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DETERMINANTS OF GOOD AGRICULTURAL PRACTICES IN CATFISH FARMING AMONG COMMERCIAL FISH FARMERS IN YENAGOA LOCAL GOVERNMENT AREA, BAYELSA STATE

Custodian D. Nnadi[1], Abraham T. Ekiyor[1], Miriam M. Obiene[1], and Florentus N. Nnadi[2]

[1] Department of Agricultural Economics, Extension and Rural Development, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

[2] Department of Agricultural Extension, Federal University of Technology, Owerri, Imo State, Nigeria.

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***Corresponding author:** Custodian D. Nnadi

Department of Agricultural Economics, Extension and Rural Development, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

Abstract

This study was on determinants of Good Agricultural Practices (GAPs) in catfish farming among commercial fish farmers in Yenagoa Local Government Area (YELGA), Bayelsa State. The objective was to describe the socio-economic characteristics of fish farmers while the hypothesis was; the socioeconomic characteristics of commercial fish farmers do not determine their GAPs implementation in catfish farming. A total of 77 fish farmers; randomly chosen from a list obtained from the Ministry of Trade and Industry, formed the sample size, and structured questionnaire used to obtain data. Data collected were analysed via descriptive and inferential statistics of mean, percentage and Ordinary Least Square (OLS) Multiple Regression analysis. Results of this study revealed that fish farming in YELGA is dominated by married (77.92%) males (87.01%) who are at their youthful age (41.05 years), maintain average household size of approximately 7 persons and have average fish farming experience of 8 years approximately. Also, YELGA commercial fish farmers are degree holders with average of approximately 16 years formal schooling. Majority (74.03%) maintain extension contact, stocked 2,419 fishes approximately per production cycle on the average; from which they make average annual income of ₦1,093,506.00. Regression result at $\alpha \leq 0.05$ indicates; Education (X4) with t-ratio = 2.1853, Fish farming experience (X5) with t-ratio = 1.9969, Stock size (X6) with t-ratio = -4.6738, Extension contact (X8) with t-ratio = 1.9615 and Annual income (X9) with t-ratio = 4.0794 were the socioeconomic variables that determined GAPs use among commercial fish farmers in YELGA. Thus legislation and advocacy by government, donor agencies and stakeholders focused on farmers' socioeconomic variables of importance in sustaining GAPs implementation was recommended.

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1. Introduction

The main sources of animal protein basically remain meat and fish. Thus, absence of either or both, could lead to protein deficiency. Unfortunately, common among most urban and rural poor households of many developing nations is the total or near absence of meat of fish in their daily meals. This trend may likely persist in countries like Nigeria; following the report by Food and Agriculture Organization (FAO) (2018) that the minimum threshold of meat consumption per capita is 35 kg whereas Nigerians' average consumption only approximated 1.9 kg. This according to Nnadi (2024), shows a deficit or shortfall of 33.10 kg. This narrative does not tell good of a country such as Nigeria in view of fact that animal protein consumption could point to the level of nourishment and health of a nation's labour force and citizens; upon which the advancement of a country and its economy could be judged or placed (Nnadi, 2024).

Despite the seeming bad condition, Adegwu (2023) reports that Nigeria holds the position of the highest producer of African catfish (Clarias gariepinus) with an estimated annual production output of one million tonnes even as FAO (2023) reports that the population of catfish producers in Nigeria is about 285,000; representing about 0.1 percent of Nigeria's population. Indeed, the production of fish for a population of over one hundred and fifty (150) million by a less than 1% seems to justify the observed shortfall and calls for worry; as supply most likely could fall short of demand. This perhaps led Nnadi et. al., (2025a); on noting similar domestic demand-supply gap of meat, advocated increasing broiler production by poultry farmers, but stressed the need to do so sustainably through Good Agricultural Practices (GAPs).

Good Agricultural Practices (GAPs) is not a new concept, but one of the frontline topics within the global best practices discourse (Nnadi et. al., 2025a). GAPs as enshrined in global standards of FAO, is critical in agricultural food production and marketing for an ecologically safe and sustainable agriculture and harmless products of higher quality and quantity that contributes effectively to food security, income generation through access to markets and upsurge on the working conditions of farming families (Nnadi et. al., 2025b). These, align with the identified four (4) GAP pillars of economic viability, environmental stability, social acceptability, and food safety and quality by FAO (2023). GAP according to Tariengco (2024), in raising animals includes minimum use of non-therapeutic antibodies or hormones, avoiding feeding livestock with animal by- products (such as processed animal protein), and ensuring adequate clean farm's equipment and machinery to prevent the spread of disease. Thus, GAPs are standards for safe and sustainable on-farm and off-farm agricultural activities aimed at maximum yields for optimum business performance at minimum cost and environmental impact.

Catfish farming generally involve series of activities ranging from pond preparation, feeding regime, pond maintenance among others. These, come with a number of challenges as mortality, stunted growth, disease outbreaks among others. However, modern technologies to overcome production challenges no doubt exist and commercial fish farmers' adoption of the technologies is not out of place. What is required therefore, is in-depth knowledge about the production of catfish in a safe and healthy manner bearing in mind the safety of consumers and the environment; for which the principles and guidelines of GAPs provide. Nevertheless, achieving GAPs by farmers are most likely to be determined by their socioeconomic variables. For example, educational level; a social variable of a farmer, could drive a farmer's willingness or desire to implement GAP of ensuring adequate clean farm's equipment and machinery to prevent the spread of disease, but, farmer's inability to back his desire with payment (an economic variable) renders it ineffective and of no consequence (Nnadi et. al., 2025a). Establishing this for commercial fish farmers in YELGA has become imperative.

Research on GAPs such as; Adoption of good agronomic practices among smallholder rice farmers in Nigeria agricultural transformation agenda (Omolehin, et al., 2019), Utilization of good agricultural practices and technologies among tomato Farmers in Oriire Local Government Area of Oyo State, Nigeria (Anifiwose, et al., 2020), Poultry farmers' awareness and performance in Good Agricultural Practices implementation in broiler production in Yenagoa Local Government Area, Bayelsa State (Nnadi, 2024), Socioeconomic determinants of good agricultural practices in broiler production among commercial poultry farmers in Yenagoa Local Government Area, Bayelsa state (Nnadi et. al., 2025a), Analysis of good agricultural practices in catfish farming among commercial fish farmers in Yenagoa Local Government Area (YELGA), Bayelsa state (Nnadi et. al., 2025b) among others exist. However, no work has been found on determinants of good agricultural practices in catfish farming among commercial fish farmers in Yenagoa Local Government Area, Bayelsa state. This formed basis for this work. This study specifically therefore, described the socioeconomic characteristics of commercial fish farmers while socioeconomic characteristics of commercial fish farmers do not determine their use of GAPs in catfish farming in Yenagoa Local Government Area, Bayelsa State was the hypothesis that guided this work.

2. Methodology

This study was in YELGA; home to the capital/seat of power of Bayelsa state, Nigeria. YELGA is located within coordinates of 4° 55′ 29′′N and 6° 15′ 51′′ E, has a total land area of 706km², a population of 524,400 and a population density of 742/km² (WorldWeatherOnline.Com, 2023). It shares boundaries with Rivers State on the North and East, Kolokuma/Opokuma LGA on the North-West, Ogbia LGA on the South East and Southern-Ijaw on the South-West. Temperature in the area typically varies from 22°C to 3 1°C and is rarely below 17°C or above 32°C (WorldWeatherOnline.Com, 2023). Vast area of YELGA is surrounded by water bodies and mangroves/swampy rain forest mostly affected by annual flooding due to the high level of rain fall and low land. In Yenagoa, the wet season is warm and overcast while dry season is hot and mostly cloudy nearly all the year round. Fishing, farming, trading, hunting, lumbering, boat carving, and making of local fishing gears are some major occupations of the people. The common spoken language in the area is English /pidgin English while Epie-Atissa and Ijaw are the indigenous languages/dialects of the people. A simple random sampling technique was used to select a total of 77 (about 30%) fish farmers drawn from a list of 257 registered fish farmers obtained from the Ministry of Trade and Industry, Bayelsa State, Nigeria and a well-structured questionnaire administered on them. Also, secondary information obtained from already existing literature and endorsed officials such as Journals, Textbooks among others were used. Data obtained were analysed using descriptive statistics of percentage and mean as well as inferential tool of multiple regression analysis. The multiple regression model is expressed thus;

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$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + e$

Where:

Y = Use of GAP (Number of GAPs in use by catfish farmers)

X_1 = age (Chronological age in years)

X_2 = sex (Dummy variable; male = 1, female = 0)

X_3 = marital status (Dummy variable; married = 1, single = 0)

X_4 = educational level (Number of years spent in formal schooling)

X_5 = farming experience (Number of years spent in catfish production)

X_6 = farm size (stocking size)

X_7 = household size (Number of persons in household)

X_8 = extension contact

X_9 = annual income (Monetary value in ₦)

e = error term

3. Result Presentation

3.1 Socioeconomic Characteristics of Fish Farmers in YELGA, Bayelsa State

Table 1: Socioeconomic Characteristics of Fish Farmers in YELGA, Bayelsa State

Variable	Frequency	Percentage	Mean
Age			
<31	7	9.09	41.05 years
31-40	28	36.36	
41-50	34	44.16	
>50	8	10.39	
Total	77	100.00	
Sex			
Male	67	87.01	
Female	10	12.99	
Total	77	100.00	
Marital status			
Single	17	22.08	
Married	60	77.92	
Widowed	0	0.00	
Divorced	0	0.00	
Total	77	100.00	
Educational level			
<12	0	0.00	15.75 years
12-18	66	85.71	
>18	11	14.29	
Total	77	100.00	
Farming experience			
<6	16	20.78	7.7 years
6-10	48	62.34	
11-15	9	11.69	
16-20	3	3.89	
>20	1	1.30	
Total	77	100.00	
Stocking size			
<6	0	0	2418.83 fishes
500-3000	61	79.22	
3500-6000	14	18.18	
> 6000	2	2.60	
Total	77	100.00	
Household size			
<6	30	38.90	6.5 persons
6-10	46	59.74	
>10	1	1.30	
Total	77	100.00	
Extension contact			
Yes	57	74.03	
No	20	25.97	
Total	77	100.00	
Annual income (₦)			
<600,000.00	17	22.08	₦1,093,506.00
600,000-1,000,000	27	35.06	
1,100,000-1,500,000	16	20.78	
1,600,000-2,000,000	6	7.79	
>2,000,000	11	14.29	
Total	77	100.00	
Source: Field Survey Data, 2024			

3.2 Age: Majority (80.52%) of fish farmers fell within the age range of between 31-50 years, 9.09% for those less than 31 years and 10.39% for those who are more than 50 years old. The mean age was 41.05 years.

3.3 Sex: The result in Table 1 above shows that majority (87.01%) were male while the remaining 12.99% were female.

3.4 Marital Status: The result in Table 1 above, shows that 77.92% of fish farmers were married. About 22.08% were single. However, no widowed and divorced farmers were recorded.

3.5 Education: The result in Table 1 above showed that 85.71% of fish farmers spent between 12 to 18 years in school, while 14.29% spent more than 18 years in school. The mean number of years spent in formal schooling by fish farmers was 15.57 years.

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3.6 Experience: From the result in Table 1 above, majority (83.12%) of fish farmers indicated that they have been in fish farming business for between 1-10 years. Only 16.88% have been in the business of catfish production for 11 years and above. The average fish farming experience is 7.7 years.

3.7 Stock Size Per Production Period: The result in Table 1 indicated that 79.22% of fish farmers stock between 500-3000 catfishes in a production cycle. Another 18.18% stock between 3500-6000 cat fishes per production cycle while a few farmers (2.60%) have stocking sizes above 6000 catfishes per production cycle.

3.8 Household Size: The result in Table 1 above shows that 59.74% of YELGA fish farmers have household sizes of between 6 and 10 persons. This is followed by another 38.96% that have household sizes below 6 persons. The remaining 1.30% have household size above 10 persons. The average household size is approximately 7 persons.

3.9 Extension Contact: From Table 1 above, result showed that 74.03% of fish farmers in YELGA have had contact with extension agents in one way or the other during their production period while 25.97% have had no extension contact at all.

3.10 Income Per Production Period: The result in Table 1 above shows that greater percentage of YELGA fish farmers (35.06%) receive annual income of between ₦600,000.00 to ₦1,000,000.00 from catfish production, about 22% receive below ₦ 600,000.00, about 21% receive between ₦1,100,000.00 to ₦1,500,000.00. Those that receive annual income above ₦2,000,000.00 represents 14.29% of the fish farmers while only 7.79% of the fish farmers indicated annual income of between ₦1,600,000.00 - ₦2,000,000.00. The average annual income recorded is ₦1,093,506.00.

3.11 Relationship between Socioeconomic Characteristics of Fish Farmers and their Use of GAPs in Catfish Farming in YELGA

Table 2: Regression Output for Relationship between Socioeconomic Characteristics of Fish Farmers and their Use of GAPs in Catfish Farming in YELGA

Variables	**Coefficient**	**Standard Error**	**T-Ratio**
Intercept	9.7373	4.6928	2.0749*
X_1 (Age)	-0.2570	0.7512	-0.3421
X_2 (Sex)	0.4237	0.8143	0.5203
X_3 (Marital status)	0.1673	0.3339	0.5010
X_4 (Education)	1.4323	0.6554	2.1853*
X_5 (Fish farming Experience)	0.0023	0.0012	1.9969*
X_6 (Stocking Size)	-2.2246	0.4760	-4.6738*
X_7 (Household size) X_8 (Extension contact) X_9 (Annual income)	0.6556 0.7003 2.8543	0.6589 0.3570 0.6997	0.9950 1.9615* 4.0794*
R^2 0.6256			
F - Value 12.4370			

Key: *significant at 5%

Source: Field Survey Data, 2024.

The result shown in Table 2 above, is multiple regression output for the hypothesis. The Semi-log functional form, gave the lead equation; with the highest value coefficient of multiple determination (R^2) = 0.6256 and F-value = 12.4370. Also, five (5) variables out of nine (9) were significant at 0.05 levels. This indicates the goodness of fit of the model and the relevance of the variables fitted into the model. The variables that were not significant includes; Age (X_1) with coefficient of -0.2570 and t-value of -0.3421, Sex (X_2) with coefficient of 0.4237 and t-value of 0.5203, Marital status (X_3) with coefficient of 0.1673 and t-value of 0.5010 and Household size (X_7) with coefficient of 0.6556 and t-value of 0.9950; thus were of no effect. On the contrary, the significant variables are; Education (X_4) with coefficient of 1.4323 and t-value = 2.1853, Fish farming experience (X_5) with coefficient = 0.0023 and t-value = 1.9969, Stocking size (X_6) with coefficient = -2.2246 and t-value = -4.6738, Extension contact (X_8) with coefficient = 0.7003 and t-value = 1.9615 and Annual income (X_9) with coefficient = 2.8543 and t-value = 4.0794.

4. Discussion

4.1 Age: The result on sex distribution of commercial fish farmers in YELGA, is a clear indication that most of the farmers are young and energetic; being in their active age of 41 years approximately on the average. The result conforms to the work of Kehinde (2022) who reported average age of 40 among catfish farmers in Osun State, Nigeria. This gives an indication that catfish farming could stimulate gainful employment for realization of potentials among youths. Government therefore should view this window to enable and escalate youth engagement/empowerment or employment to curb idleness and regulate zest for white collar job; especially with a seeming saturated civil service job opportunities.

4.2 Sex: The heavy male dominance of commercial fish farming in YELGA, Bayelsa state, Nigeria agrees with the findings of Onuwa et. al., (2020) and Umaru et. al., (2021) that men (63.3%) and (61.7%) dominated catfish farming in Ekeremor Local Government Area, Bayelsa state, Nigeria and Enugu Metropolis, Enugu State, Nigeria respectively. This is to say that catfish farming industry in Nigeria is gender sensitive in favour of men. A seeming hard labour in aquaculture generally and catfish production in particular could be attributed to this.

4.3 Marital status: The involvement of more married people in commercial fish farming in YELGA, could be to enhance income for family upkeep. Again, in comparative terms, married couples may have advantage over singles; as family labour could be harnessed. Nevertheless, non-involvement of widowed and divorced as observed is worrisome. This might be pointer to somewhat social exclusion that trail widowhood and divorce in most climes; particularly as regards resource control. This calls for legislation and advocacy to protect the right and privileges of the vulnerable in the society to enhance their social and financial inclusion and participation in activities such as commercial fish farming. Onyekuru et. al., (2019) made similar finding of only 2.5% of widows and divorced respectively involved in catfish production in Nsukka Local Government Area, Enugu State, Nigeria

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4.4 Education: YELGA commercial fish farmers are highly educated and on average possesses one higher degree or the other. This trend is highly commendable as fish farming seem to be a perfect employment window for graduates. Indeed, commercial fish farmers with their educational status, could have the capacity to comprehend innovations and technical information pertaining to fish farming such as GAPs in catfish farming. In agreement, Idris-Adeniyi et. al., (2017) reported that 70.00% of catfish farmers in Osogbo Metropolis, Osun State, Nigeria, possessed tertiary education while Umeh et. al., (2016) reported literacy by 91.70% catfish producers in Anambra State, Nigeria.

4.5 Fish farming experience: An average of 8 years approximately in fish farming among YELGA commercial fish farmers could be considered plausible and enough experience necessary for the ins and outs in catfish farming when compared with catfish farmers' fish farming experience of between 1- 4 years in Nsukka Local Government Area of Enugu State, Nigeria reported by Onyekuru et. a., (2019). Given the background and exposure of fish farmers in both academics and practice, the combination of education and farming experience of fish farmers, could make adoption of GAPs guidelines that will facilitate maximum production output their primary goal.

4.6 Stocking size: The average stock size of approximately 2419 fishes is a clear indicator that catfish farming in YELGA is for commercial rather than subsistence. This is plausible as it offers good reason for fish farmers to follow a number of GAPs guidelines concerning catfish farming in other to produce clean and safe food for consumers, contribute to sustainable environment while making adequate profits to maintain viable businesses.

4.7 Household size: The average household size of approximately 7 persons could be considered fairly large. This size, in the present economic situation of Nigeria, could present serious implications as low income per capita and poor standard of living. Nevertheless, with the global promotion of family labour; though an African tradition Nnadi et. al., (2025) large family size could become a major source of labour supply and perhaps an output determinant in agricultural production. To this end, cheap labour could be realised.

4.8 Extension contact

With approximately 74% of YELGA commercial fish farmers indicating extension contact, the result could be said to be impressive. However, this finding is contrary to that by Onuwa et. al., (2020) that 91.70% of catfish farmers in Ekeremor LGA, Bayelsa State, had no contact with extension. Proximity to the State office of the Agricultural Extension Programme; whose mandate it is, to carry out extension services to farmers may account for this. Despite the high contact with agricultural extension by majority of fish farmers, extension workers still need to reach more farmers in other to disseminate new information or innovations concerning good agricultural practices. This has become very necessary to ensure that fish farmers become well informed and knowledgeable of GAPs.

4.9 Income Per Production Period

With the average annual income of One million, ninety-three thousand, five hundred and six naira (₦1,093,506.00) a monthly income of ninety-one thousand, one hundred and twenty-five naira fifty kobo (₦91,125.50) and an income per capita of thirteen thousand and seventeen naira ninety-three kobo (₦13,017.93) approximately was maintained by commercial fish farmers. This result is plausible as the income earned by fish farmers, by far surpass both the former; thirty thousand naira (₦30,000.00) and present seventy thousand naira (₦70,000.00) minimum wage earned by civil servants in Nigeria. The finding of Omeje et. al., (2021) in a study on socio-economic determinants of net-income in fish farming in Kainji Lake Basin, Nigeria; that fish farming is a viable business with high level of turnover aligns with this result.

Indeed, aligning youth engagement with catfish farming as insinuated earlier in 4.1, could be a best bate to economic enhancement.

4.2.: Relationship between Socioeconomic Characteristics of Fish Farmers and their Use of GAPs in catfish farming in YELGA

For the hypothesis that there is no significant relationship between the socio-economic characteristics of poultry farmers and their use of GAP in broiler production in Yenagoa Local Government Area, the semi-log functional form, gave the lead equation with the highest value coefficient of multiple determinations, R^2 = 0.6256, F-value = 12.4370 and the highest significant variables (5). Of the five significant variables, only Stocking size (X_6) with coefficient and t-values of -2.2246 and -4.6738 respectively, showed a negative sign; implying an inverse relationship. That is to say that the more the stocking size, the less the GAPs in catfish farming among YELGA fish farmers. This could be true, as increasing stock size may require increasing demand for finance, personnel among others; without which farmers perhaps being driven by profit, may cut corners against GAPs. The remaining significant variables of Education (X_4), Fish farming experience (X_5), Extension contact (X_8) and Annual income (X_9) with t-value of 2.1853, 1.9969, 1.9615 and 4.0794 respectively –Table 2, exhibited linear/positive relationships. This implies that unit increase in each of the variables yields unit increase in GAPs in catfish farming among YELGA fish farmers.

5. Conclusion and Recommendation

This study concludes that the socioeconomic variables of importance for GAPs in catfish farming among commercial fish farmers in YELGA are education, fish farming experience, stocking size, extension contact and annual income. These variables of importance should be focused on, by the government, donor agencies, existing and intending farmers and indeed all stakeholders for legislation and advocacy on GAPs. A farmer-to-farmer (F2F) knowledge/information bank or platform can be established for quick updates as well as information/knowledge and experience shearing among farmers and other stake holders in the fisheries sector for the sustenance of GAPs by commercial fish farmers in YELGA, Bayelsa State and Nigeria at large.

Reference

1. Adegwu, J. (2023) Agriculture: Revolutionising Catfish Value Chain Nigeria. Bruwer,
2. Anifowose, A. J., Oyetoro, J.O., Oyediran, W.O., Alaka, F.A., Ojo, O.M. and Adebayo, B.O, (2022). Utilization of Good Agricultural Practices and Technologies among Tomato Farmers Oriire Local Government Area of Oyo State, Nigeria, Canadian *Journal of Agriculture and Crops, vol. 7(1)*, pages 20-29.

DOI: 10.5281/zenodo.16938886

3. Food and Agriculture Organization (FAO), (2018). The state of food security and nutrition in the world, FAO, Rome, Italy. Accessed from net on 28/03/2024, 00:07
4. Food and Agriculture Organization (FAO), (2023). Development of a Framework for Good Agricultural Practices, FAO - Committee on Agriculture (17th Session), Rome, 31 March-4 April 2003, https://www.fao.org/3/y8704e/y8704e.htm, Accessed from net on 28/03/2024, 00:05.
5. Kehinde, A. D., (2022). Economics of Cat Fish Production in Osun State, Nigeria, Management, Economic Engineering in Agriculture and Rural Development Vol. 22, Issue 1, 295 – 302, Retrieved 2025-02-06, 22:44 PM.
6. Nnadi, C. D., (2024). Poultry Farmers' Awareness and Performance in Good Agricultural Practices Implementation in Broiler Production in Yenagoa Local Government Area, Bayelsa State. IOASD J Bus Manag Stud, 1(1): 16-22.
7. Nnadi, C. D., Azibato, D. W., Nnadi, F. N. and Ebibi, P., (2025a). Socioeconomic Determinants of Good Agricultural Practices in Broiler Production among Commercial Poultry Farmers in Yenagoa Local Government Area, Bayelsa State
8. Nnadi, C. D., Azibato, D. W., Nnadi, F. N. and Roland, A. A., (2025b). Good Agricultural Practices in Catfish Farming Among Commercial Fish Farmers in Yenagoa Local Government Area, Bayelsa State, Nigeria.
9. Omeje, J. E., Achike, A. I., Arene, C. J., Faleke, S. A., Manuwuike, Q. C. and Usman, G. A., (2021). Socio-economic Determinants of Net-Income in Fish Farming in Kainji Lake Basin, Nigeria, *Global Journal of Agricultural Sciences Vol. 20*, 53-61, www.globaljournalseries.com
10. Omolehin. R. A., Oyewole. S. O., Muhammed, L. C. and Alexander, A., (2019). Adoption of Good Agronomic Practices among Smallholder Rice Farmers in Nigeria Agricultural Transformation. Journal of Economics and Sustainable Development, Vol.10, No.15.
11. Onuwa, G., Emmanuel, B., Fatoke, V., Eshimutu, U. and Owa, G., (2020). Economics of Catfish Production in Ekeremor Local Government Area, Bayelsa State, Nigeria, *African Journal of Sustainable Agricultural Development, Vol. 1 (4)* 89 – 105, www.ijaar.org/ajsad.
12. Onyekuru, N. A., Ihemezie, E. J. and Chima, C.C. (2019). Socioeconomic and profitability analysis of catfish production: a case study of Nsukka Local Government Area of Enugu State, Nigeria. Agro-Science, 18 (2), 51-58. DOI: https://dx.doi.org/10.4314/as.v18i2.9
13. Tariengco, J., (2024). What is Good Agricultural Practices (GAP)? Safety Culture https://safetyculture.com/topics/good-agricultural-practices/,25/03/2024,23:22.
14. Umaru, I. I., Okoh, T. C. and Ishiwu, R. C., (2021). Profitability of catfish production in Enugu Metropolis, Enugu State, Nigeria, *Open Journal of Agricultural Science (OJAS), Volume 2(2)*, 01 – 11 www.openjournalsnigeria.org.ng
15. Ume, S. I., Ebeniro, L. A., Ochiaka, C. D. Uche, F. O., (2016). Economics Analysis of Catfish Production in Anambra State, Nigeria, *International Journal of Environment, Agriculture and Biotechnology, vol. 1, no. 3*, 476 – 481, Retrieved 2025-02-06, 23:15 PM.
16. WorldWeatherOnline.Com (2023). Yenagoa annual weather averages, WorldWeatherOnline.Com, Retrieved 2023-07-25

DOI: 10.5281/zenodo.16938886