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Catfish (*Clarias gariepinus*) monoculture in sapele local government area of delta state, Nigeria: A farm household data analysis

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ABSTRACT
This paper examined catfish monoculture in Sapele Local Government of Delta State. Data were collected from 80 catfish farmers using simple random sampling technique. Descriptive and inferential statistics were used to analyse the data. The result showed that years of experience in catfish culture ranged between 1-10 years with a mean of 4 years which indicated that catfish culture is a relatively new enterprise in the study area. For the regression analysis of socioeconomic variables on output the double log model gave the best fit with the highest R^2 value of 90.2 with household size, major occupation and source of capital statistically significance at ($P<0.01$). For the regression of input on output an R^2 of 98.0 percent was obtained with feed and land significant at ($P<0.01$). The major constraint faced by catfish farmers in the area were inadequate capital. This study therefore recommends that catfish farmer be granted micro loans.

Keywords: Catfish, Monoculture, Production, Regression

1. Introduction
Clarias gariepinus belongs to the family Claridae. Among the culturable fish species in Nigeria, catfish is the most sought after. It is very popular with fish farmers and commands a very good commercial value in Nigeria [1, 2]. It is suitable for culture because of its tolerance to adverse environmental conditions (such as salinity, low oxygen concentration and low pH), rapid growth rate, efficient food conversion rate and resistance to diseases [3]. In Nigeria, fish farming started about 50 years ago with the establishment of a small experimental station in Onikan, Lagos and an industrial farm of about 20 hectares at Panyam, Jos Plateau by the Federal Government. Catfish production has grown steadily in the past ten years and has proven to be a profitable enterprise for many farmers [4]. Recent survey including [5, 6] revealed that overwhelming number of fish farmers are engaged in catfish farming and the most commonly cultured is the genus *Clarias gariepinus* as they can have a market value of two to three times that of tilapia. *Clarias gariepinus* [7] are widely distributed and commonly found in pools, swamps, lakes and rivers where they breed abundantly in the rains, especially between may and September. In culture however, breeding can be carried indoors throughout the year [8]. In Nigeria, monoculture which is the conscious rearing of single species at a particular point in time is practiced when the fish involved has good commercial value as with the case of *Clarias*. Fish culture alone is reported to have the potential to supply the
Nigeria [9] fish requirement and produce excesses for export generation and foreign exchange. As a result of its importance, this paper sought to examine catfish monoculture (*Clarias gariepinus*) in Sapele Local Government Area of Delta State.

The specific objectives were to:

- Determine the socioeconomic characteristics of catfish farmers in the study area
- Identify the factors that influence output of catfish production
- Identify the constraints of catfish culture in the study area

The following hypotheses were tested:

H_{01}: Socioeconomic characteristics does not significantly influence output of catfish production

H_{02}: There is no significant relationship between factor input and output of catfish.

2. Research Methodology

2.1 Study Area

The study was carried out in Sapele Local Government Area of Delta State. Sapele is a coastal town situated on the southern fringe of one of the navigable branch-off of the Ethiope River. It consists of urban and rural areas prominent among which are Sapele main, Okirighre, Amukpe, Gana and Ibada-Elume. It is bounded on the North-East by Ethiope west L.G.A, East by Okpe L.G.A, South West by Warri South L.G.A and Warri North L.G.A to the North West.

2.2 Method of Data Collection and Analytical Procedure

Primary data was collected using structured questionnaire and oral interview. A two stage sampling procedure was employed. In the first stage, purposive sampling was used to select farmers that engage in catfish production in Sapele Main, Okirighre, Amukpe and Gana as these were the areas that catfish culture was predominant. In the second stage, simple random sampling technique was used to select twenty (20) catfish farmers out of the total farmers bringing the total number of respondents to eighty (80). Descriptive statistics was used to describe the socioeconomic characteristics of the respondents while production function models were employed to measure the effect of independent variable on the output of catfish. Three functional forms (linear, semi log and double log functions) were tried and the models are explicitly stated:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 \ldots . \beta_nX_n + Ei \quad \text{----------Linear}$$

$$Y = \log\beta_0 + \log\beta_1X_1 + \log\beta_2X_2 + \log\beta_3X_3 + \log\beta_4X_4 \ldots . \log\beta nXn + Ei \quad \text{----Semi log}$$

$$\log Y = \log\beta_0 + \log\beta_1X_1 + \log\beta_2X_2 + \log\beta_3X_3 + \log\beta_4X_4 \ldots . \log\beta_nX_n + Ei \quad \text{--Double log}$$

Where Y = Output of catfish

For the regression of socioeconomic characteristics on output of catfish,

X_1 = Gender
X_2 = Age (years)
X_3 = Marital Status (dummy)
X_4 = Household size (no)
X_5 = Educational Level
X_6 = Years of experience
X_7 = Major Occupation
X_9 = Source of Capital
X_9 = Source of Labour
X_{10} = Source of Land

For the regression of input on output of catfish,

X_1 = Fingerlings (kg)
X_2 = Labour (man days)
X_3 = Feed (kg)
X_4 = Land (ha)

The criteria used to select the function that best fit the model were the goodness of fit test, the appropriateness of the sign of the regression coefficient, the magnitude of the standard error (SE) and the significance of the t-Statistics and the f-statistics test.

3. Result and Discussion

3.1 Result of Socioeconomic Characteristics of Respondents

Similar to the findings of [10], Table 1 showed that 66 percent of the respondents were male; majority fell between the age ranges of 31-40 years. Majority, (90 percent) were married and had a relatively large household size of 6-8 persons which accounted for about 57 percent. Classification of respondents based on educational level of education showed that about 51 percent had tertiary education while only about 3 percent had no formal education. Years of experience in catfish culture ranged between 1-10 years with a mean of (4 years). The result further showed that about 97 percent of respondents had other occupation and engaged in catfish production as a second occupation.

Table 1: Socioeconomic Characteristics of catfish farmers

Description	Frequency	Percentage
Gender		
Male	53	66.3
Female	27	33.7
Age		
21-30	5	6.2
31-40	45	56.3
41-50	28	35.0
51-60	2	2.5
>60	-	-
Marital Status		
Single	5	6.2
Married	72	90.0
Widowed	3	3.8
Household Size		
2-4	46	57.5
6-8	33	41.3
8-10	1	1.2
Educational Qualification		
No formal Education.	3	3.8
Primary Education.	10	12.5
Secondary Education.	26	32.5
Tertiary Education.	41	57.2
Years of Experience		
1-10	58	72.5
11-20	17	21.2

21-30	5	6.3
Main Occupation		
Trading	18	22.5
Crop Farming	11	13.8
Civil Service	43	53.7
Others	6	7.5
None	2	2.5
Source of Capital		
Personal Savings	63	78.8
Friends and relatives	9	11.2
Bank	2	2.5
Others	6	7.5
Source Of Labour		
Individual	18	22.5
Family	53	66.3
Hired	9	11.2
Source of Land		
Rent	7	8.8
Individual Owned	73	91.2

Source: Field Survey, 2013

3.2 Production Function Results

Table 2 shows the regression of socioeconomic variables on output. The econometric and statistical tools used were R^2, F-ratio and degree of significance of the tested variables, household size, major occupation and source of capital were statistically significance at 1%. The double log model gave the best fittings with the highest R^2 value of 90.2 percent.

Table 2: Regression result of the effect of socioeconomic characteristics on the output of catfish

Coefficient	Linear	Semi log	Double+
β_0 (Constant)	-7.468*	-.755	-.211*
	(-3.123)	(-.493)	(-2.271)
β_1(Gender)	-.045	-.306	0.43
	(-.033)	(-.062)	(.142)
β_2(Age)	.726	2.814	.479
	(.623)	(.393)	(1.101)
β_3(M. status)	-.211	1.867	-.383
	(-.136)	(.231)	(-.780)
β_4 (H. size)	1.097	4.421	.700*
	(1.432)	(1.132)	(2.970)
β_5(Education)	.584	1.345	.436
	(.864)	(.328)	(1.752)
β_6(Yrs. Of Exp.)	.288	.559	.029
	(.790)	(.133)	(.112)
β_7(Major Occu.)	-.309	-.199	.711*
	(-.440)	(-.047)	(2.770)
β_8(Source of cap.)	4.628*	22.919*	1.067*
	(7.097)	(7.975)	(6.113)
β_9(Source of Labour)	1.715	5.915	-.341
	(1.509)	(1.020)	(-.970)
β_{10}(Source of Land)	-1.374	-6.007	-.378
	(-1.006)	(-1.152)	(-1.195)
R^2	.890	.874	.902
Adjusted R^2	.874	.856	.888
F- Ratio	55.724	47.938	63.854

Source: Field Survey, 2013 * Significant at 1%.

Note: Values in parentheses are t-values, + = lead equation

The econometric analysis of the determinants of output is presented in Table 3. The value of coefficient of multiple determination (R^2) indicated that 98.0 percent of the variation in the output of catfish was explained by the semilog model and the t-value shows that feed and land were significant at 1%.

Table 3: Regression result of the effect of resource input on the output of catfish

Coefficient	Linear	Semi log+	Double
β_0 (Constant)	.279	39.338**	-.012
	(1.234)	(2.900)	(-.011)
β_1 (Fingerlings)	-.031	.213	.349
	(-.861)	(.048)	(.948)
β_2 (Labour)	-.027	-.975	-.255
	(-.546)	(-.206)	(-.644)
β_3 (Feed)	.000*	-4.464*	.234*
	(4.585)	(-2.012)	(7.517)
β_4 (Land)	21.771	26.946*	.649
	(1.857)	(4.674)	(1.346)
R^2	.983	.981	.972
Adjusted R^2	.982	.980	.971
F- Ratio	1087.430	963.833	655.301

Source: Field Survey, 2013 *, ** Significant at 1% and 5% respectively

Note: Values in parentheses are t-values, + = lead equation

3.3 Discussion

The predominance of male in catfish production in this area may be attributed to the fact that it is labour intensive and males are regarded as stronger and more energetic sex. Since majority of respondents fell between the age ranges of 31-40 years, this implies that fish farmers in the study area were relatively young people and were at the most energetic stage of their life. At this stage it is mostly assumed that individuals can afford to take risk especially as it applies to adoption on new technologies. The relatively large household size was regarded as a proxy to labour availability. The high level of literacy recorded was a reflection that probably the rate of adoption of improved techniques was high whereas the low years of experience implied that catfish culture could as well be relatively new in the study area. The result showed that about 97 percent of respondents had other occupation(s) and engaged in catfish production as a second occupation. This reflected on the fact that about 78 percent sourced capital from personal savings which most likely was obtained from their major occupation.

Household size, major occupation and source of capital were statistically significance at 1% and had a positive relationship with output of catfish e.g. the larger the household size the greater the labour availability, The double log model gave the best fittings with the highest R^2 value of 90.2 percent implying the joint effect of explanatory variables on output of catfish. The result of the regression of input on output gave an R^2 value of 98.0 percent which indicated that 98 percent of the variation in the output of catfish was explained by the semi log model.

4. Constraint to Catfish Production

Table 4 represents the constraints faced by farmers that engaged in sole catfish production in the study area. The results showed that the major constraints were inadequate capital ranking 1st (38.8 percent) followed by shortage of skilled personnel 2nd (13.7 percent), water poisoning 3rd (12.5 percent), shortage of power 5th (8.8 percent), cost of feed 6th (7.5 percent), lack of equipment 7th (5 percent). These findings is similar with the findings of [11] who reported high cost of feed, [12] who reported inadequate capital; and scarcity of seeds to be the major constraints to catfish production in their study area.

Table 4: Constraints of Catfish Production

Constraint	Frequency	Percentage	Rank
Inadequate capital	31	38.8	1st
Shortage of skilled personnel	11	13.7	2nd
Water poisoning	10	12.5	3rd
Power generation	9	11.2	4th
Pilfering	7	8.8	5th
Cost of feed	6	7.5	6th
Lack of equipment	4	5.0	7th
Others (feed poisoning, pest & disease)	2	2.5	8th

Source: Field Survey, 2013

5. Conclusion and Recommendation

The regression of socioeconomic variables on output showed that the double log model gave the best fit with the highest R^2 value of 90.2. Household size, major occupation and source of capital were statistically significance at ($P<0.01$) while for the regression of input on output, an R^2 of 98.0 percent was obtained with feed and land significant at ($P<0.01$). Catfish farmers faced constraints of inadequate capital, shortage of skilled personnel, water poisoning, shortage of power, cost of feed and lack of equipment. This study therefore recommends that catfish farmer be granted micro loans, affordable feed, training session as well as alternative power supply should be provided in order to improve the lot of catfish farmers.

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