Evaluation of Feed-Type Choices and Performance of Fish Farming in Akure South Local Government Area of Ondo State, Nigeria

[1,2]Fatuase, A.I.; [1,2]Ajibefun, A.I. and [2]Bobola, M.O.

[1]Department of Agricultural Technology, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria.

[2]Department of Agricultural Resource and Economics, Federal University of Technology, Akure, Ondo State, Nigeria.

Abstract

The long desired self-sufficiency in national and grass-root fish production is momentous to food security in Nigeria. The nature and patterns of feed utilization among fish farming households will provide a strategy to raise demand for local feeds thereby raising national feed production vis-à-vis reducing Nigeria's import dependency on feeds. The study investigated the feed choices and performance of fish farming in Akure South Local Government Area of Ondo State, Nigeria. A random sampling of 120 fish farmers was taken and subjected to profitability and multinomial logit model analyses. The findings revealed that majority of the respondents (57.50%) cultured juvenile seed while 55.83% used only earthen pond. The gross margin and net farm income were ₦531,808.36 and ₦391,790.15 respectively. The result of the expense structure ratio (ESR) showed that 50% of the total cost of fish production was made up of fixed cost items. Benefit cost ratio (1.93) and percentage profit (93%) indicated that fish farming was a profitable venture in the study area. Results of multinomial logit model revealed that the major factors that significantly influenced fish farmer's preferences for either a combination of imported and local feeds or the imported feed only to the local feed were educational status, fish price, experience, cost of feed, household income, numbers of pond and household size. The study concluded that massive awareness on the benefit of locally made feed as a viable alternative to the popular imported feed should be encouraged.

Key words: fish farmers, fish feed, multinomial logit, profitability

Introduction

The contribution of fisheries and aquaculture sector is germane to agricultural development vis-a-vis Nigeria's economy. In Nigeria, the demand for fish is increasing everyday due to its importance as a source of protein and other essential nutrients required for a balanced diet. [1] opined that Nigeria is experiencing a demand-supply gap of about a million metric tons given the national production to be 511,000 metric tons/annum and demand of 1.5 million metric tons annually. This has increased the importation of fish by 700,000 metric tons at a cost of over US$400 Million [2]. In filling the demand-supply gap, there has been a tremendous awareness of fish farming as a supplement to increase the domestic production and export of fish with the introduction of various species such as *Tilapia spp, Heterobranchus bodorsalis, Clarias gariepinus, Mugie spp, Chrysichthys nigrodigitatus, Heterotis niloticus, Ophiocephalus obscure, Cyprinus carpio and Megalo spp* [3]. The Food and Agriculture Organization of the United Nations (FAO) classified aquaculture as the World's fastest growing food production sector for nearly two decades globally. The sector has shown an

overall average growth rate of 11.0% per year since 1984, compared with 3.1% for terrestrial farm animal meat production [4]. [5] also opined that the aquaculture industry in Nigeria has grown tremendously in the past nine years with a reported production of farmed catfish of 143,207 metric tons [6] and some 20% growth per year. Moreover, Nigeria has the capacity to attain the desired fish self-sufficiency within a short of time if the numerous aquaculture potentials (land 1.7 million Ha and water, 14 million ha), which abound the nation is adequately utilized. These potentials are estimated at about 2.5 million metric tons of fish annually [4] which exceeded the total amount required by Nigerians annually. Despite the failure to explore the aquaculture potential in the country, the current development has catalyzed a well developed value chain of many participants including an estimated 5,000 or more fish farmers, some 15 large fish hatcheries and more than 100 small to medium hatcheries as well as four quality fish feeds of local manufacture, some 12 imported quality fish feeds and an undocumented large number of small artisanal fish feed producers. Equipment suppliers and consulting service providers have grown with fairly wide coverage in the different regions of the country, although most suppliers are focused in the South Western part of the country, where the aquaculture industry began [5]. This has also created job opportunities and serves as a source of income generation to thousands of Nigerians most especially unemployed graduates. Despite the increase of fish production in Nigeria, production level is still very low compared with the level of demand and this has been attributed to several factors including fish feeds. The importance of feed in fish production cannot be overemphasized. With the exception of good water quality, no single factor is of more importance in determining the success of rearing fish in captivity than the dietary composition. It is responsible for over 60% of farmers' total expenses in the course of production [7]. It has also been reported that the quality of feed will make 85 – 90% survival rates possible, compared with survival rates of 40 – 60% using feeds made on the farm locally. The feed quality affects water quality, which in turn affects fish health. The best feeds are water stable and are more efficiently utilized by fish, so that the impact on water quality is minimized [7]. Again, huge amount of money is spent in importing fish feed and concentrates because of the need to improve protein intake of Nigerians. Studies also revealed that all sort of food items were used by fish farmers ranging from animal dung, groundnut cake etc, to culture fishes to table size [7], but the best farmers use only the best feeds available, and by doing so, make more profit, despite their higher cost. Such feeds offer farmers fast growth and low feed conversion ratios [5]. Therefore, this study critically looks into the feed-type choices and performance of the fish farming in Ondo State, Nigeria. The objectives of this study are to: ascertain the socio-economic characteristics of the fish farmers; determine costs and returns of the fish farming; identify actual choice of feed type employed by the farmers; and determine the factors that influence the choice of feed-type employed by the farmers.

2.0 Methodology

2.1 Study area

This study was carried out in Akure South Local Government Area (LGA) of Ondo State, Nigeria. The LGA is one of the eighteen LGAs in the State. It is situated on longitudes $5^0\ 11^1$ E and latitudes $7^0\ 14^1$ N of the equator. It has an area of 331km^2 and a population of 353,211 [8]. The climate of the area is highly favoured for the agrarian activities of her teeming population who grow crops such as cocoa, kola nut, palm tree and arable crops like maize, yam and cassava. The annual rainfall is between 1000mm and 1500mm with a high daily temperature of about 30^0C. The majority of the population consists of peasant farmers cultivating crops and rearing livestock at a small-scale level. Livestock keeping is not a major occupation of the population but for some years' past, fish farming has been noticed to be taking recognition in the study area.

2.2 Data collection and sampling technique

Primary data were used for this study which were collected through direct personal interview and structured questionnaire to obtain pertinent information for the study. Multistage sampling technique was used to select respondents. It was commenced by purposively selecting Akure South Local Government Area (LGA) in Ondo State. This was based on the numbers of registered fish farmers as well as their contributions to the aquaculture. The LGA was further stratified into eleven (11) wards based on administrative and political stratification. Ten (10) wards were randomly selected and they were: Apomu, Oda, Owode/Imuagun, Okearo/IrowoII, Gbogi/IsikanI, Lisa, Odo petu, Okearo/IrowoII, Oshodi/Isolo and Gbogi/IsikanII. Twelve (12) fish farmers were randomly selected from each ward, making 120 respondents.

2.3 Analytical procedure

The data collected were analyzed using descriptive statistics such as frequencies, percentages to examine the socio-economic characteristics of the fish farmers in the study area. Budgetary analysis was used to determine the profitability, while multinomial logit (MNL) model was used to determine factors that influenced choice of feed-type used by the fish farmers.

2.3.1 Budgetary Analysis

Gross margin analysis was used to determine the cost and returns from fish production and the Net Farm Income (NFI) of the fish farmers were as well estimated. The Gross Margin and Net Farm Income were estimated given equations 1 and 2.

GM = TR – TVC ……..(1) and, NFI = TR – TC …….(2)

where,

TR = total revenue; GM = gross margin; TC = total cost of production (₦); TVC = total variable cost (₦); NFI = net farm income (₦); TFC = total fixed cost (₦).

If GM >0, then fish production is considered profitable

If NFI >0, then fish production is considered profitable

2.3.2 The Multinomial Logit (MNL) Model

The MNL model was employed to investigate the probable reason for fish farmers in the study area to prefer other feed types to the local Nigerian made feed type. The multinomial logit is a widely used model in econometrics to explain the choice of an alternative among a set of exclusive alternatives. This study employed the standard Multinomial Model, the probability function which was defined by [9].

Model Specification: Let Y_i be a random variable representing the main feed type chosen by any fish farmer. It was assumed that each farmer faces a set of discrete, mutually exclusive choices of feed types. The feed types were also assumed to depend on a number of socio-economic characteristics that form the factors of X_i. The MNL model for feed choice specifies the following relationship between the probability of choosing option Y_i and the set of explanatory variables X_i as reported by Greene (2003) cited in [10].

$$Prob\ (Y_i = j) = \frac{e^{\beta_j x_i}}{\sum_{k=0}^{j} e^{\beta_k x_i}}\ , j = 0, 1 \ldots J \qquad (3)$$

Where: β_j is the vector of coefficients on each of the explanatory variables, X_i. Therefore, equation (3) can be normalized to remove indeterminacy in the model by assuming that $\beta_0 = 0$ and the probabilities can be estimated as:

$$Prob\left(Y_i = \frac{j}{x_i}\right) = \frac{e^{\beta_j x_i}}{1 + \sum_{k=1}^{J} e^{\beta_k x_i}}, j = 0,2 \ldots J, \beta_0 = 0 \quad (4)$$

Estimating equation (4) yields the J log-odds ratios:

$$ln\left(\frac{P_{ij}}{P_{ik}}\right) = x_i(\beta_j - \beta_k) = x_i\beta_j, if\ k = 0 \quad (5)$$

The dependent variable is therefore the log of one alternative relative to the base alternative. The MNL coefficients are difficult to interpret, and associating the β_j with the jth outcome is tempting and misleading. To interpret the effects of explanatory variables on the probabilities, marginal effects are usually derived as stated in [11,10]:

$$\delta_j = \frac{\delta P_j}{\delta x_i} = P_j\left[\beta_j - \sum_{k=0}^{J} P_k\beta_k\right] = P_j\left(\beta_j - \bar{\beta}\right) \quad (6)$$

The marginal effects measure the expected change in probability of a particular choice being made with respect to a unit change in an explanatory variable (Long, 1997; Greene, 2000 cited in [10]. The signs of the marginal effects and respective coefficients may be different, as the former depend on the sign and magnitude of all other coefficients [10].

Therefore, the dependent variables are: Local Nigerian feed type (1), Imported feed type (2), and Combination of both local and imported feed types (3). While the explanatory variables were age (years), marital status (married=1 and 0 otherwise), household size (numbers), education (1=educated and 0 otherwise), experience (years), household income (naira), pond size (numbers), fish price (naira/kg) and access to credit (access =1 and 0 otherwise).

Results and Discussion

Socioeconomic Characteristics

The socioeconomic characteristics of the fish farmers are critical to efficient fish production. It was reflected in Table 1 that the highest proportion of the farmers were aged between 41 and 50 years' old and this represented 46.7% of the total farmers surveyed, while the lowest proportion of the farmers were aged 61 years and above. Another large proportion of the farmers were aged between 31 and 40 years' old and this represented 25% of the total farmers. The implication of the above is that fish farming enterprise in the study area is much characterized by farmers in their economically productive years which are good for the enterprise. Meanwhile, the enterprise is male-dominated as male accounted for 75.8 % of the total farmers surveyed while female accounted for just 24.2%. The much higher percentage of male famers to female farmers in the study area could be credited to the fact that fish farming is a rigorous venture which required the vim of men in the production stages.

An analysis of the household size of the respondents revealed that 40.8% of the farmers had household size between 1 and 5, 48.3% had household size between 6 and 10, while 10.9% had household size greater than 11. The moderately large household size of the farmers was probably occasioned by the need to provide labour to the farms and sustain economic activities. From these sampled respondents, only 20.0% of them were single, 74.2 % were

married while just 2.5% and 3.3% were widowed and divorced respectively. The highest percentage (74.2%) of married farmers indicated family responsibility and also justified the moderately large household size of the farmers.

Education and experience are both key to the success of any farming enterprise and most especially to the success of fish farming enterprise given the techniques and skills involved. Only 10.8% of the farmers had no formal education, 20.8 % had primary education, 32.6% had secondary education, while 35.8% had tertiary education. About 90% of the farmers had formal education in all. This is good for fish farming enterprise in the study area as adoption of improved fishing technologies and farm business management skills will be easily inculcated given the farmers' level of education. The proportion of the farmers that had fish farming experience less or equal to 5 years were 45%, 37.5 % had fish farming experience ranging between 6 and 10 years, while 17.5 % had fish farming experience greater than 10 years. The farmers' farming experience may be described as adequate, which could have positive impact on the fish production in the area.

Table1: socio-economic characteristics of the fish farming household in the study area

Socio-economic characteristics	Frequency	Percentage	Cumulative percentage
Age (years)			
≤ 30	12	10.0	10.0
31 – 40	30	25.0	35.0
41 – 50	56	46.7	81.7
51 – 60	16	13.3	95.0
61 and Above	6	5.0	100.0
Gender			
Male	91	75.8	75.8
Female	29	24.2	100.0
Household size			
1 – 5	49	40.8	40.8
6 – 10	58	48.3	89.1
11 and Above	13	10.9	100.0
Marital status			
Single	24	20.0	20.0
Married	89	74.2	94.2
Widowed	3	2.5	96.7
Divorced	4	3.3	100.0
Fish farming experience (years)			
≤ 5	54	45.0	45.0
6 – 10	45	37.5	82.5
11 and Above	21	17.5	100.0
Educational level			
No formal education	13	10.8	10.8
Primary education	25	20.8	31.6
Secondary	39	32.6	64.2
Tertiary	43	35.8	100.0
Total	120	100.0	

Source: Computed from Field Survey, 2013

Fish pond characteristics

Analysis of the fish pond characteristics of the farmers in the study area as reflected in Table 2 revealed that 18.3% of the farmers cultured fingerlings, 57.5% cultured juveniles, while 24.2% cultured both fingerlings and juveniles. Those who cultured fingerlings alone were in the business of producing juveniles for fish market, while those who cultured juveniles alone produced table size fish for consumption and this group of fish farmers was the largest. This is because fish juveniles alone were much easier to handle than fingerlings which are younger and both fingerlings and juveniles which may present some difficulties.

Important fish pond characteristics are the source of water and type of ponds used. Only 6.7% of the famers used tap/ borehole water source, 87.5% used stream/ river water source, while 5.8% used well water source. A large proportion of the farmer i.e. 85.7% of the respondents used earthen ponds, while only 6.7% used concrete ponds. The source of water and the type of ponds used are closely related. About the same large proportion of the farmers who used earthen ponds (85.7%) depended on steam/river water source (87.5%) to fill their earthen pond as they were dug close to perennial stream or river water source. The smaller proportion of farmers who used concrete pond got their water from tap/bore and or well.

Adequate and prompt financing of fish farm enterprise is fundamental to productivity and profitability in the fish business as feeds, drugs and other inputs must be adequately supplied to the fish promptly and regularly. Fish farmers in the study area used these four major credit sources- personal savings, cooperatives, thrift and save and other sources. It was also observed from Table 2 that fish farmers got their main finances from personal savings (60%) and this could hinder the expansion of fish production due to inability to access credit facilities. It was only 22.5% of the respondents that accessed credits from cooperatives, 14.2 % used thrift and save, while only 3.3% got credit from other sources such as banks, money lenders and friends and relatives.

The number of ponds each fish farmer had was directly related to the type of labour used. Just 15.8% of the farmers had between 1 and 3 ponds, 45% had ponds ranging from 4 to 6, 15.8% had pond from 7 to 10, 14.2% had 11 and 12 ponds, while 9.2% had ponds from 13 and above. In general, the study showed that many of the fish farmers still operated at a subsistent level. However, 32.5% of the farmers used family labour, 56.7% used hired labour, while 10.8% used both family and hired labour. The highest use of family labour was premised on the fact that the Akure South Local Government is in an agrarian area with agriculture occupying more than 60% of the population.

Table 2: Fish Pond Characteristics in the Study Area.

Fish pond characteristics	Frequency	Percentage
Type of fish cultured		
Fingerlings	22	18.3
Juveniles	69	57.5
Both	29	24.2
Source of water		
Tap water/borehole	8	6.7
Stream/river	105	87.5
Well	7	5.8
Type of ponds		
Earthen	103	85.8
Concrete	8	6.7
Both	9	7.5
Source of credit		

Personal	72	60.0
Cooperatives	27	22.5
Thrift and save	13	14.2
Others	4	3.3
Number of ponds		
1 – 3	19	15.8
4 – 6	54	45.0
7 – 10	19	15.8
11 – 12	17	14.2
13 and above	11	9.2
Source of labour		
Family	39	32.5
Hired	68	56.7
Both	13	10.8
Total	**120**	**100.0**

Source: Computed from Field Survey, 2013

Costs and Returns Analysis

Budgetary analysis is very germane in accessing any enterprise in order to be abreast with the financial performance of the business. It was revealed from Table 3 that the total variable cost formed the main cost (66.7%) of the total cost, while the total fixed cost was 33.3%. The depreciation cost on pond formed the bulk (22.97%) of the total fixed cost and this may be as a result of high cost of pond evacuation and materials used in constructing a standard fish pond in the study area. The cost of feed (51.5%) was also noticed to form the bulk of total variable cost which implies that feed is an important factor that determines the level of fish production in the study area as also observed by [7]. The gross margin, net farm income and percent profit of ₦531,808.36, ₦391,790.15 and 93% respectively show that fish farming is a highly profitable venture in the study area. Also, the expense structure ratio (0.50) showed that 50% of the total cost of fish farming was made up of fixed cost items. The benefit-cost-ratio of 1.93 implied that a fish farmer that invested ₦1 realized ₦1.93k as revenue or gained 93k on each naira expended. This again re-established the fact that fish farming was profitable in the study area.

Table 3: Estimation of Costs and Returns of the Fish Production in the Study Area

Items	**Mean value (₦)**	**Percentage**
A. Variable Inputs		
Cost of feed	144,253.88	34.32
Cost of fingerling	77,583.18	18.45
Cost of fertilizer	1,101.21	0.26
Cost of lime	912.34	0.22
Cost of labour	42,211.58	10.04
Cost of maintenance	9,241.01	2.20
Other costs	5,001.11	1.19
Total Variable Cost	280,304.31	66.69
B. Fixed Costs		
Depreciation cost on pond	96,545.00	22.97
Depreciation cost on water pump	11,920.58	2.84
Depreciation cost on pond equipment	15,521.12	3.69

Depreciation cost on wheel barrow	2,201.39	0.52
Depreciation cost on weighing balance	13,830.12	3.29
Total Fixed Cost	140,018.21	33.31
Total Cost of Fish Production (TCFP)	**420,322.52**	**100.00**
Total Revenue (TR)	**812,112.67**	

Source: Computed from Field Survey, 2013

Profitability measures:

Gross margin (GM) = TR – TVC = ₦531,808.36
NFI = TR – TC = ₦391,790.15
Benefit-cost-ratio (BCR) = TR/TC = 1.93
Expense structure ratio (ESR) = FC/VC = 0.50
% profit = NFI/TC x100 = 93%

Fish Farmers' Preference for Feed Utilization

The study observed that fish farmers in the area could be grouped under three categories based on their preference to the type of feeds they used in their farms. They are: those that used the local Nigerian feed (LFT) only, those that used the imported feed (IFT) only and those that used the combination of local and imported feeds (CLIFT) to raise their fishes. It was revealed in Table 4 that many of the respondents (56.7%) used IFT to feed their fishes from fingerling/juvenile to a market or table size. It was also observed from the field that majority of this group had large farm and pond sizes. About 33.3% of the respondents used CLIFT in feeding their fishes. It was told that most of them commenced the feeding by giving the fishes imported feeds for three (3) months or plus, after which they give them local feeds till maturity. Only 10% of the fish farmers used LFT only to feed their fishes from fingerling to market size. During the group discussion, some of them gave reasons for their preference as regard the choice of feeds used in their farms. The farmers reported that imported feeds make their fishes grow rapidly and faster than when they use local feeds; unlike local feeds, imported feeds do float and one will know if the fishes are consuming it or not; with imported feeds, one can know the rate at which the fishes consume the feeds as well as when they are satisfied; yield can be predicted with imported feeds; and unlike local feeds, preservation is not a problem because it has expiring date. The main constraint is that imported feeds are costly compare with local feeds. According to the farmers, local Nigerian feeds are very cheap and affordable and that they would prefer it to imported feeds if most Nigerian feed producers could improve on preservation methods cum date of expiration and floating pelletized feeds.

Table 4: Actual Choice of Feed-Type Used by the Fish Farmers

Feed-type choices	Frequency	Percentage
Local feed type (LFT) only	12	10.0
Imported feed type (IFT) only	68	56.7
Combined (CLIFT)	40	33.3
Total	120	100.0

Source: Computed from Field Survey, 2013

Factors that Influence the Preference of Feed Type Choices in the Study Area

Table 5 showed the results of MNL Regression model. The likelihood ratio statistics as indicated by χ^2 statistics (134.21) are highly significant ($P < 0.0001$), suggesting the model has a strong explanatory power. In all cases, the estimated coefficients should be compared with the base category of local Nigeria feed type (LFT) in the case of this study. Moreover, the MNL is run with and without many explanatory variables as they were in many studies such as [12] and [13] while some were later dropped because of their insignificant effect on the parameters of the estimates. The coefficients and marginal effects of the MNL with their significant level that determined the factors influencing the choice of feed-type employed by the respondents were reported as shown in the Table. It was revealed that household income, educational background, years of fish farming experience, pond size and access to credit facility were the main variables that significantly determined why respondents prefer to use imported feed type (IFT) to local Nigerian feed type (LFT). Also, the MNL estimates showed that educational background, years of fish farming experience, pond size, price of fish and cost of feeds were significantly influenced why respondents preferred combined local and imported feed type (CLIFT) to local Nigerian feed type (LFT).

Household income: The coefficient of household income was positive; implying that a unit increase in household income is associated with IFT only being 23.1% more likely. It is believed that the higher the respondents' income, the greater their assets and ability to bear risk. Despite the high cost of imported feeds, they will prefer to go for it because of the fact that they can afford it cum the advantages it has over the LFT.

Educational background: It has a positive coefficient and this implies that educated farmers will forgo LFT only for either CLIFT or IFT only by 1.3% or 1.2% respectively. Education is expected to increase the ability to make a best choice since they have relevant information to make an innovative decision. Therefore, educated farmers will want to look for a way of using the feeds in a cost minimized manner and based on his income, to achieve significant outputs.

Years of fish farming experience: Its coefficient was positive implying that a unit increase in the years of fish farming is associated with CLIFT being 2.7% more likely and IFT only being 4.3% more likely. It is usually said that experience is the best teacher. The probable reason for the result was that experienced farmers would have better knowledge and understanding on the feed utilization that will maximize output.

Pond size: The coefficient of number of ponds was positive under IFT only but negative under CLIFT. This implies that increase in the pond size will increase the likelihood of using IFT only relative to the LFT but reduce the probability of using CLIFT. The probable reason for the result might be that most of the respondents with many ponds produce in large quantity and have target to meet the demand of their customers. As a result of this, they will not want to compromise their standard and trust by using LFT. *Ceteris paribus* using IFT only, will make them to predict the yield and time of maturity of a fish to a market size.

Access to credit: It has a positive coefficient under both feed-type options but statistically significant under IFT only. Statistically, it means that the more the farmers have access to credit, the more likelihood of using IFT only relative to the LFT only by 1.3%. It can be deduced that a farmer that has access to loan or credit will prefer IFT to LFT because of the advantages or benefits he will derive by using it. The farmers also believed that using IFT only would ascertain the return of loan at a due time with an interest unlike when LFT only is used.

Fish price: This also influences the preference of the fish farmers as regards the feed-type to use. The coefficients were positive and statistically significant which implies that a unit increase in the price of fish is associated with either IFT only or CLIFT being 2.3% or 0.6% more likely respectively. If other inputs remain constant and fish price increases, there is a

probability of getting more returns from fish production that will make farmers go for more quality feeds.

Cost of feeds: The coefficient was negative but statistically significant under the CLIFT. The result implies that a unit increase in the cost of feeds is associated with CLIFT being 1.9% less likely. The law of demand is applicable in this situation because the higher the cost of feeds most especially the IFT only, the lower the demand. The farmers will like to go for the cheaper feeds or alternative rather than the costly feeds.

Table 5: Results of marginal effects of the MNL model that determine the preference for feed types

Explanatory variables	Imported feed type (IFT)		Combined local and imported feed type (CLIFT)	
	Coefficient (P-value)	Marginal effects	Coefficient (P-value)	Marginal effects
Age	-4.012 (0.123)	-0.202	5.123 (0.101)	0.910
Marital status	-0.183 (0.611)	-0.011	-0.231 (0.711)	-0.021
Household income (₦)	**6.23E-3* (0.049)**	**4.231**	1.981 (0.101)	0.049
Education	**0.028* (0.010)**	**0.012**	**0.024** (0.002)**	**0.013**
Experience	**0.588*(0.012)**	**0.043**	**0.036** (0.001)**	**0.027**
Household size	-0.026 (0.020)	-0.012	2.211 (0.101)	1.101
Cost of feeds (₦)	-3.412 (0.099)	-1.071	**-1.357*(0.037)**	**-0.019**
Pond size	**0.790* (0.041)**	**0.117**	**-0.567* (0.010)**	**-0.036**
Fish price(₦/kg)	**0.044* (0.016)**	**0.023**	**1.193**(0.007)**	**0.006**
Access to credit	**0.490* (0.031)**	**0.136**	0.274 (0.144)	0.047

Note: **significant at 1%, *significant at 5%; No.of observation = 120; LR chi-square (78) = 134.21**; Log Likelihood = - 192.93; Pseudo- R^2 = 0.271

IFT= Imported feed type; CLIFT= Combine local and imported feed type; LFT = Local Nigerian feed type [**Base category = LFT]**

Source: Computed from Field Survey, 2013

Summary, Conclusion and Recommendations

Fish feeds play a vital role in improving the level of fish production as well as increasing the protein requirements of the Nigeria populace. Therefore, the study critically examined the feed-type choices and performance of fish farming in Akure South Local Government Area of Ondo State, Nigeria. The findings of the study revealed that majority of the fish farmers (81.7%) were still young and economically active for the enterprise. The enterprise was dominated by males with married households. Many of them were educated with fairly fish farming experience. About 58% of the respondents did culture juveniles in which stream/river is the main source of water. Earthen pond was the order of the day in the study area while personal saving was the source of credit. The gross margin and net farm income of ₦531,808.36 and ₦391,790.15 respectively showed the profitability of the venture. Based on the value of profitability measures such as BCR (1.93), percentage profit (93) and ESR (0.50), it re-established the fact that Fish Farming is a lucrative venture that contributes to food security, poverty alleviation and the Nigerian economy. Only few of them used local Nigeria

feed type (LFT) only because it lacks extrusion. If it can be made float, the tendency of patronizing it will be very high. Thereby, it is capable of creating more employment, augmenting income and improving the standard of living of the people. The results of MNL revealed that household income, educational status, fish farming experience, cost of feeds, pond size, fish price and access to credit were the main factors that significantly influenced the preference of fish farmers on the choice of feed-type to employ in the course of fish production.

Therefore, the study recommended that females need to be encouraged to participate in fish farming in the area as a means of augmenting their income and improving their standard of living. Government should make credit available, affordable and accessible to the fish farmers through the agricultural banks and forming of cooperatives among the farmers will also go in along way. Lastly, urgent efforts should be made to bring down the cost of feeds by exploring Local Nigerian feeds through well-funded researches. This will stop importation of feeds into the country and therefore boost Nigerian economy by increasing its gross domestic product (GDP).

References

[1] Vincent-Akpu, I. (2013). Sustainable Development in Fisheries of Nigeria. 'IAIA13 Conference Proceedings' Impact Assessment *the Next Generation* 33rd Annual Meeting of the International Association for Impact Assessment 13 – 16 May 2013, Calgary Stampede BMO Centre | Calgary, Alberta, Canada (www.iaia.org).

[2] Ovie, S. I. and Raji, A. (2006). Food Security and Poverty Alleviation through Improved Valuation and Governance of River Fisheries in Africa. Fisheries Co-management in Nigeria: An analysis of the underling Policy Process. P.30.

[3] Adewuyi, S. A., Phillip, B. B., Ayinde, I. A. & Akerele, D.(2010). Analysis of Profitability of Fish Farming in Ogun State, Nigeria. *Journal of Human Ecology*, 31(3): 179 -184.

[4] Babalola, J.O., Deepak, B., Baboucarr, S., Zawzaw, H., Ibrahim, A. and Ananda, S. (2011). Establishment of a Commercial Catfish and Tilapia Farm at Kuchi Kuchi Kau, Karu L.G.A., Nasarawa State, Nigeria. *Organized by the Egyptian International Centre for Agriculture (EICA).*

[5] Miller, J.W. and Aleem, S. (2010). Aquaculture Buyer's Guide for Nigeria, USAID Markets Project – Maximising Agricultural Revenue and Key Enterprises in Targeted Sites. Oct., 2010.

[6] Federal Department of Fisheries, (2008). Federal Department of Fisheries, Fisheries Statistics of Nigeria Projected human population; fish demand and supply in Nigeria, 2000 – 2015. Pp.56.

[7] Adekeye, A.O. (1987). The Potentials for Commercial Production of Fish Feeds in Nigeria. In: *5th Annual Conference of the Fishery Society of Nigeria* (FISON) , 22-25 Sep. 1986 ,Ilorin, Nigeria, pp. 224-231.

[8] (NPC) National Population Commissions (2006). Nigeria: Report on the Survey of Demographic and Health Survey.

[9] Madalla, G. (1983). *Limited dependent and qualitative variables in econometrics*. Cambridge University Press.

[10] Hassan, R. and Nhemachena, C. (2008). Determinants of climate adaptation strategies of African farmers: Multinomial choice analysis. *African Journal of Agricultural and resource Economics* 2(1), 83-104.

[11] Green, W.H. (2000). *Econometric analysis*, 4th ed. Prentice Hall, Upper Saddle River, New Jersey: Prentice-Hall.

[12] Deressa, T.T.; Hassan, R.M.; Ringler, C.; Alemu, T. and Yusuf, M. (2009). Determinants of farmers' choice of adaptation methods to climate change in Nile Basin of Ethiopia. *Global Environmental Change* 19 (2009), 248-255.

[13] Gbetibouo, G.A. (2009). Understanding Farmers' Perceptions and Adaptations to Climate Change and Variability: The Case of the Limpopo Basin, South Africa. *IFPRI Discussion Paper No. 00849*. Cited 3 May, 2009.

Acknowledgement: Many thanks to NORAD for a financial support that facilitated my attendance at this conference in Australia