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Adaptive Mechanisms of Rural Fishermen Towards Climate Change On Quantity of Fish Caught in Asari-toru Local Government Area of Rivers State Nigeria.

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Abstract
This study investigated the adaptive mechanisms of rural fishermen towards climate change on quantity of fish caught in Asari-Toru Local Government Area of Rivers State, Nigeria. A purposive random sampling techniques was employed in selecting 80 (eighty) respondents in the study area. Data obtained were analyzed using descriptive statistics and net farm profit analysis. The results showed that majority (96%)of the respondents are male and their mean age ranged between 36-40years with a percentage of 27.6% while 3.5% had fishing experience ranging from 21-25years. Respondents employed building of sea walls, diversification to off-farm activities and restoration of mangroves as means of adapting to climate change. These mechanism employed improved their productivity and profitability with a net profit of N500, 455.1. The major problem encountered (14.9%) was high cost of fishing materials. An integrated approach in problem solving through knowledge of the existing adaptive mechanisms with adequate participation of the people is recommended.
Keywords: Adaptive Mechanism, Climate Change, Rural Fishermen, Fishing, Socio-economic Characteristics.

1. Introduction

Climate change in a narrow sense is the average weather condition of a place over a period of time (IPCC, 2007). It can be said to be the statistical description in terms of the mean and variability in relevant physical quantities over a period of time, ranging from months to thousands or millions of years. The climate of an area can be altered by several climatic forces such as accumulation of greenhouse gases in the lower atmosphere by human activities through combustion of fossil fuels and deforestation. These climate forces by human activities has led to climate change which is a change attributed directly or indirectly to human activities that alter the composition of global atmosphere, and which is in addition to natural climate variability observed over a comparable time period. (IPCC, 2007). The effect of climate change may be physical, ecological, social or economical. Evidence of observed climate changes by intergovernmental Panel on Climate Change(2007) includes the institutional temperature records, rising sea level and decreased snow cover in the northern hemisphere. These effects of climate change have been observed to affect rural communities which are mostly engaged in agricultural activities (Ikeme, 2009). In view of rural fishing as a vital occupation of the Riverine area, it is obvious that fishing is the greatest threat to future global fish production as the effect of fishing and climate interact in a number of ways, as fishing reduces the age, size, diversity of population and the biodiversity of the marine ecosystem. It also causes damage or change in the biodiversity, demography, stock structure of individual species, and direct or indirect changes in fishing communities. Fishes are a component of marine ecosystem and the continuous development of a precautionary ecosystem-based approach that goes beyond assessing and managing a few commercially important species provides a better basis for incorporating climate induced changes (Brander, 2007).

Several international agencies, including the World Bank and Food and Agricultural Organization (FAO), have programmes to help communities adapt to global warming such as developing policies to improve the resilience of natural resources through assessment of risk and vulnerability, increasing awareness of climate change impacts and strengthening key institutions such as weather forecasting and early warning systems. The World Bank development Report (2010), shows that rebuilding overcapacity in fishing fleets, reducing greenhouse gases emissions by fishing fleet and rebuilding fish stock can both improve resilience to climate change and increase economic returns from marine capture fisheries by US$50 billion per year. Consequently, removal of subsidies on fuel for fishing can have a double benefit by reducing emissions and preventing overfishing.

According to Brander (2007), it is difficult to provide detailed management and adaptive strategies for fisheries due to the complexity and regional variability of marine ecosystem and their responses to climate change. However, it is possible to suggest attributes of adaptation whose costs and benefits are essentially local and natural such as restoration of mangrove forests which protects shorelines from erosion and provides breeding

grounds for fish while sequestering carbon, construction of dykes and sea walls to protect against rising sea level and extreme weather such as floods, hurricane and storms.

1.1 Problem Statement

The major global trend that is climate related, that impact agricultural production is flood, drought, colder winter, hotter summer and rising sea levels (Wiley, 2003). The fishing communities in Asari-Toru local government area of Rivers State, Nigeria are subjected to sea level rise, flooding and storm which affects livelihood and fishing activities.

Current environmental problems in the coastal areas of the country are flooding which comes from high rainfall, run-off from rivers and urban chains, tidal movement and wind (Okeke, 2003). With this problem already common, the issue of sea level rise occasioned by global climate will intensify flood and make it permanent, and this may cause beach erosion and salinity distortion. The inundation arising from the sea level increases problems of sea water intrusion into freshwater sources and ecosystem, destroying stabilizing systems as well as mangrove and affecting agriculture, fisheries and general livelihood (Okali and Eleri, 2004).

Flooding of low-lying areas in the Niger-Delta Region has been observed and its consequences such as loss of fish, change in fish species, erosion of human habitat and land will have greater impacts on the welfare and the livelihood of fishermen, most especially in terms of income realized from fishing activities. Flooding has also led to the migration of some species of fishes to another location while some died, thus causing low productivity and consequently reduced fish catch, poor protein diet and low standard of living (Barnett, 2007). This has also increased the spread of different diseases like malaria, typhoid and so on among the fishing communities and their households. At this point, it becomes pertinent to investigate the adaptive mechanisms adopted by fishermen towards climate change in Asari-Toru Local government Area of Rivers State, Nigeria.

2 Objectives of the Study

The general objective of this study is to examine the adaptive mechanisms of rural fishermen towards climate change on the quantity of fish caught in Asari-toru local government area of Rivers State of Nigeria.

2.1 The Specific Objectives of this Study are to:

1. Identify the socio-economic characteristics of the respondents in the study area.
2. Identify how respondents adapt to climate change in their fishing activities in the study area.
3. Determine the profitability level of the respondents in the study area.
4. Identify the constraints encountered by the respondents in the study area.

3. Methodology

This study was conducted in some parts of Asari-toru local government area in Rivers state. The local government Area lies within the transition zone of the Niger Delta Region. It is bounded by longitude $6^0\ 50^1$E to $6^0\ 48^1$E of Greenwich Meridian and latitude $4^0\ 40^1$N to $4^0\ 50^1$N of the Equator. The New Calabar River is the major river that flows through this Local Government Area. It is a tidal river having a highly productive mangrove community. The local Government Area is one of the twenty three (23) Local Government Areas of Rivers State which was created out of Degema Local Government Area, during the regime of General Ibrahim Badamosi Babangida on the 3rd of May 1989. The indigenes of the local government area are mainly involved in fishing activities.

Asari-toru local Government Area is made up of fifteen (15) principal communities namely: Buguma, Ido, Abalama, Krakrama, Tema, Angulama, Oproama, Sama, Ilelema, Okpo, Ifoko, Omekru-Ama, Omelane-Tariama, Minama, and Sangana. Other satellite communities include; Ahikama, Elem-Bekinama, Ele-Ama, Mbiakafiama, Elem Oproama, Jelly kiri, Abbia Iwoama, Opubenibo Kiri, Asembabokiri, Ekweboko, Sagbe kiri, Elem-Minama, Elem-Ido, Captain Kiri, Elem-Sangana, Elem-Kalabari. These study site cuts across Buguma through Ido, Abalama, Tema, Oproama, Sangama, Ifoko, Sama, Tombia, and Oluama. Purposive and Random sampling techniques were employed for this study. This was to ensure a high degree of accuracy and a greater level of precision in data collection. Ten (10) communities where fishing activities are mainly carried out were randomly selected from the study area. A sample of eight (8) fishermen were randomly selected from each of the ten communities namely: Buguma, Ido, Abalama, Tema, Oproama, Sangama, Ifoko, Sama Tombia and Oluama, making a total sample size of eighty fishermen for the study.

3.1 Method and Technique for Data Analysis

Data obtained was analyzed using relevant econometric tools in order to achieve the specific objectives.

Objective 1, 2 and 4 were realized using frequency table and percentages while objective 3 was achieved by the use of Net farm profit (NFP) in order to determine the profitability level of the fishing activities in the study area.

3.2 Model Specification

Net Farm Profit Analysis

TC = TVC + TFC

TR = P x Q (kg) (Unit price of Fish product x Total Physical product)
GM = TR-TVC
NFP = GM-TFC

4. Results and Discussion

Table 4.1: Socio-Economic Characteristics of Fishermen in the Study Area

	Frequency	**Percentage (%)**
Gender	77	96.2
Male	3	3.8
Female		
Age	9	2.5
20 - 25 years	10	12.5
26— 30 years	7	8.8
31 —35 years	77	27.6
36 —40 years	22	27.6
41—45 years	14	17.5
46 — 50 years	3	3.7
Above 50 years		
Marital Status		
Single	15	18.8
Married	45	56.2
Divorced	8	3.8
Widowed	9	10.0
Separated	15	11.2
Educational Qualification		
No formal education	9	11.2
First school leaving certificate	43	53.8
SSCE / WAEC / NECO	21	26.2
BSC/HND	6	9.5
OND/NCE	1	1.2
Household Size		
1—3	19	23.8
4—6	26	32.5
7—9	19	23.8
10 and above	16	20.0
Fishing Experience		
5-10	21	26.2
11-15	11	13.8.
16-20	20	25.0
21-25	28	35.0

Source: Field survey, 2013

Table 4.1 shows the distribution of the socio-economic characteristics of the fishermen in the study area. From the table, the majority of the fishermen interviewed were males representing 96.2% while 3.8% were females.

This shows that men are mostly involved in fishing in the study area because they are much stronger and active in carrying out the drudgery activities associated with fishing. More so, the productivity and profitability level of fishing is at an increasing length due to their commitment in fishing and their capability in harvesting more fish at an instant. Most men in the community also concluded that women are meant for domestic chores because they hardly possess physical strength as they do. The percentage of the age ranges of the fishermen in the study area were 2.5% for age range between 20-25 years, 12.5% for age range between 26-30 years, 8.8% for age range between 31-35 years, 27.6% for age range of 36-40 years, 27.6% for age range of 41-45 years, 17.5% for age range between 46-50 years and 3.7% for age range above 50 years. It was observed that the age of fishermen in the study area have a positive effect on the profitability and productivity level of fishing activities because most of the fishermen fell within the age ranges of 36 — 40 and 41 — 45years and were considered to be more active in carrying out fishing activities.

In terms of marital status, 18.8% were single, 56.2% were married, 3.8% were divorced, 10.0%, were found widowed and 11.2% were separated. This shows that those that are married constitute the highest percentage and are therefore capable of producing more hands thereby reducing cost of labor and increasing productivity. The educational qualifications of fishermen in the study area shows that 11.1% had no formal education,, 53.8% of the fishermen had first school leaving certificate, 26.2% of them had SSCE/WAEC/NECO certificates, 7.5% had BSC/HND, whereas 1.2% had OND/NCE. it was discovered that those with First School Leaving Certificate constitutes the highest percentage of educational qualification. This shows that the rural fishermen lack a high degree of adaptive mechanisms which will enable them cope with the effect of climate change as manifested in flood, sea level rise which affects their productivity. Fishermen with household size ranging from 1 — 3 were 23.8%, those within the range of 4 — 6 were 32.5%, 23.8% were for those with household size ranging from 7 — 9 and 20% represented those with household size ranging from 10 and above. The household size within 4 — 6 had the highest percentage of 32.5 which signifies the reduction in cost associated with labor in fishing. The fishermen concluded that their household size was enough as labor for their fishing activity has reduced the cost of labor associated with fishing. Finally, the fishing experience of fishermen in the study area reveals that fishermen within 5 — 10 years experience were 26.2%, those within 11 — 15 years were 13.8%, 16 — 20 years were 25% and those who were within 21 — 2 years experience were 35.0%. Fishing experience is synonymous with high productivity and profitability in fishing in the study area and the fishermen who fell within the range of 21 — 25years fishing experiences had the highest percentage of 35 and were considered to have a greater knowledge of fishing and its associated problems and adaptive measures.

Table 4.2 Distribution of Adaptive Mechanisms Employed by the Respondents in the Study Area.

Adaptive Mechanisms Employed in the Study Area	Frequency	Percentage (%)
Building of sea walls	77	32.4
Diversification (that is Off-farm Business Activities)	63	26.5
Restoration and Expansion of Mangroves	52	21.8
Provision of safety nets	46	19.3
Total	**238**	**100**

Source: Field survey 2013.

Multiple Choice Responses Recorded.

Table 4.2 shows the adaptive mechanisms employed by fishermen in the study area. From the above table, 32.4% of the respondents adapt to climate change by building sea walls while 26.5% adapt to climate change by diversifying their fishing activities to other non-fishing activities to generate income. These adaptive mechanisms was to prevent sea level rise and extreme weather as floods and storms and as a result of the fact that the return from fishing activities was not what the respondents expected at that particular time, this made them to resort for other petty income generating activities like selling of petroleum products, selling of drinks, carpentry, molding of blocks and so on, in order to meet up their family needs. Also 21 .8% of the respondents strongly stated that they adapt to climate change through restoration and expansion of mangroves. This adaptive mechanism enables the fishermen to fish more, especially in times of excessive flooding in the study area, since fishes tend to move to the mangroves in times of flooding and it also prevents shorelines from erosion. Trees which make up the mangroves are being prevented from cutting down, because they provide an enabling environment for fishes to breed and reproduce more, thus increasing productivity. Finally, provision of safety nets is the least adaptive mechanism employed by fishermen in the study area. This is because safety nets are not commonly used by fishermen in the study area. However, multiple responses was recorded since more than one or two adaptive mechanisms were employed by each fisherman in the study area.

Table 4.3 Shows the Profitability Level of the Respondents in the Study Area

Items	Amount	amount in Nnnaira:kobo	% Total Cost
Gross Revenue Per Annum		1,100,462	
Bait total cost	441.3924		0.074
Sack or bags	150.0949		0.025
Total labour payments	414762		69.13
Hooks	8267.089		1.378
Total Variable Cost (TVC)		423620.6	
Gross Margin (GM)		676,841.4	
Fishing canoe	31731.01		5.29
Paddle	750.4747		0.125
Traps	2279.747		0.213
Fishing Net	17299.37		2.883
Machete	200.3165		0.033
Lantern Cost	88.48101		0.015
Torch light	13.8038		0.002
Rates and others miscellaneous	125023.1		20.84
Expenses			
Total Fixed Cost (TFC)		176386.3	
Total Cost (TC)		600006.9	
Net Profit (NP)		500,455.1	
Net Return on investment (NROI)		0.83	

Source: Field Survey, 2013

Table 3. shows that despite the vulnerability of fishermen to the effect of climate change, fishing venture is still considered a lucrative and profitable business if properly manage and adaptive mechanism effectively employed by the fishermen. On the table, the gross revenue per annum is ₦1,100,462 total variable cost is ₦423,620.6k and gross margin is ₦676,841.4 which was calculated by subtracting the total variable cost incurred by the fishermen from the gross revenue per annum. Total fixed cost incurred by fishermen is ₦176386.3 and total cost incurred by the fishermen is ₦600006.9 which was calculated by the addition of total variable cost and total fixed cost. The profitability ratio of fishing activities in the study area using the net from income was computed to ascertain the extent of the profitability of the venture which is ₦500,455.1 and was calculated by subtracting fixed cost from gross margin. The Net Return on Investment (NROI) of 83% (0.83) implies that the fishermen return on an average 83k on every #1 invested in fishing. This shows that fishing in Asari -Toru Local Government Area is highly profitable and economically rewarding. The profitability level of fishing among the fishermen in the study area was determined by the various adaptive mechanisms they employed, the age, years of fishing experience, gender and household size of the fishermen in the study area.

Table 4.4 Distributions of Respondents According to the Constraints Encountered in the Study Area.

S/N	Problems encountered	Frequency	Percentage (%)
1	High cost of fishing material	79	14.9
2	Incidence of oil spillage	76	14.3
3	Flooding due to sea level rise	72	13.5
4	Spoilage during storage	71	13.4
5	Lack of government assistance	66	12.5
6	Inadequate fishing materials	57	10.8
7	Problem of equipment preservation	51	9.6
8	Scarcity of technical expert	37	7.0
9	High cost of transportation	21	4.0
	TOTAL	**530**	**100**

Source: Field survey, 2013
Multiple Choice Responses Recorded.

The above table 4.4 shows the constraints encountered by the fishermen in the study area. High cost of fishing material was the highest problem that militates against fishing activities of the fishermen with a percentage of 14.9%. The fishermen complained that high cost of fishing materials has resulted to ineffective and inefficient work and finally low productivity. Other severe problems strongly stated were incidence of oil spillage (14.3%). Oil spillage was another critical challenge to the fishermen. In The Niger Delta oil production has greatly affected fishing activity negatively, because of oil spillage and theft which are responsible for oil pollutions in rivers, lakes, ocean,creeks and streams thereby leading to high rate of fish mortality and eventually decline in productivity. Flooding due to sea level rise accounted for 13.5% of the problem encountered by respondents in the study area. It was observed that flooding was another problem faced by the respondents.This flooding results to loss of fish from rivers and eventually results to low fish catches which declines productivity, and affects farmers standarded of living negatively as well as increased spread of diseases among the respondents and their households. 13.4% of the respondents identified spoilage during storage as a problem because, inadequate storage facilities increases detoriation of fish products. Lack of government assistance which was another critical problem made credits unavailable to respondents to augment their equity capital which resulted to inadequate acquisition of fishing materials for effective and efficient fishing. In addition, due to the high demand for collateral to obtain loans, fishermen have not been able to acquire loans from banks. Fishing materials is a major determinant of productivity and profitability of any fishing venture. However, 10.8% of the fishermen complained of inadequate fishing materials which deprive them from going to fish because they feel that they will not harvest much fish needed for their consumption and sale. This eventually leads to poor supply of sufficient fish needed by the consumers, which is an essential protein source needed by them. Inadequate fishing material as complained by them leads to low productivity and ineffective fisheries management. Finally the problem of equipment maintenance was also strongly stated by the fishermen in the study because it provides them with little or no equipment for fishing. However, the problems of the fishermen were collated using multiple responses because each fisherman had more than a single problem.

5. Conclusion

This research have been able to prove that the rural dwellers of Asari-Toru Local Government Area of River State are faced with myriads of environmental problems caused by climate change in their fishing activities which is revealed in the occurrence of sea level rise, flooding, storm, drought are so on and thus they have been able to adopt different adaptive mechanisms such as restoration and expansion of mangroves, diversification (off-farm activities), building of sea walls and the use of safety nets to these effects in order to improve or maintain the productivity and profitability level in their fishing venture.

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