Contribution of Catfish Farming to Household Income in Ukwuani Local Government Area, Delta State, Nigeria

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ABSTRACT

This study investigated the contribution of catfish farming to household income in Ukwuani Local Government Area (LGA), Delta State, Nigeria. The study involved 120 catfish farmers selected through a two-step sampling process. Data were analysed using descriptive statistics and Gross Margin analysis. Results indicated a male-dominated demographic in catfish farming, with males constituting 70.8%. The study emphasised diverse age groups, marital statuses, and educational backgrounds of catfish farmers, stressing the sector's inclusivity. Catfish farming emerged as a primary contributor to household income, constituting ₦1,008,403.53 (42.2%) of the total annual household income. Diversification of income sources, including crop farming and other economic activities, showcased the resilience of households. The study further revealed that catfish farming income significantly contributed to food (38.2%), education (20.8%), healthcare (8.0%), housing (19.7%), and savings (13.3%). Profitability analysis demonstrated that catfish farming was financially viable, with a Benefit Cost Ratio of 1.54. Challenges such as high input costs ($\bar{x}$ = 2.8), market fluctuations ($\bar{x}$ = 2.9), and limited access to credit ($\bar{x}$ = 2.8) were identified, necessitating targeted interventions. The findings provided valuable insights for policymakers, practitioners, and researchers to enhance the sustainability and socio-economic impact of catfish farming in Ukwuani LGA.

INTRODUCTION

Aquaculture has emerged as one of the fastest growing food production sectors globally, with an average annual growth rate of 5.8% since 2001 (FAO, 2020). In Nigeria, fish farming is increasingly being promoted as a strategy for enhancing domestic food and nutrition security, and raising incomes for smallholder farmers (Ume *et al*., 2016). Of the various farmed fish species, African catfish (*Clarias gariepinus* and *Heterobranchus species*) are the most predominant, constituting over 80% of total aquaculture production (Azra *et al*., 2022). Catfish is favoured by Nigerian farmers and consumers due to its resistance to disease and environmental stress, quick growth rate, and marketability (Dienye *et al*., 2021). Furthermore, African catfish can survive and grow well on affordable diets made from agricultural by-products and household wastes, making it suitable for small-scale rural aquaculture systems (Isyaku and Solomon, 2016). Consequently, catfish farming has been promoted by developmental programs as a means for rural farmers to productively utilize indigenous resources for income generation and poverty alleviation (Emmanuel *et al*., 2014).

Delta state, located in the oil-rich Niger Delta region of Nigeria, has enormous potential for aquaculture growth and productivity, given its extensive river systems, floodplains, and swampy terrains (Obiam and Amadi, 2022). Smallholder catfish farming has particularly thrived as a profitable enterprise and source of livelihood for rural households across the State (Inoni *et al*., 2017). Despite governmental and donor efforts

to promote the growth of small-scale aquaculture in rural Nigeria, there is limited empirical evidence on the actual scale and magnitude of impacts on household incomes and poverty alleviation. Previous studies have focused more on the technical and agronomic aspects of catfish production at the smallholder level rather product marketing factors that could enhance the poverty alleviation impacts of catfish farming (Nkamigbo *et al*., 2014; Inoni *et al*., 2017;Idris-Adeniyi *et al*., 2018; Arimiche and Ukaro, 2020). Furthermore, the few economic analyses have majorly examined profitability metrics rather than assessing actual income accrued to households from catfish farming and how this translates to rural welfare improvements (Ume *et al*., 2016; Onyekuru *et al*., 2019).

In the context of Delta state, empirical inquiries into small-scale aquaculture have cantered on determinants of catfish production trends, productivity and intensity (Kadurumba *et al*., 2021; Esiobu *et al*., 2022; Ogunji and Wuertz, 2023). Quantitative evidence is lacking on the relative scale of household dependence on income from catfish farming, as well as consequent effects on poverty and wellbeing compared to other livelihood activities. As Iruo *et al*. (2018) observe, most household income studies in Nigeria exclude aquaculture earnings or lack robust data capture and analytical methodologies to reliably quantify actual contributions. This significantly limits policy insights on the effectiveness of smallholder catfish promotion initiatives towards ameliorating rural poverty and vulnerabilities in Delta state.

This study seeks to address this knowledge gap by holistically assessing income contribution, profitability metrics as well as welfare impacts of African catfish farming in Ukwuani Local Government Area (LGA), Delta state, Nigeria. Findings will guide future research and development efforts aimed at enhancing productivity and returns in small-scale aquaculture enterprises within poor marginalized rural communities.

MATERIALS AND METHODS

The study focused on Ukwuani Local Government Area (LGA), located in Delta State, Nigeria. Ukwuani LGA is located at Latitude 5°50′41″ North (5.8447°North) and Longitude 6°14′15″ East (6.2375°East) and it is characterized by its diverse landscape and is known for its agricultural activities. The area's economy is influenced by farming practices, including catfish farming, making it an ideal location to investigate the contribution of catfish farming to household income. All the fish farmers in Ukwuani LGA of Delta State served as the population of the study. A two-step sampling procedure was adopted in the selection of respondents. The first step involved the purposive selection of eight communities out of the twenty communities in the LGA with high level of fish farming. These communities include Akoku, Umutu, Ebedei-Uno, Owah Abbi, Umuoshi, Ezionum, Umuebu and Amai. In the second step, 15 fish farmers were randomly selected from each of the eight communities using a list of fish farmers obtained from the extension agents covering the communities. This gave a total of 120 respondents that were involved in this study. Data for the study were collected using a structured interview schedule. Data collect were analysed using descriptive statistics and Gross Margin analysis.

MODEL SPECIFICATION

Gross Margin Analysis model that was used to estimate the profitability of catfish farming is stated as follows;

GM = TR – TVC ……..… (eqn. 1)

TC = TVC + TFC …… (eqn. 2)

NR = GM – TFC …….. (eqn. 3)

BCR = TR/TC …….. (eqn. 4)

Where: GM = Gross margin, TVC = Total variables cost, TC = Total cost, TFC = Total fixed cost, NR = Net Returns, BCR = Benefit cost ratio

RESULTS AND DISCUSSIONS

Socioeconomic characteristics of catfish farmers in the study area

In the study area, catfish farmers were primarily comprised of males (70.8%) aligning with Nigeria's agricultural gender norms, where men traditionally take on more active roles in farming operations (Deji and Koledoye, 2013). Women constituted 29.2%, playing crucial roles in managing family resources, including

income generated from catfish farming, and contributing significantly to the overall success of the enterprise (FAO, 2021). The mean age of respondents was 36 years, with diverse age ranges contributing to the farming community's richness. Marital status varied widely: 48.3% married, 37.5% single, 7.5% widowed, and 6.7% divorced. The prevalence of married catfish farmers aligns with traditional family structures in Nigeria, where marriage often signifies increased responsibilities and shared household duties (Asadu and Egbuche, 2020). This group may benefit from additional labour resources within the household, contributing to the overall success of catfish farming operations. The presence of single individuals, comprising 37.5%, suggests a potentially distinct set of challenges and opportunities, with greater flexibility in managing time and resources for catfish farming. The study revealed that 38.3% of the fish farmers have completed secondary school, 29.2% primary school, 15.8% tertiary education, and 16.7% reporting no formal education. The dominance of secondary school education suggests a relatively high level of basic education within the catfish farming community, potentially facilitating the adoption of modern farming practices (Muhammed *et al*., 2021).

There was a prevalent medium-sized household structure, with 52.5% reporting 6 to 10 persons, and a mean household size of 7 persons. This aligns with the traditional extended family system in Nigeria, where multiple generations often contribute to agricultural activities, fostering a balance between available labour resources and the management of agricultural responsibilities (George *et al*., 2014). The average stock size of the respondents was 1,884 fishes indicating a medium-sized farms. This finding suggests a balance between efficient management practices and sustainable production, as medium-sized farms are often associated with better operational control and economic stability (Alawode and Ajagbe, 2020). The distribution of farming experience showed that 48.3% of the farmers had 6 to 10 years of experience, reflecting a substantial presence of seasoned farmers with a mean experience of 8 years. Additionally, 27.5% have above 10 years of experience, while 24.2% are in their first 5 years of farming. This diverse distribution encompasses both new and experienced farmers, suggesting a community that benefits from the innovative perspectives of those new to the field and the stability and expertise contributed by experienced farmers. The prevalence of experienced farmers aligns with the potential for in-depth knowledge and skills in catfish farming practices, contributing to the overall success and sustainability of catfish farming in the region (Inoni *et al*., 2017).

Table 1: Socioeconomic characterises of the respondents

	Variable	**Frequency**	**Percent**	**Mean**
Gender	Male	85	70.8	
	Female	35	29.2	
Age (years)	18 – 24	13	10.8	
	25 – 34	40	33.3	
	35 – 44	30	25.0	36 years
	45 – 54	23	19.2	
	Above 55	14	11.7	
Marital status	Single	45	37.5	
	Married	58	48.3	
	Widowed	9	7.5	
	Divorced	8	6.7	
Educational level	No formal education	20	16.7	
	Primary school	35	29.2	
	Secondary school	46	38.3	
	Tertiary education	19	15.8	
Household size (persons)	1 – 5	45	37.5	
	6 – 10	63	52.5	7 persons
	Above 10	12	10.0	
Stock size (fishes)	Less than 1,000	43	35.8	
	1,000 – 3,000	68	56.7	1,884 fishes
	3,100 – 5,000	7	5.8	
	Above 5,000	2	1.7	
Farming experience (years)	1 – 5	29	24.2	
	6 – 10	58	48.3	8 years
	Above 10	33	27.5	

Source: Field Survey (2023)

Economic contribution of catfish farming to household average annual income in the study area

Table 2 provides the result of the economic contributions of various income sources to the average annual income of households engaged in catfish farming in the study area. The result reveals a clear economic hierarchy, with catfish farming emerging as the primary driver, contributing ₦1,008,403.53, accounting for 42.2% of the total household average annual income. This underscores the pivotal role of catfish farming in the study area's economy, aligning with previous research highlighting the significance of aquaculture in sustaining rural livelihoods in Nigeria (Ogunjiand Wuertz, 2023). The substantial contribution from catfish farming reflects not only the economic value of the practice but also the potential to serve as a catalyst for poverty reduction and rural development. While catfish farming dominates, the study also reveals the diversification of income sources among the households. Crop farming, contributing ₦403,300.58 (16.9%), signifies the importance of agricultural diversity for income stability (Okhale, 2019). Beyond agriculture, artisan activities, trading, and employment collectively contribute ₦969,444.26, representing 40.9% of the household income. This diversified income portfolio underscores the adaptability and resilience of households, engaging in various economic activities to mitigate risks associated with dependence on a single source. The multifaceted nature of income generation observed in this study area provides a nuanced understanding of the economic landscape, essential for informed policy-making and targeted interventions that aim to enhance overall economic sustainability and well-being in the study area.

Table 2: Economic contribution of catfish farming to household average annual income in Delta State, Nigeria

Source of income	**Amount (₦)**	**Percentage of household average income**
Catfish farming	1,008,403.53	42.2
Crop farming	403,300.58	16.9
Artisan	115,228.74	4.8
Trading	253,503.22	10.6
Employment	610,712.30	25.5
Total household average annual income	**2,391,148.37**	**100**

Source: Field Survey (2023)

Utilisation of average annual income generated from catfish farming

Table 3 shows the result of how the average annual income derived from catfish farming is utilized within households in the study area. The study revealed that the highest allocation, at 38.2%, is directed towards food and groceries, emphasising the pivotal role of catfish farming income in meeting fundamental sustenance needs. This finding aligns with studies highlighting the integral link between aquaculture income and improved food security for rural households in Nigeria (Anthony and Richard, 2016). The significance of catfish farming in addressing immediate nutritional requirements reflects its crucial contribution to household well-being and underlines the importance of sustaining and enhancing catfish farming practices to ensure continued food security in the region. Education expenses receive a substantial allocation of 20.8%, indicating that catfish farming income contributes significantly to educational pursuits within these households. This finding resonates with existing research emphasizing the positive correlation between income from agricultural activities and increased investment in education (Diao *et al*., 2020). The allocation to education expenses suggests that catfish farming not only serves immediate consumption needs but also plays a crucial role in fostering human capital development, potentially leading to improved socio-economic conditions for future generations in the community. The remaining income allocations to healthcare expenses (8.0%), housing and utilities (19.7%), and savings (13.3%) highlight the diversified impact of catfish farming income. These allocations signify a balanced approach, addressing both immediate needs and long-term aspirations. The investment in healthcare and housing reflects a commitment to enhancing the overall quality of life within these households, while savings contribute to long-term resilience, potentially acting as a financial buffer during periods of economic uncertainty. This multifaceted utilization pattern highlights the importance of catfish farming income not only as a means of daily sustenance but also as a driver of holistic development and improved well-being in the studied area.

Table 3: Utilisation of average annual income generated from catfish farming

Category	Amount (₦)	Percent
Food and groceries	385,210.15	38.2
Education expenses	209,747.93	20.8
Healthcare expenses	80,672.28	8.0
Housing and utilities	198,655.50	19.7
Savings	134,117.67	13.3

Source: Field Survey (2023)

Profitability of catfish farming per cycle in the study area

The result in Table 4 shows the profitability of catfish farming per cycle in the study area. Variable costs, accounting for 78.9% of the total cost, are primarily associated with inputs that vary with the scale of production. Feeds emerge as the most significant variable cost, constituting 27.2% of the total cost. This aligns with the literature, where feed costs are often cited as a major component in aquaculture production (Hecht, 2013). Medication, veterinary services, and fuel also contribute substantially to variable costs, underscoring the importance of health management practices in catfish farming. Efficient management of these variable costs is crucial for optimizing profitability and ensuring the economic sustainability of catfish farming operations. Fixed costs, accounting for 21.1% of the total cost, encompass expenses such as rent, pond construction, and depreciation. The revenue generated from selling 1,596 fishes amounts to ₦2,872,800.00, resulting in a gross margin of ₦1,401,515.95. The net revenue, calculated as the gross margin minus the total cost, is ₦1,008,403.53. The Benefit Cost Ratio (BCR), calculated as the ratio of the net revenue to the total cost, is 1.54. A BCR greater than 1 indicates positive returns, suggesting that catfish farming in the study area is financially viable and has the potential to generate profits beyond the costs incurred.

Table 4: Profitability of catfish farming per cycle in the study area

Variable cost	Quantity	Price (₦)	Amount (₦)	Percentage of Total Cost
Fingerlings/ juveniles	1,884	55	103,620.00	5.6
Feeds	40.5 bags	12,500	506,250.00	27.2
Water			115,901.31	6.2
Fuel			186,071.73	10.0
Labour			101,103.59	5.4
Medication			211,717.26	11.4
Veterinary services			186,270.36	10.0
Miscellaneous			60,349.80	3.2
Total variable cost			**1,471,284.05**	78.9
Fixed cost				
Rent	1 year		122,000.92	6.5
Pond construction	3 ponds	82,155	246,465.00	13.2
Depreciation			24,646.50	1.3
Total fixed cost			**393,112.42**	21.1
Total cost			**1,864,396.47**	
Revenue	**1,596 fishes**	**1,800**	**2,872,800.00**	
Gross margin			**1,401,515.95**	
Net revenue			**1,008,403.53**	
Benefit Cost Ratio			**1.54**	

Source: Field Survey (2023)

Challenges affecting the profitability of catfish farming in the study area

Table 5 presents the result of the assessment of the challenges affecting the profitability of catfish farming in the study area. Several challenges receive consensus among farmers, indicated by mean scores equal to or greater than 2.5. These include high input costs ($\bar{x}$ = 2.8), market fluctuations ($\bar{x}$ = 2.9), limited access to

affordable credit ($\bar{x}$ = 2.8), inadequate infrastructure ($\bar{x}$ = 2.5), unpredictable weather ($\bar{x}$ = 2.5), lack of government support ($\bar{x}$ = 2.6), competition with imported fish ($\bar{x}$ = 2.6), and environmental issues ($\bar{x}$ = 2.5). The agreement on these challenges highlights their significance in influencing the profitability of catfish farming. For instance, market fluctuations and high input costs are common concerns in agriculture globally (Mishra, Behera and Behera, 2023), emphasizing the need for adaptive strategies and targeted interventions. Challenges with mean scores below 2.5 receive disagreement among farmers. These challenges include disease outbreaks ($\bar{x}$ = 2.4), difficulty accessing reliable markets ($\bar{x}$ = 2.4), and insufficient technical knowledge ($\bar{x}$ = 2.4). While disease outbreaks are often recognized as a potential threat in aquaculture (Ina-Salwany, *et al*., 2019), farmers in this study may perceive it to be less severe compared to other challenges. The disagreement on technical knowledge and market access challenges suggests a need for targeted capacity-building initiatives and improved market linkages.

Table 5: Challenges affecting the profitability of catfish farming in the study area

Challenges	$\bar{x}$	**Standard deviation**	**Remark**
High input costs	2.8	1.1447	Agreed
Market fluctuations	2.9	1.0138	Agreed
Limited access to affordable credit	2.8	1.1530	Agreed
Disease outbreaks	2.7	1.0705	Disagreed
Inadequate infrastructure	2.5	1.1839	Agreed
Difficulty accessing reliable markets	2.4	1.1384	Disagreed
Insufficient technical knowledge	2.4	1.1378	Disagreed
Unpredictable weather	2.5	1.2256	Agreed
Lack of government support	2.6	1.0936	Agreed
Competition with imported fish	2.6	1.0447	Agreed
Environmental issues	2.5	1.1691	Agreed

Where $\bar{x} \geq 2.5$ is Agreed, $\bar{x} < 2.5$ is Disagreed

Source: Field Survey (2023)

CONCLUSION

The study on the contribution of catfish farming to household income in Ukwuani LGA, Delta State, Nigeria, revealed important socioeconomic characteristics, economic contributions, and challenges faced by catfish farmers. The dominance of males, mid-adult age distribution, and prevalence of married individuals align with broader agricultural trends in Nigeria. Catfish farming emerged as a vital contributor to household income, constituting 42.2% of the total average annual income. The diversified income sources highlighted households' adaptability, mitigating risks associated with dependence on a single activity. The study therefore recommends the need for the following targeted interventions:

i. Fish feed companies, hatcheries and research institutes should collaborate with extension agencies to promote cost-effective feeds, ensure availability of quality fingerlings and provide customized trainings to enhance productivity of smallholder catfish farms.

ii. Government agencies should facilitate partnerships between farmer cooperatives, cold storage operators, transport companies and retailers to develop cold chain infrastructure and strengthen market linkages for smallholder catfish producers.

iii. Insurance companies supported by government agencies and development organizations should design suitable risk mitigation products to safeguard smallholder catfish farmers against climate vagaries and price volatility.

iv. Rural infrastructure authorities in coordination with electricity utilities and community organizations should improve road connectivity and electricity access in concentrated catfish farming areas to reduce transaction costs for smallholder producers.

v. Financial institutions backed by favourable policies from regulators and development banks should ease collateral conditions to facilitate formal credit access for small aquaculture enterprises.

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