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Aquaculture, a Component of the Farming Systems among the Fishing Communities in Oil Producing Areas of Delta, Nigeria

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Abstract

The study focused on ascertaining the relative importance of aquaculture in the farming systems of Oil Producing Areas Delta State, Nigeria. A stratified random sample of 598 households from 47 communities was used. Primary data collected between the months of May 2009 and February 2011 by means of structured questionnaire, complemented by oral were analysed using both descriptive and inferential statistics. The results show that 69% of the respondents were into fishing/fish farming either as sole enterprise or in combination with other farming activities while 31% were into non-fish farming activities only. Among those involved in fishing activities, 37% were into capture fisheries, while about 32% were involved in aquaculture either as sole enterprise or in combination with other farming enterprises. The average size of fish pond was about 51 m^2. The mean household net income from aquaculture per annum was about ₦91, 542, giving the highest returns on investment of about 45%. The study also found that households practicing aquaculture together with arable cropping generated significantly ($P \leq 0.05$) highest net farm income (₦127342) than the rest groups of households. The major constraints to aquaculture development were inadequate finance, high cost of feeds and water pollution problems. It was recommended that the current government efforts at boosting investment in aquaculture through microcredit should be stepped up. Local sourcing of feeds by the farmers is also encouraged.

Keywords: Aquaculture, Farming systems, Profitability, Delta State, Niger Delta, Nigeria

Introduction

In the Niger Delta Areas of Nigeria is made up of six states, of which Delta State is one. Prior to oil exploration and exploitation activities, Niger Deltans were predominantly farmers and fishers due to the rich-alluvial farm lands and copious surface water-web that characterizes the basin. Among such farming activities capture fisheries formed one of the major components. This was made possible by virtue of the abundance of mangrove, creeks, rivers and rivulets which are the common features of the River Niger as it empties into the Atlantic Ocean. The mangrove area of Nigeria is estimated at 10, 515 Km^2 significant chunks of which are concentrated in the Niger Delta. However, the capture fisheries, an all important aspect of farming systems of the area is fast disappearing and no longer sustainable due mainly to increasing population pressure and pollution of the inland waterways by crude oil toxicity following frequent spillages (Spalding *et al.*, 1997). Other threat to mangroves in Nigeria are over logging, clearance for the passage of oil pipes and

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seismic lines, swamp reclamation for urban development and settlement, the spread of Nypa Palm, etc. The implication is that the means of livelihood of the bulk of the rural dwellers in this area has been eroded. As an alternative to this, many of the farmers now take to aquaculture in order to sustain the fish producing, marketing and consuming populations of the area.

On the average, fish consumption accounts for about 40% of animal protein intake in Nigeria (Central Bank of Nigeria, 2004), with the percentage being generally higher for residents of the Niger Delta Region than for the other parts of the country. A decline in fish availability will simultaneously have serious economic, social and health consequences on the nutritional status of the people, especially children who require adequate fish intake for their brain development.

Adamu (2007) gave the total domestic fish production in 2005 as 579,500 tonnes, while production from aquaculture was 56,300 tonnes in the same year. The total annual domestic fish supply in Nigeria is about 400,000 tones after accounting for losses. This figure, according to (Food and Agriculture Organisation, 1997) represents about 42% of total annual domestic fish demand. To make up for the supply gap, Nigeria imports about 560,000 tones of fish estimated at about $500 million annually (Ayinla, 2010). This makes Nigeria one of the largest importers of fish in the developing world. The total domestic output is composed of 96% from capture fisheries and only 4% from aquaculture (Federal Ministry of Agriculture and Water Resources, 2008). A solution to the country's high demand for fish cannot be sustained by reliance on capture fisheries especially in the Niger Delta Areas principally due to oil pollution of the inland and fresh water ways. The emerging and sustainable solution lies in aquaculture.

Although, expansion of output via aquaculture has been a slow process as private sector fish farmers have faced major constraints including lack of coordinated policy for the sector development (Akolisa and Okonji, 2005), aquaculture sector has made some achievements in term of production level through private sector driven production (Ajani, 2009). Part of the reasons for the slow pace of development in the sector is the common view on rural poverty reduction among the rural households in Nigeria which has been that of a sector driven and almost entirely by production of crops and livestock. Studies by several authors (Matsumoto *et al.*, 2006; Haggblade *et al.*, 2007) have shown that diversification of income help in minimizing household income variability by providing an additional source of income and employment which have implications for rural poverty reduction and enhancement of households' welfare.

Aquaculture (Fish Farming) is the art and science of controlled rearing of fish in ponds, farms and in some instances natural water bodies from hatchlings (freshly hatched" fishes) to matured size (Ahmadu Bello University, 2000; Offem *et al.*, 2010). Although a relatively new practice in Nigeria, aquaculture contributes in no small measure towards food production in many countries in employment generation, poverty reduction, overall rural development and environmental sustainability.

In the face of the never-ending water and land pollution problems in oil producing areas of Delta State, Nigeria and the consequential erosion of the traditional capture fisheries occupation of majority of the farming communities as well as the awareness on the potentials of aquaculture to contribute to domestic fish production in the state, the questions that are pertinent are;

i) to what extent has aquaculture technologies been adopted as an alternative means of livelihood among the rural households?
ii) what is the place of aquaculture in the farming systems of the people?
iii) how profitable is aquaculture in comparison to capture fisheries and other farm enterprises?
iv) what are the constraints to aquaculture as an occupation in the area?

In addressing these questions, the study sought to;

i) ascertain the extent to which aquaculture technologies has been adopted as an alternative means of livelihood among the fishing households,
ii) describe the aquaculture management systems adopted by the farmers,
iii) estimate and compare the income and profitability of aquaculture with other farm enterprises in the area,
iv) estimate the proportionate contribution of aquaculture to income of the fishing households.
v) determine the constraints to aquaculture development in the fish producing communities areas of Delta State of Nigeria.

Methodology of the Study

The study was carried out in the Fish Producing Areas of Delta State of Nigeria. The State, named after the delta region of the River Niger shares common boundaries with Edo and Ondo States to the North West, Imo and Anambra to the North East, Rivers and Bayelsa States to the South East. In the South West and South it has approximately 122 kilometres of coastline bounded by the Bight of Benin on the Atlantic Ocean. The state has an estimated population of 4,098,391 (National Population Census, 2006).

Delta State is major oil producing state and ranks second to Rivers State. The State supplies about 35% of Nigeria's crude oil and some considerable amount of natural gas. The oil producing local government areas are Warri North and South, Burutu, Isoko North and South, Ughelli North and South, Okpe, Ethiope East and West, Sapele and Ndokwa East and West (Galleria Media Limited, (2004-to-Date).

The non-oil economy of the state is divided into land based and water based. The traditional economic activities of the Land based type of economy (those on the drier parts at the northern end of the state) includes farming, fishing, collecting and processing palm fruits, as well as hunting, while the water based type of economy (those on the southern parts of the state with a less diversified economic activities) are mainly fishing and trading.

The state government in an effort to diversify the state's revenue base from being solely oil, accords various forms of assistance to farmers in the areas of fisheries, agriculture, forestry, veterinary services, produce planning and research. In particular, the state government has invested adequately in fisheries due to the fact that fresh fish, crabs, shrimps and dried fish abound in almost all the local government areas of the state. Besides oil production, Delta State is also rich in major tubers and root crops such as cassava, coco yams, yam and potatoes and assorted livestock.

A stratified random sample of 598 households from 47 fishing communities from the oil producing areas of the state was used. Primary data collected between the months of May 2009 and February 2011 by means of structured questionnaire, complemented by oral interview where necessary were used. Data were summarised using descriptive statistics. Net income analysis was employed to estimate profitability of aquaculture, fishing and other farm enterprises. Comparison of means of relevant production and income statistics was by use of analysis of variance (ANOVA).

Results and Discussion

Households in the fishing communities of Delta State engage in a wide array of economic activities, farm and non–farm alike. Besides the traditional fishing, many of the households were engaged in crop and livestock farming. Table 1 presents the distribution of respondents according to the nature of their primary enterprises. The results show that 69% of the respondents were into fishing/fish farming either as sole enterprise or in combination with other farming activities while 31% were into non-fish farming activities only. Among those involved in fishing activities, 37% were into capture fisheries, while about 32% were involved in aquaculture either as sole enterprise or in combination with other farming enterprises. Only about 11% practiced only aquaculture. This finding shows that aquaculture is assuming a position of eminence among households in the fishing communities of the state.

Table 1: Enterprise Combinations among the Households Fishing Communities

Farm Enterprises	No of Respondents	Percentage
Aquaculture only	66	11.04
Aquaculture and Capture Fisheries	67	11.20
Aquaculture and livestock	30	5.02
Aquaculture and Crop Production	28	4.68
Capture Fisheries only	169	28.26
Capture Fisheries and other Farm activities	53	8.86
Crop and Livestock Production	185	30.94
Total	598	100.00

Aquaculture production in Delta State is still traditional. This is because, as presented in Table 2, about 45% of the operators still rely on earthen pond, with its attendant poor water retention and high susceptibility to erosion. Whilst the farmer acknowledged being aware of the availability of modern types of pond, finance limited many of them from adopting them. To enable them key into the improved pond systems, the farmers have to be financially empowered.

Table 2: Distribution of Aquaculture Operators by Types of Ponds used

Types of Pond	No of Respondents	Percentage
Earthen	85	44.55
Concrete	25	12.87
Plastic/polythene	17	8.91
Earthen and Concrete	28	14.85
Earthen and Polythene	19	9.90
Concrete and Polythene	13	6.93
All three types	4	1.98
Total	191	100.00

Table 3 gives the distribution of respondents according to the size (m^2) of their fish ponds. The table shows that about 75% of the fish farmers have mean pond size of 60 m^2 or less. Only about 7% had more than 100m^2. The mean pond size was about 51 $m^{2.}$ It is obvious therefore that the scale of operation is small. While finance and managerial skills could partly be responsible for this uneconomic scale of operation, the fact the farmers are just transiting from wholesome capture fisheries into aquacultures partly explains the situation.

Table 3: Pond Size Distribution of Respondents Involved in Aquaculture

Pond size (m^2)	No of Respondents	Percentage
Less than 20	51	26.73
20 – 40	66	34.65
41 – 60	26	13.86
61 – 80	17	8.91
81 – 100	17	8.91
More than 100	13	6.93
Total	191	100

The mean annual farm income and returns on investment in the different enterprise combinations among the households are presented in Table 4. The table shows that household who combined aquaculture with crop production enterprises generated significantly (P

≤ 0.05) a highest annual farm income of about ₦127342, followed by those who combined aquaculture with livestock production (₦103450). Although the net farm income of households who engage only in aquaculture (₦91542)was significantly lower than those of households who were engaged in Aquaculture and livestock and Aquaculture and Crop Production, aquaculture as a sole enterprise generated significantly (P ≤ 0.05) the highest returns on investment than any other enterprise combination groups. Investment in aquaculture alone generated as much as 45% returns in investment compared to capture fisheries which generated only 9%. The returns on investment in aquaculture recorded in this study compares well with 55% as obtained by (Adewuyi, Phillip, Ayinde and Akerele, 2010). It however fell short of that obtained by Erih, (2010), who reported returns on investment of over 100 %. Since total net farm income is of more interest to the farmer than returns to investment in terms of contribution to welfare, they would fare better under their present income limitations to combine aquaculture with other farm enterprises, particularly crop production. However, considering the overwhelming potentials of aquaculture, in terms returns per naira invested as well as welfare statuses of the households, efforts should be made to increase cost efficiency of the farmers.

Table 4: Mean Household Net Farm Income and Returns on Investment by Type of Enterprise

Farm Enterprises	Net farm Income per Household	Returns on Investment
Aquaculture only	91542[c]	45.00[a]
Aquaculture and Capture Fisheries	78441[c]	26.00[b]
Aquaculture and livestock	103450[b]	34.00[b]
Aquaculture and Crop Production	127342[a]	25.00[b]
Capture Fisheries only	68169[d]	9.00[d]
Capture Fisheries and other Farm activities	72336[d]	18.00[c]
Crop and Livestock Production	88185[c]	21.00[c]
Mean	91863	34.31

The distribution of income by source and the proportionate contribution of aquaculture to total annual income of households of the fishing communities are presented in Table 5. It could be seen from the table that although aquaculture alone does not guarantee highest possible annual income, it boost the annual income of the households among the fishing communities. The small scale size of holding made it impossible for the households involved in only aquaculture to generate the highest possible annual income out of the possible rural enterprise combinations. The result however indicates that it contributed between about 30% and 43% to the income of household involved in aquaculture and when considered across the entire fishing communities, irrespective the enterprise involved in, aquaculture contributed about 11% to total annual income.

The foregoing makes it obvious that boosting aquaculture would enhance the annual income of households in the fishing communities of the state. This could be achieved through expanded effort at credit extension to the farmers targeted at aquaculture enterprises. Also, extension education would make more households to adopt aquaculture as a viable complementary enterprise.

A number of factors constrain aquaculture production among members of the Fishing Communities. Among these as presented in Table 6, lack of finance, high input costs and lack of storage and preservative facilities were the most severe. The respondents indicated that their inability to access adequate external funds made it impossible to expand their scope and size of operations as well as carry out all seasons stocking. Problem of finance was compounded by high cost of inputs, particularly feeds. The result is that the farmers resort to feed rationing, with negative impact of low weight at maturity.

Table 5: Proportionate Contribution of Aquaculture to Household Annual Income

Farm Enterprises	Number of Respondents	Annual Income from Aquaculture	Total Annual Income from other Farm enterprises	Non - farm Annual Income	Household Total Annual Income	Contribution from Aquaculture (%)
Aquaculture only	66	91542	0	123679	215221	42.53
Aquaculture and Capture Fisheries	67	58349	20092	117429	195870	29.79
Aquaculture and livestock	30	66301	37149	101236	204686	32.39
Aquaculture and Crop Production	28	75527	51815	126668	254010	29.73
Capture Fisheries only	169	0	68169	104212	172381	0.00
Capture Fisheries and other Farm activities	53	0	72336	71223	143559	0.00
Crop and Livestock Production	185	0	88185	74669	162854	0.00
Mean	598	23503	59498	96680	179682	11.05

Table 6: Constraints to Aquaculture Production

Constraints Item	No of Respondents	Percentage
Finance	67	35.08
Storage and Preservative difficulties	27	9.42
Low returns on investment	11	5.76
High cost of inputs	56	12.04
Low output prices	13	6.81
Seasonality of demand	9	8.9
Small weights at maturity	8	4.19
Total	191	100.00

Storage and preservative problems arose because at maturity, not all the fishes are immediately sold out. Prolonged delay before sales attracts additional cost of feeding unless the fishes were harvested, preserved and stored in such forms as to attract patronage later. The inability of the farmers to undertake these additional costs force them to sell off their fishes immediately at maturity at low prices.

Summary and Conclusion

The study was carried out among the fishing communities in the Oil Producing Areas of Delta State, Nigeria with a focus of ascertaining the relative importance of aquaculture in the farming systems of the area. The study shows that aquaculture is assuming a position of prominence among households in the fishing

communities of the state because about 32% were involved in aquaculture either as sole enterprise or in combination with other farming enterprises. The average size of fish pond was about 51 m^2. The mean net income from aquaculture per household per annum was about ₦91, 542, giving the highest returns on investment of about 45%. The study also found that households practicing aquaculture together with arable cropping generated significantly ($P \leq 0.05$) highest income (₦127342) than the rest groups of households. Involvement in aquaculture contributed between about 30% and 43% to annual income of the operators. The major constraints to aquaculture development were inadequate finance, high cost of inputs and preservation and storage problems. It was recommended that the current government efforts at boosting investment in aquaculture through microcredit should be stepped up. Also, extension education would make more households to adopt aquaculture as a viable complementary enterprise.

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