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Flooding and Welfare of Fishers' Households in Lagos State, Nigeria

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ABSTRACT The study examined the effect of flooding on the fishing households' welfare in Lagos State. Data were collected with the aid of structured questionnaire to elicit information from 412 fishers selected through a multistage random sampling technique. Data were analyzed using descriptive statistics, budgetary technique and inferential statistics. Results revealed that rainfall was the dominant climatic factor that had adverse effect on the fishing communities as 81.1% of the respondents experienced loss in income due to flooding. This occurred during the raining season between May and August. Generally, respondents have higher net income during high season when there is less likelihood of flooding than at low season. This implies that during the high season when the volume of water is low, fish catch is high. The mean income for the fishers that use boat technology during low and high seasons are N51,032.38 and N105,619.47 respectively and are significantly different at 1 percent ($p<0.01$) The income of fishers that use motorized technology for the low and high seasons are N60,950 and N131,440 and also significantly different at 1 percent ($p<0.01$). The estimated parameters from the regression analysis shows that household size, membership of association, access to credit and proportion of loss due to flooding were the significant factors explaining fishers' welfare in the study area. The study revealed that fishers employed different coping strategies such as moving permanently or relocating temporarily to another fishing site where there is no flooding to mitigate loss of income as a result of flooding.

INTRODUCTION

The increasing frequency and sometimes intensity of unusual weather-linked phenomenon as a result of climate change in recent times is evident. The United Nations Framework Convention (1992) on climate which is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. Although there is the impact of climate on food production, there is limited understanding of how climate variability currently impacts food systems and associated livelihoods (Downing 2002; Ziervogel and Calder 2003). This needs to be better understood before assessing the impact of climate change on food security. The impact of long - term trends in climate change, in particular related global warming, is less well - understood in fisheries but is beginning to receive attention. Food and Agriculture Organization (FAO) has developed expertise and experience in rapid appraisal of the impacts of disasters on local fishing communities and aquatic ecosystems and the immediate and longer-term remedial action required. Long-term climate change has important feedback loops to global ocean circulation, patterns, sea level rise and changes in ocean salinity all of which affect the biological properties and distribution of species. The Intergovernmental Panel on Climate Change (IPCC) has linked the rise in sea level to climate change. Between 1960 and 1970, a mean sea level rise of 0.462m was recorded along the Nigerian coastal water (Udofa and Fajemirokun 1978).

Current environmental problems in the coastal area of the country are flooding which comes from the high rainfall, run off from rivers and urban chains and tidal movement and wind (Okeke 2003). With this problem already common, the issue of sea level rise occasioned by global climate change will exacerbate it. In addition is the potential to cause permanent inundation, beach erosion and salinity. The inundation arising from the rise in sea level will increase problems of floods, intrusion of sea-water into fresh water sources and ecosystems, destroying such stabilizing systems as mangroves, and affecting agriculture, fisheries and general livelihoods (Okali and Eleri 2004). Flooding of low-lying areas in the Niger Delta region has been observed. Settlements in the coastal region have been cleared by coastal erosion. In some places,

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especially in Forcados, some oil wells have been lost to the ocean due to erosion (Awosika 1995).

Fisheries ecosystems and fishing-based livelihoods are subject to a range of climate-related variability, from extreme weather events, floods and droughts, through changes in aquatic ecosystem structure and productivity, changing patterns and abundance of fish stocks. Fishery resources are of particular significance in Nigeria as they provide a considerable amount of dietary protein in the country and the sector also serves as a major source of employment and labour for a large proportion of Nigerians in the riverine areas. Fishing is a major livelihood activity of the people living in the coastal areas of Nigeria. This is because most of their land area is covered by water bodies with very little percentage of the land area suitable for other agricultural production activities such as crop and livestock production. Many households in these coastal areas are most vulnerable to the impact of climate change as a result of their low adaptive capacity to climate change (Gwary 2008; Xinhua 1998). Recent occurrences of flood have been reported in these coastal areas (Obot 2008; Gwary 2008)). The consequences of flood due to climate change such as loss of fish, change in fish species, erosion of human habitat, and land will have greater impact on the welfare and the livelihood of fishers most especially in terms of income realized from fishing activities.

As a result of flooding, some species of fishes have migrated to another location while some others died. This leads to low productivity and consequently reduced fish catch and low standard of living. This has also increased the spread of different types of diseases among the fishers and their household which includes malaria, typhoid etc. All these coupled with the problem faced by fishers has led them to adopt different coping strategies.

Francisco et al. (2009) conducted a survey related to the perception of the riverine population to flood occurrences at the lower Sao Francisco river municipalities, especially with regards to the 2004 flood. To the riverine population, natural floods were always historically recognized as being positive, with the practice of agriculture on the flooded lands possible and also working as a nursery area for fish, promoting the local biodiversity conservation. With the river discharge regularization throughout the year, a decrease of fish quantity, biodiversity, and waterlogged land farming (marginal lagoon) was reported.

Jacky-Putt (2007) used both primary and secondary data to investigate the extent and impact of the environmental problem and corresponding shoreline degradation on coastal population in Lagos. She found that the beaches along the entire Nigeria coast are very susceptible to flooding. She revealed further that the sea is advancing toward humans and that flooding of the Victoria Island and other low lying areas of Lagos State are common, especially during the months of April and August when the sea swells. This results in pounding the coast with devastating effects.

Makela (2008) evaluated the impact and adaptation of flooding of the fishermen in Lagos. She showed that while flood generally takes the cake in view of past experiences, its diverse forms affect at least 20% of the Nigerian population. The probit regressions showed the impact of flooding on productivity as flooding resulted in significant economic losses. Also, flooding affects health resulting in significant impact on water source contamination, increased expenditure on health and loss of life. Obot (2008) examined the challenges of climate change for Nigeria and focused on the impact of climate change on the coastal areas in Nigeria. He showed that the sea level is anticipated to increase and that Lagos, Bayelsa, Port-Harcourt, Warri and Calabar will face increase in sea level of 6m due to rising temperature.

Gwary (2008) in his paper on climate change, food security and Nigerian agriculture indicated that virtually every Nigerian is vulnerable to disasters, natural or man-made. He highlighted that flooding occurs in Nigeria in three main forms: river flooding, urban flooding and coastal flooding.

Xinhua (1998) in a report on Nigeria floods revealed that in the city of Calabar, properties worth millions of Naira were destroyed by flood in the month of June of that year and lives were also lost.

MATERIALS AND METHODS

The study was carried out in Lagos state. The state is located in the mangrove-swamp forest region of the south-western part of Nigeria. A multistage sampling technique was used to get sample. In the first stage, four local governments from twenty local government areas in the riverine area were purposively chosen, namely, Badagry,

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Ikorodu, Epe and Eti-Osa. The choice of these local government areas was informed by the concentration of fishers as fishing activities is the major occupation of the inhabitants. The second stage of sampling involved the random selection of 20 villages from 88 villages within these local government areas in which the Lagos State Agricultural Development Program has contact fishers. The number of villages sampled in each Local Government was proportionate to the number of village listings compiled by the Monitoring and Evaluation Units of Agricultural Development Program. The last stage was the random sampling of fishers that were interviewed. A sample of 435 fishers was taken but only 412 fishers gave complete and consistent responses which were used for analysis. Primary data were collected through the use of structured questionnaire that cover the socio-economic characteristics of the respondents, extension contact, climate variables such as rainfall, wind and temperature; flooding experience, proportion of loss from flooding, coping strategies against flooding, technology use in fishing, income from fishing activities and household expenditure of the respondents.

Analytical Technique

The data were analyzed using descriptive, budgetary and regression techniques.

Descriptive Statistics: it involved the use of frequency and percentages to analyze the socio-economic characteristics of fishers, i.e age, gender, marital status, education, household size, extension contact, membership of association; climate variables (rainfall, temperature, wind, flooding experience, proportion of loss income due to flooding); technology used for fishing, coping strategies employed to mitigate flooding and households' expenditure.

Budgetary techniques were use to determine the profitability of fishers is as follows:

GM = TR - TVC ……..…..1

NI = GM - TFC ……..…..2

Where:

GM = Gross margin, TR = Total revenue, TVC = Total variable cost, NI = Net Income, TFC = Total fixed cost

The values of the fixed assets were depreciated using straight line method. The fixed assets include boats, gears, net, motorized pumps and dryers which were depreciated over a five-year period. The variable costs include costs of fuel and lubricant.

Inferential Statistics: The relationship between the household welfare and the independent variables were estimated using an ordinary least square (OLS) regression estimation procedure. The dependent variable used to capture household welfare is per capita expenditure. Expenditure on food and non-food items were aggregated for each household and divided by household size to obtain the per capita expenditure for each household. Per capita expenditure is used as proxy for per capita income and employed as a measure of welfare.

Model Specification

$Y = f(X_1, X_2, \ldots, X_{10})$ ……..3

Y = Log of per capita expenditure (Total household expenditure/ household size)

X_1 = Age of fishers in years

X_2 = Gender (1 =male, 0 = otherwise)

X_3 = Education in years

X_4 = Household size

X_5 = Dependency ratio (Non-working households / working households)

X_6 = Received Extension service (1=Yes, 0 = otherwise)

X_7 = Membership of agric. Association (1= belong to an association, 0 = otherwise)

X_8 = Access to credit (1 = have access, 0 = otherwise)

X_9 = Experience loss due to flooding (1=Yes, 0 = otherwise)

X_{10} = Proportion of loss due to flooding (% of loss of income from fishing activities due to flooding)

RESULTS AND DISCUSSION

Table 1 shows the summary of selected socio-economic characteristics of fishers in Lagos State. The summary shows that 78.4 percent of the sampled fishers are not more than 50 years of age. They are young and middle- aged with potential and drive to sustain fish production for many years. Eighty percent of the fishers are male while females are 19.7 percent which indicate that fishers are mostly male. The reason for this disproportionate distribution of gender among fishers is because fishing is a tedious task which involves spending long hours on the sea or ocean in pursuit of catching fish, hence males are more

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involved. Most of the respondents are married (85.7%) and marital status is of great importance because of its potential source of labor that can be made available for fishing. Household sizes between 4 and 12 are represented by about seventy- three percent of the respondents which is also an indication of labor availability for fishing activities. Seventy- eight percent of the respondents have at least primary education. This implies that the respondents would be able to understand innovation easily and other information from extension workers, which will help in improving their catch. About 50% of the respondents are Christians and 46.6 % are Muslims. This implies that, there is no discrimination in fishing activity based on religion. Result also reveals that fishers belong to different associations and that participation in these associations is not mutually exclusive. Benefit derived includes assistance in raising capital and assistance in form of cash and kind during disaster. The extension contact shows that 37.9% have contact with extension agent while 62.1% of the respondents did not have extension contact. This implies that majority of the fishers do not receive information directly from extension agents about climate change and available adaptation options.

Table 2 shows the climate variables in which changes were experienced by respondents in the fishing communities. About 93.7% of respondents have experienced increase in rainfall; 39.3% experienced increase in temperature while 51.1% experienced stronger winds. In addition, about 82% of the respondents reported loss of income from fishing due to flooding .This loss is attributed to reduction in the quantity of fish caught as given by the fishers. The degree of loss in income differs among the respondents. 17 percent of the fishers that experienced flooding had as much as 75 percent loss, 18.7% had 50 percent loss and the majority (64.7%) had 25 percent loss due to flooding. Other forms of losses include loss of household properties, crop and other fixed assets like gears, nets etc. The survey shows that fishers experienced flooding during the peak of the raining season between the months of May and August.

Table 1: Summary of selected socio-economic characteristics of respondents

Variable	*Frequency*	*Percentage*
Age		
< 30	70	17.0
31 - 40	131	31.8
41 - 50	122	29.6
Above 50	89	21.6
Total	412	100.0
Gender		
Male	331	80.3
Female	81	19.7
Marital Status		
Single	41	10.0
Married	353	85.7
Divorced	4	1.0
Widowed	14	3.3
Household Size		
1 - 3	110	26.7
4 - 6	198	48.1
7 and above	104	25.2
Educational Level		
No formal education	81	19.7
Primary	130	31.6
Secondary	183	44.4
Tertiary	10	2.4
Adult education	8	1.9
Religion		
Christianity	206	50.0
Islam	192	46.6
Traditional	14	3.4
Membership of Association		
Agricultural	192	46.6
Social	129	31.3
Political	191	22.1
Extension Contact		
NGO	29	7.1
Govt. Ministry	127	30.8
None	256	62.1

Source: Field survey 2009

Table 2: Experience of respondents with climate change characteristics (May - August 2009)

Climate change experience	*Frequency*	*Percentage*
Increased Rainfall	386	93.7
Increased Temperature	162	39.3
High winds	212	51.5
Flooding Experience		
Experienced loss	337	81.8
Did not experience loss	75	18.2
Proportion of Loss Due to Flooding		
75 percent	56	16.6
50 percent	63	18.7
25 percent	218	64.7

Source: Field survey 2009

Table 3 shows the income analysis of the fishers using different technologies for fishing activities in the study area at the low and high seasons. Low season correspond to the rainy season period when the volume of water is too much, thus resulting in reduction of fish catch while high season is the dry season period when the volume of water is low and the fishes are concentrated in small areas thereby increasing catch. During low season, risk of flooding is high, but the opposite is the case during high season. Irrespective of the technology used by the

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Table 3: Income analysis of fishers at different fishing season

Seasons	*Variable*	*Boat (Mean in Naira)*	*Motorized (Mean in Naira)*	*Boat and motorized (Mean in Naira)*
Low season	Gross revenue	58,141.63	52,437.50	72,238.02
	Gross margin	53,005.06	40,565.20	64,023.72
	Net income	51,032.78	60,950.80	65,247.28
High season	Gross revenue	112,752.08	125,312.00	165,775.81
	Gross margin	107,620.51	131,440.00	149,685.71
	Net income	105,619.47	131,560.00	150,784.77

Source: Field survey 2009

fishers, there is a significant difference ($p<0.1$) between incomes between low and high seasons. Fishers using motorized technology (6.1%) have higher net income than those using boat technology (79.9%) and is statistically significant ($p<0.01$). This is due to the fact that improved technology reduces the drudgery associated with fishing and enhances quantity of catch. The mean income for the fishers that use boat technology during low and high seasons are N51,032.38 and N105,619.47 respectively and are significantly different at 1 percent ($p<0.01$). The income of fishers that use motorized technology for the low and high seasons are N60,950 and N131,440 and also significantly different at 1 percent ($p<0.01$). Also, the table reveals that the net income for low and high season of fishers who make use of both boat and motorized technologies is greater than those who make use of boat only or motorized only. The difference is significant different at 1% ($p < 0.01$) compared with those of boat only during the low season but not significantly different at 10% with the motorized. However, during the high season, they were significantly different at 1% ($p < 0.01$) with boat only and at 10% ($p < 0.10$) with motorized. This implies that the combination of these two technologies though requires more capital brings about increase in the number of fish caught which leads to increase in income. The results also show that the respondents fare better in gross revenue, gross margin and net income generation during the high season when the risk of flooding is less than during the low season.

Results of OLS Estimation Technique

The household welfare model was estimated using equation 3 and the results of the estimated models are presented in table 4. Three models were estimated in which the variables; experience loss due to flooding(X9) was used in estimating model 1 while the proportion of loss due to flooding (X10) was used in estimating model 2. The last model (model 3) was estimated to improve on the estimated parameters model 2; by estimating using a stepwise regression thereby dropping the least significant variable. All the models had significant F-ratio at the 1 % level. The model with the least R^2 had 0.528 (Model1) which implies that the explanatory variables included in the model were able to explain 52.8% of the variability in the fishers' per capita expenditure.

In all the models estimated, household size, membership of association, experienced loss due

Table 4: Regression result of factors affecting household welfare

Variable	*Model 1*	*Model 2*	*Model 3*
Age	-0.008 (0.005)	-0.006 (0.005)	-
Gender	0.095 (0.094)	0.109 (0.092)	0.091 (0.090)
Education	0.020** (0.010)	0.016 (0.010)	0.014 (0.010)
Household size	-0.130*** (0.025)	-0.128*** (0.024)	-0.139*** (0.023)
Dependency ratio	-0.084 (0.062)	-0.084 (0.060)	-0.084 (0.060)
Extension contact	0.135 (0.118)	0.181 (0.118)	0.170 (0.117)
Membership of association	0.485*** (0.099)	0.423*** (0.100)	0.421*** (0.100)
Credit access	0.128 (0.089)	0.143* (0.088)	0.152* (0.088)
Experienced loss due to flooding	-0.027* (0.013)	-	-
Percentage loss due to flooding	-	-0.004* (0.002)	-0.005* (0.002)
Constant	9.404*** (0.396)	9.484*** (0.371)	9.242*** (0.306)
R^2	0.528	0.538	0.533
F-ratio	8.517*	8.866*	9.792*

Note: Figures in parenthesis are standard errors
*Significant at 1% ; **Significant at 5% ; ***Significant at 10%.

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Table 5: Coping strategies against flooding by category

Category	*Coping strategy*	*Frequency*	*Percentage*
At home	Move to another place	222	53.9
	Relocate temporarily	45	10.9
At fishing site	Move to another fishing site	295	71.6
	No response	7	1.7
At community	Assistance/support	182	44.2
	Relocation/accommodation	50	12.1
	No response	38	9.2

Source: Field survey 2009

to flooding or percentage loss due to flooding were significant factors explaining household welfare. The third model is used to explain the result of this study because access to credit was also significant with the size of the coefficient more than in model 2. Household size and proportion of loss due to flooding has negative coefficients which mean increase in these variables will reduce household welfare. This study shows that flooding affects the welfare of fishers negatively. This is not surprising since their primary occupation is fishing. Previous studies have shown that flooding resulted in the decline of the population of fish thus majority of the fishing communities have become impoverished and left with few alternatives for generating income for the subsistence of their families (Gutberlet et al. 2007). Also, Francisco et al. (2009) reported that 30% of the interviewed riverine population in Propriá commented that they find a flood to be bad because many people lost their houses, commercial establishments, and plantings. These people are left without the power to fish and even to use boats. They also reported that 50% of those interviewed in the municipalities of Brejo Grande and Ilha das Flores confirmed that they had had a loss in fish production, plantings, and had been left with destroyed bars and soccer fields used for leisure at the river banks. Belonging to an agricultural association and having access to credit enhances fisher's welfare. This is not surprising since studies have shown that social capital improves welfare (Yusuf 2008). Also, access to credit can mitigate shocks.

Except for household size, other demographic variables were not significant. This means that household welfare is not affected significantly by the age and gender of the fisher. It is worthy of note that the variable, received extension visits was not significant. This means that information on change in climate variables are either not heard of or are obtained from other sources. It further buttresses the lapses in extension service delivery in the study area.

Table 5 shows the different coping strategies adopted by the fishers to ameliorate the impact of flooding. The respondents claimed that they were not supported in any form by the government during the last period of occurrence of flooding. However, the respondents have devised various coping strategies at home, fishing site, and community levels. At home, 53.9% of the respondents moved to another place when the flooding occurred and 10.9 % relocate temporarily to come back during the high season. Similarly, 71.6% of the respondents moved to another fishing site; while at the community level the major coping strategies was in form of provision of financial assistance and accommodation for the flood victims.

CONCLUSION AND POLICY RECOMMENDATIONS

The research findings show that majority of the sampled farmers are young and middle-aged, with potential and drive to sustain fish production. This implies that the State has the potential and drive to sustained fish production for many years in the future. The perception of fishers on climate change characteristics as it affects their fishing activities in the study area revealed that rainfall accounted for 93.7% of the climate adverse, temperature (39.3%) and wind (51.5%). It was also shown that 81.8% of the respondent experienced loss in income as a result of flooding. The income analysis shows that the respondents have more income during high season than low season. This is because volume of water is low during high season which leads to more fish catch. Household size, membership of association, access to credit and proportion of loss due to flooding were the relevant and significant determinants of fishing households' welfare.

The important policy implication of this study

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is that the fishing communities who primarily depend on fisheries for their livelihood need strong facilitation by NGOs and government to establish access to credit to enhance the scale of operation, flood control measures to reduce loss of income, posting of experienced extension agents to disseminate adequate information to the fishers on possible climate change to forestall disasters and devise coping strategies to mitigate the adverse weather events. Fisher households require assets for their security during crisis periods. There is the need for establishing a social safety net in event of flooding.

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