



COMPARATIVE ANALYSIS OF THE ECONOMICS OF AQUACULTURAL FISH PRODUCTION IN SOME PARTS OF SOUTH SOUTH NIGERIA

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ABSTRACT

The study employs simple descriptive statistics and budgetary analysis to compare the production characteristics, profitability and challenges associated with fish production in Akwa Ibom and Rivers States, Nigeria. Primary data collected from 60 selected fish farmers in six Local Government Areas with the aid of a questionnaire were used for the study. From the outcome of the research, male (85%), educated (95%) and married (63.3%) with more than 5 years of experience dominated the study area. Farmers in Akwa Ibom and Rivers States have a Net Farm Income of # 998, 100 and #1, 435, 557.2 respectively, implying that fish production was more profitable in Rivers State than Akwa Ibom State. Apart from having a lower average feeding cost and mortality rates than their Akwa Ibom State counterpart, Rivers State farmers were also better in terms of sound fish management practices, access to extension service and frequency of harvest. Beyond this, average rate of return on fish sales (ROS), rate of return on variable cost (RRVC%) and operating ratio values of 0.613, 264.3, and 0.37 in Akwa Ibom State and 0.703, 349.9 and 0.28 in Rivers State all lend credence to the profitability and prospect of fish production in the study area. In addition, poor access to finance, high cost of feeds and other inputs, lack of organized market, high cost of storage and rampant incidence of theft were the major fish production challenges identified in the study area. Hence, effort to ensure credit availability, minimizing cost of feeds and other inputs, reducing storage cost, incidence of theft as well as boosting fish marketing through trainings, seminars, workshops and other awareness creation forum should be encouraged.

Keywords: fish production, profitability, challenges, comparative analysis.

INTRODUCTION

The issues of protein deficiency among Nigerians have been highlighted by several authors (see Adekun *et al.*, 2006; Kudi *et al.*, 2008; Ojo, 1991, Cohen, 2005). In Nigerian, fish and fish products constitute more than 60% of the total protein intake of adult in rural areas (Adekoya, 2004). Its contribution to Gross Domestic Product rose from 76.76 Billion to 162.61 Billion in 2005 at 2001 current factor cost (CBN, 2005). Apart from being a source of foreign exchange and income, it also provides employment for the teeming population.

The world demands for fish and fishery products have increased considerably in recent time. In Nigeria, for instance, its demand requirement is 1.4million ton per year while local production is merely 0.4 million ton per year, forcing importation, costing about US \$250 million per year (Cohen, 2005). However, Adekoya and Olunuga (1999) put Nigerian fish demand and supply at 40, 128 and 10, 561 metric tons respectively. This creates a shortfall of about 29, 567 metric tons that is met through importation. This increase in fish demand can be attributed largely to; the relative decline in the supply of animal protein from other sources, increasing population, decline in captured fishes due to pollution and over fishing, government fishing regulations, rampant growth of water plants such as water hyacinth in our rivers that disrupt the free movement of fishing trawlers as well as rampant deforestation of mangrove trees which serve as natural habitats for fishes. As noted by Ibiam (2004), Nigeria's inadequate fish supply results in the annual importation of #1 trillion worth of fish. Beyond this, Nigeria's per capita

fish consumption fell short of the World Health organization (WHO) recommended 13, 5kg by 5.0kg in 2000 (Grace, *et al.*, 2004). This is an indication that an average Nigerian is malnourished in terms of fish protein. Consequently, except this trend is reduced, Nigerian would be prone to mal-nutritional related ailments such as Kwashiorkor, goiter, berry-berry, rickets etc.

To reverse this trend, aquaculture remains the virgin and untapped area in the Nigerian fishing sector that have the prospect to bridge this demand-supply short fall. Studies such as Rana (1997), FAO, 1999, 2002), Pedini and Shehade (1997), Tobor (1984), Grace *et al.* (2004), Silva and Laszo (2001) etc all lend credence to the potential of Aquaculture in meeting fish protein requirement of developing countries.

In spite of this huge potential, couple with the optimal climatic, land and water condition in Nigeria alongside abundant proven technologies available for large scale production, the aquacultural fish sector continues to be characterized by low output, post harvest losses, poor marketing and processing system. Local fish production has failed to meet domestic demand (FAO, 1995). This translates into the accumulated huge fish import bills and rising prices of reared fishes in Nigeria. In view of these challenges, the study compares the productivity and economic potential of aquacultural fish production in Akwa Ibom and Rivers States of Nigeria, with a view to enhancing efficiency and increasing output.



MATERIALS AND METHODS

The study was carried out in South Nigeria. Two States, Rivers and Akwa Ibom States were chosen. Data were collected in the 2011 production year with the aid of a structured questionnaire. Three Local Government Areas per State were selected making a total of six Local Government Areas. Ten respondents were further selected per Local Government Area making a total of sixty fish farmers that were administered with the questionnaire. The selected Local Government Areas in Akwa Ibom State were Uyo, Itu and Etinan, while Obioakpor, Port Harcourt city Local Government and Emuoha were selected in Rivers State. Data series of interest were on socioeconomic characteristics of fish farmers as well as production characteristics of fish farmers such as extension visit, water draining pattern, frequency of fish harvest, species of fish cultured etc. Data collected were analyzed using simple descriptive statistics as well as budgeting techniques. The budgeting technique used was the Net farm income and gross margin analysis

(i) Gross margin analysis

Gross margin = TR - TVC

Where TR is the total revenue

TVC = total variable cost of production

(ii) Net farm income approach

The formula for computing the net farm income is given as:

NFI = TR - TC

Where

TC = TVC + TFC

TR = Total revenue from the sale of fishes

TC = Total cost of fish production which is the summation of all the fixed and variable cost.

TVC = Total variable cost

TFC = Total fixed cost

The following profitability ratios were also computed from the result of the budgeting analysis (see Kay, 1981).

Return on sale (ROA) = NI/TR

Rate of Return on variable Cost (RRVC %) = $\frac{TR - TFC}{TVC} \times 100/1$

Operating Ratio = TVC/ TR

Where

TVC = Total variable cost of fish production

TC = Total cost of fish production

TR = Total Revenue

NI = Net Income

TFC = Total fixed cost of fish production.

RESULTS AND DISCUSSIONS

Socioeconomic characteristics of respondents

Table-1 presents the demographic characteristics of respondents. The study area is dominated by male (65%). About 95% of fish farmers were able to read and write. Of these, 80% attended at least secondary schools. The high rate of literate farmers in the study area would impact positively on fish farming, since new fish farming techniques would easily be adopted. In terms of experience, farmers in Rivers State were better off than their Akwa Ibom State counterparts. For instance, 53.5% of farmers in Rivers State have above five years of experience compared to only 10% recorded by Akwa Ibom State. The rationale behind these low years of experience in Akwa Ibom State is because less attention used to be paid to aquaculture before now until recent. This is the case because of the State is known to have high percentage of captured fisheries. Age wise, older farmers of more than 40 years (40%) dominated fish production in Akwa Ibom State while Rivers State was dominated by farmers within the age bracket of 31-40 years (43.3%). The prevalence of active, youthful farmers in Rivers State would enhance fish production. With regards to household size, the dominant average household size was 4-9 (43.35%) persons. Akwa Ibom State farmers had the highest household size of 4-9 (66.7%) than Rivers State (20%). This high household size implies surplus or abundant labor for fish production in Akwa Ibom State than Rivers State. Beyond this, the dominant labor was hired labor in both cases (83.3%). This revelation is surprising given the high household size in Akwa Ibom State. This implies that the abundant family labor in Akwa Ibom State study area is engaged in other economic activities other than fish farming.

**Table-1.** Demographic characteristics of fish farmers.

Variable	Akwa Ibom		Rivers State		Average %
	Frequency	%	Frequency	%	
Sex: Male	21	70	18	60	65
Female	9	30	12	40	35
Educational background					
No formal education	2	6.7	1	3.3	5.0
P/school	5	16.7	4	13.4	15
Sec. School	10	33.3	10	33.3	33.3
Post sec. school	13	43.3	15	50	46.7
Marital status					
Married	20	66.7	18	60	63.3
Single	10	33.3	12	40	36.7
Years of experience					
Less than 2	18	60	4	13.4	36.7
2-5	9	30	10	33.3	31.65
Above 5	3	10	16	53.3	31.7
Age of farmers					
0-30	8	26.7	4	13.4	20
31-40	10	33	16	53.3	43.3
Above 40	12	40	10	33.3	36.7
Household size					
Less than 4	3	10	20	66.7	38.4
4-9	20	66.7	6	20	43.3
Above 10	7	23.3	4	13.3	18.30
Source of labor					
Family	8	26.7	2	6.7	16.7
Hired	22	73.3	28	93.3	83.3

Source: Computed from field survey data, 2011

FARMERS PRODUCTION CHARACTERISTICS IN THE STUDY AREA

Types of fish pond used by respondent

As evidenced in Table-2, majority (55%) of the respondents used concrete ponds, followed by rubber

tanks (25%) and earthen pond (20%). In Rivers, the use of rubber tanks ranked second (25%) while earthen pond also ranked second in Akwa Ibom (33.3%). The high preference for concrete pond in the study area is due to its ability to permit high stocking density.

Table-2. Distribution of fish farmers according to pond type use.

Pond type	Akwa Ibom		Rivers State		Average %
	Frequency	%	Frequency	%	
Concrete	15	50	18	60	55
Earthen pond	10	33.3	2	6.7	20
Rubber tank	5	16.7	10	33.3	25

Source: Computed from field survey data, 2011.



Species of fish stock by farmers

From Table-3 which presents the species of fishes stocked by respondents, cat fish took the lead with 71.6% across the study area. Only two species of fishes; cat fish (83.3%) and Tilapia (16.7%) were prevalent in Akwa Ibom State while in Rivers State, more than three species of fishes were stocked, though separately. Of these, Cat

fish took the lead with 60%, followed by Tilapia (36.7%), while other species like megalops and heterotis accounted for 3.3%. However, only catfish and Tilapia were integrated together while others were reared in separate ponds. Across the two States, cat fish was prevalent species stocked (71.6%) followed by Tilapia (26.7%) while other species accounted for 1.7%, respectively.

Table-3. Distribution of fish farmers according to species of fish stock.

Fish specie	Akwa Ibom		Rivers State		Average %
	Frequency	%	Frequency	%	
Cat fish	25	83.3	18	60	71.6
Tilapia	5	16.7	11	36.7	26.7
Others	0	0	1	3.3	1.7

Source: Computed from field survey data, 2011.

Water draining pattern of farmers per week

As visible in Table-4, the highest water draining pattern by respondents per week was twice. Most farmers in Akwa Ibom State (26.7%) especially those using earthen ponds did not drain water all most weeks, while in Rivers all respondents drained water weekly in the ratio of Twice a week (53.3%), once (16.7%) and above twice

(30%). The water draining pattern in Akwa Ibom State was poor with those draining twice (33.3%), once (40%) and nil (26.7%). None of the respondents in Akwa Ibom State drained water more than twice a week. This is capable of affecting productivity since the standard recommendation by FAO is thrice a week.

Table-4. Distribution of fish farmers by water draining pattern.

Draining pattern	Akwa Ibom		Rivers State		Average %
	Frequency	%	Frequency	%	
Nil	8	26.7	0	0	13.3
Once	12	40	5	16.7	28.4
Twice	10	33.3	16	53.3	43.3
More than twice	0	0	9	30	15.0
Total	30	100	30	100	100

Source: Computed from field survey data, 2011.

Frequency of fish harvest

In terms of frequency of fish harvest per year, more farmers (48.3%) as shown in Table-5 harvested their fishes once a year, 46.7% harvested twice while 55% harvested more than twice a year. In Akwa Ibom, a greater segment of respondents (60%) harvested once, 40% harvested twice and none harvested more than twice a year. This can be attributed to lack of organized market.

With respect to Rivers State, about 53.3% harvested twice a year, 36.7% harvested once a year while 10% harvested more than twice a year. This can be likened to the existence of organized markets and the use of better species of fingerlings in Rivers State. The overall implication is that an average fish farmer in Rivers State was more efficient than their Akwa Ibom State counterpart in terms of frequency of fish harvest.

**Table-5.** Distribution of respondents based on frequency of harvest per year.

Harvest frequency	Akwa Ibom		Rivers State		Average %
	Frequency	%	Frequency	%	%
Once a year	18	60	11	36.7	48.3
Twice annually	12	40	16	53.3	46.7
More than twice	0	0	3	10.0	5.0
Total	30	100	30	100	100

Source: Computed from field survey data, 2011.

Sources of financing operation

From Table-6 which shows the sources of fund for fish production, a greater portion (68.4%) of respondents across the study area financed their fish production through personal savings, followed by Cooperative and other thrift societies (30%), banks and other financial institutions (10%) and other donor agencies (6.6%). Farmers in Rivers had a basket of financing possibilities than Akwa Ibom State. For instance, 20% were able to accessed loan from banks and other financial

Institutions. However, 13.3% had grants from other Developmental Agencies such as Niger Delta Development Commission (NDDC) and Shell Development BP. The 68.4% funding from personal savings as revealed in this result support T the findings of Kudi *et al.* (2005) who reported that 93.2% of fish farmers in Kaduna finance their fishing production through personal savings. This high use of personal sources of finance, results in small scale fish production that dominates the study area.

Table-6. Distribution of respondent by sources of financing operation.

Source of finance	Akwa Ibom		Rivers State		Average %
	Frequency	%	Frequency	%	%
Personal effort	25	83.3	16	53.4	68.4
Coo and thrift society	5	16.7	4	13.3	30.0
Banks and other F/ ins	0	0	6	20	10
Donor agencies	0	0	4	13.3	6.6
Total	30	100	30	100	100

Source: Computed from field survey data, 2011.

Frequency of extension visit

As presented in Table-7, the number of extension visit in Rivers State was more than that of Akwa Ibom State. In Rivers State, farmers (56.7%) had 1 to 2 visits per production season, 16.7% had more than two times visit while about 26.6% were not visited at all. On the contrary, in Akwa Ibom, a greater percentage (60%) of fish farmers were not visited at all while about 36.7% had extension

visit of 1 to 2 times and only 3.3 % were visited more than twice. The more than average rate of visit in Rivers is likely to impact positively on fish production, as new fish farming practices would be frequently communicated to farmers on timely basis than their counterpart in Akwa Ibom State. This equally accounted for the lower mortality rate recorded in Rivers State.

Table-7. Distribution of respondents based on frequency of extension visit per production period.

Extension Visit	Akwa Ibom		Rivers State		Average %
	Frequency	%	Frequency	%	%
None	18	60	8	26.6	43.3
1-2	11	36.7	17	56.7	46.7
More than 2	1	3.3	5	16.7	10
Total	30	100	30	100	100

Source: Computed from field survey data, 2011.



Water source for farming

From Table-8, borehole constituted the major source of water for fish farming in the study area (65%), followed by well (27.3%), rivers/ stream (3.4%) and public tap (3.4%). Unavailability of public tap for fish farming was noticed in Akwa Ibom State. The implication

of this high utilization of borehole water is that the production cost would increase because the farmer has to drill borehole for her farming operations. In Kaduna State, Kudi *et al.* (2008) reported a greater percentage (70.45%) made use of tap water for their fish production activities.

Table-8. Distribution of respondent base on sources of water for fish farming.

Water source	Akwa Ibom		Rivers State		Average %
	Frequency	%	Frequency	%	
Borehole	17	56.7	22	73.3	65.0
Well	9	30	5	16.7	23.3
River/Stream	4	13.3	1	3.3	8.3
Public tap	0	0	2	6.7	3.4
Total	30	100	30	100	100

Source: Computed from field survey data, 2011.

Types of cultured fishes in the study area

Table-9 which presents the types of cultured fishes shows that about 73.4% of respondents stock fingerlings, 18.3% stocked juvenile while 8.3% combine both fingerling and juvenile together. Farmers in Akwa

Ibom stock more fingerlings while their Rivers counterpart stocks more of juvenile. The increased use of juvenile by Rivers farmers account for the more than twice stock and harvest of fishes in Rivers State.

Table-9. Distribution of respondents by types of cultured fishes.

Cultured fish	Akwa Ibom		Rivers State		Average %
	Frequency	%	Frequency	%	
Fingerlings	20	66.7	24	80	73.4
Juvenile	6	20	5	16.7	18.3
Fingerlings/ Juvenile	4	13.3	1	3.3	8.3
Total	30	100	30	100	100

Source: Computed from field survey data, 2011.

Profitability and prospects of aquaculture in the study area

This was measured in terms of gross margin analysis. From Table-10 which presents the average cost and return of fish farmers in the study area, average total revenue from the sale of fishes in Akwa Ibom and Rivers State were #1, 628, 700 and # 2, 040, 975 with a total production cost of #630, 599.8 and #605, 417.87 in both cases. Variable cost constituted the highest cost of production of 96.4% and 94.9% in both States. Of this, fish feeding cost accounted for 61.2% and 57.55 of the total variable costs of production.

Also, fish farmers had a total gross margin of #1, 021, 038 and #1, 466, 661.3 alongside a net farm income of #998, 100.2 and #1, 435, 557.2 for Akwa Ibom and River State, translating into a marketing margin of 61.3%

and 70.3% respectively. This implies that fish production in the study area was profitable and has more prospects. However, the buying prices of fingerlings and feeds were found to be cheaper in Rivers than in Akwa Ibom. Also, in terms of sales, average prices of fish per kilogram was higher in Rivers than Akwa Ibom. The mortality rate was higher in Akwa Ibom (11%) than Rivers (3.5%). The higher prices and lower mortality in Rivers can be attributed to increased awareness and existence of organized markets in Rivers than Akwa Ibom State. Average feeding cost per fish was lower in Rivers State (#113.98) than Akwa Ibom State (#139.34). This can be attributed partly to the high mortality rate in Akwa Ibom State and partly to the fact that Rivers State is closer to the commercial city of Aba where local feed formulation and bagging companies abound.

**Table-10.** Estimated cost and return per 3000 fishes in the study area.

Cost item	Akwa Ibom	Rivers State
Variable cost		
Cost of fingerlings	75, 000	70, 500
Feeding cost	372, 000	330, 000
Labor charge	95, 000	129, 000
Medication	14, 050	3, 572
Transport/logistics	28, 200	23, 100
Storage cost	21, 600	14, 600
Annual union dues	1, 812.5	3, 541.7
Total variable cost	607, 662.5	574, 313.7
Fixed cost		
Depreciation	3,604	5, 104.17
Rent on land	15, 683.3	23, 700
Interest on loan	3, 650	2300.00
Total fixed cost	22, 937.3	31, 104.17
Total cost	630, 599.8	605, 417.87
Revenue		
Sales of fish	1, 628, 700	2, 040, 975
Gross margin (C-A)	1, 021, 038	2, 040, 975
Net income (GM-TFC)	998, 100.2	1, 435, 557.2
Feeding cost per fish	139.34	113.98
Marketing margin	61.3%	70.3%

Source: Computed from field survey data, 2011
All Figures are in Nigerian Naira. \$1 = #150.00

Other profitability ratios

Table-11 presents the four profitability ratios computed to ascertain the profitability or otherwise of fish farming in the study area. These are Return on Sale (ROS), rate of Return on variable cost (RRVC) as well as Operating ratio (OR). For the entire farm, the average returns on sales were 0.613 and 0.703 in Akwa Ibom and Rivers State. This implies that for every #1.00 earned 61 and 70 kobo accrue to fish farmers in Akwa Ibom and

Rivers State respectively. Also, the rate or return on variable cost values of #264.3% and 349.96% for Akwa Ibom and Rivers State shows that every #1.00 cost incurred on variable cost generates #264.3 and # 349.96 respectively. The Operating Ratio of 0.37 and 0.28 for Akwa Ibom State and Rivers indicates greater total revenue over total variable cost. These further lend credence to the profitability and prospect of fish production in the study area.

Table-11. Profitability analysis of fish farmers.

State	Rate of return on sales (ROS)	Rate of return on variable cost (RRVC %)	Operating ratio (OR)
AK	0.613	264.3	0.37
RV	0.703	349.9	0.28

Source: Computed from field survey data, 2011.

Fish production constraints in the study area

From Table-12, the major production challenges identified by respondents in the study area were; poor

access to finance (46.7%), high cost of feeds and other inputs (21.7%), lack of organized market (13.4%), lack of



storage facilities (11.7%), high mortality rates (6.6%) and rampant incidence of theft (3.3%).

Taking one market at a time, poor access to finance was more severe and ranked first in both States with values of 43.4% and 46.7% respectively. High cost of feeds ranked second (2nd) in both States with 23.3% and 20% in both States. The implication of this high cost of feeds is that the production cost of fish would increase, hence their prices. Lack of organized market ranked third (3rd) in Akwa Ibom and 4th in Rivers State. These accounts for the low selling prices in Akwa Ibom State because

farmers were force to sell their fishes at give away prices. Most farmers in Akwa Ibom also fed their fishes beyond their maturity period because of lack of market. Mortality rate was higher in Akwa Ibom (10%) than Rivers (3.3%). This can be attributed to poor fish management practices in Akwa Ibom. Also, incidence of theft was more pronounce in Akwa Ibom (6.7%) than Rivers. Inadequate storage facilities was more severe in Rivers (16.7%) than in Akwa Ibom (6.7%), reason being that more farmers in Rivers processed their fishes, store and sold as frozen fishes.

Table-12. Distribution of respondents by identified production constraints.

Production constraints	Akwa Ibom			Rivers State			Average	
	Frequency	%	Rank	Frequency	%	Rank	%	Rank
Lack of organized market	5	16.7	3 rd	3	10	4 th	13.	3 rd
High cost of finance	13	43.3	1 st	15	50	1 st	46.7	1 st
High cost of feeds	6	20.0	2 nd	6	20	2 nd	20.0	2 nd
Inadequate storage facilities	1	3.3	6 th	5	16.7	3 rd	10	4 th
High mortality rate	3	10	4 th	1	3.3	5 th	6.6	5 th
Rampant incidence of theft	2	6.7	5 th	0	0	6 th	3.3	6 th
Total	30	100		30	100		100	

Source: Computed from field survey data, 2011.

SUMMARY AND CONCLUSIONS

The study revealed that fish production was dominated by male, educated and married farmers with less than two years experience and household size of 4-9. The major sources of finance, water and prevailing pond type for fish production were borehole (65%), personal savings (68.4%) and concrete pond (55%), respectively. Also, the prevalent water draining pattern per week and harvesting frequency per year were twice and once, with average extension visit of between one and two in a production period. The study further revealed that farmers in Rivers State were more profitable, efficient and had more awareness than their counterpart in Akwa Ibom State with respect to sound fish management practices, gross and net return, frequency of fish harvest per year as well as production cost per Table size fish and mortality rate. With the identified constraints, effort to ensure credit availability, minimizing cost of feeds and other inputs, reduction of storage cost, curtailing incidence of theft as well as boosting fish marketing through trainings, seminars, workshops and other interactive forums should be vigorously pursue.

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