International Journal of Fisheries and Aquaculture Vol. 4(4), pp. 63-70, 9 March, 2012
Available online at http://www.academicjournals.org/IJFA
DOI: 10.5897/IJFA11.013
ISSN 2006-9839 ©2012 Academic Journals

Full Length Research Paper

Economic analysis of fish hatchery operations in Ogun State, Nigeria

Olaoye Olalekan Jacob[1]* and Oke Abdulfatai Olubukola[2]

[1]Agricultural Media Resources and Extension Centre, University of Agriculture, P. M. B 2240, Abeokuta, Ogun State, Nigeria.
[2]Department of Aquaculture and Fisheries Management, University of Agriculture, P. M. B 2240, Abeokuta, Ogun State, Nigeria.

Accepted 4 May, 2011

This paper examines the cost and returns, and the determinants of fish hatchery operations in agricultural extension zones of Ogun state. The simple random sampling method was used in selecting 120 fish hatchery operators out of 388 registered ones using multi-stage sampling techniques. The primary data were collected in 2010 production season with the aid of well-structured, validated and pre-tested interview guides, administered through face to face interview and direct observations so as to elicit information from the fish breeders. The data collected were analyzed using descriptive statistics and budgeting technique. The mean total income of ₦1,088,933.3, ₦1,072,133.3, ₦1,122,166.7 and ₦976,151.3 were generated on sales of fish seeds in the zones, respectively. The Benefit-Cost ratio of 1.4, 2.1, 2.6 and 2.8 in the four zones, respectively indicated that fish hatchery operations were profitable and viable enterprises. Poor marketing, poor genetic brood stocks, high inflation rate in the economy, poor infrastructural facilities and lack of finance were the major constraints hindering fish seeds production and development. Hence, hatchery operations are profitable and viable enterprises. There is a need for the establishment of brood stock banks to ensure genetically improved fish seed availability, provision of infrastructural facilities by the government and improve marketing strategy for fish seed.

Key words: Fish hatchery operations, fish seed, cost, profitability, Ogun State.

INTRODUCTION

Fisheries occupy a unique position in the agricultural sector of the Nigerian economy. In terms of gross domestic product (GDP), the fisheries sub-sector has recorded the fastest growth rate in agriculture to the GDP. The contribution of the fisheries sub-sector to agriculture GDP was estimated as 4.0% in the year 2007, out of the total estimate of 40% being contributed by agriculture to GDP (FDF, 2008).

The Food and Agricultural Organization (2006) stated that Nigeria is a protein-deficient country. The protein deficiency in the diet can be primarily remedied through the consumption of either protein-rich plant or animal foodstuffs. Protein from animal sources is in short supply in Nigeria due to the rapid increase in human population annually as well as the decrease in livestock population due to several factors including diseases, desertification, drought, climate change, global warming, scarcity and high cost of quality feeds, poor genetic qualities, limited supply of indigenous breeds and avian flu disease (H_5N-1) which brought about mass mortality of poultry. These factors combined, have raised the cost of animal protein to a level that is almost beyond the reach of the ordinary citizen. This situation therefore has given rise to a considerable increase in the demand for fish to supplement the needed animal protein intake. Fish is an important source of protein to large teaming population of Nigeria. According to Adekoya and Miller (2004), fish and fish products constitute more than 60% of the total protein intake in adults especially in rural areas.

According to FAO (2006), to maintain the present per caput fish consumption level of 13 kg per year, 2.0 million

*Corresponding author. E-mail: olaoyejacob@yahoo.co.nz. Tel: +2348030609566.

metric tons of food fish would be required. It has been noted by some workers that the only means of meeting up with this annual fish demand for the country would be through a pragmatic option of intensive fish farming (Ezeri et al., 2009; Viveen et al., 1985).

From the economic point of view, fishery contributes to provision of employment and income generation. Fingerlings production can also act as a source of revenue to the state government in the form of tax collection. The steadily growing importance of fish farming has compelled improvement in the technologies necessary for securing the initial and basic requirement for productive aquaculture, namely: the production of fish seed for stocking. The high demand for fish products both at the household and industrial level have also stimulated local production. Fish culture today is hardly possible without the artificial propagation of fish seeds of preferred culturable fish species (Pillay, 1987). The need for the production of quality fish seed for stocking the fish ponds and natural water bodies has increased steadily (Brain and Army, 1980). Artificial propagation methods constitute the major practicable means of providing enough quality seed for rearing in confined fish enclosure waters such as fish ponds, reservoirs and lakes (Charo and Oirere, 2000).

The production of marketable fish begins with the stocking of fish fingerlings or juveniles into a rearing environment that assures optimum and rapid growth to allow harvest in the shortest possible time. The fish farmer has to obtain adequate number of young fish to meet his production goals. The possibility of obtaining quality fish seed in adequate numbers from natural sources are rather limited. Even the spawners which reproduce successfully in confined fish enclosure are propagated artificially. Apart from being able to obtain quality seed, the artificial propagation technique can also be used to develop strains superior to their ancestors by the methods of selective breeding and hybridization. Depending on the perfection of the system, at least 65% of the eggs produced can be raised to viable fingerlings as against less than 1% survival rate in natural breeding. It is through this method that out of season supplies of fingerlings are achieved.

Fish hatchery is the bedrock upon which true and sustainable fish farming can be built. This is because, as the adult and table sizes fish are sold out from ponds and reservoirs for food, young ones (fingerlings and juveniles) must be procured to replenish the stock. The successful development of the embryonic aquaculture industry in Nigeria is developing on the availability of sufficient number of high quality fish seed for stocking. Quality seed and fish feed are the essential components for the fish growth. At present, those in the fish production are aware of the relatively low supply of such seeds. In promoting seed supply, consideration should be given to the fact that small localized hatcheries, whilst delivering seed locally, can be more responsive to changing trends in demand, more economically flexible, and have lower start up costs. They can thus play an important role in the sustainability and equity of seed supply and in many cases may be more appropriate media for seed distribution than larger centralized seed supply systems (Graham, 2002). The potential negative impacts of genetics related brood-stock's management issues such as inbreeding, genetic drift, introgressive hybridization and unconscious selection have been well established that many, if not the majority, of aquaculture stocks have been negatively impacted by poor genetic management (Graham, 2002).

Availability of fish seed of the candidate species in adequate quantity is one of the most important factors for a sustainable and profitable fish farming which involves a number of management practices in the maintenance of quality in adequate number. The over-riding objective of a private fish hatchery operator is profit maximization. Therefore, the economic viability of the project is a very important requirement for the adoption of fish hatchery establishment.

Profile of fish hatcheries in Ogun State

Fish hatcheries in Ogun State have grown from the mere five (5) governmental fish seed centres and three (3) private owners of 1976 to 388 in 2008 (OGADEP, 2009) (Table 1). This growth in the fish hatcheries ownership is synchronous with the rapid development of fish culture (aquaculture) in Ogun State within the same period. Also, there is growth with this feature, considering the greater private sector presence in the fish farming business which has continued to make more demands on the technical support processes required (Olaoye et al., 2007).

The focus of this research work is to examine the cost and returns of fish hatchery practices in Ogun State of Nigeria. Specifically, the study attempts to:

1) Estimate the cost and returns, and hence, the profitability of fish hatchery operations.
2) Investigate the constraints associated with fish hatchery production.

RESEARCH METHODOLOGY

Study area

The study was conducted in Ogun State in South-western Nigeria. The state has a total population of 3,728,098 according to National Population Commission (NPC, 2006). The state is located in the rainforest vegetation belt of Nigeria within longitude 2° 45' E and 3° 55' E and latitudes 7° 01' N and 7° 8' N in the tropics. It is bounded in the west by Benin Republic, in the south by Lagos State and Atlantic Ocean, in the east by Ondo State, and in the north by Oyo State. It covers a land area of 16,409.28 km^2, less than two percent (2%) of the country's landmass (Olaoye et al., 2007).

Table 1. Ogun State fingerlings production from Year 2000 to 2008.

Years	Fish hatcheries (No.)	Fish hatchery production (No.)
2000	70	7,369,000
2001	75	11,405,800
2002	85	16,816,000
2003	102	43,069,385
2004	128	44,742,849
2005	180	75,759,000
2006	220	104,144,000
2007	304	118,622,000
2008	388	134,513,000

Source: OGADEP (Fisheries Unit), 2009.

The state has marine and riverine biotopes estimated at 173.8 km^2 (Adekoya, 2001; Ita and Sado, 1984) covering 12,482,640 ha, lacustrine biotopes totaling 4,404.35 ha and estuarine biotopes covering a total of 767.3 km^2 (Ayansanwo, 1999; Olaoye et al., 2007) and is well endowed with natural water bodies such as springs, perennial flowing rivers, lakes and brackish waters.

There are twenty Local Government Areas in the state. The capital of the state is Abeokuta. The main occupations of the people in the state are: agriculture, fishing, clothing, textiles and civil service. The state was divided into four Agricultural extension zones namely: Abeokuta, Ilaro, Ijebu-Ode and Ikenne (OGADEP, 2005).

The four agricultural zones are well known as best ecological suitable areas for fish production and hence the state is referred to as "the basket of fish for the nation" because of abundance of wetland with annual growth rate of 3% per annum. As at 2008, farmed fish produced by 6,664 productive fish farmers was found to be synchronous with the growth trend of aquaculture and the resources in Ogun State within the same period (OGADEP, 2009).

Sampling procedure and sample size

A multi-stage sampling technique was used. Thirty (30) Fish hatchery operators were selected from each of the four Agricultural Extension Zones in the state making a sample size of one hundred and twenty (120) respondents. This was based on the intensity of hatchery operators in the study areas.

In Abeokuta zone, four (4) agricultural extension blocks were purposively selected out of six blocks. There was a selection of eight (8) circles out of thirty five total circles using simple random sampling techniques across four (4) local government areas within the zone. In all, a total of thirty (30) respondents were selected from the sample frame of 107 hatcheries provided by fisheries unit of OGADEP using simple random sampling method.

In Ijebu-Ode zone, two (2) blocks were also selected purposively out of six extension blocks of the zone. There was a selection of six (6) viable circles out of the total of thirty five circles by using simple random sampling techniques to make a total of thirty (30) respondents out of the frame work of 114 hatcheries across two (2) local government areas in the zone.

In Ikenne zone, four (4) agricultural extension blocks were purposively selected in which eight (8) viable circles were also selected out of twenty five total circles using simple random sampling techniques. A total of thirty (30) respondents were selected out of the frame work of 114 hatcheries within the zone. This was done across three local government areas of the zone.

In Ilaro zone, three (3) blocks were selected purposively out of four extension blocks of the zone. Four (4) viable circles were also selected out of thirty (30) circles in the zone, using simple random sampling method. A total of thirty (30) respondents were selected from the frame work of 83 hatcheries across two (2) local government areas in the zone. This method was an adaptation of the method used by Apantaku et al., (2005), Fabusoro et al., (2007) and Olaoye (2010).

Sources and collection of data

The primary data were collected with the aid of a well structured interview guide from fish breeders in both private and government owned hatcheries in the state after validated by experts and pre-tested. Government published data, annual reports from Ogun State Agricultural Development Programme (OGADEP) and Federal Department of Fisheries (FDF) are the secondary data used.

Data analysis

Data obtained from the field were subjected to descriptive and budgeting technique.

Analysis of cost structure and returns

This was used to determine the profitability level of fish hatchery production.

Mathematically, $\prod = TR - TC$; Where $\prod$ = profit, TR = total revenue, TC = total cost.

The following profitability indicators were calculated:

1) Net farm income (NFI) = Total value of product (TVP) minus total fixed cost (TFC) minus total variable cost (TVC).
2) Rate of return to investment (RRTI) = (NFI/TCP) x 100%.
3) Return on fixed cost of production (RFC) or Gross margin (G.M) = Total value of production (TVP) minus total variable cost (TVC).
4) Rate of return on fixed cost (RRFC) = (RFC/TFC) x 100%
5) Rate of return on variable cost = (TVP – TFC)/TVC x 100%
6) Net margin = Total income – Total fixed cost.

TC = Total cost (sum total of both variable and fixed cost)
TR = Total revenue (product of output and unit price of output)
The variable inputs are items such as brood stock, chemicals, feed, hormone, labour etc.

Table 2. Distribution of fish hatchery operators by cost elements in fish breeding.

Zone	X (Mean) (N)	% of total cost
Abeokuta		
TVC	314132.7	41.47
TFC	443421.1	58.53
TC	757553.8	100.00
Total income	1088933.3	0.0
Gross margin (GM)	774800.7	0.0
Net farm income	413797.3	0.0
Net margin	645512.2	0.0
Ijebu-Ode		
TVC	251046.7	50.03
TFC	250717.4	49.97
TC	501764.1	0.0
Total income	1072133.3	0.0
Gross margin (GM)	821807	0.0
Net farm income	570370	0.0
Net margin	821415.9	0.0
Ikenne		
TVC	225153.2	52.62
TFC	202706.7	47.38
TC	427859.9	100.00
Total income	1122166.7	0.0
Gross margin (GM)	897013.5	0.0
Net farm income	755205.9	0.0
Net margin	919460.0	0.0
Ilaro		
TVC	158663.5	46.22
TFC	184597.3	53.78
TC	343260.8	100.00
Total income	976151.3	0.0
Gross margin (GM)	828999.4	0.0
Net farm income	644402.1	0.0
Net margin	791554.0	0.0

Source: Field survey (2010).

RESULTS AND DISCUSSION

The result examined the economic analysis of fish hatchery operations which spread across the four agricultural extension zones (Abeokuta, Ijebu-Ode, Ikenne, and Ilaro) of Ogun State.

Cost elements in fish breeding

The cost elements revealed that the total variable costs (TVC) constitute 41.47, 50.03, 52.62 and 46.22% of the total cost of production (TCP) while the total fixed cost (TFC) account for 58.53, 49.97, 47.38 and 53.78% in Abeokuta, Ijebu-Ode, Ikenne and Ilaro zones, respectively (Table 2).

Majority of the respondents across the four zones produced an average of 50,000 fish seed per month. This is in line with the submission of OGADEP (2009) that average production and distribution of fish seed per farmer per month is 31,576 in year 2008.

The study revealed that 20.0% of the respondents in Abeokuta, Ijebu-Ode and Ilaro zones respectively sold less than 25,000 pieces of fingerlings in their farm per cycle while 26.7% of the respondents in Ikenne zone sold the same number of fingerlings pieces. Also, in Abeokuta, Ijebu-Ode, Ikenne and Ilaro zones respectively, 20.0, 33.3, 43.3 and 26.7% of the respondents sold

Table 3. Other profitability indicators.

Zone	Ratio	Percentage
Abeokuta		
Benefit cost ratio (BCR)	1.4	0.0
Expense structure ratio (ESR)	0.59	0.0
Rate of return to investment (RRTI)	0.0	54.6
Rate of return to fixed cost (RRFC)	0.0	174.7
Rate of return to variable cost (RRVC)	0.0	333.9
Ijebu-Ode		
Benefit cost ratio (BCR)	2.1	0.0
Expense structure ratio (ESR)	0.50	0.0
Rate of return to investment (RRTI)	0.0	113.7
Rate of return to fixed cost (RRFC)	0.0	327.5
Rate of return to variable cost (RRVC)	0.0	327.2
Ikenne		
Benefit cost ratio (BCR)	2.6	0.0
Expense structure ratio (ESR)	0.47	0.0
Rate of return to investment (RRTI)	0.0	176.5
Rate of return to fixed cost (RRFC)	0.0	442.5
Rate of return to variable cost (RRVC)	0.0	408.4
Ilaro		
Benefit cost ratio (BCR)	2.8	0.0
Expense structure ratio (ESR)	0.54	0.0
Rate of return to investment (RRTI)	0.0	187.7
Rate of return to fixed cost (RRFC)	0.0	442.8
Rate of return to variable cost (RRVC)	0.0	498.9

Source: Field survey (2010).

fingerlings quantity within the range of 75,000 to 100,000 per cycle.

The average income of the respondents from the sales of fingerlings per cycle was between ₦200,000 to ₦299, 999. The survey revealed that majority of the respondents sold juvenile quantity that ranges between 5001 to 10,000 pieces in their farm per cycle.

The study indicated that majority of the respondents realized the income range between ₦400,000 to ₦499, 999 from the quantity of juvenile sold per cycle while the total income earned ranged between ₦ 250,001 to ₦500,000 per fish seed production cycle.

The respondents earned their incomes from the sales of fish seeds and other forms of livelihood taken as either primary or secondary occupation. It was therefore pertinent that the respondents brought in more profit to alleviate poverty.

The survey revealed that majority of the respondents (30.0, 20.0, 36.7 and 13.5%) in Abeokuta, Ijebu-Ode, Ikenne and Ilaro zones respectively earned total income that ranged between ₦ 250,001 to ₦ 500,000 per fish seed production cycle while 6.7% of the respondents across the four zones respectively earned total income that ranged between ₦1,000,001 to ₦1,250,000. However, the mean total income of the respondents from all forms of livelihood, fish breeding inclusive, in Abeokuta zone was ₦1,088,933.3, the gross margin was ₦774,800.7 and the net farm income was ₦413,797.3 while in Ijebu-Ode, Ikenne and Ilaro zones, the mean total income was ₦1,072,133.3, ₦1,122,166.7, ₦976,151.3, the gross margin was ₦821,807, ₦897013.5, ₦817487.8 and the net farm income was ₦507,370, ₦755,205.9 and ₦644,402.1 respectively. This agreed with the observation of Adegbite (2002) who stated that the established indicators abound to lend credence to the fact that about 80% of Nigeria's over 100 million population are barely existing even below the internationally recognized poverty line of $1 (About ₦135) per day, lacking a combination of food, shelter and clothing and operating within an extreme poverty bracket.

The mean total cost were ₦757,553.8, ₦501,764.1, ₦427,859.9 and ₦343,260.8 for Abeokuta, Ijebu-Ode, Ikenne and Ilaro zones respectively (Table 2). The BCR of 1.4, 2.1, 2.6 and 2.8 (Table 3) in Abeokuta, Ijebu-Ode,

Table 4. Percentage distribution of hatchery operators by constraints to fish seed production and development.

S\N	Problem	Very serious (4)		Serious (3)		Not a problem (2)		Do not know (1)	
		Frequency	%	Frequency	%	Frequency	%	Frequency	%
	Abeokuta Zone								
1	Disease and predators	3	10.0	9	30.0	17	56.7	1	3.3
2	Poor feed quality	2	6.7	8	26.7	20	66.7	0	0.0
3	Lack of finance	13	43.3	15	50.0	2	6.7	0	0.0
4	Lack of appropriate land	0	0.0	4	13.3	26	86.7	0	0.0
5	Old age / health status	0	0.0	0	0.0	28	93.3	2	6.7
6	Insufficient labour	0	0.0	10	33.3	20	66.7	0	0.0
7	Poaching	0	0.0	2	6.7	28	93.3	0	0.0
8	High inflation rate in the economy	12	40.0	17	56.7	1	3.3	0	0.0
9	High cost / lack of construction equipment	10	33.3	11	36.7	9	30.0	0	0.0
10	Marketing of fingerlings / juveniles	17	56.7	11	36.7	2	6.7	0	0.0
11	Poor genetic brood stock fish	3	10.0	8	26.7	19	63.3	0	0.0
12	High cost of brooders	7	23.3	19	63.3	4	13.3	0	0.0
	Ijebu-Ode Zone								
1	Disease and predators	0	0.0	6	20.0	24	80.0	0	0.0
2	Poor feed quality	0	0.0	4	13.3	26	86.7	0	0.0
3	Lack of finance	8	26.7	18	60.0	4	13.3	0	0.0
4	Lack of appropriate land	0	0.0	2	6.7	28	93.3	0	0.0
5	Old age / health status	0	0.0	28	93.3	2	6.7	30	100.0
6	Insufficient labour	2	6.7	2	6.7	26	86.7	0	0.0
7	Poaching	0	0.0			30	100.0	0	100.0
8	High inflation rate in the economy	14	46.7	12	40.0	4	13.3	0	0.0
9	High cost / lack of construction equipment	2	6.7	18	60.0	10	33.3	0	0.0
10	Marketing of fingerlings / juveniles	14	46.7	8	26.7	8	26.7	0	0.0
11	Poor genetic brood stock fish	4	13.3	16	53.3	10	33.3	0	0.0
12	High cost of brooders	6	20.0	22	73.3	2	6.7	0	0.0
	Ikenne Zone								
1	Disease and predators	15	50.0	4	13.3	11	36.7	0	0.0
2	Poor feed quality	0	0.0	9	30.0	21	70.0	0	0.0
3	Lack of finance	11	36.7	16	58.3	3	10.0	0	0.0
4	Lack of appropriate land	0	0.0	14	46.7	16	53.3	0	0.0
5	Old age / health status	0	0.0	4	13.3	26	86.7	0	0.0
6	Insufficient labour	0	0.0	14	46.7	16	53.3	0	0.0
7	Poaching	0	0.0	4	13.3	26	86.7	0	0.0
8	High inflation rate in the economy	22	73.3	8	26.7	0	0.0	0	0.0
9	High cost / lack of construction equipment	6	20.0	6	20.0	17	56.7	1	3.3
10	Marketing of fingerlings / juveniles	17	56.7	10	33.3	3	10.0	0	0.0
11	Poor genetic brood stock fish	2	6.7	17	56.7	11	36.7	0	0.0
12	High cost of brooders	6	20.0	22	73.3	2	6.7	0	0.0
	Ilaro Zone								
1	Disease and predators	6	20.0	12	40.0	12	40.0	0	0.0
2	Poor feed quality	0	0.0	6	20.0	24	80.0	0	0.0
3	Lack of finance	8	26.7	20	66.7	2	6.7	0	0.0
4	Lack of appropriate land	4	13.3	8	26.7	18	60.0	0	0.0
5	Old age / health status	0	0.0	0	0.0	28	93.3	2	6.7
6	Insufficient labour	0	0.0	8	26.7	27	73.3	0	0.0
7	Poaching	0	0.0	2	6.7	28	93.3	0	0.0

Table 4. Contd.

8	High inflation rate in the economy	0	0.0	22	73.3	8	26.7	0	0.0
9	High cost / lack of construction equipment	2	6.7	16	53.3	12	40.0	0	0.0
10	Marketing of fingerlings / juveniles	22	73.3	6	20.0	2	6.7	0	0.0
11	Poor genetic brood stock fish	4	13.3	24	80.0	2	6.7	0	0.0
12	High cost of brooders	0	0.0	10	33.3	20	66.7	0	0.0

Source: Field survey (2010).

Ikenne and Ilaro zones respectively indicated that fish hatchery operations is profitable. The ESR 0.59, 0.50, 0.47 and 0.54 implies that 59, 50, 47 and 54% of the total cost of production in the four zones respectively are made up of the fixed cost. The rate of return to investment was 54.6, 113.7, 176.5 and187.7% while rate of return on fixed cost was 174.7, 327.5, 442.5 and 442.8% compared with rate of return to variable cost of 333.9, 327.2, 408.4 and 498.9% in Abeokuta, Ijebu-Ode, Ikenne and Ilaro zones respectively. Also, the net margin was ₦645512.2, ₦821415.9, ₦919460 and ₦791554 in the four zones respectively (Table 2). The estimated gross margin analysis of the fish breeders in Abeokuta, Ijebu-Ode, Ikenne and Ilaro zones was presented in the Table 2.

Constraints to fish seed production and management

Table 4 indicated the various constraints hindering fish seed production and management. Many (56.7%) of the respondents from Abeokuta and Ikenne zones, 46.7 and 73.3% from Ijebu-Ode and Ilaro zones, respectively, considered marketing of fish seeds as a very serious constraint to fish seed production and development. Others include high inflation rate in the economy, poor genetic brood stocks, lack of finance and epileptic power supply. The mean of the distribution was 33.5±3.01 while the standard deviation was 0.55.

Conclusions

The net farm income in Ikenne zone (₦755,205.9) was the highest while Abeokuta was the least (₦413,717.3). Also, the BCR was highest in Ilaro zone (2.8) while least (1.4) in Abeokuta zone. This indicated that fish hatchery operations are profitable and viable in Ogun state.

High cost of investment and feeding, poor marketing channels, poor genetic brood stocks, high level of quackery in the business among others were problems facing aquaculture development in the study area. The fact that aquaculture venture is growing rapidly does not mean that the fish breeding aspect of it can be carried out haphazardly.

RECOMMENDATIONS

From the study, the following were recommended:

1) There should be an improved marketing strategy for fish seed.
2) There is a need for certification of qualified fish breeders so as to checkmate quackery in the profession.
3) Government should establish a brood stock bank to ensure the supply of high quality brood stocks.
4) Government should provide more infrastructural facilities that will reduce the cost of investment and provide a standardized law to regulate the price of fish seed in the market.

REFERENCES

Adegbite DA (2002). Analysis of the repayment of loans Beneficiaries under the Nigeria Agricultural co-operative Bank Limited and Agricultural Credit Guarantee Scheme, Ogun State Nigeria. An Unpublished Ph.D Thesis in the Department of Agricultural Economics. University of Ibadan, Ibadan, Nigeria.

Adekoya BB (2001). Programme Planning for Fisheries Extension "Training Module 1." Workshop Paper on "Creation of a Critical Mass of Fisheries extensionists" at NIOMR, p. 14.

Adekoya BB, Miller JW (2004). Fish Cage Culture Potential in Nigeria - An Overview. National Cultures. Agric. Focus, 1(5): 10.

Apantaku SO, Awotunde JM, Adegbite DA, Ajayi EA (2005). The Feasibility of Private Integrated Agricultural Extension Services in Ogun State. Nig. J. Soc. Dev. Afr., 20(1): 59-76.

Ayansanwo TO (1999). Aquatic Biotopes, Fish and Fisheries of Ogun State, Nigeria. Aqua field, 11: 15-27.

Brain FD, Army C (1980). Induced Fish Breeding in South East Asia. Report of the Workshop Held in Singapore 25th-26th November, 1980, pp. 10RC-178e.

Charo H, Oirere W (2000). River-based Artificial Propagation of the African Catfish; *Clarias gariepinus:* An Option for the Small Fish Farmer. NAGA-The ICLARM, 23(1): 14-16.

Ezeri GNO, Olaoye OJ, Agbon AO (2009). Fish Fingerlings Production and Management. Agricultural Media Resources and Extension Centre, University of Agriculture, Abeokuta, p. 36.

Fabusoro E, Lawal-Adebowale OA, Akinloye AK (2007). A study of rural livestock farmers' patronage of veterinary services for healthcare of small farm animals in Ogun State. Nig. J. Animal Prod., 34(1&2): 132-138.

FAO (2006). Yearbook of Fishery Statistics Summary Table. www.fao.org/fi/statist.asp.

Federal Department of Fisheries (2008). Fishery Statistics, FDF, Abuja, Nigeria. 4th Edition.

Graham M (2002). Supply of Good Quality Fish Seed for Sustainable Aquaculture. Aquacult. Asia, 7(2): 135-142.

Ita EO, Sado EK (1984). Inventory Survey of Nigerian Inland Water and their Fishery Resources with Special Reference to Ponds, Lakes, Reservoir and Major Rivers, Kainji Lake Research Institute, New Bussa, p. 17.

National Population Commission (NPC) (2006). National Population Census 2006 Provisional Results, Abuja, Nigeria.

OGADEP (2005). Annual (in-House Review Fisheries Report. Ogun State Agricultural Development Programme (OGADEP) Fisheries Unit, p. 10.

OGADEP (2009). Ogun State Agricultural Development Programme Fisheries Report, p. 12.
Olaoye OJ (2010). Dynamics of the Adoption Process of Improved Fisheries Technologies in Lagos and Ogun States, Nigeria. A Ph.D thesis in the Department of Aquaculture and Fisheries Management, University of Agriculture Abeokuta, Ogun State, Nigeria, p. 367.
Olaoye OJ, Adekoya BB, Ezeri GNO, Omoyinmi GAK, Ayansanwo TO (2007). Fish Hatchery Production Trends in Ogun State: 2001-2006. J. Field Aquat. Stud. - Aquafield, 3: 29-40.
Pillay TJM (1987). Planning of Agriculture Development and Introductory Guide on Fish Seed Production, p. 3.
Viveen WJAR, Richter CJJ, Van Oordt PGWJ, Janseen JAL, Huisman EA (1985). Practical Manual for the Culture of the African Catfish (*Clarias gariepinus*). Res. Technol., p. 100.