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Full Length Research Paper

Factors determining fish hatchery operations in Ogun State, Nigeria

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The study was carried out to examine the factors determining fish hatchery operations in the four agricultural extension zones (Abeokuta, Ijebu-Ode, Ikenne and Ilaro) of Ogun state. One hundred and twenty fish hatchery operators were selected out of three hundred and eighty eight registered hatcheries using multi-stage sampling techniques and structured interview guides to elicit information from the fish breeders. The data collected were analyzed using descriptive and inferential statistics. The study revealed that respondents were mostly male (74.3%) with mean age of 45.2 years, 96.7% were married and 93.4% had tertiary education while 68.4% had household sizes between 4 and 6 persons. Sources of information were mainly through multimedia approach. 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 seed production and development. There are positive significant differences ($t = 9.460$; $p< 0.05$) between farm income and the constraints. It can be concluded that the constraints had positive effect on breeders' income. 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, constraints.

INTRODUCTION

The Food and Agricultural Organization of the United Nations (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. Fish provides 40% of the dietary intake of animal protein to the average Nigerian, Federal Department of Fisheries (FDF, 1997). 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.

In developing countries, aquaculture development has become a necessity because of rapid growth of populations and deterioration of natural fisheries (George et al., 2010). However, the development of aquaculture has been hampered by a number of constraints. The principal one is the shortage of quality fish seed due to a

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Table 1. Ogun state fingerlings production from year 2000 to 2008.

Year	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: Ogun State Agricultural Development Programme (OGADEP (Fisheries Unit) (2009).

shortage of operating hatcheries (Aquaculture and Inland Fisheries of Nigeria, AIFP, 2005; Otubusin, 1998). As a result, most fish farmers do not have enough seed to sustain their operations, and many have had to abandon aquaculture altogether (Ezeri et al., 2009, In press; Olaoye et al., 2007; Viveen et al., 1985). Fish fingerlings are essential fish seed needed for the growth of aquaculture.

In developing countries, the fish seed has always been collected from the wild for stocking the ponds (Geoege et al., 2010). The fry and fingerlings of cichlids, clarias, and mullet are available in Nigeria water freely in large quantity all the year round. Mullet are obtained in coastal lagoon all the year round, Clarias fry and fingerlings are found in forest stream and river in Nigeria, while cichlids for example *Sarotherodon melanotheron* can be collected all the year round in rivers, lakes and lagoon. *Heterotis niloticus* is more seasonal in abundance and can be collected within a short period in a year usually at about the beginning of rainy season. The collection of fry is carried out with the use of some gear like; lift net, hand net or scoop net and seine net. The collected fry are transported in well aerated and cool water to the pond for stocking. Where there is no special tank for transportation, polythene bags or gourd containing water can be used. It is not advisable, reliable or insufficient to depend on collection of fish fingerlings from the wild for fish farming, at the expense of hatchery management, because of some certain constraints associated with the collection. These include:

(1) For many fish species, the fry may not be available as at when required, hence there is a shortage of fry for stocking leading to low fish production.
(2) Weed fish and fish enemy including dragon fly, water bugs, frog and tadpole which may feed on eggs or attack the fish seed. Fish parasite for example leaches may also be collected along with fish seed from the wild, and introduced into the rearing pond.
(3) The method is uneconomical, because the cost of going to the wild and paying the workers to gain access to the spawning site through trial and error method is expensive.
(4) There is high mortality during catch and transportation.
(5) The problems are further complicated by difficulty of accurate identification of fry or fingerlings stage of certain species which result in the desire species being stocked with undesirable small or stunted species for example Clarias fingerlings stocked with barbels.

All these problems associated with the collection of fish seed in the wild lead to hatchery production of fish seed (Ezeri et al., 2009 In press; Viveen et al., 1985). 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 Ogun State Agricultural Development Programme (OGADEP, 2009) (Table 1). This grown in the fish hatcheries ownership is synchronous with the rapid development of fish culture (aquaculture) in Ogun State within the same period (Olaoye et al., 2007). There has also growth with this feature, the considerable greater private sector presence in the fish farming business which has continued to make more demands on the technical support processes required.

The demand for fish seed is more than the supply, as a result of increase in fish farming to cushion malnutrition and higher price of alternative protein sources hence, the need to increase fish fingerlings production and management of fish hatchery to bring about self sufficiency in aquaculture.

In view of these, this paper intend to examine the factors determining fish hatchery operations in Ogun state of Nigeria. Specifically, the study attempts to:

(1) Describe the socio-demographic characteristics of the fish hatchery operators in Ogun State.
(2) Determine the source of information used by hatchery farmers in their breeding exercise.

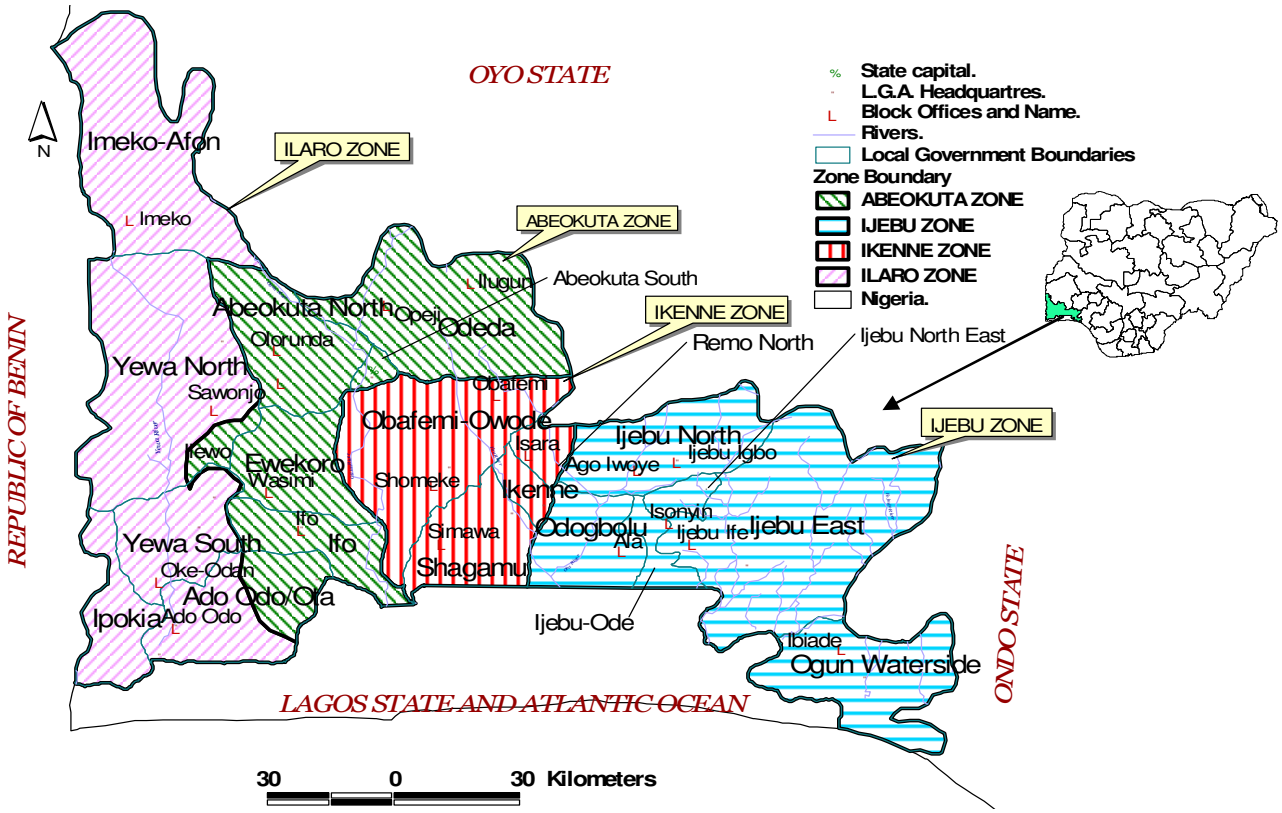

Figure 1. Map of Ogun State ADP zones and blocks showing study location.

(3) Identify the constraints associated with fish hatchery production in the study area.

METHODOLOGY

The 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 (N.P.C, 2006). The state is located in the rainforest vegetation belt of Nigeria within longitude 2 45' 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). The rainy season starts around the middle of March and continues until late October. The dry season starts in November and lasts until February in most locations in the state. Rainfall ranges between 1600 and 900 mm annually. The state is warm throughout the year with a temperature of between 28 and 35°C. Humidity is between 85 and 95% (Oloruntoba and Adegbite, 2006).

The state has marine and riverine biotopes estimated at 173.8 square kilometres (Adekoya, 2001; Ita and Sado, 1984) covering 12,482,640 Ha, lacustrine biotopes totaling 4,404.35Ha and estuarine biotopes covering a total of 767.3km^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) Figure 1. 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) respondents (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 fish 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) viable circles out of the total of thirty five 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 (Table 2).

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 data used in this study include primary and secondary 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. Government published data, annual reports from OGADEP and FDF, map and publications of international organizations on aquaculture are the secondary data used.

Data analysis

Data obtained from the field were subjected to descriptive and inferential statistical analysis, using analyzed statistical package for social sciences (SPSS) version 10.0. Frequency counts, percentage table and mean were used to describe the socio-demograpphic characteristics of respondents. Sources of information on hatchery business were measured with likert -type scale of “Always use’, “Occasionally use’, or “Do not use”. Constraints to Fish seed production and management was measured with Likert-type scale of very serious, serious, not a problem and do not know.

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.

Socio demographic profile of the respondents

Entries of the socio-demographic characteristics of the fish hatchery operators were presented in Table 3. The table revealed that out of the 120 respondents that were interviewed across the four zones, 86.7, 67, 76.7 and 66.7% were males while 13.3, 33.3, 23.3 and 33.3% were females in Abeokuta, Ijebu-Ode, Ikenne and Ilaro, respectively. The sex of the respondents was an essential variable in this study as it focused on decision making on the fish breeding systems. However, aquaculture practices were not limited to a particular gender. Both male and female farmers were engaged in fish breeding to increase fish production; improved food security and incomes. The survey indicated that fish breeding was predominantly a male occupation in the study area. This supports Andre et al. (1994) cited in Agwu and Afieroho (2007) who reported that in Africa, fish farming is an activity taken up by male farmers. It also agreed with Apantaku et al. (2005) who reported that there was low participation of females in farming occupation in Nigeria.

Majority of the respondents across the four zones were between the age’s brackets of 41 and 50 years. These were ages in which they were considered highly productive and active to undertake strenuous task associated with farm work. This was in line with the assertion of Olowosegun et al. (2004) that age has positive correlation with acceptance of innovations and risk taking as germane to fish breeding activities.

The survey revealed that 93.3% of the respondents from Abeokuta and 93.3% from Ijebu-Ode zones were married while 100% from Ikenne and 100% from Ilaro zones were also married which is an indication that fish breeding serves as source of livelihood.

Many (56.7%) of the respondents in Abeokuta and Ikenne zones, 80% in Ijebu-Ode and Ilaro zones, respectively, had the household size that ranges between 4 and 6 persons. The implication was that the relatively small household size may increase the number of labour needed as against (Adegbite and Oluwalana, 2004) that the larger the household size, the more the likelihood of sustainable labour efficiency on farmer’s farm given the constant labour.

Education is an important factor which can influence farm productivity and determine farmer’s level of understanding and adoption of improved fish breeding techniques, level of education according to the study showed that 90, 86.7, 96.7 and 100% of the fish breeders had tertiary education in Abeokuta, Ijebu-Ode, Ikenne and Ilaro zones of the study area, respectively. This was contrary to the general opinion that most farmers were illiterates or semi-illiterates; most of whom had dropped out of the formal school system, as evidence from the study of Ozor, (1998). From the results, one can also inferred that Christianity was mostly practiced than any other religion as majority (60, 63.3, 66.7 and 50%) of the fish breeders in Abeokuta, Ijebu-ode, Ikenne and Ilaro zones respectively were christians.

Cooperative Society involves a social participation that helps farmers to pool their resources, to have access to fisheries inputs and to have insights in their fishing issues. Memberships of cooperative societies are therefore a factor which influences the adoption of improved fisheries technologies and poverty alleviation. 23.3, 60.0, 43.3 and 33.3% of the respondents in Abeokuta, Ijebu-Ode, Ikenne and Ilaro zones respectively belong to a cooperative society while 76.7, 40.0, 56.7 and

Table 2. Sample size of respondents and study location.

Agricultural development zones	Extension blocks	Circles	LGAs of study	Number of respondents per circle	Total number of respondents
Abeokuta	Ilugun	Ilugun Osiele Odeda	Odeda	5 6 2 } 13	30
	Ilewo	Ilewo Obada Ibara-Orile	Abeokuta-North	2 } 2	
	Ifo	Ota	Ado-Odo/Ota	2 } 2	
	Wasimi	Papalanto	Ewekoro	1 } 1	
Ijebu-Ode	Ijebu-Ife	Ife Mushin Tajala	Ijebu-East	9 5 2 } 16	30
	Isonyin	Esure Ogbogbo Ilese	Ijebu-North East	5 4 5 } 14	
Ikenne	Obafemi	Adigbe Obafemi	Obafemi-Owode	6 5 } 12 11	30
	Someke	Oba Ofada Someke		5 2 2 } 9	
	Isara	Iperu	Ikenne	4 } 4	
	Simawa	Sagamu Simawa	Sagamu	3 3 } 6	
Ilaro	Ado-Odo	Ado-Odo	Yewa-South	10 } 10	
	Oke-Odan	Oke-Odan		7 } 7	
	Imeko	Aiyetoro Ilara	Imeko	7 6 } 13	
Total					120

Source: Field survey (2009).

derive benefits from the groups such that they will not have derived individually if they were acting alone.

Sources of information on hatchery business

Information is the key to transformation. The survey indicated the various sources of information on hatchery operations in the study area (Table 4). Most of the respondents across the four zones of the study area "always use" seminar/training, extension guide/bulletin, extension agents and telephone/G.S.M as source of information on fish hatchery business .The mean of the distribution was 19.6; this may be attributed to improvement in technology.

Constraints to fish seed production and management

Table 5 indicated the various constraints hindering fish

Table 3. Percentage distribution of hatchery operators' socio-demographic characteristics.

	Abeokuta zone		Ijebu-Ode zone		Ikenne zone		Ilaro zone	
Variable	**Frequeny**	**%**	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
Sex								
Male	26	86.7	20	67	23	76.7	20	66.7
Female	4	13.3	10	33.3	7	23.3	10	33.3
Total	30	100.0	30	100.3	30	100.0	30	100.0
Age (years)								
31-35	6	20.0	2	6.7	10	33.3	10	33.3
36-40	2	6.7	2	6.7	2	6.7	2	6.7
41-45	7	23.3	6	20.0	8	26.7	8	26.7
46-50	7	23.3	4	13.3	2	6.7	2	6.7
51-55	7	23.3	10	33.3	2	6.7	2	6.7
56-60	1	3.3	4	13.3	6	20.0	6	20.0
61 and above	0	0.0	2	6.7	0	0.0	0	0.0
Mean		44.3		49.3		43.6		43.7
Total	30	100.0	30	100.0	30	100.0	30	100.0
Marital status								
Single	2	6.7	0	0.0	0	0.0	0	0.0
Married	28	93.3	28	93.3	30	100.0	30	100.0
Divorced	0	0.0	2	6.7	0	0.0	0	0.0
Total	30	100.0	30	100.0	30	100.0	30	100.0
Household size								
< 3	5	16.7	2	6.7	7	23.3	4	13.3
4-6	17	56.7	24	80.0	17	56.7	24	80.0
7-9	6	20.0	2	6.7	4	13.3	2	6.7
10 & above	2	6.7	2	6.7	2	6.7	0	0.0
Mean		6.0		6.0		6.0		6.0
Total	30	100.0	30	100.0	30	100.0	30	100.0
Educational status								
Completed secondary Education	3	10.0	2	6.7	1	3.3	0	0.0
Tertiary education	27	90.0	26	86.7	29	96.7	30	100.0
Adult education	0	0.0	2	6.7	0	0.0	0	0.0
Mean		18.2		16.7		19.8		19.2
Total	30	100.0	30	100.0	30	100.0	30	100.0
Religion								
Christianity	18	60.0	19	63.3	20	66.7	15	50.0
Islam	12	40.0	11	36.7	10	33.3	15	50.0
Total	30	100.0	30	100.0	30	100.0	30	100.0
Cooperative society membership								
Yes	7	23.3	18	60.0	13	43.3	10	33.3
No	23	76.7	12	40.0	17	56.7	20	66.7
Total	30	100.0	30	100.0	30	100.0	30	100.0

Source: Field survey (2009).

Table 4. Percentage distribution of fish breeders by sources of information on hatchery business

Variable	Always use (1)		Occasionally use (2)		Do not use (3)	
	Frequency	%	Frequency	%	Frequency	%
Abeokuta zone						
Extension agent	10	33.3	9	30.0	11	36.7
Radio broadcast	3	10.0	16	53.3	11	36.7
Television broadcast	7	23.3	15	50.0	8	26.7
Newspaper	5	16.7	14	46.7	11	36.7
Friends and relations	9	30.0	7	23.3	14	46.7
Extension guide/bulletin	21	70.0	6	20.0	3	10.0
Seminar / training	23	76.7	7	23.3	0	0.0
Telephone (GSM)	22	73.3	6	20.0	2	6.7
Total	30	100	30	100	30	100
Ijebu-Ode zone						
Extension agent	20	66.7	6	20.0	4	13.3
Radio broadcast	6	20.0	24	80.0	0	0.0
Television broadcast	6	20.0	24	80.0	0	0
Newspaper	4	13.3	22	73.3	4	13.3
Friends and relations	4	13.3	12	40.0	14	46.7
Extension guide/bulletin	24	80.0	6	20.0	0	0.0
Seminar / training	20	66.7	10	33.3	0	0.0
Telephone (GSM)	20	66.7	10	33.3	0	0.0
Total	30	100	30	100	30	100
Ikenne zone						
Extension agent	17	56.7	7	23.3	6	20.0
Radio broadcast	13	43.3	13	43.3	13.3	4
Television broadcast	18	60.0	10	33.3	2	6.7
Newspaper	18	60.0	10	33.3	2	6.7
Friends and relations	8	26.7	20	66.7	2	6.7
Extension guide/bulletin	21	70.0	7	23.3	2	6.7
Seminar / training	28	93.3	0	0.0	2	6.7
Telephone (GSM)	24	80.0	6	20.0	0	0.0
Total	30	100	30	100	30	100
Ilaro zone						
Extension agent	24	80.0	4	13.3	2	6.7
Radio broadcast	4	13.3	24	80.0	2	6.7
Television broadcast	8	26.7	20	66.7	2	6.7
Newspaper	6	20.0	20	66.7	4	13.3
Friends and relations	13	43.3	12	40.0	5	16.7
Extension guide/bulletin	20	66.7	8	26.7	2	6.7
Seminar / training	28	93.3	2	6.7	0	0.0
Telephone (GSM)	18	60.0	12	40.0	0	0.0
Total	30	100	30	100	30	100

Source: Field survey, 2009.

seed production and management. Many (56.7%) of the respondents from Abeokuta and Ikenne zones respectively, 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

Table 5. Percentage distribution of hatchery operators by constraints to fish seed production and development.

S\N	Problems	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	9	30	17	56.7	1	3.3
2	Poor feed quality	2	6.7	8	26.7	20	66.7	0	0
3	Lack of finance	13	43.3	15	50	2	6.7	0	0
4	Lack of appropriate land	0	0	4	13.3	26	86.7	0	0
5	Old age / health status	0	0	0	0	28	93.3	2	6.7
6	Insufficient labour	0	0	10	33.3	20	66.7	0	0
7	Poaching	0	0	2	6.7	28	93.3	0	0
8	High inflation rate in the economy	12	40	17	56.7	1	3.3	0	0
9	High cost / lack of construction equipment	10	33.3	11	36.7	9	30	0	0
10	Marketing of fingerlings / juveniles	17	56.7	11	36.7	2	6.7	0	0
11	Poor genetic brood stock fish	3	10	8	26.7	19	63.3	0	0
12	High cost of brooders	7	23.3	19	63.3	4	13.3	0	0
	Ijebu-Ode zone								
1	Disease and predators	0	0	6	20	24	80	0	0
2	Poor feed quality	0	0	4	13.3	26	86.7	0	0
3	Lack of finance	8	26.7	18	60	4	13.3	0	0
4	Lack of appropriate land	0	0	2	6.7	28	93.3	0	0
5	Old age / health status	0	0	28	93.3	2	6.7	30	100
6	Insufficient labour	2	6.7	2	6.7	26	86.7	0	0
7	Poaching	0	0			30	100	0	100
8	High inflation rate in the economy	14	46.7	12	40	4	13.3	0	0
9	High cost / lack of construction equipment	2	6.7	18	60	10	33.3	0	0
10	Marketing of fingerlings / juveniles	14	46.7	8	26.7	8	26.7	0	0
11	Poor genetic brood stock fish	4	13.3	16	53.3	10	33.3	0	0
12	High cost of brooders	6	20	22	73.3	2	6.7	0	0
	Ikenne zone								
1	Disease and predators	15	50	4	13.3	11	36.7	0	0
2	Poor feed quality	0	0	9	30	21	70	0	0
3	Lack of finance	11	36.7	16	58.3	3	10	0	0
4	Lack of appropriate land	0	0	14	46.7	16	53.3	0	0
5	Old age / health status	0	0	4	13.3	26	86.7	0	0

Table 5. Contd.

6	Insufficient labour	0	0	14	46.7	16	53.3	0	0
7	Poaching	0	0	4	13.3	26	86.7	0	0
8	High inflation rate in the economy	22	73.3	8	26.7	0	0	0	0
9	High cost / lack of construction equipment	6	20	6	20	17	56.7	1	3.3
10	Marketing of fingerlings / juveniles	17	56.7	10	33.3	3	10	0	0
11	Poor genetic brood stock fish	2	6.7	17	56.7	11	36.7	0	0
12	High cost of brooders	6	20	22	73.3	2	6.7	0	0
	Ilaro zone								
1	Disease and predators	6	20	12	40	12	40	0	0
2	Poor feed quality	0	0	6	20	24	80	0	0
3	Lack of finance	8	26.7	20	66.7	2	6.7	0	0
4	Lack of appropriate land	4	13.3	8	26.7	18	60	0	0
5	Old age / health status	0	0	0	0	28	93.3	2	6.7
6	Insufficient labour	0	0	8	26.7	27	73.3	0	0
7	Poaching	0	0	2	6.7	28	93.3	0	0
8	High inflation rate in the economy	0	0	22	73.3	8	26.7	0	0
9	High cost / lack of construction equipment	2	6.7	16	53.3	12	40	0	0
10	Marketing of fingerlings / juveniles	22	73.3	6	20	2	6.7	0	0
11	Poor genetic brood stock fish	4	13.3	24	80	2	6.7	0	0

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.

Significant differences between farm income and constraints

A positive significant differences occurred between farm income and constraints at $t = 9.460$; $p<0.05$ and $F = 27.9$ throughput the study area as showed in the Table 6.

CONCLUSIONS AND RECOMMENDATIONS

The result of this study revealed that majority of the fish farmers involved in fish hatchery operations were males and most of the fish farmers' age range was equally within the economically active age, which favored aquaculture development.

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. Hence, there is a need for the government to regulate the fish hatchery operations by certification of professional breeders and establishment of brood stock banks to ensure high quality fish seed both genetically and physiologically. From the study, the following were recommended:

(1) There should be an improved marketing strategy for fish seed.
(2) There is 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.

Table 6. Significant differences between farm income and constraints

Paired samples test								
Farm income	**Paired differences**					**t**	**df**	**Sig (2-tailed)**
	Mean	**Std deviation**	**Std. error mean**	**95% Confidence interval of the difference**				
				Lower	**Upper**			
Total income - Cons	148660	8931.6433	21421.5	06092.5	391227	9.460	64	0.000

Constraints	**Sum of square**	**Df**	**F**	**Sig. 1**	**Decision**
	4598.7	3	27.9	0.00	Accept H_1

Source: Field Survey (2009).

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