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GENDER-RESPONSIVE POLICIES FOR ENHANCING FOOD SECURITY IN AQUACULTURE AMIDST CLIMATE CHANGE IN ONDO STATE, NIGERIA

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ABSTRACT
Gender disparities persist within the aquaculture value chain, affecting women's empowerment and overall food security. Multi-stage sampling techniques were used in selecting 231 catfish farmers for the study. Data were collected with the aid of structured questionnaire and were subjected to descriptive statistics such as frequency, percentage and mean as well as inferential statistics such as Food Security Index and Logistic regression. Results revealed that average age for catfish farmers were 42, 43 and 40 years for the pooled, male and female respectively ($p<0.10$). The distribution of catfish farmers according to years of fishing experience showed that the mean farming experience of the fish farming were 11, 12 and 9 years for the pooled, male and female respectively ($p<0.05$). The results showed that while food insecurity affects households led by men and women equally, it affects the latter group more severely. Household size ($p<0.10$), education ($p<0.01$), fishing experience ($p<0.05$), climate effects ($p<0.05$), were found to be significant factors influencing food security status for families headed by men and women, respectively. The study concluded that food insecurity affects female households' more than male households. The study therefore recommends that gender should be mainstream in aquaculture policies and programs by fishery stakeholders in addition to enforcing policies that guarantee women's rights to access to land and water bodies for aquaculture through facilitating women's access to microcredit, grants, and insurance tailored to aquaculture activities.

Keyword: Gender, Aquaculture, Food Security, Climate change, Logistic

INTRODUCTION
Aquaculture plays a crucial role in global food security, providing sustenance and livelihoods for millions of people. However, gender disparities persist within the aquaculture value chain, affecting women's empowerment and overall food security. Aquaculture has the potential to reduce poverty and food insecurity across gender because is the fastest growing food sector and literature reveals that productivity increases by involving women in smallholder aquaculture which is important for countries experiencing fish supply deficits, such as Nigeria, (Egwuonwu (2022).

In some studies (Aboaba, Fadiji and Hussayn 2020; Olive, Aloysius and Beauty 2020), when women in aquaculture are empowered, there are empirical evidence that there is increase in productivity. In addition, household income and fish consumption increases as a reason for women's involvement in aquaculture and thus beneficial to households and national economies, (Adam and Njogu 2023). The Nigerian government recognizes the importance of equality in agriculture and the aquaculture value chain for the country's development. The government has implemented initiatives and policies to promote overall gender equality, such as the National Gender Policy and the National Gender Policy and

Strategic Framework (2021-2026). Moreover, gender has also been recognized in development and social inclusion policy strategies such as Nigeria's National Development Plan and the Affirmative Action (Odoemena, 2020). However, these initiatives have achieved very little success, as extensive gender inequality gaps still prevail in Nigeria.

Change in climate poses a menace to all aspects of human existence, not just the socioeconomic and agricultural development of any one country (Adejuwon, 2004). The average weather during a specific time period was the Intergovernmental Panel on Climate Change (IPPC)'s definition of climate change in 2007, (IPPC, 2007). It is a statistical description of appropriate magnitudes ranging at instant periods, from months to thousands or millions of years, in terms of their mean along with variability. Variability in whole rainfall, temperature, air, and humidity are all detrimental to the aquaculture system's ability to produce. These problems have caused large productivity losses and increased socioeconomic and financial vulnerability among farmers. The following effects of climate change on fish production have been noted by Allison *et al.,* (2007) and Adebayo, (2012): an increase in rainfall rate, too much wind, an earlier start to the season, occurrence of drought, an increase in drought, occurrence of flood in the farm area, a prolonged harmattan season, an increase in pond size, and an increase in precipitation. According to Adebayo and Daramola (2013) general decline in productivity and produce quality, which invariably endangers the condition of food security at both the national and household levels are recognized as climate change effect on catfish in Nigeria. Habitat degradation, overfishing, pollution, parasites, diseases, and more recently, due to the increased variability brought on by climate change have threatened fisheries resources. Climate change plays a major role in defining the habitat and distribution of marine and aquatic fishes through its influences on the physical properties of marine and aquatic environments. These include temperature, salinity, vertical mixing rates and thermohaline and wind-driven circulations, (IPCC, 2011).

Catfish farming is one of the most important aquaculture activities in many countries, providing food and income for millions of people. However, catfish farming is susceptible to the climate change impacts as rising temperatures, water scarcity, water quality degradation, diseases and pests. These impacts can reduce catfish growth, survival, quality and profitability, and threaten the food security and livelihoods of catfish farmers and consumers. Therefore, it is essential for catfish farmers to adapt to the changing climate by adopting various strategies that can enhance their resilience and productivity. Some of these strategies include changing the species or breeds of catfish, using water-saving technologies, improving water quality management, diversifying income sources, accessing credit, extension services, information and markets. However, the adoption of these strategies depends on various factors, such as socio-economic variables of farmers, farm size, and access to resources, policies and institutions.

Therefore, catfish producers can adjust to climate change by diversifying their sources of income, and switching to other species, or, in the worst case scenario, ceasing fish production (Coulthard, 2008). Catfish producers must therefore employ adaptation measures to lessen the effects of climate change in order to maximize the production of catfish needed to feed the world's expanding population. Moreover, the effectiveness of these strategies in improving catfish production and food security is not well understood and documented. Nonetheless, according to Opaluwa *et al.,* (2019), gender-based differences in needs, favorites, and precedence must be guaranteed by suitable government policies, programmes, and institutional structures. Absence of access to adequate food impacts human growth, thus access to adequate food for all is in question particularly for women as they are discriminated against with denial of certain entitlements. Unfortunately, women experience greater rates of food insecurity in households even when they manage food for everyone, tend to home duties, and work on farms, (Ghale *et al.,* 2018). For this reason, gender analysis plays a crucial role in food security analysis. The Nigerian government has performed poorly in terms of addressing gender mainstreaming and targeting in food policy and programmes. Thus, there is a need for coordinated initiatives to boost empirical research in that area. Given the disparities between men and women, most especially in cat fish production, there is therefore the need to examine the gender dimension to climate change, effects, adaptation measures on food security. Addressing gender barriers that inhibit women from fully engaging in the aquaculture sector value chain in Nigeria will increase the number of actors participating in and benefiting from the sector, which, in the long run, will increase the supply and accessibility of fish in the country. Thus, the purpose of this work is to close this gap by examining the gender-responsive policies for enhancing food security in aquaculture: a case study of catfish farming communities in Ondo State, Nigeria.

MATERIALS AND METHODS

Ondo State is the study area for this study. With coordinates of 6.9149° N and 5.1478°E the State lies between longitude 4"30" and 6" East of the Greenwich Meridian, 5:45" and 8"15" North of the Equator. It has about 15,500km^2 (6,000 square miles) land area and a population of 3,460,877 (National Boundary Commission (NBC) of Nigeria 2020). There are 18 Local Government Areas (LGAs) in it. Its climate has two distinct seasons: the rainy season (April to October), and the dry season (November to March). The State is divided into six agricultural zones namely Akure, Owo, Ondo, Akoko North, Ikare and Okitipupa according to Agricultural Development Programme (ADP) delineation, NBC, (2020). The study employed multistage sampling technique. The first stage is the purposive selection of all the six ADP zones. This is because all the ADPs are noted for catfish farming. By making use of the list of the registered fish farmers which cuts across all the ADPs, a random and proportionate selection of two hundred and thirty one (231) cat fish farmers were selected for this study. Descriptive and inferential (Likert Scale, Food Security Index, Weighted Mean and Logistic Regression) analytical tools were employed in analyzing the data collection.

Likert scale

Likert scale was used for ranking respondents' response to climate indicators in the study area. A Likert scale is a type of ranking scale used to measure perceptions of individual regarding a particular topic or issue, Likert, (1931) adapted by Adeleke, Ajibefun and Famoofo (2016). However Likert scale can be used to collect data on the how strongly or how frequently respondent believe that climate change has affected catfish production. In order to gather information, Likert-type questions with a five-point rating scale were utilized. The questions ranged from: Strongly Agreed, Agreed, Undecided, Disagreed, and Strongly Disagreed on the scale of 5 to 1 respectively.

Weighted Mean (WM)

Simple, weighted and geometric averages are the three approaches that are most frequently employed to calculate an average (or mean). When forecasting nonrecurring (NR) costs utilizing ratios of NR expenses to first unit production costs, analysts frequently employ averages as estimating guidance. The applicability of utilizing simple and weighted averages has some scholarly critics. The "wrong math," according to some observers, is how simple averages are created because it violates the fundamental principles of mathematics. According to Shu-Ping (2011), weighted averages are based on the "correct maths" and need to be used as such. Other analysts contend that the geometric average is the best strategy because both simple and weighted averages have drawbacks, (Shu-Ping 2011).

Given a set of n observations:

$$Z_1, Z_2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Z_n \quad \ldots. \; 1$$

WM is defined by the following formula:

$$WM = \frac{\sum_{i=1}^{n} w_i Z_i}{\sum_{i=1}^{n} w_i} \quad \ldots..2$$

Where sample size = n and the weighting factor of the i^{th} observation$i = 1 \ldots\ldots\ldots n = w_i$.

Shu-Ping (2011) believed weighted averages are based upon the "correct math" and should be applied accordingly.

Measuring Food Security: Food Security Index (FSI) was used to measure how food secured the catfish farmers in the study area are. Food Security Index (FSI) as used by Omonona and Agoi (2007); Ohajianya *et al*., (2011); Zubairu and Maurice (2014); Haddabi, Ndehfru and Aliyu (2019) and Adio and Olarinde, (2020) were adopted. The Food Security Index (FSI) calculates the per-capita food expenditure of households (including both cash and farm produce consumptions) in monetary (naira) terms. If a household spends at least two-thirds of the income on the average on food expenditure of the sampled households, it is regarded to be food secure; otherwise, it is deemed to be food insecure. FSI is thus given as:

$$F_i = \frac{\text{per capita food expenditure for the ith households}}{{}^2/_3 \text{ mean per capita food expenditure in all households}} \quad \ldots..3$$

Where:

$$F_i = Food\ security\ index$$

When

$$F_i \geq 1 = food\sec ure - ithhousehdd,$$

$$F_i \leq 1 = foodin\sec ure - ith - household$$

The Logit Regression (LR) Model: Each predictor in a logistic regression is assigned a coefficient that expresses how much of an independent contribution it makes to the variation in the dependent variable. If the response is "food secure," the dependent variable Y takes a value of 1, and if it is "food insecure," it takes a value of 0. The logit regression equation according to Green, (1993) is stated thus:

$$P_i = \frac{e^{\beta x}}{1+e^{\beta x}} \text{ .... } 4$$

Where P_i = 1(For food secure) and 0 for food insecure. Since Logistic regression calculates the probability of success (p) over the probability of failure (q), the results of the analysis are in the form of an odds ratio (p/q).

Odds Ratios: Changes in the odds, or the likelihood of witnessing a positive event as opposed to a negative one, can be used to interpret the effects of the Logit model.

$$\Omega = \frac{\Pr(y=1)}{\Pr(y=0)} = \frac{Pr(y=1)}{1-Pr(y=1)} \quad \text{......}5$$

The term "Logit" refers to the log of the chances, and the Logit model is linear in the Logit.

$$ln[\Omega] = ln\left[\frac{Pr(y=1)}{1-Pr(y=1)}\right] = \beta_o + \beta_1 x_1 \ldots\ldots \beta_9 x_9 \quad 6$$

Xi = explanatory variable vector, which is described as

X_1 = age of cat fish farmers (years), X_2 = Marital Status, X_3 = Education of Catfish Farmers, X_4 = Catfish Farming Experience, X_5 = Association Membership, X_6 = Number of Labour Used, X_7 = Climate Indicator (Aware 1 = Yes and otherwise 0)

RESULTS AND DISCUSSION

The summary statistics of the socioeconomic characteristics and the significant differences between the two groups of catfish farmers were in particular, observed with respect to age, marital status, education, household size, years of fishing experience and membership of association as shown in Table 1. The food security index for male catfish farmers was 9.43% higher than that of female catfish farmers indicating significant differences in food security. This difference reveals that food insecurity is more pronounced among female catfish farmers than male catfish farmers. The distribution of the farmers by age showed that the mean age for male catfish farmers was 43 years while that of the female was 40years and 42 years for the pooled. There was a significant difference between the means of (groups) on (outcome or measure) (t(df) = t-value, p = p< 0.01). The implication of this is that the catfish farmers were still within their productive age and can still take on proficiently in catfish production. The findings are similar to those of Olajide and Omonona (2019) who reported that the mean age of fish farmers in Osun State was 49 years. The results of the study on distribution of the fish farmers by sex revealed that the males dominated the enterprise. This is an indication that fish farming activities is cut across gender in the study areas. The average years spent in school was 13 years for both the male and the female catfish farmers. This result indicated that the fish farmers in Ondo State were educated. In addition, it is also an indication that the fish farmers will be more open to extension agents for information and embracing other best practices for improved species and harvesting techniques that would control the quality of fish. Findings on the marital status of catfish farmers revealed that majority of both categories (the male and the female) were married.

The result of years of fishing experience showed that catfish farming has been a long time practice among the respondents in the State although the male are more experienced than their female counterpart. The average fishing experience was 12, 10 and 11years for male, female and pooled respectively and significant difference at 5% (t-test mean comparison). This is consistent with the findings of Adeleke, Ajibefun and Famofo (2016). The result of the findings also revealed that some of indicators that were reported as change in climate in catfish farming according to the study areas included among others flooding (Mean 1.35, 1.6 and 1.42, SD 0.84, 1.06 and 0.90), long harmattan period leading to fish production increase (2.98, 1.46 and 3.03, SD 1.34, 1.46 and 1.37), precipitation increase resulting to increase in production of fish (2.52, 2.30 and 2.47, SD 0.95, 0.95 and 0.95), long period of hot season resulting to decrease in production of fish (2.11, 2.21 and 2.13, SD 0.82, 0.95 and 0.85), Situation of drought resulting to decrease in production of fish, decrease in fish farming, and decrease in quality of fish (2.01, 2.13 and 2.03; SD 0.50, 0.72 and 056). However, the Standard Deviations (SD) values of change in climate indicators on catfish production indicated that there are variations in catfish farmers' responses. This is in agreement with the work of Egwuonwu, (2022) that noted climate change as variations in rainfall patterns, inconsistencies in precipitation patterns, a reduction of the wet season, droughts, a shrink in volume of river water, and more of daytime and nighttime temperatures.

The probable coping strategies as revealed by the respondents were: construct ponds near water sources (1.43; 1.34 and 1.41;SD 0.53; 0.48 and 0.52), digging bore hole and/or wells for alternative water source at dry seasons (1.71; 1.82 and 1.74; SD 0.47; 0.61 and 0.50), time of stocking adjustment (1.85; 2.02 and 1.89; SD 0.74; 0.90 and 0.78), sourcing climate change information (1.71; 1.77 and 1.73; SD 0.65; 0.83 and 0.70), stocking favoured climate change fish species (1.6; 1.59 and 1.60; SD 0.61; 0.87 and 0.68), avoidance leakage of pond (1.61; 1.66 and 1.62; SD 0.55; 0.77 and 0.61), ensuring good water circulating system (1.56; 1.54 and 1.56; SD 0.67; 0.76 and 0.70), purchase of weather monitoring kits (1.69; 1.69 and 1.69; SD 0.68; 0.84 and 0.72), erecting embankments to reduce/prevent flood water (1.63; 1.66 and 1.64; SD 0.70; 0.84 and 0.73), stocking of fingerlings that is healthy (1.73; 1.71 and 1.72; SD 0.66; 0.73 and 0.67), usage of better varieties of fish (1.78; 1.88 and 1.81; SD 0.73; 0.79 and 0.74), clearing pond regularly (1.71; 1.77 and 1.72; SD 0.45; 0.54 and 0.47), ensuring better inlet and outlet (1.72; 1.84 and 1.75; SD 0.83; 0.97 and 0.86), and diverting water ways (1.57; 1.52 and 1.56; SD 0.54; 0.97 and 0.56). The findings of this study are in agreement with Opaluwa, *et al.,* (2019) and Oyebola, *et al.,* (2021)'s work on potential adaptation techniques for climate change impact among flood-prone fish producers in climate hotspot Uganda.

Climatic effects and Adaptation Measures: The result of climatic indicators as revealed by the respondents in the study areas is shown in Table 2. Climate change indicators were rated with Likert-type rating scale questions of 5-points rated as Strongly Agreed, Agreed, Undecided, Strongly Disagreed, and Disagreed, with a scale from 5 to 1 respectively. Included among others flooding, long period of harmattan season leading to increase in fish production, precipitation increase resulting to increase in production of fish, long period of hot season resulting to reduction in fish production, long period of hot season resulting to reduction in fish production, situation of drought resulting to decrease in production of fish, decrease in fish farming, and decrease in quality of fish. In ranking situation of drought resulting to decrease in production of fish rank first followed by clearing pond regularly, avoidance of leakage of pond and so on as shown in Table 2.

The adaptation strategies employed by the respondents (male and female catfish farmers in the study area according to Table 2 were construction of ponds near water sources, digging bore hole and/or wells for alternative water source at dry seasons, time of stocking adjustment, sourcing climate change information, stocking favoured climate change fish species, avoidance of leakage of pond, ensuring circulation of good system, weather monitoring kits purchase, erecting barriers reducing flooding, fingerlings stocking that are healthy, stocking of better fish varieties, regular pond clearing, ensuring better inlet and outlet and diverting water ways. According to Table 2, digging bore hole and/or wells for alternative water source at dry seasons ranked first followed by clearing pond regularly, avoidance leakage of pond, stocking of fingerlings that is healthy respectively for the pooled. for the male catfish farmers, avoidance leakage of pond, ensuring circulation of good water system, weather monitoring kits purchase, erecting barriers reducing flood water, ensuring better inlet and outlet were the prominent while ensuring better inlet and outlet, diverting water ways, clearing pond regularly, digging bore hole and/or wells for alternative water source at dry seasons, usage of better varieties of fish were the adaptation strategies for the female catfish farmers respectively.

Effect of climate change on fish farmers Food Security (Food Security Index): Food security index which is per capita food expenditure for the i^{th} household divided by 2/3 mean per capital food expenditure of all households was used to determine the food security status. Household with Food Security Index (FI) greater or equal to one was considered food secured. The result in Table 3 showed that, the monthly mean per capita food expenditure for the total household was ₦59,065.03 and the 2/3 mean per capital food expenditure for all the household was ₦39375.35. Using ₦39375.35 as the standard, 42.86% of the households was estimated to be food secure (Table 3) while 57.14% of the respondents were food insecure (pooled). More explicitly on the disaggregate level from Table 3, the result also revealed that food insecurity exists among both the male-headed households and female-headed households. For the male catfish farmers 59.43%

of the households were estimated to be food secure while 40.57% of the respondents were food insecure while the female catfish farmers, 50.00% of the households were estimated to be food secure while 50.00% of the respondents were food insecure. This suggests that households headed by men were more food secure than women headed households. The discrepancy in food insecurity between households headed by men and households headed by women was found to be 9.43%. This difference probably could be attributed to the negative effects of climate on the production of catfish across gender. This is contrary to the study by Olayiwola, *et al.,* (2017) and Oyekale, *et al.,* (2017) who used 2/3 of average mean per capita expenditure on food in their studies as the food secured line and reported that respondents studied were food secure.

Effects of climate change and adaptation strategies on Catfish Farmers' Food Security: Result in Table 4 showed the factors contributing to rise in food insecurity among catfish farmers in the study area. Results revealed that household size, ($p<0.10$) increases the food insecurity of catfish farmers in Ondo State (pooled). Implication of this implies an increase in the size of the household reduces the likelihood for the household to become food secure. This is consistent with Opaluwa, *et al.,* (2019) findings. In addition, education ($p<0.01$) has the probability of decreasing food insecurity of respondents. Coefficient (0.857) of the education has a positive relationship with household's food insecurity status. The result suggests food security increases with years of formal education among male headed household heads in the study area. This might be due to the fact that in Nigeria, years of formal education are major criteria in wage determination. Moreover, human capacity and technical know-how which transit in advancing the productivity of such households and consequently their food security status are related to education. This is in support of the work carried out by (Oyebola, 2021). The coefficient of the variable experience, ($p<0.05$) reduces the probability of catfish farmers being food insecure suggesting that the more experience household (male and female) had on catfish farming the less the probability of being food insecure and vice versa (reduces the odd of being food insecure). The coefficient climate variables (access to information on climate) of the respondents have a positive connection with household food security status. Indication of this reveals that households with climate information have higher probability of being food secure compared to those that did not have. The reason being that access to information enhances the chances of households having access to better information relevant to climate variability that has to do with catfish production and how to cope or mitigate against them as well as other incentives in production and these go to affect their output vis-à-vis their food security status. On the disaggregation for the male catfish farmers, the coefficient (0.922) of the education shows a positive relationship with household's food insecurity status, implying that education reduces the odd of being food insecure for the male catfish farmers. Also, the coefficient climate variable ($p<0.05$) of the male respondents have positive association to the food insecurity status of male households. This is an indication that male households with access to climate information have greater chance of being food secures than their female counterparts. For the female catfish farmers, experience ($p<0.10$) reduces the odd of being food insecure.

CONCLUSION

The study highlights the critical role of gender-responsive policies in ensuring food security within catfish farming communities. By examining the unique challenges faced by male and female-headed households, the study concluded that female-headed households experienced more severe food insecurity compared to their male counterparts. Factors such as household size, education, and climate conditions significantly influence food security outcomes. Climate change exacerbates existing vulnerabilities, affecting both catfish production and household well-being. Addressing these disparities requires targeted interventions that recognize gender-specific needs. Educating catfish farmers about climate change and building their adaptive capacity is crucial. Moreover, women's access to climate-resilient technologies like improved fish breeds, feed, and storage facilities should be promoted and gender-targeted training on sustainable aquaculture techniques and climate adaptation strategies should be organized. Finally, female extension workers to improve outreach to women and address socio-cultural barriers should be deployed. The study therefore recommends that gender should be mainstream in aquaculture policies and programs by fishing stakeholders in addition to enforcing policies that guarantee women's rights to access land and water bodies for aquaculture through facilitating women's access to microcredit, grants, and insurance tailored to aquaculture activities.

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Table 1: Summary statistics by gender dimension

	Pooled			Male			Female			
Variable	Obs.	Mean	SD	Obs.	Mean	SD	Obs.	Mean	SD	p-value
Age	231	42	10.69	175	43.03(0.82)	10.8	56	40(1.35)	10.10	0.0645*
Marital status	231	2.00	0.622	175	2.02(0.047)	0.62	56	1.96(0.084)	0.63	0.5811
Labour	231	4.02	1.06	175	4.02(0.079)	1.05	56	4(0.15)	1.11	0.8890
Education	231	13.21	4.89	175	13.02(0.37)	4.88	56	13.82(0.66)	4.90	0.2850
Household size	231	4.40	2.37	175	4.39(0.18)	2.40	56	4.45(0.31)	2.30	0.8740
Experience	231	11.77	7.74	175	12.39(0.62)	8.17	56	9.82(0.78)	5.86	0.0301**
Fish association	231	0.59	0.49	175	0.62(0.037)	0.49	56	0.52(0.067)	0.50	0.0896*
Food security	**231**	**0.429**	**0.50**	**175**	**0.41(0.067)**	**0.49**	**56**	**0.50(0.037)**	**0.50**	**0.0163****
Climatic effects										
Flooding	231	1.42	0.90	175	1.35	0.84	56	1.60	1.06	
Long period of harmattan season leading to increase in fish production	231	3.03	1.37	175	2.98	1.34	56	3.16	1.46	
Precipitation increase resulting to increase in production of fish	231	2.47	0.95	175	2.52	0.95	56	2.30	0.95	
Long period of hot season resulting to decrease in production of fish	231	2.13	0.85	175	2.11	0.82	56	2.21	0.95	
Situation of drought resulting to decrease in production of fish	231	2.03	0.56	175	2.01	0.50	56	2.13	0.72	
Decrease in fish farming	231	2.11	0.64	175	2.05	0.55	56	2.30	0.83	
Decrease in quality of fish	231	2.32	1.00	175	2.30	0.96	56	2.39	1.14	
Adaptation strategies										
Construct ponds near water sources	231	1.41	0.52	175	1.43	0.53	56	1.34	0.48	
Digging bore hole and/or wells for alternative water source at dry seasons	231	1.74	0.50	175	1.71	0.47	56	1.82	0.61	
Time of stocking adjustment	231	1.89	0.78	175	1.85	0.74	56	2.02	0.90	
Sourcing climate change information	231	1.73	0.70	175	1.71	0.65	56	1.77	0.83	
Stocking favoured climate change fish species	231	1.60	0.68	175	1.6	0.61	56	1.59	0.87	
Avoidance leakage of pond	231	1.62	0.61	175	1.61	0.55	56	1.66	0.77	
Ensuring good water circulating system	231	1.56	0.70	175	1.56	0.67	56	1.54	0.76	
Purchase of weather monitoring kits	231	1.69	0.72	175	1.69	0.68	56	1.69	0.84	
Erecting embankments to reduce/prevent flood water	231	1.64	0.73	175	1.63	0.70	56	1.66	0.84	
Stocking of fingerlings that is healthy	231	1.72	0.67	175	1.73	0.66	56	1.71	0.73	
Usage of better varieties of fish	231	1.81	0.74	175	1.78	0.73	56	1.88	0.79	
Clearing pond regularly	231	1.72	0.47	175	1.71	0.45	56	1.77	0.54	
Ensuring better inlet and outlet	231	1.75	0.86	175	1.72	0.83	56	1.84	0.97	
Diverting water ways	231	1.56	0.56	175	1.57	0.54	56	1.52	0.97	

Source: Field Survey, 2023. Standard errors in Parentheses $^{**}p<0.05$; $^{*}p<0.1$

Table 2: Weighted mean (Derived from Likert Scale)

Variable	Male				Female			
	N	WMS	MS	Rank	N	WMS	MS	Rank
Climatic effects								
Flooding	175	720	4.1	4	56	222	4.0	5
Long period of harmattan season leading to increase in fish production	175	540	3.1	7	56	177	3.2	7
Precipitation increase resulting to increase in production of fish	175	687	3.9	6	56	229	4.1	4
Long period of hot season resulting to decrease in production of fish	175	756	4.3	3	56	236	4.2	2
Situation of drought resulting to decrease in production of fish	175	814	4.7	1	56	257	4.6	1
Decrease in fish farming	175	816	4.7	1	56	233	4.2	2
Decrease in quality of fish	175	713	4.1	4	56	212	3.8	6
Adaptation strategies								
Construct ponds near water sources	175	770	4.4	9	56	243	4.4	6
Digging bore hole and/or wells for alternative water source at dry seasons	175	821	4.7	1	56	264	4.7	3
Time of stocking adjustment	175	772	4.4	9	56	238	4.3	11
Sourcing climate change information	175	772	4.4	9	56	237	4.2	12
Stocking favoured climate change resistant fish species	175	784	4.5	3	56	237	4.2	12
Avoidance leakage of pond	175	793	4.5	3	56	246	4.4	6
Ensuring good water circulating system	175	763	4.4	9	56	244	4.4	6
Purchase of weather monitoring kits	175	789	4.5	3	56	236	4.2	14
Erecting embankments to reduce/prevent flood water	175	780	4.5	3	56	244	4.4	6
Stocking of fingerlings that is healthy	175	794	4.5	3	56	249	4.4	6
Usage of better varieties of fish	175	774	4.4	9	56	251	4.5	5
Clearing pond regularly	175	825	4.7	1	56	261	4.7	3
Ensuring better inlet and outlet	175	756	4.3	14	56	393	7.0	1
Diverting water ways	175	788	4.5	3	56	278	5.0	2

Source: Field Survey, 2023: WMS = Weighted Mean Score, MS = Mean Score

Table 3: Respondents distribution according to food security status

	Pooled		Male		Female	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Food secure	99	42.86	28	50.00	71	40.57
Food insecure	132	57.14	28	50.00	104	59.43
Total	231	100	175	100	56	100

Source: Field Survey, 2023

Table 4: Logistic regression result

	Pooled			Male			Female		
	Odd Ratio	**Std. Err.**	**p-value**	**Odd Ratio**	**Std. Err.**	**p-value**	**Odd Ratio**	**Std. Err.**	**p-value**
age	0.991	0.027	0.733	0.977	0.0203	0.257	1.014	0.0393	0.719
Marital status	1.275	0.571	0.588	1.316	0.394	0.359	2.525	2.010	0.244
Household size	0.776	0.106	0.063*	0.874	0.0785	0.134	0.917	0.147	0.591
Education	0.857	0.045	0.003***	0.922	0.338	0.026**	1.038	0.0716	0.585
Fishing experience	0.917	0.0348	0.022**	0.986	0.0244	0.559	0.880	0.0638	0.078*
Association	1.452	0.699	0.439	1.272	0.433	0.480	0.913	0.551	0.880
Labour	1.122	0.404	0.750	1.581	0.549	0.188	0.771	0.329	0.542
Climate indicator	1.113	1.549	0.039**	0.767	0.313	0.017**			
Constant	28.54	67.16	0.154	6.001	7.032	0.126	0.634		0.793
Observation	231			175			56		
LR $chi^2(8)$	22.49			14.37			6.20		
Prob > chi^2	0.0041			0.0727			0.5162		
Pseudo R^2	0.1634			0.0601			0.0811		

Note: *, ** and *** Represents 10%, 5% and 1% significant levels respectively

Source: Field Survey, 2023