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ADAPTATION TO CLIMATE CHANGE: EVIDENCE OF COPING STRATEGIES USED BY FISH FARMERS IN PATEGI LOCAL GOVERNMENT AREA OF KWARA STATE, NIGERIA.

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ABSTRACT

Despite the importance of fish to the world economy, reports around the world indicate vulnerability of fish production to climate change. This study therefore ascertained climate change adaptation strategies used by fish farmers in Pategi Local Government Area (LGA) of Kwara State, Nigeria. A systematic random sampling technique was used to select 185 respondents for the study. Data were elicited with the aid of a questionnaire coupled with interview schedule and analyzed using descriptive statistics and Probit regression model. Results revealed that the mean age of respondents was 42.6 years while 65.4% were literate. Majority (87.5%) of the respondents exhibited a high level of awareness of the impacts of climate change on their fish farming activities and livelihoods. Radio (26.7%) and internet (17.8%) were the major sources of information utilized by the fish farmers on climate change. Prominent adaptation strategies used by the farmers include: building ponds close to water sources, stocking of early maturing fish species, building concrete/tarpaulin, preventive treatment of fish and others. The standardized coefficients for age (0.022), education (0.041) and farming experience (0.037) had a positive influence (*P≤0.05) on the use of coping strategies by farmers. It was recommended that government through the ministry of agriculture formulates policies specifically focused on farmers' adaptation to climate change so as to improve income. Also, efforts should be geared towards enlightening fish farmers on the use of indigenous climate

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change adaptive strategies in combination with the modern methods so as to help combat climate change impact sustainably and enhance better livelihoods.

Keywords: Adaptation Strategies, Climate change, Information, Awareness, Fish farmers, Kwara State

INTRODUCTION

Climate is an average atmospheric condition of a place for a long period of time usually 35years and above (Intergovernmental Panel on Climate Change, 2007). Climate change refer to any change in climate over time whether due to natural variability or as a result of human activities. This usage differs from that in the United Nation Framework Convention on Climate Change (UNFCCC, 2007) which defines climate change as change of climate which attributed directly or indirectly to human activity that alter the composition of the global atmosphere and which is in addition to natural variability observed over a comparable time (IPCC, 2007). Climate change is defined as a thirty or more years of persistence pattern of revolving changes in weather characteristics, these are in relation to temperature, pressure, wind system and direction, humidity, cloud cover and precipitation (IPCC, 2007). In Nigeria just as in many developing countries in the sub-tropical region, the agricultural sector is more vulnerable to climate change, landless farmers, livestock keepers, people on poor health; those with low level of education are more exposed to risk of climate change (Barber, 2003). The climate change patterns play a fundamental role in shaping natural ecosystems and the human economies and cultures that depends on them. Because many systems are tied to climate, a change in climate can affect many related aspects of where and how people and animal live, such as food production, availability and use of water and health risks, climate change is projected to increase threats to human health. One of the major aspects of agriculture that has been significantly affected by climate change is fish farming.

Millions of people in developing countries derive their livelihoods from fishing while about 2.6 billion people get their protein from seafood (Ogunlade, 2007). Fishing provides employment for up to ten million people in Africa and provides a vital source of protein to 200 million people in Africa (Sekaleli and Sebusi, 2013). About 30% (29.5 Mt) of the world fish catch is used for non-human consumption, including the production of fishmeal and fish oils that are employed in agriculture, in aquaculture, and for industrial purposes (Adebo and Ayelari, 2011). Fishmeal and fish oils are key diet components for aquaculture production; depending on the species being cultured, they may constitute more than 50% of the feed (Adeleke and Balogun, 2013).

Reports around the world indicate vulnerability of fish production to climate change. According to Intergovernmental Panel on Climate Change (2001), climate change could have dramatic

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impacts on fish production, which would affect the supply of fishmeal and fish oils and that future aquaculture production could be limited by the supply of fishmeal or fish oils if stocks of species used in the production of fishmeal are negatively affected by climate change and live-fish production. Fifty million people could be at risk by 2080 because of climate change and increasing coastal population densities (UNDP, 2005). Projections suggest that these combined pressures will result in reef loss and a decline in fish availability for per capita consumption of approximately15% by 2015 (UN, 2008). According to FAO (2008), the world is likely to see significant changes in fisheries production in the seas and oceans. For communities who heavily rely on fisheries, any decrease in the local availability or quality of fish for food or increases in their livelihoods' instability will pose even more serious problems. Fishing communities located in the high latitudes and those that rely on climate change-susceptible systems, such as upwelling or coral reef systems; will have the greatest exposure to climate-related impacts (FAO, 2008). In addition, fisheries communities located in deltas, coral atolls and ice-dominated coasts will be particularly vulnerable to sea level rise and associated risks of flooding, saline intrusion and coastal erosion. But countries with limited ability to adapt to the changes, even if located in low risk areas, are also vulnerable (UN, 2008).

Presently in Kwara state, seasons that were predictable are no longer so. Season rains are erratic and droughts have become more frequent and severe even as many rivers are drying up over the years (Adefalu *et. al., 2013*). Overall, climate change has brought poverty to the people of the state. To cope with these changes, it is necessary that fish farmers adopt some coping strategies for them to be able to adapt to the effect of climate change on their fish farming enterprise. According to UNDP (2004), adaptation is a process by which strategies to moderate with the consequences of climate change can be enhanced, developed and implemented. Adaptation to climate change involves changes in agricultural management practices in response to changes in climatic conditions and often involves a combination of various individual responses at the farm-level (Shashidahra and Reddy, 2012). It is on this note that this study seeks to examine the climate change adaptation strategies utilized by fish farmers in Pategi LGA of Kwara state, Nigeria. Specifically, the objectives are to: examine fish farmers' awareness of climate change, identify the sources of information about climate change by fish farmers, examine the coping strategies employed by the farmers and examine the influence of socio-economic characteristics of fish farmers on the coping strategies employed.

METHODOLOGY

Study Area:

The study was conducted in Pategi Local Government Area of Kwara state, Nigeria. It is one of the major fish farming areas in Kwara state. Pategi is inhabited by the Nupe people who also

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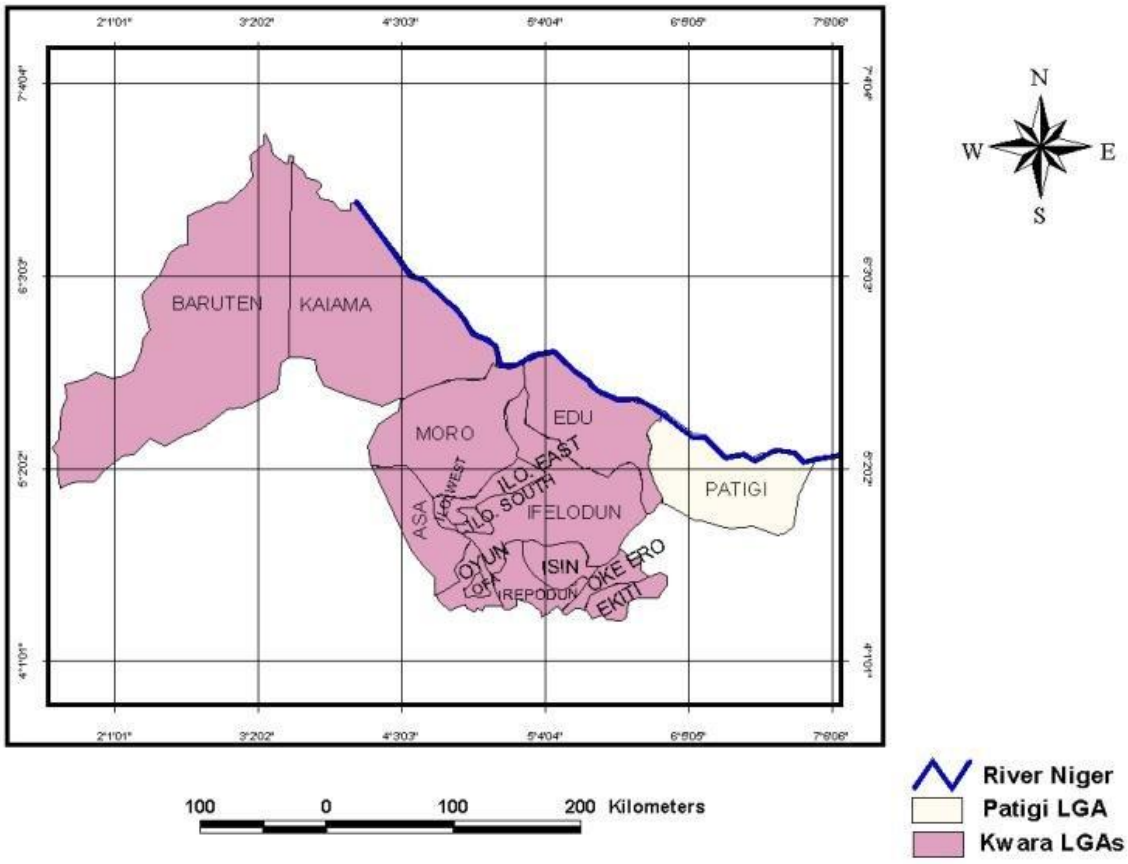
exhibit a linguistic repertoire of the Yoruba dialect. They are farmers, aquatic sellers/fishers and traders. The Local Government has River Niger as the primary source of water which makes many of the people engage in farming activities.



Sampling Procedure and Sample Size:

The study targeted fish farmers in Patigi LGA of Kwara State. The list of the villages in the local government area was gotten from Kwara State Agricultural Development Project office. Five communities were purposively selected based on their level of fish production. These villages were Pategi, Godiwa, Edogi, Kpan-sanko, Lade and Sakpefu. In each community, the researchers obtained the list of farmers from the village agricultural extension officer. From the list, 37 respondents were selected from each village using systematic random sampling technique to obtain 185 respondents using the formula proposed by Israel (2012).

$$N = \frac{Z^2 \times PQ}{e^2}$$

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Where:

n = required sample size,

Z = confidence level at 95% (standard value of 1.96),

p = is the estimated proportion of an attribute that is present in the population (for this case p= 0.4 i.e. 40%).

e = margin of error at 5% (standard value of 0.05)

i.e.

$$n = \frac{1.96^2 \times 0.2(1 - 0.6)}{0.05^2}$$

$$n = 185$$

Data collection and analysis:

Data were collected through the use of questionnaire coupled with interview schedule and analyzed using descriptive statistics such as frequency counts, means and percentages and appropriate charts while Probit regression model was used to analyze the factors influencing the coping strategies used by fish farmers in the study area.

RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents

Results in table 1 revealed that the mean age of the respondents was about 43 years. This results agree with Adefalu *et al.* (2013) and Egbufor, *et. al.*, (2012) who in their separate studies reported that young able bodied men were the ones largely and actively involved in fish farming. These buttress the fact that fish farming also requires a high sense of maturity, vigour and energy which might be difficult for the aged to do. Also, more than half (56%) of the fish farmers were male (Table 1). This is in agreement with Falola, Banjoko and Ukpebor (2012); Olaoye and Oloruntoba (2011) and Ogunlade (2007) who revealed that males were mostly involved in fish farming than females. This can be attributed to the tedious nature of fish farming particularly in the aspect of culturing, as noted by Okonji and Bekerederemo (2011). The results in table 1 shows that about 54.0% of the respondents were married. This implies that most of the fish farmers have family responsibility ties that will require more financial commitment which may serve as an impetus for them to use adaptation strategies in fish farming practices that can enhance more income.

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The results in Table 1 also reveals that about two-third (65%) of the fish farmers were literate. This is in contrast with Ndanitsa (2005) and Tsoho (2005) who in their separate study reported that rural farmers' are characterized by low level of literacy. Further results in table 1 showed that majority (85.4%) of the respondents had 5 years and above fish farming experiences while the remaining few (14.6%) had less than 5 years' experience in fish farming. This implies that majority of the respondents had some level of experience in fish farming. As revealed by Riddler and Hishamunda (2001), experience is a risk management factor in fish farming.

Table 1: Socio-economic characteristics of the respondents

Variable	Frequency	Percentage
Age		
≤ 30	31	16.7
31 – 40	59	31.9
41 – 50	66	35.6
51 – 60	19	10.3
> 60	10	5.4
Mean		**42.6**
Gender		
Male	103	55.7
Female	82	44.3
Marital Status		
Single	43	23.2
Married	100	54.0
Widowed	29	15.6
Separated	13	7.03
Educational Level		
No formal education	23	12.4
Primary education	41	22.1
Secondary education	71	38.4
Tertiary education	50	27
Fish Farming Experience (Yrs.)		

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≤ 4	27	14.6
5 - 9	61	33.0
10 - 14	66	35.6
> 14	31	16.7
Total	**185**	**100.0**

Source: Field Survey, 2018

Fish farmers' awareness of climate change

The results on fish farmers' awareness of climate change in Figure 1 indicate that majority (87.5%) of the respondents were aware of climate change impacts on their fish farming activities and livelihood. Specifically, it was found that 23.2% of the respondents indicated that they know little about the phenomenon while about 19% stated that they do not know about climate change at all. On the other hand, figure 2 reveals that about 40% of the respondents indicated they know about climate change impacts to a reasonable extent while only 17.8% of respondents claimed to be very knowledgeable about climate change impacts which implies a reasonable extent of respondents' awareness on climate change impact. This may be attributed to the high level of education of the respondents in the study area. This result negates the reports of Nzeadike *et. al*, (2011) that the level of awareness of local communities on climate change impacts was still low. Aphunu and Nwabeze (2012) also reported the mean (x) of 2.0 on the extent of awareness of climate change among fish farmers in Delta state, which implies a low level of awareness of climate change impact.

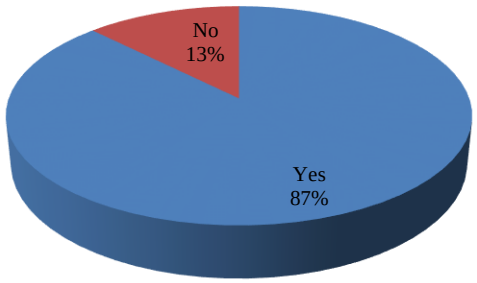

Fig. 1: Respondents' awareness on climate change

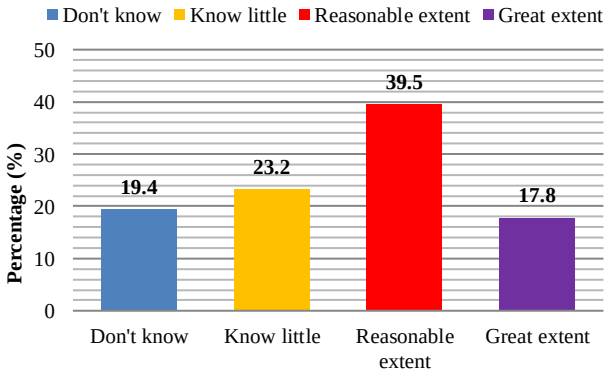

Fig. 2: Extent of knowledge of respondents on climate change

Source: Author's field survey (2018)

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Source of information on climate change used by the respondents

The results in Figure 3 revealed that the main sources of information on climate change were through radio (26.7%), followed by internet (17.8%), television (15.8%) and farmers' association (10.1%). The findings contradict George (2010) who reported that personal contacts, family and friends were the main sources of information on climate change. The contradiction in the result might be attributed to the fact that majority of the respondents are literate and so could take advantage of the use of the internet in getting information on climate change impact. Also, there were radio stations who reported agricultural related information to the farmers in the study area. Similarly, Tologbonse *et. al.*, (2010) found out that the most important information source on climate change was personal experience followed by radio and television. Figure 3 also shows that 6.9% of the farmers received information on climate change through personal experience and this can be attributed to the fact that their livelihood seems to be seriously threatened as a result of climate change impact. Results in Figure 3 also showed that Research institutes (2.1%) and Newspaper (2.1%) were the least source of information on climate change in the study area. Also, very few of the respondents (9.8%) received information on climate change from Extension workers. Extension agents are regarded as the customary source of dependable information to farmers; therefore, there is the need to strengthen the capacity of the extension agent on issues relating to climate change and its impact.

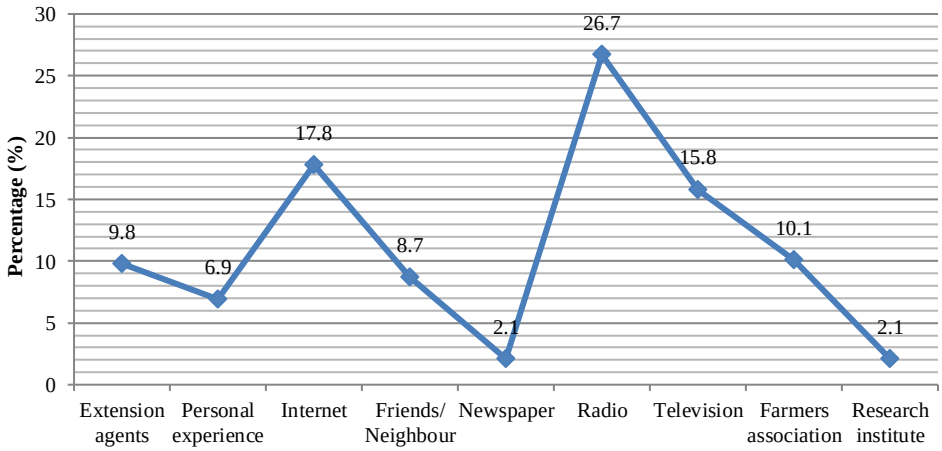

Fig. 3: Respondents' sources of information on climate change

Source: Author's field survey (2018)

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Coping Strategies Employed by Fish Farmers to Climate Change Impact

Results in Figure 4 shows that majority (72%) of respondents employed building ponds close to water sources while 71.4% used coping strategies such as stocking of early maturing fish species. About two third (64%) adapted to climate change impact by using strategies such as building concrete/tarpaulin and preventive treatment of fish (63.9%) and 62.9% said they adapted by providing alternative sources of water for their ponds in dry season. Furthermore, about 59% adapted by building embankments to prevent flood water, while 56.7% of the farmers adapted by seeking /listening to information about climate change. Other coping mechanism employed by fish farmers in the study area include adjustment in the time of stocking (51.8%), erecting cover/shades over ponds especially in dry weather (31.3%), use of circulatory system (29.6%), stocking fish species that are more favoured by climate change (21.0%), better weather forecasting/environment monitoring (19.7%), and planting trees (12.8%) respectively. The result indicates that many of the respondents adopted different measures to reduce the effect of climate change on fish farming. The result agreed with Adeleke et. al., (2013) in the assessment of the current knowledge of the fisher folks on climatic variables that, fisher folks had different perception and attitude towards increase or decreases in the climatic variables, hence, the various inadvertent and intentional methods of adapting to climate change. Sekaleli and Sebusi (2013) differ in the adaptation strategies used by farmers to include water harvesting technologies, conservation tillage, use of keyhole and trench gardens, agro-forestry and application of traditional medicine to control pests and diseases.

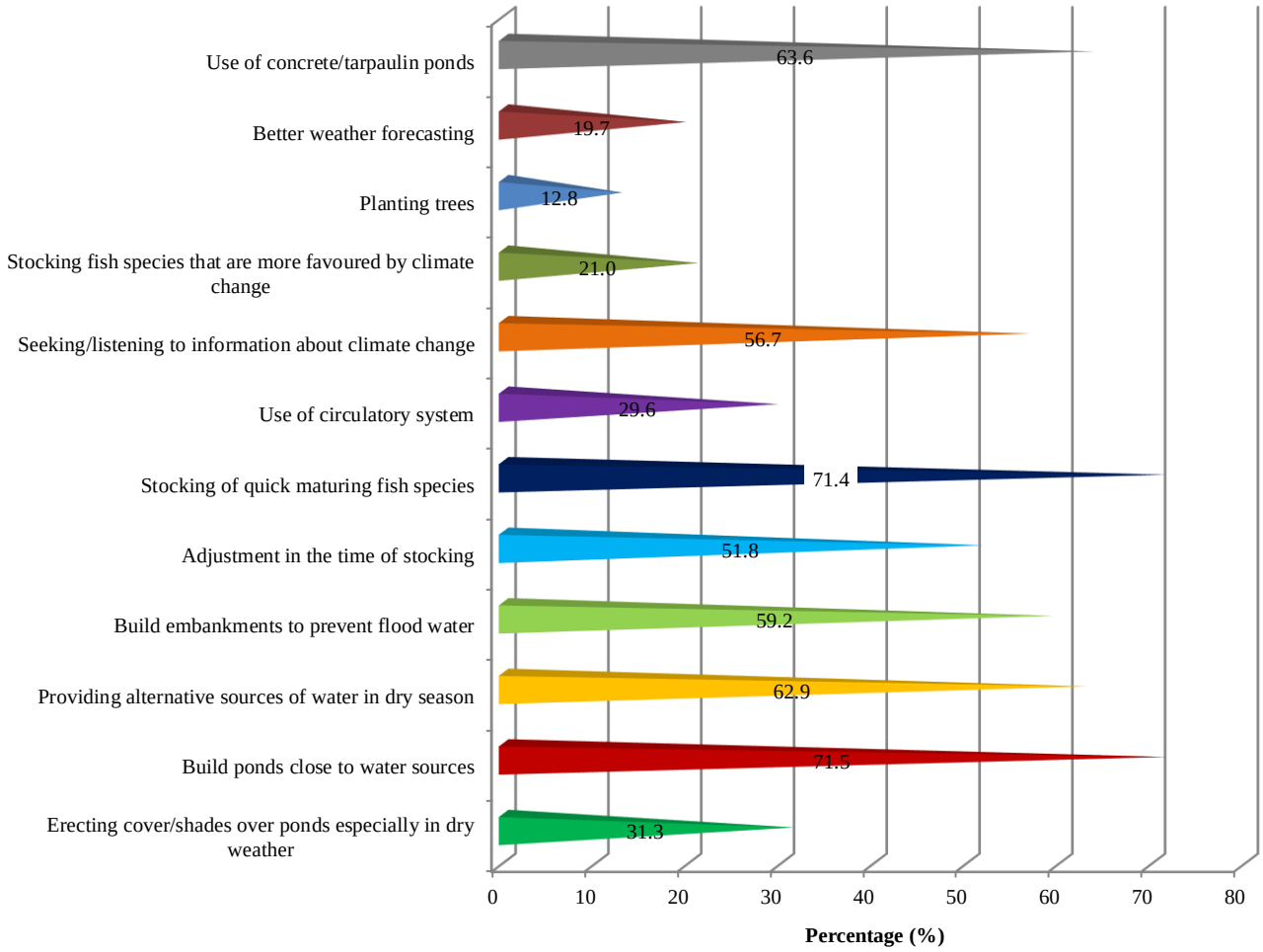

Fig. 4: Distribution of respondents by adaptation strategies employed in combating climate change impact

Source: Author's field survey (2018)

Socio-economic Factors Influencing Coping Strategies used by Farmers

Table 2 present the result of the factors influencing the coping strategies employed by the fish farmers. The variables that had significant positive influence on coping strategies used were: age (0.022), Farming experience (0.037), and Level of education (0.041). The use of climate change coping strategies increases as age, farming experience, and education increases. On age, Langy and Mekura (2005) reported that older farmers have higher accumulated capital, more contacts with extension workers, are better preferred by credit institutions and have larger family size, all of which may enhance their adoption and use of some coping strategies to combat the effect of

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climate change. Older farmers are assumed to have gained knowledge and experience over time and are better able to evaluate technology information than younger farmers (Mignounaet al, 2011).

Years of experience also had significant influence on coping strategies used. Farmers with more experience would be more efficient, have better knowledge of climate change coping strategies and are thus, expected to be able to combat climate change impact in fish production and run a more efficient and profitable farming enterprise (Oluwatayo *et. al.*, 2008). As farmers' years of farming experience increases, the probability of farmers having experience in coping with climate change effect increases. This could be because with more experience, the farmer is likely to manage climate change impact better and make more informed decisions. It is expected that the more the experience farmers have in farming practices, the more the farmers might adopt the right coping strategies and use them effectively. This finding is also in consonant with those of Danso-Abbeam et al. (2014), Kouame and Koumenan (2012) who showed a direct correlation between years of farming experience and probability of adopting new technology.

Table 2: Influence of Socioeconomic Characteristics on Coping Strategies Used

Variable	Co-efficient Std.	Err.	P-value
Age	0.9269	0.4332	0.022**
Level of Education	0.8742	0.4839	0.041*
Gender	-0.5012	0.3144	0.126
Marital status	0.0151	0.0299	0.632
Farming Experience	-0.1214	0.0543	0.037**

Note: *, **, - Variable is significant at 10%, 5%, respectively
Source: Field Survey, 2018

CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, it could be concluded that, fish farmers in the study area were aware of climate change phenomenon and their level of knowledge about the impacts of climate change was high. Also, the study confirms that the farmers are engaging in various coping strategies to climate change. Based on these, the study recommends that the government through the Ministry of Agriculture should formulate policies specifically focused on farmers' adaptation to climate change so as to improve their productivity and consequently income. Also, efforts should be geared towards enlightening fish farmers on the use of indigenous climate change adaptive strategies in combination with the modern methods such as De-silting of the natural water bodies; integration of fishing or aquaculture with agriculture to diversify the economy and empower the communities; promotion of fish culture in cages and irrigation canals

of the reservoirs so as to help combat climate change impact sustainably and enhance better livelihoods.

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