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Review Article

Determinants of Climate Change Risk Management Strategies Among the Aquaculture Fish Farmers in Nigeria using Multinomial Logit Model

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ABSTRACT

Nigeria's domestic supply of fishery products falls short of the demand; however, there is a growing aquaculture industry that has come to the rescue in filling the gap between supply and demand. The aquaculture fish farmers are prone to the risk of climate change, since weather and extreme events have become more unpredictable. This study assessed the climate change risk management strategies among the aquaculture fish farmers in Southwest Nigeria. Multi-stage sampling technique was used to select 480 aquaculture fish farmers in the study area. Descriptive statistics, likert scale and multinomial logit model were used to analyze the data. The study revealed that all the respondents were aware that climate is changing. The commonly used adaptation strategy by the fish farmers in the area was use of concrete /plastic pond (78%). The result of the multinomial logit model revealed that farm income influences the adoption of flood control/provision of water outlet by 19.22%, provision of alternative water supply (Well/Borehole) by 45.11% and the use of the concrete/plastic pond by 18.89%. Flood control/provision of water outlet, providing alternative water supply (Well/Borehole), use of concrete /plastic pond are all investment that were positively significant at 1%. Therefore, increase in farm income will lead to increase in these adaptation strategies to mitigate the effects of climate change on fish production in the study area. The study recommends that government at all levels should provide loan at a single digit interest rate to mitigate the effects of climate change on aquaculture fish farming.

Keywords: Climate change; Fish farmers; Risk management strategies; Multinomial logit model, Southwest Nigeria

INTRODUCTION

Nigeria is certainly a food deficit nation and it is obvious that protein intake is grossly inadequate in both qualitative and quantitative terms. Although, fish is generally regarded as a cheap source of animal, the shortfall in domestic production due to the neglect of the sub-sector and climate change risk effects on fish production has resulted in an increase in importation of fish in Nigeria [1, 2]. However, there is a growing aquaculture industry that has come to the rescue to fill the gap between supply and demand because of its profitability. The available data on aquaculture attest to this fact.

Furthermore, agriculture in the form of crop production, livestock breeding, fishery and forestry is the primary sector of the economy of Nigeria, accounting for employment for majority of the Nigerian population. About 80% of the country's poor people live in rural areas and work primarily in agriculture. About 25% of Nigeria's Gross Domestic Products (GDP) comes from agriculture and related activities, and close to 70% of the national labour force is employed in agriculture, 10% in manufacturing industry and mining, and 20% in services. So, Nigeria's economy is therefore predominantly agrarian; agriculture remains the driving force for the country's economic development [3].

Again, most of the empirical works to date on the effects of climate change on agricultural sector have focused on crops and livestock Intergovernmental Panel on Climate Change. Most physical and economic modelling and analyses have focused on the northern latitudes and high-income countries to the neglect of the developing low-income countries like Nigeria. Furthermore, scientists fear that most of the adverse effects of climate change is likely to occur in these poorer countries, such as Nigeria. The effects of climate change urgently need to be assessed at the level of the aquaculture fish farmers, so that poor and vulnerable aquaculture fish farmers' whose livelihood dependent on fish farming can be appropriately targeted in research and development activities for

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poverty alleviation. This is with the aim of providing meaningful insight and contributing to efforts aimed at formulating policies at all tiers of government in order to ensure increased food availability through sustainable domestic fish production and increased income from fish production such as aquaculture fish farming in Nigeria [4-6].

Hence, findings of this study will assist the traditional aquaculture fish farmers in Nigeria toiling daily to provide food for subsistence and cash to improve their purchasing power. They will also be guided on the adaptation strategies to mitigate the effects of climate change. Also, the findings will equally provide the expected back-up data to be used by planners and policies makers at all tiers of government. Therefore, the study intends to find out the fish farmers awareness of climate change and their perceived effects of climate change on fish production in the study area. The adaptation strategies used by the fish farmers to mitigate perceived effects of climate change on fish production and the factors that influence the adaptation strategies used by the fish farmers in the study area was also determined in the study. This is to enhance the formulation of efficient and effective policies that will mitigate the effects of climate change risk on the aquaculture fish farmers' productivity in Southwest Nigeria.

METHODOLOGY

Study area

The study was conducted in Ekiti, Ondo, Oyo and Osun States in the Southwest Nigeria. The four States are in the southern guinea savannah of Nigeria which covers an area that has an average annual temperature and rainfall of 27.3 ° C and 1051.7 mm, respectively. The false balsam Copaiba used for carving mortars and pestles for pounding yam and Vitex, Khaya senegalensis the poor mahogany are the species found in the guinea savannah of Nigeria. The rainforest zone of Nigeria is characterized with a prolonged rainy season, resulting in average annual rainfall close to 1500mm, thereby ensuring an adequate supply of water and promoting perennial tree growth. Economic cash crops such as oil palm, , cocoa banana/plantain and cola nut are found in the rainforest zone of Nigeria. The four States have a high density of human population of 12,388,711 with agriculture as primary occupation of the people. Also found are some principal staple food crops such as yam, cocoyams, maize, rice, and cowpeas as well as a number of fruits. The States are endowed with abundant natural resources ranging from huge mineral deposits, rich forest resources, great human and institutional resources [7].

Sample and sampling techniques

A multi-stage sampling technique was used for the study. Three States namely Ekiti, Ondo, Oyo and Osun were purposively selected for the study because the States accounted for the highest number of aquaculture fish production in the Southwest region of Nigeria. In each State, two Local Government Areas that accounted for the highest number of aquaculture fish farmers were purposively selected for the study. In each LGA, three communities that accounted for the highest number of fish farmers were purposively selected through the assistance of the State Department of Fisheries extension agents in each state. In each community, 20 fish farmers were randomly selected. Therefore, 180 fish farmers were interviewed for the study.

Nature and sources of data

Primary data were used for this study; data were obtained through administering structured questionnaire on the fish farmers who were visited. The dataset collected from the farmers include: their awareness of climate change, the observable climate change phenomenon, the adaptation strategies commonly use to mitigate the perceived effects of climate change on their fish production.

Data analysis and model specification

Descriptive statistics comprising of frequency distribution, mean, bar chart and percentages were used to describe the socio-economic characteristics of the aquaculture fish farmers, awareness of climate change, the climate variables observed, and adaptation strategies practiced by fish farmers in the study area. A 5-points Likert-type scale was used to determine farmers' perception of effects of climate change on fish production in the study area. Fish farmers were asked to respond to statements. The grand means for all the statements were calculated and used to place all the responses on a continuum that enabled a conclusion to be drawn on the perception of the aquaculture fish farmers' effects of climate change on fish production in the study area [8].

RESULTS AND DISCUSSION

From the result as shown in the gender variation of the respondents as observed on the field shows that 84% of the respondents were males, which shows that fish farming is male dominated agribusiness in the study area. This may be due to the labourious nature and time required for sustaining a fish farm enterprise. The results further revealed that 81% of the respondents were within the working productive age and this was buttressed by the mean age of about 50years. The study further reveals that the mean farming experience of the respondents is 7.79 years with having a modal distribution of 277 (57.7%). This implies that fish farming is not a new agribusiness in the study area. Experience gained on farm first-hand is better than theory read in schools or from seminars and workshops. The marital status of respondents reveals that 82.7% of the respondents were married; most of the fish farmers may likely rely on family labour to augment hired labour thereby reducing the cost of labour in the study area. Also, 62.3% of the respondents were solely into fish farming, such may be vulnerable to climate change risk since they depend solely on income from the fish farm. While the remaining 37.7% may be less vulnerable to climate change risk because they are civil servants and can fall back on their salary for livelihood sustenance in case of risk because of climate change. The study reveals the level of education of the fish farmers was high, tertiary educational level had a modal frequency distribution of 277 representing 57.7%. It provides readability, consciousness and awareness, which enhance better decisions to be made. Therefore, the higher the level of farmer's education, the better his decision-making ability, especially in the adoption of new technologies and innovation".

Earthen pond depends on stream, river and irrigational canals water and it's susceptible to climate change effects such as flood and drought. According to the respondents, earthen pond used to be their normal fish farming practice without taking into cognizance the concept of climate change. Earthen pond solely depends on rainfall which is one of the climatic variables. Fluctuation in rainfall is one of the key features of climate change that serves a source

of risk to aquaculture fish farmers' that depend on earthen pond. Frequent rainfall leads to flooding which washes the fish away and when the frequency of rainfall is low, it leads to drought. Hence, fish farming becomes difficult because expected natural water from the stream, river and irrigation canal will not be available according to the respondents. Plastic/concrete ponds depends on wells and boreholes. Is more secure and under control environment. The pond is less prone to climate change risk because it was designed to mitigate the effect of climate change in the study area. According to the fish farmers' in the study area, since they perceived climate change via fluctuation in rainfall which often affects the availability of water for their fish farming, they have to design the plastic and concrete pond. The plastic and concrete ponds do not depend on rainfall but on borehole, hence it mitigates the effect of climate change on their fish farming in the study area. It safe them from loosing the fishes during rain flood and help mitigate against drought [9].

Likert scale revealed that the respondents agreed that increase in rainfall has a positive impact on fish farming. According to the respondents, increase in rainfall enhances availability of water for fish production in the study area. The respondents disagree (2.48) that increases in rainfall have a negative impact on fish farming. They disagree (2.46) that flood occurrence affects fish production positively, they explained that flood usually washes away some of their fish and agreed that it affects fish production negatively. This buttresses the findings of Thompson, (2017) that climate change through unprecedented increase in rainfall that leads to flooding affects the fisheries sub-sector of Nigeria. The respondents as shown were undecided about the positive (2.81) and negative (2.96) effects of drought on fish farming in the study area. There is likelihood that they may be indifferent to the effects of drought on fish farming since they do not depend on rainfall. This is in conformity with the findings of that when fish farmers don't depend on streams, rivers and irrigational canals which are natural sources of water for fish farming, they are less prone to climate change risk as a result of flood and drought.

All the respondents (100%) in the study area were aware of climate change. Hence, they tried to mitigate its effects on their fish production. The least (2%) used adaptation strategy in the study area was flood control/provision of water outlets. This is very expensive for them and may be unreliable if the flood become unprecedented during heavy and incessant rainfall [10, 11].

CONCLUSION

The study assessed the fish farmers awareness of climate change, determine the most observable climate change phenomenon and the adaptation strategies commonly use to mitigate the perceived effects of climate change on their fish production in the study area. Again, fish farmers' perception of effects of climate change on fish production in the study area was determined in the study. The profitability of aquaculture fish production was determined in the study. The factors that influence the number of risk management strategies used by the aquaculture fish farmers' in the study area was determined in the study. The study revealed that all the respondents in the study area were aware of climate change. Hence, they tried to mitigate its effects on their fish production. The commonly used adaptation strategy by the fish farmers in the study area was use of concrete/plastic pond. Age significantly affects the provision of alternative water supply (Borehole) in the study area as revealed in the study. Farm income positively influence the use of flood control/provision of water outlet and provision of alternative. Access to credit and size of pond were positively determine the provision of alternative water supply (Well/Borehole) as means of climate change risks management strategies in the study area. Farming experience was positively determined the use of flood control/provision water outlet as a means of climate change risks management strategies in the study area.

Therefore, from the study, the following policy implications can be deduced, government and Non-Governmental Organizations (NGOs) should take into consideration the age of the fish farmers in any intervention programmes. Since the aged fish farmers will not be willing to take risk, then such intervention should consider the young fish farmers. Efforts should be made to boost the income of fish farmers to enhance their mitigation effort against the effect of climate change in the study area. Credit facilities should be made available to the fish farmers in the study area, because this will empower them to efficiently manage climate change risk as appropriate. Likewise, policy makers at all levels should take into consideration the farming experience of the fish farmers in planning any environmental related intervention for the aquaculture fish farmers in the study area.

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