The Aquaculture Industry in St. Lucia, West Indies

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ABSTRACT

Aquaculture is currently considered by the Ministry of Agriculture to be a means of agricultural diversification, income enhancement and import substitution. Efforts have been made by the State to develop the industry through farmer education, infrastructural change, drafting of legislation and the provision of technical services. The strategies employed have been designed to meet the unique conditions present in a small, developing island state. The benefits derived from aquaculture are measuredby both economic and social parameters.

KEY WORDS: aquaculture extension, *Macrobrachium rosenbergii*, St. Lucia, tilapia,

INTRODUCTION

Historical

St. Lucia is a small volcanic island, 238 square miles located in the tropical Caribbean. The island's main income earner is tourism with its chief agriculture crop being bananas. The island, with a population of 146,000 persons, has a small fishing industry with about 1,500 full and part-time fishermen. Wooden canoes and fibreglass boats, both with outboard motors, are the main crafts used. Pot, seine and scuba-diving are the methods of fishing most commonly employed. Few boats have the capacity to remain out at sea for more than 2 – 3 days at a time. The Fisheries Department has, over the last few years, introduced new fishing methods and equipment to help increase fish catch and improve efficiency within the industry. The role of the Fisheries Department is marine conservation and resource management.

Aquaculture is a recent development in Fisheries in St. Lucia. In the 1960s, fish culture was initiated with the introduction of the silver tilapia *Oreochromis niloticus* into St. Lucia. Culture of this fish occurred on an artisanal level for several years, mainly at the government research centre. In 1988, aquaculture got a boost with the introduction of shrimp culture by the Taiwanese Agriculture Mission on the island. With Taiwanese assistance, a shrimp hatchery and two nursery ponds were built and a full-time culturist was employed. A few years later, the St. Lucia government took over the responsibility of operating the hatchery and employing additional officers to conduct aquaculture education and extension.

Rationale

St. Lucia, because of its topography and social and economic conditions, is well suited for aquaculture development. The island enjoys a warm climate 12 months of the year, and it has several rivers which are still fairly free of chemical pollutants. In addition, despite its hilly nature, there is some flat land available within the rural areas. Culturally, the people have a long farming history and have always depended on the land to provide them with a livelihood. Finally, the need to identify a new money crop has become of great importance because of the threat of loosing the once guaranteed European market for bananas. The growth of the tourism industry has also led to an increasing demand for fish food and thus a new market for shrimp and fish products. The suitability of St. Lucia for aquaculture development is described in further detail in Table 1.

METHODS

Over the last 6 – 8 years, the Fisheries Department has actively promoted aquaculture in St. Lucia. Based on biological, social, economic and infrastructural considerations, it was decided in 1988 that the industry would first be introduced as a pilot project with a select group of volunteer farmers. The response from the pilot study would determine the future of the industry. Invariably, farmer satisfaction would be the measuring stick used to calculate success. A Fisheries Aquaculture Programme was set, and over the last eight years frequently modified to improve efficiency. The system currently in use, as seen in Figure 1, has as its primary focus technical assistance.

From the onset of the aquaculture programme, farmer interest and involvement have been positive. From 1990 to the present time, farmer participation has continued to grow (Table 2) and the pilot project started in 1988 has become a significant newcomer to the Fisheries agenda. The result of the fisheries promotion efforts has been in general, an increasing commercial production of freshwater shrimp and fish, and an overall expansion of the aquaculture industry (Table 2 and Figure 2).

1. Fisheries officers give public talks and participate in workshops and exhibitions

2. Farmers' interest aroused and contact made with a Fisheries/aquaculture officer

3. Discussion held

4. A site survey is arranged and a feasibility report prepared by aquaculturist

5. Based on the report, the farmer decides whether he will proceed

FARMERS OPTIONS:

6. Site not suitable for aquaculture, farmer informed not to proceed by aquaculture officer

OR

6. Project too costly and/or the returns are not sufficiently encouraging; farmer chooses not to proceed

OR

6. Feasibility report is encouraging, farmer chooses to proceed

7. Technical assistance is provided for pond design and construction; also for farm layout, crop choice, pond and farm management

8. Fish and shrimp stock are supplied at subsidized prices to the farmer from the Government/Fisheries hatcheries

9. Monthly pond sampling is conducted by Aquaculture officers; assistance is provided to all farmers during harvesting in the form of technical advice, identification of markets and pricing

Figure 1: The Aquaculture Programme in St. Lucia

Table 1: Potential status of St. Lucia for aquaculture development

GEOLOGY/BIOGRAPHY	STATUS	DESCRIPTION
flat to gently sloping land	14.1% of the island has <5% slope and no settlements; 14.8% has a 5 - 1-%	There are about 8,526 hectares of flat land and 9,115 hectares of sloped land available for aquaculture
overall topography	generally hilly >60% of land has a slope of 10 - 20% and more; and 11.67% has a slope >30%	most rivers have steep gradients and are fast flowing. Oxygen levels are often high (>100% sturation).
freshwater resources availability	good; mainly surface runoff, few underground sources exists	there are 17 large rivers and a few small springs, no natural lakes are present
freshwater resources - quality	often good. especially at high altitudes where agriculture and domestic influences are few	some pesticide and faecal contamination occurs downstream.
incidence of clay soil	very high, >80% of land is clay	absent mainly at river banks and along the beachfront
climate	always warm	between 28 - 33°C.
SOCIAL		
local response to freshwater fish and shrimp	moderate to good	preference has always been for marine products. However, hotel demand for local fish and "crayfish" increases steadily
overseas market for local fish	none established	all fish and shrimp from the island are consumed locally
tradition/culture	aquaculture is relatively new	aquaculture is still unknown to some farmers and many St. Lucians
farmer interest	good, farmers want agriculture diversification	economic potential of the new industry is encouraging and comparable to other crops. Technical advise is free and readily available

Table 1 (cont.)

INFRASTRUCTURE		
road access to farm	generally poor	trucks or jeeps are necessary to reach more farms
rural supplies of electricity, water and telephone to farms	poor, absent on most isolated farms	available within all residential areas, which are often only very short distances away from farm
access to overseas markets	good	there are two airports (one international) and 2 seaports
presence of support structures	good	hatcheries, research centres, training colleges and fish processing plants are available
avaialability of juvenile stocks of fish and shrimp	good, it is believed that everything needed can be produced locally	a fish and a shrimp hatchery exist; broodstock ponds are maintained at the hatcheries
availability of pelletted fed	good but not optimal	feed is imported from within the region; prices are high and quality needs improving
government support	very good	legislation is in place to encourage, facilitate and protect the industry
private enterprise involvement	good	hotels and restaurants willingly purchase and consume the local fish products
support of research institutions	good	assistance is alw ays available from Government and non-governmental agencies primarily for site surveys and water quality management
financial assistance	good	commercial banks as well as private agencies provide soft loans to farmers

[1] Engineering Department, Ministry of Agriculture; see also Table 5(b)
[2] Physical Planning Section, Ministry of Planning; see also Table 5(a)

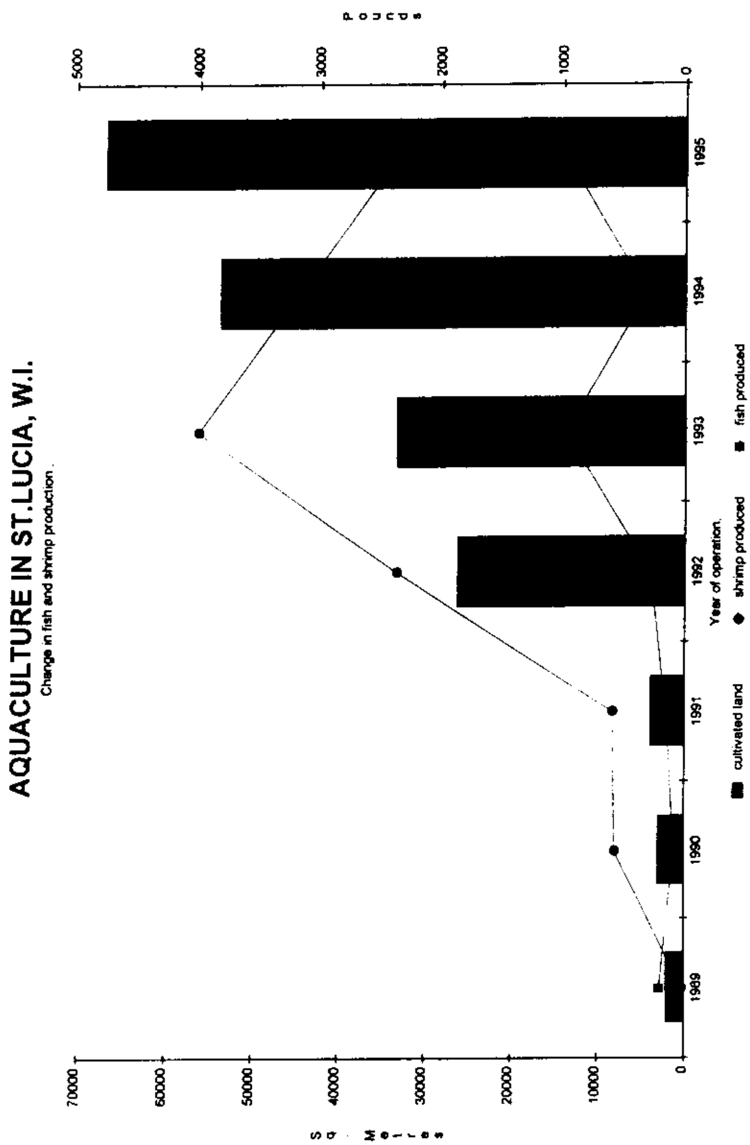

Figure 2. Trends in aquaculture development in St. Lucia, 1989 – 1995.

Table 2. Trend in aquaculture production in St. Lucia, 1989 – 1995.

Year	Number Of Farmers	Shrimp Production (pounds)	Fish Production (pounds)	Land Area (m^2)[1]	Shrimp Productivity[2]
1989	1	20	200	2,034	0.15
1990	3	564	79	2,934	0.15
1991	4	586	148	3,834	0.30
1992	11	2,367	276	26,506	0.34
1993	16	4,005	982	33,153	0.14
1994	23	3,173	309	53,463	0.17
1995	27	2,344	988	66,641	0.16

[1] Total land area under aquaculture production in square meters
[2] Average weight of shrimp per square meter of pond in production

The Aquaculture Industry In St. Lucia - Present Status

Government Programmme — To assist farmers in the establishment of at least 40 acres of pond for fish and shrimp culture. This will help provide employment, meet local demand for shellfish and reduce imports.

Government Support — Technical support, construction and operation of one fish and one shrimp hatchery; subsidized stock prices, equipment loans, legislation in support of the industry have all been provided.

Pond Locations — These are mainly in rural areas, distanced from human communities to avoid interference from domestic activities (such as water contamination). Within reasonable access to electricity and telephone.

Pond Descriptions — Earthen structures, on average, about 1000 m^2 or 1/8 acre in size. Approximately two out of three receive water by gravity flow. The remaining 1/3 receive water by pumping; these are mainly fish ponds.

Farm Description — Most farmers have 1 – 2 ponds. Most ponds are operated in conjunction with bananas or other agricultural crops. In no instance is aquaculture the sole income earner.

Production Design — Extensive pond culture is practiced. Ponds are stocked at $10/m^2$ (shrimp), and $1/m^2$ (fish).

Table 3. Annual shrimp production for a 1 acre pond.

Facts	Assumptions	Deductions
ponds stocked at 10/m^2		40,000 shrimp stocked/acre
shrimp cost EC$0.05		total cost = EC$2,000
	2 shrimp crops/year	80,000 shrimp stocked at EC$4,000
	50% of shrimp stocked survive	40,000 shrimp survive/year/acre
	at harvest, 15 shrimp weigh 1 pound	2,666 pounds shrimp harvested/year/acre
Minimum market price = EC$ 15.00/lb		value of harvest = EC$40,000
	FCR = 5:1 (5 lb. of feed for 1 lb. of shrimp at harvest)	13,330 pounds of feed used/year
Feed cost = EC$0.85/lb.		total cost of feed = EC$11,330
	labour cost insignificant water by gravity flow	total cost = EC$800 + 10,880 = EC$11,680
Profit = revenues - cost		EC$40,000 - 15,330 = EC$24,670

Crop — Only two species are cultured - the freshwater fish, *Oreochromis niloticus,* and the freshwater shrimp, *Macrobrachium rosenbergii* (locally called "crayfish").

Pond Management — Juveniles are transported in cooled water to the ponds; feeding occurs twice daily (at dawn and at dusk); water stable, high protein foods (25 – 35%) are used as well as farm wastes. Water exchanges in the ponds is made at least twice per week for shrimp, fortnightly for fish; monthly checks are conducted on both the ponds and the crop by Fisheries officers. The growth rates and health of the crops are thus closely monitored. Harvesting is almost always supervised by a fisheries officer. Harvesting is either partial, by seining, or complete, by pond drainage. The harvested crop is immediately placed on chipped ice at the pond site and transported to market or to any other buyer.

Table 4. Annual fish production for a 1 acre pond.

Facts	Assumptions	Deductions
ponds stocked at $1/m^2$		4,000 fish stocked/acre
fish cost EC$0.10		total cost = EC$400
	2 fish crops/year	8,000 fish stocked at EC$800
	80% of fish stocked survive	6,400 fish/year/acre
	at harvest, fish weighs one pound	6,400 pounds fish harvested/year/acre
Minimum market price = EC$ 3.00/lb		value of harvest = EC$19,200
	FCR = 2:1 (2 lb. of feed for 1 lb. of fish at harvest)	12,800 pounds of feed used/year
Feed cost = EC$0.85/lb.		total cost of feed = EC$10,880
	labour cost insignificant water by gravity flow	total cost = EC$800 + 10,880 = EC$11,680
Profit = revenues - cost		EC$19,200 - 11,680 = EC$7520

Financing — This is provided mainly by the Development Bank but also by some commercial banks.

Production Levels — These are well below maximum capacity. Growth periods tend to be longer than normal. This is sometimes due to the use of poor quality feed and or underfeeding of the fish and shrimp. There are sometimes delays in restocking, because of a shortage in shrimp or fish juveniles from the hatcheries. Ponds thus stay empty longer than they should. High mortalities during the production period sometimes arise because of poor water quality.

Production Capacity — This is about 6,400 lbs/acre for fish and 2,666 lbs/acre for shrimp. At a projected 40 acres (the set target for the island), this represents 256,000 lbs of fish and 106,640 lbs of shrimp.

Marketing — The fish and shrimp are sold primarily to hotels and restaurants. However, an agreement exists between the Fish Marketing Corporation and the Fisheries Department of the Ministry of Agriculture. The Corporation will purchase all products grown by aquaculture farmers; the Fisheries Department, on the other hand, guarantees the quality and safety of all fish and shrimp sold by farmers.

Availability Of Inputs — Pelleted feed is imported from within the region (Trinidad). However, more than 50% of the feed used is comprised of local fruit, vegetables, farm wastes and fish and meat scraps from local markets. All hatchery equipment is imported from the United States. All seed stock (except during a crisis, for example hurricanes and floods) are produced locally.

Water Quality — Good. Access is often at the higher reaches of rivers and streams and upstream of possible agriculture and domestic contamination.

Disease — No incidences have been recorded for either crop.

Problem Areas

i) Insufficient funds available for pond construction. Farmers must often seek loans to build their ponds.
ii) Low production of shrimp and fish juveniles by the hatcheries. This causes delayed stocking and production.
iii) Food quality is often below standard.
iv) Poor pond care by farmers – farmers often do not follow instructions from fisheries officers. Feeding and water exchange rates are often not adhered to.
v) Market response is not as good as it could be.

Significant to the growth of Aquaculture is Government support.

This can be described as follows :

i) Implementation of training programmes for technical staff of the Department of Fisheries of the Ministry of Agriculture;
ii) Implementation of free training and extension programmes for farmers through its Department of Fisheries;
iii) Regulation of the use of aquatic resources such as rivers, streams and natural ponds
iv) Facilitation of scientific research;
v) Establishment of support facilities such as shrimp and fish hatcheries and a Fish Marketing Corporation;
vi) Development of a network of roads, telephone, water and electricity;

vii) Regulation of imports of exotic species for culture;
viii) Provision of tax incentives on imports of equipment and materials, and on income arising out of the industry;
ix) Regulation of shrimp imports from non-regional states;
x) Development of support facilities such as processing plants, equipment retail outlets, feed manufacturing and retail outlets;
xi) Establishment of lending agencies specifically for agriculture development;
xii) Regulation of potentially damaging or non-environmentally friendly industries
xiii) Implementation of formal training for primary and secondary school persons through the Ministry of Education.

Through these measures, the aquaculture industry has enjoyed some protection from would-be competitors, it has become easier for farmers to obtain construction loans, farm equipment is available and more affordable and some assurance exist for sustainability through environment protection measures. Thus, aquaculture has been afforded several avenues for growth.

The Economic Potential of the Industry (as determined from data collected from 1990 - 1996.

A major factor influencing the establishing of an aquaculture system in St. Lucia is profitability. Farmers are discouraged from embarking on any project if conditions do not favour income generation. In order to assist farmers in determining costs and returns, the Fisheries Department thought it necessary to devise a system of accounts for aquaculture. All figures used in the assessments described in Tables 3 and 4 are based on what exists in St. Lucia. Efforts are made to ensure accuracy, and the constants used (such as feed costs, survival and market price) are reviewed annually and adjusted to reflect changes. It must be remembered that the inferences made are specific to St. Lucian conditions and may not apply elsewhere.

DISCUSSION

Aquaculture education is facilitated through public exhibitions, talks and educational programmes. Free technical advice and assistance during pond development and crop production, subsidized prices for hatchery reared fish and shrimp juveniles, and help in marketing are all provided as incentives to farmers. It is believed that the combined effects of Government support for and promotion of the industry, the possible economic viability of aquaculture, the availability of land and water resources, the need to diversify out of bananas and, quite possibly, the growth in the fish food market due to tourism development, have contributed to farmer interest in aquaculture. Unlike many developed states, aquaculture development was not symbolized by the establishment of large production systems, that is farms of 10, 50 or 100 or more acres. The country does not possess such volumes of flat land. Similarly, production methods were chosen that were not capital or labour intensive. Most farmers belong to the low-income and mid-income brackets. Such an approach would have not catered to the average land owner. The cultured species have been limited to two. This is deliberate and will, hopefully, ensure that the small hatcheries focus on product improvement and avoid the risk of over extension which can effect product quality and availability. Fisheries support is significant and free. New technology is not easily available to the farmer and most often must be translated in a way that can be understood and accepted by older persons. Without support factors such as workshops, routine farm visits, regular farmer/officer dialogue, and occasional assistance with transportation (of the crop to market for example), several presently successful farmers would not have become involved or remained in the industry. Aquaculture officers needed to make themselves available round the clock to deal with farm emergencies. Assistance was also found to be most productive if the social, cultural, educational and economic state of the farmer was taken into consideration.

Production trends

The aquaculture industry in St. Lucia grew significantly from 1989 to 1993 (Table 2). However, in the following year, 1994, a drop in both fish and shrimp production occurred. In September of 1994, Tropical Storm Debbie ravaged the island causing severe flooding. Several aquaculture ponds were washed out causing losses of 75 – 100% of the crops in production. Where ponds were not actually destroyed, banks were damaged and or severe siltation from land slips occurred; again significant crop losses were the end result. In other instances, dams were destroyed and water pipes were broken and/or washed away. This meant that although some ponds were not damaged, they still suffered some crop loss due to an interruption of their water supply.

The shrimp hatchery was seriously damaged by the storm. All ponds were completely flooded (with flood waters in excess of four feet above ground level), suffering 100% crop losses. All broodstock was lost as well, and all larvae and post larvae in culture in the hatchery were washed away. Flood waters capsized culture bins, destroyed air blowers and generators and washed away tools, hatchery equipment and food stores. Thus, the months immediately following the storm were periods of rebuilding, with most ponds not being repaired or restocked before December 1994 and January 1995. In effect, the low production figures for 1994 represent production for only the pre-Debbie part of that year (January – September 1994).

Table 5a. Topography profiles for St. Lucia, West Indies

Description of Land	% of Total Island Area
Having a 5% slope or less	24.76
Slope of 5 – 10%	14.84
Slope of 10 – 20%	29.86
Slope of 20 – 30%	18.88
Slope >30%	11.67
Land in use (domestic, industrial, agriculture, part of lake or river, forest reserve, quarry or queen's chain	33.40
Unutilized land	66.60
Unutilized land with <5% slope	14.10

Total land area = 152,248.6 acres = 60,899.4 hectares.
Source: Physical Planning Section, Ministry of Planning, Personnel Establishment and Training, Castries, St. Lucia

Table 5b. Topography profiles for St. Lucia, West Indies

Gradient	Acreage
0 – 2°	10,900
2 – 5°	3,900
5 – 10°	15,000
10 – 20°	37,000
20 – 30°	46,000
> 30°	19,800
Miscellaneous	19,068

Source: Engineering Division, Ministry of Agriculture, Lands, Fisheries and Forestry, Castries, St. Lucia

In 1995, shrimp production fell below the 1994 figure, while fish production increased noticeably. A possible reason for this is that several ponds that previously grew shrimp were used for fish production in 1995. Why was this? First, a fall in the availability of shrimp juveniles at the hatchery contributed to a shift by farmers (on advice from aquaculture officers) away from shrimp into fish production. Secondly, the introduction of the red hybrid tilapia led to an increased demand for the fish and also a higher market price. This made fish aquaculture more attractive to the farmer. Shrimp production was also low in 1995 because many shrimp ponds remained out of production for most of the year. Unfortunately, many farmers who lost ponds or whose ponds were damaged in 1994 had to make repairs on their own. Some of them were only able to accomplish this by mid and late 1995. Presently, most ponds have been repaired, and it is hoped that the 1996 production figures will reflect this improvement.

Present Economic Status Of Farmers

As a result of negotiations between the Fisheries Department and the Fish Marketing Corporation of St. Lucia, a minimum total body length (TBL) of 14.0 cm approximately 34 grams, at harvest has been negotiated. At this size, the Marketing Corporation will purchase the shrimp at EC$15.00/US$5.50 per pound. Most hotels and restaurants request that the shrimp not be smaller than 12.0 cm TBL. Private buyers, such as the hotels and restaurants, pay anywhere from US$5.00 – US$11.00 per pound for the shrimp. Based on Table 6, shrimp start to approach harvest size at about 20 weeks (approximately five months) when they are about 28 – 34 g (Table 7). Continuous harvesting is most often practiced on the island. Thus from about five months and continuing until the seventh month, selective harvesting is conducted using seine nets. At each harvest, shrimp 14.0 cm and above are removed and sold. In some circumstances, harvesting may commence at 12.0 cm.

The farmers involved in aquaculture are, on average, making small profits from the enterprise. However, results are well below expectation, and it is believed that most farmers can achieve high production than presently realized. The main constraint appearss to be poor farm management and insufficient funds to operate the ponds efficiently during the production period. Farmers do not feed the animals sufficiently or as often as recommended. In many instances, fish and shrimp go without food on weekends and holidays. When workers are ill, pond-reared animals also go hungry. In other cases, farmers do not allocate sufficient funds to meet food bills and they run out of money before harvest time. Animals are then fed on either low protein diets (cheaper foods) or fed much less than the advised amounts. Growth rates therefore fall, and or cannibalism increases resulting in lower production than expected. High mortality also occurs during the production period especially when water exchange is controlled by pumping. Pumps breakdown regularly, and repairs always seem to be delayed. Poor water quality as a result of insufficient water exchange has often been the cause for significant shrimp mortalities in production ponds.

Some farmers have a problem with grass in their ponds, and this reduces production. Local fish, *Oreochromis mossambicus*, also pose a problem when they enter the ponds through water intake. Mesh on intake pipes must be checked daily and replaced when tears occur. Holes allow unwanted fish and shrimp to invade the ponds, where they either prey on the culture animals or compete for food. These fish reproduce rapidly and compete with the culture crop for food and space. If some of the above problems are addressed, the chances are favourable for improvements in production and thus increases in profit levels.

CONCLUSION

Can Aquaculture make a positive contribution to the economy of St.Lucia and/or to the physical well-being of the people?

A large proportion of the population of St. Lucia depends on agriculture for a livelihood. Of the persons involved in this industry, about 90% rely primarily on banana cultivation, and a small number are involved in livestock and vegetable farming. In the last 10 years, and even earlier than this, farmers have been encouraged by the Ministry of Agriculture to diversify and become less dependent on traditional crops. Income earned from bananas fluctuates widely, but at best averages only EC$3,000 per acre per year (Statistical Division, Ministry of Agriculture; see also Table 8). Agriculture products are sold to supermarkets, hotels and restaurants. Roadside vendors sell vegetables and fruit to the general public, and some fruits and flowers are exported.

Recently, the demand for fish and fish products has increased, and this has favoured the growth of aquaculture. The increasing interest in health foods has meant that people eat more white meat and fish and less red meat. Tourism has contributed to an increased demand for fish due to the high consumption of the product by visitors.

The popularity of pond reared fish has also been influenced by recent trends in agriculture. Over the last few years, there has been a move towards organic or environmentally friendly farming (which avoids the use of pesticides, herbicides and other poisons). In general, forms of agriculture that promote recycling of resources are being encouraged. Aquaculture, in this light, is highly suitable because the industry facilitates the production of fish and allows the use of untapped island resources {water, non-agricultural land, waste from poultry

Table 6. Age length relationship of pond reared *Macrobrachium rosenbergii* in St. Lucia, 1995.

Age/Weeks	Minimum Tbl/Cm	Maximum Tlb/Cm	Average Tbl/Cm
2 – 3	3.0	3.0	3.0
3 – 4	—	—	—
4 – 5	—	—	—
5 – 6	3.0	3.0	3.0
6 – 7	3.4	5.4	4.1
7 – 8	5.2	7.4	6.0
8 – 9	5.6	5.6	5.6
9 – 10	6.4	7.4	7.0
10 – 11	4.8	9.0	6.4
11 – 12	8.4	8.4	8.4
12 – 13	6.9	8.2	7.6
13 – 14	6.5	9.8	8.1
14 – 15	6.3	11.2	8.5
15 – 16	6.5	7.2	6.9
16 – 17	8.1	11.9	8.9
17 –18	7.1	9.5	8.4
18 – 19	8.1	10.4	9.2
19 – 20	7.5	14.0	10.2
20 – 21	8.2	8.9	8.5
21 – 22	11.1	11.11	11.1
22 – 23	9.2	9.2	9.2
23 – 24	10.0	12.1	11.1
24 – 25	8.1	13.4	10.8
25 – 26	9.6	10.8	10.2

Table 7. Length/weight relationship of the freshwater prawn, *Macrobrachium rosenbergii*, grown in dirt ponds in St. Lucia, W.I.

Total Body Length (cm)	Minimum Dry Weight (gm)	Maximum Dry Weight (gm)	Average Dry Weight (gm)
4.0	1.0	1.0	1.0
4.5	1.0	1.0	1.0
5.0	1.0	2.0	1.0
5 .5	1.0	2.0	2.0
6 .0	2.0	2.0	2.0
6.5	2.0	3.0	3.0
7.0	4.0	4.0	4.0
7.5	4.0	4.0	4.0
8.0	4.0	6.0	5.0
8.5	5.0	6.0	6.0
9.0	7.0	8.0	8.0
9.5	7.0	9.0	8.0
10.0	9.0	12.0	10.0
10.5	10.0	12.0	11.0
11.0	12.0	15.0	13.0
11.5	13.0	17.0	15.0
12.0	15.0	22.0	18.0
12.5	18.0	23.0	20.0
13.0	8.2	8.9	8.5
21 - 22	11.1	11.11	11.1
22 - 23	9.2	9.2	9.2
23 - 24	10.0	12.1	11.1
24 - 25	8.1	13.4	10.8
25 - 26	9.6	10.8	10.2

rearing and fishing}. Aquaculture also provides a lucrative alternative to traditional agriculture because it is simple enough that all persons, even those with no previous training or education, can become commercially involved and labour inputs are minimal. Based on the limited demand for labour, pond owners are free to undertake other forms of employment while managing the ponds. Similarly, students and housewives can either assist or on their own manage the ponds concurrent with other activities. Finally, aquaculture projects allow persons to produce their own sources of protein, particularly in inland rural areas where income levels are low and going out to fish is not practical.

In St. Lucia, aquaculture has served all of these purposes. Training workshops have facilitated technology transfer to students, school dropouts from rural areas unable to find employment, housewives and banana farmers looking for crop alternatives. Income from aquaculture has helped many farmers significantly increase their purchasing power. Low income earners have also been able to improve their families' protein consumption at a fraction of the normal costs.

The Ministry of Agriculture in St. Lucia believes that aquaculture can be considered as a young, commercially, viable form of agriculture capable of providing an alternative form of income to landowners. It can reduce imports and save foreign exchange, as well as meet local demand for fish and shrimp and help farmers achieve agricultural diversification. Secondly, the industry represents a new source of protein production on the island. It can help St. Lucians become less dependent on imported meats and may form the basis for an increased protein composition in the diets of poor rural families. One may argue that on this basis alone aquaculture can make a very important contribution to the development of rural communities.

In conclusion, small scale aquaculture as is practiced in St. Lucia, may not make a significant contribution to the per capita income, but the returns generated by the industry may have important social and health consequences. The ability to produce more food for local consuption is critical to developing countries and has far greater economic benefits than one may first realize. If low income groups are encouraged to grow fish and shrimp for their own consumption and thus be less dependent on imported foods, earnings from other forms of employment can be diverted to medical care, education and housing. For many small countries this can impact significantly on the social and or economic growth of the people. It is with these possible contributions in mind, and the desire of the Government to consider all aspects of growth in development for the nation, that the Ministry of Agriculture continues its efforts at promoting and encouraging aquaculture in St. Lucia.

Table 8. Comparison of returns for the five major agriculture crops grown St.Lucia - September 1996.

Crop	Net Profit (EC$)
CARROT	EC$6,085/crop = EC$9,127 – $12,170/acre/yr
TOMATO	$10,345/crop = EC$31,035 – 41,480/acre/yr
CABBAGE	EC$EC3,300/crop = EC$6,600 – 8,250/acre/yr
SWEET PEPPER	EC$8,731/crop = EC$21,827 – 26,193/acre/yr
BANANAS	EC$980 – 3,357/acre/yr

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