ASSESSING THE EFFICACY OF FISHERIES CO-MANAGEMENT AMIDST CLIMATE CHANGE IMPACTS: A STAKEHOLDER PREPAREDNESS EVALUATION IN LAKE VICTORIA, KENYA.

Patrick Wanguche Otuo
Kenya Marine and Fisheries Research Institute
pwanguche@go.ke; partyotuo2009@gmail.com

Supervisor:

Catherine Chambers: cat@uw.is
Stefansson Arctic Institute, University Centre of the Westfjords

This paper should be cited as: Otuo, P. W. 2024. *Assessing the efficacy of fisheries co-management amidst climate change impacts: A stakeholder preparedness evaluation in Lake Victoria, Kenya.* GRÓ Fisheries Training Programme under the auspices of UNESCO, Iceland. Final project. https://www.grocentre.is/static/gro/publication/1935/document/Otuo23prf.pdf

ABSTRACT

There is a common agreement that the establishment of co-management could benefit the fisher community and other stakeholders across the African Great Lakes. This study examined the efficacy of community-level fishery co-management organisations called Beach Management Units (BMUs) along the Kenyan shores of Lake Victoria in the wake of climate change impacts. Data were collected from five BMUs along the Kenyan shores of Lake Victoria. A total of 99 respondents and 20 key informant interviews were conducted in all five riparian counties of Lake Victoria. Descriptive and inferential analyses were performed using Excel and **R-4.4.0.tar.gz**. Data were collected through site observations and questionnaire-led interviews involving key informants and Beach Management Unit members. The study revealed that the main causes of climate change are deforestation (82%), industrialisation (43%), rainfall (23%), and GHGs (21%), while the main consequences are food insecurity (64%), drought (60%), rainfall (57%), fish stock change (56%), and poor human health (52%).The survey results indicate that 93.9% (Figure 5) of the respondents were aware of climate change. Despite the majority of the respondents being aware of climate change, only 34.4% agreed on evidenced climate change impact adaptation strategies within the co-management framework. Furthermore, climate change considerations appeared to be insufficiently integrated into co-management structures. A substantial proportion of BMU committee members (38%) and leaders (50%) reported no integration, while 58% of fish traders were uncertain. Perceptions of community education on climate change and co-management were moderate to low across stakeholder groups, with ratings of 50% (BMU committee members and leaders), 35% (fish traders), 28% (fishermen), and 42% (other stakeholders). The low rating of such measurable attributes advocates the lack of effectiveness of co-management in Lake Victoria, Kenya. This was attributed mainly to the lack of continuous awareness creation amid the changing lake environmental conditions and dynamics in the specific species fishery. There is a need to sustain the achievements attained so far in promoting co-management and ecosystem sustainability, as enforcement of laws and regulations can be a challenging undertaking without government support. Governments should ensure financial and material provision to expand the capacity of co-management units to promote community livelihoods and fishery sustainability.

Key words: Lake Victoria, co-management, climate change, impacts, Kenya.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 Background

Co-management has been promoted as a way to improve the effectiveness and efficiency of fisheries management for at least the last twenty years, recognising that the inclusion of resource users in management should promote understanding, ownership, and commitment (Nunan, 2010). A desk study on the governance of the Lake Victoria fishery revealed that the fishery was experiencing management problems because of illegal fishing and poverty in the fishing communities. Co-management was adopted in 1997 in Lake Victoria as a solution to these problems that threatened the sustainability of the fishery (Kateka, 2010).

Fisheries co-management, a collaborative approach involving government bodies, local communities, and other stakeholders, plays a crucial role in sustainable fisheries management. However, the efficacy of co-management strategies in the face of climate change has become a subject of growing concern. Prior to the late 1990s, Lake Victoria fisheries management was conducted through centralised state-controlled fisheries authorities with little or no provision for involving fisheries stakeholders in the decision-making process (Lwenya & Abila, 2003; Ogwang & Nyeko, 2009). However, this management system failed to sustain fisheries for those dependent on the resource for their livelihood. These approaches to co-management and governance raise conceptual and practical challenges in developing appropriate systems and processes that can be flexible, responsive, power-sharing, and able to draw and act on multiple sources of knowledge (Nunan, 2010).

The co-management approach involves collaboration among government agencies, local communities, and other stakeholders. The principle behind co-management is that some responsibility for the management of resources should be transferred from the state to the resource user groups. Sen and Nielsen (1996:407) define co-management as an arrangement in which the responsibility for resource management is shared between the government and user groups. Jentoft et al. (1998:423) define it as "...the collaborative and participatory process of regulatory decision-making among representatives of user groups, government agencies and research institutions." Therefore, co-management is a collaborative agreement between the government and user groups, in which both parties share authority for resource management to varying degrees. The basis of co-management is that neither local communities nor central governments can successfully manage common resources on their own. Therefore, collaborative managerial agreements between states may ameliorate some of the problems of command-and-control regimes described above. In addition, Jentoft et al. (1998) argue that resource users should be allowed to participate in regulatory decision-making, implementation, and enforcement because they have extensive knowledge and experience of the resource base and its dynamics. Furthermore, their participation in management legitimises the managerial process (Dubbink and Vliet, 1996; Jentoft et al., 1998).

Co-management formation can be traced from the regional, national, district, and finally, local or beach levels. For Lake Victoria, fishing communities participate in co-management through organisations called Beach Management Units (BMUs). BMU is defined as 'an organisation of fisher folk at the beach (boat crew, boat owners, managers, charterers, fish processors, fishmongers, local gear makers or repairers and fishing equipment dealers) within a fishing community' (LVFO, 2008).

At the regional level, the Lake Victoria Fisheries Organisation (LVFO), funded by the European Union, organises the drafting of harmonised BMU guidelines for the riparian states. This was done in 2004, and capacity building (raising awareness) was conducted from 2004 to 2005. Several workshops have been held at the regional level for riparian fisheries officers, fisher folk representatives, NGOs, and other stakeholders to create awareness of co-management (Etiegni, Irvine, & Kooy, 2020). At the National level, the development of national BMU guidelines and regulations was done in 2006 and 2007. Capacity building to create awareness was conducted in 2007. Workshops/meetings held for fisher folk and other stakeholders on draft BMU guidelines and regulations. Fisheries officers in Lake Victoria (Kenya) riparian districts organised meetings for fisher folk and other stakeholders on draft BMU guidelines and regulations. At the local level, the development of BMU structures and beach-specific by-laws started in 2006 using harmonised BMU guidelines, with fisher folk, fisheries officers, and local leaders (chiefs and village heads) involved in demarcating BMU boundaries. BMU leaders were also elected, and beach by-laws were developed by fisher folk under the guidance of fisheries officers. The by-laws were submitted to the Director of Fisheries for approval.

In Kenya, Fisheries are managed by the Kenya Fisheries Service, a corporate body established under the Fisheries Management and Development Act No. 35 of 2016. The purpose of the service is to conserve, manage, and develop Kenya's fisheries and aquaculture resources. Fisheries management employs co-management which involves sharing roles and responsibilities for resource management between the government, resource users, and civil society. Successful co-management requires certain essential conditions to be met. First, it requires an appropriate institutional and organisational framework for the governance of common property resources. Second, resource user groups must be adequately organised to act collectively for their common good. As Baland and Plattean (1996) point out, co-management may have very little success if user groups are incapable of collective action to manage resources. Olson (1965) explains why communities may not act collectively to solve common or public problems, and by extension, why co-management may be difficult to establish. Co-management is based on the idea that some responsibility for resource management should be passed from the state to the resource user groups. As a result, co-management is a collaborative agreement between the government and user groups in which both sides share resource management responsibilities to varying degrees.

As climate change continues to impact ecosystems, including aquatic environments, it is crucial to assess how existing co-management strategies align with evolving environmental conditions. Through co-management strategies, the governments have delegated some management and revenue-raising responsibilities to Beach Management Units (BMUs), thereby giving fisheries communities a clear stake in the governance of fisheries resources. Therefore, the focus of this study is to assess the nature preparedness of co-management stakeholders amidst uncertain climate change consequences for fisheries by studying both BMUs and the government.

1.2 Rationale

There is a need to comprehensively understand and evaluate the effectiveness of fisheries co-management in Lake Victoria, Kenya, particularly in the face of the escalating challenges posed by climate change. As climate change continues to impact ecosystems, including aquatic environments, it is crucial to assess how existing co-management strategies align with evolving environmental conditions. By conducting a Stakeholder Preparedness Evaluation, this study aims to discern the adaptability and resilience of fisheries co-management in addressing the dynamic interplay between climate change and the sustainable management of Lake Victoria's

fisheries resources. The insights gained from this study can inform policymakers, resource managers, and stakeholders about the potential enhancements needed in the co-management approach to ensure the long-term sustainability of fisheries in the region.

2 STUDY OBJECTIVES

2.1 General objective

This study was designed to explore the effectiveness of fisheries co-management strategies in the wake of climate change and assess stakeholders' readiness to address these challenges. This study aims to discern the adaptability and resilience of fisheries co-management in addressing the dynamic interplay between climate change and the sustainable management of Lake Victoria's fisheries resources.

2.2 Specific objectives

i. Assess how the present management practices under the Beach Management Unit (BMU) incorporate locals and their perceptions of climate change and its effects on fisheries.
ii. Assess the preparedness of stakeholders (communities, government, NGOs) through the assessment of selected BMUs to adapt co-management practices to combat climate change.
iii. Assess the challenges and expectations of BMUs amidst climate change impacts on fisheries.

3 LITERATURE REVIEW

3.1 Relationship between fisheries co-management and the challenges posed by climate change.

Climate change is reshaping the world's landscapes and impacting ecosystems, economies, and societies. As the effects of climate change become more pronounced, vulnerable populations often lack the resources to adapt and are at an increased risk. Social protection measures, encompassing policies and programs designed to enhance the resilience and well-being of communities, have emerged as critical components in addressing the social implications of climate change. Climate change is likely to have multifaceted impacts on Lake Victoria fisheries, affecting the ecological balance, socio-economic aspects, and traditional practices of communities dependent on the lake for their livelihoods. Effective adaptation and mitigation strategies and international cooperation are essential for addressing these challenges and ensuring the long-term sustainability of Lake Victoria fisheries.
Climate change poses a significant threat to communities worldwide, affecting the environment and exacerbating social vulnerabilities. The impacts of climate change, such as extreme weather events, rising sea levels, and shifts in temperature patterns, can disproportionately affect already marginalised and vulnerable populations. In response to these challenges, the concept of integrating social protection measures with climate change adaptation and mitigation strategies has gained prominence in recent years.

3.2 Climate change and Lake Victoria basin

The waters and coastlines of Lake Victoria will progressively experience the detrimental effects of climate change. The survival of aquatic life may be impacted by interannual and interseasonal variability in temperature and rainfall, which would increase the variability of fish harvests. In addition, inland agriculture yield uncertainties would attract additional fishers each year. The ongoing influx of political and environmental refugees into the basin and fishery is likely to increase under all climate change scenarios (Myers, 2002; Awange and On'Gan'ga, 2006). Although comprehensive research incorporating the possible biophysical, ecological, and social effects of climate change is still needed, climate scientists have already discovered broad patterns and projected the effects of climate change on the basin.

Hydrologists applying climate change scenarios to the water balance of the lake predict a fall in lake levels by2030 and a subsequent rise by 2080 (Tate et al., 2004). Lake-level declines in recent times support these forecasts and imply that certain models might be overly cautious.

In addition to having an impact on the lake's hydrology, biological, and ecological processes, these variations will have a major impact on public health in terms of disease outbreaks and the availability of sufficient supplies of drinkable water. Climate change will lead to a rise in vector- and waterborne illnesses, such as malaria and cholera, in addition to a decrease in the amount of freshwater available.

Furthermore, the number of phosphorus-rich sediments entering the lake is expected to increase in tandem with the estimated increase in storm event severity under future climate change scenarios. More stressors for the social-ecological life in the basin will probably result from this increased nutrient loading, which will also probably worsen the lake's ongoing eutrophication and declining oxygen availability (Johnson, 2009)

Changes in temperature and other environmental factors may favour certain fish species while disadvantaging others. This can result in shifts in the composition of fish species in the lake, impacting biodiversity and potentially leading to the decline of some commercially important species. These events can disrupt fishing activities, damage fishing infrastructure, and affect the overall resilience of local fisheries.

Although Lake Victoria is a landlocked freshwater lake, changes in precipitation patterns and hydrological cycles influence its water levels. Changes in water level may affect shoreline ecosystems, breeding grounds, and habitats that are critical for fish reproduction. The socio-economic impacts of climate change on Lake Victoria fisheries are significant. Fishing communities heavily depend on lakes for their livelihoods, and any changes in fish abundance, distribution, or composition can have direct implications for food security and income.

Changes in fish distribution and abundance may lead to increased competition among fishing communities for limited resources. This can potentially exacerbate existing conflicts over fishing grounds and resource availability. Climate change poses challenges to the adaptation of fisheries management strategies. Traditional knowledge may become less reliable as climate patterns shift, requiring adaptive and flexible approaches to sustainably manage the fisheries.

The impact of climate change on Lake Victoria fisheries also emphasises the importance of international collaboration. Shared management strategies and cooperation among riparian countries are crucial for addressing the common challenges related to climate change.

3.3 Fisheries co-management and climate change

Numerous studies have highlighted the historical successes of fisheries co-management in promoting sustainable resource use and community engagement. However, a consensus has emerged that the effectiveness of co-management may be compromised by climate change-induced disturbances.

Integrating climate adaptation measures into co-management frameworks is crucial for addressing evolving ecological conditions and safeguarding livelihoods. Institutional frameworks are key to enhancing or hindering the adaptive capacity of fisheries co-management. Effective institutions are crucial for facilitating the integration of climate-related considerations, fostering communication, and enabling the flexibility required to respond to changing conditions. Community involvement is a cornerstone of co-management success. It is necessary to highlight how social capital within fishing communities can be leveraged to enhance resilience. However, climate change can strain social networks, making it imperative to understand the dynamics of social capital in the context of environmental stress.

Several studies have identified barriers to the effective integration of climate change considerations into fisheries co-management. These include limited financial resources, institutional rigidities, and a lack of awareness or understanding of climate impacts among stakeholders (Daboh, 2020; Lwenya and Abila, 2003).

There is a need for an innovative co-management model that explicitly addresses climate change challenges. Adaptive co-management, which emphasises learning and adjusting strategies in response to changing conditions, has emerged as a potential framework for enhancing the resilience of fisheries co-management.

Indigenous knowledge systems are acknowledged for their potential contributions to adaptive co-management. Studies highlight the importance of incorporating traditional ecological knowledge into co-management approaches, recognising the valuable insights of local communities in responding to climate change impacts.

4 METHODOLOGY

4.1 Study area

Lake Victoria is one of Africa's great lakes and the second largest freshwater lake in the world, occupying a surface area of 68,000 km^2. The lake is shared by three countries: Uganda (43%: 31, 000 Km^2), Tanzania (51%: 33,700Km^2) and Kenya (6%: 4,100 Km^2) (Aura *et al.* 2013). This study was conducted in Kenya's portion of the Lake, which has five administrative units (counties): Kisumu, Siaya, Busia, Homabay, and Migori (Figure 1)**Error! Reference source not found.**.

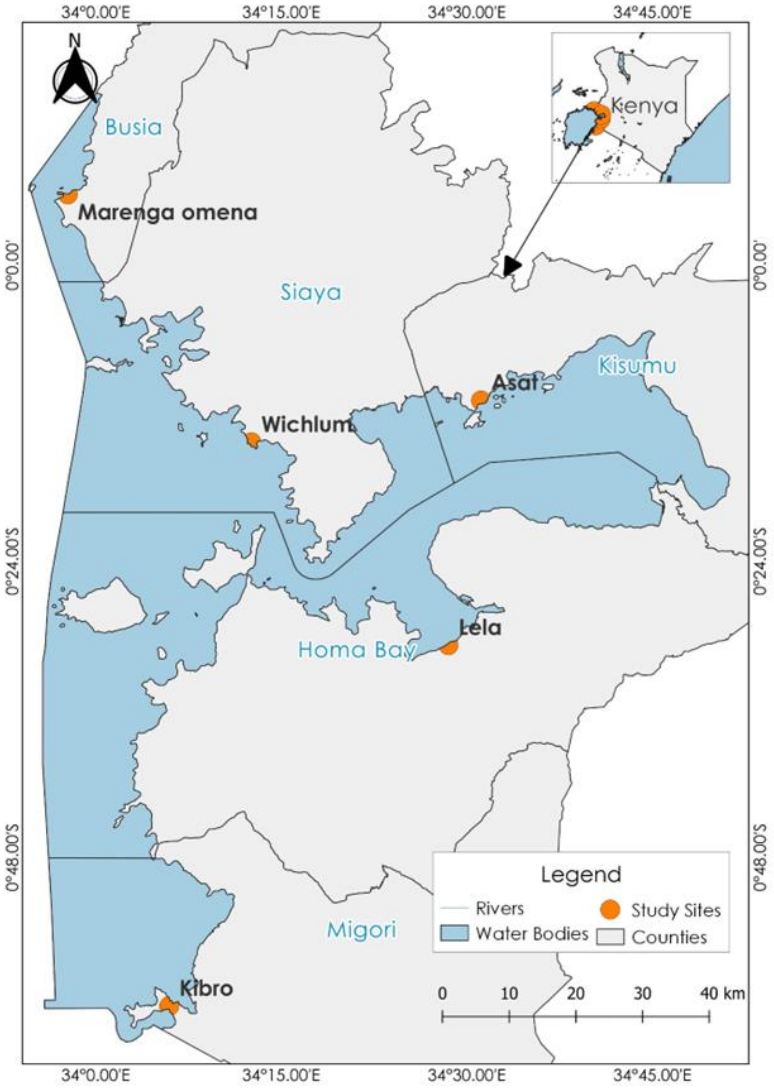

Figure 1. Location of Lake Victoria, Kenya, showing the administrative counties and respective beaches where data collection was conducted (author's own source).

Primary data collection for this project was conducted in two ways: using structured questionnaires and key informant interviews (see Appendix 1). Structured questionnaires were digitally administered to fishers, processors, BMU members, traders, and other fisheries stakeholders. Key informant interviews were limited to BMU leaders, BMU committee members, CBO leaders, and Fisheries Officers attached to the various locations. Prior to the survey, to determine the suitability of the structured questionnaires used in this study, a pilot (pre-test) of the questionnaires was conducted in one location. The final survey questionnaire was prepared, and questions were digitised into the Kobo toolbox in readiness for data collection in the five Lake Victoria Riparian counties. Data collectors were drawn from the KMFRI Kisumu socioeconomic department due to their vast experience in social data collection. They liaised with the BMU leaders, village elders, and fisheries officers of the selected beaches to obtain respondents. One beach was selected per county in all five Lake Victoria Riparian counties. Asat, Kibro, Lela, Wichlum and Marenga Omena beaches were respectively selected for Kisumu, Migori, Homabay, Siaya and Busia Counties. The location and size of the beaches were the main factors considered during the selection for accessibility and to have a mixture of small,medium, and large beaches involved. The targeted respondents

were all resource users directly involved in fishing activities, as they were best equipped to understand the reality of the situation. They were randomly selected from a list provided by the community and BMU leaders. The purpose of targeting different respondents (fishermen, processors, traders, and BMU members) was to obtain an independent and balanced assessment of the BMUs performance and the implementation of co-management policies amidst the impacts of climate change. The data collection process was effective due to the long history of work among the data collectors, BMU leadership, and fisheries officers. Nonetheless, some traders exhibited non-cooperative postures as they were in a rush to purchase the landed catches and therefore did not pay much attention to the interview. Ninety-nine people responded to the questionnaires (Appendix 1), each lasting for about 45 minutes, and 15 BMU leaders and five Fisheries Officers were interviewed (Appendix 2). Both random and non-random sampling techniques were used. Random sampling was used to select respondents for the structured questionnaires, while non-random sampling was used to target BMU leaders and fisheries officers attached to the five regions. This was necessary to target individuals with the best knowledge of the topic. Data collection lasted for two weeks. Secondary data were obtained from government documents, archival material, published studies, and consultant reports on co-management in Kenya and East Africa, which provided additional details.

4.2 Data processing and analysis

Completed questionnaires were downloaded into Microsoft Excel, and the data were cleaned for further analysis using both Excel and R-Studio. Quantitative data were analysed using Excel, and summaries of the data were generated as frequencies, means, and percentages and presented in tables and charts. More detailed statistical analyses of variable responses were performed for selected data (or questions/responses) using mainly cross-tabulations. For the KIIs, a content analysis method was used to analyse qualitative information, particularly taped dialogues which were broken into meaningful themes or tendencies. Responses on the assessment of BMU performance on fisheries management activities (from structured questionnaires) were subjected to further analyses using a chi-square (χ 2) test to examine whether there were significant differences between the expected and observed frequencies and to assess whether there was a significant difference between BMUs in undertaking their activities. This is essential because chi-square tests enable the testing of formal hypotheses about the independence of probabilities for different categories of respondents. The null hypothesis is a statistical independence. Statistical significance in this case implies that the differences are sufficiently unlikely to be due to chance alone but may be indicative of systematic factors, that is, the probabilities are dependent on categories. The ordinal probit regression model was used to analyse ordered categorical variables (Pfarr et al., 2010). Many of the results from the study were measured on ordered scales, such as not effective to very effective. They were based on a 5-point Likert scale (Joshi et al., 2015) categorical variables with 1 indicating not effective and 5 very effective respondents reported opinions on the BMUs in Lake Victoria, Kenya.

4.3 Weighted Average Score

To calculate the weighted familiarity score, numerical values were assigned to each response category, reflecting the level of familiarity, for example, with the causes and consequences of climate change. These values were chosen to represent the intensity of familiarity on a scale from 0 to 5, where a higher number indicates a greater familiarity: Very familiar: 5, Somewhat familiar: 4, Neutral: 3, Not very familiar: 2, Not familiar at all: 1, and Do not know: 0 (this typically represents a lack of familiarity, but for calculating averages, it does not contribute to

the total familiarity score). Each response was then mapped to its numerical value based on the assigned scale. Each numerical value was multiplied by the number of responses it received to obtain the total contribution of each familiarity level to the overall score. All these weighted contributions were summed to obtain a single numerator. This sum was divided by the total number of responses (excluding 'Do not know' if not contributing to the familiarity score) to obtain the average familiarity score.

Variable	N	**Busia**, N = 20[1]	**Homabay**, N = 20[1]	**Kisumu**, N = 20[1]	**Migori**, N = 20[1]	**Siaya**, N = 19[1]	**p-value**[2]

5 RESULTS AND DISCUSSION

The following sections present analyses and discussions on the efficacy of BMUs in Lake Victoria, Kenya, to combat the impacts of climate change. The analyses and discussions mainly focused on the BMUs performances, challenges, and expectations in BMUs inlight of climate change and whether there are adaptive strategies to combat climate change impact within Lake Victoria, Kenya.

5.1 Demographic characteristics of respondents

There were 99 responses in total, of which 67% were men. The respondents' ages ranged from 18 to 50 years. Roughly 86% of the respondents in each of the five sampled regions completed primary or secondary schooling. A society's potential to flourish depends greatly on the human resource capacity of its educated populace, and education is crucial for the sustainability of natural resources. Most resource actors in artisanal fisheries, particularly in developing nations, lack formal schooling. In this case, the goal of management is challenging. The findings show that, in contrast to non-formal education, the majority of BMU members targeted at least completed primary or secondary schooling (Table 1).

The study (Table 1) revealed that most parameters had no significant difference, with p-values exceeding 0.03. All five riparian counties of Lake Victoria, Kenya, were targeted in this study. Above 80% of the respondents were married, and the study also revealed that the majority of the respondents were fishermen, 51(n=99). The study also shows a significant difference in the years of experience of the respondents across the five countries.

Table 1. Demographic characteristics of respondents

Gender	99					0.3
Female		7 (35%)	8 (40%)	8 (40%)	7 (35%)	2 (11%)	
Male		13 (65%)	12 (60%)	12 (60%)	13 (65%)	17 (89%)	
Marital_status	99					0.5
Married		17 (85%)	17 (85%)	19 (95%)	18 (90%)	15 (79%)	
Separated		0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (5.3%)	
Single		3 (15%)	3 (15%)	0 (0%)	1 (5.0%)	2 (11%)	
Widowed		0 (0%)	0 (0%)	1 (5.0%)	1 (5.0%)	1 (5.3%)	
Age	99					
18 - 35		10 (50%)	12 (60%)	3 (15%)	9 (45%)	7 (37%)	
36 - 50		4 (20%)	6 (30%)	11 (55%)	8 (40%)	12 (63%)	
Over 50		6 (30%)	2 (10%)	6 (30%)	3 (15%)	0 (0%)	
Education	99					
No formal education		1 (5.0%)	0 (0%)	1 (5.0%)	1 (5.0%)	0 (0%)	
Primary school		11 (55%)	6 (30%)	10 (50%)	11 (55%)	10 (53%)	
Secondary school		4 (20%)	10 (50%)	8 (40%)	7 (35%)	9 (47%)	
Tertiary Education		4 (20%)	4 (20%)	1 (5.0%)	1 (5.0%)	0 (0%)	
Years_experience	99	5 (2, 9)	8 (3, 13)	12 (10, 19)	15 (10, 20)	4 (0, 10)	<0.001
Familiarity with co-management	99	13 (65%)	15 (75%)	13 (65%)	18 (90%)	6 (32%)	0.003

[1]n (%); Median (IQR)

[2]Pearson's Chi-squared test; Fisher's exact test; Kruskal-Wallis rank sum test

5.2 Causes, consequences and familiarity with climate change

The study revealed that the main causes of climate change are deforestation (82%), industrialisation (43%), rainfall (23%), and GHGs (21%), while the main consequences are food insecurity (64%), drought (60%), rainfall (57%), fish stock change (56%), and poor human health (52%) (Figures 2 and 3). Climate change is primarily caused by human activities such as burning fossil fuels, deforestation, and industrial processes that release greenhouse gases. These emissions trap heat in the Earth's atmosphere, leading to rising global temperatures and a range of consequences. The study shows that the respondents were more conversant with the consequences than the causes. Addressing these causes and consequences requires global efforts to reduce emissions, transition to renewable energy, and adaption to changing climates.

The weighted average score for familiarity with the causes and consequences of climate change in Lake Victoria was 3.59 (see Figure 4).

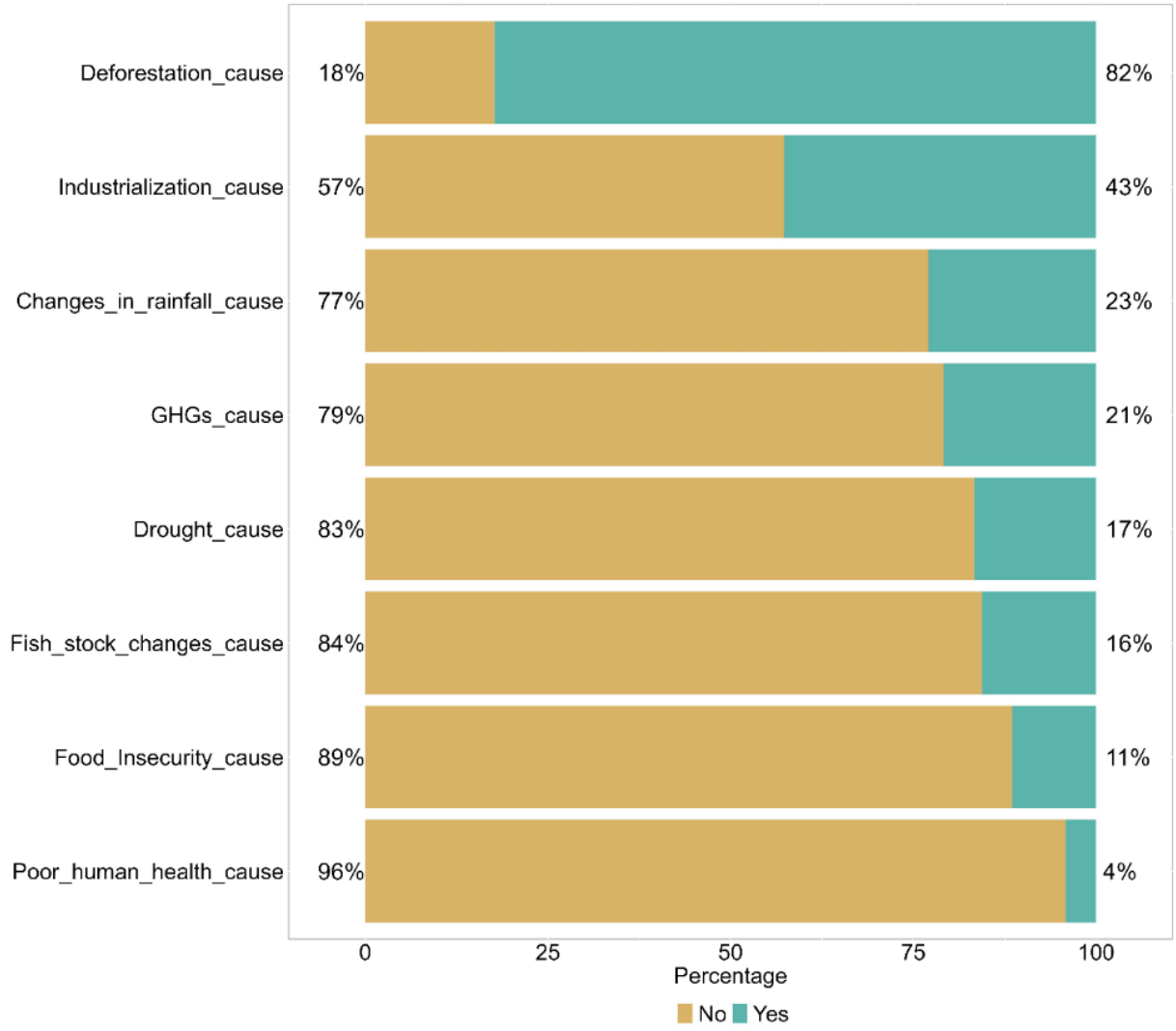

Figure 2. Demographic characteristics of the respondents.

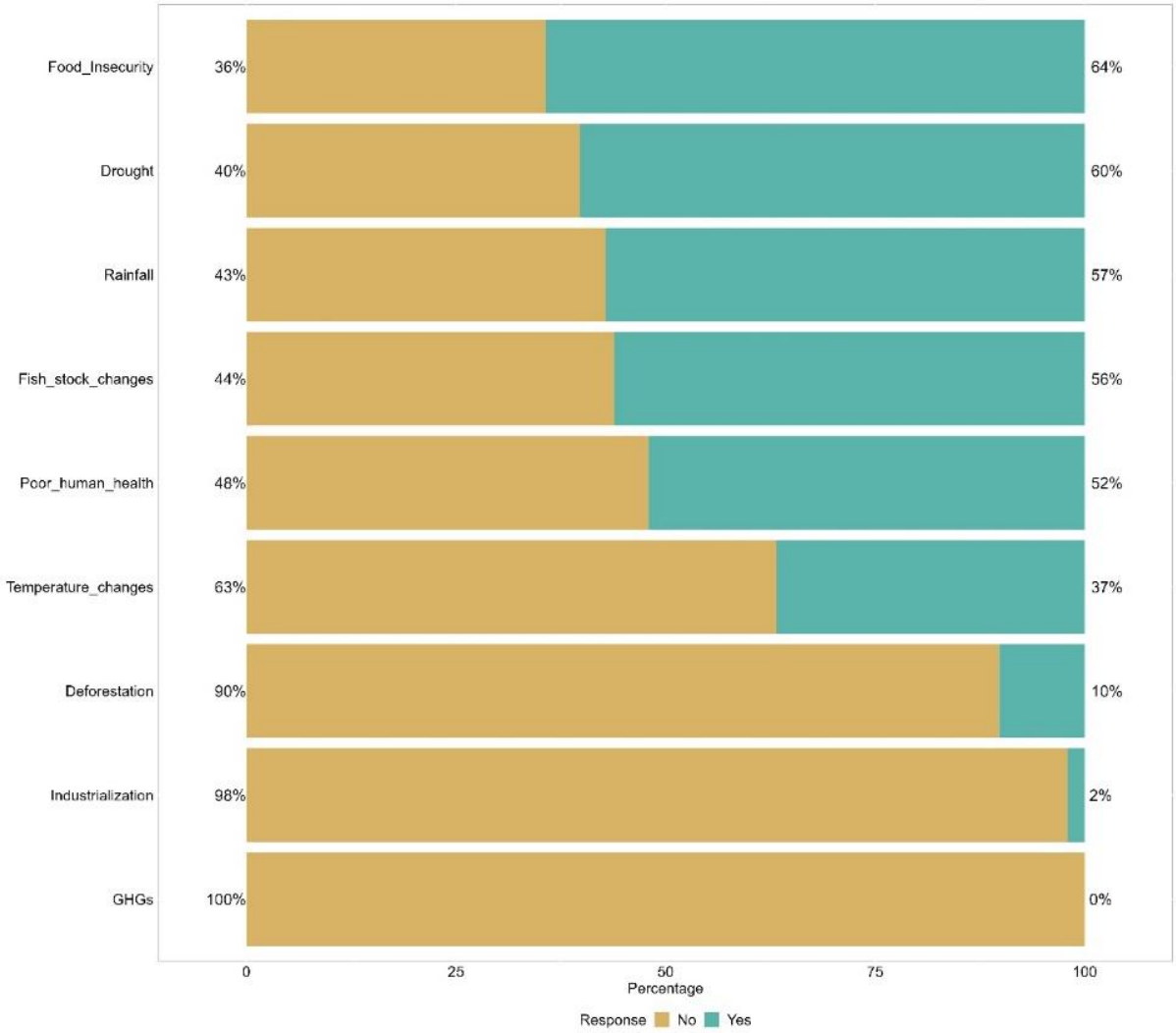

Figure 3. Perceptions of respondents on the consequences of climate change.

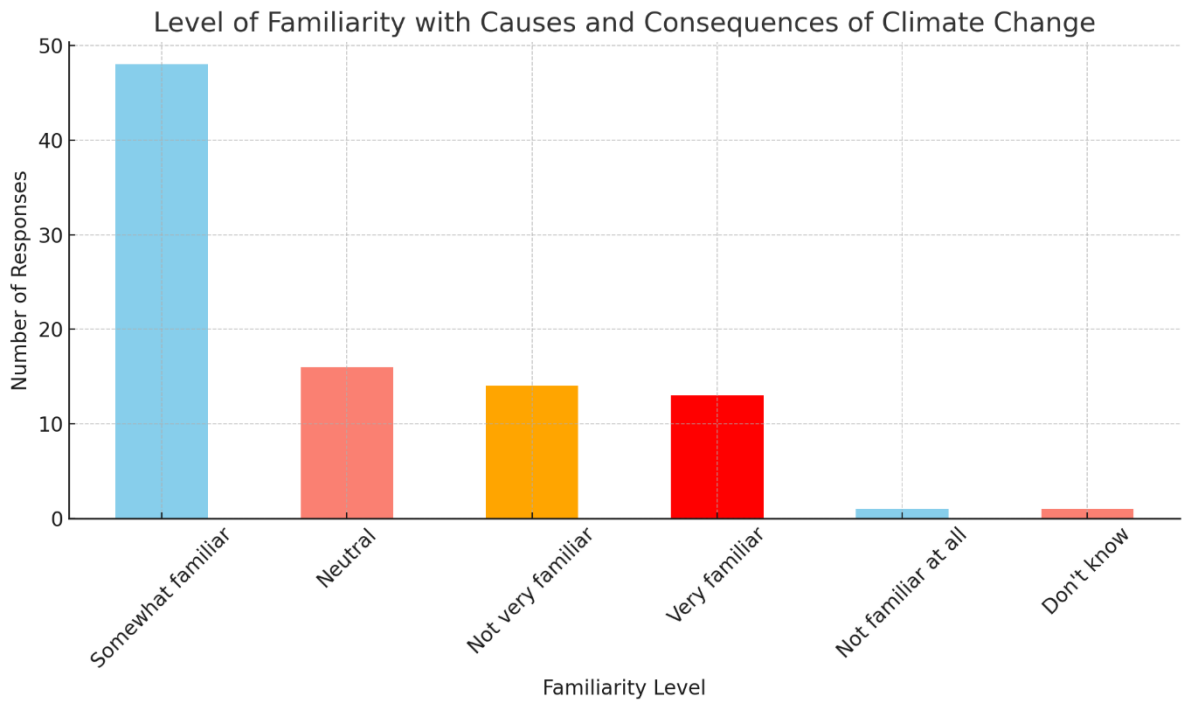

Figure 4. Level of familiarity with the causes and consequences of climate change.

5.3 Awareness of the impacts of climate change among stakeholders.

The survey results indicate that 93.9% (Figure 5) of the respondents were aware of climate change. Despite the majority of the respondents being aware of climate change, only 34.4% (Figure 6) agreed on evidenced climate change impact adaptation strategies within the co-management framework. The two pie charts display the stakeholders' levels of awareness of climate change. This shows a clear division between those who are aware and those who are not, indicating the need for enhanced educational and awareness programs. The pie chart (Figure 6) demonstrates the reported successful adaptation to climate change within the co-management initiatives around Lake Victoria. It highlights both the presence and absence of reported adaptations, suggesting areas where further development and documentation of effective practices are required.

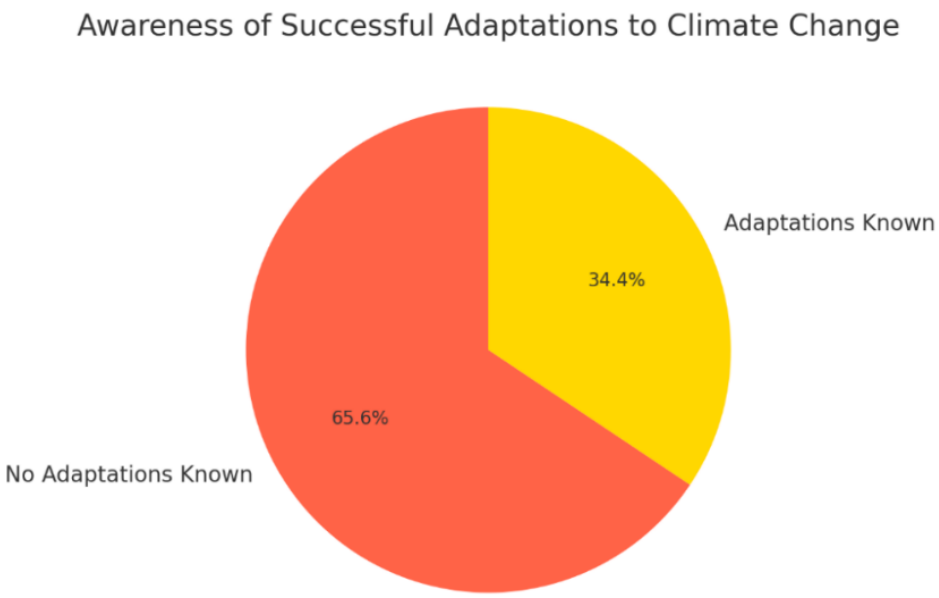

Figure 5. Awareness of adaptation strategies to climate change impacts.

5.4 Stakeholders' preparedness to adapt co-management practices to combat climate change.

Figures 6– 11 provide insights that help reveal the perspectives and experiences of different stakeholders within the co-management framework, providing an understanding of how roles may influence attitudes and knowledge about managing fisheries in the face of climate change. It is clear across the different stakeholders that people know of the existence of co-management 50%, 50%, 69%, 65% and 79% for BMU members, BMU leaders, fish traders, fishers, and others respectively agree to be aware of co-management (Figure 5). As shown in Figure 7, while the stakeholders are aware of co-management, most are only somewhat knowledgeable about what co-management entails. There is a mixed reaction regarding the integration of climate change initiatives within co-management. Only fishermen (42%) feel that climate change considerations are strongly integrated (Figure 8), and 50% of the BMU leaders feel that there is no integration, while 58% of the fish traders do not know whether there is integration. The study revealed that most respondents believed that there was collaboration among the different stakeholders of fisheries co-management in Lake Victoria, although the reactions were mixed. Of the BMU leaders, 50% totally believe that collaboration exists, 47% of the fishers believe, while 38% of the fish traders and other stakeholders as per this study do not believe that there is collaboration. Most stakeholders are only moderately educated and informed about co-management and climate change.

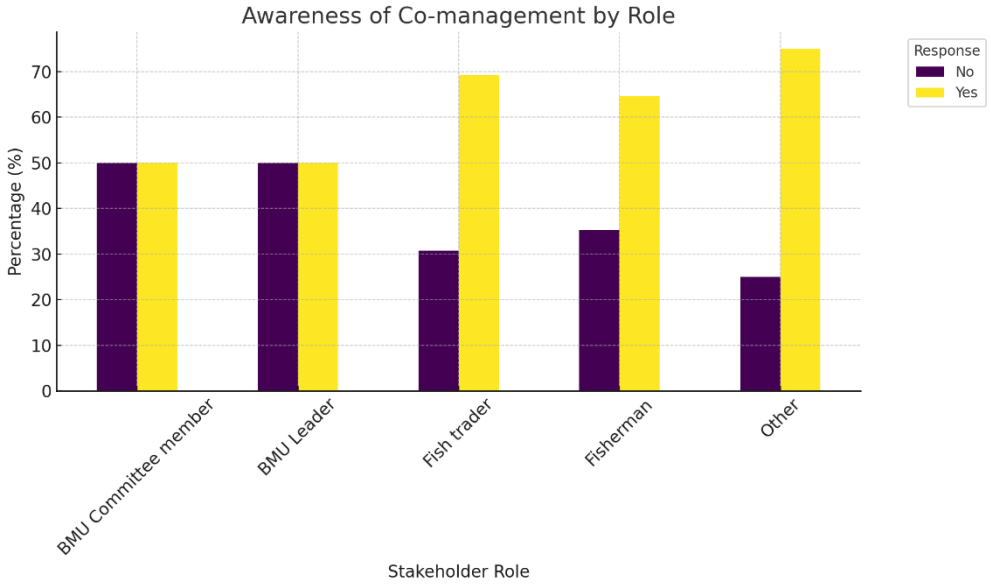

Figure 6. Co-management awareness by each role.

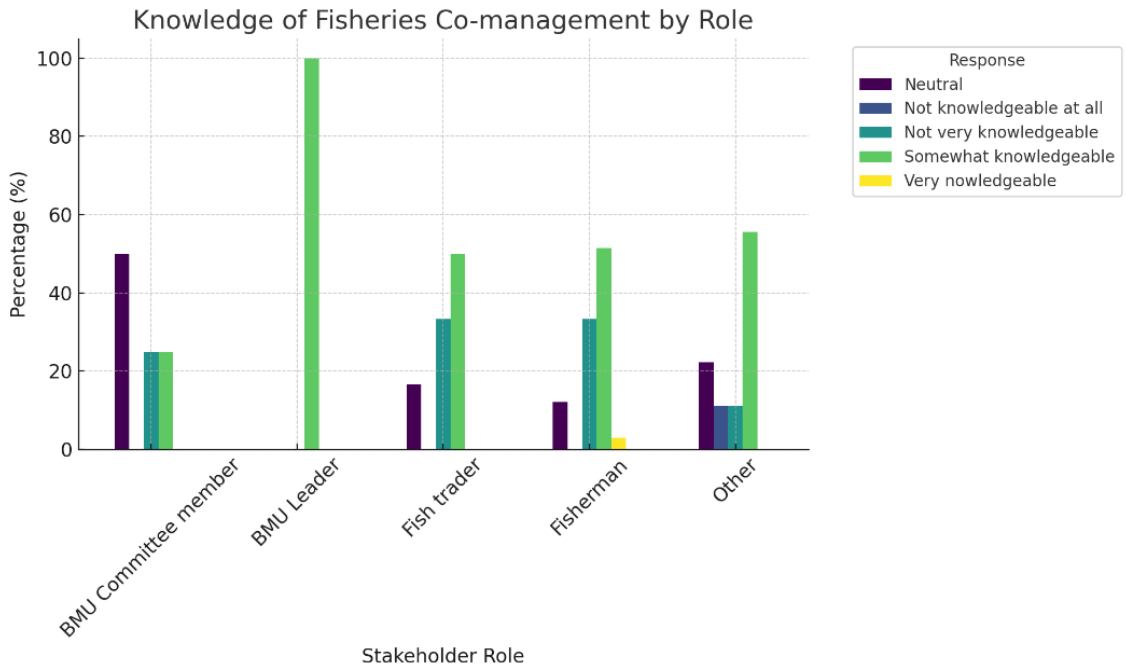

Figure 7. Knowledge of fisheries co-management by role.

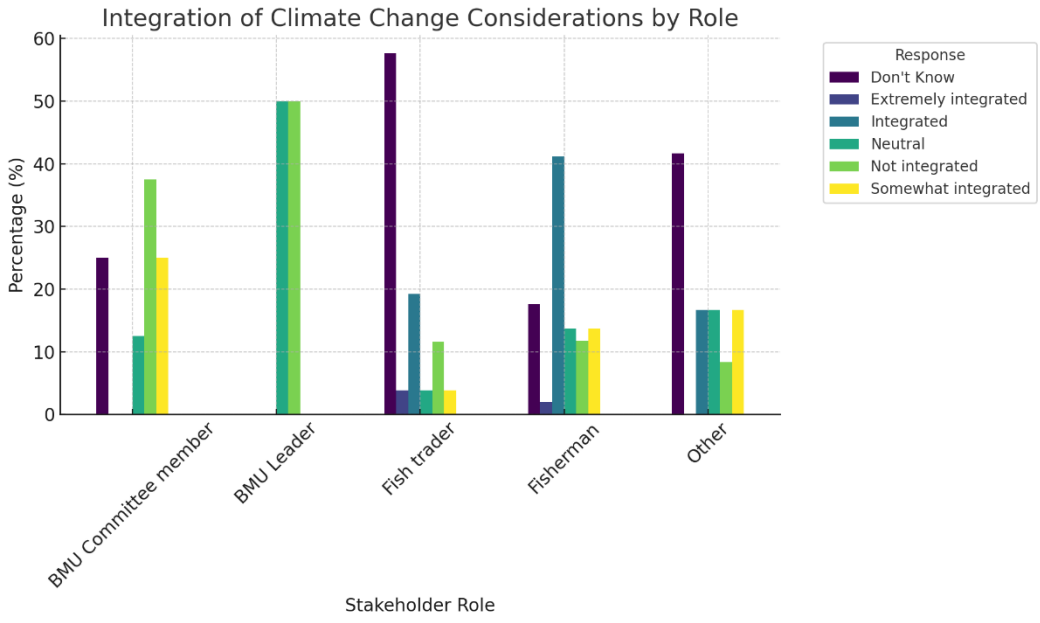

Figure 8. Perceptions of how well climate change considerations are integrated into co-management practices across different roles.

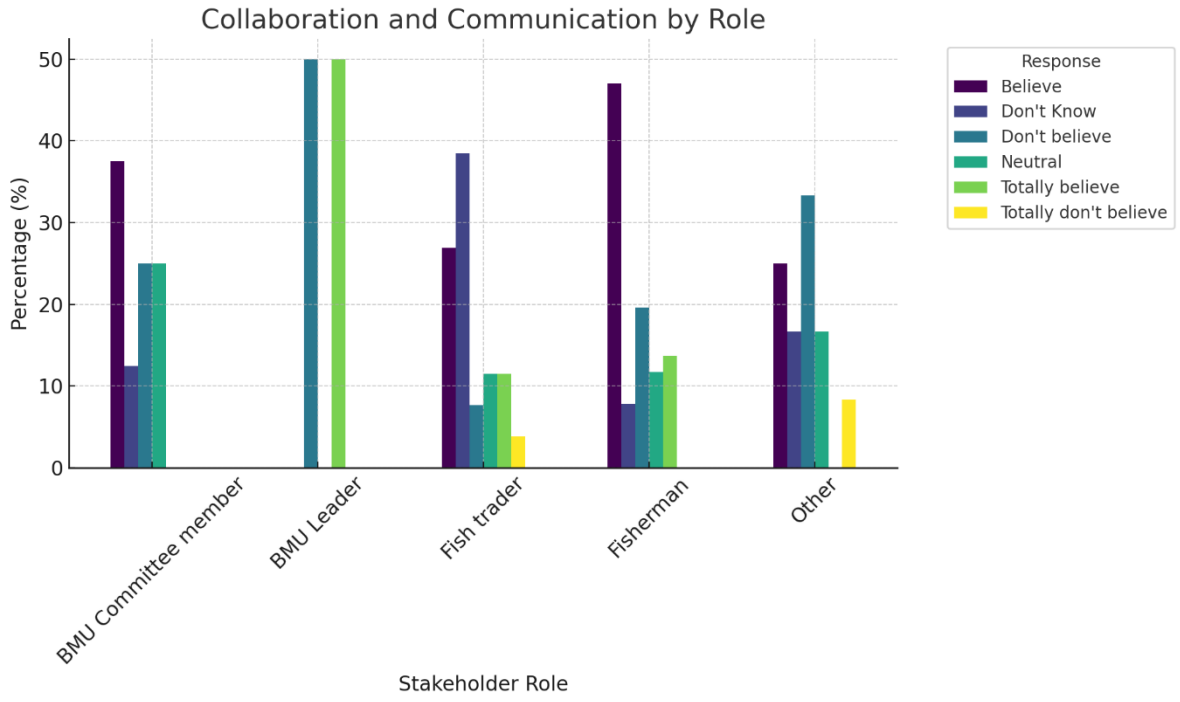

Figure 9. Perceived level of collaboration and communication among stakeholders from different roles.

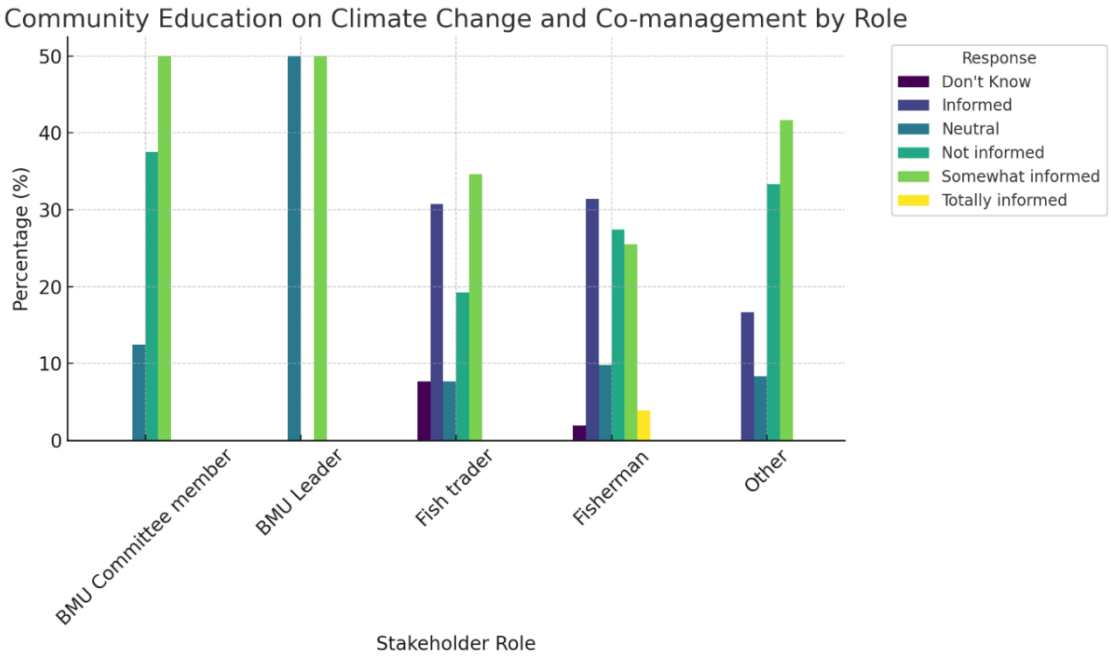

Figure 10. How informed and educated stakeholders feel about climate change impacts on fisheries and co-management strategies, segmented by role.

5.5 Word puzzle visualisation and sentiment analysis of the remarks on co-management and climate change impacts.

The word cloud visualises the most common words and phrases found in the final remarks on co-management and climate change impacts provided by the respondents. This graphical representation helps quickly identify the key themes and concerns that are top of mind for stakeholders. Words such as "management", "climate", "change", and "fisheries" appear prominently, indicating a strong focus on these areas. The strong focus on climate-related terms suggests that stakeholders are highly aware of and concerned about their impact. Terms related to management indicate ongoing discussions on how fisheries co-management can be improved or adapted to better handle the challenges posed by climate change.

A sentiment analysis of the survey responses was performed. This analysis helped us understand the overall sentiment—positive, negative, or neutral—toward the current state of fisheries co-management and climate change impacts among the stakeholders. This provides deeper insight into how stakeholders feel about the effectiveness and challenges of co-management practices. The mean Sentiment Score was 0.085, indicating a slightly positive overall sentiment, and the standard deviation was 0.195, showing moderate variability in sentiment across responses. This ranges from Range of Sentiment from -0.413 (most negative) to +0.600 (most positive).

Figure 11. Word cloud visualisation remarks on co-management and climate change impacts.

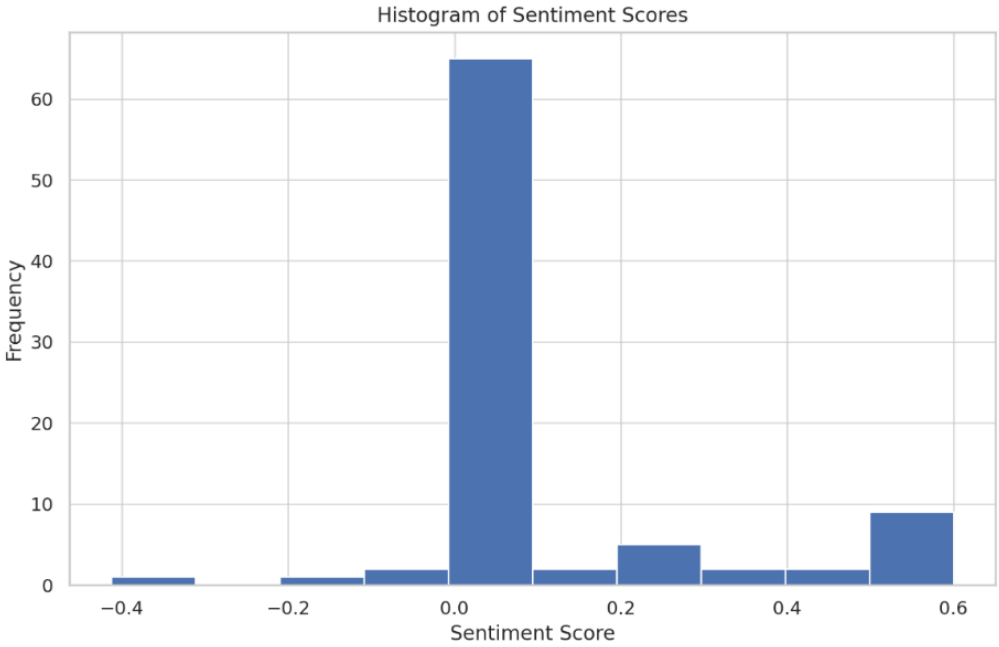

Figure 12. Sentiment score for the general remarks of the respondents.

5.6 Discussion of the challenges and expectations of BMUs amid climate change impacts on fisheries.

Fisheries co-management is an approach that has been accepted internationally in response to the apparent failure of centralised management of fisheries in averting the decline of fish stocks and the lack of capable government agencies to effectively manage fisheries resources and tackle socio-economic issues arising from fisheries (Daboh, 2020). The study revealed that the main causes of climate change, as identified by respondents, were deforestation, industrialisation, rainfall patterns, and greenhouse gas emissions. These findings align with the scientific consensus, which attributes climate change primarily to human activities, including the burning of fossil fuels, land-use changes, and industrial processes. The high percentage of respondents identifying deforestation as a leading cause underscores the significance of land use practices in shaping climate dynamics in the region.

The survey indicated a high level of awareness among respondents regarding climate change, with 93.9% acknowledging its existence. This finding underscores the recognition of the significant environmental challenges facing the region, particularly in the context of the Lake Victoria fisheries. Despite widespread awareness of climate change, only 34.4% of respondents reported the presence of evidence-based climate change adaptation strategies within the fisheries co-management framework. This discrepancy suggests a gap between awareness and action, indicating the need for more effective integration of climate change considerations into co-management practices.

Interestingly, the study found that respondents demonstrated a higher level of familiarity with the consequences of climate change than with its causes. Food insecurity, drought, changes in

rainfall patterns, fish stock fluctuations, and adverse impacts on human health were the most prominent consequences identified by the respondents. This indicates a strong recognition of the tangible impact of climate change on livelihoods, ecosystems, and human well-being in the Lake Victoria region.

The disparity in respondents' familiarity with the causes and consequences of climate change has important implications for fisheries co-management strategies. Although awareness of climate change consequences is relatively high, there appears to be a need for greater education and awareness-building efforts focused on understanding the underlying causes. Strengthening the knowledge base of local communities regarding the drivers of climate change can enhance their capacity to advocate and participate in climate mitigation and adaptation initiatives within the fisheries sector. The weighted average score for familiarity with the causes and consequences of climate change reflected a moderate level of understanding among the respondents. This underscores the importance of integrated approaches that address both mitigation and adaptation strategies within fisheries co-management frameworks.

Efforts to enhance stakeholder awareness and capacity building should be complemented by actions to address the root causes of climate change, such as reducing emissions from deforestation and transitioning to renewable energy sources.

While stakeholders demonstrate awareness of co-management principles, the survey revealed varying levels of understanding and knowledge regarding its implementation. While some stakeholders are familiar with co-management, others have limited knowledge of its intricacies, indicating the need for targeted capacity-building efforts and educational programs. Stakeholders have mixed perceptions of integrating climate change initiatives into the co-management setup. While some believe that climate change considerations are strongly integrated, others express uncertainty or scepticism about this. Similarly, opinions on collaboration among different stakeholders vary, with some expressing confidence in existing partnerships and others questioning their effectiveness and efficiency.

The sentiment analysis of the survey responses revealed a slightly positive overall sentiment toward the current state of fisheries co-management and climate change impacts. Although there was variability in sentiment across responses, the mean sentiment score indicated a generally optimistic outlook tempered by moderate variability in perceptions and experiences.

Weather changes can lead to fisher drowning. Pollution from upstream sources leads to reduced fish stocks and production. Strong winds reduce fish stocks and pose a risk of drowning to fishers. Rising lake water has submerged bandas at many fish landing sites across Lake Victoria. Increased levels of pollution, including waste disposal through runoff into the lake, and consequent increased eutrophication have led to the emergence of invasive species such as water hyacinth. This has caused backflow in the lake, interfering with fish breeding zones. Climatic changes and extreme temperatures interfere with the degradation of wild habitats, increasing human conflict as animals run in search of new territories and boundaries (Daboh, 2020).

6 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The study's findings underscore the nuanced relationship between climate change perceptions, fisheries co-management, and local livelihoods in the Lake Victoria region. While stakeholders exhibit a generally positive but cautious sentiment toward co-management practices and climate change impacts, there is a notable disparity between awareness and action in addressing the challenges posed by climate change impacts. Despite a strong recognition of the consequences of climate change, this study highlights the critical need to bridge the gap between understanding its causes and implementing effective adaptation measures within fisheries co-management frameworks. Moving forward, it is imperative for stakeholders, including government agencies, NGOs, fisherfolk, and local communities to collaborate closely to address the identified gaps and challenges. This collaborative effort should focus on implementing successful adaptation measures to mitigate the negative impacts of climate change on fishing communities and broader ecosystems. Key recommendations include enhancing educational and awareness programs, improving the integration of climate change considerations into co-management practices, and fostering collaboration among different stakeholders. By working together and adopting holistic approaches, stakeholders can promote resilience and sustainability in Lake Victoria fisheries, ultimately safeguarding the well-being of local communities and the ecological integrity of the region.

6.2 Recommendations

Based on the outcomes of this study, the following recommendations are made to enhance the effectiveness and general operation of fisheries co-management to implement successful adaptation measures to prevent climatic change effects:

- While some stakeholders are familiar with co-management, others have limited knowledge of its intricacies, indicating the need for targeted capacity-building efforts and educational programs.
- The study recommends financial support for fishing communities to enable them to engage in alternative income-generating activities.
- There is a need to integrate climate change considerations more effectively into co-management frameworks. These are essential for building resilience and sustainability in the Lake Victoria fisheries.
- More research is needed to understand the impact of climate change on fisheries and identify responses.
- Integrate fisheries into national food security and climate-change adaptation strategies.
- Promote the diversification of fishing-dependent communities.
- Early warning systems for risks and threats to fisheries should be developed.
- Improve communication networks within and among fishing communities.

ACKNOWLEDGEMENTS

First, I wish to thank the Almighty God for good health throughout my training. I would like to express my sincere thanks and gratitude to my supervisor, Dr. Catherine Chambers, Senior Scientist at the Stefansson Arctic Institute and Research Manager at the University Centre of the Westfjords, for her excellent professional and technical guidance during this study. My special thanks to the director of the GRO-Fisheries Training Programme, Þór Heiðar Ásgeirsson and his team: Julie Ingham, Mary Frances Davidson, Stefan Ulfarsson, David Thomas Daviðsson, and Zaw Myo Win for their support, guidance, and hospitality in Iceland. The kindness and understanding you have shown me have kept me going.

My gratitude to Akureyri University GRO-Fisheries Policy and Management line led by Hreiðar Þór Valtysson and his colleagues: Magnus, Hörður, Thanh, Freysteinn, Fjola, Eva, Lilja, Hjordis, Gustavo, Cynthia for their lectures and the educative trips they organised. To the fellows of the 2023-2024 GRÓ FTP, especially my Policy and Management colleagues, I appreciate your support and understanding. You made my stay in Iceland memorable.

I wish to awknowledge KMFRI management: Professor James Njiru, Institute Director, Dr. Jacob Ochiewo, Director of Socioeconomics, Dr. Christopher Aura, Director fresh water systems, and Dr. Chrisphine Nyamweya, Assistant Director of Limnology for the nomination and guidance through this prestigious training. Former Kenyan GRO fellows Madam Venny and Chadwick, your kindness and availability for consultation were greatly appreciated. To the socio-economics department at the Kisumu station led by Horace Owiti, Jane, Eric, Pamela, Julia, Hezron, Kevin and Kemei thank you so much for your dedication during the data collection process without which this project would not have been a success.

Finally, I would like to thank my mother Anastancia Adhiambo, my uncle Vincent Wanguche, my brother James Otuo, my sisters Magret Akinyi and Grace Achieng, and most importantly my wife Eunice Odongo and baby Joy, for their prayers courage and understanding during my absence from home. You have my unending admiration.

REFERENCES

Aura, M. C. (2013). Fish restocking of lakes in Kenya: Should it solely be an environmental issue? In W. A. Adoyo & C. I. Wangai (Eds.), *African political, social, and economic issues: Kenya political, social issues.*

Baland, J.-M., & Platteau, J.-P. (1996). Halting degradation of natural resources: Is there a role for rural communities? Food and Agriculture Organization of the United Nations (FAO).

Daboh, A. (2020). *Assessing the effectiveness of co-management in the artisanal fisheries of Sierra Leone.* GRÓ Fisheries Training Programme under the auspices of UNESCO, Iceland.

Dubbink, W., & van Vliet, M. (1996). Market regulation versus co-management? Two perspectives on regulating fisheries compared. *Marine Policy, 20*(6), 499–516. https://doi.org/10.1016/S0308-597X(96)00035-8

Etiegni, C. A., Irvine, K., & Kooy, M. (2020). Participatory governance in Lake Victoria (Kenya) fisheries: Whose voices are heard? *Maritime Studies, 19*, 489–507. Retrieved from https://doi.org/10.1007/s40152-020-00195-x

Johnson, J. L. (2009). Climate Change and Fishery Sustainability in Lake Victoria. (L. V. Organisation, Ed.) *African Journal of Tropical Hydrobiology and Fisheries*, 31-36.

Jentoft, S., McCay, B. J., & Wilson, D. C. (1998). Social theory and fisheries co-management. *Marine Policy, 22*(4–5), 423–436. https://doi.org/10.1016/S0308-597X(97)00040-7

Joshi, A., Kale, S., Chandel, S., & Pal, D. K. (2015). Likert scale: Explored and explained. *British Journal of Applied Science & Technology, 7*(4), 396–403. https://doi.org/10.9734/BJAST/2015/14975

Kateka, A. G. (2010). *Co-management Challenges in Lake Victoria Fisheries.* Stockholm: Stockholm University.

LVFO. (2008). *Co management.* Retrieved from https://www.lvfo.org/

Lwenya, C., & Abila, R. O. (2003). Co-management in the Lake Victoria fishery, realities, constraints, and opportunities in Kenya. *Aquatic Ecosystem Health and Management Society*, 1-15. Retrieved from https://www.researchgate.net/publication/263684470

Nunan, F. (2010). *Governance and Fisheries Co-management on Lake Victoria: Challenges to the Adaptive Governance Approach.* University of Birmingham, International Development Department, Birmingham, UK. Birmingham: University of Birmingham.

Ogwang, O. V., & Nyeko, I. J. (2009). Implementing Co-management of Lake Victoria's Fisheries: Achievements and Challenges. *African Journal of Tropical Hydrobiology and Fisheries, 12*, 52-58.

Olson, M. (1965). The logic of collective action: Public goods and the theory of groups. Harvard University Press.

Pfarr, C., Schmid, A., & Schneider, U. (2010). Estimating ordered categorical variables using panel data: A generalised ordered probit model with an autofit procedure (EERI research paper no. 43/2010). Economics and Econometrics Research Institute.

Sen, S., & Nielsen, J. R. (1996). Fisheries co-management: A comparative analysis. *Marine Policy, 20*(5), 405–418. https://doi.org/10.1016/S0308-597X(96)00028-0

Tate, E., Sutcliffe, J., Conway, D., & Farquharson, F. (2004). Water balance of Lake Victoria: Update to 2000 and climate change modelling to 2100. *Hydrological Sciences Journal, 49*(4), 563–574. https://doi.org/10.1623/hysj.49.4.563.54422

APPENDICES

Appendix 1: Structured Questionnaire

GRO-FTP 2024: ASSESSING THE EFFICACY OF FISHERIES CO-MANAGEMENT AMIDST THE IMPACTS OF CLIMATE CHANGE, A STAKEHOLDER PREPAREDNESS EVALUATION IN LAKE VICTORIA KENYA.

Introduction: Greetings from Patrick Otuo Wanguche, a socioeconomics research scientist at Kenya Marine and Fisheries Research Institute in Kisumu Station who is currently working on a project titled, 'Assessing the efficacy of fisheries co-management amidst the impacts of climate changre: Astakeholder preparedness evaluation' The project is a requirement for his ongoing six months GRO-Fisheries Training Program in Iceland under the sponsorship of UNESCO. This is inline with the fisheries policy training and management. This questionnaire aims to gather valuable insights into the effectiveness of fisheries co-management practices in Lake Victoria, Kenya, particularly in the context of climate change impacts. Your responses will contribute to understanding the challenges, successes, and opportunities for enhancing co-management strategies. Please take a few moments to answer the questions provided. Your responses will be kept confidential and will be used solely for research purposes. Take note that your participation is voluntary, highly appreciated and will help us in developing sustainable strategies for fisheries management. For more information, you can contact Patrick directly at: Email patrick@unuftp.onmicrosoft.com pwanguche@go.ke or partyotuo2009@gmail.com Mobile Phone +254710826449.

Consent

Do you have any questions regarding this study?

- ◯ Yes
- ◯ No

If yes, what is the question and answer given?

Do you agree to participate in this study?

- ◯ Yes
- ◯ No

Co-management of Lake Victoria

» SECTION A : GENERAL INFORMATION

1. Date

yyyy-mm-dd

2. GPS

latitude (x.y °)

longitude (x.y °)

altitude (m)

accuracy (m)

3. County

- ◯ Busia
- ◯ Siaya
- ◯ Kisumu
- ◯ Homabay
- ◯ Migori

4. Site or Beach Name

» SECTION B: SOCIODEMOGRAPHICS

5. What is your name (Optional)

6. Phone number(Optional)

7. What is your gender?

- ◯ Male
- ◯ Female
- ◯ Prefer not to say
- ◯ Other

7.1. Specify other

_____

8. What is your age in years

- ◯ Under 18
- ◯ 18 - 35
- ◯ 36 - 50
- ◯ Over 50

9. What is your marital status

- ◯ Single
- ◯ Married
- ◯ Separated
- ◯ Divorced
- ◯ Widowed
- ◯ Other

9.1. Specify other

_____

10. What is your level of education?

- ◯ No formal education
- ◯ Primary school
- ◯ Secondary school
- ◯ Tertiary Education
- ◯ Other

10.1. Specify other

_____

11. Years of Experience in Fisheries Management?

_____

12. What is your affiliation?

- ◯ BMU leader
- ◯ Community member
- ◯ Government
- ◯ Researcher
- ◯ NGO
- ◯ Other

12.1. Specify other

_____

13. What role do you play in this beach?

- ◯ Fisherman
- ◯ Fish trader
- ◯ BMU Leader
- ◯ BMU Committee member
- ◯ Other

13.1. Specify other

_____

14. What is your main occupation?

- ◯ Fishing
- ◯ Fish farming
- ◯ Crop farming
- ◯ Salaried
- ◯ Other

14.1. Specify other

_____

» SECTION C: GENERAL UNDERSTANDING OF CO-MANAGEMENT AND CLIMATE CHANGE

15. Have you ever heard of the word co-management?

- ◯ Yes
- ◯ No

15.1. If yes, What is the meaning of fisheries co-management?

_____

15.2. How do you rate your knowledge of fisheries co-management in Lake Victoria Kenya?

- Very nowledgeable
- Somewhat knowledgeable
- Neutral
- Not very knowledgeable
- Not knowledgeable at all
- Don't know

16. How would you describe the current state of fisheries co-management in Lake Victoria, Kenya?

_____

17. In your opinion, what are the primary challenges facing fisheries co-management in the region?

_____

18. Have you ever heard of the word climate change?

- Yes
- No

18.1. If yes, What is the meaning of the word climate change?

_____

18.2. Rate your level of familiarity with the causes and consequences of climate change in Lake Victoria Kenya?

- Very familiar
- Somewhat familiar
- Neutral
- Not very familiar
- Not familiar at all
- Don't know

19. From the list what are the causes of climate change that are familiar to you?

- [ ] Deforestation
- [ ] Drought
- [ ] Industrialization
- [ ] Greenhouse Gas Emissions
- [ ] Changes in rainfall
- [ ] Food insecurity
- [ ] Fish stock changes
- [ ] Poor human health
- [ ] Temperature changes

20. From the list what are the consequences of climate change that are familiar to you?

- [ ] Deforestation
- [ ] Drought
- [ ] Industrialization
- [ ] Greenhouse Gas Emission
- [ ] Changes in rainfall
- [ ] Food insecurity
- [ ] Fish stock changes
- [ ] Poor human health
- [ ] Temperature changes

20.1. How effective do you perceive BMU to curb the consequences of climate change?	Very effective	Effective	Neutral	Ineffective	Very ineffective	Don't Know
Rate the effectiveness of BMU to deal with changes in fish stocks	◯	◯	◯	◯	◯	◯
Rate the effectiveness of BMU to deal with changes in GHGs	◯	◯	◯	◯	◯	◯
Rate the effectiveness of BMU to deal with changes in drought	◯	◯	◯	◯	◯	◯
Rate the effectiveness of BMU to deal with changes in deforestation	◯	◯	◯	◯	◯	◯
Rate the effectiveness of BMU to deal with changes in food insecurity	◯	◯	◯	◯	◯	◯

20.2. What obstacles or limitations do you perceive with the current operational measures utilized by the BMU to curb the impacts of climate change?	Very high	High	Moderate	Low	Very low	Don't Know
Technological constraints	◯	◯	◯	◯	◯	◯

Limited funds constraints	◯	◯	◯	◯	◯	◯
Gender inequality constraints	◯	◯	◯	◯	◯	◯
Conflict s over resource use constraints	◯	◯	◯	◯	◯	◯
Awareness or uncertainty constraints	◯	◯	◯	◯	◯	◯
Weak institutional capacity constraints	◯	◯	◯	◯	◯	◯
Fragmented policy and regulation constraints	◯	◯	◯	◯	◯	◯
Poverty constraints	◯	◯	◯	◯	◯	◯
Others	◯	◯	◯	◯	◯	◯

If other please state

_____

» SECTION D: CO-MANAGEMENT PRACTICES

21. Do you think key stakeholders are always involved in key decision making related to fisheries management in Lake Victoria?

- ◯ Yes
- ◯ No
- ◯ Not sure

21.1. If yes, rate the level of involvement of key stakeholders when making decisions related to fisheries management in Lake Victoria?

- ◯ Extremely involved
- ◯ Involved
- ◯ Neutral
- ◯ Somewhat involved
- ◯ Not involved
- ◯ Don't Know

22. To what extent do you think climate change considerations are integrated into current fisheries co-management practices?

- ◯ Extremely integrated
- ◯ Integrated
- ◯ Neutral
- ◯ Somewhat integrated
- ◯ Not integrated
- ◯ Don't Know

23. Are there specific adaptive measures or strategies within the co-management framework that address the impacts of climate change?

- ◯ Yes
- ◯ No

23.1. If yes, please provide examples.

_____

24. Indicate your understanding of climate change and social protection.	1=Strongly agree	2=Agree	3=Neutral	4=Disagree	5=Strongly disagree	Don't Know
Climate change and social protection bridges the gap for vulnerable communities	◯	◯	◯	◯	◯	◯
Fisheries policies and programs designed to enhance the resilience and well being of communities is a critical component in addressing the impacts climate change.	◯	◯	◯	◯	◯	◯
The interconnectedness of climate change and social vulnerability can not be assumed.	◯	◯	◯	◯	◯	◯
Working collaboratively of policy makers, development agencies and communities can build a resilient future for all.	◯	◯	◯	◯	◯	◯
Social protection is a crucial tool to address and mitigate grassroot impacts of climate change	◯	◯	◯	◯	◯	◯
Social protection measures contribute to enhancing the adaptive capacity of the vulnerable populations	◯	◯	◯	◯	◯	◯

» SECTION E: STAKEHOLDER INVOLVEMENT AND COLLABORATION

25. To what level do you believe that there is effective collaboration and communication among different stakeholders involved in fisheries co-management?

- ◯ Totally believe
- ◯ Believe
- ◯ Neutral
- ◯ Don't believe
- ◯ Totally don't believe
- ◯ Don't Know

25.1. If you believe, why?

_____

25.2. If you don't believe, why not?

_____

26. To what extent are local communities informed and educated about climate change impacts on fisheries and the co-management strategies in place?

- ◯ Totally informed
- ◯ Informed
- ◯ Neutral
- ◯ Somewhat informed
- ◯ Not informed
- ◯ Don't Know

» SECTION F: SUCCESSES AND CHALLENGES

27. In your opinion, what are the key successes of the current fisheries co-management system in Lake Victoria?

_____

28. What challenges do you perceive in the implementation of effective fisheries co-management, particularly in light of climate change impacts?

_____

29. Are there specific examples of co-management initiatives that have successfully adapted to climate change in Lake Victoria?

- ◯ Yes
- ◯ No

29.1. List them

_____

30. Your final remarks on co-management and climate change impacts, recommendations on what needs to be improved

_____

Your insights are invaluable in understanding the dynamics of fisheries co-management amidst climate change impacts in Lake Victoria, Kenya. Thank you for your participation.

_____

Thank you for your participation.

_____

Appendix 2: Key Informant Interview Guide

Assessing the Efficacy of Fisheries Co-Management Amidst the Impacts of Climate Change , A stakeholder preparedness evaluation of Lake Victoria, Kenya

Introduction: Greetings from Patrick Otuo Wanguche, a socioeconomics research scientist at Kenya Marine and Fisheries Research Institute in Kisumu Station who is currently working on a project titled, **'Assessing the efficacy of fisheries co-management amidst the impacts of climate changre: Astakeholder preparedness evaluation'** The project is a requirement for his ongoing six months GRO-Fisheries Training Program in Iceland under the sponsorship of UNESCO. This is inline with the fisheries policy training and management.

This questionnaire aims to gather valuable insights into the effectiveness of fisheries co-management practices in Lake Victoria, Kenya, particularly in the context of climate change impacts. Your responses will contribute to understanding the challenges, successes, and opportunities for enhancing co-management strategies. Please take a few moments to answer the questions provided. Your responses will be kept confidential and will be used solely for research purposes. Take note that your participation is voluntary, highly appreciated and will help us in developing sustainable strategies for fisheries management. For more information, you can contact Patrick directly at: Email patrick@unuftp.onmicrosoft.com pwanguche@go.ke or partyotuo2009@gmail.com Mobile Phone +254710826449.

* Indicates required question

GRO-FTP 2024: ASSESSING THE EFFICACY OF FISHERIES CO-MANAGEMENT AMIDST THE IMPACTS OF CLIMATE CHANGE, A STAKEHOLDER PREPAREDNESS EVALUATION IN LAKE VICTORIA KENYA.

Introduction: Greetings from Patrick Otuo Wanguche, a socioeconomics research scientist at Kenya Marine and Fisheries Research Institute in Kisumu Station who is currently working on a project titled, 'Assessing the efficacy of fisheries co-management amidst the impacts of climate changre: Astakeholder preparedness evaluation' The project is a requirement for his ongoing six months GRO-Fisheries Training Program in Iceland under the sponsorship of UNESCO. This is inline with the fisheries policy training and management. This questionnaire aims to gather valuable insights into the effectiveness of fisheries co-management practices in Lake Victoria, Kenya, particularly in the context of climate change impacts. Your responses will contribute to understanding the challenges, successes, and opportunities for enhancing co-management strategies. Please take a few moments to answer the questions provided. Your responses will be kept confidential and will be used solely for research purposes. Take note that your participation is voluntary, highly appreciated and will help us in developing sustainable strategies for fisheries management. For more information, you can contact Patrick directly at: Email patrick@unuftp.onmicrosoft.com pwanguche@go.ke or partyotuo2009@gmail.com Mobile Phone +254710826449.

Consent

Do you have any questions regarding this study?

◯ Yes

1. County *

   Mark only one oval.

   - ◯ Busia
   - ◯ Siaya
   - ◯ Kisumu
   - ◯ Homabay
   - ◯ Migori

2. Sub-county *

   _____

3. Type of organisation *

   Mark only one oval.

   - ◯ Government
   - ◯ NGO
   - ◯ Private sector
   - ◯ Community-based

4. Institution name *

   _____

5. Designation *

   _____

6. Email address/contact

   _____

7. 1a) How long have you been engaged in fisheries management activities around Lake Victoria?

8. b) Can you provide an overview of your role and involvement in the fisheries co-management initiatives in Lake Victoria?

9. 2a) From your perspective, how aware are the stakeholders involved in fisheries co-management of the potential impacts of climate change on Lake Victoria's ecosystem?

10. 2b) How would you describe the current state of fisheries co-management in Lake Victoria, Kenya?

11. 3. What specific climate change-related challenges do you think are most pertinent to the fisheries in Lake Victoria?

12. 4. How would you describe the level of collaboration among different stakeholders involved in fisheries co-management in the region?

13. 5.Are there existing mechanisms or forums for stakeholders to discuss and address climate change impacts within the context of fisheries co-management?

14. 6. What adaptation strategies or measures have been implemented or proposed to address the impact of climate change on fisheries in Lake Victoria?

15. 7. In your opinion, how effective have these adaptation strategies been in mitigating climate change effects on the fisheries sector?

16. 8. Can you identify any challenges or barriers that stakeholders face in implementing effective fisheries co-management strategies in response to climate change

17. 9. Are there any financial, institutional, or social constraints that hinder the successful implementation of climate-resilient fisheries management practices

18. 10. How is information on climate change impacts and adaptation strategies communicated among stakeholders in the fisheries co-management system

19. 11. Do you think there is a need for improved communication channels or tools to enhance information sharing on climate-related issues?

20. 12. How do existing policies and governance structures support or hinder the integration of climate change considerations into fisheries co-management plans?

21. 13. Are there policy gaps or areas that need improvement to enhance the resilience of fisheries co-management in the face of climate change?, Please elaborate

22. 14. To what extent have stakeholders been provided with training and capacity-building initiatives to enhance their ability to respond to climate change impacts in the fisheries sector?

23. 15. What additional capacity-building measures do you believe are necessary for stakeholders to effectively address climate-related challenges?

24. 16 What recommendations do you have for improving the effectiveness of fisheries co-management in the face of climate change in Lake Victoria?

25. 17 How can the involvement of local communities in fisheries co-management be enhanced?

26. 18 What role do you think external actors (e.g., government agencies, NGOs, international organizations) should play in supporting fisheries co-management in Lake Victoria?