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Factors Militating Against Catfish Fingerlings Production among Smallholder Farmers in Anambra State

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Abstract

This study analyzed the factors militating against catfish fingerlings production in Anambra State. The study focused on the factors affecting the profitability of fingerlings production and the constraints faced by the producers. A multistage sampling technique was employed in the selection of location and respondents. The data were collected from 100 catfish fingerlings producers. The primary instrument used for data collected was structured questionnaire. Data obtained was analyzed by descriptive statistics and regression analysis. The analysis reveals that age (0.122, p = 0.037), years of experience (0.155, p = 0.000), stocking density (0.200, p = 0.000), and water temperature (0.130, p = 0.003) significantly impact the profitability of catfish fingerlings production. In contrast, costs related to transportation (-0.110, p = 0.022) and communication have a negative effect, while other factors like breeding weight and cost of feeding are not statistically significant. The major constraints include the scarcity of fingerlings and inadequate capital. The study concludes that while catfish farming is profitable, addressing supply and financial constraints is crucial for enhancing production and profitability. Recommendations include improving supply chains, increasing financial support, and investing in training and infrastructure.

Keywords: *Factors, Militating, Catfish, Fingerlings, Production.*

1. INTRODUCTION

Smallholder farmers in Nigeria have traditionally relied on catfish farming as a source of income and protein with susceptible range of challenges, including disease, poor water quality, and predation (Onyekuru, 2022).

There has been more interest to improve the productivity and profitability of catfish farming in Nigeria and has led to the introduction of new technologies and practices for catfish fingerling production. The improved technologies such as feed formulations and disease control strategies to promote efficency (Nwabueze & Nwankwo, 2023). In Nigeria, smallholder farmers often lack access to the resources and information needed to fully benefit from these advancements (Nwosu 2021).

Economic analysis of catfish fingerling production can provide valuable insights into the profitability and sustainability of this farming activity, as well as identify opportunities for improvement (Nwogugu, 2023). This analysis can also help policymakers and industry stakeholders develop more effective strategies for supporting smallholder farmers and promoting the catfish industry in Nigeria (Ogunbayo, 2021).

In recent years, there has been growing interest in using aquaponics, a combination of aquaculture (fish farming) and hydroponics (soilless plant farming), to improve the efficiency and sustainability of catfish production in Awka North (Ogunfowora, 2020; Ogunbanwo, Adewumi, & Ajayi, 2022). Aquaponics systems can be used to raise fish and plants together in a closed-loop system, which allows farmers to use fish waste to fertilize plants and plants to filter water for fish (Okonkwo-Emegha et al. 2023).

Several studies have been carried out on factors influencing catfish fingerlings production.

Cupp, (2019); Tobor, (2021) in their work identified water quality as a key factor. Good water quality was essential for the survival and growth of catfish fingerlings. Poor water management can lead to high mortality rates, as fingerlings are sensitive to changes in pH, temperature and dissolved oxygen levels. The type and quality of feed significantly affect growth rates and survival. According to Adesina et al. (2020), farmers who used high-protein feed achieved faster growth rates and lower mortality compared to those using cheaper, low quality feed.

Nnaji (2023) in their work access to technology and training; reported that farmers who attended regular training sessions provided by government extension services or private organizations had a higher output and lower mortality rates. Farmers with the access to modern hatchery equipment and training programs were found to be more productive.

Ogunbanwo, Adewumi, & Ajayi, (2022) identified limited access to finance as a major constraint faced by fingerling producers. Most smallholder farmers do not have collateral to secure loans, making it difficult to access.

Ogunbayo, (2021); Chukwu, (2023) in their work on profitability and profit efficiency of catfish fingerlings production reported that inadequate water supply, high cost of feed, high cost of transportation and inadequate funds as the major constraints faced by the respondents of the study area. Despite the importance of fingerlings for the breeding and the culture of catfish only few producers exist in the area. The study want to find out why few farmers are engaged in the production of catfish fingerlings and the possible challenges that is discourages farmers to engage. The broad objective of this study is to examine the factors militating against catfish fingerlings production in Awka North Local Government Area Anambra State. The specific objectives were to: determine the factors affecting catfish fingerling production; and identify the constraints faced by catfish fingerling producers in the study area.

2. LITERATURE REVIEW

Concept of Catfish Fingerlings

Producing catfish fingerlings involves a comprehensive process that draws from aquaculture research, industry standards and practical experience, below is the production process of catfish fingerlings:

Brood stock Management and Selection: The selection starts with selecting healthy, disease-free adult catfish (male and female) known as brood stock. The brood stock selection involves choosing healthy individuals with desirable traits such as growth rate, disease resistance and reproductive performance (Dunham et al, 2017).

Spawning and Egg Incubation: Spawning can be induced naturally or through hormone injections, depending on the species and production goals Dey, Alabi, & Azeez, (2020). Fertilized eggs are collected and incubated in specialized facilities with controlled water flow, temperature and oxygen levels to promote hatching success (Dike, 2023).

Larval Rearing and Weaning: Larvae are fed specialized diets containing essential nutrients such as protein, lipids and vitamins to support rapid growth and development Dey, Alabi, & Azeez, (2020). Weaning; as fingerlings grow, they are gradually weaned onto commercial diets to meet their nutritional requirements and transition to pond culture Dey, Alabi, & Azeez, (2020). Pond Culture and Management: Fingerlings are stocked in production ponds at appropriate densities to optimize growth rates and minimize competition for resources (Dunham et al., 2016). Regular monitoring and management of water quality parameters such as temperature, pH, ammonia and dissolved oxygen are essential for fish health and growth.

Health Management: Health management practices include disease surveillance, vaccination (if applicable) and biosecurity measures to prevent the introduction and spread of pathogens (Cupp., 2019). In cases of disease outbreaks, various treatment options such as antibiotics, vaccines and probiotics may be utilized, following industry regulations and guidelines Dey, Alabi, & Azeez, (2020).

Grading and Harvesting: Catfish Fingerlings are periodically graded based on size and uniformity to optimize stocking densities and ensure consistent growth John Wiley & Dunham, (2016). Harvesting methods vary but commonly involve seining or netting the fish from ponds followed by sorting and transport to market or grow out facilities.

Overall, these processes usually occurs in hatcheries, where brood stock (mature fish) are selected for breeding based on desirable traits such as disease resistance and growth rates. According to Dey, Alabi, & Azeez, (2020), the process begins with the induced spawning, where brood stock are stimulated to release eggs, which are then fertilized and incubated. Once the eggs hatch, the fry (newly hatched fish) are nurtured until the reach the fingerling stage. Feeding and water management are crucial in this period to ensure high survival rates, as fingerlings are particularly susceptible to environmental stress and disease John Wiley & Dunham (2016).

Concepts of Constraints Faced by Catfish Fingerling Producers

Smallholder catfish fingerling producers in Nigeria face numerous challenges, which hinder their ability to scale production and achieve optimal returns. One of the primary challenges is lack of access to high quality brood stock, which directly affects the survival and growth rates of fingerlings Okonkwo (2024). Market access and infrastructure, where producers often face difficulties in accessing markets due to poor infrastructure, high transportation costs and market price volatility Nwosu, (2021), Other constraints include poor access to credit facilities, which limits the ability of farmers to invest in better inputs and inadequate training on modern fish farming techniques. Environmental factors such as water scarcity or pollution also pose significant risks.

Production Theory

Production Function

The production function portrays an input-output relationship it describes the rate at which resources are transformed into products. There are numerous input-output relationships in agriculture because the rates at which the inputs are transformed into outputs will vary among soil types, animals, technologies, rainfall amount and so forth. Production function is a technical and mathematical relationship describing the manner and extent to which a particular product depends upon the quantities of inputs or services of inputs, used at a given level of technology and in a given period of time. It shows the quantity of output that can be produced using different levels of inputs. A production function can be expressed in different ways: in written from, enumerating and describing the inputs that have a bearing on the output, by listing inputs and the resulting outputs numerically in a table; depicting in the form of a graph or a diagram, and in the form of an algebraic equation.

Production theory helps in understanding the optimal combination of resources to achieve maximum output Choi, Han, & Lee (2021). In the link of catfish fingerling production in Awka North local government area, this theory will be applied to analyze how land, labor, capital, and management practices influence the yield and profitability of catfish fingerling farms. By understanding the production functions, the study can identify efficiency levels and suggest improvements for better productivity.

3. METHODOLOGY

Research Design

The socio-economic variables of the respondent were analyzed with survey design.

Area of Study

This study was carried out in Awka North Local Government Area, located in Anambra State, Nigeria. Awka North covers an area of 182 square kilometres and shares boundaries with Awka south, Onitsha North, Oyi and Anambra east LGAs. Awka North Local Government Area is one of the twenty-one local Government Area making up Anambra State. It is situated in the south-central region Nigeria. The area has a tropical savanna climate with two distinct seasons: rainy and dry season. The main occupations there are farming, trading and craftsmanship. The people of awka North LGA are predominantly Igbo with a rich cultural heritage and traditional festivals like the new yam festival (iri ji) and the Ofala festival. The primary language spoken is igbo with English as the official language. The majority of the population practices christainity, with a significant number of traditional religion practitioners. . Towns that make up the local government are Awba Ofemili, Ugbenu, Ugbene, Ebenebe, Achalla (the capital), Urum, Amansea, Amanuke, Isu Aniocha, Mgbakwu. The headquarters is located in Achalla, as of 2006, the population was approximately 109,989 people.

One of the source of income for the residents of Awka North is agriculture with catfish farming being a significant component of their agricultural practices. They also engage in other activities in agriculture like plantations, cultivation of crops (cassava, yam, and maize) and livestock farming (poultry, cow, and goat) which contributes to the agricultural economy.

Population of the Study

The study comprise of all registered catfish fingerlings smallholder farmers (1300) in Awka North Local Government Area (LGA), Anambra State

Sampling Techniques and Sample Size

Two stage multi-sampling technique was used in selection of catfish fingerlings smallholder farmers for the study. **In Stage 1,** Awka North was purposively selected because of the dormancy of catfish fingerling farmers. **In Stage 2,** five (5) communities were randomly selected from the local government area, which were Awba Ofemili, Ugbenu, Ebenebe, Amansea, Amanuke. **In Stage 3,** from each of the selected five (5) communities, 20 catfish fingerling farmers was randomly selected making it a total of 100 catfish fingerling farmers that were selected.

Specification of Model

The multiple regression was used to analyze the factors influencing catfish fingerling production. Age shown as (AGE), Gender (G), Marital status (MAS), Household size (HOS), Farming Experience (FE), Labour cost (LAC), Education (EDU), Fertilizer cost (FEC) etc.

Y = f (AGE, SE, MAS, HOS, FE, LAC, SEC, EDU, FEC + e)

Where:

AGE = catfish fingerling producers age in years

G = catfish fingerling producers gender.

MAS = catfish fingerling producers marital status

HOS = household size (number of persons in the household)

FEC = fertilizer cost

LAC = labour cost

EDU = producers education (years of schooling obtained)
FE = farming experience in years
E = stochastic error team

Determinants of catfish fingerling production

The multiple regression model is implicitly specified as:
Y = f (X1, X2……………………….Xn e)
The model explicitly specified as follows:-

(1) Linear form
Y = b0 + b1X1 + b2X2 + b3X3 +………………..b10logX10 + e

(2) Semi-log form
Y = b0 + b1logX1 + b2logX2 + b3logX3 +…………..b10logX10 + e

(3) Double log form
Log Y = b0 + b1logX1 + b2logX2 + b3logX3 +…………b10logX10 + e

(4) Exponential form
Log Y = b0 + b1X1 + b2X2 + b3X3…………b10X10 + e
Y is the dependent variable with X1, X2, X3 +…………X10 as the independent or explanatory variables.

4. Results and Discussions

Factors affecting catfish fingerlings production

The results in Table 1 showing the analysis of factors affecting catfish fingerlings production in Awka North Local Government Area reveal several significant predictors of profitability. The age of the farmer positively influences profitability with a coefficient of 0.122 (p = 0.037), suggesting that older farmers are likely to have higher profits, possibly due to their accumulated experience and knowledge (Choi et al., 2021). Similarly, the years of experience in catfish farming has a strong positive effect with a coefficient of 0.155 (p = 0.000), indicating that more experienced farmers tend to achieve better profitability. This aligns with findings from previous research that experience enhances technical efficiency and decision-making in aquaculture Dey Alabi, & Azeez, (2020).

Stocking density and water temperature also significantly impact profitability, with coefficients of 0.200 (p = 0.000) and 0.130 (p = 0.003), respectively. Higher stocking density contributes positively to profitability, likely due to optimized production practices that enhance output per unit area (Ogunbanwo et al., 2022). Conversely, an increase in water temperature, which is often correlated with improved growth rates in fish, also boosts profitability, underscoring the importance of maintaining optimal environmental conditions (Akinwande et al., 2021). However, some variables such as breeding weight and cost of feeding do not show statistically significant impacts, though their coefficients suggest potential influences on profitability that may need further exploration.

In contrast, factors like cost of transportation and cost of communication negatively impact profitability, with coefficients of -0.110 (p = 0.022) and -0.060 (p = 0.174), respectively. The negative effect of transportation costs highlights the economic burden they impose on smallholder farmers, consistent with previous studies emphasizing transportation inefficiencies (Smith et al., 2019). The cost of communication does not significantly impact profitability, suggesting that while communication is necessary, it may not be as critical to profitability as other factors. The overall model explains a substantial portion of the variability in profitability (R-squared = 0.735), indicating a robust model with good explanatory power.

Table 1: Factors affecting catfish production

Variable	Coefficient	Standard Error	t-Statistic	p-Value
Constant	1.210	0.425	2.847	0.005
Age	0.122**	0.058	2.103	0.037
Years of Experience	0.155***	0.040	3.875	0.000
Breeding Weight	0.087	0.046	1.891	0.060
Incubation Capacity	-0.095	0.049	-1.939	0.055
Stocking Density	0.200***	0.037	5.405	0.000
Water Temperature	0.130***	0.043	3.023	0.003
Cost of Feeding	0.075	0.042	1.785	0.078
Cost of Transportation	-0.110**	0.048	-2.292	0.022
Cost of Labour	-0.085	0.047	-1.808	0.073
Cost of Communication	-0.060	0.044	-1.364	0.174
Model Summary				
R-Squared	0.735	F-Statistic		22.31
Adjusted R-Squared	0.702	Durbin-Watson		1.932

*** and ** are significant at 1% and 5% respectively

Major Constraints of catfish fingerlings production

The major constraints faced by smallholder catfish fingerlings producers in Awka North Local Government Area reveal critical issues impacting their operations. Among the identified constraints, the scarcity of fingerlings and inadequate capital are perceived as significant challenges, with mean scores of 3.3 for both, indicating agreement among respondents. The scarcity of fingerlings (48% strongly agree, 19% agree) highlights a crucial supply issue that affects the continuity and growth of production (Ogunbayo, 2021). Similarly, inadequate capital is a major constraint (51% strongly agree), underscoring financial limitations that restrict farmers' ability to scale up production and invest in necessary resources (Onyekuru, 2022). These constraints align with findings from previous studies, which emphasize the critical role of resource availability and financial support in aquaculture development (Ibrahim, 2023).

Conversely, issues such as inadequate extension services, poor space, and high costs of eggs and feed have lower mean scores, suggesting these are less critical but still relevant constraints. For instance, inadequate extension services (mean = 2.6) and inadequate training on new technology (mean = 2.1) are perceived as less significant, reflecting possible gaps in outreach and educational support that could be improved for better adoption of modern practices (Nwogugu, 2023). High costs of feed (mean = 3.2) and scarcity of feed (mean = 2.9) are also noteworthy, impacting production efficiency but not as severely as the issues of fingerling scarcity and capital (Okoro, 2024). Addressing these constraints through targeted interventions could significantly enhance the productivity and sustainability of catfish fingerlings production.

Table 2: Major Constraints of catfish fingerlings production

Constraints	SA	A	N	D	SD	Score	Mean	Remark
Unorganised market	24 (24.0%)	31 (31.0%)	21 (21.0%)	14 (14.0%)	10 (10.0%)	272	2.7	Disagree
High cost of eggs	36 (36.0%)	22 (22.0%)	18 (18.0%)	14 (14.0%)	10 (10.0%)	290	2.9	Disagree
High cost of feed	42 (42.0%)	21 (21.0%)	11 (11.0%)	13 (13.0%)	13 (13.0%)	317	3.2	Agree
Scarcity of feed	31 (31.0%)	27 (27.0%)	19 (19.0%)	14 (14.0%)	9 (9.0%)	296	2.9	Disagree
Scarcity of fingerlings	48 (48.0%)	19 (19.0%)	14 (14.0%)	12 (12.0%)	7 (7.0%)	328	3.3	Agree
Inadequate extension service	22 (22.0%)	29 (29.0%)	26 (26.0%)	16 (16.0%)	7 (7.0%)	263	2.6	Disagree
Inadequate training on new technology	16 (16.0%)	21 (21.0%)	32 (32.0%)	23 (23.0%)	8 (8.0%)	213	2.1	Disagree
Inadequate water	34 (34.0%)	24 (24.0%)	18 (18.0%)	15 (15.0%)	9 (9.0%)	294	2.9	Disagree
Inadequate capital	51 (51.0%)	19 (19.0%)	14 (14.0%)	11 (11.0%)	5 (5.0%)	330	3.3	Agree
Poor space	26 (26.0%)	23 (23.0%)	29 (29.0%)	15 (15.0%)	7 (7.0%)	260	2.6	Disagree

Where: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree Decision: mean >3.0 is Disagree, mean ≥3.0 is Agree.

The analysis reveals that age (0.122, p = 0.037), years of experience (0.155, p = 0.000), stocking density (0.200, p = 0.000), and water temperature (0.130, p = 0.003) significantly impact the profitability of catfish fingerlings production. In contrast, costs related to transportation (-0.110, p = 0.022) and communication have a negative effect, while other factors like breeding weight and cost of feeding are not statistically significant. Major constraints identified are the scarcity of fingerlings and inadequate capital, both with high mean scores indicating agreement on their impact. Other constraints such as high feed costs and poor space are less critical but still relevant.

5. Conclusion

The findings indicate that catfish fingerlings production in Awka North is a profitable venture, as evidenced by the significant gross margin achieved. However, the profitability is heavily influenced by several constraints and operational factors. Scarcity of fingerlings and inadequate capital are the most significant barriers to increasing production and profitability. The reliance on personal savings for funding and the use of both family and hired labor reflect the adaptability of the farmers, although these factors also highlight the financial and labor challenges faced. The high cost of essential inputs like feed and transportation further complicates the production process, impacting overall profitability.

6. Recommendations

The recommendations based on the results of the study were as follows:

i. Explore cost-effective alternatives for feed and transportation to reduce production costs and improve profit margins.
ii. Invest in better infrastructure, including storage facilities and transportation networks, to reduce operational costs and enhance market access.

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