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PRODUCTION EFFICIENCY IN CATFISH (CLARIAS GARIEPINUS) BURCHELL, 1822 IN CROSS RIVER STATE , NIGERIA

[1]ADINYA, I. B, and [2] IKPI, G. U.
[1]Department of Agricultural Economics and Extension, [2]Department of Fisheries, Cross River University Of Technology (CRUTECH) Obubra Campus, Cross River State, Nigeria.

ABSTRACT
In the study, the production efficiency of catfish in Cross River State was determined. Data was obtained from 120 fish farmers were randomly selected from Cross River Agricultural Zones, using a multistage random sampling technique. Multiple regression analysis model was the main tool of data analysis where different functions were tried. The results indicated that Cobb-Douglass production function had the best fit in explaining the relationship between output of catfish and inputs used, the coefficient of multiple determinant (R^2 = 0.61) indicates that sixtyone percent of the variability in output of catfish is explained by the independent variables. The results also indicate that farmers' educational level positively influence their level of efficiency in catfish production in the study area. The F-value of 16.427 indicates the overall significance of the model at 1 percent level, indicating that there is a significant linear relationship between the independent variables taken together and the yield of catfish produced in Cross River State. The marginal value products of fish pond size (farm size), labour and feed (diet) were ₦67.50, ₦ 178.13 and ₦ 728.00 respectively, while allocative efficiency for (farm size), labour and feed (diet) were (0.09 over utilized, 2.85 under utilized and 0.99 over utilized), respectively, there existed allocative in-efficiency, there is a high potential for catfish farmers to increase their yields and income. Based on the findings of this study, it is recommended that fish farmers should expand fish farms, improving on production efficiency and adopting new technologies. Regular awareness campaign about new technologies in fish farming should be embarked by extension agents to make fish farmers know the importance of adopting new technologies.

KEYWORDS: Production efficiency, Catfish, Cobb-Douglass, Production function, Cross River State

INTRODUCTION

Fish provides an excellent source of protein in the diet of many families in tropical Africa (Sule, 2006). Of all the animal protein foods produced and consumed in Nigeria, fish is of prime importance as it has remained a major source of protein which is rich in essential-amino acids for both rural and urban poor households (Murtala, *et al* 2005).

According to Lale and Sestswa (1996) fish is rich in protein, which is very essential for the health of the body and it account for about 40 percent of the total animal protein of an average person in the tropics. Fish is rich in fats, phosphorus, sulphur, potassium, iron, calcium and copper. Fish fat is characterized by high poly-unsaturated acid, which provides diet low in cholesterol. Its oil has high quantities of vitamin especially vitamin A, B and D, thiamin, riboflavin, nicotinic acid and vitamin B12 (Disney, *et al* 1978). Fish contains less than 1% fat and about 10% protein with energy value ranging from 220 – 330 Kilojoules (50 – 80Kcal/100g) of fish (John 1980). In Nigeria, fish is consumed fresh or processed (dried). Fish meal and fish flour are two products produced by fishing industries, which are used as food in dairy animals and poultry (Disney, *et al* 1978; Sule 2006).

Akpet, *et al* (2005) revealed that the recent ban on the importation of broilers has further put the cost of animal protein beyond the reach of many, especially the rural population, they have resorted to consumer fish. The low

price per kilogram of fish, is a very strong indicator that they can be used to bridge the wide animal protein gap that has become the hallmark of most developing countries (FAO, 2005; Essien ,*et al* 2008).

According to Campbell-Platt (1984) the world population reaching the 6.0 billion mark by year 2000 A.D, a lot of pressure is being placed on the world fish production in order to meet the high demand from the teaming human population. This demand is greater in tropical countries including Nigeria with increasingly rising human population. In Nigeria, fish production over the years has been inadequate to bridge the demand supply gap. Nigeria with about 13 million hectares of fresh water bodies capable of producing 511,702 metric tones of fish under adequate management but the actual production is about 334,213 metric tones. Thepotential yield of fish from the coastal and brackish water of Nigeria has been estimated as follows 22,000 metric tones from demersal resources, 120,000 metric tones from pelagic resource and 48,000 metric a total yield of 190,000 metric tones which is far below the quantity demanded in the markets (Ayayi, 1996; Ezekiel, 2005).

Cross River State is endowed with natural and human resources being presently exploited. According to Ezekiel (2005), fish is the most widely exploited natural resources by man. The state has the potential to be self-sufficient in fish production because of the presence of rivers and suitable ecological zone for its production either in ponds, dams or rivers. In the local markets in Cross River State, there is a great gap between production and consumption offish. Unfortunately, fish production in Cross River State has been inadequate to bridge the demand-supply gap. There exists a high incidence of protein malnutrition as a result of non-optimal use of resource and enormous losses in post-harvest of fish. To reserve this trend, the rural farmers must learn to use improved technologies and improvement in efficiency of resource use (Idiong , *et al* 2006). However, given the low rate of adoption of fish technologies by farmers, improvement in efficiency remains the most cost effective way in enhancing productivity in the shortrun.

Efficiency could be measured from a production function or profit function approach. Efficiency of production is a very important factor for productivity especially in areas where resources are meager as in Nigeria (Adinya, *et al* 2008). Efficiency of production is achieved through optimal resource allocation such that more output is achieved with the same resource level or the same level of output is achieved using fewer resources. Production function gives the possible output that can be produced from given quantities ofa set of inputs (resources) and their quantities can be varied to obtain optimal output. In carry out econometric analysis, production function provides the basis of decision making for fish farmers.

Economic theory identifies three important production efficiencies (Farrel, 1984). These include allocative, technical and economic efficiencies. Allocative efficiency is the ability of the farmer to use the inputs in optimal proportions given their respective prices and the production technology. Technical efficiency is the measure of the farms success in producing maximum output from a given set of resources (inputs) i.e. ability to operate on the production frontier (Farrel, 1984).

Economic efficiency is the product of the technical efficiency and allocative efficiency. There is evidence that fish farmers in developing countries fail to exploit fully the potential of resources and make allocative errors; which results to low yields.

Several studies have shown that resources are not efficiently utilized by fish farmers in Nigeria (Adeleye,1996; Lale and Sestswa 1996; Murtala , *et al* 2005; Ezekiel,2005; Sule, 2006; Ibrahim and Olayemi,2006). Therefore, having established the obvious fact that resources are not efficiently utilized in fish production in Cross River State, itis the aim of this study to examine critically the problems of resource use in fish production. Ultimately, it is hoped that the study will help to bridge the gap between resources availability and efficient utilization in fish production in Cross River State. This study seeks to examine the production efficiency in catfish (*Clarias gariepinus* ; Pisces; CLARIIDAE) in Cross River State, Nigeria; therefore this paper tried to provide some useful information in policies towards increasing fish production in Nigeria. Hence, this study had the following objectives:

(i) To analyze the production function of fish in the study area.
(ii) To analyze the costs and returns of fish production in the study area.
(iii) To determine resource use efficiency (allocative efficiency) in fish production.

METHODOLOGY

STUDY AREA: The research study will be conducted for a period of one year and three months from 15th October, 2005 to15th December,2007 in Cross River State,Nigeria. The state occupies an area of about 22, 342.176 Square Kilometers (Quarterly News Letter of the Ministry of Local Government Affairs, C.R.S 2006 Pp 4-8). It is located at Latitude 5^o 25'N and longitude 25^o 00'E (Figure 1). The soils of Cross River State are utisols and alifisol but predominantly utisol (USDA) or (FAO/UNESCO, 1974).

The state's geographical almalgam strecting from the mangrove swamps, criss-crossed by rivers on the Atlantic-coast in the central to the rugged and mountain savannah in the north. Cross River State has the largest rainforest covering about 7,290 square kilometers described as one of Africa's largest remaining virgin forest harbouring as many as five million species of animals insects and plants (MOFINEWS, 2004). Cross River State is located within the evergreen rainforest zone. There are two distinct climate seasons in the area, rainy season from March to October and dry season from November to February. The annual rainfall varies from 2,942mm to 3,424mm. The averagetemperature is around 28^oc (CRADP, 1992). Cross River State is characterized by presence of numerous ecological and zoo-geographically important high gradient streams, rapids and waterfalls. About 2,888,966 people inhabit the area, of which the Efiks, Ejaghams and Bekwarras are the major ethnic groups (Population Census 2006 In MOFINEWS, 2007. Fishing and subsistence agriculture are the main occupations of the people. Crops grown in the locality include rice, maize, yam, cassava, plantain and banana. Population depends largely on natural water sources for all their water-related activities, as piped water supply is limited and grossly inadequate. Health services in the area require a lot of improvement. Level of hygiene in the communities is generally poor (Arene,*et al* 1991).

A multi-stage stratified random sampling technique was used to select the respondents. This procedure recognized the delineation of the study area into zones. The Cross River Agricultural Development Project (CRADP) divided this agricultural zone into Northern Zone (Ogoja Zone), Central Zone (Ikom Zone) and Southern Zone (Calabar Zone) of the state. There are 18 Local Government Areas in Cross River State. The agricultural zones consists of 17 blocks, 8 circles and 136 cells with 5200 contact farmers. At the first stage seventeen (17) local government areas were selected from eighteen (18) local government areas, four (4) farming communities were randomly chosen from each of the three agriculturalzones of the state. For better coverage in the study area, one village was randomly chosen from each of the communities (therefore twelve villages were taken from the three agricultural zones). Ten respondents were randomly chosen from each of the selected villages. In all, 120 respondents were randomly selected from a list compiled by the extension agents of Cross River Agricultural Development Programme.

DATA COLLECTION AND ANALYTICAL TECHNIQUE

The researchers visited the villages to administer copies of the questionnaire to selected respondents as a pilot survey to pretest the instrument. Thereafter, the instrument was corrected based on the experience gained in the pilot survey. Thus, the problem of ambiguity and misperception was sufficiently dealt with and enough time was spent on the administration of interview schedule to ensure that the records are accurate. The completed questionnaires were checked for quality. In the course of doing this, 120 questionnaires were distributed to respondents in the three agricultural zones at the rate of 40, 40 and 40 to Northern Zone (Ogoja Zone), Central Zone (Ikom Zone) and Southern Zone (Calabar Zone), respectively.

Data for this study was subjected to different types of analytical tools. This study employed the following analytical tools in order to achieve the already stated objectives of the study:

(1) The descriptive statistics such as frequencies distribution, and percentages were used.

(2) The inferential statistics is the regression analysis. Regression analysis is important and useful for describing the relationship between the exogenous and endogenous variables. It estimates the statistical significance of the exogenous variables as well as the overall effect of all these variables on the endogenous variables. The data obtained were analyzed using the Ordinary Least Square (OLS) multiple regression technique to determine the relationship between fish output and the selected variables. The linear, double-log and semi-log function forms were used to determinewhich of the forms would best fit the relationship between fish output and the explanatory variables.

The implicit form of regression model for this analysis was given as:

$Y = f(X_1, X_2, X_3, X_4, X_5 e_1)$ and explicitly form of the regression model for this analysis is given by:

$Y = bo + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e$

Where Y = Output of fish (kg)

X_1 = Fish pond size (Farm size) (ha)

X_2= Labour (man-days)

X_3,= Feed(Diet containing 40% crude protein was used in feeding fish(fish ingredient was measured on a 9 point scale of yellow maize =1, groundnut cake=2, fish meal=3, brewer's grain=4, oil =5,bone meal= 6 oyster shell=7, AD-Vitamin=8, salt=9)

X_4=Adoption of improved technologies (measured on a 3 point scale of improved management of fish farm=1, improved catfish fry/fingerlings production=2, construction of fish pond=3)

X_5= Educational level of the respondents (measured on a 4 point scale of First School Leaving Certificate=1, JSSC/SSC=2, Tertiary Institutions=3, no formal education=4)

e_1= Error term (error or disturbance term is included to capture the effects of exogenous and endogenous variables not included in the model).

Three linear function forms were tried; these are Linear, Cobb-Douglas production function (double logarithm), and semi-log production function forms. Whichever model that has the highest R^2 and shows many statistical significant variables will be adopted following (Kmenta, 1971; Koutsoyiannis, 1977 and Awoke, 2001). The functional forms fitted are specified below:

(a)Linear production function: $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e$…equation (1)

X_1-X_5= are defined in the implicit form

b_1-b_5=Regression coefficients of variables X_1-X_5 a = Constant term

e = Error term

(b) Cobb-Douglas Production Function (double log)

$\text{Log } Y = \text{Log } a + b_1\text{Log}X_1 + b_2\text{Log}X_2 + b_3\text{Log}X_3 + b_4\text{Log}X_4 + b_5\text{Log}X_5 + e$…equation (2)

(c) Semi-Log Production Function:

$Y = \text{Log } a + b_1\text{Log}X_1 + b_2\text{Log}X_2 + b_3\text{Log}X_3 + b_4\text{Log}X_4 + b_5\text{Log}X_5 + e$… equation (3)

Each resource was measured using the formula:

The average physical product (APP) was derived by dividing total output by total input i.e. $APP = \frac{Y}{X}$

The marginal physical product (MPP) was derived by dividing total output by total inputs $MPP = \frac{DY}{DX}$

MPP x Price of product= marginal value product (MVP)

The allocative efficiency (AEL) of resource was determined by ascertaining whether or not the ratio of the marginal value product to the inputs price was equal to one

$$AEL = \frac{MVP}{P} = 1$$

where MVP= Marginal Value Product

P= Unit Price of Input

The marginal Products (MP) were derived by multiplying the average product (AP) by the elasticity of production(EP), given that: MP= AP x EP

$$EP = \frac{MP}{AP}$$

RESULTS AND DISCUSSION

Table1: Distribution of respondents according to socio-economic characteristics of fish farmers in Cross River State

Educational Attainment	Northern Zone (Ogoja Zone	Central Zone (Ikom Zone	Southern Zone (Calabar Zone),	Frequency	Percentage (%)
FSLC	4	10	14	28	23.33
JSSC/ SSSC	21	13	13	47	39.17
Tertiary Institution	15	14	12	41	34.17
No formal education	-	3	1	4	3.33
Total	40	40	40	120	100
Farm size (Ha)					
0.1-2	34	37	27	98	81.67
3-4	6	3	1 3	22	18.37
5-6	-	-	-	-	-
7-8	-	-	-	-	-
9ha and Above	-	-	-	-	-
Total	40	40	40	120	100
Labor (man-days)					
1	9	5	4	18	15.00
2	12	10	10	32	26.67
3	8	12	9	29	24.17
4	4	9	7	20	16.67
5	5	1	6	12	10.00
6 man-days and above	2	3	4	9	7.50
Total	40	40	40	120	100
Adoption of improved technology					
Improved management of fish farm	10	19	10	39	32.50
improved catfish fry/ fingerlings production	1	5	13	19	15.83
Construction of pond	29	16	17	62	51.67
Total	40	40	40	120	100
Diet					
31% of protein diet	11	10	7	28	23.33
34% of protein diet	8	10	8	26	21.67
37% of protein diet	1	6	4	20	16.67
40% of protein in diet	10	8	15	24	20.00
48.8 -50% of protein diet	10	6	6	22	18.33
Total	40	40	40	120	100

Source: Field survey, 2008

Analysis of table 1 revealed that 39.17% of the respondents had Junior Secondary School Certificate (JSSC)/ Senior Secondary School Certificates (SSSC). However, 34.17% of the respondents revealed that they attended high education. While 23.33% of the respondents disclosed that they had First School Leaving Certificates (FSLC). Only 3.33% of the respondents never had any formal education. The result implies that education acquired by fish farmer is

very important for taking positive decisions aimed at improving their income. Of course, this goes to confirm the earlier deduction by (Adinya,2001; Idiong , *et al* 2006) that technical and commercial education broaden farmer's intelligence and it also enable fish farmer to perform the farming activities intelligently and improve their income.

Table 2: Average Production Costs, Inputs Usage and Returns Per Hectare of Catfish Production in Cross River State

Variables	Unit price(₦)/kg	Northern Zone (Ogoja Zone	Central Zone (Ikom Zone	Southern Zone (Calabar Zone),	State's average	State's average value
1. Fish output(FO)kg	100	3.56	4.30	4.58	12.44	1,244,000
2. Capital operating inputs *Catfish fingerlings/ fry	30	1.78	2.15	2.30	6..23	186,900
** Feed input	735.17	25,065	28,075	35080	-	88,220
3.Labour input(man-days) *Family Labour **Hired labor	 62.5 62.5	 60 36	 72 42	 84 48	 216 126	 13,500 7,875
4 Fixed cost rent on land Fish pond size (farm size) □ Maximum □ Minimum □ mean □ Depreciation	 1000 500 750	 2.0 1.0 3.00	 2.5 1.2 303.3	 2.8 1.6 306.7	 7.3 3.6	 7,300 1,800 910
5 Total variable cost (TVC=TCO=TLI)						2,900
6.Total fixed cost (TFC)	966.66	966.66	966.66			
7. Total cost TC=TVC=TFC						)9405
8. Net Return						934595

Source: Field survey, 2008

Table 1, also revealed that 81.67% of the respondents farm sizes were between 0.1-2 hectares While 18.37% of them had farm sizes ranging from 3-4 hectares. The result suggests that most people practicing fish farming are mostly in the low- income class. The result confirms similar findings by Etim, *et al* (2006) that farmers who had plot size 1.5 hectares are mostly in the low- income class who farm mainly to augment family income and nutrition supply.

Further analysis of Table 1 revealed that 24.17% of the respondents spent 3 man-days. Whereas, 10% of them spent 5man-days. Only 7.50% of the respondents spent 6 man-days and above. Table 1 revealed that 32.50% of the respondents adopted improved management of fish farms, while 15.83 percent of them adopted improved catfish fry/ fingerlings production. The result suggests that most fish farmers refused to adopt improved catfish fingerlings production. The result of findings agrees with the findings of Ajayi and Madukwe (2001)that some illiterate farmers refused to adopt improved technologies in agricultural production. Food crisis in Nigeria can be arrested through agricultural research, adoption improved technologies, improvement in efficiency of resource use and effective /efficient agricultural extension services. However, some farmers in the rural areas are illiterates, therefore cannot

read or write, they need agricultural extension agents through which such information from research station(s) will be interpreted to them. Agricultural extension service is a necessary prerequisite to widespread and sustained agricultural development. Further analysis of table 1 revealed that 20.00 per cent of the respondents used 40% of protein in diet to feed fish, this promote the growth of fish. The result of findings agrees with the findings of Ugwu , *et al* 2001 that the linear increase in specific growth rate (specific growth rate of the Africa catfish fry) of experimental fish fry with increasing dietary protein level to 40 percent. While*Clarias gariepinus* fry fed 48.8percent of protein in diet showed relatively poor growth response(Ugwu , *et al* 2001).

Table 2 revealed that the per hectare state's average value of catfish production was ₦1244000.00. A total of 342 man-days was used in catfish production. The average yield was 12.44(tons) per hectare. The profit margin obtained was ₦ 934595.00 per hectare.

Table 3: Multiple Regression Equations for Catfish Production in Cross River State, Nigeria

Production function forms	CONSTANT	X_1 Fish pond size (Farm size)	X_2 labour	X_3 Feed (Diet)	X_4 Adoption of improved tech.	X_5 edu. Level	R^2	AdJ R^2	F-
Linear	-2.659 (1.498	0.130 (0.117)	1..237 (0.163)	1.295 (0.0492)	0..281 (0.374)	0.134 (0.212)	0.601	0.565	16.427
Semi-log	-5.754 (5.058	1.053 (0.912)	7.249 (1.182)	4.018 (1.681)	0.991 (1.306)	0.579 (1.008)	0.551	0.510	13.393
Double-log	-1.313 (0.710	0.252 (0.128)	-0.941 (0.166)	0.553 (0.236)	0.164 (0.183)	9.687E-02 (-0.142)	0.612	0.576	17.163

Source: Field survey, 2008 Note: = Values significant at 1%
Figure in parentheses are standard errors.

Table 4: Estimated Elasticities of Production Function (EP), Average Product(AP) Marginal Product(AP), Marginal Value Product(MVP) and Allocative efficiency(AEL)

Variables	EP	AP	MPP	MVP	P	AEL	Inference
X_1 Fish pond size (Farm size)	0.00082	10.9	0.09	67.50	750.00	0.09	Over utilized
X_2 Labour	0.0083	342	2.85	178.13	62.50	2.85	under utilized
X_3 Feed (Diet)	0.00825	119.9	0.99	728.00	735.17	0.99	Over utilized

Source: Field survey, 2008

Table 3: Judging from the value of the R^2 in the analysis above for the three production function forms, one can conclude that double log equation is a good one compared to all other functional forms (linear and semi-log production functions). Double –log (Cobb-Douglass production function) is the lead equation because it has the

highest R^2 value (0.612) and meeting other econometric criteria. The F-value for the functions are also significant at 1 percent indicating that there is a significant linear relationship between the independent variables taken together and the yield of catfish produced in Cross River State, Nigeria.

The regression analysis, however, revealed that education has positive influence on output of fish production and are significant at 1 percent level of significance.

Further analysis of Table 3, revealed that labour, farm size, diet has positive influence on output of catfish production and it is significant at 1 per cent level of significance. The F-value of 17.163 indicates the overall significance of the model at the one percent level. Karlirajan(1981) and Fujimoto (1988) reported similar results for labour in the aggregate; while (Ugwu, 1984;Ugwu , *et al* ,2001) reported similar results for diet and *Clarias gariepinus* fry.

Table 4 revealed the marginal value products of fish pond size (farm size), labour and feed (diet) were ₦67.50, ₦ 178.13 and ₦ 728.00 respectively, while allocative efficiency for (farm size), labour and feed (diet) were (0.09 over utilized, 2.85 under utilized and 0.99 over utilized), respectively, there existed allocative in-efficiency, there is a high potential for catfish farmers to increase their yields and income. This findings agrees with the findings of Adeleye, 1996; Ohen and Dixie, 2007 that fish farmers are

in-efficient in catfish production because not all of them possess the skills necessary to know how to improve productivity and this implies that actually farmers are operating below their full potential due to lack of skills, the cost per unit output was proportionately higher.

CONCLUSION AND RECOMMENDATIONS

This study has revealed that catfish production was profitable but catfish farmers are not allocative efficient. There is a very high potential for fish farmers to increase yield. Based on the findings of the study, it is recommended that catfish farmers should increase their yield and income by expansion of their fish farms, improving efficiency and adopting new technologies. Beside that, extension agents should train fish farmers on the adoption of new technologies in fish production.

Food crisis in Nigeria can be arrested through agricultural research and effective /efficient agricultural extension services. However, some farmers in the rural areas are illiterates, therefore cannot read or write, they need agricultural extension agents through which such information from research station(s) will be interpreted to them. Agricultural extension service is a necessary prerequisite to widespread and sustained agricultural development.

REFERENCES

Adeleye O.A (1996); Conservation needs of fisheries resources and re-orientation for sustainable captive and culture practices FISON Proc. Abeokuta.12th-15thOctober,1996 .

Adinya I. B. (2001) "Factors influencing Labour Utilization in Small – Scale Cassava Production: A Case Study of Uyo Agricultural Zone of Akwa Ibom State. M.sc. Thesis Unpublished, University of Uyo, Akwa Ibom State. Pp1 – 109.

Adinya I.B., O.O Kuye, M.U. Awoke, S. Ajayi, I.E. Ele; K.I. Ogbonna, S.O. Akpet and O.A. Agba (2008), *Production Function Analysis of Cassava Role Cropping System in Akwa-Ibom State, Nigeria.* Global Journal of Pure and Applied .14 (1): 13 - 17 .

Ajayi S.S. (1996), Fish and Wildlife Biodiversities and Development. FEPA Report, Abuja, Nigeria Pp1-12.

Ajayi, A.R.and Madukwe (2001). The Potential Role of Agricultural Extension in Agro- Biotechnological Innovation Generation and Adoption in Developing Countries: A case Study of Nigeria. Jounal of the Science of Agriculture,Food Technology and The Environment, 1(1):39-46.

Akpet S.O., G.E. Arikpo, E.A. Agbogo, and L.O Ogbonnaya (2005); *Indigenous knowledge in supplementary dietary protein needs Among the Rural Population of Cross River State*. A paper presented at the 2nd annual conference of the Nigerian Society of Indigenous Knowledge and development held at Cross River University of Technology Obubra, Cross River State, Nigeria. Pp.1-5

Arene, F.I.O.,Ibanga, E.S. and Asur, J.E(1999). Freshwater Snail Crab Intermediate Host of Paragonimus Species in Two Rural Communities in Cross River Basin,Nigeria. Global Journal of Pure Sciences 5(2):184-187.

Awoke, M.U.(2001).Econometrics: Theory and Application, WillyRose and Appleaseed Publishing Company Abakaliki, Nigeria p10.

.

Campbell-Platt G. (1984). *Traditional West African Food Processing of Institute of Food Science and Technology, United Kingdom 17(4).*

Cross River Agricultural Development Project (1992) Crop Production guide pp 1 – 10.

Disney, J.G. A. Hoffman, J. Olley, I.J Clucas, A.Barranco, and B.J. Francis (1978.) *Development of Fish Silage/Carbohydrate Animal Feed for Use in the Tropics*. Tropical Sciences. 20(2): 127-145 .

Effiong E.O. and C.E. Onyenweaku(2006). Profit Efficiency in Broiler Production in Akwa Ibom State. Global Journal of Agricultural Sciences 5(1):43-47

Essien A, G.O Alonge, S.C. Etop , E.E. Umoh and I.B. Adinya(2008) Consumer Preference for Different Poultry Species in Calabar . A Paper Presented at Annual Conference of World's Poultry Congress in Brisbane Australia 30th June – 4th July 2008.

Etim, N.A., Azeez, A.A. Asa U.A.(2006).Determinants of Urban and Peri – Urban Farming in Akwa Ibom State, Nigeria, Global Journal of Agricultural Sciences .5(1):13-16.

Ezekiel A.O. (2005), *Indigenous knowledge and aquatic Resources Conservation and Management in Nigeria*. A paper presented at the 2nd annual conference of the Nigerian Society of Indigenous Knowledge and development held at Cross River University of Technology Obubra, Cross River State, Nigeria. 9 – 12th November, 2005. pp. 78 – 84.

FAO/UNESCO(1974). Soil Map of the World Report.pp1-10

Farrel M.J. 1984. *The Measurement of Production Efficiency*. Journal of Royal Statistic Society Series120(3):253 281.

Food and Agricultural Organization (FAO), (2005). World Tables on Meat Production , Imports, Exports and Consumption.

Ibrahim F.D. and Olayemi (2006), *Marketing of Smoked Fish in Some Selected Areas of Niger State.* A paper presented at the 20th Annual National Conference of Farm Management Association of Nigeria held at Forestry Research Institute of Nigeria, Federal College of Forestry Bauchi, Plateau State. Date: 18th – 21st September 2006. Pp.371 – 377.

Idiong C.I, D.I. Agom and S.B. Ohem (2006) *Comparative Analysis of Technical Efficiency in Swamps and Upland Rice Production System in Cross River State, Nigeria.* A paper presented at the 20th Annual National Conference of Farm Management Association of Nigeria held at Forestry Research Institute of Nigeria, Federal College of Forestry Bauchi, Plateau State. Date: 18th – 21st September2006. Pp. 30 – 38.

John T.R. (1980), *Elementary Food Science.* Second Edition, AVI Publishing Company 205pp. Jories.

Kmenta, J(1971).Elements of Econometrics, Macmillan Co.Inc.New York.pp1- 18.

Koutsoyiannis,A.(1977).Theory of Econometrics.Published by Macmillan London,.pp1- 667.

Lale, N.E.S. and B.M Sestawa (1996). *The Effect of Sun-Drying on the infestation of the African Catfish Claries gariepine Against Post Harvest Insect* in the International Journal of Pest Management 42:28, - 283.

MOFINEWS (2004). Why Agriculture? Cross River State: Producing Milk and Honey for the Nation. A Bi-monthly Journal of Finance Incorporated, Calabar, Cross River State, Nigeria. July- August 2004 3 (6): 4–5.

MOFINEWS (2007) Population Census 2006

Murtala O ,S.,H. O. John and D.S. Peter(2005) Fish Feeds in available in Nigeria and evalution of two commercial pangas feeds through growth trial in ponds , Ministry of Fisheries and Livestock and Department of Fisheries.

Ohen S.B. and G.Dixie (2007). Evaluating the supply Chain for Interregional Quacultured Catfish Trade in Nigeria .Global Journal of Agricultural Sciences 6 (1): 5- 10.

Onu, D.O., Adesope, O.M and Udokang D.O.(2003). Evaluation of work- Related Stress Characteristics Among Agricultural Extension Agents, Journal of Agricultural,Forestry and Social Science 1 (1):13.

Quarterly New Letter of The Ministry of Local Government Affairs Cross River State(2006).pp4-8.

Sule H. (2006), Fish Processing and Preservation for sustainable Food Security in Nigeria. A paper presented at the 20th Annual National Conference of Farm Management Association of Nigeria held at Forestry Research Institute of Nigeria, Federal College of Forestry Bauchi, Plateau State Date: 18th – 21st September 2006.

Ugwu L.L C.,B.O.Mgbenka, H.O.Nwamba and B.I. Odo (2001). Nitrogen Metabolism and Specific Growth Rate of Africa Catfish Fry (*Clarias geriepinus*) Fed different protein Levels. Journal of the Science of Agriculture Food Technology and The Environment 1 (1): 5-8.

Ugwu L.L C(1984). Protein Requirement of Africa Catfish (*Clarias lazera*) fry . M.Sc Thesis University of Ibadan, Nigeria Pp180-184.

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Corresponding Author
ADINYA, I. B
Department of Agricultural Economics and Extension, Cross River University Of Technology (CRUTECH) Obubra Campus, Cross River State, Nigeria.