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Urban Aquaculture: Producer Perceptions and Practices in Lagos State, Nigeria

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Abstract: The dramatic growth of cities coupled with incessant migration emanating from rural-urban drift in Nigeria has brought with it a new challenge-widespread and increasing urban food insecurity, malnutrition as well as poverty. Many of the anti-poverty reforms have traditionally targeted rural areas, which were presumed to have been worse off than urban areas. But the problems of poor city dwellers have become more pressing, including the issues of how the urban poor earn their livelihoods and the ways in which this affects key indicators of human welfare, such as food security and nutrition. This report discusses urban aquaculture in Lagos State, Nigeria. The project focused solely on fish culture and endeavored to determine producer perception and practices in existing ponds. Physical, social and economic constraints to fish culture in urban areas are presented in addition to impact of aquaculture in the urban area.

Key words: Aquaculture % urban and diversification

INTRODUCTION

Urban Agriculture (UA) in Nigeria like many developing countries in the world has never received much attention from scientists and development workers. But it is estimated that, today, close to 800 million people are engaged in urban agriculture worldwide [1]. Of these, 200 million are market producers. UA is very much in the limelight of research from many different angles, looking at themes as urban food security and poverty eradication; urban health; urban planning; and integrated city development [2]. To date a sizable body of research conducted principally under the recent IDRC funded research initiatives on 'Cities Feeding People' programme confirms the significance of urban and peri-urban agriculture for employment, food security and income generation [1]. Almost all these studies relating to African U and PU agriculture, however, *excluded* aquafarming from their research [3, 4]. Consequently, the significance of aquafarming in and around African cities is largely unknown but *ad hoc* information, especially in Nigeria, suggests it's a growing phenomenon. UA is still a fast-evolving field, in which concept development is still occurring at a high pace and is growing out of its ability to assist with, resolve or cope with diverse development challenges. One of its main characteristics is its integration into the local urban economic and ecological system. However, unless this dimension is enhanced and made operational, the concept will remain little useful on the scientific, technology and policy fronts.

Aquaculture is regarded as being uniquely placed to reverse declining supplies from capture fisheries (mean caput fish availability in Africa declined 20% between 1990-1996 and has declined further) and the activity has notable potential for new livelihood opportunities, providing the mechanism for lower priced fish, enhanced nutritional security and employment for poor communities by servicing urban markets [5]. For instance, aquaculture production in Nigeria is currently about 40,000 metric tones contributing 6% of domestic fish production. Aquaculture may also provide an important opportunity to recycle wastes generated by the zero grazing and other agriculture practices increasingly common in the region's U and contributing positively to growing urban waste disposal issues and adding value to scarce water resources [6, 7].

The substantial expansion in aquaculture production is an indication that the sector could be a major player in augmenting the supply of fish protein for consumption and a major source of income for farmers and for foreign earnings. This also supports an earlier observation that

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freshwater aquaculture would become a major source of growth for the sector. Given the proper environment for growth, the country can still accelerate the expansion and development of its aquaculture industry. The country has large natural resources to support aquacultural development: inland freshwater of 14 million hectares and available land area of 1.7 million hectares for aquaculture development [8].

Although the potential of aquaculture in the country and the changing impacts of urbanization are noted, the lack of a realistic knowledge base to inform policy and planning processes is a severe constraint. Much remains to be examined, though, for the up-and downstream effects of UA in the local economy are largely unknown and could be considerable. Types of economic activities location, types of areas where it is practised, types of production systems, product destination and production scale needs to be investigated.

In the light of current government efforts to accelerate the growth of freshwater aquaculture [9], which is the focus of this study, aquaculture should be assessed in terms of its socio-economic influence on fish production, producer perception and practices. Hence, this study seeks to provide an understanding of urban aquaculture with emphasis on production, accessibility and trends of cultured species. This study also examines factors that influence accessibility and producers perception and practices as a means of increasing the availability of aquaculture products and with a view to determine requisites for sustained growth and development and improving the well being of producers as well as the populace.

MATERIALS AND METHODS

The study was conducted in Lagos State, Nigeria. The State was recently ranked thirty-first expensive cities in the world. Structured interview were conducted with a sample of 56 fish farmers having accomplished at least one harvest in the past one year. The samples were drawn using simple random techniques. Data collection took place between October 2004 and November 2005. Fish farmers were identified in the city with the technical assistance of Lagos State Agricultural Development Authority (LSADA) and Fish Producer Organisation in the State. Each of the respondent via a personal interview, questions about farm operation, perception and numbers of socioeconomic and institutional information for the study area. Data were analysed using descriptive statistics and tests of differences between means and proportions, as well as correlation techniques.

RESULTS AND DISCUSSION

A summary of socioeconomic characteristics of the sampled respondents in the study area are presented below:

Respondent characteristics: Table 1 describes the individual and household characteristics of the study respondents. Women in fish production comprised 16.1 percent of the respondents. While fish production seems

Table 1: Respondent characteristics, fish farmer in urban center

	%
Gender of respondents	
Male	83.9
Female	16.1
Age of respondent (year)	
Less than 25	0.0
25-34	21.4
35-44	23.2
45-54	30.4
55-64	19.6
65 and above	5.4
Household of respondent	
Four or less	33.9
5-8	33.9
9-12	14.3
13-16	1.8
16 and above	3.6
No response	12.5
Marital status	
Single	12.5
Married	87.5
Divorce	0.0
Separated	0.0
Widowed	0.0
Years of experience (year)	
Less than 6	59.0
6-10	35.6
10 and above	5.4
Educational level	
No formal schooling	1.8
Primary	3.6
Secondary	14.3
Tertiary	73.2
Vocational	5.4
No response	1.8
Purpose of farming	
Market driven	96.4
Consumption	1.8
Recreation	1.8

Source: Field survey, 2003-2006

Table 2: Ownership of land

	%
Land ownership	
Purchase	89.3
Rent	1.8
Family	7.1
Government	0.0
Communal/cooperative	1.8
Squatter	0.0
Size of land owned	
Less than 1 ha	100.0
1-5 ha	0.0
6-10 ha	0.0
> 10 ha	0.0
Number of pond	
1-5 pond	26.8
6-10 pond	28.6
11-15 pond	12.5
16-20 pond	16.0
20 and above	16.1
Type of enclosure	
Earthen/Dugout	21.4
Concrete	32.5
Plastic tank	1.8
Fibre tank	0.0
Race way	0.0
Cage	0.0
Earthen/concrete	8.9
Concrete/fibre tank	1.8
Earthen/fibre tank	1.8

Source: Field survey, 2003-2006

primarily to be the province of men. About 75 percent of the respondents were still within their productive age bracket of 25-54 years. The highest age bracket of 45 to 54 years observed in the State was 30.4 percent. The mean age of the respondent was 45 years. About 33.9 percent respondents reported less than four and between 9 and 12 families' household members.

Table 2 profiles the land holding, ownership, number of pond and rearing facilities. As a result of land distribution and increasing population in the urban center, all the respondents sampled owned less than one hectare of land with an average land holding of 0.01 ha. Regardless of the size of land holding, most of the fish pond farmers practised semi-intensive farming, using mainly commercial feed and less inputs available on-farm. Land owned and used by respondents were found to fall into four tenure categories: purchased, inheritance or family, lease or rent and communal. In all the four, purchases accounted for the largest proportion, 89.3 percent indicating a highly developed land market and a long-term security that is required for fish farming. This characteristic differs from the findings of Lawry and Stienbarger [10] where only a tiny share of land came under purchases. Family and rent accounted for 7.1 percent and 1.8 percent respectively in the urban centre.

Because of the nature of land holding, private ownership is common in aquaculture systems in the State. Recently, big corporations and private companies have started commercial aquaculture operations. With the widening gap between fish supply and demand, the emergence of commercial operations has not yet negatively affected the profitability of fish culture and consumption. It is conceivable that large operations might reduce the gap between supply and demand for the benefit of consumers, as more products from aquaculture become available in the market. From the sample respondents, more than 28 percent had six to ten pond of various shapes and sizes and about 26.8 percent had but one to five unit of pond as shown in Table 2. In the study of Molnar *et al*., [11], more than 85 percent of the fish farmers had but a single pond. All the ponds studied were located within the residence and it the involved the conversion of part of the building or land for fish culture. Farmers primarily filled their pond from borehole using gravity flow method. Most farmers never experienced problems obtaining water for their fish pond except farms that were rainfed.

Greater demand from markets coupled with the need for diversification often constitutes a particularly important driver for intensification in the study area. From the findings, 96.4 percent were of the opinion that market driven force was behind the idea of going into the enterprise while 1.8 percent reported that consumption and recreation purposes were the reasons for going into the enterprise.

Fish culture facilities: Fish farmers in the study location employed different shades of rearing facilities. The type of rearing facilities adopted was however a function of availability of space, mode of operation, objectives and more importantly finance. The most widely adopted rearing facilities were concrete tanks accounting for 62.5 percent. The adoption of concrete tank was based on durability, ease of management and pollution control. The use of dugout or earthen pond was still noticeable in the city, with 21. 4 percent of the respondents engaged in the use of dugout system in raising fish. Fibre/plastic tanks are also gaining prominence even though it accounted for a tiny proportion (1.8 percent).

Table 3: Production techniques and species cultured

	%
Culture system	
Monoculture	80.4
Polyculture	5.4
Integrated	14.2
Production technique	
Stagnant water	35.7
Flow Through system	48.2
Water recirculatory	16.1
Type of fish raised	
Tilapia	5.4
Carp	14.6
Catfish	73.2
Ornamental	5.4
Others	1.8

Source: Field survey, 2003-2006

Table 4: Feeding practices by fish farmer in urban center of Lagos State

	%
Feed type*	
Pelleted feed	74.5
Float feed	48.9
Kitchen waste	42.0
Slaughter waste (Animal offals)	38.9
Food processing waste	61.8
Agricultural by-products	56.5
Feeding frequency	
Three-four times daily	70.2
Twice daily	28.4
Once daily	1.2
Less often	0.2
Never	0.0

*Multiple responses possible Source: Field survey, 2003-2006

Table 5: Harvesting strategy, forms of fish sold and post-harvest storage facilities

	%
Harvesting strategy	
Partial	75.0
Complete	19.5
Combined (Partial + Complete)	5.5
Forms of fish sold	
Live 92.6	
Fresh	1.8
Smoked	0.0
Frozen	5.6
Fillet	0.0
Post-harvest storage facilities	
Holding tank	39.3
Cold room/refrigerator	12.5
Ambient storage	1.8
Processing facilities	0.0
None 46.4	
Average weight harvested	
Fingerling	8.9
Up to 49g	1.8
100-499g	39.3
500-999g	5.4
1kg and above	43.6

Source: Field survey, 2003-2006

Table 3 shows that monoculture was the most frequent culture system in practiced in Lagos state, used by about 80 percent of the farmers. Integrated system was the next most frequent system (14.2 percent). Fish farmers were observed to be raising livestock with fish in the State. Chicken was reported to be the most common animal enterprise combined with fish, followed by pigs and small ruminant. Such integrated operations recycle the undigested feed and other nutrients from penned animals. About 5 percent of the respondents practiced polyculture. Farmers in the State used various production techniques in raising fish. The common technique is Flow Through system, used by 48.2 respondents. Stagnant pond accounted for 35.7 percent while water recirculatory is gradually gaining prominence with 16.1 percent presently using the system. New trend was observed by farmers using WRS as some (65 percent) of those using WRS were found to be adopting locally fabricated WRS using lava stone or shell with beer/mineral crate (Fig. 1). From Table 3 above, Clarias species (mudcat fish) was the most frequent cultured fish, grown by about 73 percent of the farmers. Carp was the next most frequent culture while ornamental was also been grown by 5 percent of the farmers in the State.

Table 4 describes the feeding practices adopted by the farmers in the study area. Farmers fed their fish with various kinds of feeds ranging from pelleted feed to even kitchen waste. This is especially true of farmers using dugout system and those practicing still pond system. For those using intensive water recirculation and flow through system, farmers used only pelleted and float feed. In all, 74.5 percent of the respondents used locally compounded feed which is cheaper than the imported float feed. Food processing waste such as cerelac waste constitute 61.8 percent, agricultural by-products accounted for 56.5 percent while animal waste such as chicken and animal offal/wastes accounted for 38.9 percent. Access to production-enhancing inputs such as waste resources, food-processing by-products

Fig. 1: Water recirculation using locally fabricated material for fish culture

Fig. 2: Growing fish in the city

Fig. 3: Effluent from a fish farm in Lagos State

were discovered to be some factors stimulating intensification of fish culture in the State.

About 70.2 percent of the fish producers fed their fish three to four times a day. The availability of feed was a function of feeding regime or frequency of feeding. Twice feeding per day constitute 28.4 percent while feeding once per day accounted for 1.2 percent.

Table 5 depicts the harvesting strategy, forms of fish sold and other post-harvest activities embarked upon by the farmers. Fish harvesting is not frequently done. Less than 10 percent of the respondents harvest fish every week (Table 6). The majority of farms harvesting every week were those using water recirculation system. Quarterly and biannual harvesting were found

Table 6: Period of sale, place, frequency and volume of sold in the study area

	%
Period of sale	
Daily	0.0
Weekly	7.1
Fortnightly	1.8
Monthly	10.4
Quarterly	50.0
Yearly	3.6
Biannual	26.8
Place of sale	
Farm gate	91.1
Market	8.9
Shop 0.0	
Frequency of sale	
Always	94.7
Sometimes	3.6
Rarely	1.8
Never	0.0
Volume sold	
75-100% (farm gate)	92.8
51-75% (market)	1.8
26-50% (shop)	0.0
No response	3.6

Source: Field survey, 2003-2006

to be predominant in the study area. Fish farmers prefer to harvest fish during the festive seasons when there will be premium for their products. In all partial harvesting is practiced by 75.5 percent of the while complete harvesting was found to be 19.5 percent. The forms and size of fish sold is dictated by the consumer preference. Consumers in the study area prefer live and big-size fish compared to processed fish. As a result of these factors, over 90 percent of the fish producers sold fish live while frozen fish were 5.6 percent. The average size (one kilogramme and above) of fish harvested by farmer was 43.6 percent. Small size fish (100-499 g) was 39.3 percent. Farmers trading in fingerling/juvenile were less than 10 percent.

Due to the perishability of fish and fish products, most (91.1 percent) farmers in the study area prefer to sell fish by the pond side (farm gate). The disadvantage of selling fish at farm gate is that the price does not compare favourably well with fish sold in the market. Only 8.9 percent of the fish farmers have other avenue such as market for selling fish. The volume of fish sold at the farm gate was over 90 percent when compared with the quantity taken to the market which was less than 2 percent.

Urbanisation and aquaculture: Growing fish in and around the major cities of Lagos State show some interesting trends (Fig. 2). Many of the production systems appear to meet the growing needs among urban people for fresh and culturally preferred types of fish. Fish farming in or around cities varies from the relatively small-scale semi extensive culture system to the high-tech, intensive (WRS) culture of catfish in concrete/plastic tanks. It was observed that even though the entire city of Lagos was surrounded by water and inside the city areas and in the periphery is many ponds, lakes, small river and water bodies, most of the water bodies are not well managed for aquaculture purposes. There is no proper fish culture going on in the water bodies including the lakes and the rivers.

The process of urbanisation has had a negative overall effect on fish production in the State in terms of accessibility to land by investors and farmers (small-scale) planning to expand. Lagos is growing on daily basis. Over 80 percent of the respondents agreed that extensive system using dug out (earthen pond) cannot be practiced any longer within the cities because of the industrialization process. According to the farmers, the ever-increasing number of people migrating to the cities is putting pressure on the land. However, with the recent introduction of WRS it is expected that fish production will continue to increase but effluent emanating form the same could have serious effect on the populace as some farms are finding it difficult to discharge the waste at the moment (Fig. 3). Fish products of urban aquatic systems in the study are mostly consumed by the urban dwellers.

Constraint to fish farming: Aquaculture like any other agricultural enterprises is also constrained by a number of factors. Some of the factors militating against the development of aquaculture can be categorized as economical, technical, ecological and institutional factors. The most commonly expressed problems facing aquaculture development in the country is the technical know-how. The producers in the urban zones ranked this factor highest as a major constraint negating the old norm whereby fish feed used to be a major challenge to the farmers. Other constraints include, high cost of inputs and lack of adequate information on aquaculture techniques and marketing. Institutional factors identified to be militating against the development of aquaculture in the city were limited infrastructure such as lack of capital, changes in land use and policy.

CONCLUSIONS

The dynamic nature of Lagos cities has experienced rapid growth in recent decades. More people in the cities have led to increasing opportunities for aquatic farming. Aquatic production systems, including farming fish, play an important role in the livelihoods of many urban dwellers employed as farmers and traders.

This study demonstrate that comparative reviews of performance, resource base and current policies in aquaculture show that opportunities exist for the government to improve farm productivity through the promotion of appropriate production and extension technologies that is environmentally friendly and policy modification and to ensure that aquatic products are accessible even to poor consumers in urban centers.

In the light of this dynamic market situation the government needs to consider how to sustain aquatic production systems in Lagos urban areas by removing identified bottlenecks, as they are an important source of aquatic foods and employment for the local economy. Increased coordination between relevant stakeholders is also important to ensure proper formulation and implementation of sound urban aquaculture policies and programmes.

Therefore, in order to achieve sustained growth for aquatic products in these changing markets, it will be necessary to place higher priority in the near future on fish safety, which includes a safe and clean production process which the urban consumer can have confidence in. The danger of uncontrolled effluent discharge to the environment must be seriously looked into by the formulation of sound policy for aquaculture system siting.

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