PERCEPTION AND ADAPTATION STRATEGIES OF CATFISH FARMERS TO CLIMATE CHANGE IN YENAGOA, BAYELSA STATE, NIGERIA

***[1]BAI E. M. AND [2]V. E. AKPOREHWE**
Department of Agricultural Economics, Extension and Rural Development, Niger Delta University Wilberforce Island, Bayelsa State, Nigeria.
**Corresponding Author's E-mail:eres76@mail.ru, +234 8069724056*

ABSTRACT

This research work examined the Perception and Adaptation Strategies of Catfish Farmers to Climate Change in Yenagoa, Bayelsa State, Nigeria. The objectives were to describe the socio-economic characteristics of earthen catfish farmers, identify the awareness of catfish farmers on climate change, ascertain their coping strategies and identify the constraints they face. A two-stage sampling technique was used to select 100 respondents who provided data for the study through a set of structured questionnaires administered to them. Descriptive statistics such as percentage, mean and Likert Scale rating technique were employed to analyze the data. Results of the study showed that 75% of males were involved in the business. The majority (52%) of the respondents had less than five years of farming experience. Additionally, the catfish industry in Yenagoa is dominated by aged people, (56%) were full time farmers, majority (52%) had a household size of 6-10 persons and 94% of the respondents had 1-10 numbers of ponds. The study also noted that most of the respondents (94%) are aware of the impacts of climate change and they have a reasonable knowledge of the impact and majority (61%) get their information from personal experience. The respondent's perception on the impacts of climate change reveals that majority of them strongly agreed on drastic change in weather condition effect and high temperature with heavy waves which affects fish production. While in strategies to cope with impacts of climate change, majority of the farmers tend to dig boreholes well to supply water during dry season. Majority of the farmers are also faced with quite a number of constraints such as inadequate capital and extension services.

Keywords: Aquaculture system, weather influence.

INTRODUCTION

Climate is the change in weather conditions over a period of time consequent upon the natural variability, properties or due to human activity is interpreted in many quarters with scientific data and analysis (Lomborg, 2001). With a focus on the freshwater environment, this research looks at how climate change is already having a significant impact on aquaculture. So, to determine the main impacts of climate variations on the freshwater ecosystem and aquaculture practice in particular, the study emphasizes the current practices across various areas and climates. After giving each factor due consideration, the study found that annual flooding and other climate-related issues would have the greatest influence on fish output. The various cultural systems in existence determine the extent to which the various elements or climate changes might be directly or indirectly beneficial or harmful. Allanwu *et al*. (2004) noted that our research helped to shed light on the complexities of climate change and its effects on aquaculture productivity, as well as the potential societal responses to these challenges.

Many species of catfish, including those belonging to the family Claridae, are farmed in Nigeria. Fish is a staple in many Nigerian diets since it is inexpensive compared to meat and contains a lot of animal protein. In Yenagoa, Bayelsa State, it is a staple food for many people and considered a top protein source. Additionally, many people raise catfish in earthen ponds for their businesses. There are a lot of catfish farms since their fish is worth twice as much as tilapia, according to the Food and Agricultural Organization, (2005). Catfish are best reared in earthen ponds, which are man-made reservoirs, lakes, or dams used for other fish species. This sort of pond mimics the natural aquatic habitat as closely as possible, and the fish thrive in it. Many components interact intricately to regulate the water quality in a fish pond (Abdul, 2024). This field study is being carried out in Yenagoa, Bayelsa State, to assess the viewpoints of farmers who raise catfish in earthen ponds.

Growing catfish in Yenagoa, Bayelsa State, is a simple, lucrative, and productive enterprise. Scientific research confirms its high protein content and finds it to be more cost-effective than alternative protein sources, Agussalim, (2025) and Bem *et al*., (2024). It has been demonstrated; however, that catfish production is declining, which is preventing fish farmers from maximizing their yield (Okechukwu, 2022). Although weather is a factor, it is far from the only one. Climate change, according to fish farmers, is responsible for extreme weather events such as floods, bad harvests, hot temperatures in the summer and low temperatures in the winter, as well as the danger of low oxygen levels in ponds. According to Aphunu and Nwabeze (2012), although climate plays a significant role in ensuring the growth and sustainability of the aquaculture sector, it can also have a negative impact on production in pond systems. This, in turn, causes farmers to lose a lot of production and become more economically and socially vulnerable. This study aims to examine the impact of climate on catfish farming in Yenagoa using clay ponds.

Specifically, the study was carried out to describe the socio-economic characteristics of earthen pond Catfish Farmers in Yenagoa, ascertain the awareness of earthen pond Catfish Farmers on climate change and how it affects their business, ascertain the earthen pond Catfish Farmers perception on the effects of climate change, ascertain the earthen pond catfish farmers coping strategies on the impacts of climate change and identify the constraints facing earthen pond Catfish Farmers.

MATERIALS AND METHODS

The study was carried out in Yenagoa Local Government Area in Bayelsa State, Nigeria and it is the capital city of the state. Its precise location in the southern region of the nation is 4°55'29" N 6°15'51" E. According to the 2006 census, there were 352,285 people living in the 706 km² of the Local Government Area (National Population Commission of Nigeria, 2006). The area's postal code is 561. Yenagoa Local Government is home to several ethnic groups, some of which speak languages other than English, including Epie Attissa, Ijaw, and Zarama. Yenagoa is located in a region characterized by tropical rain forests, mangroves, and marshes. According to the Bayelsa State Council of Arts and Culture (2006), the main occupations of the locals include fishing, farming, grinding palm oil, logging, tapping palm wine, marketing local gin, carving, weaving, and trade.

Method of sampling

This study employed a two-stage sampling procedure. Firstly, a purposive sampling technique was used to select ten (10) communities in Yenagoa where earthen pond fish production is predominantly practiced. Secondly ten (10) fish farmers were selected from each of the community to make a total number of respondents of one hundred (100) from the study area. To obtain the information from the respondents, a well-structured questionnaire was distributed and interview schedule was also used.

Method of Data Analysis

Simple percentages and meanwere among the descriptive statistics used, and four-Likert scalemeasurement tool was also used to examine the gathered data. SPSS software was used to run the analyses.

RESULTS

Socio-Economic Characteristics of Earthen Pond Catfish Farmers

The result on Table 1 shows that male respondents constitute 75% compared to female which has 25% in fish farming. The mean age of fish farmers is 30 years. Married individual are 55% while singles are 45%. The religious composition reveals that Christianity has 85%, Islamic with 7% and Traditional has 8% of the respondents. A 52% of majority has experience of 5 years in fish farming. More than half (56%) engage in fish farming full-time. Majority (76%) of the fish farmers have tertiary education. Larger households size category of (6–10 members) with an average household size of 5. Most respondents operate on a small scale (1–10 ponds), highlighting the prevalence of smallholder fish farming with mean ownership of >10.

Table 1: Socio-Economic Characteristics of Respondents

Profile	Variables	Frequency	Percentage	Mean
Gender	Male	75	75	
	Female	25	25	
Age	<20	12	12	30
	20-29	15	15	
	30-29	16	16	
	40-49	22	22	
	>50	35	35	
Marital Status	Married	55	55	
	Single	45	45	
Religion	Christianity	85	85	
	Islamic	7	7	
	Traditional	8	8	
Farming Experience	<5	52	52	
	5-10	27	27	13
	11-15	0	0	
	16-20	7	7	
	21>	7	7	
Farmer's Status	Fulltime	56	56	
	Part-time	44	44	
Level of Education	No formal education	7	7	
	Primary education	7	7	
	Secondary education	10	10	
	Tertiary education	76	76	
Household size	3-5	33	33	5
	6-10	52	52	
	>10	15	15	
Pond owned	1-10	94	94	
	10-20	0	0	
	>20	6	6	

Source: Fieldwork, 2025

Earthen Pond Catfish Farmers Awareness of Climate Change Impact

The results from Table 2 shows the **Percentage Distribution of Earthen Pond Catfish Farmers' Awareness of Climate Change Impact which** reveal that the overwhelming majority of respondents (94%) are aware of the impact of climate change on aquaculture, while only a small fraction of 6% reported no awareness.

Table 2: Percentage Distribution of Earthen Pond Catfish Farmers Awareness of Climate Change impact

Awareness of climate change impact	Frequency	Percentage
Yes	94	94
No	6	6
Total	100	100

Source: Fieldwork, 2025

Extent of Knowledge of Climate Change

The result from Table 3 shows the **Percentage Distribution of Earthen Pond Catfish Farmers According to Extent of Knowledge of Climate Change** provides valuable insight into how well-informed farmers are about climate change and its implications for aquaculture. According to the results, **6%**of the respondents reported **no knowledge** of climate change, **35%** indicated having **little knowledge**, **28%** claimed a **reasonable extent of knowledge** and **31%** reported **great knowledge**.

Table 3: Percentage Distribution of Earthen Pond Catfish Farmers according to Extent of Knowledge of Climate Change.

Extent of knowledge of climate change	Frequency	Percentage
No knowledge	6	6
Little knowledge	35	35
Reasonable extent	28	28
Great knowledge	31	31
Total	100	100

Source: Fieldwork, 2025

Source of Information on Climate Change to Fish Farmers

The result on Table 4 shows the multiple responses on source of information on climate change which reveals that the majority of farmers (61%) rely on personal experience as their primary source of information on climate change. The internet (19%) and radio/television (14%) are the most significant media sources of information after personal experience. Meanwhile, 6% of respondents rely on friends and neighbours.

Table 4: Percentage Distribution of Earthen Pond Catfish Farmers according to Source of Information on Climate Change to Fish Farmers.

Source of information	Frequency	Percentage
Extension workers	0	0
Friends and Neighbours	6	6
Internet	19	19
Personal experience	61	61
Newspaper	0	0
Radio and television	14	4
None	6	6
Total	100	100

Source: Fieldwork, 2025

Earthen Pond Catfish Farmers' Perception on the Impact of Climate Change

The Table 5 shows the result of the Mean score of the farmers Perception on the Impact of Climate Change of whichthe responses are measured on a 4-point Likert scale: Strongly Agree (SA = 4), Agree (A = 3), Disagree (D = 2), and Strongly Disagree (SD = 1), with mean scores computed for each item. The mean scores reveal that farmers strongly agree that drastic weather changes, high temperatures, and droughts negatively affect fish production (mean scores above 3.60).There is also considerable agreement on the effects of flooding ($\bar{x}$ = 3.66), excessive sunshine ($\bar{x}$ = 3.51), and fish disease outbreaks ($\bar{x}$ = 3.21). Interestingly, the respondents disagreed that climate change increases fish harvest ($\bar{x}$ = 2.00) or causes direct damage to earthen ponds ($\bar{x}$ = 2.18). Climate change increases cost of production ($\bar{x}$ = 3.42) is also notable.

Table 5: Mean of Earthen Pond Catfish Farmers according to the Perception on the Impact of Climate Change.

-	Item	SA	A	D	Sd	Mean (x̄)	Interpretation
1	Drastic change in weather condition effects fish production	71	29			3.71	Strong agreement
2	High temperature and heavy waves decrease fish production	70	30			3.70	Strong agreement
3	Climate change from heavy windstorms causes destruction of properties	49	51			3.49	Agreement
4	Climate change causes excessive sunshine	25	63	12		3.51	Agreement
5	Climate change causes increased incident of flooding	20	75	7		3.66	Agreement
6	Climate change causes increased incident of drought	66	34			3.66	Strong agreement
7	Climate change increases harvest of fish	7	12	55	26	2.00	Disagreement
8	Climate change increases fish disease infection	35	51	14		3.21	Agreement
9	Climate change increases cost of production	57	28	15		3.42	Agreement
10	Climate change damages earthen ponds	14	28	20	38	2.18	Disagreement

Source: Fieldwork, 2025

Strategies to Cope with Impact of Climate Change

Table 6 shows the results on the coping strategies adopted by earthen pond catfish farmers to mitigate the impacts of climate change of which most farmers prioritize specific adaptive measures. The percentages indicate how many farmers consider each strategy important in coping with climatic variability. The majority of respondents (above 85%) consider several structural and management interventions as critical for coping with climate change impacts which are: Building ponds close to water resources (100%) and digging boreholes for dry season water supply (100%) are viewed as essential strategies. Adjustment in stocking time (100%) and stocking quick-maturing fish species (100%) are also universally deemed important. The importance of erecting covers/shades over ponds (86%) and building embankments to prevent floodwaters (87%), stocking fish species favored by climate (86%), use of indoor fish production facilities (60%), seeking and listening to information about climate change (65%) and notably, procurement of weather/water monitoring kits is (35%).

Table 6: Percentage of Earthen Pond Catfish Farmers to Cope with Impact of Climate Change

Items	Important	Not Important	Percentage		decision
Erecting cover/shades over ponds especially in dry weather	86	14	86%	14%	Above 50% important
Build ponds close to water resources	100	0	100%	0%	Above 50% important
Dig boreholes well to supply water during dry season	100%	0%	100%	0%	Above 50% important
Build embankment to prevent flood water	87	13	87%	13%	Above 50% important
Adjustment in the time of stocking	100	0	100%	0%	Above 50%important
Stocking of quick maturing fish species	100	0	100%	0%	Above 50% important
Use of indoor fish production facilities	60	40	60%	40%	Above 50%important
Procurement of weather/water monitoring kits	35	65	35%	65%	Below 50% not important
Seeking/listening to information about climate change	65	35	65%	35%	Above 50% important
Stocking fish species that are more favored by climate	86	14	86%	14%	Above 50% important

Source: Fieldwork, 2025

Constraints Faced by Earthen Pond Catfish Farmers

Table 7 shows the result on constraints experienced by earthen pond catfish farmers clearly highlight several critical challenges impacting the sustainability and productivity of fish farming operations. These constraints are typical barriers in smallholder aquaculture, especially within developing country contexts.

A significant majority of farmers (93%) identified inadequate capital as a major constraint, while 65% of farmers reported inadequate information as a constraint. Almost all farmers (94%) indicated that the inadequacy of extension agents is a significant challenge. Flooding was noted by 88% of respondents as a major constraint affecting pond farming. Only a small proportion of farmers (6%) cited wind/logging as a constraint.

Table 7: Percentage Distribution of Earthen Pond Catfish Farmers According to Constraints

Inadequate capital	Frequency	Percentage
Inadequate Capital	93	93
Inadequate information	65	65
Inadequacy of Extension Agents	94	94
Flooding	88	88
Wind/Logging	6	6

Source: Fieldwork, 2025

DISCUSSION

Socio-Economic characteristics

The result shows the predominance of male in fish farming which aligns with findings from Adewuyi *et al*. (2010), who reported that male predominance in aquaculture in Nigeria due to land ownership, access to capital, and the labor-intensive nature of the enterprise. Cultural norms often limit female involvement to processing and marketing rather than production. The mean age of 30 and significant proportion of older farmers (>50 years) suggest that aquaculture is more popular among middle-aged and older individuals. This supports the view of Olagunju et al. (2007), who noted that older individuals are more involved in fish farming due to access to resources and land, while youth may avoid it due to limited capital or preference for white-collar jobs. A higher proportion of married respondents may indicate stability and possibly access to family labor in managing farms. This is consistent with Ugwumba and Chukwuji (2010), who highlighted the role of household structure in sustaining small-scale fish farms. The largely reflects regional (Christianity) demographics and may not significantly affect fish farming practices, though it could influence attitudes toward certain management techniques or labor practices in some areas (Ajibefun and Aderinola, 2004).

A majority with less than 5 years of experience in fish farming suggests increasing interest or entry into fish farming by newer farmers. The absence of respondents in the 11–15 year category may reflect business turnover or transitions to other livelihoods. Kinwumi *et al,* (2013) also observed that new entrants are drawn by high returns, though lack of technical skill may limit productivity early on. The full-time engagement of fish farming which suggests strong economic reliance on aquaculture. This supports findings by (FAO, 2005) that aquaculture has transitioned from a supplementary to a main income source for many households in Africa. The high proportion of tertiary educated farmers suggests that fish farming attracts educated individuals, likely due to its technical nature and potential profitability. Education enhances farm management skills, adoption of innovation, and record-keeping practices (Olaoye *et al*., 2019). Larger household size may provide needed labor for fish farming. This is in agreement with Olasunkanmi and Yusuf (2012), who stated in their findings that household size is positively correlated with farm labor availability, especially in rural settings. Small scale fish farming (1–10 ponds) is in line with FAO (2014) reports, which indicate that over 80% of African aquaculture is done on small farms, typically under 1 hectare.

This profile reveals that fish farming in the study area is largely driven by educated, middle-aged to older males, many of whom rely on the venture as their primary livelihood. The data indicate a strong presence of small-scale operations with increasing participation from new entrants. Educational background and household size are key enablers of effective farm management, while limited experience in the sector highlights the need for continuous training and support.

Earthen Pond Catfish Farmers Awareness of Climate Change Impact

This high level of awareness among earthen pond catfish farmers is significant, indicating that most farmers recognize the potential risks and challenges posed by changing climatic conditions.

These findings are consistent with previous research in the field. For instance, Nzeadibe *et al*. (2011) observed that a high percentage of rural farmers in Nigeria had some level of awareness regarding climate change, often linked to direct experiences of irregular rainfall patterns, increased temperatures, and extreme weather events. Similarly, Fapohunda (2020) found that aquaculture farmers in southwestern Nigeria reported increased awareness of climate variability, particularly concerning water temperature, fish mortality, and feed utilization.

The high awareness level (94%) might be attributed to farmers' exposure to media reports, extension services, or personal experiences of climate-related events affecting

pond water levels and fish health. According to Ayoola (2010), fish farmers are increasingly aware of how climate change can exacerbate issues such as reduced water availability, increased incidence of disease, and changes in fish breeding patterns. Respondents who indicated no awareness may reflect limitations in access to information, education level, or remoteness of location, which are commonly identified barriers in the literature (Tambo and Abdoulaye, 2013).

Extent of Knowledge of Climate Change

These findings suggest that while 94% of farmers have at least some awareness of climate change (as reported in the earlier table), their depth of knowledge varies considerably. Only a combined 59% (those with "reasonable extent" and "high level of knowledge") possess a moderate to high level of understanding. The remaining 41% (those with "no" or "little knowledge") have limited comprehension of climate change, which may impact their ability to implement effective adaptive strategies.

This aligns with the observations of Ifeanyi-Obi *et al*., (2012), who reported that while awareness of climate change among rural Nigerian farmers was generally high, the depth of knowledge often remained shallow due to limited access to formal training or reliable information sources. Tambo and Abdoulaye, (2013) also emphasized that most farmers rely on indigenous knowledge and experiential learning, which, although useful, may not be sufficient to address the complexities of climate change impacts on aquaculture systems.

The presence of 31% of farmers with great knowledge is encouraging, indicating that a significant minority have either benefited from educational outreach, training programs, or personal learning. However, the relatively large proportion (35%) with only "little knowledge" suggests a need for intensified extension efforts, targeted capacity-building, and tailored information dissemination strategies. This is especially important in aquaculture, where climate change can influence pond water levels, fish health, disease outbreaks, and feed availability (Fapohunda, 2020; Ayanwale *et al*., 2017).

Source of Information on Climate Change to Fish Farmers

This reliance on experiential knowledge is consistent with findings by Ifeanyi-Obi *et al*., (2012) and Tambo and Abdoulaye, (2013), who reported that farmers in Nigeria often base their understanding of environmental changes on firsthand observation rather than structured scientific or institutional input. Extension workers and newspapers are unused sources. This is particularly concerning, as extension services are traditionally the primary channels for disseminating agricultural innovations and climate-related information. The complete absence of extension involvement may reflect inefficiencies, lack of outreach, or low trust in public extension systems. Fapojuwo *et al*., (2020) emphasized the importance of functional extension systems in enhancing farmers' adaptive capacities to climate change, suggesting a critical gap in service delivery in this context. Internet and radio/television reflect increasing access to digital tools and broadcast media among rural populations. This trend aligns with the growing role of information and communication technology (ICT) in agricultural education and knowledge sharing.

Friends and neighbours source of information demonstrates that a notable portion of farmers remain disconnected from structured climate knowledge networks, increasing their vulnerability to climate-induced risks.

The result suggests a pressing need to revitalize extension services to effectively educate and engage aquaculture farmers, promote ICT-based platforms and localized media programs to improve information dissemination, encourage community-level knowledge sharing, leveraging trusted local networks and integrate climate education into farmer training programs, ensuring information is both accessible and practical.

Earthen Pond Catfish Farmers' perception on the Impact of Climate Change

Farmers who strongly agree that drastic weather changes, high temperatures, and droughts negatively affect fish production is supported by the findings of Ayanwale *et al*., (2017) and Fapohunda, (2020), who noted that fluctuations in temperature, precipitation, and water levels influence fish growth, breeding cycles, and survival rates in aquaculture systems. The effects of flooding, excessive sunshine and fish disease outbreaks aligns with the work of Eze *et al*., (2021), who reported increased vulnerability of fishponds to floods and disease outbreaks due to shifting climatic patterns. Respondents who disagreed that climate change increases fish harvestor causes direct damage to earthen ponds suggests that while farmers perceive climate change as generally harmful to productivity and costs, they do not associate it with improved yields or widespread pond infrastructure damage possibly due to local adaptation practices or pond design resilience. Climate change increases cost of production reflects rising operational costs due to feed inefficiency, disease treatment, and water management, which are frequently cited in climate-aquaculture studies (e.g., Olufeagba *et al*., 2015).

The perception result shows that earthen pond catfish farmers have a well-developed understanding of the negative effects of climate change on aquaculture. Their concerns are consistent with empirical evidence in the literature, underlining the need for targeted interventions, including climate-resilient aquaculture techniques, disease control, and disaster risk management strategies.

Strategies to Cope with Impact of Climate Change

Building ponds close to water resources and digging boreholes for dry season water supply are actions that ensures consistent water supply, which is vital for maintaining adequate pond conditions during droughts or irregular rainfall. This aligns with findings by Eze *et al*., (2021) and Fapohunda, (2020), which emphasized water

availability as a major constraint for aquaculture sustainability under climate stress.

Adjustment in stocking time and stocking quick-maturing fish species are adaptive management practices which help farmers better synchronize production cycles with favorable climatic conditions, thereby minimizing losses due to extreme weather. This concurs with Ayanwale *et al*. (2017), who observed that timing adjustments and species selection are key farmer-led strategies to adapt to climate variability. Erecting covers/shades over ponds and building embankments to prevent flood waters indicates farmers' recognition of the need to protect ponds from excessive heat and flooding both common climate-related challenges affecting water quality and fish survival (Olufeagba *et al*., 2015).Stocking fish species favored by climate reflects an understanding of species-specific resilience or tolerance to changing environmental conditions, echoing the recommendations by Ifeanyi-Obi *et al*. (2012) on species diversification as an adaptive strategy.

Use of indoor fish production facilities suggests that a majority but not all farmers see the value in controlled environment systems, which can mitigate climate risks but require higher capital and technical skills (Tambo and Abdoulaye, 2013), seeking and listening to information about climate change highlights the growing importance of knowledge and awareness in climate adaptation, though there is still a gap compared to physical infrastructural adjustments. Procurement of weather/water monitoring kits is considered less important by most farmers. This could be due to factors such as high costs, lack of technical know-how, or limited access to such technologies in rural areas, a challenge documented by Fapojuwo *et al*. (2020). This suggests a need to improve accessibility and training to encourage adoption of monitoring tools that could provide early warnings and enhance adaptive capacity.

The overwhelming preference for infrastructural improvements and adaptive stocking practices underscores the practical and immediate coping mechanisms favored by earthen pond catfish farmers facing climate change challenges. While technological solutions like monitoring kits are less prioritized, enhancing access and education on their benefits could support better farm-level decision-making in the future.

Constraints Faced by Earthen Pond Catfish Farmers

Inadequate capital as a major constraint is consistent with the broader literature on small-scale aquaculture, where limited financial resources restrict farmers' ability to invest in quality inputs such as fingerlings, feed, pond construction, and adaptive technologies (Fapohunda, 2020; Olufeagba *et al*., 2015). The lack of access to affordable credit or formal financial services is a well-documented impediment to scaling and improving fish production systems (Ayanwale *et al*., 2017). Access to reliable and timely information is essential for adapting to climate variability and adopting improved management practices. The relatively high percentage indicates a knowledge gap which may limit farmers' ability to respond effectively to climate-related risks (Eze *et al*., 2021). This aligns with findings from Ifeanyi-Obi *et al*. (2012)**,** who noted that extension services and information dissemination are often insufficient or poorly coordinated in rural aquaculture communities.

Extension services play a vital role in bridging knowledge gaps, providing technical support, and facilitating access to innovations that enhance climate resilience (Fapojuwo *et al*., 2020). The shortage of extension workers limits farmers' capacity to adopt best practices and adapt to changing environmental conditions, as also reported by Tambo and Abdoulaye, (2013) in similar agrarian settings.

Floods can cause fish escape, damage pond structures, and degrade water quality, leading to production losses (Eze *et al*., 2021). This environmental hazard is a direct consequence of changing climate patterns and poor watershed management, emphasizing the urgent need for flood control measures such as embankments and drainage systems (Olufeagba *et al*., 2015). Lower figure of wind/logging may reflect the lesser frequency or localized impact of these factors compared to the other constraints. Nevertheless, windstorms can cause physical damage to ponds and infrastructure, as documented by Ayanwale *et al*. (2017).

The results demonstrate that capital shortages, insufficient extension support, and climate-induced challenges such as flooding dominate the constraints faced by earthen pond catfish farmers. These findings underscore the importance of targeted interventions including improved financial services, strengthened extension systems, and climate-resilient infrastructure to enhance aquaculture sustainability.

CONCLUSION

The findings of the research established that the earthen pond catfish farmers are said to have knowledge about climate change. However, they still require further training on how to cope with climate change. The study revealed that a reasonable number of earthen pond catfish farmers agreed that there is great impact of climate change on catfish production, while just a few of the farmers disagreed to that fact.

Recommendation

Based on the observation and findings of this research study, there are some important and vital policy implications for improvement of the enterprise, some of the major and vital policy recommendations that deserve attention in this enterprise are:

i. earthen pond catfish farmers should be encouraged to form cooperatives societies because from the result finding it is noted that there are more educated people that are engaged in the business. Through this means, they can schedule seasonal conferences to educate themselves on more adaptive strategies in coping with the impact of climate change.
ii. inadequate extension services are major challenge

faced by earthen pond catfish farmers in the study area. To this end, it is recommended that government should recruit more extension agents and provide more services on climate change to earthen pond catfish farmers.

iii. earthen pond catfish farmers should be encouraged to embrace new ways of rearing catfish such as floating cage fish production system which serves as a major coping strategy to avert annual flooding in communities along river sides in the Local Government Area.

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