AN ASSESSMENT OF THE TECHNOLOGY AND ECONOMIC'S OF FISH FARMING IN KWARA STATE, NIGERIA.

BY

OGUNRINOLA STEPHEN OLADELE
M. TECH/SAAT/866/2001/2002

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BEING A PROJECT PRESENTED TO THE DEPARTMENT OF FISHERIES, FEDERAL UNVERISTY OF TECHNOLOGH, MINNA IN PARTIAL FULFULMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF TECHNOLOGY (FISHERIES) FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

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EXTERNAL EXAMINAR

MARCH, 2005

DEDICATION

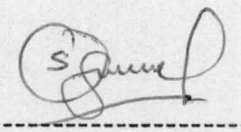
This project work is dedication to God the creator of heaven and earth and to the memory of my late father and mother pa. J.A. Ogunrinola and Mrs. S. I. Ogunrinola.

DECLARATION

I declare that this work titled An assessment of the technology and economic's of fish farming in Kwara State was carried out by me and has not been presented for award of any degree.

Ogunrinola, S.O.

Name



Signature

CERTIFICATION

This project work by Stephen. O. Ogunrinola entitled. An assessment of the technology and economic's of fish farming in Kwara State meets the require meets for the course of M. Tech (Fisheries) of the federal University of Technology, Minna and is approved for its contribution to scientific knowledge and literary presentation.

26/04/2006

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ACKNOWLEDGMENTS

My most sincere gratitude goes to God for giving me grace to start this work and get to the conclusive end. My special appreciation goes to my major supervisor Dr J.O. Otitolaye, for his enormous contributions, his advise, and criticism of this work even with his tight schedules, may God's blessing be upon you.

MY gratitude also goes to Dr. Ibrahim Yaro my co-supervisor who has also laboured to read through the work and make appropriate corrections. My thanks also goes to my head of department, Dr. S.E.O. Sadiku for his encouragement and for his assistance . y statistical analyses.

In the same vein, I am expressing my unalloyed gratitude to Mr. Kayode Abejide, Mr. Gboyega Ogunniran, Mr. Jimoh Abdulkkadir, Mr. Shina Yusuf, Mr. Gbega Ajiboye and Mr. Bimbo Olawale for their support during my field survey. My appreciation also goes to my past and present heqd of department (fisheries) in Kwara state Dr. A. O. Adekeye and Mr.A S. Ahman.

I want to finally appreciate my wife and children for their endurance and encouragements during the course of this work even at a very difficult time at home. The Lord will reward every body Abundantly.

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ABSTRACT

Survey of fish farming technology and economic of fish farming was carried out in Kwara State between September 2003 and February 2004. 82 fish farmers were interviewed through a structured questionnaire in 13 out of 16 Local Government Areas in the state. Data were analyzed based on the 4 ADP zones in the state. Underground/spring provided the highest percentage 57.3%, clay soil showed highest percentage 59.8%, gentle slope 52.4% showed the highest. Ponds of less than 1ha had the highest percentage (80.5%). 47.1% are between ages 41-50 while 87.0% were married, 59.7% had. post secondary education and 67.4% had less than 10 years experience. The sampled fish farms were established between 1984 and 2003. Farm sizes ranges from 0.04ha to 13ha. Fish farmers experience ranged from 1 year to 22years. Sources of fund for the fish culture enterprise ranged from personal savings, cooperative thrift and credit society loans to other sources of loans. The commercial fish farmers accounted for (79.3%) subsistence (17.7%), purposes, other purposes included Hatchery (2.4%), Research (1.2%) the intensive fish farm has (71.7%), semi-intensive (9.9%) and extensive (18.3%) with polyculture (48.8%) and monoculture (51.2%) practice. Average capital cost /ha for intensive and semi-intensive and extensive were N74,779.1, N53286.6, and N43,734.3 respectively. Average operating cost /ha obtained were N63,108, N31,963.3, and 16,215.8 for the 3 systems respectively. Average mean profit /ha ranged between N112,339.1 and N35,519.4 within the state. Constraints to fish farming operations in the state were lack of fund and credit facilities (24.6%) high cost of input (21.6%) lack of infrastructure (12.5%) inadequate extensive services (8.9%) lack of pond construction equipment (19.3%) Non-profitability (2.4%), and lack of interest (1.6%) inspite of these constraints fish farming business had witnessed a great improvement in the state. For improvement and higher productivity, farmers could be encouraged to form cooperatives societies, attend courses and workshops and fishing input could be subsidized by government or government agencies. If all recommendations are addressed based on the results. fish farming industry will be transformed in the state

CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND INFORMATION

Fish has long been valued as a source of animal protein for human nutrition. Hence, it has contributed immensely to the well being of man. The deficiency of protein in the diet has led to malnutrition which predispose man to disease. Fish contain about 16 – 20% protein compared to about 12% in eggs and 3.5% in milk (Kummer, 1990). Osajuyigbe (1981) reported that fish is a first class protein and relatively the cheapest source. Fish is a less tough and more digestible compared to beef, mutton, chicken and bush meat. They are in abundance in most markets in fresh, smoked, dried, canned, chilled or frozen and there is hardly any religious taboo attached to fish consumption (Eyo, 2001). Fish has long been valued as a source of animal protein for human nutrition. The consumption of first generally cuts across ecological, socio economic, cultural and religions boundaries leading to its predominant role as an animal protein. Fish is a first class animal protein and relatively the cheapest source (Osajuyigbe, 1981) Acheampong (1996) reported that about 40% of global fish production enter the international trade, based on the assertion and the fact that fish together with chicken represents

the cheapest source of animal protein for the most vulnerable parts of the West Africa countries. Acheampong (1996) also observed that the incident of protein energy malnutrition is one of the most direct manifestations of household food insecurity in west Africa. The continuous effect of this could be very disastrous to the entire population of West Africa.

Fish are very rich in edible oils, mainly poly-unsaturated fatty acids which have an anti cholesterol factor. Tait (1978) observed that fish livers are important source of vit. A and D. The utilization of fish in animal husbandry and fish seed industries is second to non (Akegbejo-Samson, 1999).

In view of these challenges; it is therefore imperative for the developing countries to utilize the naturally endowed potential of swamps flood-plains, manmade lakes and reservoirs to develop aquacultural fish production to meet up with the much desired fish protein requirements. Jean-francois (1996) reported that many countries have started to develop aquaculture as a provider of animal protein in order to establish sufficient resources and to keep up with the growing demand for animal protein.

Ayinla (1991) stressed that the demand for fish protein and the agricultural policy of Federal Government of Nigeria which emphasize

economic activity in the rural areas to curtail urban drift is in favour of fish cultivation in the swamps and flood plain which is abundant in Nigeria.

The history of fish farming in Nigeria dated back to between 1951 and 1954 which was characterized by FAO interventions in both Panyam and Oyo fish farm (Shimang, 1999). Thereafter, a number of fish farms were established across the nation. In February 1977, the Kwara State Government constructed the New Yidi fish farms in Ilorin. Kwara State which has a land area of about 32,500km^2 with available essential features for establishing fish farms, they include – good clay soil, adequate Fadama land, flood plain and rivers. (KWADP 1998) Inspite of the abundant natural resource, there seems to be poor response to aquacultural development until recently when abandoned ponds are been reactivated and new ones are been put in place. The study is expected to look critically into the present status of fish farming development in Kwara state with a view to having adequate recommendations that would help the overall development of aquaculture in the State.

Fish has long been valued as a source of animal protein for human nutrition. The consumption of fish generally cuts across ecological, socio economic, cultural and religious boundaries leading to its predominant role as an animal protein. presently fish accounts for over 50% of the total animal protein consumed in most countries of the world (FAO 1991) Acheampong (1996) reported that about 40% of global fish production enter the international trade, based on the assertion and the fact that fish together with chicken represents the cheapest source of animal protein for the most vulnerable parts of the West Africa Countries. Acheampong (1996) also observed that the incident of protein energy malnutrition is one of the moist direct manifestations of household food insecurity in West Africa. The continuos effect of this could be very disastrous to the entire population of West Africa.

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1.1 STATEMENT OF RESEARCH PROBLEM

Economic study of aquacultural status in Kwara State is very important in view of the natural endowment coupled with the socio-economic problems ravaging the state.

Capture fisheries has failed to meet the domestic need of fish supply and demand by consumers and producers generally. River Niger and its tributaries passes through few communities in the state. Between 1985 and 1998 government made several efforts to encourage the artisanal fishermen with a view to increase their catch per unit efforts by providing subsidized fishing equipment. All these encouragement's has not brought a corresponding increase to fish production in Kwara State.

In general terms, it appears that economic study on equaculture in developing country have not been thoroughly addressed. This genuine appraisal would be a right approach to effect changes in the aquacultural investment in the state.

There have also been the problem of collecting statistical data from prospective fish farmers in the state, the fear has been that they will be heavily taxed by the government if they should declare their

assets. This research work is meant to reveal the true position of aquacultural potentials in Kwara State. The survey of the existing fish farms will provide better information for decision making and formulation of public policies. The study is very important in view of the natural endowment, coupled with the socio-economic problems ravaging the state

1.2 JUSTIFICATION OF THE STUDY

Kwara State is endowed with a lot of human and material resources that could make agriculture the main stay of our economy. These resources are in terms of perennial waters fadamas, flood plains, good topography and of course technical know-how that could manage the resources. Some work was done on the analysis of the existing resources in Kwara State by Ogunniran in the year 2000.

There is the continous poor catches from the artisanal sector which is grossly inadequate for local consumption. It was also noticed that a lot of farmers are interested in investing on fish farming industry but are afraid of failure because of lack of information on the economic viability of the venture.

The finding will go a long way in helping prospective farmers and interested public and the government agencies in planning and utilizing the available resources to enhance the prospect of fish farming enterprise in the state.

1.3 OBJECTIVES OF THE STUDY

The general objective of this research work is the economic study of aquacultural fish production in Kwara State.

The specific objectives are:

(a) to describe the technology of fish farming in Kwara State.

(b) to determine the level of economic viability of fish farming in the state.

(c) to quantify the economic returns to the investment made by the fish farmers.

(d) to identify the basic production constraints affecting aquaculture development in the state.

(e) to make recommendations for future development of aquaculture based on the findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 AQUACULTURE

Aquaculture or aquatic farming is the husbandry of aquatic plants and animals. This is the propagation of aquatic organism under a complete human control, this includes fish, moluscs, crustacean and aquatic plants (FAO 1998). Aquaculture is a science of managing aquatic resources in order to enhance their production level. Fish culture, a frontier of aquaculture is the rearing of economically important members of fish for ornamental, recreational and food purposes. Some other frontiers of aquaculture are concerned with growing seaweed, oyster, frog and crustaceans.

2.2 TREND IN AQUACULTURE DEVELOPMENT.

Aquaculture is a very old and highly productive management practice with a history of at least 2000 years (Jeans Francois, 1996) The first written account of fish culture in ponds was by Fan-lai a Chinese fish farmer in 475BC. Some forms of aquaculture have been part of traditional family occupation in some countries like Egypt and China for centuries (Chakroff 1976).

In South-East Asia, fish ponds were believed to evolve naturally along with salt making in coastal areas; salt beds were utilized to grow milk fish during raining season (Lovel, 1989)

A number of factors have brought about the recent development in aquaculture, these includes the increasing demand for fish protein by rapidly increasing populations, setback in livestock production due to drought, outbreak of epidemic, desert encroachment, pollution of water body, diminishing return in fish catch even with increasing fishing efforts which could be due to absence of established inland fisheries laws and regulations in many countries and inadequate stocking of man-made- lakes (Ita, 1986). Therefore, the need to seek for alternative animal protein sources of food is inevitable. In view of this; many countries started developing aquaculture as alternative source of animal protein (Jean-Francois, 1996).

Fish farming constitute an effective and rational way of utilizing lands which has not been useful for other agricultural purposes. For many decades, many African countries like Nigeria have been struggling to develop agriculture with foreign development agencies.

This has resulted in the transfer to technology through creation of government demonstration centres, extension services and establishment of hatcheries to procure fish seeds (Ayinla, 1991). Berg (1996), observed that aquacultural development has not been very successful, this is evident in many developing countries of the world. Presently world per capital sea food consumption of fish stands at 19kg/yr. The world population is estimated to reach 6.6m and per capital consumption of fish has been predicted to increase from 11.8 to 13.3 m in 2000.(FAO, 1980 in Otubusin, 1992)

2.3 WORLD AQUACULTURE PRODUCTION

Aquaculture is one of the fastest growing food production system in the world. Increases in global fisheries production have been due to increases in aquaculture production within the same time, the total contribution of aquaculture production to global fish food has been on an average compounded growth rate of 9% per year (FAO/ FIDI 1995)

FAO (1998) reported over 26.3 metric tones as fish production from aquaculture in 1996, in order to maintain the current level, of fish consumption of 13kg in the year 2010 when population forcast would

be 7,032 million, 91 million metric tonnes of fish would be required to feed the whole world. FAO/FIDI 1995) compared this with 72.3 million metric tonnes produced in 1993, such production increase is feasible if aquaculture production can be doubted before the year 2010 and significant improvement made in conserving and managing the captured fisheries Tobor (1994) estimated that the annual potential fish yield potential in Nigeria inland, coastal and marine waters above 200m dept is 512, 360 metric tonnes while demand for fish is over 1million metric tonnes, with a population of about 92m domestic production of less than 450,000 metric tonnes. Nigeria has a serious problem of bridging the gap between her fish demand and supply.

2.4 RECENT TECHNOLOGICAL INNOVATIONS IN AQUACULTURE

In recent time, attention is turned towards aquaculture technology as a way of enhancing effeciency of the operations.Great successes have been recorded in the area of seed propagation by various workers like Madu *et al*, (1986) Ojo *te al*, (1988), Ayinla, (1991). In integrated aquaculture, the more efficient use of water and labour as well as waste recycling into fish use are two obvious

examples that compliment and improve the overall efficiency of many types of fish farm. The use of irrigation structure and water supplies to raise fish in rice fields are also good examples (Little and Muir 1987)

Olatubosun (1986) observed that the development and assistance to small- scale fisheries is a policy of yearly high priority in Asia countries. Some break through were achieved in the operation of shrimp/ prawn hatcheries in some countries in the region too. In National Institute for Freshwater Fisheries (NIFFR), floating bamboo net-hapa hatchery/ nursery system have been developed (Op.cit).

In Nigeria, aquaculture has witnessed a lot of developments, in the area of innovations in hypophysation and genetics, feed formulation, Recyclelatory system technique. Introduction of new species, establishment of a large research base and commercial investment is also been directed into aquaculture. Lovell (1989) refers to this advancement as the 'blue revolution'.

2.5 AQUACULTURE DEVELOP0MENT IN NIGERIA

From inception of aquaculture development in Nigeria in the 1940s to middle 70s, the Nigerian fisheries development (Aquaculture) have been characterized by FAO interventions. Between 1951-1954 Dr. K.K. Zwilling, an Austrian came to manage both Panyam and Oyo fish farms under the auspices of FAO (Shimang 1999). Expansion of aquaculture was intensified with the adoption of unified agricultural extension system (UAES) by the Agricultural Development Programme (ADPS), Some years ago (Okomoda et al, 1995).

After the commencement of Panyam and Oyo Fish Farm, quite a number of fish farms have been established across the country. Ita et al (1985) stated that a low figure of 1945 hectares of ponds were already developed while 3500 hectares were under construction. Ita (1993) estimated about 10,000 metric tonnes of fish per year from about 5,500 ha surface area.

In 1978; different survey of suitable aquaculture development land were carried out at different places, some of which a team of

fisheries consultants from Philippines- the Asiaphil consultant team surveyed suitable sites for fish farm development (Shimang, 1999).

Fish farming in Nigeria were categorized into two periods, they include 1950-1970 and 1970-1992. The first period was used to publicise fish farming while the second period was for establishment and expansion (Ezenwa, 1994)

Federal government of Nigeria between 1987 and 1980 encouraged the eleven River Basin Development Authorities to build fish farms (Ezenwa, 1994) The projects witnessed a dramatic change in fish farming industry due to the efforts of the expatriate fisheries personnel invited to monitor the projects.

Generally, the assistance rendered by FAO/UNDP in aquacultural operations in Nigeria has brought about a tremendous improvements in the industry. Some noticeable areas they have affected our development include hatchery construction and management, training and research and extension services. (Ezenwa, 1994)

2.6 STATUS OF FISH FARMING IN KWARA STATE

The earliest work in the fish farming industry in Kwara State was done by the state's Ministry of Agriculture. and Natural Resources in 1977. About 2 ha fish farm constructed and partitioned into 8 separate ponds of about 0.25 ha each in 1988, The government, through the Directorate of Food Road and Rural Infrastructure (DFRRI), constructed additional infrastructure to include fish hatchery programme. The project seemed to succeed for some years with the production of fingerlings meeting about 10% of the projected 1.5 million fingerlings per year. The Ministry of Agriculture also proposed Oke-Ode Fish Farm, Lade and Osin River Fish Farm (Ita et al 1985). Federal Department of fisheries in the early 80s commenced a 8.5ha. fish farm project at New yidi, Ilorin. For over a long time the project was abandoned until recently when the ponds were been allocated to interested fish farmers to reconstruct with minimal charges attached to it.

In order to further enhance fish production in the State, the Niger River Basin Authority constructed 8.ha reservoir and 1.0 ha fish pond at Ilorin and Ira respectively. In 1997, the National institute for

Fresh-Water fisheries (NIFFR) also stocked Agba/Asa Dam reservoirs with thousand of Juvenile sized *Clarias gariepinus* to boost fish production.

Asa Local Government constructed a 0.5 ha fish pond at Afon in 1978 while Irepodun Local Government Authority also constructed a 0.04 ha fish pond at Omu-Aran in 1988. The University of Ilorin also constructed a dam for fish production and research work. There have also been a lot of private fish farms and homestead ponds in recent time. Before this fieldwork there were already 80 documented fish farm \ ponds in Kwara State (Table2.1). The recent fieldwork has revealed that there are quite a number of them that have been abandoned while new ones are springing up.

TABLE 2.1:Documented Fish Farms in Kwara State

OWNERSHIP	KWARA ADP ZONES					
	A	B	C	D	Total	%
Institution/Mission	1	-	4	2	7	8.75
Government	-	-	3	1	4	5.00
Corporate/Community	-	4	1	5	10	12.50
Individual	2	3	37	17	59	73.75
TOTAL	3	7	45	25	80	100

Source: KWADP, 1998

2.7 AQUACULTURE AND SOCIO ECONOMIC DEVELOPMENT IN NIGERIA

Fish farming in recent time is contributing immensely to the socio- economic development of Nigeria. A lot of the aged and youth are engaged in fish farming industry as a way of livelihood and thereby improve the status quo of these group of people. Berg (1996) reported that aquaculture has been recognized in most developing countries as a major avenue for improving the living standard of rural dwellers. Little and Muir (1987) observed that fish farming compared with other domestic animals has the advantage of converting wastes, piggery wastes, cowdung and other organic industrial by product into useful protein efficiently. This makes the industry contribute to the management of waste in the environment.

Faturoti and Obasa (1992) listed the fish species and shellfish that can be profitably cultured to provide enough fish for local consumption and for export, they include Clarias *gariepinus, Oreochromis niloticus, Chryscihthys nigrodigitatus, Sarotherodon melanoptaron, mugil spp, Elops lacerta, Heterotis niloticus,*

melanoptaron, mugil spp, Elops lacerta, Heterotis niloticus, Penaeus nitilatis, Macrobranchum spp, Crassotrea gasar and Lutyanus spp

Tobor (1994) reported that in 1993, fish farming contributes about 1.2% of domestic fish supply in Nigeria and this is considered low compared with aquaculture potential in the country. In view of this, top priority must be given to intensify research and development of all aspect of aquaculture in the country. Beside, it would also help the country to generate income and would help to minimize fish importation.

Okoye (1986) reported that the expected population of Nigeria and the fish demand by the year 2000 is 106.7 million and 1.281million metric tonnes respectively. It is evident that this projection could not have been met, and this has resulted into wide gap between fish demand and supply in the country. However, controlled production of fish in ponds in sufficient quality could have favourable impact on the Nigerian efforts to achieve self sufficiency in the much needed animal protein (Okoye 1986) Tobor (1994) also stressed the importance of training of senior aquaculturist at post

graduate level as this would help to alleviate man-power problem thereby contributing to the socio-economic development of the nation.

2. 9 ECONOMIC CONSIDERATION

In order to establish a fish farming project, it is very essential to take into consideration the economic aspect before the commencement of the venture , Ayinla (1991) observed that a well located, constructed project could still fail if the economic consideration aspect of the project is faulty . Some of the economic constraints include, land price, market values, feed, fertilizer and cost of labour. There must be a thorough analysis of financial inputs, market, expected income, and management of resources (human and materials). The fish farming project should not commence unless the aforementioned are well articulated, otherwise the whole venture will be a failure.

2.9 CONSTRAINTS TO FISH FARMING DEVELOPMENT IN NIGERIA

Shimang (1999) identified major obstacles to the rapid development of aquaculture in Nigeria, which includes inadequate

level man power, low priority by Government, lack of knowledge of profitability, unavailable access to credit facility and high cost of labour and inputs

Other constraints to aquaculture developments includes insufficient earth moving equipment and expensive hiring rates for the available ones (Ayinla 1991). Insufficient production of fingerlings for stocking, and high cost of feed and ingredients.(Williams,1986)

2.9.1 FINANCIAL INPUTS

If there would be a thorough assessment of the total output in an aquaculture business, the detail expenditure or the financial input must be taken into consideration.

Ayinla(1991) considered cost of land acquisition, survey/design construction and maintenance and marketing, processing and preservation.

In order to get the best out of the aquaculture venture, the costs of each of these areas of expenditure and other necessary components must be considered.

2.9.2 CREDIT FACILITY

In Nigeria, many farmers find it very difficult to secure loan from the banks, this is because most farmers would not have sufficient collateral to stand in case they are unable to pay back the loan. In some cases, farmers secure credits through cooperative society of which they are members and would be returned as stipulated (Ogunniran 2000)

It is noticed that the initial capital required for aquaculture venture is very high , thereby making it very difficult for subsistence fish farmers to embark on. The support of the government in the take off of such project. Is very necessary where subsistence or market production of fish is considered and particularly desirable, subsidized credit may be given (little and Muir 1997). Of a particular note is the fact that financial experts and loan application analyst who process aquaculture loan requests are not technically competent to asses loan application (Olaniyi, 1989)

2.9.3 PROFITABILITY

One of the major constraints in aquacultural development in developing countries is the lack of knowledge of profitability. It has actually resulted into abandoning of major aquacultural project. This ignorance has also affected the willingness of banking institution to

fund aquaculture projects, fish farming as an industry is truly a long term profit oriented investment, which could compare favourably with other agro-allied business.

Eneriene(1984) observed that profitability would depend on sound application of scientific, ecological, technological and economic, principles. In essence, for a fish farmer to succeed, he must have the knowledge of the species to culture, the feed to use and of course the labour to manage the farm. Lovell, (1989) saw aquaculture as viable and profitable enterprise since it could supply a large percentage of consumable fisheries products

2.9.5 FISH MARKETING

Fish farmers see the period of harvesting and marketing as the most important occasion in their farming cycle. The farmers decision to sell the product fresh or smoked depends on prevailing situations in the market. Marketing fish requires an efficient system, which must not operate in an information vacuum. Adequate Information on the market demand of fish is of importance for commercial fish farmers to identify his marketing channels. This channels include nature of

product, its extent, the buyer and quantities involved (Diallo et al, 1997).

Adeyemo (1986) revealed three well established fish distribution channels in Nigeria. they include fish traders with cold storage facilities, coastal or riverine fish traders with no cold storage facility and the road side retail fish traders. Further more, the wide variations in per caput fish consumption between countries can be explained by relative influence of prices, income, consumer's preference and market availability.

CHAPTER THREE

METHODOLOGY

3.1 STUDY AREA

An assessment of the technology and economic's of fish farming was carried out in Kwara State. The state created on 27th May, 1967, covers a land area of 32,500km^2 with 16 local government areas Kwara State occupies latitudes 08^0 and 09^0 6'N and longitudes 02^0.6' and 06^{0}1^E with population of over 3million people. It shares international broader with Republic of Benin towards the North Western part of Baruteen Local Government. It also shares boundary with Oyo, Niger, Kogi, Ekiti and Osun States. (KWADP 1998)

The state is endowed with major rivers which have influenced the choice of this project. The rivers include River Niger, Oyi, Ogun, Asa, Osin, Awonga and Awu. All these rivers have contributed in no small way to the economic development of the state.

3.2 SAMPLING METHOD

stratified purposive sampling method was principally used for this study. The survey was carried out between September, 2003 and

February 2004. The study covered 13 out of 16 local government areas of the state. A total number of 120 questionnaires were distributed through the Extension agents in Kwara ADP, out of these figure, 82 farmers responded and were interviewed Agriculture development project (ADP) has been divided into four (4) zones for easy development and administrative convenience. The sampling of this study was done according to the 4 zones of Kwara ADP.

They include:

FIGURE 1

1. **Zone A.** Comprises of Baruten, Kiama. Kiama as Its Headquarters.
2. **Zone B.** Comprises of Edu. Patigi, Patigi as its Headquarters
3. **Zone C.** Comprises of Asa, Ilorin-East, Ilorin-West, Ilorin-South & Moro LGA. Molete as Headquarters.
4. **Zone D.** Comprises of Ekiti, Ifelodun, Irepodun Offa, Oyun, Isin & Oke-Ero LGA. Igbaja as Headquarters.

3.3 DATA COLLECTION

Information were solicited directly using personal interview and structured questionnaires (Appendix 1) designed to ensure that the

information gathered are accurate for statistical analysis. The questionnaire focused on relevant issues such as fish farmer's background, ecological characteristics of the fish farms, management techniques, sizes of investment, economic returns and marketing. The purposive soil analysis and the topography of each of the farm sampled was according to methods described by Bard *et al* (1967).

3.4 DATA ANALYSIS

Frequency counts, mean scores, percentages, Standard Deviation (SD) and Coefficient of Variation (CV) were used to analyse the data. Analysis of Variance (ANOVA), correlation coefficient and were also used in the analysis of selected variables like relationship between fish farming constraints. The gross revenue from the farm in each zone was estimated by multiplying the quantity of fish in kilograms by the average market price per kilograms of fish in the zone. The profit for each zone was computed as the difference between the gross revenue and the total annual operating cost (Shang, 1984). The break-even analysis According to Shang (1984) that: Break-even price = Total Operating Cost/ Quantity of fish produced: Break-even prod. Total Operating Cost/Unit price of output

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 EDAPHIC CHARACTERISTICS

A. Sources of Water

The results of the Edaphic characteristics of sampled fish farm in Kwara State are presented in Table 4.1. The result showed sources of water supply to the fish farms. Underground/spring provided the highest percentage (57. 3%) of water source to the farms. Also, 20.2% of the water supply is from stream/rivers, while 14.6% are from bore holes/wells, while. rainfed ponds accounted for 6.1%. Majority of the farms (57.3%)in Kwara State had their sources of water from underground/spring. The implication of this is that many of the fish farmers sought the assistance of fisheries personal before commencing their projects since most of the rivers and streams have their origin from underground/spring. Logsdom (1978) observed that the first and most preferred source of water for aquaculture is the running spring. The author also stressed that out of the existing bodies of water, the spring has the best chance of not being polluted and seems to be the most economical since little energy loss was

involved. The implication of farms with 20% river/stream is that there will be sufficient water to feed the ponds throughout the year. The danger of predators and unwanted fishes can be removed by screening of the inlets

Shang (1984) observed that water supply from well and bore holes tend to be more dependable and is usually free from diseases parasites, predators and pollutants. The consistent supply is also an advantage to fish farmers. They are however too costly to invest on by small scale farmers. However, there is an associated poor oxygen concentration, which can be increased through constant exposures and falls.(Shang 1984)

The rainfed source has quite a number of advantages which included high oxygen content, freedom from pollution and predators. However, the supply is seasonal, and cannot be totally relied upon, and this is probably why it carried the least percentage in the state.

B. Types of Soil

The analysis of soil type showed that 59.8% were clay, 30.5% sandy clay, 3.7% sandy soil while rocky and loamy soil were 2.4% and 1.2% respectively.

Retention ability and fertility are two aspects of soil quality which affect pond construction and maintenance costs. 59.8% of the farmers used clay soil . .The type of soil has high water retaining power and so adequate for all purposes of fish farming. Needom (1987) stressed that the size of pond dykes and the slope gradient have relationship with the quality of soil used, the higher the clay content the more compacted and durable the embarkments. 30.5% of the farmers used sand clay, this type of soil is also vary suitable for fish farming activities. Sandy and rocky soil, are not adapted for earthen pond construction. The high percentage of farmers using suitable soil for construction could have been the reason for ponds durability and high productivity among many of the farmers interviewed.

C. Topography

The topography of the land shown table 4.1, showed 52.4% gentle slope, 18.3% and 2.4% were of flat and steep slope terrain respectively, the assurance of pond longevity is guaranteed. In view of high percentage of claysoil reported during the purposive sampling. This could have brought about the reduction in the cost of construction since little earth movement were involved. Shang (1984) observed that a slope of 5% is most desirable because of extra construction costs associated with backflling and increased possibility of run-off problems.

D. Pond Type

Table 4.1 also revealed that 62.2% of the farms had earthen, ponds 25.6% concrete ponds while 11.0% comprised of both earthen and concrete ponds. Majority of the sampled fish farms were earthen ponds. Fish farmers preferred earthen ponds to concrete ponds probably because high productivity usually is observed in earthen pond. This is however dependent on proper management and feeding. It has also been observed that the cost of construction of concrete ponds is on the high side due to soaring price of building

materials. With all these, earthen ponds ranked best among farmers in Kwara State.

E. Pond Size

The small sized pond (<1ha) had the highest percentage distribution of 80.5% while (≥ 5 ha) recorded the lowest distribution of 1.2% pond size of between 2 and 2.99ha had 6.1% while 1 and 1.99ha and 3-4.99ha accounted for 9.8% and 24% respectively. Most farmers embarked on smaller ponds in the state because they believed that bigger farms require modern pond engineering and advanced management techniques, which could not be met by poor and average fish farmers. The values for pond sizes were supplied by many of the respondents based on the records given by the fisheries personal who constructed the ponds. The pond sizes in each farm were calculated together to arrive at total hecrage,

TABLE 4.1: EDAPHIC CHARACTERISTICS OF FISH FARM IN KWARA STATE.

ADP ZONE

CHARACTERISTICS	A	B	C	D	TOTAL NO	PERCENTAGES
(1) WATER SOURCE						
(a) Stream/Rivers	0	1	10	6	17	20.7
(b) Underground (spring)	1	5	29	12	47	57.3
(c) Rain	1	0	2	2	5	6.1
(d) Well/Borehole	1	1	7	3	12	14.6
(e) Others	0	0	0	1	1.82	1.2
(2) SOIL TYPE						
(a) Sandy Soil	0	0	2	1	3	3.7
(b) Clay	2	3	30	16	49	59.8
(c) Sandy Clay	1	3	13	8	25	30.5
(d) Rock	0	0	2	0	2	2.4
(e) Loamy Soil	0	1	1	0	1	1.2
					82	
(3) TOPOGRAPHY						
(a) Gentle Slope	2	4	33	14	43	52.4
(b) Flat Basic	1	2	7	5	15	18.3
(c) Steep Slope	0	0	1	1	2	2.4
(d) Others	0	1	7	4	12	14.6
					82	
(4) Pond Type						
(a) Earthen Pond	2	4	30	15	51	62.2
(b) Concrete Pond	1	2	11	7	21	25.6
(c) Both	0	1	6	2	9	11.0
					82	98.9
(5) POND SIZE(HA)						
(a) < 1.00	3	4	40	18	66	80.5
(b) 1.00 – 1.99	0	2	4	2	8	9.8
(c)2.00 – 2.99	0	1	2	2	5	6.1
(d)3.00 – 4.99	0	0	1	1	2	2.4
(e) ≥ 5.00	0	0	1	1	2	1.2

Source: Field Survey, 2004.

4.2 SOCIO – DEMOGRAPHIC CHARACTERISTICS

Age Distribution

Table 4.2, showed that 47.1% of the fish farmers were between 41 and 50years, 30.5% were between 51 and 60 years, 13% were between 30 and 40 years while 9.4% of them were 60years and above.

Since the majority of the farmers belonged to the middle age bracket who were physically and mentally alert, they would be able to learn new concepts about fish farming enterprise than the older farmers. The fearly old farmers (51 – 60years) could also accept innovation and contribute to the growth of aquacultural business.

Marital Status

The table 4.2 also revealed that 87.0% of the farmers were married while only 13% were single. Ajayi and Baiyeri (1997) reported that one of the most important factors affecting the level of production and productivity is the marital status of the farming family. It is believed that the labour could be supplied by husbands, their wives and children. Igben (1988) observed that one of the most important

factors conditioning the level of production and productivity is the marital status of the farming family.

Educational Qualification

Table 4.2 further revealed that 59.7% of the farmers had post secondary education, 19.7% had secondary education and 16.6% with primary education. Those with other forms of education were 4%. Igben (1988) reported that the role of education in the increased adoption of improved farm practices and ultimately improved farm production and productivity cannot be over-emphasized. The high percentage (59.7%) of educated fish farmers in the state could actually influence their productivity.

Farming Experience

Also in the same table , 67.4% of the farmers had less than ten years experience in pond management, 25.9 % had between 10 and 20years experience while 6.7% had more than 20years. A long farming experience is of great advantage for increased farm productivity in the same way specialization does (Ajayi and Baiyeri 1997). In this study, only very few fish farmers had a long term experience. The reason could be because fish farming is just finding its feet in the state and many farmers are just investing on the fish farming business. There is no traditional fish farming in Nigeria like the case of crop/livestock production. As such the need for extension/ technical support.

TABLE 4.2: **SOCIO – DEMOGARPHIC CHARACTERISTICS. OF THE FARMERS**

ADP ZONE

CHARACTERISTICS	A	B	C	D	MEAN %
AGE (YEARS)					
(1) 30 – 40	0	0	22.9	29.2	
(2) 41 – 50	33.33	57.1	47.9	50.0	13.0
(3) 51 – 60	33.33	42.9	29.2	16.7	47.1
(4) > 60	33.33	0	0	4.1	30.5
					19.4
MARITAL STATUS					
(1) Married	66.7	100.0	89.6	91.7	87.0
(2) Single	33.3	0	10.4	8.3	13.0
LEVEL OF EDUCATION					
(1) Primary	33.3	14.3	6.3	12.5	16.6
(2) Secondary	0	28.6	25.0	25.0	19.7
(3) University/	66.7	42.9	66.7	62.5	59.7
Polytechnic.	0	14.3	2.0	0	4.0
(4) Others					
FARMING EXPERIENCE					
(1) < 10	66.7	57.1	66.7	79.2	67.4
(2) 10 – 20	33.3	28.6	26.0	16.7	25.9
(3) > 20	0	14.3	8.3	4.1	6.7
SOCIAL ORGANISATION					
(1) Farmers co-op. Society.	66.7	42.9	25.0	16.7	37.8
(2) FISON	0	0	16.7	0	4.2
(3) Thrift & Credit	0	14.3	29.1	20.8	16.1
(4) Others	33.3	42.8	29.2	62.5	41.9
OCCUPATION					
(1) Farming	33.3	57.1	12.5	12.5	28.9
(2) Civil servant	0	14.3	37.5	12.5	16.1
(3) Trading	33.3	14.3	16.7	12.5	19.2
(4) Self Employed	33.3	14.3	33.3	62.5	35.9

Source: Field Survey, 2004.

4.3 PURPOSE FOR ESTABLISHING FISH FARMS

Table 4.3 showed the distribution and purpose of fish farm in Kwara State. 79.3% were established for commercial purposes, 17.1% for subsistence , 2.4% for hatchery while 1.2% for research.

Table 4.3: PURPOSE OF FISH FARMS ACCORDING TO ZONES.

	ADP ZONES					
PURPOSES	**A**	**B**	**C**	**D**	**NO**	**%**
Substances	0	3	8	3	14	17.1
Commercial	3	4	37	21	65	79.3
Hatchery	0	0	2	0	2	2.4
Research	0	0	1	0	1	1.2
Total	**3**	**7**	**48**	**24**	**82**	**100**

Source: Field Survey, 2004.

The major purpose for which aquacultural projects were established is mostly for commercial (that is, to improve the living standard of the operators (farmers) through sales of their products). It is believed that the end result of all other purposes would amount to an economic benefit. A subsistence fish farmers would supply fish to the extended family to improve the protein consumption and so would supplement meat consumption. Thus, the money would have become part of the savings. Research and hatchery projects could only be

ventured into by people with technical-know-how. Research purposes was only noticed in zone C of the university of Ilorin Dam site.

Growing fish in ponds is a more useful practice than trying to catch fish from rivers, streams or lakes. Fishes caught in ponds could be controlled unlike in the wild situation.

4.4 SPECIES CULTURED AND STOCKING RATE

Species of fish cultured in Kwara State include *Clarias gariepinus, Heterobranchus spp, Hetcrotis nuoticus and Oreochromis* niloticus (Tilapia). The stocking rate practised was between the range of 2 – 10 fish per m^2 (2 – 10/m^2). For the cultured fishes. This is in line with recommendation of Egwui (1978) who recommended the above named species of fish for stocking and stocking rate of 5Fish/m^2 minimum for better performance. In farms where polyculture of catfishes and Tilapia. Is practiced they are in the ratio of 3:1. The cost range for fingerlings was between ₦2 to ₦10.

4.5 SOURCES OF FINGERLINGS

Sources of fingerlings are shown in Table 4.5. The results shows that 79.2% from hatchery, 3.4% from the wild while 7.3% came from other sources. Most of the fish produced in Kwara State were procured from

hatcheries. This implied that most fish production in the state are from known and approved sources, and this could have accounted for good performance of a number of fish farmers in the state. According to Ayinla *et al*, (1978), the cost and availability of fish seed is an important factor in over- all production costs.

TABLE 4.4: COST OF FISH AND THEIR STOCKING RATE

FISH SPECIES	COST RANGE/SEED N :K	STOCKING RATE	COST/TABLE SIZE/KG
Clariids	6-15	4-10/m^2	250-350
Tilapia spp.	2-5	2-5m^2	100-120
Heterotis spp.	10	2-3m^2	250-350

Source: Field Survey, 2004.

TABLE 4.5: SOURCES OF FINGERLINGS

SOURCE	A	B	C	D	TOTAL	%
Hatchery	3	5	38	19	65	79.2
Wild	0	2	10	5	17	20.7

Source: Field Survey, 2004.

4.6 PRODUCTION TECHNOLOGY

Result of the study indicated that 71.7%, 18.3%, 9.8% of the respondents practised intensive, extensive and semi-intensive respectively (Table 4.6). Besides, 51.2% practised monoculture while 48.8% were into polyculture.

TABLE 4.6: PRODUCTION TECHNOLOGY EMPLOYED

Production technology	Zones				Total	%
	A	B	C	D		
(a) Intensive	3	5	35	16	59	71.7
(b) Extensive	0	1	9	5	15	18.3
(c) Semi-Intensive	0	1	4	3	8	9.9
Total	**3**	**7**	**48**	**24**	**82**	**99.9**
(a) Mono culture	2	3	27	10	42	51.2
(b) Polyculture	1	4	21	14	40	48.8
Total	**3**	**7**	**48**	**24**	**82**	**100**

Source: Field Survey, 2004.

Intensive fish culture is a system which aimed at achieving the highest possible fish production with respect to the area and the masses of water used for the purpose. The decision on mode of operation depends on available capital, the experience of the operator, and of course, availability of equipments needed for the operation. If several techniques appear technically acceptable, the one estimated to provide the greatest economic returns should be the usual choice. Although this may not be enough to ensure economic success, but it could help in the survival of the business for instance, species of fish to be cultured will determine the accuracy of technical information on biological requirements, and at the same time, they must be desirable as food which its growth rate must be very high to make its culture economically viable. In short, factors of production should be considered for the overall success of the business.

4.2 FERTILIZATION, FEED

To enhance fish productivity, 79.3% of the fish farmers used fertilizers, while 20.7% did not use at all. Out of this percentage, 72% used organic fertilizer such as poultry manure, cowdung, pig dung. while others (7.3%) used inorganic fertilizer (NPK). The quantity of

organic manure used ranges between 200 to 500kg per month. None of the fish farmers combined or complemented organic and inorganic manure. Only 29.3% of the farmers used lime (CaoH). Table 4.7 also indicated the cost of inorganic fertilizer as ₦30/kg while organic fertilizer and lime costs ₦3/kg and ₦30/kg respectively.

Little *et al* (1987) observed that fish farming compared with other domestic animals has the advantage of converting wastes such as poultry and piggery wastes, cow dung, and other industrial by-products into useful protein efficiently. In essence, fish farming in the state could contribute to the management of wastes in the environment. In support of this observation most poultry houses in the state are being visited daily by fish farmers to source for manure and maggots.

TABLE 4.7: TYPES AND COSTS OF FERTILIZER, AND FEED USED BY FARMERS IN KWARA STATE.

ITEMS	RANGE	NO OF USERS – ADP ZONE				TOTAL	%
	Cost/kg	A	B	C	D		
FERTILIZER							
(a) Organic	2/kg	2	5	36	16	59	71.9
(b) Inorganic	30/kg	0	1	3	2	6	7.3
(c) None	-	1	1	9	6	17	20.7
LIME							
(a) Lime(CaoH)	₦25-₦30/kg	1	2	15	6	24	29.3
(b) None	-	2	5	33	18	58	70.7
FEED INGREDIENTS							
(a) Compounded diet	₦30 – ₦42 per kg	3	5	35	18	61	74.4
(b) Natural/maggots	-	0	2	13	6	21	25.1
(c) None	-	-	-	-	-	-	-

Source: Field Survey 2004.

Fish farmers in the state used varieties of feed ingredients to compound their feeds. It was observed that most fish farmers compounded their feed locally while some fish farmers purchased from authorized feed millers. Information on mixing ratio of the ingredients could not be given by the fish farmers. Some of such ingredients include corn, soyabean (toasted), fish meal rice bran or wheat offal, groundnut cake, and fixed ingredients. Ayinla *et al* (1987)

observed that the combination of overall feed into a ration has greater nutritional value than if the feed stuff were fed separately. Thus, offering a balance of nutritional elements.

4.8 ECONOMIC CHARACTERISTICS OF FISH FARMING SYSTEM

The estimated costs and return of fish form in Kwara State are presented in Table 4.8. The table shows that average farm size ranged from 0.15ha to 0.74ha with a mean of 0.61^{+}0.10SD. In the state: The average capital cost per hactare ranged from ₦35,969.00 to ₦52,103.30 with a mean of ₦42,950.00^{+}₦6,777SD across the state. The average annual administrative cost/ha had a range of ₦2,915.90 and ₦4,231.00 with a mean of ₦3,487.79^{+}₦550.40SD.

The average variable cost ranged from ₦12,086.50 to ₦15,512.30 with a mean of ₦13,331.70^{+}₦1,700:20SD On the average, total operating cost ranged between ₦23,260.90 and ₦33,751.20 with mean of ₦27,821.90^{+}₦4,390.60SD.

Table 4.8 further revealed that average gross revenue per ha had a range of ₦135,660 and ₦225,000 with a mean of ₦172,227^{+} ₦39,879.30SD . The average profit of fish farming operation in the state showed a range ₦112,399.10 and ₦194,248 per hectare with a mean of ₦144,415.10^{+} ₦ 35,519.40SD.

Zone C has the highest profit of ₦194,248 followed by zone D with ₦143,178.00, zone B with ₦127,834.30 and the least was zone A with a profit of ₦112,399.10.

Giving the indication of the cost to be expected in establishing and managing a fish farm, a general economic model can be formulated for different aquacultural system. But the cost of any particular model may differ considerably depending on design, site and management variables. The figures here revealed the breakdown of average capital and operating costs of fish farms in Kwara State.

TABLE 4.8: AVERAGE COST AND RETURN PER HECTARE OF FISH FARM IN KWARA STATE.

ADP ONES	AVERAGE FARM SIZE HA	AVERAGE CAPITAL COST N: K	ANNUAL ADMINIST-RATIVE Cost N: K	AVERAGE VARIABLE COST	INPUTED COST OF FAMILY LABOUR	ANNUAL INTEREST AND DEPRECIATION	AVERAGE TOTAL OPERATING COST	AVERAGE GROSS REVENUE	AVERAGE PROFIT
A	0.51	35,967	2,915.9	12,086.5	56.0	9,447.3	23,260.9	135,650	112,399.1
B	0.58	40,873.7	3,316.2	12,394.5	73.7	10,743.9	26,453.7	154,288	127,834.3
C	0.75	52,103.3	4,231.0	15,812.3	81.3	13,707.8	33,751.2	228,000	194,248.8
D	0.60	42,950	3,487.8	13,034.5	67.0	11,299.6	27,821.9	172,237	144,415.1
X	0.61	42,950	3,487.7	13.331.7	67.0	11,299.6	27,821.9	172,237	144,415.1
SD	0.10	6,77.9	500.4	1,700.2	10.6	1,783.2	4,390.6	39,879.3	35,519.4

4.9 CAPTIAL COSTS

The summary of the total average capital cost are given in Table 4.9. Items considered were land acquisition, land clearing, pond and monk/culvert construction and other equipment including net and netting materials. The result of the study, showed that the cost of constructing a monk has its highest percentage for all the three operative system in the study 38.4%, 46.9% and 57.2% for intensive, semi-intensive, and extensive, respectively. This was closely followed by the cost of construction of 1ha pond for intensive (36.9%), semi-intensive (26.6%) and extensive (18.8%). This was followed by the cost of land which were 22.2%, 15.9% and 11.3% for intensive, semi-intensive and extensive respectively. Cost of land (11.3%) was lower in extensive than the cost of netting materials which had (12.8%).

The same table indicated that the average cost of pond construction (monk inclusive) per hectare generally accounted for large proportion (75.3%) of the average capital cost compared with high investment on land (22.2%) for intensive fish culture system. The

size, dept and shape of the major factor affecting the cost of construction.

Needom (1987) stressed that a good design does not only beautify the farm, but it also plays very important role in both economy and managerial aspects of the farm activities.

Fish farm can be constructed by manual or machines, the choice of alternative will be based on the relative costs and efficiency of construction, for example, a turned-down drainage pipe system is presently been used to improvise the concrete monk at a considerably low price. However, its durability could not be compared with the concrete monk (though they served same purpose). Turned-down pipes are used for small and medium sized ponds.

Other capital costs estimated were land acquisition (22.2%) and nets /netting materials (12.8%) all for intensive system. Cost of land varies from one place to the other. Land unavailability and cost could discourage interested fish farmers from embarking on fish farming project. Most suitable land for aquaculture in Kwara State are mostly inherited family land, hence the bottle neck of extended family are experienced.

Only netting materials were mentioned under equipment in this report but other equipment may be required where the construction system demand it, for instance; pond where water cannot be drained by gravity, a pumping machine will be required and this would be an additional cost.

4.9.1 OPERATING COST

The operating cost were classified as variables and fixed costs. Variables costs were fish seed which has the highest percentage for all the three system, 34.9%, 35.7% and 40.7% respectively the fish farmers in the state used the stocking rate of between 2 and 10/m^2 depending on the system of their operations. Stocking rate can also be increased where provisions are made for flow through system. The cost per fingerling as indicated in Table 4.4 ranged between ₦6 and ₦15 for claridae and between ₦2 and ₦5 for *Tilapia spp.* Other variable costs were feeds (11.3% and 11.4% for intensive and semi-intensive. Fertilizer also had 1.2% each for intensive and semi-intensive respectively. The least variable costs were the inputed family labour with 0.23% for intensive and semi-intensive. Also, in the table were administrative costs which included salaries and wages

with costs with 17.6% and 8.9% for intensive and semi-intensive respectively. All these were classified as fixed variables costs.

Procurement of seeds and optimum stoking densities have significant effect on the average operating variables costs in the state. The backbone of aquaculture is the production of fish seed. Madu *et al* (1986) stressed that scarcity of fish seed, is one of the major constraints to the rapid development of aquaculture in Nigeria.

Fish feeds is of paramount importance if there would be a break through in aquaculture business. According to Fatunroti and Obasa (1992) if maximum benefit was to be achieved, fish feeding will take over 60% of the operation cost of a fish culture business. Various domestic and agricultural wastes such as corn/rice bran, wheat offal, groundnut cakes, palm kernel cakes were used with other ingredients like soybeans meal, fish meal, bone meal and fixed ingredient to compound high protein food. Balogun *et al* (1992) reported that the choice of different ingredient for use in fish culture should be determined by cost, quality, availability and crude protein and energy requirement of the fish to be fed. The low figure (11.3%) recorded in the study was connected with the high cost of conventional feed stuff.

Cost of fertilizers also took 1.2% in both intensive and extensive system. The high cost and scarcity of inorganic fertilizer has been an hindrance to rapid development of aquaculture organic manure are often been used as substitute to inorganic fertilizer by many fish farmers in Kwara State.

Interest on capital and annual depreciation at (19%) were 34.9%, 42.6% and 59% for intensive, semi-intensive and extensive respectively.

COST BENEFIT ANALYSIS

Cost Components	B Values	Significant Level
Capital Cost	113.27	P<o.005
Administrative Cost	-1308.45	P<0.005
Variable Cost	-0.44	P<0.005
Labour Cost	-927.88	P<0.005

Model equation: profit- 8.89+ 113.27 cap cost- 1308.45 Admin Cost – 0.44 Variable Cost-927.88 Labour +1.50

Operating cost, interest depreciation and gross variables are linear combinations of other cost like capital cost, administrative cost, the variable cost and labour cost and therefore did not fit into the model. Others used for the model shows that there is positive relationship

between capital cost and profit while profit related to administrative cost, variable cost, and labour cost showed negative relationship. All relationship were found to be significant ($p<0.05$).

This implies that independent variables like administrative cost, variable cost, labour cost reduce when profit increases. The capital cost is positive and this shows that more profit will be made if more money is invested into the business or capital cost is increased.

TABLE 4.9: AVERAGE COST OF INVESTMENT FOR INTENSIVE, SEMI-INTENSIVE AND EXTENSIVE FISH FARMING IN KWARA STATE.

ITEM	INTENSIVE	SEMI-INTENSIVE	EXTENSIVE
i) Average Pond Size(HA)			
ii) CAPITAL COSTS	.37	.19	.11
(1) Land Acquisition	16, 567.2(22.2)	8,507.5 (15.9)	4,925.4(11.3)
(2) Pond Construction (land clearing inclusive)	27, 611.9 (36.9)	14,179.1 (26.6)	8,208.9 (18.8)
(3) Monk	25,000(38.4)	25,000 (46.9)	25,000 (57.2)
(4) Net/Netting materials	5,600 (7.5)	5,600 (10.5)	5,600 (12.8)
TOTAL	**74,779.1 (100)**	**53,286.6 (100)**	**43,734.3 (100)**
iii) OPERATING COSTS			
a. Variable Cost			
(1) Seed (fingerlings)	22,000 (34.9)	11,400 (35.7)	6,600 (40.70)
(2) Feeds	7,104 (11.3)	3,646 (11.4)	-
(3) Fertilizer	740 (1.2)	380 (1.2)	-
(4) family Labour	148 (.23)	76 (.23)	
b. Fixed Cost			44(.27)
(1) Administration	11,101 (17.6)	2,850 (8.9)	
(2) Interest on capital and depreciation (19%)	22,015 (34.9)	13,611.3 (42)	-
			9,571.8 (59.0)
TOTAL	**63,108 (100)**	**31,963.3 (100)**	**16,215.8 (100)**

Source: Field Survey, 2004.

4.9.2 ECONOMIC PERFORMANCE OF FISH FARMS

Break-even analysis was used to measure the level of price and production at which fish farm operates. The result are presented on Table 4.9.1 The breakdown price ranged from ₦49.50 to ₦72.70 with a mean of ₦62.00 ±9.56SD Also, the breakdown of production showed a range of 347.8kg and 397.5kg/ha with the mean of 378.4kg ± 23.96kg/ha for Kwara State.

TABLE 4.9.1: ECONOMIC PERFORMANCE OF FISH FARM

ADP ZONES	BREAK-EVEN PRICE (₦)	BREAK-EVEN PRODUCTION (KG)
A	72.70	397.5
B	63.90	397.5
C	49.50	347.8
D	61.80	370.9
Mean	62.0	378.4
SD	9.56	23.9

Source: Field Survey 2004.

4.9.3 FISH FARM SIZE AND YIELD

The mean yield/ha of fish farm is presented on Table 4.11 which ranged between 1530kg and 2250kg/ha. Zone C had the highest yield/ha (2250kg) and it had a mean farm size of o.75ha. Followed by Zone D (1800kg/ha) with a mean farm size of 0.60ha

and Zone B (1740kg/ha) with a mean farm size of 0.58ha. Zone A had a mean size of 0.51ha.

Table 4.11 also showed the overall mean farm size 0.16±0.01. and a mean yield of 1830±302.9 respectively.

The result of survey showed significant ($r = 0.77$ $p < 0.05$) relationship between fish farm size and yield/ha. Land is just one of the several factors that determines the productivity of fish farm. Gempesaw II *et al* (1992) stressed that the economic selection of optimal pond size is characteristics by four factors, firstly, the costs of both land and equipment which involved monetary investment, secondly, the fixed assets (usually non reversible). Thirdly, the returns from the pond investment may take several years to occur and finally, capital investment in ponds and equipment which implies that the revenue may be received over difficult time period.

Although, there is no broad answer to the optimal size of pond, but the larger the pond size the lower the cost of construction per unit of water area and the greater the efficiency in land utilization (shang 1984). National weather condition may also affect the mortality rates and yield per hectare. The size of fish pond can affect

the level of control by the farmer especially in harvesting. The smaller the pond size the easier the level of management though the construction costs are relatively high.

TABLE 4.11: FISH FARM SIZE AND YIELD/HA

ADP ZONES	MEAN FARM SIZE (HA)	YIELD/HA (KG)
A	0.51	1530
B	0.58	1740
C	0.75	2250
D	0.60	1800
Mean	0.61	1830
SD	0.10	302.9

Source: Field Survey 2004.

4.9.4 FISH MARKETING

An effective marketing process is very important in fish farming business for a successful marketing strategy. Fish farmers must identify effective marketing channels since fish is a perishable product. Diallo *et al.* (1997) highlighted the channels as nature of product, the buyer and the quantities involved. Based on the study, it shows that fish farmers in the state did not experience difficulties in marketing their fish products. Although, there were variations in per caput fish consumption between urban centres and villages in the

same area, influence of price, income, and consumers' preference, had some effect on the price of fish in the state. Adeyemo (1986) revealed that there were three established distributing channels as: (a) traders with cold storage (b) traders of riverine or fish farm site and (c) road side retail traders. The last two categories are relevant to fish farming industry in the state because there are no sufficient fish to store for a long time, and besides most of the fishes caught are sold alive or at least when freshly killed.

4.12 PROFITABILITY

The results presented on Table 4.8 showed that fish farming business is profitable in Kwara State. The profit shown in the study ranged between ₦112,399.10 and ₦194.248.80. Zone C had the highest mean profit of ₦194,248.80. This could be due to proximity of the zone to the State Capital (Ilorin) where commercial activities were high. In the same vein, the low productivity recorded in Zone A compared with others could be due to the fact that fisheries business has not been properly embraced in the area; and could also be due to low population density and lack of infrastructures in the area. For fish culture to be profitable, technical information on biological

requirements of the species to be cultured is very paramount. Shang (1984) observed that for aquaculture to realize its potentials it should be technically, economically and socially visible in a given area.

4.9.6 CORRELATION BETWEEN FISH FARMING CONSTRAINTS

The result on Table 4.13 showed positive correlation between most of observed constraints across the state. The significant relationship ranged from $r = 0.77$, $p < 0.05$ to $r = 0.94$, $p < 0.05$. The highest correlation were recorded between Lack of fund/credit facility and high cost of input and lack of infrastructure and high cost of pond construction equipment ($r = 0.92$. $p < 0.05$). Lack of fund/credit facility and high cost of pond construction equipment recorded significant relationship of $r = 0.91$, $p < 0.05$. High cost of input and lack of infrastructure also has significant relationship $r = 0.90$, $p<0.05$. Inadequate extension services and lack of pond construction equipment also had correlation ($r = 0.85$, $p<0.05$). Lack of fund/credit facility also correlated with inadequate extension services. ($r = 0.77$, $p<0.05$). The table also showed significant association between lack of infrastructure and inadequate extension services.

4.9.7 CONSTRAINTS OF FISH FARMING IN KWARA STATE

The result showed on Table 4.14 explained the constraints to fish farming industry in the state. The major constraint was lack of fund/credit facilities (24.0%). Olaniyi (1986) identified limited fund as a major constraint. Okoye (1986) observed that banking institutions always feel reluctant to fund aquaculture projects as in other projects. The reason could be due to the long term gain experienced in agricultural projects. Another reason could be due to lack of collateral. Also loan application analysts are not technically competent to assess loan application in banks (Okoye 1986).

High cost of input (21.6%) is another constraint. Madu *et al* (1986), and William (1986) saw insufficient production of fingerlings of cultivated fish species as a major constraint to aquaculture development in Nigeria. The demand for fingerlings has been estimated at over 18million per annum, but less than 2% of this demand could be met at present (Madu, 1986). The exorbitant prices of inorganic fertilizers and feed ingredients are constituting problems to aquaculture development.

Also observed was high cost of pond construction equipment (19.37). As major constraints to aquaculture development, construction equipment were insufficient and are very expensive to hire in Nigeria (Ayinla, 1991). Lack of infrastructure (12.5%) like land, access roads, vehicles, electricity have also constituted problems in the industry. Land tenure system have since been one of the major problems militating against effective agriculture and rural development in Nigeria (Ajayi and Bajyeri, 1997).

Land acquisition in Kwara State is mainly through family and inheritance. Thus, non-utilization of vast suitable land for aquaculture purpose existed in area with low population density. Other problem is inadequate extension services. It was observed that fisheries development has not been given the desired recognition in the state. until very recently when the department was given a full fledge directorate. This we belief as time goes on would improve the shortage of fisheries personnel in the state. Wade and Ufodike (1986) identified shortage of manpower as an impediment to aquaculture. The Unified Agricultural Extension System (UAES) has not made the expected impact on aquacultural development in the state.

Aguacultural services are highly technical and should be handled only by those trained on the field

Non-profitability and lack of interest are the least on the Table with 2.4% and 1.6% respectively. It is necessary to have knowledge of economic returns from the existing fish farms and plan accordingly for the success of the enterprise.

Significant correlation existed between most of these constraints in the state. This relationship ranged between $r = 0.77$, $p<0.05$ and $r = .94$, $p<0.05$. This showed that the constraints are dependent on each other. Therefore, solution to any of them cannot be said to be appropriate without an attempt to have solution to all at the same time. Despite these constraints there were growing interest in fish farming in the state. In order to keep these interest burning, there is a need to find lasting solutions to the constraints enumerated.

BLE 4.13: CORRELATION BETWEEN FISH FARMING CONSTRAINT IN KWARA STATE

Constraints	CONSTRAINT						
	1	2	3	4	5	6	7
1		0.94*	0.90*	0.77*	0.91*	0.49^{ns}	0.12^{ns}
2			0.86*	0.84*	0.89*	0.46^{ns}	0.23^{ns}
3				0.77*	0.92*	0.43^{ns}	0.05^{ns}
4					0.85*	0.06^{ns}	0.18^{ns}
5						0.22^{ns}	0.30^{ns}
6							0.16^{ns}

(1) Lack of fund/credit facility

(2) High cost of Input

(3) Lack of Infrastructure

(4) Inadequate Extension Services

(5) Lack of Pond Construction Equipment

(6) Non-Profitability

(7) Lack of Interest

* - Significant Correlation ($P<0.05$)

NS – Not Significant.

TABLE 4.14 PERCENTAGE DISTRIBUTION OF FISH FARMING CONSTRAINT IN KWARA STATE

LGA	1	2	3	4	5	6	7
A							
Kiama – A	66.7	66.7	33.3	33.3	66.7	0	0
B							
Edu B	28.6	42.9	14.3	28.6	28.6	0	0
Patigi	57.1	57.1	28.6	14.3	42.9	14.2	0
C							
Ilorin West	25.8	18.8	8.3	6.3	14.6	4.1	4.2
Ilorin East.	14.6	10.4	10.4	4.2	8.3	0	0
Ilorin South C	18.8	12.5	14.6	10.4	16.7	4.1	2.1
Moro	12.5	8.3	4.1	2.1	4.2	0	0
Asa	18.8	10.4	8.3	4.2	10.4	4.1	2.1
D							
Isin	8.3	4.2	0	0	4.2	0	0
Irepodun	25.0	16.7	12.5	4.2	4.1	4.2	8.3
Ifelodun D	12.5	8.3	16.7	8.3	20.8	0	4.1
Offa	12.5	12.5	8.3	0	12.5	0	0
Oyun	18.6	12.5	8.3	0	16.7	0	0
Mean	24.6	21.6	12.5	8.9	19.3	2.4	1.6
SD	17.7	157	9.2	10.7	17.9	4.1	2.6
CV%							

(1) Lack of fund/credit facility

(2) High cost of Input

(3) Lack of Infrastructure

(4) Inadequate Extension Services

(5) Lack of Pond Construction Equipment

(6) Non-Profitability

(7) Lack of Interest

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY OF THE MAJOR FINDINGS

Summary of major findings of this study and their implications are presented below:

1. Fish farming is a profitable enterprise operated by farmers in the study area more than 47.1% of whom were above 40years. The implication of this finding is that all forms of extension programmes (modern agriculture operations) could easily be assimilated and put into practice by the age group.
2. A greater proportion of the farmers (59.7%) had post-secondary education, hence they would be able to learn and utilize fast any new technology which could ensure economic survival of aquaculture business. However, the greater proportion of fish farmers (67.4%) that had less than 10years experience in fish farming could have a negative effect on the aquaculture business because of their limited experience. which would affect feeding, fertilization, stocking and other management of farms. But the interest of this group could be accomplished by

meaningful programmes inform of enlightenment campaigns In the same vein, a greater percentage of fish farmers (87.0%) are married and possibly with children. The implication of this is that the farmers would enjoy the assistance of members of the family in the management of the farm, thereby increasing the yield of the farm.

3. The profitability of a fish farming in the state ranged from ₦112,399.1 and ₦194,248.8/ha. The reliability of basic inputs and output figures depended on economic, technical and managerial factors. Therefore, they are capable of affecting the expected returns from the level of production per unit of water area and cost of production.

4. The study also recorded some production constraints which included, lack of fund/credit facility (24.6%), high cost of input (21.5%), lack of infrastructural (12.5%), inadequate extension services (8.9%). Lack of pond construction equipment (19.3%), non-profitability (2.4%) and lack of interest (1.6%). To alleviate some of these problems, a critical look must be taken at some badly planned and under funded government owned

aquaculture projects so as to serve as models to convince farmers of the viability of the aquaculture venture.

5.2 CONCLUSION

The contribution of aquaculture to national development can not be over-emphasized. An assessment of the technology and economic of fish farming in Kwara state has shown that the state has not reached her full potential in aquacultural production. The prevailing situation in many fish farms in the state has encouraged high productivity of aquaculture projects and as such efforts should be intensified to enhance various technological concept for greater economic break through.

5.3 RECOMMENDATION

It is also noticed that a number of aquacultural constraints could affect the economic viability of aquacultural projects if prompt and proper attention are not taken to profer solutions. The presence of aquacultural potential in the state is posing a great challenge to prospective fish farmers to arise and harness the naturally endowed resources. Therefore, the following recommendations were made:

(1) Majority of the respondents were faced with many farm production problems such as lack of capital, land acquisition problem, high cost of inputs, lack of pond construction equipments, lack of inputs, inadequate infrastrure and extension services etc. In order to alleviate these problems, government/organizations/agencies should come to the aid of the farmers, land tenure system should be reviewed to allow fish farmers to have assess to suitable areas of land without any problem, cooperatives/ financial houses could assist farmers, raise loan, problem of aquaculture inputs like feed, seed and fishing gear could be minimized if feed mills, hatcheries etc are established close to the farmers. Locally invented construction equipments and human labour could alleviate the problems of construction equipment's while the problem of in-adequate extension services could be minimized by fish farmers themselves attending workshops, lectures and seminars organized by organizations and other agencies so as not to wait for extension officers, more extension agents could

also be employed by the appropriate organizations to minimize the problem.

(2) A great proportion (67.4%) of the fish farmers had less than 10 years pond management experience. The conclusion here is that meaningful strategies (for examples, holding frequent meetings, workshops, seminars with the farmers, supply of fingerlings, fish feed, netting materials at highly subsidized rate) should be embarked upon by the concerned agencies /organizations and/or government for the purpose of encouraging and re-kindling the interest of the fish farmers. Fishery Science could also be incorporated into the secondary school as a component in agricultural science while higher institutions are encouraged to establish fish farms to serve as research centre

The findings of this study, showed that fish farming is a viable and profitable investment in Kwara State. Investing in aquaculture will provide much needed animal protein for a large population. The result of the findings also showed that there were growing interest in fish farming in the state. However, this interest can only be sustained

when all the constraints peculiar to the sub-sector in the state are properly addressed.

Fish farming is still at its teething stage unlike forestry and veterinary, hence, its evaluation at the macro-economic level at this time will be premature. The sub-sector should be evaluated in terms of sustainability, socio-economic value and roles in household food production.

If all the aforementioned recommendations are addressed, fish farming industry as a sub-sector of agriculture will witness a tremendous development in Kwara State.

REFERENCES

Adeyemo .R (1986). The power fish association in the marketing of fish in Lagos State in E.O. Ita (ed) *Proceedings of the 3rd Annual Conference of the Fisheries Society of Nigeria (FISON)* pp. 137 – 140.

Ayinla, O. A. (1991). Economic of fish farming "In *Proc. Of the fish seed propagation course)* African Regional Aquaculture Centre (ARAC) Nigerian institute for oceanography andmarne research (NIOMR) Aluu. Port-Harcourt 14th – 28th Augus 1991, PP. 88-92.

Ayinla, O. A. and Idoniboye Obu T.I.E (1987). Basic principles of feed formulation. *Proceedings of the Aquaculture Training Programme* (ATP) African Aquaculture Centre (ARAC) Allu, NIOMR, Port Harcourt Nigeria pp. 85-88.

Akegbejo – Samson, (1999) "Growth response and nutrient digestibility by *Clarias gariepinus* fed varying levels of dietary periwinkle flesh as replacement of fish meal in low-cash diets". In *Applied Tropical Agriculture* Vol. 4 No 1 June 4 (1):37-41

Ajayi A. R. and Baiyeri K. P. (1997). Socio-economic characteristics and production constraints of *Musa* producers in a sub-humid zone of Nigeria *Applied Tropical Agriculture* 2. 102 – 109.

Acheampang. A. (1996). "Will the new. food security programme and fisheries go together" EC Fisheries Cooperation Bulletin 9 (2) 6-7

Ajayi A.P. and Baiyeri K.P (1997) socio-economic characteristics and production constraints of Musa producers in sub- human zones of Nigeria Applied tropical Aguaculture 10 (2) 102-109

Berg. Fran Vanden (1996). "The Private Sector. A Potential Key Element in the Development of small-scale Agriculture in Africa. Lesson from Madagascar" *FAO Aquaculture Newsletter(* 12): 14-16 pp. 14 –16.

Bard, J. Lazard, J. Lemasson. J. and Lessent. P. (1967) the hand book of tropical fish culture. Centre technique forestier tropical. Nogent-surmarn-france pp129

Chacroff M. (1976). "Fresh water fish pond culture and management" *APCP Training Journal Manual* Series No IBVITA series No. 36E p. 196.

Diallo, M. M., Frantrel, R. P. and Solie, K. (1997). "Fish marketing in Guinea Identification of marketing channels" EC . Fisheries cooperation Bulletin . 10 (2):10 1997 pp. 10.

Eyo, A.A (2001) fish processing Technology in the Tropical

national institute for fresh water fishiness research

new Bussa Nigeria. P.P 1-10

Enerience G. (1984). Some Biological and Economic Consideration in

Tropical Fishculture. Unpublished Msc seminar. Dept of Zoology, University of Jos Nigeria pp. 38 – 46.

Egwu O. C. (1987). Homestead Concrete Fish Pond, Construction and Management Techniques. *Proceeding of the Aquaculture Training Programme* (ATP) conducted by ARAC, ALLU, NIOMR Port Harcout. pp.31-36.

Ezenwa B. I. O. (1994). Agriculture development and research in Sub-Sahara Africa" National Review *CIFA Technical Paper* (23)45 – 73.

FAO (1998). Aquaculture production statistical 1984 – 1993 *Food*

and Agricultural organization. (FAO) fisheries

circular No 515 Rev. 7 Rome p. 186

FAO/FIDI (1995) Aguaculture production statistics 1984-93 *FAO fisheries circular* No 815 Rev:7 Rome
pp 186

Fatunroti, E.O and Obasa, S. O. (1992). Growth responses and yield of *Heterotis nilotica* on artificial diet" in *Proc. Of the 10th Annual Conference, of the FISON*, Abeokua 16th – 20th Nov. 1992 pp 87 – 93.

Gempesaw C. M., Bacon J. R. and Wirth. F. F, (1992). Economics of pond size for hybrid stripped Bass growout *Journal of World Aquacultures society* 23 (1): 15

Ita E. O. (1993) Inland fisheries resources of Nigeria *CIFA Occasional Paper* No 20 FAO Rome, pp. 120.

Ita, E. O. (1986). Reservoir, Lake and River fisheries management and investment opportunities, fisheries enterprises and information brochure. In com of the 5th Annual Conference FISON, Ilorin. Sept. 1986 pp. 4-6.

Igben, M.S (1988) farmers' capability profile in Nigerian farmers and Agricultural institutions an Assessment NISER, Ibadan, Nigeria pp 67-92

Jean-Francois .A. (1996) "Research for Development: The genetics programme "*EC. Fisheries Cooperation Bulletin* Vol. 9 No. 3 Sept. 1996. pp.16.

Kummer .D. (1990). Fish culture in undrainable ponds. A manual for extension. *FAO Fisheries Technical Paper* 325. pp.1-3.

KWADP, (1998) Off Field Adaptive Research Extension Reports Kwara Agriculture Development, Ilorin pp 1-9.

Little, D. and Muri J. (1987). *A Guide to Integrated Warm Water Aquaculture* Institute of Aquaculture Publication, University of Sterling FK 94LA Scotland p. 238.

Logsdon .G. (1978). *Getting Food from Water. A Guide to Backyard Aquaculture.* Rhodate Press Inc. pp. 371.

Lovell, .T. (1989). *Nutrition and Feeding of fish.* Auburn University, Published by Van Nostrand Reinhold, New York 260.

Madu, CT, Okoye, F.C and Ita, E.O (1986) Commercial Production of Clarias fry and fingerlings in indoor and outdoor concrete tank systems. In *proc. 5th Annual conference FISON,* Ilorin 22nd – 25th Sept. 1986 pp. 181 – 186.

Needom J. G (1987). Pond Engineering and Survey. *Proceeding of the Aquaculture Training Programme* (ATP) African Regional Aguaculture Certre (ARAC,) ALLU, NIOMR Port Harcourt pp. 37 – 41.

Olaniyi AO.A (1986)" credit financing of Aguaculture Porgrammes: A *Review in Proc. 5th Annual Conference FISON Ilorin* sept. 22nd- 25th 1986 pp 339-347

Ojo, C. T., Okoye, F. C. and Ita, E. O. (1986), Investment prospects in the Production of Common Carp (Cyprinus carpio) fingerlings in fresh water ponds *"In Proc. 5th Annual Conference FISON Ilorin* 22nd – 25th Sept. 1986 pp. 187 – 193.

Okoye, F.C. (1986)"Fish pond culture" Fisheries enterprise and *Information Brochure. 5th Annual conference of FISON,* New Bussa pp.11.

Okomoda (1995). "Impact Assessment of the NIFFR Extension Demonstration of Homestead Fish Pond Culture" *1994 Annual Report NIFFR,* New Bussa pp. 163 – 164.

Otubusin S.O (1986) " small-scale commercial production of Tilapia fingerlings in floating Bamboonet-hapas" In: *pro. 5th Annual Conference, FISON* Ilorin pp 164-173

Osajuyigbe .O. (1981). Public investment on Fisheries in Nigeria *M.Sc.* thesis, Department of Agriculture. Economic University of Ife, Ile-Ife, Nigeria. pp 32

Ogunniran Y.A (2000) Economic analysis of fish production in Kwara State. *M. Tech thesis.* 2000 Department of Agriculture, Federal University of Technology Akure. Pp.20-28

Shang, Y, C. (1984). Economic aspects of aquafarm construction and maintenance west view press Inc. London. England pp. 540 – 548.

Shimang, G. N (1990). Status Review of Aquaculture Development in Nigeria, Federal Department of Fisheries Abuja pp. 7-9.

Trait R. V. (1978). Element of Marine Ecology. An Introductory Course Butterworths, London, Boston Sydney. Reprinted . pp. 274 – 278.

Tobor J.G (1994): A fisheries policy for Nigeria, *paper presented at FISON Quarterly public lecture* in Lagos, 10th June 1994. Published by NIOMR- Technical paper No 97. Pp. 22

Williams S. B. (1986) "fish farming in Anambra State Economic Criteria" *in Proc. 5th Annual conference of the FISON* Ilorin. Sept. 22nd –25th 1986 pp. 358 – 364.

Wade, J.W and Ufodike E.B.C (1986)" Investment prospects of fish farming in the Jos-plateaus Nigeria" FISON *proc. 5th Annual Conference of theFISON* Ilorin sept 22nd-25th 1986 pp 300-315

APPENDIX I

QUESTIONNAIRE TO INVESTIGATE THE TECHNOLOGY AND ECONOMIC'S OF FISH FARMING KWARA STATE, NIGERIA

NOTE:-

- Please endeavour to give correct and accurate answers to these questions.
- All information gathered shall be treated privately and for the purpose of the research only.
- Please write all information legibly and or underline the applicable answers.

Date:.....

A. PERSONAL DATA OF RESPONDENT

1. Name of respondent.....
2. Occupation (a) Farming (b) Civil Servant (c) Trading (d) Self Employed.
3. Age.....(a) Owner (b) Employee
4. Level of Education: (a) Primary (b) Secondary (c) University/Polytechnic (d) others (specify).....

5. Marital Status (a) Married (b) Single

6. Experience in Pond Management .....

7. Do you belong to any society (a) Farmers Coop. Society, (b) FISON (c) Thrift credit coop. (d) others (specify).....

B. FISH FARM DATA

1. Location – Town ..... LGA.....ADP ZONE.....

2. Year of establishment .....

3. Source of fund for the project: (a) Personal saving, (b) Govt. Loan (c) Bank Loan (d) others (specify).....

4. Size of the farm and number of ponds

POND	NUMBER	SIZE
i. Production Pond	.....	.....
ii. Nursery Pond	.....	.....
iii. Rearing Pond	.....	.....
iv. Concrete Pond	.....	.....
v. Brood Stock Pond	.....	.....
vi. Reservoir	.....	.....
vii. Building Structures	.....	.....
viii. Unused Land	.....	.....
Total	.....	.....

5. Type of pond i. Earthen Concrete

ii. Earthen No _____Size_____

ii. Concrete No_____ Size_____

6. Source of water supply (a) Stream/River, (b) Underground (spring) (c) Rain (d) Well (e) others (specify).....

7. Type of soil:- (Based on responces) (a) Sandy soil (b) Pure Clay (c) Sandy Clay (d) Rock (e) Loamy Soil

8. Topography:- Based on responces (a) Gentle Slope (b) Flat Basic (c) Steep Slope

9. Cost of acquiring the site (a) ₦5,000 – ₦20,000 (b) ₦20,000 – ₦40,000 (c) ₦40,000 – ₦50,000 (d) ₦50,000 and above (e) free(specify).....

D. MANAGEMENT

1. Type of culture – (a) Mono-culture, (b) Poly-culture (c)Mononsex-culture (d) other (specify).....

2. Type of fish stocked (a) clariids (b) Tilapia spp. (c) Heterotis sp. (d) CyprinusCarpio (e) others (specify)....

What is the total number of fish stocked?. (a) 500 – 1,000 (b) 1,000-2,000 (c) 2,000 – 3,00 (d) 3,000 and above (e) others (specify).....

Where did you source your stock (a) Hatching (b) Wild (c) others (specify).....

At what stage did you stock (a) fry (b) juvenile (c) fingerlings (d) post fingerling.

How mush does it cost to produce these fishes

SPECIES	NUMBER	UNIT PRICE	TOTAL PRICE
Lates niloticus			
Heteriotis niloticus			
Cichilids			
Clariids			
Others			
TOTAL			

i. What culture practise did you employ? (a) intensive (b)extensive

ii. If intensive what type of supplementary feed do you use? (a) compound diet/pellets (b) local available feed stuffs (c) natural foods.

iii. if natural food what type? (a) insect larvae (b) maggots (c) animal intestine (d) animal carcass (e) all of the above.

8. Do you fertilize your ponds (a) Yes (b) No

   i. If yes, which type of fertilizer do you use? (a) Organic (b) Inorganic, if inorganic what type? (a) NPK (b) Urea (c) super phosphate (e) other (specify).

9. Do you use lime? (a) Yes (b) No

   i. If yes, what type of lime do you use? (a) Agric lime($CaCO_3$) (b) Quick lime ($Ca(OH)_2$) (d) Calcium Cyonamide ($CaCN_2$)

10. How do you acquire knowledge of feeding, fertilizing and liming? (a) Experience (b) extension agent (c) literature (d) training.

11. Cost analysis of basic inputs.

INGREDIENTS	UNIT COST(KG)	QUANTITY USED (KG/HA)	TOTAL COST
(i) FEED STUFF Maize Groundnut Soyabeans Ricebran Bonemeal Bloodmeal (ii) FERTILIZER (iii) LIME			

12. What is the annual salary range for categories of workers? (a) ₦2,000 – ₦5,000 (b) ₦5,000 – ₦10,000 (c) ₦10,000 – ₦15,000 (d) ₦15,000 – ₦20,000 (e) ₦20,000 and above.

13. What is the average hours spent on the farm by you and your family members per week? (a) 1-2hours (b) 2-3hours (c) 3-4hours (d) 5 hours and above.

14. How often do you harvest? (a) Annually (b) Festival periods (c) any time for consumption customers.

15. What type of harvest? (a) Partial cropping (b) Total cropping

16. What type of gear do you use? (a) Gill nets (b) draw nets (c) cast nets (d) hook/hook lime (e) traps.

17. What is the average quantity of fish harvested annually? (a) Less than 1 ton (b) 1-2Tonnes (c) 2-3tonnes (d)3-4tonnes (e) 4tonnes and above.

RKETING/REVENUE

How do you market your product? (a) Direct sale (b) cooperative sale (c) others (specify).....

In what condition do you sell your fish (a) fresh (b) cured

What is the mode of payment? (a) cash (b) credit (c) settlement of loan (d) others (specify).....

How much do you realize from the sales annually?

(a) ₦1,000 – ₦10,000 (b) ₦10,000 – ₦20,000

(c) ₦20,000 – ₦30,000 (d) ₦30,000 and above

Would you consider aquaculture business profitable (a) Yes (b) No.

What is the average profit made per annum?

.....

ROBLEMS AND SUGGESTIONS

What are the problems encountered in the aquaculture business?.....

.....

.....

.....

In what ways could government help to improve aquaculture business.....

.....

.....

.....

General comments/advise on how to improve aquaculture in Kwara State and Nigeria.....

.....

.....

.....

APPENDIX II

LIST OF THE FARMERS,LOCATION, AND SIZE OF FISH FARMS IN KWARA STATE.

NAVIC farm, Koko, - 2ha.

Pioneer fish pond Otte – 0.5ha

Ekundayo fish pond GRA Ilorin – 0.5ha

Asa LGA fish farm Afon – 0.5ha

Ilesanmi fish farm Tanke, Ilorin – 0.5ha

Salem fish farm Oke Ose, Ilorin – 2.6ha

Adoration Sisters (catholic farm). Sango Ilorin -0.5ha

Ella fish pond-patigi – 0.3ha

Abdulkadir J. fish pond– 0.4 ha

Rev.Fr (Dr) frante (catholic farm) – 0.3 2ha

Brig. Jubril farm, Tampafu patigi – 0.8 3ha

Darosa fish farm Geri Alimi Ilorin -1ha

Alaran fish pond Aran orin – 0.1ha

Ajasepo High school fish farm, Ajasepo – 2ha

U.B. Abu farm Ilesha Baruba – 0.2ha

Sharon fish farm, Agbonda –3ha

De-Johnson fish pond Apata Yakuba – 0.5ha

Diskabog fish farm, Aiyepe Ilorin- 3ha

Olawepo fish farm Agbamu – 3ha

Timothy fish pond Agbonda – 0.2ha

Alhaj. Saka Saadu, fish pond Lasoju, Ilorin- 2.5ha

NEFRADAY farms Lasoju, Ilorin- 13.0ha

Dr Oyedepo fish pond fate, Ilorin – 0.02ha

Dodondawa fish farm Egi-Oyopo- 1ha

Shaaba fish farm Ilorin – 1.1ha

Mr R. Bello fish Pond, Tanke Ilorin – 0.25ha

S. Olomu fish Pond – Offa road, Ilorin- 0.5ha

Ijara- Isin High school farm Ijara-Isin – 0.2ha

Dn Olakunle fish pond, Tanke, Ilorin- 0.36ha

Tewogbola fish pond Ijagbo – 0.36ha

Dn Awopetu fish pond Gaa Akanbi, Ilorin – 0.25ha

Okin fish farm Offa -2ha

Chief Arosanyin fish pond Ilorin- 0.4ha

Mr Kola Abolarin fish pond GRA Ilorin – 0.16ha

Irepodun LGA fish pond Omuaran- 0.1ha

New Yidi Government fish farm, Ilorin- 1.2ha

Etsu Tsaragi fish pond Tsaragi- 0.2ha

Akintola fish pond Igbaja – 0.2ha

S.O. farm Egbejila, Ilorin- 0. 9ha

Demosco fish ponds erinile-5ha

Dr Oloruntobi fish pond GRA Ilorin- 0.25ha

Nigeria Air port Authority Reservour, Ilorin- 1ha

Mr Adisa fish pond, Ilorin- 0.2ha

Fatsonic farms Offa -2.ha

Mr J. Olawoyin fish pond, Offa- 0.75ha.

Lata community farm, lata, pategi- 0.4ha

Dr Oyedepo fish pond fate, Ilorin- 0.01ha

Ololade fish pond, GRA, Ilorin- 0.03ha

Alhaji Abubakar farm, shiya, kanma- 0.1ha.

Mr Tiamiyu fish pond, Ilorin -0.15ha

Rogun community farm Rogun, Pategi- 0.25ha

Engineer Omosewo fish pond Basin road, Ilorin -0.18 m^2

Animasahun fish pond, Ilorin- 0.120ha

Mr deji Aina fish pond GRA Ilorin -0.05ha

Mrs sadiku fish pond, stadun road, Ilorin- 0.16ha

Oniyangi fish pond GRA Ilorin -150m^2

Mr J. Olanrewaju fish pond kulende Ilorin -100m^2

Ipetu fish pond Ipetu- 2ha

Mr Shina Yusuf fish farm, New Yidi Ilorin- 2ha

Dr Alao fish pond Odota, Ilorin -300m^2

Mt carmel college fish pond Ilorin- 0.6ha

Mr Olaniyi fish pond Oloje, Ilorin -0.5ha

Mr S. Olomu, Offa road, Ilorin- 0.2ha

Dn Olakunle Tanke Ilorin- 36m^2

Mr Olayide Olumade fish pond Omupo- 0.05ha

Mr Adebayo farms Offa -0.50ha

Mr Tiamiyu fish pond Ilorin- 0.1ha

Late Col. Rani fish pond Pategi- 0.15ha

Oyeloti fish farm. Esie- 3ha

Osi community Dam Osi- 1ha

Omuaran community Dam, Omuaran- 5ha

Ayoola (carpet) farms Offa- 6ha

Mr Aroyemi fish pond, Igbaja -0.1ha