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MANAGEMENT PRACTICE, ADOPTION AND PRODUCTIVITY OF SMALL-SCALE COMMERCIAL AQUACULTURE PRODUCTION IN OGUN STATE, NIGERIA

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ABSTRACT

This study investigated the management practice, adoption and productivity of commercial aquaculture in Abeokuta, Ogun State, Nigeria. The study was conducted in Abeokuta, Ogun State. One hundred and fifty respondents (150) were selected using multi-stage sampling technique. It was observed that majority were married males, educated and within active economic age with mean household size of 4.83. The mean output per production cycle was 1,236.91±752.41 kg, and the most commonly reared fish species was *Clarias spp*. The most commonly practiced culture system was earthen ponds. Also, the result revealed that easy access to inputs is the most available factor of production, with a mean score of 1.66 ranked first, followed by conducive environment/climatic factors (1.63 ranked Second). Majority (55.3%) of the respondents fell within the medium adopter category, while 25.3% classified as high adopters while 19.3% of fish farms are classified as low adopters. This investigation reveals that education, experience, training, extension services, and participation in cooperative societies are critical factors that promote the adoption of scientific aquaculture management practices in commercial fish farms. The study also indicate that farmer needs competent knowledge, skills and techniques to maximize profit.

Key words: Adoption, Fish farming, Innovation, Techniques, Scientific.

INTRODUCTION

Aquaculture plays an important role in nation economic development, potentially offering valuables, skill-based employment opportunities and stabilizing the economy (Nuseibeh, 2023; Nwuba *et al.,* 2022). Aquaculture is the rearing of fish in an enclosed and fairly shallow body of water where all its life processes can be controlled. It is an important sector for the nation's economic development, at a time when government is seeking for ways to diversify the economy, from being purely oil based. It is a potential means of contributing to the food security of the nation, directly by producing fish for food and indirectly by generating employment for the teaming unemployed populace, save foreign exchange and generate foreign exchange through export of fish and fish products (Dey *et al.* 2010).

As human standard of living continues to improve, especially in developing countries, a number of economic activities have continuously become important sources of livelihood, providing the much-needed food and income. Thus, aquaculture sector plays a significant role in reducing protein deficiency and malnutrition, generating employment and earnings foreign exchange.

Fishing contributes about 5% of the per capita animal in-take and employs about 8 million people worldwide (Abulude and Kolawole, 2020). Fish is an important and indispensable source of animal protein which provide at least 50% of the mineral intake and essential animal protein for over hundred million of people from the poorest South Asian and African countries (Food and Agriculture Organization (FAO) (2019). The industry helps in improving the nutrition and health of families, increasing people's income, and acts as active agent of economic development and social change (Ifejika *et al*., 2008).

In Nigeria, fish production is from both external and internal sources. The internal sources, after captured fisheries the second most important is aquaculture. To fulfil the excess demand of growing population, aquaculture productivity needs to be increased. The aquaculture sub-sector is considered a very viable alternative to meeting the nation's need for self sufficiency in fish production. This is based on its high reliability in return on investment. Nigeria is blessed with numerous opportunities for large-scale aquaculture; although the opportunity seems to be over ride by challenges. The main input of fish production is feed account for about 70% of total production cost (Khan *et. al.* 2021,

Ashley-Dejo *et. al.* 2017, Alam et. al. 2012). Another important input that moves-up the productivity of aquaculture is good quality fingerling.

Profitability and productivity are inseparable entities in commercial aquaculture (FAO, 2018). Therefore, analysis and understanding of these important factors for different fish culture systems, is paramount. Profitability and productivity in aquaculture cannot be overemphasized because the two factors largely depend on the level of investment in appropriate technologies and sufficient capital management. Thence, the larger the investment the higher the profit often associated with economies of scale (FAO, 2018).

One way to boost fish production is through the adoption of aquaculture technologies, improve self-sufficiency in fish production and contribute to food security in Nigeria. Rogers (2003) described the adoption process as a mental process through which an individual pass from learning of new idea. The decision to adopt or reject the new idea depends on farmers and their environment, the appropriateness and gains of such innovation. These factors are therefore pre-requisite for adoption of improved farm technology and cultural practices essential for the achievement of self sufficiency in the production of food. Peace Corps (1976) postulate that farmers must pass through five stages of adoption before the idea is accepted. If they are not aware of the ideas, they will not be interested; if they are not interested they cannot evaluate its usefulness; if they do not evaluate, they will never try it, and if they do not try it they would certainly not adopt it. These five stages of adoption are inseparable as a link of a chain. Adoption takes place after people have successfully passed through the five stages. Williams (1968), explained the adoption process with the following steps: awareness; interest; action; desire; conviction and satisfaction. Thus, this study investigated the management practice, adoption and productivity of commercial aquaculture in Abeokuta, Ogun State, Nigeria.

MATERIALS AND METHODS

Study area, sampling size and data analysis technique

The study area is Ogun State situated within the tropics and located in the rain forest belt. The state is located in the rainforest vegetation belt of Nigeria within longitude $2^0$45′E and $3^0$55′E and latitudes $7^0$01′N and $7^0$8′N in the tropics. The state is bounded in the West by the Benin Republic, in the South by Lagos State and the Atlantic Ocean, in the East by Ondo State and in the North by Oyo and Osun State. Multistage sampling procedures were used to select respondents for this study. In the first stage Abeokuta zone was purposively selected out of four Agricultural Development Zones in Ogun State. The selection was based on the intensity of fish farming activities. In the second stage, three (3) Local Government Areas (LGAs) were selected from the six (6) LGAs using simple random sampling. Snowball technique was used in the identification of 484 fish farmers and simple random sampling technique was used in the selection of 150 respondents. The data for this study were subjected to both descriptive (percentages, mean, frequency count, standard deviation) and inferential (multi-variance logistic regression) analysis using.

The explicit form of the multi-variance logistic regression model is expressed as shown below:

$Y = a + b_1X_1 + b_2X_2$ ---------- B_nX_n

Where

Y = Factors affecting adoption of scientific aquaculture management practices

a = Constant.

X_1 = Age

X_2 = Educational qualification

X_3 = Household Size

X_4 = Fish farming experience

X_5 = Training

X_6 = Extension services

X_7 = Participation in cooperative society

RESULT AND DISCUSSION

Socio-economic characteristics of the Respondents

Table 1 provides socio-economic characteristics of commercial fish farmers in the study area. Out of the 150 respondents, 83 (55.3%) were male, and 67 (44.7%) were female. In most cases, fishing activities were

done by men, although women were more engaged in the processing and marketing activities. The findings were similar with the study conducted by (Ajabe *et al*., 2022).

This becomes prevalent because in most communities almost every adult female is likely to be married. This is verified from the result in this study as majority (67.3%) of the respondents were married with a mean household size of 4.83. The mean age of the sampled group was 39 years, this indicated that the respondents were relatively young. The mean age of farmers in Nigeria is usually between 45-48 years (Adeoye 2020; Ogunwale, 2000). More-so, this age range has been tagged productive age as well as active economic age (Ashley-Dejo and Adelaja 2022, Ashley-Dejo *et al.,* 2017). Literacy level was assessed through educational qualification, about 64.7% had tertiary education and only 7.3% had no formal education (Table 1). This implies that respondents in the study area had very high literacy levels which might positively affect the management practices and adoption level. Olaifa *et al,* (2022) pustulated that farmers with low literacy levels hardily adopt nor appreciate most of the improved technologies. Results showed that the fish farmers made an average income of N861,360 per production cycle. Fish farmers in the study area were experienced with an average experience year of 8 years this could made them capable of knowing how best to carry out the production exercise (Table 1). This finding is supported by results of (Ozoemena *et al,* 2022) who asserted that the more years acquired by producers, the more they know about the activities carried out. Such knowledge also translates to lowering cost of production, which consequently increase income generated from production and sales with majority of the respondents.

Factors contributing to management practice, adoption and productivity of fish production

The factors that contribute to management practice, adoption and productivity of fish production in the study area is presented in Table 2. The table shows that easy access to inputs is the most important factor, with a mean score of 1.66 and ranked first, followed by conducive environment/climatic factors (1.63). Other factors that ranked high include a ready market for output, closeness to the source of the market, and accessibility of extension agents. On the other hand, availability of basic/social amenities was the least available factor (Table 2). The finding was similar with Yusuf *et al*., (2022) who reported that access to fish farm input, climatic factor, closeness to source of market were ranked high among other factors considered in their study.

Adoption level of aquaculture management practice

The adoption level of aquaculture management practices by fish farmers in the study area is presented in Table 3. The table indicates that majority (55.3%) fell within the medium adopter category, while 25.3% are classified as high adopters while 19.3% are classified as low adopters. This suggests that most fish farmers have adopted management practices to a significant extent, with a considerable proportion classified as high adopters. The adoption of management practices is crucial for the growth and success of fish farming businesses. Management practices help fish farmers to optimize production, improve efficiency, and reduce risks. The findings from this study suggest that fish farmers have recognized the importance of adopting management practices in their operations and it supports the findings of Ashley-Dejo *et al*., 2016 whose research showed that higher proportions of fish farmers were aware, tried and adopted most of the improved aquaculture technologies with some of the fish farmers also discontinuing most of the previously adopted technologies.

Constraints to management practices adoption

Information on the constraints to the adoption of management practices and productivity of fish farmers in the study area is presented in Table 4. The table shows that inadequate capital, high cost of input, high cost of fish feed, land acquisition system, inadequate extension services, and pollution were the most serious constraints to the adoption of management practices and productivity of commercial fish farming. These findings suggest that access to capital, quality inputs, and extension services

can facilitate the adoption of improved management practices and enhance the productivity of fish farming. The constraints identified in this study are consistent with previous research on the challenges facing the aquaculture sector in developing countries (Assefa *et al*., 2018; Little *et al*., 2018). Similarly, inadequate extension services have been identified as a significant constraint to the dissemination of knowledge and adoption of best practices in aquaculture (Assefa *et al*., 2018).

Regression analysis on the factors affecting adoption of scientific aquaculture management

The results of regression analysis examining the factors that affect the adoption of scientific aquaculture management practices in the study area is presented in Table 5. It was observed that several variables are significant predictors of the adoption of these practices.

Firstly, educational qualification has a significant positive effect on the adoption of scientific aquaculture management practices, with a coefficient of 1.63 and a p-value of 0.01. This finding is consistent with previous studies that have identified education as a critical factor in the adoption of modern farming practices (Akinwumi *et al*., 2018). Secondly, fish farming experience also has a significant positive effect on the adoption of scientific aquaculture management practices, with a coefficient of 1.89 and a p-value of 0.05. This finding suggests that farmers with more experience are more likely to adopt these practices, perhaps because they have encountered more challenges and realized the benefits of using scientific management approaches. Thirdly, training has the most significant positive effect on the adoption of scientific aquaculture management practices, with a coefficient of 11.74 and a p-value of 0.01. This result highlights the importance of training programs in promoting the adoption of modern farming practices (Rahman *et al*., 2017). Lastly, extension services and participation in cooperative societies also have significant positive effects on the adoption of scientific aquaculture management practices. These findings support the idea that access to information and social networks can facilitate the adoption of modern farming practices Akinwumi *et al*. (2018).

CONCLUSION AND RECOMMENDATION

This study examined the demographic characteristics, management practices, and productivity of small-scale fishers in commercial aquaculture. The results showed that the majority of the respondents were male, most of the respondents had tertiary education, and the average household size was 4.83. Additionally, adoption of management practices such as easy access to inputs, a conducive environment/climatic factors, a ready market for output, and closeness to the source of the market contributed to the productivity of commercial aquaculture farms. The study also found that earthen ponds were the most common type of culture system used. Adoption of scientific aquaculture practices was average. Also, education, experience, training, extension services, and participation in cooperative societies are critical factors that promote the adoption of scientific aquaculture management practices in the study area.

However, the availability of certain factors such as basic amenities and suitable government policies can pose a challenge to the success of the farms. Thus, there is a need for policymakers to provide an enabling environment for the growth of the aquaculture industry in terms of infrastructure, funding, and policy support. The study indicate that farmer needs competency in knowledge, skills and techniques involved in the efficient management of fish to maximize profit, provision of basic infrastructures, electricity and quality water supply, provision of extension services including education program to fish farmer.

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Table 1: Socio-economic characteristics of the Respondents

Variable	Frequency	Percentage	Mean±SD
Gender			
Male	83	55.3	
Female	67	44.7	
Age (years)			
Less than 25	17	11.3	
25 – 35	44	29.4	
36 – 45	41	27.3	39.64±11.06
46 – 55	39	26	
56 and above	9	6.1	
Religion			
Christianity	119	79.3	
Islam	31	20.6	
Marital status			
Single	29	19.3	
Married	101	67.3	
Widowed	16	10.7	
Divorced	4	2.7	
Educational level			
No formal education	11	7.3	
Adult education	8	5.3	
Primary education	5	3.3	
Secondary education	29	19.3	
Tertiary education	97	64.7	
Household or family size			
Less than 4	31	20.6	
4 – 6	97	64.7	4.83±1.95
Above 7	22	14.8	
Do you attend any training program on fish farm management			
Yes	106	70.7	
No	44	29.3	
Reason for farming venturing into fish farming			
Subsistence	50	33.3	
Demand for fish	29	19.3	
Price	11	10.4	
Household consumption	16	10.7	
Years of Fish Farming Experience			
Less than 5	57	38	
5-10	51	34.1	8.05±6.121
11 and above	42	28	
Participation in cooperative society			
Yes	69	46	
No	81	54	

Source: Field survey, 2022

Table 2: Factors contributing to management practice, adoption and productivity of fish production

Factors	Available	Not available	Mean score	Rank
Easy access to inputs	99 (66.0)	51 (34.0)	1.66	1st
Conducive environment/climatic factor	95 (63.3)	55 (36.7)	1.63	2nd
Ready market for output	91 (60.7)	59 (39.3)	1.61	3rd
Closeness to source of market	90 (60.0)	60 (40.0)	1.60	4th
Accessibility of Extension agent	89 (59.3)	61 (40.7)	1.59	5th
Free from theft	75 (50.0)	75 (50.0)	1.50	6th
Affordability of inputs	72 (48.0)	78 (52.0)	1.48	7th
Absence of pest and plague	64 (42.7)	86 (57.3)	1.43	8th
Assess to fund	64 (42.7)	86 (57.3)	1.43	8th
Suitable Government policy	53 (35.3)	97 (64.7)	1.35	10th
Availability of basic/social amenities	41 (27.3)	109 (72.7)	1.27	11th

Source: Field survey, 2022

Table 3: Adoption level of aquaculture management Practice

Adoption level category	Adoption range (%)	Percentage of adopter
Non-adopter	0	0.0
Low adopter	1 – 33.33	19.3
Medium adopter	33.34 – 66.66	55.3
High adopter	66.67 – 1000	25.3

Source: Field survey, 2022

Table 4: Constraints to management practice adoption

Constraints	Very serious	Serious	Not Serious	Not a Constraint	Total score	Mean	Remarks
Land acquisition system in Nigeria	62(41.3)	36(24.0)	19(12.7)	33 (22.0)	427	2.85	S
Inadequate capital	71(47.3)	63(42.0)	6(4.0)	10 (6.7)	495	3.3	S
Inadequate extension services	40(26.7)	39(26.0)	28(18.7)	43 (28.7)	376	2.51	S
Low quality of fish seed	36(24.0)	57(38.0)	33(22.0)	24 (16.0)	405	2.7	S
Pollution	37(24.7)	49(32.7)	49(32.7)	15 (10.0)	408	2.72	S
Managerial problem	35(23.3)	35(23.3)	58(38.7)	22 (14.7)	383	2.55	S
Flooding	66(44.0)	39(26.0)	28(18.7)	17 (11.3)	454	3.03	S
High cost of input	86(57.3)	34(22.7)	25(16.7)	5 (3.3)	501	3.34	S
Predators	28(18.7)	48(32.0)	54(36.0)	20 (13.3)	384	2.56	S
Harvesting cost	29(19.3)	45(30.0)	43(28.7)	33 (22.0)	370	2.47	NS
Poaching	28(18.7)	32(21.3)	65(43.3)	25 (16.7)	363	2.42	NS
Insufficient water for production	29(19.3)	46(30.7)	45(30.0)	30 (20.0)	374	2.49	NS
Disease and pest infestation	35(23.3)	32(21.3)	63(42.0)	20 (13.3)	382	2.55	S
Poor performance of species of fish	42(28.0)	23(15.5)	58(38.7)	27 (18.0)	380	2.53	S
High cost of fish feed	96(64.0)	29(19.3)	19(12.7)	6 (4.0)	515	3.43	S
Lack of fisherman cooperative society	25(16.7	58(38.7)	41(27.3)	26 (17.3)	382	2.55	S
Inadequate information	50(33.3)	46(30.7)	32(21.3)	22 (14.7)	424	2.83	S

Source: Field survey, 2022

Table 5: Tobit regression for factors affecting adoption of scientific aquaculture management practices

Adoption	Coefficient	Standard error	P-value
Constant	37.73	15.63	0.02
Age	-0.26	0.34	0.53
Educational qualification	1.63***	0.63	0.01
Household size	1.26**	1.45	0.05
Fish farming experience	1.89**	0.89	0.05
Training	11.74***	4.51	0.01
Extension services	2.74**	0.34	0.03
Participation in cooperative society	8.63*	1.74	0.06
F-value		61.63	
P-value		0.00	

Significance level: *** for 1%, ** for 5% and * for 10%

Source: Field survey, 2022