# URBAN AGRICULTURE, CITIES AND CLIMATE CHANGE

Edited by

**Remi Adeyemo**



Cuvillier Verlag Göttingen
Internationaler wissenschaftlicher Fachverlag

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# Preface

This publication is a selected refereed research papers from the Humboldt International conference (Humboldt Kolleg), Ile-Ife, 2010 which was sponsored by Alexander Humboldt Foundation, Germany. The original idea of the conference which was to discuss urban agriculture emerged from two research visits to Justus-Liebig University, Giessen, Germany.

It is noted that increasing urbanization in West Africa sub-region is causing dwindling agricultural resources and accelerating deterioration in the quality of life for those living in urban areas. There are urgent and pressing challenges that need an equally urgent and adequate response from city dwellers and national authorities. It is vital that researchers, policy makers and other stakeholders involved in urban agriculture must be aware of the scope of existing problems and future urban development activities. The situations call for improved access of the urban inhabitants to adequate food and fiber, basic facilities and friendly environment. The conference was convened in order to broaden the scope of the research visits.

As it turned out, the conference attracted considerable interest and enthusiasm which was reflected in a large attendance. About one hundred and eighteen papers were submitted and presented during the conference out of which sixty were selected for peer review evaluation This volume contains forty-four selected research papers after subjecting them to review mechanism.

The book is a component in many disciplines; which will be useful to those who have the opportunity to read it especially if considered by agriculturalists, urban researchers, geographers, sociologists, environmentalists, health workers and policy makers.

At this point l gratefully acknowledge the financial support of the Humboldt Foundation without which this publication would not have been possible. Many thanks go to the staff of the foundation for making this publication possible.

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# OPERATIONAL ATTRIBUTES OF URBAN AQUACULTURE SYSTEMS IN IBADAN MUNICIPAL, OYO STATE, NIGERIA

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## Abstract

The study evaluated the operational attributes and the associated factors affecting operation of three urban aquaculture systems in Ibadan City. Multi-stage sampling technique was used to select nine Local Government Areas from eleven based on intensity of fish farming activity. The second stage involved random selection of fish farms within the Local Government Areas from list of fish farmers compiled by Federal and State Departments of Fisheries, Oyo State. A sample of 59 fish farmers composed of 19 earthen pond fish farmer, 25 flow-through fish farmers and 15 re-circulatory system operators was used for the study. Structured questionnaires were administered to collect primary data and analyzed using descriptive statistics. Fish farmers had 1 – 5 years experience (64.4%) and 66.1% were between the ages of 31 – 50 years. Empirical evidence from the analysis reveal that 55.9% are small farm-holders (≤0.25 ha) and 59.3% combine fish farming with other occupation for sustainable livelihood. Analysis of pooled data and its ranking indicates that poaching and transportation were ranked topmost by the farmer and followed by input procurement. Earthen pond, flow-through and re-circulatory system farmers ranked transportation/lack of technical personnel, high cost of input procurement and inconsistency of electric power supply as the topmost constraints respectively. In conclusion, production, social and environmental factors are constraints for urban aquaculture.

## INTRODUCTION

The fisheries sector in Nigeria is a vital source of food, employment, recreation and foreign exchange earnings. According to the 2007 Fishery Statistics (FDF, 2007) fisheries contributed 4.0% to Agricultural GDP and US$38.3million as export earnings. In terms of domestic fish production, artisanal fisheries contribute 81.9%, while aquaculture produces 13.3%. The per capita fish consumption has remained low at 9.68 Kg per person per annum due to the decreasing fish catch from the wild and increasing human population. Inadequate domestic fish supply has resulted to the importation of frozen fish to offset the gap in the domestic demand (Ojo *et al.* 2006). Due to the decrease in artisanal fish supply as a result of overfishing and pollution, aquaculture has been identified as a solution to meeting the fish demand. The aquaculture industry in Nigeria has become an important source of income and employment generator, source of animal protein in the urban and rural areas (FDF, 2007). Oyo State as a land locked state depends on aquaculture to supply cultured fish to meet the demand for animal protein. Aquaculture has also become a vital source of animal protein, food security, employment and trade for the people of Ibadan Municipal, despite the prevailing evidence of climate change as rain fall delay, decline of fish catch from inland water bodies and other constraints (Fregene and Adesola, 2008; WorldFish Center, 2007 and FAO, 2008).

Urban aquaculture has become a solution to food insecurity in the cities. In a study by Adeogun *et al* (2007) growing fish in and around the major cities of Lagos State appear to meet the growing needs among urban people for fresh and culturally preferred types of fish.

But the production systems used are confronted with some of the challenges such as economical, technical, ecological and institutional factors. It has become imperative to understand the operational status of variety of systems of aquaculture in Ibadan Municipal and the main constraints confronting these systems. The objective of the study was therefore to evaluate the socio-economic characteristics of fish farmers, production

### Study Area

Attributes of three urban aquaculture systems in Ibadan City and rank the factors affecting their operation. The urban aquaculture systems are earthen pond, flow-through and re-circulatory system operators.

## RESEARCH METHODOLOGY

The study was carried out in Ibadan Municipal or Region, the largest urbanized region in Oyo State of the South-Western part of Nigeria. Ibadan Municipal is made of eleven Local Government Areas (LGA), namely: Ibadan North East, Ibadan North, Ibadan South East, Ibadan South-West, Ibadan South, Oluyole, Egbeda, Lagelu, Iddo, Ono-Ara and Akinyele; and has a population of 1,228,663 from 1991 population census. The area is located on Longitude 3 54'E and Latitude 7 23'N with the total land area of 130 $km^2$ and 750m above sea level. Major seasons are the rainy season being from March to October, while the dry season runs through November to February. Maximum temperature is $37^0$C and has mean minimum temperature of $22^0$C. Its landforms are characterized by hills, which constitute about 5%, plains about 80% and the rest made up of valleys. The city is drained mainly by Rivers Ogunpa and Ona.

### Sampling Technique and Data

Multi-stage sampling technique was used to select 9 LGAs from 11based on intensity of fish farming activity. These are Ibadan Northeast, Ibadan North, Ibadan Southwest, Ibadan South, Oluyole, Egbeda, Lagelu, Ono-Ara and Akinyele. The second stage entailed selection of fish farms was from list of fish farmers compiled by Federal and State Departments of Fisheries in Oyo State. Total sample of 80 fish farms were selected for the study, but 21 were rejected because they were invalid for analysis due to incomplete information, inconsistency, and spurious response. A sample of 59 fish farmers composed of 19 earthen pond fish farmer, 25 flow-through fish farmers and 15 re-circulatory system operators were used for analysis. Structured questionnaires were administered to collect primary data. Descriptive statistics was used to analyze the data.

## RESULTS AND DISCUSSIONS

### Demographic Characteristics of Farmers of the Urban Aquaculture Systems

Presented in Table 1 are the demographic characteristics of fish farmers based on the type of aquaculture system practiced. Most of the fish farmers are male (89.8%), within the productive age of 31-50 years (66.1%) and married (79.7%). These age groups in the society are often described as most socially and economically active. The pooled data analysis revealed that 52.5% have attained university degree. It was also observed by Fregene and Digun-Aweto (2007) in their study in Osun State that 60% of the fish farmers have university degree.

**Table 1: Distribution of Farmers Based on their Demographic Characteristics**

| Demographic Characteristics | Earthen Pond | | Flow Through | | Re-circulatory | | Pooled | |
|---|---|---|---|---|---|---|---|---|
| | N (27) | % (45.8) | N (15) | % (27.1) | N (16) | % (26.1) | N (59) | % (100) |
| **Sex** | | | | | | | | |
| Male | 25 | 42.4 | 13 | 22.0 | 15 | 25.4 | 53 | 89.8 |
| Female | 2 | 3.4 | 3 | 5.1 | 1 | 1.7 | 6 | 10.2 |
| **Age** | | | | | | | | |
| < 30 | 5 | 8.5 | 1 | 1.7 | 7 | 11.9 | 13 | 22.0 |
| 31-40 | 10 | 16.9 | 5 | 8.5 | 6 | 10.2 | 21 | 35.6 |
| 41-50 | 9 | 15.3 | 7 | 11.9 | 2 | 3.4 | 18 | 30.5 |
| 51-60 | 3 | 5.1 | 2 | 3.4 | 1 | 1.7 | 6 | 10.2 |
| >60 | 0.0 | 0.0 | 1 | 1.7 | 0.0 | 0.0 | 1 | 1.7 |
| **Educational status** | | | | | | | | |
| Primary | 3 | 5.1 | 1 | 1.7 | 0.0 | 0.0 | 4 | 6.8 |
| Secondary | 3 | 5.1 | 2 | 3.4 | 1 | 1.7 | 6 | 10.2 |
| Polytechnic | 12 | 20.3 | 3 | 5.1 | 3 | 5.1 | 18 | 30.5 |
| University | 9 | 15.3 | 10 | 17 | 12 | 20.4 | 31 | 52.5 |
| **Marital Status** | | | | | | | | |
| Single | 5 | 8.5 | 1 | 1.7 | 6 | 10.2 | 12 | 20.3 |
| Married | 22 | 37.3 | 15 | 25.4 | 10 | 16.9 | 47 | 79.7 |
| **Household size** | | | | | | | | |
| ≤ 5 | 16 | 27.1 | 8 | 13.6 | 9 | 15.3 | 33 | 55.9 |
| 6-10 | 10 | 16.9 | 6 | 10.2 | 7 | 11.9 | 23 | 39.0 |
| 11-15 | 1 | 1.7 | 2 | 3.4 | 0.0 | 0.0 | 3 | 5.1 |
| **Years of Experience** | | | | | | | | |
| 1-5 | 16 | 27.1 | 11 | 18.6 | 11 | 18.6 | 38 | 64.4 |
| 6-10 | 10 | 16.9 | 5 | 8.5 | 3 | 5.1 | 18 | 30.5 |
| 11-15 | 0.0 | 0.0 | 0.0 | 0.0 | 2 | 3.4 | 2 | 3.4 |
| 16-20 | 1 | 1.7 | 0.0 | 0.0 | 0.0 | 0.0 | 1 | 1.7 |
| **As a mode of Livelihood** | | | | | | | | |
| Fulltime | 9 | 15.3 | 6 | 10.2 | 9 | 15.3 | 24 | 40.7 |
| Part-time | 18 | 30.5 | 10 | 16.9 | 7 | 11.9 | 35 | 59.3 |

Majority (64.4 %) of the fish farmers have been into production activities for not more than five years. Earthen pond farmers dominate the distribution as well as those practicing flow through and re-circulatory system. It was observed that as years of experience increased, population of farmers reduced. Fish farming have become a major source of livelihood because 40.7% practice it on full-time basis while 59.3 % combine it with other occupation for sustainable livelihood. This will likely enhance household fish food security and sufficiency.

**Operational Attributes of Urban Aquaculture Systems in the Region**

Operational attributes are shown in Table 2. Fish farmers in Ibadan metropolis are small farm-holders of ≤0.25 ha (55.9%) on land that was purchased (62.7%) by themselves. The major source of financing the fish farm is through own savings (71.2%).

Sole producers of *Clarias species* producers are 62.7 %, Tilapia (5.1 %) and Carp (1.7%). Very few combine *Clarias* with Tilapia (6.8 percent) for more economic returns. According to

Atanda (2007) more than 80 % of cultured fish in Nigeria is catfish, mainly *Clarias* spp., *Heterobranchus* spp. and their hybrids. Brood-stock for breeding (93.2%) and fingerlings for stocking (62.7%) are bought from other fish farms. It is interesting to note that 32.2% of fish farmers breed their fingerling themselves. The data confirms that farmers are conscious of buying or raising species that grow fast and can be profitably marketed. This could be due to the effort of the Training and Visit (T&V) system of extension services adopted by the Agriculture Development Programme (ADP) in Nigeria that has ensured that improved production technology reach a larger proportion of fish farmers for increased aquaculture production to meet national fish demand (Bolorunduro and Fregene, 2000). But 39.0% of the fish farmer do have problem of sourcing for fingerlings to stock their rearing systems. Investment financing and indebtedness has been one of the sources of worry for aquaculture entrepreneurs in Nigeria. Level of investment in any sector could also be influenced by the market attractiveness, price stability and information. Majority (64.4%) indicated they enjoyed stable market situation which is required for sustainable aquaculture development.

**Table 2: Operational Status of Aquaculture Production Systems in the Urban Region**

| **Demographic Characteristics** | **Earthen Pond** | | **Flow Through** | | **Re-circulatory** | | **Pooled** | |
|---|---|---|---|---|---|---|---|---|
| | **N (27)** | **% (45.8)** | **N (15)** | **% (27.1)** | **N (16)** | **% (26.1)** | **N (59)** | **% (100)** |
| **Farm Size** | | | | | | | | |
| ≤ 0.25 | 14 | 23.7 | 9 | 15.3 | 10 | 16.9 | 35 | 55.9 |
| 0.26-0.5 | 11 | 18.6 | 5 | 8.5 | 4 | 6.8 | 20 | 33.9 |
| 0.51-0.75 | 2 | 3.4 | 1 | 1.7 | 1 | 1.7 | 4 | 6.8 |
| 0.76-1 | - | - | 1 | 1.7 | 1 | 1.7 | 2 | 3.4 |
| **Form of Land Acquisition** | | | | | | | | |
| Inherited | | 6.8 | | 5.1 | | 3.4 | | 15.3 |
| Lease | | 11.9 | | 3.4 | | 6.8 | | 22.0 |
| Purchased | | 27.1 | | 18.6 | | 16.9 | | 62.7 |
| **Sources of Finance** | | | | | | | | |
| Own Saving | 20 | 23.9 | 13 | 22.0 | 9 | 15.3 | 42 | 71.2 |
| Bank Loan | 4 | 6.8 | 2 | 3.4 | 5 | 8.5 | 11 | 18.6 |
| Cooperatives | 3 | 5.1 | 1 | 1.7 | 2 | 3.4 | 6 | 10.2 |
| **Species Cultured** | | | | | | | | |
| *Clarias* spp | 17 | 28.9 | 8 | 13.6 | 12 | 20.4 | 37 | 62.7 |
| Tilapia spp | 3 | 5.1 | - | - | - | - | 3 | 5.1 |
| Carp | 1 | 1.7 | - | - | - | - | 1 | 1.7 |
| *Clarias* spp and Tilapia spp | 2 | 3.4 | 1 | 1.7 | 1 | 1.7 | 4 | 6.8 |
| *Clarias* spp and Carp | 2 | 3.4 | - | - | - | - | 2 | 3.4 |
| **Sources of brood stocks** | | | | | | | | |
| The Wild | - | - | 1 | 1.7 | - | - | 1 | 1.7 |
| Other fish farms | 26 | 44.1 | 13 | 22 | 16 | 27.1 | 55 | 93.2 |
| On-farm breeding | 1 | 1.7 | 2 | 3.4 | - | - | 3 | 5.1 |
| **Sources of Fingerlings** | | | | | | | | |
| The Wild | 1 | 1.7 | 1 | 1.7 | 1 | 1.7 | 3 | 5.1 |
| On-farm breeding | 5 | 8.5 | 4 | 6.8 | 10 | 16.9 | 19 | 32.2 |
| Other fish farms | 21 | 35.6 | 11 | 18.6 | 5 | 8.5 | 37 | 62.7 |
| **Availability of Fingerlings** | | | | | | | | |
| Yes | 18 | 30.5 | 10 | 16.9 | 8 | 13.6 | 36 | 61.0 |
| No | 9 | 15.3 | 6 | 10.2 | 8 | 13.6 | 23 | 39.0 |
| **Stability of Market** | | | | | | | | |
| Yes | 15 | 25.4 | 11 | 18.6 | 12 | 20.3 | 38 | 64.4 |
| No | 12 | 20.3 | 5 | 8.5 | 4 | 6.8 | 21 | 35.6 |

**Relative Ranking of Factors Affecting Operation of Fish Farm**

Table 3 shows the mean rating response and the corresponding ranking positions of the aquaculture systems and pooled data. Challenges of earthen pond system of aquaculture identified by fish farmers are lack of access to technical personnel, poaching and transportation as most severe constraints. In the fourth position is marketing while cost of feed ranked fifth position. The flow-through system fish farmer ranked input procurement topmost while poaching and inconsistent electricity supply were ranked in second position, transportation (fourth) and high cost of feed (fifth) among other factors. Inconsistent electric power supply was the topmost ranked constraint for the re-circulatory system; others are cost of feed and supply of energy (2nd), high cost of fuel (fourth), inadequacy of feed (fifth) and transportation (sixth). Analysis of pooled data and its ranking indicates that poaching and transportation were ranked topmost by the farmers. It was followed by input procurement in third position; cost of feed and supply of energy was fourth, while scarcity of fingerlings, and inconsistent electricity supply occupied the sixth position.

**Table 3: The Relative Ranking of Factor Affecting Operation of Fish Farming**

| FACTOR | ES | $n^{th}$ | FT | $n^{th}$ | RS | $n^{th}$ | Pooled | $n^{th}$ |
|---|---|---|---|---|---|---|---|---|
| Cost of feed | 2.59* | 5 | 2.13* | 10 | 2.94* | 2 | 2.56* | 4 |
| Inadequacy of feed | 2.41 | 7 | 2.56 | 7 | 2.50 | 5 | 2.47 | 10 |
| Scarcity of fingerlings | 2.41 | 7 | 2.06 | 11 | 2.25 | 7 | 2.54 | 6 |
| Marketing | 2.63 | 4 | 2.44 | 9 | 2.06 | 11 | 2.42 | 11 |
| Transportation | 2.67 | 1 | 2.90 | 4 | 2.38 | 6 | 2.64 | 1 |
| Lack of Technical Personnel | 2.67 | 1 | 2.63 | 5 | 2.13 | 10 | 2.51 | 8 |
| Input procurement | 2.56 | 6 | 3.06 | 1 | 2.19 | 9 | 2.59 | 3 |
| Poaching | 2.67 | 1 | 3.00 | 2 | 2.25 | 7 | 2.64 | 1 |
| Inconsistent power supply | 2.37 | 9 | 3.00 | 2 | 3.08 | 1 | 2.54 | 6 |
| Supply of energy | 2.37 | 9 | 2.50 | 8 | 2.94 | 2 | 2.56 | 4 |
| High cost of fuel | 2.30 | 10 | 2.63 | 5 | 2.75 | 4 | 2.51 | 8 |

**N/B**

$n^{th}$ = The ranked position

* = The rating mean index of factors affecting aquaculture

***ES = Earthen Pond System***

FT = Flow through System

RS = Recirculatory System

## CONCLUSION

The study has shown that fish farmers are mainly male and highly educated. *Clarias species* is the main species cultured using personal savings. Sizes of the farms are relatively of small size holdings on purchased land. Production, social and environmental factors are constraints which must be taken into consideration for urban aquaculture. Provision of security of fish farms must be ensured to guide against poaching. Stable electricity is essential for sustenance of the re-circulatory system. Extension activities should disseminate and build technical knowledge for adoption of flow-through and re-circulatory systems.

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