STATE OF FISHERIES RESOURCES IN LAGOS, OGUN AND OYO STATES, SOUTHWESTERN, NIGERIA

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ABSTRACT

This study investigated the status, development of new strains, management and constrains of fish culture systems in selected states of Southwestern Nigeria. Primary data were collected through a well-structured questionnaire from 300 fish farmers randomly selected from communities in the three study areas based on their fishing activities. The data were analyzed using descriptive statistical analysis. The investigation revealed that most of the fish farms were in existence for less than a decade. Farmers majorly reared Clariids (99.3%) and Cichlids (17.87 %). Lagos (114) and Oyo (120) States have the highest respondents using concrete pond while the earthen pond is most common in Oyo (97) and Ogun (90) states. Oyo state was the only location that reported the development of new strain; however, it has not yet been registered as it is still undergoing close evaluation. Smoking as a value addition (76.9%) was mostly adopted by farmers in all states. Challenges identified by a larger group of the farmers include lack of capital (83.8%) and the high cost of feeds (28.4%). It is suggested that governmental and non-governmental organizations should explore the possibilities of making available funds to overcome impediment limiting good performance and maximum output for sustainable aquaculture production in Nigeria.

Keywords: cultured fish species, new breeds, registered strains

INTRODUCTION

Globally, the fishing industry provides its populace with a valuable supply of high-quality foods which contains an essential part of a healthy and balanced diet (FAO, 2014). Bartley (2005) reported that the world's aquatic resources are composed of 974 taxa of fin-fish, 143 crustacean, 114 mollusks and 73 taxa of miscellaneous animals; whereas aquaculture production is composed of 153 species of fish, 60 mollusks, 44 crustaceans and several other miscellaneous taxa which has been described to be underestimated.

In Nigeria, about 41% of the total animal protein intake by an average inhabitant is majorly fish (FDF, 2008). Consequently, the demand is soaring greatly with the increasing population. There is recognition that many of numerous natural water bodies have abundant fish resources (Olaosebikan and Raji, 1998; Idodo-Umeh, 2003; Meye and Ikomi, 2008) and are being harvested to their limit (Lakra and Ayyappan, 2003). Many major fish stocks are showing steep declines in productivity which arose from overexploitation of choice stocks, enhancement and stocking of water body, pollution, use of wrong gears, explosives, to mention a few (Raji *et al.*, 2012). As a measure for solving the problem of demand of fish by the increasing populace, aquaculture has been uniquely positioned and considered a means of bridging the gap between the supply and demand for fish since fish capture is fast decreasing. Jagger and Pender (2001) reported that aquaculture has notable prospective for new livelihood opportunities, enhanced nutritional security, providing a mechanism for lower- priced fish and employment for communities by servicing urban markets. The Nigerian Government has given high priority to aquaculture in its development plans after identifying its huge potential for contributing to food security, generating foreign exchange and elevating the socioeconomic status of rural communities.

Despite the abundant fishery practices and the relatively high consumption of fish in Nigeria, there is still large deficit between the demand and supply of fish (Olaoye *et al.*, 2013). There is a need for more efficient aquaculture production system owing to the increasing demand for its produce (Dunham, 2004). Hammed *et al*. (2010) revealed that development of improved fish strains can contribute to increased fish production, hence a key solution to meeting the future food demands of the growing world population.

Most empirical research, for instance, revealed mainly the fish farm farming systems and

technologies used, common species cultured and area of land utilization. This study is therefore, an attempt to provide a checklist of various fish farms practices, possible newly developed fish strains, marketing strategies and possible challenges of the farms in Southwestern Nigeria.

Study area

This study was conducted in three states in Southwestern Nigeria (Oyo, Ogun and Lagos). Lagos lies between latitude 6º and 7º of North of the equator and longitudes 3º and 4º East of the Greenwich Meridian. The state lies extensively within the southern rainforest zone of the humid tropics and it is bounded in the North by the Atlantic Ocean, in the East by Ogun State and in the West by the Republic of Benin.

The northern area with an undulating plain topography has floodplains of the rivers that run through the state interspersed with swamps. Lagos State has a total area of about 4000km^2. Seventy - eight per cent of this total area (3277km^2) is covered with land. Creeks and lagoons intersperse coastal belt of sandy ridges of the state, favourably, making the state rich in water resources for fishing and aquaculture activities through. The state experiences annual rainfall of 1312 – 1726mm. The ambient temperature is moderately high (32ºC) though moderated by the Cool Coastal wind. The relative humidity is on the average over 60% throughout the year. The state comprises of 20 local government areas (Omofunmi *et al.*, 2016).

Ogun 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 north by Oyo State, in the south by Lagos State and the Atlantic Ocean, in the east by Ondo State and in the west by the Benin Republic. It covers a land area of 16,409.28 km^2 less than 2% of the country's land mass. The rainfall pattern of this area like other areas of the state is characterized by two peaks usually in May and September. The average rainfall of the area ranges from 1500 to 1800mm and most of this fall between March and October. The dry season lasts for about 5 months between November and March. The state has marine and riverine biotopes estimated at 173.8 km^2 covering 12,482,640 ha, lacustrine biotopes totaling 4,404.35 ha and estuarine biotopes covering a total of 767.3 km^2. It is well endowed with natural water bodies such as springs, perennially flowing rivers, lakes and brackish waters. (Oloruntoba and Adegbite, 2006; Olaoye *et al*., 2007). The main activities of the people in the state include agriculture, fishing, textiles and civil service. There are four agricultural zones and 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 the abundance of wetland with an annual growth rate of 3% per annum (OGADEP, 2009).

Oyo state lies in the rainforest vegetation belt of Nigeria within longitude 7^{0}23'47" North and 3^{0}55'0" East. It is bounded in the north by Kwara State and in the south by Ogun State, in the east, it is bounded by Osun State while in the west by the Republic of Benin. Oyo state exhibits the typical tropical climate of high temperatures, high relative humidity and generally two rainfall maxima regimes during the raining period of March to October. Oyo State now consists of thirty - three local governments and the capital of the state is Ibadan. The main occupations of the people in the state are Agriculture which is the mainstay of the economy of the State. The tropical nature of the climate favours the growth of a variety of food and cash crops and fishing. The climate is equatorial, notably with dry and wet seasons with relatively high humidity. The dry season lasts from November to March while the wet season starts from April and ends in October. Average daily temperature ranges between 25 °C (77.0 °F) and 35 °C (95.0 °F), almost throughout the year (Olaoye *et al.*, 2013).

METHODOLOGY

Data collection

A multi-stage random sampling method was adopted for the collection of data and analysis. Data were collected from 5 locations in Lagos State (Ikorodu, Epe, Lekki, Surulere and Lagos Island), 5 locations in Oyo State (Oyo, Eruwa, Saki, Ogbomoso and Ibadan) and 4 agricultural zones in Ogun State (Abeokuta, Ijebu, Ikenne and Ilaro).

The locations were selected based on the involvement in fish culture. Government agencies, research institutes and tertiary institutions in the states were also visited during the course of the survey. Finally, a total of 300 farmers were randomly selected from the study area with a sample proportional to the number of the farmers in each area. After a careful analysis of the study objectives, a structured questionnaire was developed in order to obtain the required data for the study.

The questionnaire was administered to both male and female farmers subsequently after this; it was validated, pre-tested and modified by the researchers to ensure that important issues in the study were not excluded. Data on various fish farming practices and development of newly improved strains of fish were sought. The data obtained were subjected to descriptive statistical analysis of simple percentages, mean and proportions.

RESULTS

Fish farmer information and fish culture and management practices

The respondent information and various fish culture practices are presented in Table 1. Most (39.9%) of the fish farms visited in Lagos state falls within the range of 6 – 10 years of the establishment while the least (7.5%) recorded was within the range of 16 – 20 years. On the other hand, Ogun state had the highest (53.6%) values recorded for respondents whose farms existed within 0 - 5 years while the lowest (20.6%) was recorded in farms established within 6 – 10 years. Oyo state shows the highest proportion (29.9%) within 11 – 15 years and the lowest (9.5%) years of establishment recorded is similar to that of Lagos state. The findings of the study revealed that the fish farms were owned by private individuals with a proportion of more than 90% across the three states. Fish reared in the three states were mostly the catfish families which include: *Clarias gariepinus, Heterobranchus bidorsalis, Heterobranchus longifilis and Heteroclarias. C. gariepinus* accounted for the highest cultured in all the states with an average proportion of 99.3% while the least cultured fish is *Heteroclarias* reported to be about 15.5% on the average**.**

The cichlid family was also observed to be reared in the farms. *Oreochromis niloticus* was reared in the three states with Ogun state having the highest number (49) while the Lagos State had the least (7). *Tilapia zilli* and *Tilapia mariae* culture were only practiced in Oyo state with a proportion of 25.1% each. Other fish species (*Chrysichthis nigrodigitatus, Lates niloticus*) surveyed in the farms were only recorded in Oyo state and they accounted for only 2.2%. Fish seeds were mostly (> 95%) procured from established hatcheries in all three states while fish sourced from the wild recorded low value of 4.1% on the average, only fish farms in Ogun state procured exotic seeds in addition to the fish seeds sourced from hatcheries.

In terms of culturing facilities, the majority of the respondents predominantly use the concrete and earthen ponds as shown in Figure 1. Lagos and Oyo state had the highest (120 and 114 respectively) respondents rearing their fishes in concrete ponds while Ogun state showed the lowest value (49). Most of the farms culturing in earthen ponds were recorded in Oyo and Ogun states with an average of 93.5% while Lagos only recorded 45%. Other rearing facilities observed during the survey were moveable plastics, wooden troughs and re-circulating systems**.** Moveable plastics were commonly used in Oyo and Lagos state with 28% and 29% respectively while Ogun State had the least value of 9%. The use of wooden troughs and re-circulating systems in the three states recorded an average value of 11.7 and 8.3 respectively. Figure 2 reveals that most farmers (95.1%, 89.7% and 40.2%) preferred to produce table size fish while the least preferred is the production of fry (12.0%, 7.2% and 7.3%) in Lagos, Ogun and Oyo respectively.

All respondents (100%) in Lagos and Ogun state procure imported feed for their fishes while 66.4% of the respondents in Oyo state use imported feed. The next most used is the indigenous feed, Lagos state respondent accounted for the highest (96.2%) followed by Ogun state (79.4%) and finally, the least was observed in Oyo state (34.3%). On - farm feed was carried out in all the state in the proportion of 15.8%, 10.3% and 32.9% respectively for Lagos, Ogun and Oyo states. More than 72% of the fish farmers produced below 1,000 tonnes per standing crop. Averagely 26% produced between 1,000 to 5,000 tonnes per standing crop and 10.4% produced above 5, 000 tonnes per standing crop in all the state on the average.

Development of new strains of fish in the three States in Southwestern Nigeria

No new strain of fish was recorded in any of the fish farms visited in the three states except in Oyo and which accounted for only 0.73% of the total farms visited as shown in Figures 3. The new strain reported is yet to be registered (figure 4), therefore, no new strain has been registered across the three states.

Market approach

Several value additions were employed by the respondents in other to increase their market value as illustrated in Table 2. Smoking of fish was mostly done in (Lagos (97.9%), Oyo (72.2%) and Ogun (60.6%) States. Icing of fish was only recorded in Lagos state with a percentage of 5.3. Filleting was recorded in Lagos (11.3%) and Oyo (5.1%) state only. More than half of the fish farmers sold below 1,000 tonnes of catfish in a month. Lagos state had the highest sales of 79.7% followed by Oyo state which has the proportion of 70.8%. Sale of Tilapia below 1,000 tonnes was reported only in Oyo state. All (100%) sales made in the three states were done locally.

Challenges

The challenges faced by fish farmers are shown in Table 3. The major constraint noted was lack of capital in Lagos (99.3%), Ogun (97.9%) and Oyo (54.1%) state. The next commonly encountered constraint is the prohibitive cost of feed. Respondents in Lagos state were the highest (37.6%) that reported high cost of feeds while Ogun state reported the lowest

(12.4%). Also, fish farmers in Oyo state face the highest (46%) recorded challenge of reduced sales resulting from poor market; on the other hand, Lagos state recorded the lowest (25.6%). Insecurity is also a major factor posing a threat to Lagos state (30.8%) fish farmers which are next by farmers in Oyo state (13.5%). Other constraints reported by the respondent include theft (9.4%) and source of water (25.6%).

Table 1: Fish farmer's information and fish culture practices in three selected states in Southwestern Nigeria.

Location	Lagos		Ogun		Oyo	
	Total frequency	**%**	**Total frequency**	**%**	**Total frequency**	**%**
Numbers of farms visited	133	100	97	100	137	**100**
Year of establishment						
0-5	49	36.84	52	53.61	35	25.5
6-10	53	39.85	20	20.62	30	21.9
11-15	18	13.53	25	25.77	41	29.9
16-20	10	7.52			13	9.50
>20					16	11.7
Type of establishment						
Government owned	1	0.75	1	1.03	2	1.46
Private owned	132	99.23	96	98.97	135	98.54
Types of fish reared						
Catfish						
Clarias gariepinus	133	100	95	97.94	137	100
Herobranchusspp	15	11.25	28	28.87	40	29.20
Heteroclariasspp	3	2.26	23	23.71	28	20.44
Tilapia						
O. niloticus	7	5.26	49	50.52	32	23.36
T. zilli					7	5.11
T. mariae					7	5.11
Other spp					3	2.19
Source of fish						
Wild	2	1.50	9	9.28	2	1.46
Established hatchery	133	100	95	97.93	137	100
Exotic			4	4.12	-	-
Production level						
<2000 tons standing crop	130	97.74	51	52.58	92	67.15
>2000 but< 10,000 tons	19	14.29	47	48.45	25	18.25
> 10,000 tons	7	5.26	11	11.34	20	14.60
Types of feeds						
Imported feed	133	100	97	100	91	66.42
Indigenous feed	128	96.24	77	79.38	47	34.31
Unconventional feed	10	7.52			11	8.03
On farm feed	21	15.79	10	10.31	45	32.85
All of the above					17	12.41

Source: Field Survey, 2015

Table 2: Value addition practices of fish farmers in the three states in Southwestern Nigeria

Location	Lagos		Ogun		Oyo	
	Total frequency	%	Total frequency	%	Total frequency	%
Numbers of farms visited	133	100	97	100	137	**100**
Value addition						
Smoking	130	97.94	70	72.16	83	60.58
Icing	7	5.26			-	0
Sun drying					-	0
Degutting			4	4.12	11	8.03
Packaging	10	7.52	9	9.28	18	13.14
Salting					-	0
Filleting	15	11.28			7	5.11
Volume of sales (tons/M)						
Catfish						
<1,000tons	106	79.70	51	52.58	97	70.8
>1,000tons	13	9.77	37	38. 14	26	18.98
Tilapia						
<1,000tons					18	13.14
>1,000tons					-	-
Source of market						
Export					-	-
Local market	133	100	97	100	137	100

Source: Field Survey, 2015

Table 3: Challenges faced by fish farmers in three states of Southwestern Nigeria

Location	Lagos		Ogun		Oyo	
	Total frequency	%	Total frequency	%	Total frequency	%
Numbers of farms visited	133	100	97	100	137	**100**
Challenges						
Lack of capital	132	99.25	95	97.94	84	54.1
Poor market	34	25.56	30	30.93	76	46
Insecurity	41	30.82	8	8.25	16	13.5
Costly feeds	50	37.59	12	12.37	27	35.1
Theft	23	17.29			15	10.8
Source of water	17	12.78	32	32.99	20	16.2

Source: Field Survey, 2015

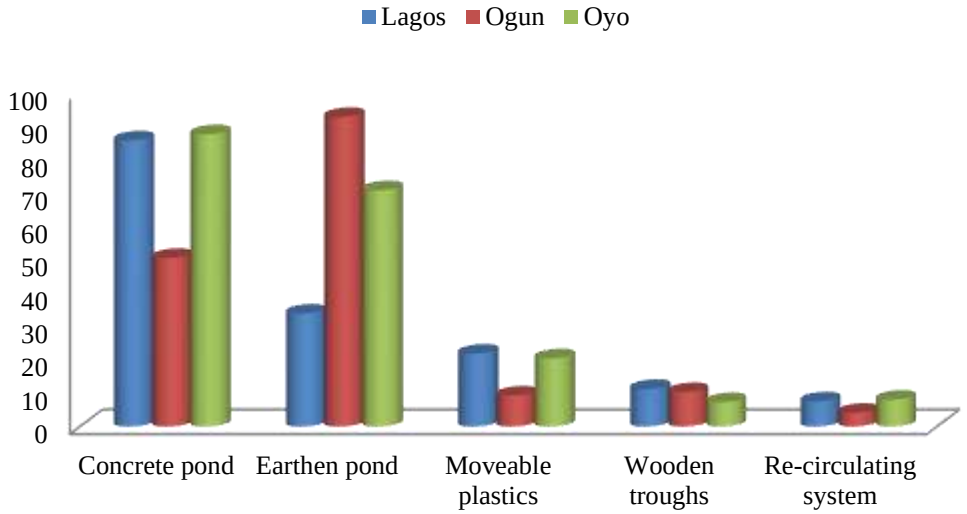

Fig. 1: Types of fish culture facilities in three states in Southwestern Nigeria

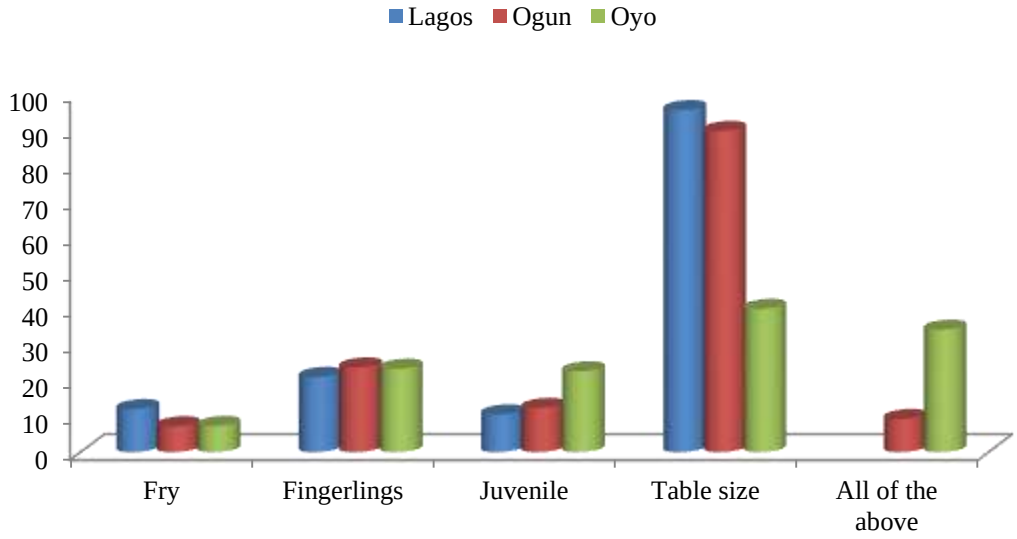

Fig. 2: Production level of fish in three states in Southwestern Nigeria

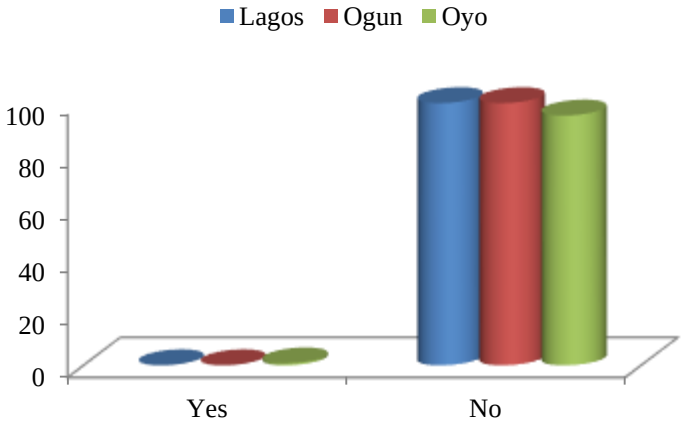

Fig. 3: Comparison of development of new strains in the three states in Southwestern Nigeria

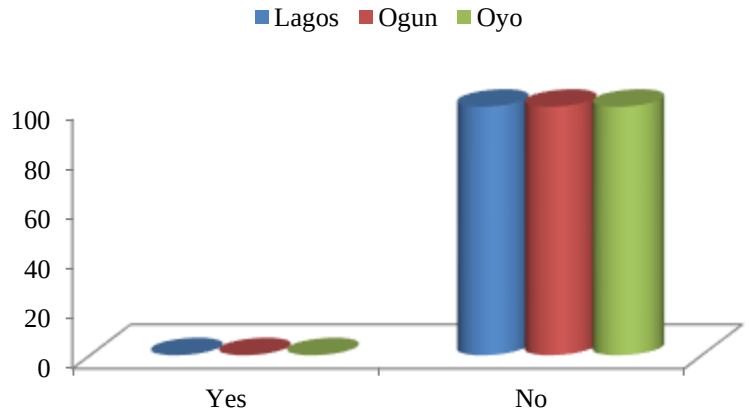

Fig. 4: Pattern of registered strains in the three states in Southwestern Nigeria

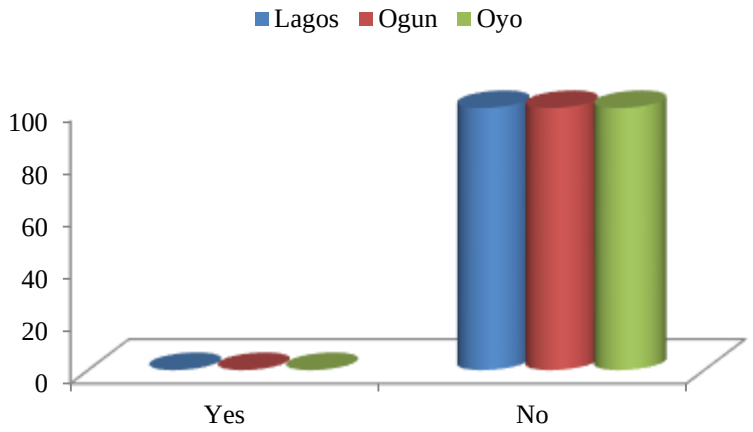

Fig. 5: Pattern of registered strains in the three states in Southwestern Nigeria

DISCUSSION

The survey revealed that most fish farms that existed below a decade as reported in Lagos and Ogun States may indicate that some of the respondents are involved in other occupation other than fish farming (Aghoghovwia and Ohimain, 2015) as these areas are highly industrialized compared to Oyo state where most fish farms have been in existence for more than a decade. This implies that most of the fish farmers in the study area are experienced; consequently, causing suboptimal production and innovation (Ibemere and Ezeano, 2014). Ownership of fish farms indicates that majority of the respondents own their farms. This may suggest that level of efficiency and the level of dedication to farm profitability based on the fear of uncertainty by the government policy on the usage of the land such as, revocation, review of land rent fee, tax imposition etc on the rented land is not a major problem which also encourages them in fish farming (El-Naggar *et al.*, 2008; Ahmed *et al.*, 1996). During the course of the survey, it was recorded that the catfish families (*Clarias gariepinus*, *Heterobranchus bidorsalis* and *H longifilis*) were the most cultured. This is in line with findings of Offem *et al*., (2010) who attributes it to the Clariid species being able to tolerate harsh environmental conditions, fast growth and generally accepted by people. Furthermore, this corroborates the findings by Olaoye *et al*. (2013) who reported that fish farmers majorly cultured *Clarias spp* when they analyzed the socio-economic of fish farming in Oyo State, Nigeria and they attributed it to the influence of high market price, greater demand preferences, hardiness of the stock, fast growth, high feed conversion ratio, high survival rate under captivity. The cichlids (*Oreochromis niloticus*) were next in terms of the cultured fish in the farms visited. This could have resulted from the fact that the species may not perform well under captivity and do not command a good market price compare to the catfish family, hence, farmers may not be prompted to rear this species of fish. Majority of the respondents sourced their seeds from established hatcheries and this reveals that there are adequate numbers of hatcheries where fish farmers can procure good seeds for production. The high percentage of concrete ponds in Lagos could result from lack of space for expansion which has majorly been occupied by industries and residential houses and also prevention of environmental contamination arising from these industries (Offem *et al*., 2010). The increased number of earthen ponds in Oyo and Ogun States implied availability of land and water for fish culture. Other types of rearing facilities observed in the farms augmented the major rearing systems. The major source of feed used by the fish farmers is an imported feed which is augmented with locally made ones. The use of these imported feed supports the findings of Ele *et al.* (2013) which was attributed to the provision of quality nutrients required for maximum performance of the fish. Furthermore, the high demand of the feed may have resulted in an increase in the cost of feed.

The production of most farms stands below 1000 tones. This may be due to the insufficiency of both fund and space for expansion. The respondent who produced within the range of 1,000 to 5,000 tones were probably commercial farmers or have a reservoir which may even limit their production to one cycle per year (Adelakun *et al*., 2015). The study also showed that fish farmers were more interested in raising the fishes to table size. The result of new strains development by fish farmers revealed no fish farm had new strain except in Oyo state where it was observed in a fish farm owned by the government.

This development of new strains may be due to the fact that the government provides funds to carry out research to develop new and improved strains of fish so as to increase an efficient fish production in the country. Furthermore, tertiary institutions are equipped with human resources that are informed on the technical know-how on how to apply biotechnological techniques in the development of the new strains. All this is at the disadvantage of private own fish farm because while many farmers may be aware of the use of biotechnology to develop new strains, lack of funds and required techniques to carry out the activity may pose a major challenge. Presently no new strain has been registered as the new strain reported in the tertiary institution is still undergoing investigation and monitoring.

The high prevalence of smoking as value addition to catfishes across the three states may indicate the effect of the smoke to destroy bacteria found on the fish simultaneously impacting an attractive sheen and pleasant taste which is cherished by the common populace (Lydia, 1997) Smoking of fish is a commonly practiced in Africa (UNIFEM, 1988) and also render a long shelf life which could be attributed to the drying and cooking effects (Tawari and Abowei, 2011).

The average farm sales which were all made locally were calculated based on the output of the fish harvested at the end of each cropping season, regardless of the various cultural practices used by the producers. Yields were below 1,000 tones in all the states, higher sales observed in Lagos State might be attributed to the higher purchasing power of consumers in urban centers (Adeogun *et al.*, 1998).

All fish farmers had one hindrance or the other with capital as the major constraint, to run and

expand their establishment. This may imply that most of the farmers rely on banks and cooperatives as a source of credit facilities. A similar observation was reported by Fagbenro (2005), Fregene and Digun-Aweto (2008) and Adelakun *et al.,* (2015). Another great challenge faced by fish farmers during the survey was the high cost of quality fish seed which was a factor militating against aquaculture development (Olaoye *et al.,* 2013). Other constraints recorded include poor market, insecurity, theft and inadequate availability of water.

CONCLUSION

Aquaculture production is on the increase in Nigeria, however, the industry has not grown in a sustainable pattern fast enough to meet the projected demand. The current study revealed that most fish farms have been in existence for a period between five and ten years and the farms were owned by private individuals. The major cultured fish is the catfish family (*Clarias gariepinus*) and cichilids (*Oreochromis niloticus*). Farmers preferred culturing fingerlings to grow-out fishes. Throughout the study, no new strain of fish was recorded except in a tertiary institution in Oyo state. Therefore it is imperative that farmers should develop new strains of fish through training and collaborations with appropriate institutions in order to bridge the gap between the demand and supply of fish products in the country.

REFERENCES

Adelakun, K. M., Amali R. P., Ogundiwin, D. I. and Bakare, K. (2015). Assessment of catfish farming in Osogboand its environs. Peer Journal PrePrints. 14pp.

Adeogun O. A., Ayinla O. A., Ajao E. A.and Ajana A. M. (1998). Economic Impact Assessment of Hybrid Catfish in Nigeria. World Bank Technical Report. 12pp.

Aghoghovwia, O. A. and Ohimain, E. I. (2015). Survey of aquaculture practices in Yenagoa, Bayelsa State, Nigeria. *Nigerian Journal of Agriculture, Food and Environment.* 11(3):87-90.

Ahmed, M., Bimpao, M. P. and Gupta, M. V. (1996). Economics of Tilapia aquaculture in small water bodies in Bangladesh. In: The Third International Symposium on Tilapia in Aquaculture. ICLARM Conference Proceedings. 471p.

Dunham, R. A. (2004). Aquaculture and Fisheries Biotechnology – Genetic Approaches. CABI Publishing. 372pp.

Ele, I. E., Ibok, O. W., Antia-Obong, E. A., Okon, I. E. and Udoh, E. S. (2013). Economic Analysis of Fish Farming in Calabar, Cross River State, Nigeria. *Greener Journal of Agricultural Sciences*. 3(7):542-549.

El-Naggar, G., Nasr-Alla, A. and Kareem, R. O. (2008). Economic analysis of fish farming in Behera Governorate of Egypt. In: Elghobashy, H., Fitzsimmons, K., Diab, A.S. (eds.) *Proceedings of 8th International Symposium on Tilapia in Aquaculture, Cairo, Egypt, "From the pharaohs to the future*". 52pp.

Fagbenro, O. A. (2005). *Aquaculture in Nigeria: History, Status and Prospects. A Report on FAO world Fish Centre Workshop Cameroon.*

Fregene, T. and Digun-Aweto, T. (2008). Use of Aquaculture Technologies in Osun State, Nigeria. *African Journal of Livestock Extension*, 6: 36-4.

FAO. (2014). The State of World Fisheries and Aquaculture. Food and Agricultural Organization, Rome, Italy.

FDF. (2008). Fisheries Statistics of Nigeria. Fourth edition, 1995 – 2007, Nigeria. 48pp

Hammed, A. M., Fashina-Bombata, H. A. and Osinaike, A. O. (2010). The use of cold shock in inducing triploidy in African mud catfish (*Clarias gariepinus*). *African Journal of Biotechnology*, 9(12):1844-1847.

Ibemere, I.F. and Ezeano, C. I. (2014). Status of fish farming in Rivers State, Nigeria. *Journal of Fisheries and Aquatic Science.* 9(5):321 329.

Idodo-Umeh, G. (2003). *Freshwater Fishes of Nigeria (Taxonomy, Ecological Notes, Diets and Utilization)*. Idodo-Umeh Publication Ltd. Benin City, Nigeria, 232pp.

Lakra, W. S. and Ayyappan, S. (2003). Recent Advances in Biotechnology Applications to Aquaculture.*Asian-Australian Journal of Animal Science*, 16(3): 455-462.

Lydia C. M. (1997). *So easy to Preserve*, 3rd Edition Co-operative Extensive Service, the University of Georgia College of Agriculture, 265pp.

Meye, J. A. and Ikomi, R. B. (2008). A study on the fish fauna of Urie Creek at Igbide, Niger Delta. *The Zoologist*, 6:69-80.

Nwokwa, M. C. (2012). The review of recent advances in fish genetics and biotechnology. *Continental Journal of Fisheries and Aquatic Science*, 6(1): 9-18.

Offem, B. O., Ikpi, G. U. and Ada, F. (2010). Fish culture technologies in South-eastern Nigeria. *African Journal of Agricultural Research*, 5(18):2521-2528.

OGADEP. (2009). Ogun State Agricultural Development Programme Fisheries Report, 12pp.

Olaosebikan, B. D. and Raji, A. (1998*). Field guide to Nigeria Freshwater Fishes*. Federal Collegeof Freshwater Techn, New Busssa, Nigeria. 104pp.

Olaoye, O. J, Ashley-Dejo, S. S, Fakoya, E. O, Ikeweinwe, N. B, Alaegbeleye, W. O, Ashaolu, F.O and Adelaja, O. A. (2013). Assessment of Socio-Economic Analysis of Fish Farming in Oyo State, Nigeria. *Global Journal of Science Frontier Research Agriculture and Veterinary*, 13(9):46-54.

Olaoye O. J, Adekoya B. B, Ezeri G. N. O, Omoyinmi G. A. K, Ayansanwo, T. O. (2007). Fish Hatchery Production Trends in Ogun State: 2001-2006. *Journal of Field Aquaculture Studies*, (3):29-40.

Oloruntoba, A. and Adegbite, D. A. (2006). Improving Agricultural Extension Services through University Outreach Initiatives: A Case of Farmers in Model Villages in Ogun State, Nigeria. *Journal of Agriculture Education Extension*. 12(4): 273-283.

Omofunmi O.E. Adewumi, J. K, Adisa, A. F, and Alegbeleye, S.O. (2016). Technical assessment of Catfish effluents management in Lagos State, Nigeria. *International Journal of Agricultural Sciences.* 6 (2): 927–930.

Pandian, T. J. and Koteeswaran, R. (1998). Ploidy induction and sex control in fish. *Hydrobiology*, 384:167-243.

Tawari, C. C and Abowei, J. F. N (2011). Traditional Fish Handling and Preservation in Nigeria. *Asian Journal of Agricultural Sciences,* 3 (6):427-436.

UNIFEM. (1988) Fish processing, Food Cycle Technology, Source B