

Report on the State of Aquaculture in St. Lucia, W.I. 1989 - 1993

MARIE-LOUISE FELIX

*Aquaculture Division, Department of Fisheries,
Ministry of Agriculture, Lands, Forestry and Fisheries.*

ABSTRACT

Aquaculture has slowly been developing in the island of St. Lucia since the early 1960s. As the economy expands, the need to introduce new industries has grown and this has led to greater interest being placed on aquaculture. The threat of an open European market has also contributed to this interest. Promotion of the industry by the Fisheries Department has led to the building of hatcheries and to the establishment of Government and private commercial ponds. Significant growth in aquaculture has occurred during 1990 and 1993 and this is expected to continue as a result of the promotion and extension activities of the Fisheries Department. The current status of aquaculture in St. Lucia, and the promotion, extension and research efforts made to ensure its expansion are described.

INTRODUCTION

Aquaculture has existed in St. Lucia since the early 1960s with the establishment of small fish (*Tilapia*) ponds. However, it is only in the last ten years that any significant attention has been given to the industry. The St. Lucia Government has tried to encourage agricultural diversification through the promotion of aquaculture. A special division has been established in the Department of Fisheries (DOF) to deal with aquaculture development. Through a series of educational and promotional activities by this aquaculture division, a number of land owners, most of whom are banana farmers, grow either freshwater fish or freshwater shrimp. The choice of crop is dependent on the quantity of available water on the land. To ensure success of the programme, attempts are made by the DOF to identify common problems amongst farmers and explore various means of solving them. Careful scrutiny of the development of aquaculture in St. Lucia over the last three to four years, indicates that the industry has the potential for becoming a significant money earner and freshwater shrimp a worthwhile alternative to bananas as a money crop. Currently, farmers are being encouraged to get involved in aquaculture by establishing production ponds. All technical advice and services are provided free of cost and seed stock is sold at subsidized prices.

METHODS

The state of aquaculture in St. Lucia can be summarized as follows: There are two species of animal cultivated; these are the freshwater shrimp, *Macrobrachium rosenbergii* and the freshwater fish *Oreochromis niloticus* and

its red hybrid. Support facilities include two hatcheries, one for tilapia production and one for shrimp production.

In the case of the shrimp culture, batch and semi-continuous methods are practiced. Farmers receive their first crop of animals as two week old post-larvae straight from larval tanks in the hatchery. Animals would have been introduced to freshwater and pelleted feed one week after metamorphosis and whilst still in the larval tanks. Postlarvae are transported in plastic larval bags during the early morning hours to the pond site. Transportation is often designed so that arrival at the pond occurs by about 6:00 am - 7:00 am. Since most farmers own on average just one or two ponds, there are no nursery ponds, just production ponds. Shrimp will thus remain in the ponds in which they have been stocked as post-larvae until harvest time. Shrimp are fed on either ground sardines or a pelleted feed with about 30 - 40% protein. Farmers are advised to feed at least twice a day (at about 6:00 am and 6:00 pm). Feeding rates are calculated monthly by the aquaculture fisheries officer after pond sampling. Continuous water flow systems are encouraged. Where water exchange depends on pumping, this is done, at first, once then twice per week. The first harvest is planned for the fifth month where all marketable sized shrimp are removed. At this time the pond may or may not be restocked. This will depend on the density of animals left back after harvest. Normally however, enough animals would have been removed to make restocking possible. The second harvest should occur at the sixth to seventh month, that is, two months after the first harvest.

In the case of the Tilapia, batch harvests are most common. Fingerling fish that have been hand sexed are transported in large insulated coolers to the pond. Stocking occurs either early morning or late afternoon. Most fish farmers do extensive culture with stagnant water systems. Wherever continuous water is available, farmers opt to do shrimp. Fish are fed once or twice a day on chicken feed, or on a pelleted floating fish feed, and sometimes on sardines and termites. Harvesting occurs by the fifth to sixth month. Complete harvesting often occurs by first seining then draining the pond. Drying of the pond (for at least a week) is encouraged and then it is restocked.

All aquaculture planning, pond stocking and harvesting activities are supervised by fisheries officers. At all harvests of shrimp and fish, animals are rinsed after removal from the pond, and placed in chipped ice whilst still alive. This ensures a good quality product on arrival at the market.

The number of farmers involved in aquaculture has been growing steadily over the last few years (Figure 1). There are about sixteen farmers presently involved in aquaculture. Together they own 33 private ponds which make up about ten acres of land. Of these 33 ponds, four are used for fish production and all others are used for shrimp. In addition, there are seven Government

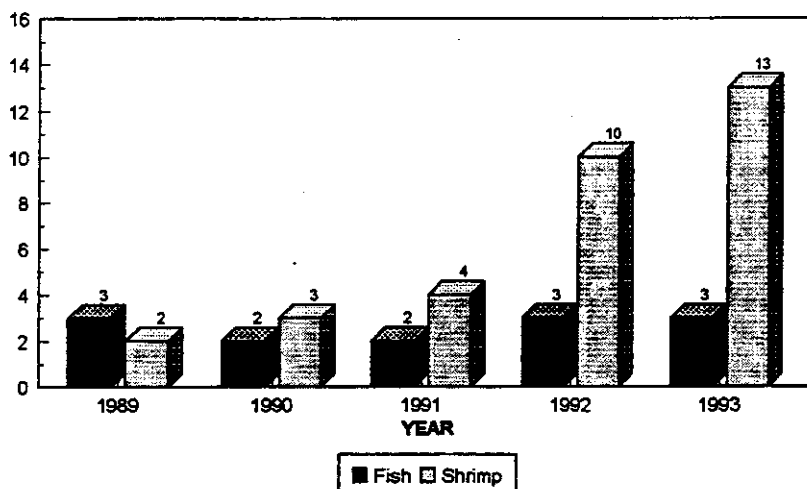


Figure 1. Farmer involvement in aquaculture in St. Lucia from 1989 - 1993.

ponds, four are used for shrimp and the rest for tilapia. All Government ponds are primarily used to produce broodstock and fry. Ponds on the island range from one-eighth acre to one acre.

All aquaculture extension, promotion and support activities on the island are organized by the Government through the DOF. There are presently two fisheries officers, one Taiwanese technician and four pond attendants that comprise the aquaculture work team. The officers are responsible for hatchery management, coordination of aquaculture activities, aquaculture promotion and farm extension services. Other activities include aquaculture research and public education.

Potential aquaculturists on the island are farmers and other land owners, many of whom are businessmen. The main buyers are the hotels, restaurants and the general public. Fish are sold at \$3.00 per pound and shrimp at \$15.00 per pound. Most of the aquaculture products are first sold to the Fish Marketing Cooperation which then retails to the public. Overall, response by business places and the general public has been quite good. Presently, although production has grown significantly in the last few years (Figure 2), levels still fall far below public demand.

Production figures for the last five years are :

- 1989 – 91 kg (fish); 9 kg (shrimp)
- 1990 – 36 kg (fish); 256 kg (shrimp)
- 1991 – 67 kg (fish); 266 kg (shrimp)
- 1992 – 266 kg (fish); 1074 kg (shrimp)
- 1993 – 446 kg (fish); 1817 kg (shrimp)

Production is primarily to meet local demand; however, some interest has recently been shown by foreign restaurants in purchasing the St. Lucian grown freshwater shrimp. In July 1993, 100 pounds of shrimp were sold to a neighbouring island.

Establishment Of Aquaculture Systems In St. Lucia.

It is the function of the Aquaculture Division of the DOF to assist all interested persons to get started in aquaculture. Persons are encouraged to call the Fisheries Department and request a meeting with the aquaculture officers. Persons who qualify for help would include farmers and other land owners with gently sloping or flat land which is within easy reach of a river or spring. Land with a water source at a higher elevation to the pond sites is most preferred since pumping can thus be avoided. Similarly, land with at least 20% clay soil is advised so that it is not necessary to clay, concrete or rubber line the ponds.

Where land is surveyed and found suitable for aquaculture by the fisheries officers, a feasibility report is prepared so that the farmer gets a clear idea of the costs and revenues to expect from his particular project. This will allow him to decide whether or not to proceed. Farmers are always advised to build ponds no smaller than a one-fourth acre but no larger than one acre. It is also recommended that shrimp culture be attempted only where water is easily available and preferably by gravity flow. As much as possible attempts are made to avoid reliance on pumps. The fisheries officers will help determine the design and location of the ponds and water systems. Supervision of pond construction, stocking, management and harvesting is also part of the responsibility of the fisheries officers.

First time fish farmers are given very special attention and are almost hand held through the entire first production period. Visits to the ponds are made weekly and feed rates, water quality and quantity are constantly monitored. Only when the aquaculture staff feel confident in a farmer's ability to manage his system properly on his own is this monitoring relaxed. The aquaculture staff are available round the clock to deal with any emergencies that may arise.

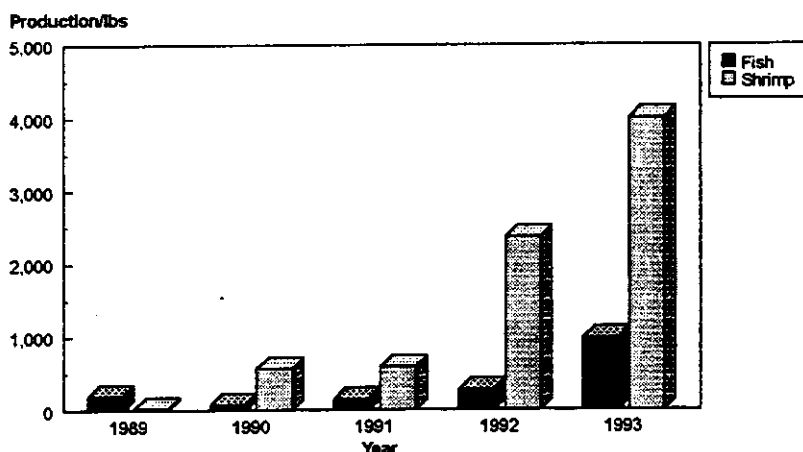


Figure 2. The growth of aquaculture in St. Lucia.

Aquaculture Economics For The St. Lucian Farmer.

The following describes the data used in preparing economic feasibility reports for St. Lucian farmers. All figures have been derived from statistics obtained from production reports of farmers over the last three years. The figures are modified annually to reflect changes in the collected data.

These are the statistics used as the basis for further calculations:

1. Average stocking densities are 1 - 2/m² (fish) and 10 - 15/m² for shrimp.
2. Post-larval shrimp and fingerling fish costs are \$0.10 each with a concession price of \$0.02 each for the first batch purchased.
3. Survival in the ponds is 90% for fish and 40 - 50% for shrimp.
4. Feed costs are \$0.90 per pound.
5. Feed conversion ratios (FCR) are 2:1 for fish and 3 - 5:1 for shrimp.
6. The average production period is six months.
7. At harvest, the average weight of fish is 0.75 - 1 pound and 25 - 40 grams for shrimp. Generally ten to fifteen shrimp will weigh 1 pound.
8. Market prices are \$3.00 per pound for the fish and \$12 - \$15 per

pound for shrimp.

Based on the above, the DOF is able to estimate returns for various sized aquaculture operations. The most common quotations are made with reference to a one acre pond in production for one year. The calculations are shown below.

Returns for fish for a one acre pond for one year :

1 acre \approx 4,000 m

no. of fish stocked at 1 production phase = 4,000; in one year = 8,000.

cost of fingerling fish = $8,000 \times \$0.10 = \800

expected weight of produce = $8,000 \times 90\% = 7,200$

expected value of produce = \$21,600

weight of food used (FCR 2:1) = $7,200 \times 2 = 14,400$ pounds

cost of food = $14,400 \times \$0.90 = \$12,960$

profit = $21,600 - (800 + 12,960) = \$7,840$

(Note : for a one acre pond, labour costs are considered insignificant).

Returns for shrimp for one acre for one year :

no. of shrimp stocked (10/sq.m) = 40,000; 80,000 / yr.

cost of postlarval shrimp = \$8,000

expected weight and value of crop = $80,000 \times 40\% = 32,000 = 2133$ pounds

(15 per pound) \approx \$32,000 (\$15 per pound)

food needed = $2133 \times 5 = 10,665$ pounds = \$9,598.50

profit = (Revenue - costs) \$14,401.50

It is the policy of the aquaculture division to quote returns from the lower end of the scale so that farmers do not become over optimistic about their projects.

In addition to the economic aspect of the industry, farmers are also provided with an information sheet which summarizes basic details on aquaculture. An example of this information sheet is shown here.

Aquaculture Information Sheet

- a. Minimum land area recommended = one quarter of an acre
- b. Site requirements = clean flowing river, gently sloping land and clay soil.
- c. Minimum flow needed = fourteen gallons per minute per acre
Maximum flow needed = 48 gallons per minute per acre
- d. costs :
stock = \$0.10 for every small fish or shrimp
feed = \$0.90 per pound (this can range from \$0.50 - \$1.00)
- e. Production time = average six months

- f. Returns per acre per year (assume two crops per year).

7,200 pounds fish, revenue \$21,600, profit ~\$9,000

2,133 pounds shrimp, revenue \$32,000, profit ~\$14,400

- g. Construction costs for ponds

for 500 sq.m = \$3,000 - \$5,000

for 1/4 acre = \$5,000 - \$7,000

for 1/2 acre = \$7,000 - \$9,000. Note that construction costs will vary greatly from site to site. Road access, pond location and land topography all influence costs.

- h. Costs of water system :

dam = \$100 - \$300, 4 inch pipes = \$4.00 per foot,

- 2 inch pipes = \$2.50 per foot (includes labour)

- i. Risks involved:

°Water quality can fall if water exchange is insufficient, if significant overfeeding occurs or if toxic substances are allowed to enter the ponds. When water quality is unsuitable, high shrimp mortalities can take place. Poor water conditions may be reflected in any of the following: high nitrate or ammonia levels, extremes of pH, low oxygen levels, high temperatures, discoloration of the pond water, formation of scum on the water surface, dead fish or shrimp.

°Mortalities will also occur if harmful substances enter the pond. This is an important consideration for farmers whose ponds are on or near agricultural land. Indiscriminate use of pesticides and herbicides by farm workers often leads to river contamination. When contamination occurs upstream of the water intake, ponds can be seriously affected.

°Loss of the crop can also be due to the human factor: theft. No cases have been reported for St. Lucia, but farmers should still take care in choosing workers, and choosing sites. The further away a pond is from populated areas, the less likely the chance of human interference.

°Predation by birds, other fish and eels can significantly affect survival. Birds especially are known to cause serious problems in many parts of the world. Farmers must constantly clean their water filters and discourage birds, cattle and other animals from hanging around the pond.

°Underfeeding is just as bad as overfeeding. Hungry animals may attack each other often causing mortalities. Undersized animals also often sell for less money.

- j. Market description:

It is estimated that St. Lucia can absorb at least 45,000 pounds of shrimp per year. The Fish Marketing Cooperation will purchase all the shrimp and fish produced through aquaculture once the quality and size of the product are acceptable. The Fisheries Department thus

supervises harvests to ensure a good quality product. With the developing tourist industry, the demand for freshwater shrimp is expected to increase. Hotels and restaurants are presently the greatest consumers of the product. The demand far exceeds the supply. Farmers are thus encouraged to grow as much shrimp as possible to help satisfy the market. Response by the general public to the fish and shrimp has also been quite good.

Hindrances To Aquaculture Development In St. Lucia.

There are a number of factors which affect the expansion of aquaculture in St. Lucia. Many of these factors have been identified by the DOF and are being addressed. One of the major restraints to farmers is the high cost of pond construction. In St. Lucia, many persons can obtain the necessary land and water needed for aquaculture but unfortunately, have limited cash resources. The chances of obtaining bank loans is often low, since many farmers do not hold clear titles or deeds to their property. Even when ownership is clear, the property may not be sufficient to secure a bank loan. However, through recommendations by aquaculture officers, some farmers have been successful in obtaining funds for pond construction and equipment, namely pumps. To date three farmers have received loans from banks for aquaculture enterprises.

Shrimp and tilapia feeds are not made in St. Lucia. In fact, presently, there is no feed mill in operation on the island. Therefore, all feeds including the fish feed must be imported. Shipping costs increase the price of food. As this is the greatest cost during production, profits are significantly affected. Farmers have been advised to use local products as much as possible to help reduce their dependence on the imported feeds. Chopped fish and sardines are often used as alternatives. Crushed green figs, breadfruit and chicken feed mixed with a fishmeal powder is also recommended. Fish offal is also used. Farmers have recorded very good growth with these feeds. Some of these feeds are seasonal and so alternatives are constantly being sought.

The island is to a large extent under banana cultivation and thus the use of pesticides and herbicides is widespread. Large shrimp losses over the last 2 years are thought to have maybe been caused by water pollution with toxic agricultural substances.

There are many areas on the island that are not yet serviced with electricity. Suitable land for aquaculture is sometimes found in such areas. This has proved a problem where aerators and work houses are required. Running electricity lines is generally beyond the capabilities of most individuals due to the high cost. One solution has been the use of generators. At least one farmer in St. Lucia is totally dependent on a generator to operate his farm. Another infrastructural problem is the quality of roads in the rural

areas on the island. There are a few farmers who cannot reach their ponds by vehicle (even with four-wheel drive trucks) when it rains heavily. Harvests are often postponed due to bad weather. Government assistance with road repairs is sometimes available in heavily used areas but difficult to obtain on private property.

There are no special lending agencies on the island set up specifically for aquaculture development, thus farmers must meet the normal collateral requirements of the banks if they wish to borrow money for pond and farm construction. As explained above, most cannot meet these requirements.

Some research is necessary to help the aquaculture division deal with the problems of feed substitutes using locally available materials, difficult to control aquatic weeds, water pollution and unexplained low production in ponds. Because the aquaculture work team is too small to undertake much research in addition to its other responsibilities, a larger work force is necessary.

Projections For 1994 - 1998

The St. Lucian Government's intention is for the country to meet the bulk of its shrimp requirements through aquaculture. The Fisheries Department thinks that this can be accomplished if at least 50 acres of land is allocated to shrimp production. Fish production is also expected to increase to help meet the demand for fish in the low fish season. Continued efforts in aquaculture education and extension services to farmers will be made in order to both increase farmer numbers and pond acreage but also to improve farmer pond management skills. Production per acreage should also increase due to improvements in pond management especially by the more experienced farmers. Due to the greater production levels expected, it is hoped that market demand will also increase since product supply will be more reliable.

Production of a locally produced food using local materials is envisioned. Some research to help solve specific production problems and thus maximize pond productivity is also anticipated.

Finally, an attempt will be made to set up a lending system for aquaculture farmers to assist them in meeting construction and equipment costs.

DISCUSSION

Generally, aquaculture in the Caribbean is considered underdeveloped (Shleser *et al.*, 1992). The reasons cited include the absence of suitable species for culture, better land sites elsewhere, Government bureaucracy and skepticism about the success of such projects in the Caribbean. In addition, there are other possible deterrents to successfully establishing aquaculture businesses in small countries, for example, the limited land area available and

lack of research facilities and technical personnel. However, in St. Lucia, as well as in other states such as Dominica (New *et al.*, 1978) and Taiwan (Chao, 1979), it has been realized that aquaculture can play a very important role in the development of small communities. In the country areas, land is plentiful and the rivers are clean and fast flowing. Most soil types also have high clay contents making them suitable for aquaculture. Backyard ponds can be built to meet the demands of the family and neighbours, and crops from larger ponds will bring in some income in the market. Through extensive culture of fish for example, farmers' incomes can be augmented through sale of the crop. Little or no funds would be needed for feed inputs.

Small communities are well suited for extensive aquaculture. Persons are always home (older children and mothers), and can feed and care for the pond. Products of small scale animal breeding (most small farmers tend to have a few livestock around) can be used for pond fertilization and animal nutrition. Neighbours are almost always available to assist in pond construction and harvests. Even if the crop is small, little money has gone into its production. Aquaculture products are generally good sources of protein so that improvements in the community diet are likely to result.

The St. Lucia experience, recent as it is, has shown that profits can be generated from ponds as small as one-eighth acre – one-fourth acre. Presently, with the exception of instances of total shrimp mortalities (most often due to low oxygen conditions) all farmers on the island have been making profits from their aquaculture ponds (generally \$4,000 - \$8,000 per acre per harvest). In some instances profits may be quite small, no more than a \$300 - \$400 per crop, but may be significant when compared to the normal earnings of the farmer. With the admittedly limited flat land available, the approach has been to encourage integrated farming systems that would

- a. utilize land unsuitable for other forms of agriculture
- b. augment farm income
- c. meet the demand for freshwater jumbo shrimp on the local market
- d. encourage a form of environmentally friendly agriculture
- e. produce a substitute for imported shrimps.

CONCLUSION

Although the potential for large (> ten acres) aquaculture farms in St. Lucia is low, the economic and social benefits to be derived from the industry are not insignificant. Compared to the other income generating activities available to land owners, aquaculture is highly attractive. The Government of St. Lucia intends to continue its thrust for aquaculture development and it has based its decision on the present returns being derived from the industry by farmers and the ever increasing demand for the products especially the shrimp, by residents and visitors alike.

LITERATURE CITED

- Chao, N. 1979. Freshwater prawn farming in Taiwan—the patterns, problems and prospects. *Proc. World Mar. Soc.* 10: 51-67.
- New, M.B., S. Sanders, R.L. Brown, and R.C. Cole. 1978. The feasibility of farming *Macrobrachium* in Dominica, West Indies. *Proc. World Mar. Soc.* 8: 67-81.
- Shleser, R.A., D.E. Alston, and R.H. Arthur. 1992. Status and opportunities of shrimp farming in the Caribbean islands. Pages 1-16 in P.A. Sandifer, eds. *Shrimp culture in North America*. World Aquaculture Society.