100.0

Source: Research Department, Bank of Jamaica, *Monthly Review*, November 1977, pp. 46-47.

J\$30 million to J\$40 million was expected for 1977, but the improvements came largely at the expense of import curtailment. Imports were reduced through restrictions on various types of commodities and manufactured goods. Table 2 reports the percent change in various types of imports from 1976 to 1977 for the January-September period and the percentage of the total which the various categories comprised for the 2 years. The overall trade balance is shown in Table 3 for the periods January-September 1976 and 1977.⁵

TABLE 3. TRADE BALANCE CHANGES FOR JANUARY - SEPTEMBER 1976 AND 1977, INCLUDING PERCENTAGES

Trade	Trade balances			
	Jan.-Sept. 1976	Jan.-Sept. 1977 ¹	Change	Percent change
	J\$000	J\$000	J\$000	
Exports (F.O.B.) ..	421,895	494,312	+ 72,417	+ 17.2
Imports (C.I.F.) ...	622,551	557,527	- 65,024	- 10.4
Trade balance	-200,656	-63,215	+137,441	+68.5

¹Provisional and unadjusted for dual exchange rate.

Source: Research Department, Bank of Jamaica, *Monthly Review*, November 1977, p.42.

The balance of payments problem became serious because of (1) declining prices in sugar and bauxite, (2) accompanying export declines, and (3) declines in tourism induced by various manifestations of political unrest. The former two problems were related to world recessionary conditions, while the latter was an internal problem. Regardless of the reason, according to the *Monthly Review*, "For the period January to August 1977 estimated expenditures by tourists amounted to J\$60.6 million, J\$22.8 million or 27 percent less than for a similar period of 1976. Compared to the 1976 period, declines were reported for all major visitor categories, with that of the long-stay category being the most significant. The long-stay category reported a decline of 69,675 persons."⁶ Bauxite, alumina, sugar, and bananas make up over 79 percent of Jamaican exports.⁷ The end result is that some

⁵Ibid. p.44.

⁶Ibid. p.48.

⁷Ibid. p.44.

imports are suffering from conditions external to Jamaica's economy and from internal political and institutional problems unrelated to the need for imports.

About one-half of the 70 million pounds of fish consumed annually in Jamaica is imported. Fish culture could be used to supply a part of this consumption, but a large proportion of the imported quantity is in the form of salt fish whose use has become a tradition in local diets in combination with vegetables such as ackee. The ability to substitute fresh fish for imported salt fish depends on how tenaciously consumers hold to traditional food demand with combinations of complementary consumption goods.

The above data and discussions strongly suggest that serious consideration be given to fish culture as a development mechanism. The basic factor requirements and market considerations of fish culture will be given below.

THE DEVELOPMENT POTENTIAL FOR FISH CULTURE IN JAMAICA

The previous discussion indicates that fish culture has strong possibilities for development in some situations in Jamaica. This section will examine some of the factors affecting the potential of fish culture and some of the constraints which will affect its viability. Like any other production enterprise, fish culture at the business firm will depend on the basic factors of production, land, labor, capital, and entrepreneurship or management ability. The usefulness of these basic factors may be constrained or limited by basic infrastructures of the economy, by various political restraints, and by the customs, folkways, and mores of the society.

Without a developed general marketing and transportation network, it is difficult to develop a large-scale, viable fish culture program. If the people will not eat fish because of a tradition of not eating fish, the industry cannot sur-



Laying out fish pond on dairy farm.



Renovation of fisheries experimental operation at Twickenham Park.

vive. If proper financing is not available, the industry cannot flourish. Particular nutrients (feed and fertilizer), water, labor, and other inputs must also be together at the same time; i.e., location is important for proper operation of a fishery. A proper extension system is also necessary to educate potential growers of fish and the consuming public.

Land with accompanying amounts of suitable water is a major constraining factor on fish culture. Of the approximately one million acres of agricultural land in Jamaica, only about 25 percent is flat to undulating.⁸ Proper soil types and water availability would limit pond construction to a small fraction of this amount, pending the degree of competition from other alternative enterprises. A cursory examination indicates that a sizable proportion of the island's land does not hold water effectively due to a sandy, gravelly texture and an undependable limestone base. Opportunities to build ponds on land which has little use in other enterprises should be exploited to the extent feasible. Additional opportunities will exist for using ponds whose costs have already been "sunk" for other enterprises, such as for supplementary irrigation or stock watering. In such instances, the profits from the fishery are essentially a "free lunch." A part of the coming year's activities will be used to assess and inventory land to specifically appraise potential for fish culture.

Official estimates of unemployment in Jamaica are in the 25 percent range, and officials familiar with the situation indicate that the real unemployment rate is about 5 percentage points higher. Labor is, therefore, available for most jobs requiring little technical ability. Minimum wages, lack of mobility, and other conditions may prevent particular individuals from taking certain jobs. Labor should not be a serious constraint for fish culture de-

velopment, however, if proper extension education programs are available as aids to entering this new enterprise. Some farm and other labor is underemployed and could be utilized in greater productivity if additional enterprises were available. Pond fish culture is not a labor-intensive operation and should not be expected to have a large impact on the economy through employment effects. Fish farming activities can be scheduled to coincide with periods when other farm activities are low, however.

Capital equipment purchases and other investments are ultimately dependent on money capital available in the country. This factor is likely to be a problem, or at least a restraint, in fisheries operations. The commercial bank prime lending rate during 1976 and 1977 averaged approximately 11.0 percent and will probably go higher in view of recent events in Jamaica's economy.⁹ Capital flowing out of the country may amount to as much as \$100 million this year. According to the *Monthly Review*, "Industrial unrests continued throughout September, with the most significant being the Jamaica Public Service strike which affected consumers of electricity."¹⁰ This activity in conjunction with the flour mill strike and service station slow-down in January of 1978 are further deterrents to cheap money capital accumulating in the country.

Managerial ability is a factor which must be developed gradually in a developing country. To be effective in management there must be a group of innovators subject to training and directing affairs of others. For a fish farm to operate properly, the operator must have the ability to use technology or previously known cultural practices. With adequate research and extension personnel in inland fisheries, optimum operation becomes largely a matter of

⁸Research Department, Bank of Jamaica, *Statistical Digest*, December 1977.

¹⁰Research Department, Bank of Jamaica, *Monthly Review*, November 1977, p.3.

⁸FAO/IDB Cooperative Programme, Jamaica: *Preparation of Agricultural Marketing Project*, Main Report, Vol. 1, No. 8/77, p.9.



Research operations in ponds at Twickenham Park.

dedication of the operator and his employees in applying proper cultural practices for the particular enterprise.

The marketing infrastructure seems to be adequate for beginning a fish culture operation in Jamaica. As the productive capacity increases, there should be no problem in the marketing system expanding to meet the country's needs. All indicators point to a sizable demand for the types of fish which aquaculture could furnish. Prices at retail in the Kingston-Spanish Town area ranged from J\$0.50 per pound for 5-inch sardines and herring used as soup fish to J\$2.50 per pound for fish in the red snapper-yellow tail category. Squirrel fish, considered a "trash" fish, in 8-inch sizes were selling for J\$1.00 per pound, while parrot fish, considered a "common" fish for marketing purposes, was selling for J\$1.40 to 1.50 per pound. Prices go higher in times of low supply. The fish are kept on ice and are usually held for a maximum of about 3 hours at the local markets by individual traders, called higglers, who have brought the fish from the boats. Limited data from the AMC show that African perch (*Tilapia mossambica*) were selling for J\$1.30 per pound after being purchased for J\$0.60 per pound. Initially there was a resistance to its purchase because of its dark color. Among local fish, the African perch holds the most promise for pond culture. Introduction of new species may be a way to open up new markets.

Officials of the AMC pointed out that they had 21 major outlets in the country and that there were 43 special shops for low income areas of the country. All shops have cooling facilities and could handle fish. Some problems exist in maintenance and keeping older cooling and freezing equipment in operation. Some 78 trucks are available, part of which are equipped with ice carrying equipment for distribution of fish. Ice availability was not likely to be a problem according to AMC officials. AMC officials did not envision significant problems in having fish delivered on a regular basis on given days of the week.¹¹

An FAO/IDB study proposed replacement of the parish markets with new facilities where they existed and construction of a market at one town which had none. Some

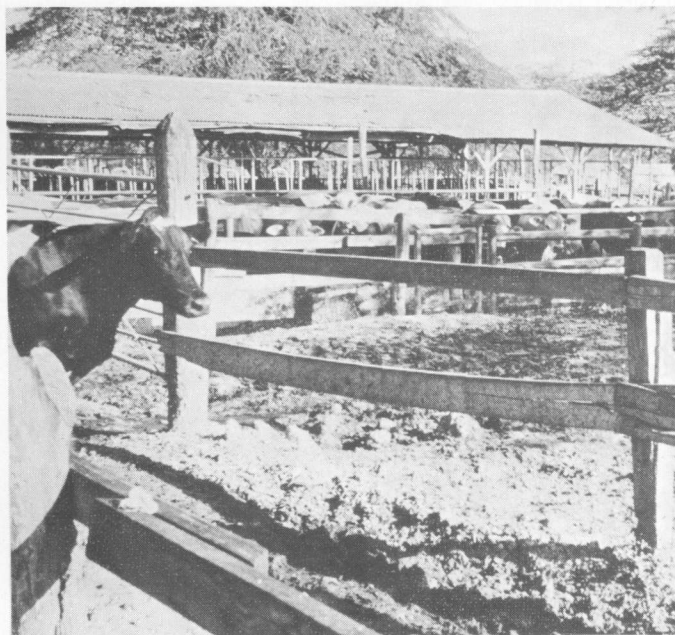
5,700 vendor stalls were envisioned in the project. Total cost of the project was estimated at US\$20 million at the old rate of US\$1.00 = J\$0.91. The project was justified largely in terms of a reduction of waste and consumer benefit efficiencies gained.¹²

The FAO/IDB study recommended that at least two fish stalls be available in each of the proposed markets. These stalls were to be arranged close to ice rooms, and plastic tote boxes were to be provided to vendors for holding iced fish. Crushed ice would be provided for holding excess fish from one day to the next.¹³

Initially, the present marketing system should be able

¹²FAO/IDB Cooperative Programme, Jamaica: *Preparation of Agricultural Marketing Project*, Main Report, August 1977, Vol. I, pp. ii-iv.

¹³Ibid, p.80.



Potential source of fish pond nutrients at dairy farm.

¹¹Interview with Ray McKinley, Managing Director of AMC, January 1978.

to handle all fish produced in ponds. Higglers handle about 80 percent of the fresh food in Jamaica. There are some 18,000 higglers in the country, 5,000 of whom sell meats, fish, and related animal products. The higgler business is filled largely by older persons and has not been able to attract younger persons in recent years.¹⁴

The data cited indicate that the marketing and transportation infrastructure should be adequate for building a sound fishery program.

Except for the problem of a severe capital shortage, the major factors necessary for a viable fish culture operation seem to be available. Land availability is questionable in certain areas, however. The extent of expansion and the types of operation may be limited by several other considerations which have an important bearing on the economics of the enterprise. The problem of using largely imported feed and fertilizer for fish culture can only be resolved on the basis of the expected costs and benefits of the enterprise. Imports are subject to new turns in the political system, however, and should be properly appraised from a risk standpoint in making future expansion plans. Any type expansion should be based on the best cost and returns information available.

Early expansion in fish culture should be planned around available local supplies of feed and other nutrients in the country which do not have alternative uses to bid the factors away. Byproducts, such as manures from cattle, swine, and poultry, furnish nutrients directly to fish or indirectly through plant life that is eaten by fish. Coffee pulp and various brewery byproducts, available locally, may be used to economic advantage in fish production. Analyses are being performed on processed sugar cane wastes to determine if they are economically feasible for fish pond nutrients.

Approximately 5.6 million pounds of coffee pulp are available in Jamaica annually. In Spanish Town, 10 tons per week of rice bran is also available at a cost of J\$0.06 per pound. Analyses indicated that the bran contained about 50 percent carbohydrates, 13 percent ash, 12 percent protein, and 9 percent fiber. Jamaica Flour Mills has about 60 tons per day of excess wheat middlings from their operations at a cost of around J\$0.10 per pound. The mills use a part of their byproducts in their own animal feed operations. The wheat middlings contain about 14 percent protein, 10 percent fiber, and 4 percent fat. Large dairies, poultry farms, and swine production operations exist within Jamaica. Knowledge of their relationship to fish culture operations will help to determine the feasibility of an adjunct facility to use the wastes. Transportation costs and the value of the manures in alternative uses must also be considered. A part of next year's activities will be directed toward procuring data on locations of nutrient sources, their prices (where market prices exist), productivity in fish culture operations, and transportation costs.

SUMMARY AND CONCLUSIONS

It has been established that Jamaica has a strong need for additional sources of cheap animal protein. Fish culture has possibilities which must be considered in view of the development plan for the country. The study reported here established information relevant to decision-making

about fish culture in Jamaica, delineated areas in which information deficiencies exist, and suggested means for obtaining information needed for decision-making.

A. Facts related to decision-making are:

1. A sizable demand exists for fresh fish in Jamaica. This result is manifest through:
 - (a) high prices of other fish in existing markets, and
 - (b) high prices of competitive high-protein food products.
2. The labor supply for fisheries operations should be adequate to begin this enterprise in the country with selected farmers. Extension education is a necessary complement to a fishery venture.
3. Byproduct feedstuffs are available in sufficient quantities to begin fishery operations in certain areas.
4. An adequate marketing and transportation infrastructure is available for beginning a fish culture enterprise.
5. Interest rates are high in Jamaica, and are not likely to be reduced soon in view of capital outflows.
6. Sizable risks may be encountered in a fish culture operation subject to:
 - (a) the ability of operators to utilize the appropriate technology,
 - (b) sandy and porous limestone base soils leading to leaks in ponds and loss of water, and
 - (c) a possible dependence on imports of feeds and fertilizers which are subject to fluctuations in world prices and to government import restrictions.

B. Areas in which more information specific to Jamaica is needed are:

1. The extent of the market for fresh fish in Jamaica.
2. Production rates of fish utilizing different types of locally available feeds and fertilizer materials.
3. Costs of the various types of inputs to pond fish culture.
4. Costs of construction of different types of ponds.
5. Alternative uses of inputs suitable for fish culture.
6. Extent and location of lands suitable for aquacultural development.

C. The above types of missing information are to be obtained by:

1. Complete record keeping on costs of construction, maintenance, and variable inputs to the fish culture operations for different sized ponds.
2. Setting up pond experiments with alternative feeding and fertilization methods.
3. Observing market price changes and responsiveness of customers to the product presented by size of fish.
4. An appraisal of alternative uses of resources used in fish culture operations.

The requirements under C can be met by use of extension personnel, by outside consultants on the marketing aspects, and by observation of the fisheries staff on the project. The next year will afford the opportunity to gather a large amount of the data needed.

¹⁴Ibid, pp. 29-30.