



Original Research Article

Climate Change Adaptation Measures of Aquaculture Enterprises in Delta State, Nigeria

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Abstract

As the population of the world is increasing, so is the demand for food, especially protein, which is necessary for growth. Production from fisheries is crucial for food security in the face of current population increases. Despite the reliability on fisheries and aquaculture to supply the animal protein needed by the world's population, climate change has significantly reduced production and increase instability in the sector. In order to achieve food security and achieve fisheries development goals, climate change adaptation measures are needed to lower greenhouse gas emission intensities with output. This study therefore discusses adaptation measures employed by aquaculture practitioners in Delta State, Nigeria. Accordingly, 480 copies of a structured questionnaire were shared across the three senatorial districts in Delta state using the multi-stage sampling technique. The study used simple percentages to present the results obtained from descriptive analysis of the sourced data. The study found out that, a little over half of the respondents (50.42%) were aware of climate adaptation measures. Household income diversification, disaster risk management, building response capacity were the top three measures adopted by 81.67%, 75.83% and 71.67% of the respondents respectively. With as many as 49.58% of the respondents ignorant of climate change adaptation measures, it was recommended that the government should step up its farmers' enlightenment programmes through effective extension services, and provide training and financial support to the farmers.

Keyword: Climate Change, Aquaculture, Adaptation Measures

Introduction

The continual burning of fossil fuel, and changes in land use by man have continued to emit increasing quantities of greenhouse gases into the Earth's atmosphere. These greenhouse gases include carbon dioxide (CO₂), methane (CH₄) and nitrogen dioxide (NO₂), and a rise in these gases has caused a rise in the amount of heat from the sun withheld in the Earth's atmosphere, heat that would normally have been radiated back into space. This increase in heat has led to the greenhouse effect, resulting in climate change. The main characteristics of climate change are increases in average global temperature (global warming); changes in cloud cover and

precipitation particularly over land; melting of ice caps and glaciers and reduced snow cover; and increases in ocean temperatures and ocean acidity – due to seawater absorbing heat and carbon dioxide from the atmosphere (UNFCCC, 2021). It is now widely accepted that climate change is no longer simply a potential threat, but a consequence of 200 years of excessive greenhouse gas (GHG) emissions from fossil fuel combustion in energy generation, transport and industry, deforestation and intensive agriculture as noted by Inter-governmental Policy on Climate Change (IPCC, 2007; Onada and Ogunola, 2017).

In Nigeria, climate change has significant effects on Nigeria's freshwater and marine aquatic systems and, consequently, on the country's fisheries and aquaculture (FDF, 2007). The effects of these changes have resulted in elevated water temperatures (IPCC, 2007) which affect fish physiological processes, thereby affecting spawning, survival of the juveniles, development into the exploitable phases of the population, population size, production and yield (Tubiello and Fischer, 2007). The negative impacts of increased flooding of the freshwater bodies are erosion of watersheds, destruction of fish feeding and breeding habitats, decrease in primary productivity and alteration of the normal resilience of the aquatic systems, while the positive impact includes expansion of aquatic habitats for primary and secondary fish production, especially during the dry season (Tubiello and Fischer, 2007). In the event of drought, water reservoirs in lakes and streams are diminished (Jamieson *et al.*, 2004), and give rise to insufficient water flow in the river basins for spawning and primary production thereby affecting fish production. The implications of this are low output of fish and other aquatic products for family consumption, as well as for sale, which in turn, affects market prices of fish especially when demand is high and supply is low.

Considering the importance of fish to Nigeria's economy through provision of food supplies, enhancement of food security, creation of employment opportunities and income generation, the sector has contributed 3-4% of Gross Domestic Product to the national, and provided employment for over a million people (FDF, 2008), and contributed about 50% of the animal protein intake of the population (IFC, 2003). It is important, therefore, to protect the sector from the adverse effects of climate change, whose impacts are already being felt by small-scale fisheries investors.

This study set out to examine the various climate change adaptation measures which the government of Delta State, Nigeria has provided for use in order to combat and reduce the negative impact caused of climate change. In view of the above, this paper focused on the climate change adaptation measures of aquaculture enterprises in Delta State of Nigeria.

Materials and Methods

Study Area

The study was conducted in Delta State, located in the South-South geopolitical zone of Nigeria. The State consists of 3 Senatorial districts, and 25 local government areas (LGAs).

Data Collection and Analysis

The study adopted the multistage sampling technique. From each of Delta State's three (3) senatorial districts, which are: Delta North (DN), Delta Central (DC) and Delta South (DS) senatorial districts, two (2) local government areas (LGAs) were selected as follows: Ukwuani and Aniocha South LGAs for DN senatorial district; Ethiope East and Isoko South LGAs for DC senatorial district, and Burutu and Warri South LGAs for senatorial district. The last stage involved the selection of two (2) rural and one (1) major urban centre in each zone as shown in

Table 1 below. The sourced data were descriptively analyzed and presented as simple percentages.

Table 1: Sampling Frame

Senatorial Districts	LGAs	Rural Settlements	Urban settlements
Delta North	Ukwuani	Ezionum and Obiaruku	Asaba
	Aniocha	Idumujunor and Ewulu	
Delta Central	Ethiope East	Isiokolo and Okpara Inland	Ughelli
	Isoko South	Igbide and Uzere	
Delta South	Burutu	Okpokunu and Odimodi	Warri
	Warri South	Obodo and Ubeji	
Total Distributed		240	240

Source: Field Survey (2022)

Results and Discussion

Socio-economic Characteristics of the Respondents

This section presents the socio-economic characteristics of the respondents (Table 2). The result indicates that majority of the respondents (36.04%) fell in the age brackets of 31-40. Those aged 41 to 50 years (20.42%) followed closely while those aged above 60 years constituted 18.96%;

Table 2: Socio-economic Characteristics of the Respondents from the State

Characteristic	Frequency (F)	Percentage (%)
Age Group		
≤ 25	54	11.25
26-30	64	13.33
31-40	173	36.04
41-50	98	20.42
>60	91	18.96
Total	480	100.00
Gender		
Male	218	45.42
Female	262	54.58
Total	480	100.00
Education		
No Formal	55	11.46
Primary	131	27.29
Secondary	143	29.79
Tertiary	151	31.46
Total	480	100.00
Occupation		
Civil servants	61	12.71
Business	75	15.63
Farming	101	21.04
Artisan	53	11.04
Students	56	11.67
Unemployed	98	20.42
Housewife	36	7.50
Total	480	100.00

Source: Field Survey (2022)

those aged 26-30 years were 13.33% while those aged 60 years \leq 25 constituted 11.25% of the respondents. This indicates that about 55 of the respondents were above 30 years old, and were therefore old enough to assess environmental changes in the study area.

It terms of gender representativeness, females were more than male respondents (54.58% vs 45.42%). Again, most (>88%) of the respondents had some form of formal education. Meanwhile, most of the respondents (21.04%) identified farming as their primary occupation, while the rest of the respondents followed the following sequence: Unemployed (20.42%), Business men/women (15.63%), Civil servants (12.71%), Students (11.67%), Artisan (11.04%), and Housewives (7.50%).

Awareness of Climate Adaptation Measures

Table 3 evidenced that, 50.42% of our respondents were aware of Climate Adaption Measures while the remaining 49.58% were not. This reveals that, there is still much to be done in this regard.

Table 3: Awareness of Climate Adaptation Measures

Response	Frequency	Percentage
Yes	242	50.42
No	238	49.58

Source: Field Survey (2022)

The climate risk response measures adopted by farmers in the Delta State are presented in Table 4. Household income diversification was an important adaptation effort of fish farmers in Delta state. About 81.67% of the respondents stated that they responded by integrating fish farming with other aquaculture activities such as fish processing, fish gear production and cultivation of aquatic vegetables. Diversifying into other means of livelihoods is an important strategy for building resilience and managing climate risks (FAO, 2014). By implication, pursuing a single form of livelihood puts fish farmers at great risk when a shock occurs and, to overcome this, many fish farmers in Nigeria combine fish farming with other livelihood activities including petty trading, crop and poultry farming and artisan works. This is in line with the findings of Adeleke and Omoboyeje (2016).

In like manner, adoption/introduction of income stabilization programmes is also critical as it contributed 50.83%. Evidently, it reduces the level of variability in farm income over the investigated periods. More so, social protection consists of policies and programs designed to reduce poverty and vulnerability by promoting efficient labour markets, diminishing people's exposure to risks, and enhancing their capacity to manage economic and social risks, such as unemployment, exclusion, sickness, disability, and old age. *However*, innovative risk financing instruments and insurance schemes was adopted by only 15% of the farmers to manage climate risks in fish farming. By implication, most aqua-farmers in the study area are yet appreciate the protection that insurance provides. A study by Isife and Ekeremor (2015) in Bayelsa state found that aquaculture insurance was the climate change adaptation measure least used by fish farmers.

The table shows that the most common adaptation practice was building response capacity, conservation of genetic resources; implement co-management systems, and managing climatic risks. Approximately, 75.83%, 39.17%, 65.00% and 67.50% of the farmers, respectively, adopted this strategy. Again, other two (2) common strategies were managing climate risk and

disaster risk management. Approximately, 67.50% and 71.67% of the farmers adopted these strategies, respectively.

Flood represents a major threat to fish farming in Nigeria and in other developing countries (Oyebola *et al.*, 2018).

Table 3: Climate Adaptation strategies Adopted by Aquaculturists in Delta State

Adaptation strategy	Frequency (N)	Percentages (%)
Household Income Diversification	392	81.67
Adoption of income stabilization programmes	244	50.83
Social protection initiatives	300	62.50
Community-based risk management	208	43.33
Innovative risk financing instruments and insurance schemes	72	15.00
Building response capacity	364	75.83
Conservation of genetic resources	188	39.17
Implement co-management systems	312	65.00
Managing climate risk	324	67.50
Disaster risk management	344	71.67

Source: Field Survey (2022)

Conclusion and Recommendations

Adapting to climate change will entail adjustments and changes at every level – from community to national and international. For instance, communities must build their resilience, including adopting appropriate technologies while making the most of traditional knowledge, and diversifying their livelihoods to cope with current and future climate stress. The study concludes that a little over half of our respondents were aware of climate adaptation measures, and that household income diversification, disaster risk management and building response capacity, topped the list of climate adaptation measures adopted by most of the respondents. As such, local coping strategies and traditional knowledge need to be used in synergy with government and local interventions. The choice of adaptation interventions depends on national circumstances. To enable workable and effective adaptation measures, ministries and governments, as well as institutions and non-government organizations, must consider integrating climate change in their planning and budgeting in all levels of decision making.

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