

Aquaculture Operations and Feeding Practice of Fish Farmers in Bida Local Government, Niger State, Nigeria

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Abstract: This study was carried out to examine the feeding practices adopted by fish farmers in Bida local government area of Niger State Nigeria. Specifically, the objectives were to describe their socio economic characteristics, evaluate the availability of feeds and feed ingredients in the study area, identify the type of fish farming practices and characteristics, determine the frequency and methods used to feed fish and identify the constraints to efficient use of feeds in the study area. A simple random sampling method was used to select fish farmers in the study area. The study was conducted using well-structured questionnaires, administered to respondents. Data were analyzed using descriptive statistics. The results showed that majority of the fish farmers in the area were male (64.52%). Higher proportions of the farmers were of the age range of between 41 and 50 years (41.94%); Most of them were married (70.97%) and they were mostly with tertiary education (70.97%), and most of them were part time fish farmers (51.67%). Most of the fish farmers cultured *Clarias gariepinus* (87.10%). Substantial number of the fish farmers use commercial feed rather than local feed. (51.61%), with majority of the fish farmers making preference of concrete tanks over other culture facilities (51.61%). The major constraint faced by fish farmers was inadequate funding and high cost of feed (25.81%) which was ranked first. Other constraints were high cost of feed (22.58%), then inadequate funding (16.13%).

Key Words: Fish, Farmers, Aquaculture practice, Fish Nutrition and Feed type.

I. INTRODUCTION

Aquaculture production in Africa involves both intensive and semi-intensive system of production, which are daily gaining grounds in the continent. The increase in African's contribution to world fish production and the fast growth of aquaculture in Africa cannot be discussed without making reference to Nigeria. Being the second highest producer of cultured fish in Africa (second to Egypt) and the highest producer of the second most important aquaculture product in Africa (*Clarias gariepinus*) (FAO, 2012). Fish is the major source of cheap high quality proteins vital for healthy populace in the developing world. Fish consumption is highly relished among people of all classes and ages in that the fish is less tough and more digestible when compared to beef,

mutton chicken and bush meat. Fish as a source of rich food for the poor can play a crucial role in improving the food security and nutritional status of the millions of the people in Africa and other developing part of the world (Ayoola, 2010; Adeniyet *et al.*, 2014). Therefore, the importance of the fishing industry to the sustainability of animal protein supply in the country cannot be over-emphasized. The development of the fish industry will increase local production of fish and save much of the foreign exchange being used for fish importation. Specifically, it has a special role of ensuring food security, alleviating poverty and provision of animal protein (Sadiq and Kolo, 2015). For any aquaculture venture to be viable and profitable, it must have a regular and adequate supply of balanced artificial diets for the cultured fishes. Fish farming is a profitable business, feeding being a major aspect of it. Feeding plays a major role in determining the success of any fish venture. According to (Ayinla, 2007), Fish feed and feeding is an important component of aquaculture as feed account for approximately sixty percent of the variable production cost in intensive aquaculture systems in Nigeria. Furthermore, the degree to which growth potential is realized is highly dependent on feed intake and on how well the feed has been adjusted to the nutritional needs of the fish. Hence, the profitability of an aquaculture venture depends largely on the adoption of correct feeding strategy (Eriegha and Ekokotu, 2017). Fish have a certain biological requirement for nutrients in order to have a healthy, vigorous growth and these nutritional requirements vary mainly depending on the species, its size / life stage and the environment. Therefore, there is a need to develop and encourage fish farmers to make use of ideal pond fertilization programs, non-conventional feed resources, feed stuff processing, refinement and formulations that take cognizance of the requirements of the various species and their stages (Ibiyo and Olowosegun, 2004; Robb and Crampton, 2013). The objective of this study was to investigate the level of engagement and interest of the rural people in fish farming enterprise. Therefore it is imperative that a survey of feeds used in fish farms in Bida Local Government Area be carried out. This is in other to have a reliable data on this important aspect of fish farming and also

to be able to advise the farmer appropriately on the type, quantity and quality of the feed to be used to bring about profitable fish farming business as the major goal in any business is to make profit. This will in turn bring about poverty alleviation and improvement of livelihoods, ensures resource sustainability and foster economic growth.

II. MATERIALS AND METHOD

This survey was carried out among people in Bida Local Government Area. Simple Random sampling techniques were used to select thirty (31) respondents. The data for this study were collected through the use of structured questionnaire to obtain information from fish farmers. The research was designed to cover all the active fish farms in the study area and this was achieved by obtaining the list and addresses of fish farmers and the locations of their farms from fish farmer groups and individuals that had information about fish farm locations. Descriptive statistics (frequency counts and percentages) were used for the data presentation.

III. RESULTS AND DISCUSSION

Demographic Profile of Respondents

These characteristics included the background information, which are inherent attributes of the individual which are acquired as he grows (Tarnongu, 2002). The Socio-economic characteristics of farmers considered in this study include gender, age, marital status, level of education, farming status and farming experience.

Gender Distribution of respondents / Age of Respondent

Males accounted for 63.33% of the total respondents while women accounted for 36.67% of the total respondents which is quiet low when compared to the males (table 1). The implication is that fish farming is dominated by males who have strength for the job in the study area. The result implies that fish farming activities are dominated by males who have strength for the job. Gender plays a very important role in fish farming and agriculture, in terms of property acquisition, for example, fixed assets like land and machines. This is in agreement with (Aliuet *al.*, 2017) who noted that majority of fish farmers were males in his evaluation of the aquaculture status in Ondo state. Results from table 1 below also revealed that fish farming activities are dominated by people between 41-50years of age which is the more active age bracket who have both strength and a reasonable level of maturity. This age bracket is a productive age which portends better future for catfish production also considered as an economically active age. This indicates that very few young and old people are involved in fish farming. This is because fish farming requires adequate attention and a lot of sense of responsibility. This is in agreement with the results of (Bolorunduro, 2003) who observed same in fish farmers in Niger State; he reported that the age group 41-50 is the most active productive years of farmers.

Table 1: Gender Distribution of respondents / Age of Respondent

Gender Distribution of respondents			Age of Respondent		
	Frequency	Percentage		Frequency	Percentage
Males	20	64.52 %	Less than 30yrs	8	25.81%
Females	11	35.48%	31-40	5	16.13%
Total	31	100 %	41-50	13	41.94%
			51-60	5	16.13%
			Above 60	0	0.00%
			Total	31	100%

Marital Status of Respondents/Educational status

The result from table 2 below shows that fish farming activities are dominated by people who are married. This suggests that fish farming is mostly a business for those who have the desire to provide some financial support towards the upkeep of their families and that there is quiet attractive financial gain for those who are yet to marry. (Ekong, 2003) Pointed out that marriage in our society is highly cherished. This assertion was further confirmed by the report of (Oladojaet *al.*, 2008) and (Aliu et al., 2017) who assert that marriage confer some level of responsibility and commitment on individual who are married. This is consistent with other fisheries studies. Also contained in table 2, the results revealed that most of the people involved in fish farming in Bida local government are educated. This means that fish farming is dominated by the educated class and mostly by those with tertiary education. This is so because fish farming requires a lot of technical and scientific knowledge to be successfully undertaken. This is in agreement with (Elekwachi, 2018) who observed literacy level of fish farmers in Edo state. Also (Okunlola, 2009) stated that educational level is one of the factors that influences adoption of new technology by farmers.

Table 2: Marital Status of Respondents/Educational status

Marital Status of Respondents			Educational status		
	Frequency	Percentage		Frequency	Percentage
Single	8	25.81%	Informal	3	9.68%
Married	22	70.97%	Primary	1	3.23%
Divorced	1	3.23%	Secondary	5	16.13%
Widow/Widower	0	0.00%	Tertiary	22	70.97%
Total	31	100%	Total	31	100%

Farming status/Years in fish farming

Part time farmers accounted for 51.61% of the total respondents while 48.39% were full time famers. This result implies that some of the people involved in fish farming in Bida local government are engaged in other occupation apart

from fish farming (table 3). Occupation remains valid in our society as people have one or two things they engaged in which gives them sense of satisfaction and belonging in the society. This agrees with that of (Ifejika and Ayanda, 2005) in Niger State and that of (Aliuet *al.*, 2016) in Edo State who both reported that involvement of most fish farmers in the state are on part-time basis. The result from table 3 also highlighted that those who had 1- 5 years of experience had the highest number and they were accounted for by 64.52%, followed by those who have between 6-10 years of experience and they accounted for 32.26% of the total population. Least represented were those who had above 10 years of experience which were accounted for by 3.23%. This is consistent with (Salauet *al.*, 2014) who observed that most of the farmers have less than ten years of experience. High farming experience enables the farmers face production constraints (Henri-Ukohaet *al.*, 2011).

Table 3. Farming status/Years in fish farming

Farming status			Years in fish farming		
	Frequency	Percentage		Frequency	Percentage
Part Time	16	51.61%	1 – 5yrs	20	64.52%
Full Time	15	48.39%	6 – 10	10	32.26%
Total	31	100%	Above 10	1	3.23%
			Total	31	100%

Culture facilities used/Culture technique

The result revealed that most fish farmers used concrete tanks, this was accounted for by 51.61% of the total respondents, followed by those who use plastic tanks which accounted for 19.35%, closely followed by those who used earthen pond, and this was accounted for by 16.13%. Those who used both concrete and plastic tanks accounted for 9.68% of the total respondents and the least were those in the category of others which accounted for 3.23% (table 4). The results showed that concrete tanks were the most used culture facility in the study area; this could be a result of low clay content in the soil which makes the soil unable to retain water, thereby leading farmers to explore other alternative culture facilities. This is similar to the findings of (Olaoye, 2010) and (Aliuet *al.*, 2016) that fish farmers prefer concrete tanks against earthen fish ponds. This is however in contrast to the work of (Obe and Omojola, 2015) in Ekiti state where a higher percentage of farmer also use earthen pond. The results from the survey, as revealed in Table 4, 83.87% of the respondents practiced mono specie culture technique followed those who practiced poly culture and accounted for 12.90% of the total respondents, and the least was those in the category of integrated culture which recorded 3.23% of the total respondents. This is in agreement with the findings of (Daudaet *al.*, 2017) in Katsina state who reported that most of the fish farmers practiced mono specie culture technique.

Table 4. Culture facilities used/Culture technique

Culture facilities used			Culture technique		
	Frequency	Percentage		Frequency	Percentage
Earthen	5	16.13%	Mono specie	26	83.87%
Concrete	16	51.61%	Poly culture	4	12.90%
Plastic	6	19.35%	Integrated	1	3.23%
Concrete / Plastic	3	9.68%	Total	31	100%
Others	1	3.23%			
Total	31	100%			

Species of Fish Cultured/Type of feed used

From the result obtained, 87.10% of fish farmers prefer monoculture of catfish this may be as a result of poor market price for Tilapia due to too much bone (table 5). The reasons for this species might also be due to the fact that the species has a high market value and it can attain the market size under a few months of rearing. This is similar to findings of (Olaoye, 2010) and (Aliuet *al.*, 2017) that adoption rate of monoculture of Clarias sp. had replaced poly culture due to better market prices, greater demand preference, cultural preferences of most customers, hardiness of fish stock convenient for culture, presentation of fish live at sales point and relatively superior/timely growth performance. The result of the study from table 5 also indicated that most farmers (51.61%) in Bida local government go for commercial source of feed. This is a common practice of many fish farmers who believe that the imported feeds are high quality fish meal feeds with a complete nutritional profile for meeting the nutritional requirement of fish (Hardy and Tacon, 2002), and that it will give the specially young and vulnerable fingerlings a healthy start. This is in agreement with (Omitoyin, 2006) who pointed out that the effectiveness of a feed is a preferred determinant rather than the cost of the feed.

Table 5. Species of Fish Cultured/Type of feed used

Species of Fish Cultured			Type of feed used		
	Frequency	Percentage		Frequency	Percentage
Catfish	27	87.10%	Commercial	16	51.61%
Tilapia	0	0.00%	Local	5	16.13%
Catfish/tilapia	4	12.90%	Both	10	32.26%
Total	31	100%	Total	31	100%

Reason for Choice of Feed/Frequency of feeding

From the study as shown in table 6 below, 48.39% which constituted the majority on this category choose the option of both feed being good. This implies that the local feed is already meeting up to the standards required and expected by fish farmers. This report differs with the work of (Rana and

Hasan, 2013) who reported that when farmers used locally made feeds, feed cost always tend to drop by 10-20% irrespective of intensity of stocking or species stocked. The values recorded from Table 6 also highlighted that most farmers in the study area feed their fish twice daily. Reasons for this might be to reduce feed wastage and save cost. This is in agreement with the work of (Marimuthuet *al.*, 2010) who found feeding twice a day as the best feeding frequency for *Clarias gariepinus* and *Heterobranchus longifilis* fingerlings respectively. Also, (Ajani *et al.*, 2011) found that feeding *Clarias gariepinus* fingerlings twice or thrice a day was effective for optimum result in growth. 38.71% of the farmers chose feeding three times a day and this is similar to report of (Adewolu and Adoti, 2010) that feeding *Clarias gariepinus* fingerlings thrice a day gave best results in terms of growth and economic profit.

Table 6. Reason for Choice of Feed/Frequency of feeding

Reason for Choice of Feed			Frequency of feeding		
	Frequency	Percentage		Frequency	Percentage
They are both good feeds	15	48.39%	Once daily	2	6.45%
Lower cost of local feed	2	6.45%	Twice daily	17	54.84%
Based on availability	5	16.13%	Thrice/more daily	12	38.71%
Can't formulate local feed	5	16.13%	Total	31	100%
Local feed is an alternative	4	12.90%			
Total	31	100%			

Method of feed application/Feeding technique

From the study in table 7 below, 58.07% which constituted the majority on this category choose the option of broadcasting method of feed application whilst the remaining 41.94% practiced spot feeding. This implies that most fish farmers in Bida local government chooses more of broadcasting method of feed application when compared to spot method of feed application. This result is in agreement with that of (Dauda *et al.*, 2017) in Katsina state who stated from his report that higher percentage of fish farmers chooses broadcasting method of feed application. The results as shown in Table 7 did revealed that 45.16% of the respondents practiced feeding to satiation technique followed by those who practiced feeding according to discretion and accounted for 32.26% of the total respondents, and the least was those in the category of feeding by percentage body weight which recorded 22.58% of the total respondents. Although, data has showed that feeding the fish to satiation produced better yield compared to a restricted feeding rate (Li *et al.*, 2006). This is however in contrast to the work of (Aliu *et al.*, 2016) in Edo state where a higher percentage of farmers practiced feeding by percentage body weight.

Table 7. Method of feed application/Feeding technique

Method of feed application			Feeding technique		
	Frequency	Percentage		Frequency	Percentage
Spot	13	41.94%	Satiation	14	45.16%
Broadcasting	18	58.07%	Percentage body weight	7	22.58%
Total	31	100%	Discretion	10	32.26%
			Total	31	100%

Feeding mechanism/Local and foreign feed comparison

As revealed from the survey, 100% which constituted all respondents on this category choose the option of hand feeding method of feed application (table 8). This is also referred to as manual feeding mechanism. This is similar to findings of (Elekwachi, 2018) in Edo state where a higher percentage of farmers practiced manual feeding mechanism. Feeding fish requires a high level of experience and patience. Therefore, the longer the time spent on the cultured fish during feeding, better the chance of feed consumption and utilization. Feeding fish in a hurry may lead underfeeding or overfeeding, while some of the feed may even not be accessible to the fish, thus resulting in feed wastage (Eriegha and Ekokotu, 2017). Table 8 also revealed that 48.39% of the total respondents selected that they can't compare locally made feed with commercial feed why 41.93% selected that they could compare locally made feed to commercial feed nutritionally. This is in line with the submission of (Jamu and ayinla, 2003) and (Aliu *et al.*, 2017) that the low quality of fish feed and its attendant high cost are the major factors limiting the development of aquaculture in Africa.

Table 8. Feeding mechanism/Local and foreign feed comparison

Feeding mechanism			Local and foreign feed comparison		
	Frequency	Percentage		Frequency	Percentage
Hand feeding	31	100%	Yes	13	41.93%
Automatic feeder	0	0%	No	15	48.39%
Total	31	100%	I don't knw	3	9.68%
			Total	31	100%

Constraints in Feeding and Feed source

The result in table 9 below shows that 16.13% of farmers suffer from inadequate funding, 22.58% of farmers chose high cost of feed. Other farmers chose a combination of inadequate feeding, high cost of feed, high cost of ingredient and transportation cost which accounted for 12.90%. 16.13% chose just combination of inadequate funding, cost of feed and scarcity of ingredients; It was observed that majority of the respondent picked high cost of feed as major constraint to

fish farming in Bida local government. The result of this study revealed that the major problem militating against adequate feeding of fish is inadequate funding and high cost of feed constituting 25.81%, this is most likely be due to lack of capital in procuring the feeds and the feed ingredients. This agrees with the work of (Fagbenroet *al.*, 2005) who reported that feed constitute about 60% of production cost. (Obe and Omojola, 2015) also reported cost of feed as major constraint facing fish farmers in Ekiti state.

Table 9: Constraints in Feeding and Feed source

	Frequency	Percentage
1	5	16.13%
2	7	22.58%
3	3	9.68%
4	0	0%
1,2	8	25.81%
1,2,3	5	16.13%
1,2,3,4	4	12.90%
2,3	2	6.45%
Total	31	100%

1. Inadequate funding, 2. High cost of feed, 3. scarcity of feed/feed ingredients, 4. High cost of transportation

IV. CONCLUSIONS

Fish farming in Bida local government is characterized majorly by semi-intensive system of aquaculture with the use of plastic and concrete tanks with a higher preference for concrete tank facility and catfish species being the major culture species. The type of feed used for feeding is majorly drawn commercially (imported feed) from the market, although some farmers manufacture their own feed but do not believe it can compare nutritionally with the commercial feed. It is therefore evident from the result obtained in this study that catfish should be fed twice or three times daily; morning, noon and evening time of the day. Feed is the single most important cost in total production cost for fish. This study has shown that the cost of feed for fish farmers in Bida local government is high, but is similar to prices in other parts of Nigeria. Farmers need to improve their production practices to understand proper feeding regimes so they can reduce the amount they spending on fish feeds and put their income to more productive use.

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