# ASSESSING THE CONTRIBUTION OF FISHERIES MANAGEMENT STRATEGIES ON COMPLIANCE TO FISHERIES REGULATIONS BY FISHER FOLK IN LAKE VICTORIA: A CASE STUDY OF BUSIA COUNTY, KENYA

BY

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A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCE

SCHOOL OF AGRICULTURE, FOOD SECURITY AND ENVIRONMENT SCIENCES

MASENO UNIVERSITY

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# DECLARATION

I declare that this thesis is my original work and has not been presented to another University or any other institution of higher learning for any award. All the work in this thesis has been carried out by myself and quoted sources of information well acknowledged by way of referencing.


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# DEDICATION

This thesis is dedicated to my loving wife, Jill Odende and our children Ian, Givens, Marleen, Kelvin and Paulin for their love and inspiration for pursuit of academic excellence.

## ABSTRACT

Fisheries resources in Lake Victoria have been under immense pressure leading to over utilization and decline of fish. Fisheries resources support livelihoods, generate income, ensure food security, and provide raw materials used in animal feeds and pharmaceutical industry. However, fisheries resources have faced ecological challenges in many freshwater lakes worldwide. Lake Victoria's ecological health has been deteriorating due to overfishing, use of illegal fishing gears and fishing methods. Fisheries management strategies and regulations have been enacted to regulate fishing in Lake Victoria. However, it was not known whether these strategies could enhance fisher folks' compliance to fisheries regulations. In addition, Busia County government introduced aggregated farming practices as income diversification. However, it was unknown whether these alternative farming practices could improve fisher folks' compliance with fisheries regulations. Therefore, the goal of this study was to evaluate the impact of fisheries resources management strategies on fishermen's compliance to fisheries regulations in Busia County, Kenya's Lake Victoria. The objectives were to: Examine the perceptions of fisher folks towards the types of fisheries management strategies and fisheries regulations; determine the relationship between types of punitive measures and compliance with fisheries regulations; and determine the relationship between categories of alternative livelihoods and compliance with fisheries regulations. Descriptive cross-sectional research design was used in this study. The study population consisted of 4200 participants including fishermen, boat owners, fish merchants, regional manufacturers of fishing gear, and equipment dealers. The sample size of 324 respondents was calculated using Kothari (2004) formula. Primary data was gathered from 13 landing beaches in the Samia and Bunyala sub counties using structured questionnaires, Key informant interviews and focus group discussions. Frequencies and percentages were used to present the data, and the Chi-square test of independence and Spearman Rank correlation were used to investigate the relationships between the variables. The results showed that respondents strongly agreed (r=0.714) that current laws and regulations were easy to understand but the approaches used were ineffective. In addition, the respondents strongly agreed (r=0.896) that even though fishermen are aware of fisheries regulations, they are forced by hard economic conditions to violate income diversification approaches. Types of punitive measures such as closed seasons, fish landing areas restrictions, fishing areas restrictions, fishing methods restrictions and gear size restrictions showed a statistically significant ($p < 0.01$) association with compliance to fisheries regulations. Moreover, alternative livelihoods: Aggregated horticulture farming ($\chi^2_6$=30.35, p=0.00003), aggregated dairy and poultry farming ($\chi^2_6$=21.38, p=0.0016) and aggregated aquaculture farming ($\chi^2_6$=94.79, p=0.0000) showed statistically significant association with compliance to fisheries regulations. In conclusion, stakeholders had positive attitude towards fisheries management strategies and regulations. Low compliance to fisheries regulations led to dwindling fish stocks. Strengthening punitive measures and aggregated farming practices could enhance compliance. There was need to create awareness on fisheries management strategies and regulations, and build capacity on aggregated farming practices to enhance compliance with fisheries requlations among the fisherfolks.

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# LIST OF ABBREVIATIONS AND ACRONYMS

BMUs          Beach Management Units

CIFA          Committee for Inland Fisheries of Africa

DDT           Dichlorodiphenyltrichloroethane

EAC           East African Community

FAO           Food and Agriculture Organization

FGD           Focus Group Discussion

FMP II        Fisheries Management Plan II

FMP III       Fisheries Management Plan III

GoK           Government of Kenya

IUCN          International Union for Conservation of Nature

KNBS          Kenya National Bureau of Statistics

KII           Key Informant Interviews

KMFRI         Kenya Marine and Fisheries Research Institute

LVB           Lake Victoria Basin

LVFO          Lake Victoria Fisheries Organization

NGOs          Non-Governmental Organizations

USD           United States Dollar

# WORKING DEFINITION OF TERMS

**Fisheries management strategies and regulations:** Management strategies are the sum of all the management measures selected to achieve the biological, ecological, economic and social objectives of the fishery while fisheries regulations are the various bylaws governing the use and conservation of fisheries resources meant to operationalize policies. In this study fisheries management strategies and regulations included: (Co-management of beaches (BMU), aggregated production, income diversification, arrest and prosecutions, closed seasons, restriction on fishing areas and fishing methods.

**Alternative livelihoods:** These are interventions that aim to reduce the prevalence of activities deemed to be damaging to fisheries resources by substituting them with lower impact livelihood activities that provide at least equivalent benefits. In this study the provision of alternative livelihoods provided include: Aggregated horticulture farming, aggregated dairy and poultry, and aggregated aquaculture farming.

**Perceptions:** The way in which the fisher folks regard, understand or interpret the fisheries management strategies and fisheries regulations. In this study the perceptions of stakeholders were sought on fisheries regulations which included: Arrest and prosecutions, co-management of beaches, closed seasons, fishing areas, fishing methods, income diversification and aggregated production

.**Fisher folk compliance:** The ability of the fishermen to follow and observe the various policies and regulations regarding the utilization and conservation of the fisheries resources. In this study the compliance considered were fisher folk compliance with fisheries regulations on: Arrest and prosecutions, co-management of beaches, closed seasons, fishing areas, fishing methods, income diversification and aggregated production.

**Aquaculture:** Entails farming of aquatic organisms, including fish, mollusks, crustaceans and aquatic plants, in natural or controlled marine or freshwater conditions.

**Fisheries policy:** Guidelines that define and outline the regulations for the utilization and conservation of the fisheries resources.

**Stakeholders:** They are parties that have interest in fishery resources. Their decisions in the development and execution of fisheries management policies and plans may either negatively or positively affect them.

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Background to the Study

Globally, fisheries play an essential role in the socio-economic development as it supports livelihoods, provides employment opportunities, and generates income. Fisheries resources are also important as they ensure that nations are food secure and provide raw materials used in the manufacture of feed and pharmaceutical products (Muigua *et al*., 2015). However, prevailing ecological challenges have caused a significant reduction of several fisheries in many freshwater lakes worldwide (Beeton, 2002; Arthington *et al*., 2016). The freshwater ecosystems have experienced severe ecological perturbations and negative impacts from overfishing, pollution, weak enforcement of management measures, lack of compliance with fisheries policies and laws, and more recently, impacts related to climate change (Kimani *et al*., 2018). The researches which have been done have improved our understanding on the environmental and socioeconomic factors causing fisheries reduction in aquatic ecosystems; including the importance of fisheries as source of human proteins, animal feed, and pharmaceutical industry. However, these studies have not enlightened us on the contribution of fisheries management strategies on fisher folks' compliance with fisheries policies.

Currently, in Africa there is widespread debate regarding the overall fisheries' status. Some researchers have projected total collapse some fisheries if punitive measures are not enacted and compliance with fisheries regulations are also not complied with (Silsbe & Kecky 2008). For instance, unregulated destructive fishing methods have been reported in the fisheries of several lakes in East Africa like Tanganyika and Kyoga in Tanzania and Uganda, respectively (Okello *et*

*al*., 2010; Van der Knaap *et al*., 2014). Another case in point is Lake Malawi's fisheries that almost collapsed due to unregulated fish cage aquaculture coupled with destructive fishing methods and overcapacity (Pitcher, 2015; Mulwafu & Oswald, 2017). Furthermore, several fisheries resources have been affected by both natural and human induced problems leading to adverse consequences on the fisheries and the livelihoods of the people living near various water bodies (Kimani *et al.,* 2018). These studies have demonstrated challenges facing fisheries resources in Africa. Nevertheless, the researchers have pointed out the punitive measures which can be enacted in order for the fisher folks to comply with fisheries regulations. However, the effect of the enacted punitive measures on fisher folks' compliance with fisheries regulations has not been established. Therefore, research is needed to determine the association between punitive measures and compliance with fisheries regulations.

In Kenya, the fishing sector generated an average annual Gross Domestic Product of 0.5 % in 2019. (KNBS, 2020). With the increasing human population around most of the Kenyan freshwater lakes including Lake Victoria, Lake Naivasha, and Lake Turkana, coupled with unsustainable utilization of its fisheries resources, the lakes and their resources are under immense pressure (Harper *et al*., 2011). A lack of stakeholder engagement and participation in the development and execution of fisheries management policies and plans is one of the other difficulties (Oyugi *et al.,* 2011). Currently, the Lake Victoria Basin in Kenya is characterized by high poverty levels, joblessness, HIV and AIDS and other nutrition-related diseases due to a lack of sufficient livelihoods from the lake ecosystem (Kwena *et al*., 2020). The researches carried out in Kenya have revealed unsustainable utilization of its fisheries resources due to habitat destruction, overfishing and use of illegal fishing gears. However, these studies have not established the relationship between punitive measures which have been enacted and fisher folks compliance with

fisheries regulations. Therefore, there is need for further research on the relationship between punitive measures and compliance with fisheries regulations.

An estimated 1.2 million people are employed directly and indirectly in the fishing, production, and supply chains as a result of Lake Victoria, which supplies around 80% of freshwater fish (Kimani *et al*., 2018; Odoli *et al.*, 2019). However, since 1960s ecological health of the lake has been reducing (Rutjes *et al*., 2007; Njiru *et al*., 2012), causing a systematic decline of the native biodiversity, including hundreds of fish species (Ogello *et al*., 2013; Outa *et a*l., 2020). The Lake Victoria Fisheries Service (LVFS) was established in the late 1920s and carried out the first fisheries survey as the first step in managing Lake Victoria's fishery (Graham, 1929). The Lake Victoria Fishery Fisheries Management Plan (FMP I) was created in 2001 and executed from 2005 to 2008, while the FMP II was implemented from 2009 to 2014. The current FMP III (2015-2020) was developed to address the weaknesses in the first two plans. Although some of these plans provide for the encouragement of alternative livelihood activities for the people around the lake, the focus and emphasis have been on the punitive measures which have yielded no fruit (Etiegni *et al*., 2011). Some of the punitive measures include arrest of fishermen, and the seizing of their gear, fishing vessels and catches. The method seems to have worsened the situation (Etiegni et al., 2011). This is mainly because such strategies deter the fishermen from accessing the resource rather than empowering them to conserve it (Bennett et al., 2015). The systematic reduction of fisheries and wanton destruction of fisheries resources has brought into focus the relevance and applicability of the existing policies designed to protect the ecosystem health of the lake (Luomba *et al*. 2016). The studies have demonstrated fisheries management plans which were developed to encourage alternative livelihood activities for the people living around Lake Victoria in order to comply with fisheries regulations. However, the contribution of the alternative livelihoods on

compliance with fisheries regulations has not been determined. Hence, there is need for further research on the relationship between provisions of alternative livelihoods and compliance with fisheries regulations.

Researchers have argued that the most effective resource conservation strategies make the resource users own the conservation efforts (Medard *et al*., 2016). However, the main problem in the conservation of transboundary resources like Lake Victoria is the lack of uniformity in the policies in the different countries sharing the resource (Belinskij, 2015). Beach Management Units (BMUs) have earlier been created in an effort to bring the management and implementation of laws closer to the people through a bottom-up management approach. However, the BMU strategy seems to have failed to address the challenges bedeviling Lake Victoria fisheries. The failure is partly attributed to the open-access nature, also known as the 'tragedy of the common' (Ogello *et al*., 2013). Other causes include poverty and lack of proper support for alternative livelihood activities around the lake Silsbe & Hecky (2008). Due to poor agricultural output around the Lake Victoria region, communities have relied on the lake's fisheries resources to sustain their livelihoods, leading to more pressure on the fisheries resources (World Agroforestry Centre, 2006). This necessitates the need for alternative policy implementation strategies to effectively manage the lake's fisheries resources. Nonetheless, the level of awareness and perception of the various stakeholders on the policies and their implementation strategies have been questioned (Njiru *et al*., 2018). Hence, there is need for research on perceptions of fisher folks towards fisheries resources management strategies and fisheries regulations.

In 2010, Kenya promulgated a new constitution that created County governments with full control of fisheries functions and resources within their domain. Busia County has implemented, among other strategies, the Aggregated Aquaculture Production Parks (Aqua Parks) where smallholder

fish farmers are aggregated into clusters and then supported by the government to produce fish (Busia County Integrated Development Plan 2018-2022 (2018). This has been implemented for both land-based fishponds as well as fish cages. The strategy has increased aquaculture production in the county and engaged the youth who would otherwise be involved in fishing activities in the lake. The county also adopted a voluntary weekend ban on fishing, which resulted in an increase in fisheries production by 2.6% in 2019 (https://busiacounty.go.ke/main/index.php/fisheries). This is one of the basis upon which this County has been chosen for the current study. There is thus a need for a paradigm shift in the implementation strategies for the various fisheries management policies. The policies and their implementation strategies should focus on involving, engaging and empowering stakeholders in the fisheries sector and making them own the conservation initiatives rather than barring them from accessing the resource as argued by Lundholm et al. (2014). Therefore, there is need for further research on the relationship between provisions of alternative livelihoods and compliance with fisheries regulations in Lake Victoria in Busia County.

**1.2 Statement of the problem**

An estimated 1.2 million people in Kenya are supported by Lake Victoria both directly and indirectly through the fishing, industry, and supply chains. Despite this immense prominence, the lake has been under increasing pressure leading to reduced ecological health, destruction and reduction of the fisheries resources. Beach Management Units (BMUs) were established to make management and law enforcement more accessible to the populace. However, the level of awareness and perception of the various stakeholders on the policies and their implementation strategies is not known. A variety of policies and methods for managing fisheries resources are also in place to safeguard the lake, but overall there is a dearth of enforcement of laws and regulations controlling the fisheries sector. There is need to examine the perceptions of

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stakeholders towards fisheries resources management strategies and fisheries regulations. Moreover, most fisheries policies focus on punitive action against breakers of the laws. However the effect of the enacted punitive measures on fisher folk's compliance with fisheries regulations is unknown. To determine the link between punitive measures and adherence to fishing laws, more research is required. Furthermore, there is need to shift the focus to providing alternative livelihood activities like farming, aquaculture and other economic activities to the populace around the lake. This requires further research on the relationship between provisions of alternative livelihoods and compliance with fisheries regulations. Therefore, the aim of this research was to determine the contribution of fisheries resources management strategies on fisher folk compliance to fisheries regulations in Lake Victoria, Busia County, Kenya.

## 1.3 Objective of the study

### 1.3.1 General objective

To assess the contribution of fisheries management strategies on fisher folk compliance to fisheries regulations in Lake Victoria, Busia county, Kenya.

### 1.3.2 Specific objectives

1. To examine the perceptions of fisher folks towards the types of fisheries management strategies and fisheries regulations (Co-management of beaches (BMU), aggregated production, arrest and prosecutions, closed seasons, restriction on fishing areas and fishing methods) in Lake Victoria in Busia County, Kenya.

2. To determine the relationship between types of punitive measures (closed seasons, fishing landing areas restrictions, fishing areas restrictions, fishing methods restrictions, and gear

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size restrictions), and compliance with fisheries regulations in Lake Victoria in Busia County, Kenya.

3. To determine the relationship between categories of alternative livelihoods (aggregated horticulture farming, aggregated dairy and poultry, and aggregated aquaculture farming) and compliance with fisheries regulations in Lake Victoria in Busia County, Kenya.

**1.4 Research questions**

1. What were the perceptions of fisher folk towards types of fisheries management strategies and fisheries regulations (Co-management of beaches (BMU), aggregated production, income diversification, arrest and prosecutions, closed seasons, restriction on fishing areas and fishing methods) in Lake Victoria, Busia County, Kenya?

2. How did types of punitive measures (closed seasons, fishing landing areas restrictions, fishing areas restrictions, fishing methods restrictions, and gear size restrictions) relate with fisher folk compliance with fisheries regulation in Lake Victoria, Busia County, Kenya

3. What were the relationship between categories of alternative livelihood (aggregated horticulture farming, aggregated dairy and poultry, and aggregated aquaculture farming) to fisher folk and compliance with fisheries regulations in Lake Victoria, Busia County, Kenya?

**1.5 Justification of the study**

This study provides empirical information on stakeholders' perspectives of fisheries policies and management strategies for the fisheries resource which will aid in the efficient and sustainable management of Lake Victoria's fisheries resource. Generally, punitive measures like arrests and prosecutions have been the main enforcement strategies in the county of Busia. These, according to the fishermen have been counterproductive. There is therefore a need to find either better or a

combination of strategies that can be more productive. For the sustainable management of the fisheries resources, an evidence-based investigation into the use of voluntary, participatory conservation methods, such as restricted fishing zones and voluntary compliance, is essential. The inadequate information has impeded the formulation of sound enforceable laws and regulations. In order to effectively manage the lake's fisheries resources for the benefit of the riparian communities and those who depend on them, the study examined viable alternative livelihood approaches like aquaculture and agriculture in the conservation of fisheries resources and their implementation strategies. Finally, the comprehension of stakeholders' perceptions on fisheries management strategies will guide researchers and policymakers both at the national and county level why the punitive approach to the management of fisheries resources have failed; and how to involve the stakeholders more effectively into the management of the fishery resources.

**1.6 Scope and limitations of study**

The scope of the study were beaches within two sub counties (Samia and Bunyala) because they are the only sub counties that border the Lake Victoria in Busia County. Within these sub counties, data were collected from 13 landing beaches. Some beaches were excluded from the sample due to the beach's submersion, and hence inaccessible. Each landing beach captured variability in various market conditions (market accessibility, infrastructure etc.), fish species landed, and population size, among others. This study was focused only on the stakeholders within the fisheries sector comprising mostly fishermen, fish traders, and boat makers of ages from 30 years. The variables considered include: Perceptions of stakeholders, fisheries resources management strategies and regulations (Co-management of beaches (BMU), aggregated production, income diversification, arrest and prosecutions, closed seasons, restriction on fishing areas and fishing

methods), provisions of alternative livelihoods (aggregated dairy and poultry farming and aggregated aquaculture farming), and compliance with the fisheries regulations.

The presence of the COVID-19 pandemic at the time of the study, presented potential threats during data collection. For instance, the focus group discussions were split up into smaller units and were in several rounds of interviews. Further, given that there could have been a potential spread through contact with paper and pencil, Computer Assisted Personal Interviewing (CAPI) was adopted over paper and pencil. Digitizing the questionnaire ensured data quality and safety. Besides, this study relied on a cross-sectional dataset. Challenges of non-response were encountered in the study area due to hostility of some respondents. To address this, the respondents were assured of the confidentiality of the information they provided. These challenges were not systematic and did not bias the study findings. In terms of replicability of results in other beaches that were not sampled, the findings can generally be applied since the general population and activities are not significantly different especially in terms of their utilization of the lake's fisheries resources.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

This literature reviews socio-economic importance of Lake Victoria fishery; status and trends of Lake Victoria fisheries, status and trends of fishing gears, methods and capacity; existing fisheries policies; Fisheries management strategies; approaches of administering the fisheries management strategies; stakeholder awareness and perception of the fisheries policies and the implementation strategies; theoretical and the conceptual framework.

## 2.2 Socio-economic importance of Lake Victoria fisheries

The second-largest freshwater lake in the world, Lake Victoria is a valuable resource known for its enormous socioeconomic and ecological advantages (Odoli et al., 2019). Lake Victoria sustains an estimated 1.2 million people directly and indirectly through the fishing, production, and supply chains in Kenya, where it contributes to around 80% of the country's freshwater fish production (Ogello et al., 2013; Kimani et al., 2018; Odoli et al., 2019). The fishing industry's average annual Gross Domestic Product contribution to the nation was 0.5 % in 2019 (KNBS, 2020). Fishers, fish traders, processors, transporters, and consumers are the sector's direct gainers. Indirect gainers include boat builders, net and hook producers, outboard engine suppliers, fish vehicle providers and mechanics, fuel suppliers, fish bait suppliers, ice suppliers, and providers of containers and packaging materials (Mgale & Nikusekela, 2017). Since the turn of the century, overfishing, pollution, non-selective fishing, and the introduction of invasive alien species have drastically altered Lake Victoria's fishery (Downing et al., 2013). Due to these difficulties, the native and endemic biota unique to Lake Victoria have been destroyed. In the last decade alone, about 70 %

of Lake Victoria's cichlid taxa were lost (Oyugi *et al*., 2011; Downing *et al*., 2013). About 100 native fish species unique to Lake Victoria were listed as endangered in the IUCN Red Book in 2000. Numerous studies document considerable post-perch structural modifications that have an immediate effect on the biodiversity levels' niche composition (Downing et al., 2013).

Before the 1950s, the fish fauna of Lake Victoria comprised a flock of more than 300 indigenous cichlid species (Awiti, 2011). Scientists repeatedly objected against the import of Nile Perch (Lates spp.) from Lake Turkana and Albert into Lake Victoria in the 1950s, but the fish population exploded by the early 1980s as a result. As a consequence, haplochromines declined, as exhibited by the landed catch. Predation pressure from the Nile Perch is attributed to the decline in haplochromine stocks and size, although increased fishing efforts also played a significant role in their reduction (Outa *et al*., 2017; Yongo *et al*., 2018). Currently, the fisheries of the lake are dominated by three commercially valuable species; *Lates niloticus* 60 %, *Rastrineobola argentea* 19 % and *Oreochromis niloticus* 7% (Ojwang *et al.,* 2014; Cornelissen *et al*., 2015). The remaining proportion is contributed by the other species like the haplochromines, the catfishes and cyprinids. Despite the massive potential of Lake Victoria supporting high fish species diversity and abundance, serious problems still abound primarily due to anthropogenic activities within the lake itself and the lake basin (Achieng et al., 2021).

The aquatic resources are vital to the life of the people who reside in the Lake Victoria basin. As a result, these resources are always under stress, which is made worse by three important factors: i) high and rapid rates of population growth; (ii) a high rate of human settlements with insufficient access to basic infrastructures like water and sanitation; and (iii) a lack of specialized knowledge regarding the management of sustainable land and water resources along with destructive practices at the local and sub-basin levels (Eggert *et al*., 2015). In addition, abject poverty among most

(70%) of the LVB inhabitants drives the locals to the intensive fishing effort, making environmental degradation observed across the entire lake a logically inevitable outcome.

## 2.3 Status and trends of Lake Victoria fisheries

Overfishing, pollution, lax enforcement of management measures, noncompliance with fisheries regulations and laws, and more recently, effects connected to climate change, have all had a significant detrimental influence on freshwater ecosystems worldwide (Kimani *et al.,* 2018). The ecological challenges have caused a significant reduction of several fisheries in many freshwater lakes worldwide (Beeton, 2002; Arthington *et al.*, 2016). Several interconnected human activities are placing significant strain on the transboundary resource Lake Victoria, which has seen significant environmental changes during the past two decades (Luomba et al., 2016). Numerous quickly developing changes in the lake, including overfishing, species invasions, industrial pollution, eutrophication, and climate change, pose a serious danger to the operation of the lake's ecosystem and its total variety (Kundu et al., 2017). There is no doubt that during the past 50 years, rapid eutrophication of Lake Victoria and diminishing fishery resources have been caused by sediment and nutrient run-off, city and industrial point sources of pollution, and deforestation in the water catchment areas (Njiru *et al*., 2008). These changes in the lake's environmental conditions occasioned by nutrient loading have changed the plankton community structure within the lake, which has affected the fish (Yongo & Outa, 2017). Generally, there has been a downward trend in fish production and landings from Lake Victoria over the years (Figure 1), occasioned by the lake's aforementioned problems and its fisheries resources (Njiru *et al.,* 2018).
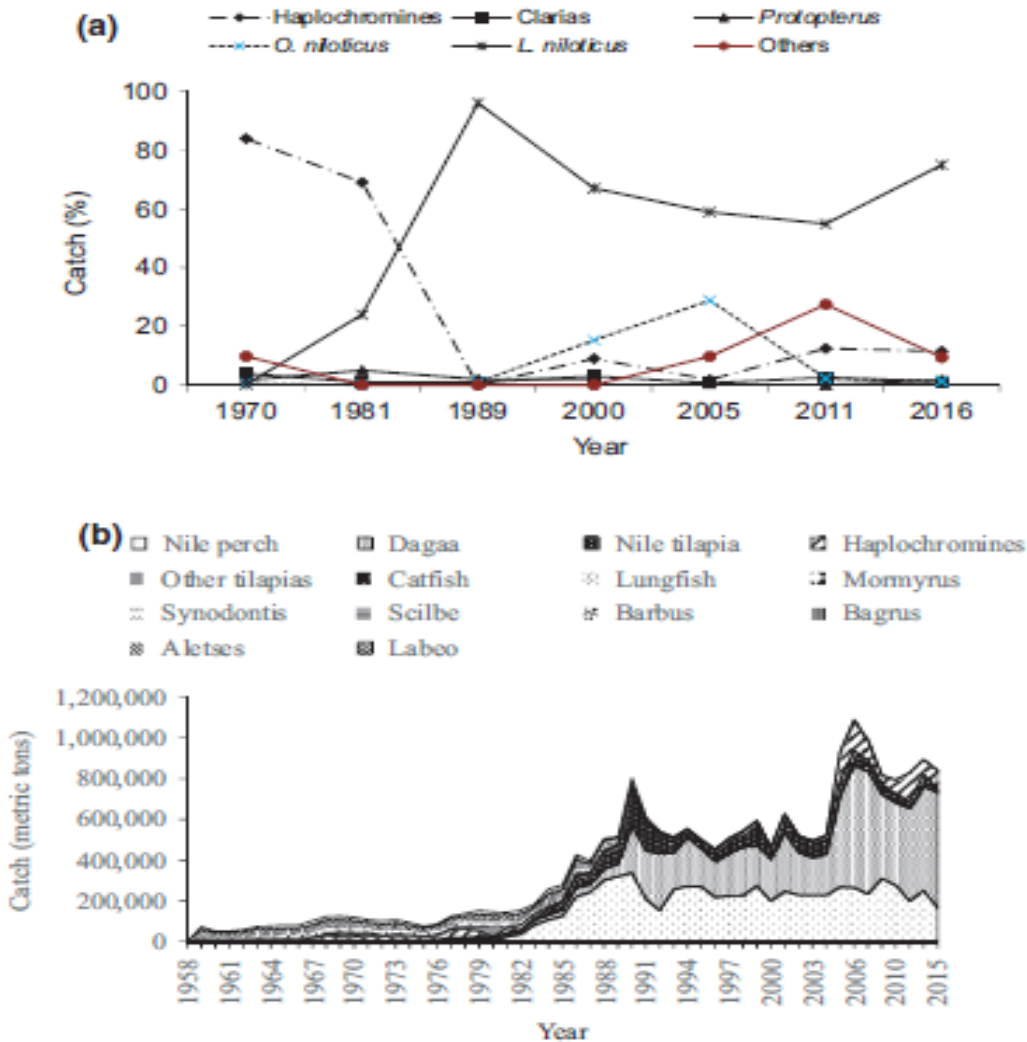
**Figure 1:** Contribution (a) and amount of fish catch (b) from Lake Victoria over the years

(Adapted from Njiru et al., 2018)

## 2.4 Stakeholder perceptions of the fisheries policies and the implementation strategies

### 2.4.1 Stakeholders in the fisheries management sector

The management of Lake Victoria's fishery resources is intricate and multidisciplinary, involving several stakeholders in different fields. (FAO, 2022). Stakeholders are all the people who benefit from or have an interest in a resource. They are essentially people or groups with stakes in

managing a resource (Etiegni *et al*., 2020). In the fisheries sector, some stakeholders include the fishermen, fishmongers, boat owners, and other people and groups that are direct beneficiaries of the fisheries and other resources within the lake. In management, the stakeholders are the Ministry and the departments of fisheries from both the national and county governments. There are also officers from related ministries like those mandated with the management of the lake's environment like National Environmental Management Authority (NEMA), Water Resource Management Authority (WARMA), and Kenya Wildlife Services (KWS) (Ikwaput-Nyeko *et al*., 2010). These bodies are mandated with the task of ensuring that the lake's environment remains habitable to fish. Other actors include the Lake Victoria Fisheries Organization (LVFO), fisheries research institutes like Kenya Marine and Fisheries Research Institute (KMFRI), and higher learning institutions such as universities and tertiary colleges (Ikwaput-Nyeko *et al*., 2010). For any resource conservation initiatives succeed, all the stakeholders must be involved and engaged adequately and appropriately. Therefore, stakeholder mapping should be an integral part of the management strategy (Ikwaput-Nyeko *et al*., 2010).

## 2.4.2 Stakeholder awareness and perceptions on fisheries policies and the implementation strategies

The level of knowledge and perception of both the policies themselves and the implementation strategies among the various stakeholders is vital in the fisheries management initiatives (Chuenpagdee & Jentoft, 2007). This is crucial, especially among the fishermen who are the fisheries' direct beneficiaries and utilizers. A good policy can fail to achieve its objectives if the stakeholders concerned are not in support of either the policy itself or the implementation strategies adopted. This can only be achieved through capacity building in terms of training and engaging these stakeholders fully both at the policy formulation and implementation stages (Hudson et al.,

2019). This makes them own the initiative enhancing their understating of the objectives and goals of the policies and their implementation strategies (Lundholm *et al*., 2014). In the case of Lake Victoria, for example, lack of compliance to the fisheries policies, laws, and regulations results from the lack of/little understanding of these policies and their implementation strategies (Etiegni, et al., 2020). The top-down approach to fisheries management mainly causes this.

**2.5 Status and trends of fishing gears, methods and capacity**

Inappropriate exploitation has increased the fishing efforts against the diminishing fish reproduction rate. Fishing activity on the Kenyan side of Lake Victoria grew from 60,431 in 2014 to 100,123 in 2018 (LVFO, 2017). On the Kenyan side of Lake Victoria, the number of fishing boats climbed from 20,234 in 2010 to 34,876 in 2018. During the same time frame, the number of lake-wide anglers climbed from 376,211 to 532,651 and the number of fishing vessels increased from 42,519 to 64,595 (LVFO, 2017). The amount of authorized fishing gear used, such as gill nets and long line hooks, has significantly grown in Lake Victoria. Gill nets with mesh sizes >5 inches which were lawful increased from 13,456 in 2010 to 275,355 in 2018, while illegal gill nets (mesh sizes < 5) increased from 33,544 to 47,638 over the same time frame (LVFO, 2017). Gillnets of all mesh sizes have generally been increasing in quantity over time, rising by 159.8 % between 2010 and 2018. The number of long line hooks climbed by the most within the same period of time, rising by 160.6% from 1,039,893 to 2,710,395. Monofilament gillnets are another example of illegal nets that have expanded from 78 in 2014 to 469 in 2016, 4,190 in 2008, and then 1,468 in 2010 (LVFO, 2017).

## 2.6 Existing fisheries policies and regulations

Fisheries policies are categorized as either international, regional, national, or local (county) (FAO, 2022). These policies are drafted to manage fisheries resources and their habitats for sustainable use and the betterment of livelihoods. The Food and Agricultural Organization (FAO) code of conduct for responsible fisheries, for instance, establishes guidelines for nations worldwide on how to create effective fisheries management plans based on the sustainably harvested fisheries resources (FAO, 2020). The code is a milestone of global cooperation and an accepted set of rules and principles to aid in the development, management, and conservation of the world's fishing resources for the benefit of both the present and the future (FAO, 2015). The transboundary nature of Lake Victoria requires policies formulated at the regional level (by the riparian states) to help harmonize the fisheries policies and implementation strategies (FAO, 2022).

The three riparian states (Kenya, Uganda, and Tanzania) have established and are collaboratively implementing policies and legislation for the efficient regional management of the resources of the shared lake (Ntiba et al., 2001). In the late 1920s, when the Lake Victoria Fisheries Service (LVFS) was established and the first fisheries survey was carried out, attempts were made to regulate Lake Victoria's fishery at the regional level (Graham, 1929). During the colonial era, the East African Freshwater Fisheries Research Organization took over LVFS in 1947. (EAFFRO). EAC's establishment in 1967, which bolstered EAFFRO after independence, crumbled in 1977 (LVFO, 2021). To coordinate regional fisheries efforts on the lake, the three riparian Partner States founded the Lake Victoria Fisheries Organization (LVFO) in 1994. However, the Lake Victoria Fisheries Research Project LVFRP (1999-2002) and Lake Victoria Environmental Management Project LVEMP (1997-2005) both supplied systematic scientific data that served as the foundation for important fisheries management choices (Ntiba et al., 2001; LVFO, 2021). The first Fisheries

Management Plan (FMP I) for the Lake Victoria fisheries was created in 2001 and put into effect from 2005 to 2008. It is also based on this baseline data. FMP 2 was implemented from 2009 to 2014. The current FMP 3 (2015-2020) was developed to address the weaknesses in the first two plans (LVFO, 2021). Although some of these plans encourage alternative livelihood activities for the people around the lake, the focus and emphasis have been on punitive measures. There is, therefore need to do things differently. Nationally, Kenya has its own fisheries policies and implementation strategies that extend to other inland fisheries (LVFO, 2021).

The Kenya Marine and Fisheries Research Institute (KMFRI), established as a state corporation through the Science and Technology Act (Cap 250), conducts fisheries research. Nationally, fishery resources in Kenya are managed by the Department of Fisheries under the provisions of the Fisheries Act (Cap 378) and Maritime Act (Cap 250) of the Laws of Kenya (Munene & Wanjiku, 2022). Often under distinct ministries, these two organizations are presently managed under the Ministry of Fisheries and Livestock Development. The Ministry of Fisheries aggressively explores methods to guarantee the growth of fisheries in a sustainable manner (Mangubhai et al., 2022). These tactics should ideally involve enforcing fishing laws that forbid damaging fishing methods and encouraging industrial growth through extension services, research, and fish product marketing and infrastructure. Implementation of most of these policies is never affected (Luomba et al., 2016). The Kenyan parliament passed the current fisheries act in 2012 which was amended in 2016. The law has decrees that restrict certain destructive fishing practices, such as the prohibition of using electric shock devices, the restriction on trawling within five nautical miles of the Kenyan shoreline of Lake Victoria, the restriction on anyone using a vessel without a valid registration certificate for fishing, and the restriction on anyone fishing in Kenyan waters without a valid registration certificate (FISHERIES ACT, 2016). The Act also prohibits

landing fish that are smaller than 25 cm, with the exception of *Rastrineobola argentea*, and prohibits the use of seine nets with a mesh size of less than 50 mm or gill nets with a mesh size of less than 50 mm, with the exception of *R. argentea*, where a minimum size of 10 mm is permitted (FISHERIES ACT, 2016). The Fisheries Act 2016 provided in parts II and III provided for the creation of the Kenya Fisheries Advisory Council and the Kenya Fisheries Service, respectively (FISHERIES ACT, 2016). The Act also provided in Part XVIII for the establishment of the Fisheries Marketing Authority. Due to the devolution of fisheries functions, most counties have developed unique fisheries policies (Mangubhai et al., 2022).

At the County level, laws and implementation strategies for the fisheries policies are unique to the various counties. Busia County, for example, has adopted, among other strategies the closed weekends under which fishermen have voluntarily accepted to stop fishing during weekends to help conserve and sustainably utilize the fisheries resources within the county (https://busiacounty.go.ke/main/index.php/fisheries). The county has also adopted the Aqua Park concept to aggregate fish cage and pond-based aquaculture systems for ease of management and increase aquaculture production within the county. Such initiatives have been seen to increase aquaculture production and conserve the fisheries resources within the lake as further discussed below (https://busiacounty.go.ke/main/index.php/fisheries).

## 2.7 Fisheries management strategies

Policies are only as good as their implementation strategies (Catedrilla *et al.*, 2010). These strategies are the steps and structures adopted and used in the enforcement or execution of the policy's various provisions in question. As such, different policies adopt different implementation strategies to achieve their objectives. The strategy of choice depends on, among other factors, the

goals and objectives of the policy as well as the institutional framework under which it is being implemented (Lebel *et al*., 2006). In the Kenyan context and particularly in the fisheries sector, various strategies have been adopted. Some are punitive, while some are participatory. Some notable implementation strategies used for the execution of fisheries policies are discussed below (FAO, 2022).

**2.7.1 Gear size and fishing method restrictions**

Under this method, slot sizes are specified for each fishery, and failure to comply either attracts cancellation of fishing licenses or arrest and/or destruction of the gears (Catedrilla *et al*., 2010). For instance, landing fish less than 25 cm is forbidden in Kenya, with the exception of *R. argentea*. Gill nets and seine nets with mesh sizes smaller than 50 mm are also prohibited, with the exception of *R. argentea*, which allows a minimum size of 10 mm (Luomba *et al*., 2016). Any gears that are not in agreement with the set standards are usually seized and destroyed. In April 2020, for example, the government, through the Department of Fisheries destroyed illegal gear worth Ksh. 4 million in Kisumu County alone (www.the-star-newspaper.co.ke). This happens even though co-management through Beach management units incorporates the fishermen in implementing the fisheries policies at the lowest level (beaches) (Bailey & Sumaila, 2015). Some laws have also focused on restricting destructive fishing methods like the use of dynamites and poison. These methods have been shown to be destructive and disruptive, not only to the fish but also to the lake ecosystem as a whole (Bailey & Sumaila, 2015).

**2.7.2 Closed seasons**

These are periods when fisheries either of the entire lake or a specific fish of interest are restricted. This is usually to allow the fisheries or the species' population to recover from factors like overfishing and other impacts within the habitat (Chuenpagdee & Jentoft, 2007). For example, in Lake Victoria, this method was established in the fisheries of *Restrineobola argentea* in 2001 and has stayed to date. Under the method, the fisheries of *R. argentea* are closed from 1st April to 31st July of each year (Ojwang *et al*., 2014). Closed seasons as a strategy can either be voluntary, like closed weekends in Busia County, or imposed on the fishermen by the relevant authorities. People who contravene this measure are usually arrested or have their gear and catch seized and/or destroyed (Bailey & Sumaila, 2015).

**2.7.3 Fishing entry restrictions**

This can either be through regulating the number of fishermen entering the fishery or restricting entry into specific areas of the lake. Such areas could be those dedicated as refugia or breeding areas for fish. Fishing quotas can also be adopted to reduce the amount and type of fish caught from the fishery (Obiero *et al* 2019). Williams (2018) argues that quota systems have a high chance of success over the medium run. All interested parties must be included, and the management of the process must shift from being driven by the government to being driven by the community (Perry et al., 2022). Instances of the process ought to start in places where the environment encourages sustainability and self-regulation. With little expense, this approach should be able to reduce the number of participants and efforts to a manageable level (Perry et al., 2022).

## 2.8 Approaches of administering the fisheries management strategies

To ensure compliance among the fisherfolk, the enforcing agencies have adopted different approaches and methods (Lent et al., 2022). These are meant to ensure that the resource users do not break the law and that they comply with the provisions of the law and implementation strategies discussed above.

## 2.8.1 Awareness creation and Co-management of fisheries resources

One of the surest ways to convince resource users to embrace conservation efforts is through education and awareness creation. This makes them more aware of the need and the benefits of conserving the resources. If this is not done, the laws and policies to hem will appear imposed and there are chances of failure (Ikwaput-Nyeko *et al*., 2010). Awareness creation helps encourage co-management since the fishermen feel like they are part of the management effort. The governments of the riparian states (Kenya, Uganda, and Tanzania) formed Beach Management Units (BMUs) in 2007 in an effort to promote co-management. The BMUs have networks at the local, state, and federal levels, as well as on the beaches, to allow fishermen to take part in the co-management of the fisheries resources (Etiegni et al., 2020). As the main parties involved in the management of the fisheries' resources, this was done to include the fishermen. This was done to promote bottom-up management of fishery resources rather than the more traditional top-down method. In Kenya, this concept has been established in all fisheries in the country (Etiegni *et al.*, 2020). All the above strategies have recorded varying levels of success.

## 2.8.2 Arrests and prosecutions

This is a punitive measure where fishermen and other resource users who contravene the laws and policies are apprehended and taken through a judicial process (Ghambi & Mzengera, 2016). This

strategy's main idea is deterrence, especially when the penalty is either jail terms or fines. In Kenya, most fisheries policies have adopted this approach. The arrests are usually a result of breaking laws regarding gear use, destructive fishing methods, fishing in breeding areas and breaking the closed season laws (Ghambi & Mzengera, 2016). When fishermen are arrested for not adhering to the policies' requirements, their gears are usually seized and destroyed (Saputra, 2020).

### 2.8.3 Provision of alternative livelihoods to encourage compliance

Alternative livelihood activities either reduce the over reliance on fishing or could take fishermen out of the sector altogether (Aura et al. 2020). This can also encourage them to comply with the fisheries regulations. If the youth; who are the dominant age group in the sector are provided with viable and sustainable livelihood activities, they have been seen to comply. The kind of alternatives depend on the region and the resources available for the various activities. Some of the alternatives to fishing could include aquaculture, farming, business etc (Aura et al. 2020). For those whose lives revolve around fishing and fish trade, the most acceptable one could be aquaculture. One such model has been tried under the Aqua Park Concept in Busia County where the current study was conducted. As argued by Odende *et al*., (2022), the concept is an ideal model for youth involvement in aquaculture.

### 2.9 Theoretical framework

### 2.9.1 The theory of the maximum equilibrium yield

The goal of fisheries management is to benefit people, not fish. As a result, the effect of fisheries management on fishery resources cannot be viewed as advantageous in and of itself. However, the management's financial benefits depend on biological reactions to various forms of exploitation (Burkenroad, 1951). The mass of the fish is anticipated to decrease when fishing pressure on a

particular population of fish grows. In other words, the more fishing done, the less can be harvested with the same amount of labor. As a result, it would be reasonable to assume that a given stock might "add more to itself in a given amount of time than it did when very weakly fished." In addition, as fishing reduces the density of the stock, the degree of saturation of the range that sustains the fish should decrease (Mainardi, 2010).

Under basic ideal circumstances, the stock should decline gradually over time, reaching a new equilibrium at a mass smaller than that of the virgin stock if a certain modest crop is maintained year after year (Mainardi, 2010). Thus, decreased abundance can simply be an indicator that a resource is being used. However, there must be a threshold below which the pace at which the stock can replenish itself stops increasing with stock-density fall, meaning that the capacity of a fish stock to balance with a fishery must have a limit (Burkenroad, 1951). With fishing up until this time, it would be predicted that the catch with which the stock would attain equilibrium would increase.

The sustainable catch should subsequently start to decrease with more persistent effort over the crucial threshold. As a result, "overfishing" is the condition in which an increase in fishing effort must result in a drop (relative to what would have otherwise happened) in both the stock's density and the total weight of the catch (Burkenroad, 1951). The fishing effort can go on even after the stock has been reduced below the level necessary for maximum equilibrium output if there is enough demand for a fish, which will cause its price to rise enough as a result of scarcity. Due to the possibility that the same equilibrium poundage might have been produced with less labor before the stock was dropped below the critical point, the interaction of social elements can waste effort that management could have avoided (Burkenroad, 1951). If fishing continued profitable

until the stock was reduced below the level at which it could maintain equilibrium with irreducible causes of mortality other than fishing, a commercial fishery may result in extinction (Mainardi, 2010). As a result, it is simple to characterize the effects of lowering a stock below the level necessary for the greatest equilibrium yield in terms of lost effort. However, it is more difficult to demonstrate the societal advantages of management saving this effort (Burkenroad, 1951).

**2.9.2 Theory of fisheries management**

If the fundamental presumption in fisheries management is that all benefits derived from aquatic natural resources accrue only to mankind, then a broad theory of fisheries management may be expressed as follows:

$Q_{Max} = f(X_1, X_2, \ldots X_n / Y_1, Y_2, \ldots Y_m);$   (Lackey, 1978), where

$Q$ = some numerical value of societal benefit

$X_n$ = management strategies (n = the number of all possible strategies); and

$Y_m$ = probability of compliance to management strategies (m = the number of all possible of compliance/constraints).

The theory reads:  the highest societal value or fisheries resources (Q) derivable from a fishery may be obtained by modifying a series of management strategies (X's) given a set of limitations (Y's); the slash line (/) is shorthand for "provided that." Noncontrollable variables (Ys) are random or reliant on other elements, such as weather, whereas controlled or partially controlled strategies (Xs) are those seen as management prerogatives (stocking, habitat maintenance, etc.) (Lackey, 1978).

## 2.10 Conceptual framework

The conceptual framework used in understanding resource governance outcomes first conceptualized by ICLARM & IFM (1998), modified by Obiero *et al*. (2015) and has been modified for this study. The dependent variable is Fisher folk compliance with fisheries regulations. The independent variables are the fisheries management strategies. The intervening variables are the availability of fish stocks, weather and habitat maintenance. (Figure 2).

The conceptual framework shows that types of fisheries management strategies such as stakeholder perceptions, types of punitive measures and types of alternative livelihoods are interrelated with compliance with fisheries regulations on: Arrest and prosecutions, co- management of beaches, closed seasons, fishing areas, fishing methods, income diversification and aggregated production. These interrelationships can be influenced by the availability of fish stocks, weather conditions and fish habitat maintenance.

**Independent Variable**

**Fisheries Management Strategies**

1. Types of punitive measures
   - Gear size restrictions
   - Closed seasons
   - Fishing methods restrictions
2. Types of alternative livelihoods
   - aggregated horticulture farming
   - aggregated dairy and poultry
   - aggregated aquaculture farming

**Dependent Variable**

**Compliance with fisheries regulations on:**
1. Arrest and prosecutions
2. Co- management of beaches
3. Closed seasons
4. Fishing areas

**Intervening Variables:**
Availability of fish stocks
Weather
Habitat maintenance

**Figure 2:** Conceptual framework showing the relationship between fisheries resources management and compliance with fisheries regulations (Researcher, 2021).

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

The study region, research design, study population and sample, field data collecting procedures, methods for determining the reliability of the data, and data analysis methodologies that were used are all described in this chapter.

## 3.2 Study Area

### 3.2.1 Location and size

This research was conducted in the western Kenyan county of Busia, which lies within the Lake Victoria Basin and is situated between 0043'N and 340 15'E. (Figure 3). The study focused on fish landing sites in Busia County, Kenya. There are undulations in Busia's elevation, which ranges from a minimum of 1,130 meters above sea level along the Lake Victoria shore to a high of 1,500 meters in the Samia and North Teso Hills. The Yala Swamp, a region that has been down-warped as a result of Lake Victoria's development, covers the southernmost portion of the county. Alluvial and lacustrine deposits from the Pleistocene and recent eras cover this region.

### 3.2.2 Rainfall and climate

Between 760 mm and 2000 mm of precipitation fall annually in the County. Between late March and late May, when the long rain season is at its peak, around 50 % of the rainfall occurs, whereas only 25 % does so between August and October during the short rains. December through February is the dry season, with sporadic rainfall. The average maximum temperatures each year are between 26 and 30 °C, while the average lowest temperatures are between 14 and 22 °C.

### 3.2.3 Socio-economic status

One of the highest rates of unemployment in the western area is found in the County. The unemployment rate now stands at 66.7 %. Busia's main economic activity is fishing, and Lake Victoria is the main supplier of both Tilapia and Nile Perch. Two of the seven sub-counties of Busia County, Bunyala and Samia, border the lake. This industry employs many youths within the county. The high unemployment rate, especially among the young, contributes to the destruction and unsustainable utilization of the fisheries resources in Lake Victoria within the county. Farming for both food and cash crops is one of the county's other economic pursuits (Busia County Integrated Development Plan 2018-2022, 2018).
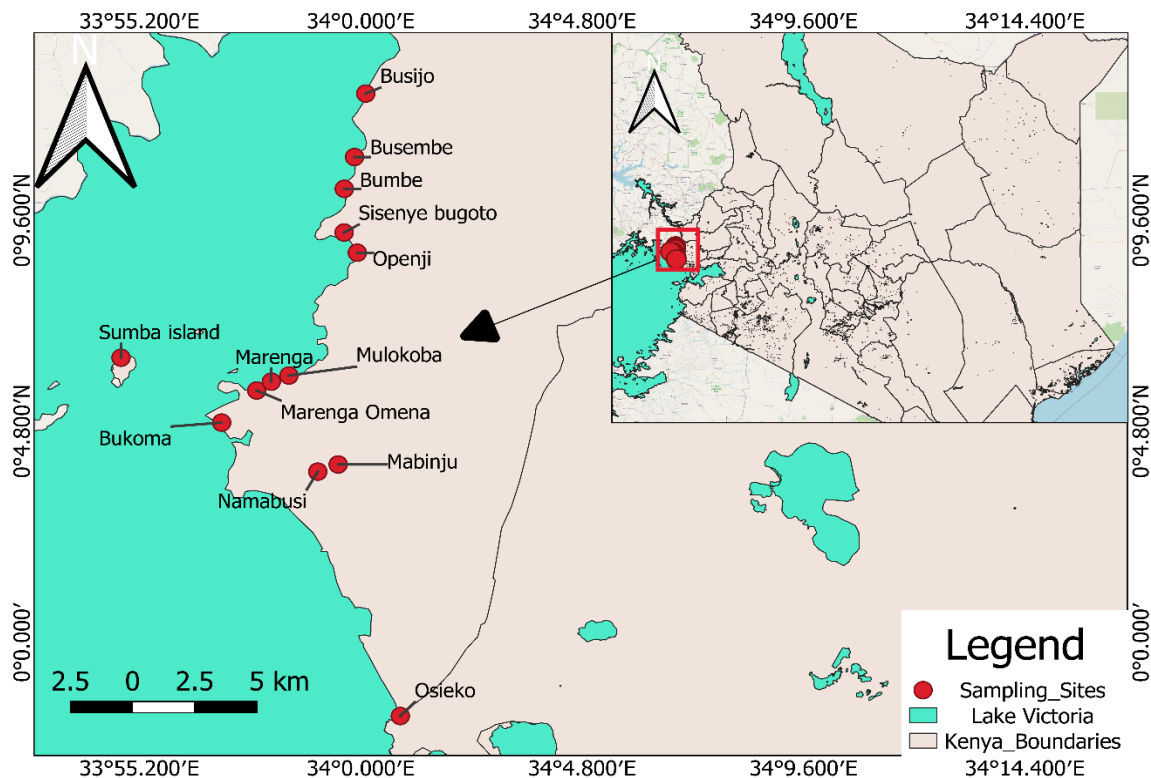


**Figure 3:** Location of study area with in the Kenyan context and the location of sampling sites, 13 landing beaches (Odende et al., 2021)

## 3.3 Research design

The study adopted a descriptive cross-sectional study design. The study focused on how the types of management strategies and fishing regulations were interrelated with compliance with fisheries regulations. Thus, information was acquired through key informant interviews, the questionnaires, and focus group discussions. Individuals and groups of individuals served as the units of analysis, including fishermen, boat owners, fish sellers, local gear makers and repairers, and dealers in fishing equipment.

## 3.4 Study Population and Sampling

The study population was drawn from Bunyala and Samia sub-counties, the riparian areas of Busia County with 20 beaches. On three beaches in Samia and ten beaches in Bunyala sub-counties, the sample frame consisted of a list of fishermen/fisher folk, boat owners, fish sellers, local gear makers and repairers, and fishing and equipment dealers. These beaches were selected on the premise of high dominance of fishing as an economic activity, presence of different fish species landed, presence of high population densities of communities who to a larger extent rely on the Lake Victoria fisheries, adequate marketing prospects and existing infrastructure. The study used the computing formula provided by Kothari (2004) for a finite population, which is as follows:

$$n = \frac{Z^2 \cdot p \cdot q \cdot N}{e^2(N-1) + Z^2 \cdot p \cdot q} \qquad = 324 \qquad (1)$$

Where: $n$ = sample size; $p$ = Sample proportion; $q$ =1- $p$; $N$ = The estimated population (approximately 4200). $e$= acceptable margin of error/precision rate: The desired precision was 4%. $Z$= 1.96; the estimated standard variation at 95% confidence interval. Table 1 shows how the sample size 324 respondents were distributed among 13 landing beaches.

**Table 1:** Number of respondents sampled in 2 Sub Counties and 13 landing beaches

| Characteristics | N = 324 |
|---|---|
| **Sub-county** | |
| Bunyala | 256 (80 %) |
| Samia | 68 (20 %) |
| Landing Beach | |
| Bukoma | 27 (8.3 %) |
| Bumbe | 22 (6.8 %) |
| Busembe | 23 (7.1 %) |
| Busijo | 22 (6.8 %) |
| Mabinju | 23 (7.1 %) |
| Marenga | 28 (8.6 %) |
| Marenga Omena | 25 (7.7 %) |
| Mulokoba | 25 (7.7 %) |
| Namabusi | 26 (8.0 %) |
| Openji | 26 (8.0 %) |
| Osieko | 26 (8.0 %) |
| Sisenye bugoto | 26 (8.0 %) |
| Sumba island | 25 (7.7 %) |

The questionnaire survey was carried out utilizing digital questionnaires. Focus groups with various stakeholders and key informant interviews supplemented survey data. Three focus group discussions with the Beach Management Units (BMUs) chairmen, National Environment Management Authority, Kenya Fisheries Service, the Kenya Wildlife Service, Nature Kenya, Kenya Marine and Fisheries Research Institute, the Beach Management Network chairman, Kenya Coast Guard Service, Busia County Fisheries Department and the Samia sub-county administrator were undertaken (i.e. smaller units and undertake several rounds of interviews as a Covid-19 mitigation measure) to triangulate and interpret results from the survey.

## 3.5 Data Collection Methods

The primary data was collected from two sub-counties: Samia and Bunyala, covering thirteen out of twenty landing beaches in Busia County in Kenya. Secondary information from the Busia County department of fisheries was used to identify the landing beaches. Some beaches were excluded from the sample due to the beach's submersion, thus inaccessible. Each landing beach captured variability in various market conditions (market accessibility, infrastructure etc.), fish species landed, and population size, among other facets. Requisite primary data from a cross-section of respondents were collected on socio demographic characteristics of respondents.

The Likert scale of measurements were used to collect data on: Stakeholders' perceptions on the existing management strategies and fisheries regulations; how types of punitive measures interrelate with compliance with fisheries regulations; and how types of alternative livelihoods interrelate with compliance with fisheries regulations. A digitized semi-structured questionnaire on the Open Data Kit (ODK) suite was installed on android smartphones to ensure quality check and data safety. A pilot study was undertaken to pre-test the questionnaires before administration to respondents in its final form. Based on the findings from pre-testing, the questionnaires were further refined.

## 3.6 Data analysis and results presentation

The Likert scale data on stakeholders' perceptions on the existing management strategies and fisheries regulations were analyzed using descriptive statistics, including frequencies, percentages, and Spearman's rank correlation coefficient. The Likert scale data on how types of punitive measures interrelate with compliance with fisheries regulations; and how types of alternative livelihoods interrelate with compliance with fisheries regulations were analysed using frequencies and Chi- square test of homogeneity. The results were presented in narrative and tables.

## 3.7 Reliability analysis

The Cronbach's alpha reliability test was done to evaluate the internal reliability and consistency of the questionnaire section. The results as illustrated were given in terms of the alpha and the standardized alpha and the number of items in every section. The results from every construct were expected to be above 0.70 for the reliability of the questionnaire to be accepted as answering the questions being asked. The results as illustrated in Table 2 were given in terms of the alpha and the standardized alpha and the number of items in every section. The stakeholder perceptions towards existing fisheries management strategies fisheries regulations had a Cronbach's alpha value of 0.65 which is within the acceptable range. However, compliance with fisheries regulations when provided with types of alternative livelihoods had the lowest Cronbach's alpha values of 0.56. Whereas compliance with fisheries regulations when punitive measures were enforced had the highest alpha values of 0.73 which falls within good internal reliability of the questionnaire. The Cronbach's internal reliability alpha values indicated that the questionnaire was sufficiently formulated to ask and answer the questions as expected.

**Table 2:** Cronbach's internal reliability test

| Questionnaire Section | Cronbach's Alpha | Cronbach's Alpha Based on standardized items | Number of items |
|---|---|---|---|
| Stakeholder perceptions types of management strategies and fisheries regulations | 0.65 | 0.66 | 14 |
| Compliance with fisheries regulations when provided with types of alternative livelihoods | 0.56 | 0.60 | 17 |
| Compliance with fisheries regulations when punitive measures are enforced | 0.73 | 0.74 | 17 |

## 3.8 Validity

The researcher solicited the opinions of professionals in the subjects, particularly university faculty members, to make sure the questionnaire was genuine. The process of designing the research instrument took the expert viewpoint into consideration, which produced a legitimate questionnaire.

## 3.9 Research Ethics

The researcher ensured that before field data collection, the research proposal was approved by the School of Graduate Studies, Maseno University. The researcher upheld the highest standards of integrity and ethical principles in all the stages, from data collection, analysis, and thesis writing. The whole process was guided by objectivity, honesty, and critical ethical principles, including; beneficence, autonomy, justice, confidentiality, and non-maleficence.

# CHAPTER FOUR

# RESULTS AND DISCUSSION

## 4.1 Introduction

This chapter gives the presentations of results and the explanation of the pattern of findings. It also contains the findings on sociodemographic characteristics of respondents. Moreover, the findings and discussions on stakeholders' perceptions on types of management strategies and fisheries regulations are presented including Spearman's Rank correlation analysis for stakeholder perceptions. The chi-square test of homogeneity results and discussions on how types of punitive measures and types of alternative livelihoods interrelate with compliance with fisheries regulations are also included.

## 4.2 Socio demographic characteristics of respondents

The respondents were drawn from two sub-counties, i.e., Bunyala (80%) and Samia (20%) in which respondents sample size were distributed in 13 landing beaches (see Table 1). There were more males (78%) compared to women (22%), with the majority of the respondents being married (86%), single (9.3%), divorced (1.9%), and widowed (2.5%). This indicates that the fishery sector is male-dominated due to its labor-intensive nature, as previously alluded to and supported by the findings of Bahadur *et al*., (2020) and Himes (2003). Because men do the majority of the fishing in the lake, more men were interviewed about their perceptions than women (who are mainly found in the upper nodes of the fish value chain). Fishermen are the ones who deal with aspects of fisheries resource management on a daily basis in the lake, particularly through interactions with enforcement officers and other stakeholders. However, women dominate the fish trade and value chain processing nodes as reported by Awuor *et al*., (2019). As a result, they do not have as much

interaction with the laws governing fisheries management, particularly at the fishing level. They are primarily impacted by policies and laws pertaining to fish marketing and processing. This is not to say that they are unaware of or unaffected by fisheries laws; rather, their interactions with these laws may be more distant. This could be because their businesses are dependent on whether or not the fishermen bring fish ashore. As a result, if the laws are either prohibitive or ineffective, resulting in low (or no) fish catches, their businesses and livelihoods will suffer. As a result, interventions must include players in this segment of the fish value chain (Bahadur *et al.*, 2020). The interventions should therefore be gender-sensitive and should not be prohibitive to either gender.

Regarding age brackets, the respondents between 30 and 40 years made up the largest proportion of 34 % while the below 20 years and above 70 years had the lowest proportion (Figure 4).
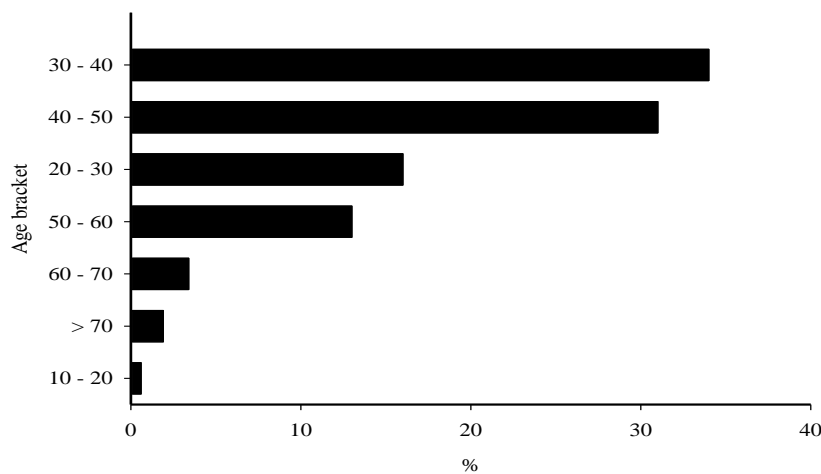


**Figure 4:** Age ranges for the respondents in years

This implyies that the fisher community is made up of active middle-aged workers. This age group is regarded as the most productive in terms of capital and energy to work optimally (Davidescu et al., 2020). As a result, the fisheries sector around the lake is primarily composed of young people. This is consistent with data collected in surveys around the lake by other researchers, including Aura *et al*., (2020), who reported that the Lake Victoria fisheries sector is dominated by youth. This could be because fishing is a labor-intensive activity that attracts young and energetic members of society. It can also be attributed to the fact that fishing and many of its associated activities do not require formal training (thus attracting a large number of young people), as they can easily learn from others through observation and participation (Harper *et al*., 2011; Njiru *et al*., 2017). The implication for fisheries resource management is that there will be sustained pressure on the fisheries within the lake, especially as the number of youths entering the trade grows. Youth are also more defiant (and risk-taking) and less interested in following fisheries relegations (Kuteesa *et al*., 2022). They are also more creative, which allows them to easily adopt and craft harmful and unconventional fishing methods (which they may consider more effective) but are detrimental to the lake's fisheries. Any intervention(s) must thus be designed with this in mind. It also implies that interventions must be tailored to be not only beneficial but also appealing to youth (Smith et al., 2021). The stakeholders involved in the intervention's formulation and communication must also consider youth-friendly channels for communicating the interventions and raising awareness (OECD-FAO, 2018). In addition to traditional communication channels, these could include the use of modern platforms such as social media. This information should also be packaged in youth-friendly, simple language and format, with the goal of instilling behavior change and responsible fishing practices. Because different sections of the fisheries value

chain are dominated by a specific gender (Odhone et al., 2020), this can also be packaged to target the different genders among the youth.

Most of the respondents (60%) attained primary education while only 2% had attained undergraduate degree (Figure 5).
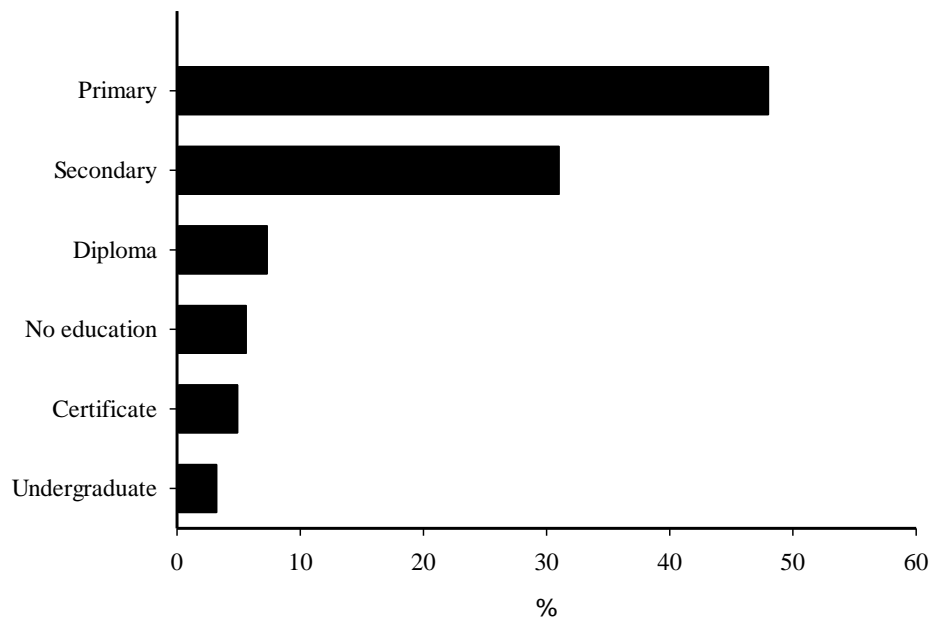


**Figure 5:** Education levels of the respondents

This implies that the fishing community is made up of people with little (formal) education. This finding is supported by the reports of Yongo et al. (2013). Education level influences cognitive ability and thus can play a role in levels of awareness, perception, and compliance (Darling-Hammond et al., 2019). It is believed that education allows for faster perception, interpretation, and response to new information, as well as faster adoption of new technology (Karr *et al*., 2017). However, higher formal education levels can open up more appealing employment opportunities among the fishing community (Karr *et al*., 2017). This could reduce the pressure on the lake's

fisheries. However, given the high rates of youth unemployment in Busia and throughout the country, this may not be the case. The findings of this study also revealed that there was no relationship between education level and knowledge (and perception) of fisheries policies and implementation strategies. This implies that, while education level can influence understanding and application (including knowledge), this is not the case with Busia County stakeholders in this sector. As a result, alternative interventions (whether new or modified from existing ones) must be sensitive to educational level. Messages and interventions must thus be interpreted and packaged in simpler and more understandable ways.

The majority of the respondents were fisher folk or fishermen followed by fish traders also known as fishmongers with 49% and 26% respectively. Boat owners only comprised 15% of the respondents while local gear makers and dealers comprised only 8.6%. The occupation of the spouses interchanged with that of the partner. The fishmongers are more in the category of the spouse meaning that when a respondent was found to be fisher folk or fisherman, the spouse was likely to be a fishmonger and vice versa (Figure 6).
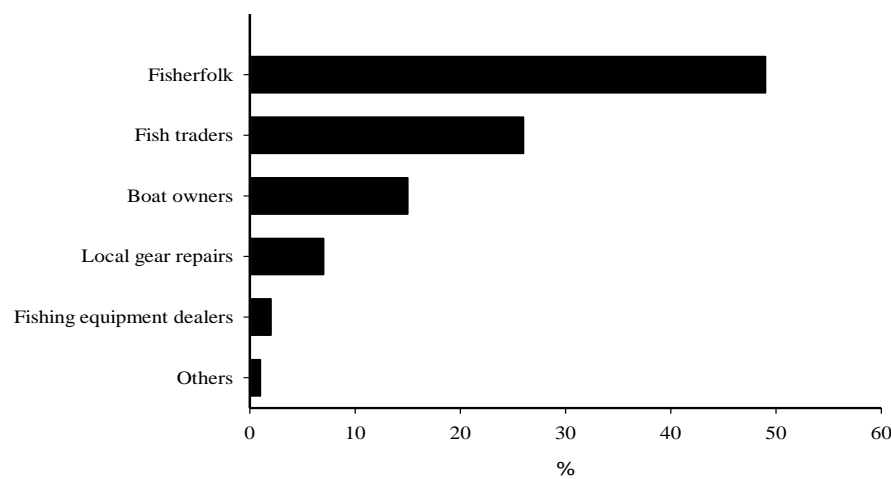


**Figure 6:** Occupation of respondents in the sector

**4.3 Stakeholders' perceptions on the existing fisheries management strategies and fisheries regulations**

Table 3 shows the results of stakeholder perceptions ranked on a five-point scale from strongly agree to strongly disagree. The results of each existing policy statement are plotted on a five-point scale, and the percentages that fall on those scales are computed along with their frequencies. The position in the ranking with the highest percentage and frequency of responses is considered the general perception of that policy statement. About 89 of the respondents (27%) disagree with the statement that arrests and prosecutions are too punitive, while 25 percent strongly agreed with the statement. Concerning the efficiency of BMU Co-management, 44% of respondents disagreed with the statement that BMU Co-management is inefficient. As the leading perception among the fisher community, 140 respondents (43%) agreed that aggregated production was a good alternative livelihood initiative. Closed seasons work better under the alternative livelihood model, according to 143 respondents (44%). Statements such as "few women and youth participate in the fishery," "fishermen forced by the difficult economy to violate regulations," "awareness of illegal activities," and "income diversification mitigates violation impacts" were all ranked as the top perceptions. The majority of respondents (70%) agreed that low compliance was a leading factor in the dwindling of Lake Victoria's fishery stocks, while 48 percent agreed that current strategies are also counterproductive. In general, 42 percent of respondents agreed with the status quo of the policy statements distributed to them.

**Table 3:** The frequencies and percentages of stakeholders' responses ranked on a five-point likert scale from agree, disagree, neutral, strongly agree to strongly disagree with policy statements on fisheries management strategies and fisheries regulations

| Policy Statement on fisheries management strategies and fisheries regulations Name | Agree | Disagree | Neutral | Strongly Agree | Strongly Disagree |
|---|---|---|---|---|---|
| Regulations on arrests prosecutions are too punitive | 79 (24%) | 89 (27%) | 7 (2.2%) | 80 (25%) | 69 (21%) |
| Co management (BMU) is inefficient in enforcement | 109 (34%) | 143 (44%) | 33 (10%) | 23 (7.1%) | 16 (4.9%) |
| Aggregated production is a good alternative livelihood initiative | 140 (43%) | 42 (13%) | 15 (4.6%) | 45 (14%) | 82 (25%) |
| Regulations on closed season works best under the alternative livelihood model | 143 (44%) | 93 (29%) | 16 (4.9%) | 23 (7.1%) | 49 (15%) |
| Current approaches are ineffective | 132 (41%) | 93 (29%) | 27 (8.3%) | 56 (17%) | 16 (4.9%) |
| Few women and youth participating on BMU current approaches to compliance | 147 (45%) | 47 (15%) | 8 (2.5%) | 120 (37%) | 2 (0.6%) |
| Fishermen forced by economy to violate income diversification approaches | 168 (52%) | 25 (7.7%) | 6 (1.9%) | 114 (35%) | 11 (3.4%) |
| Fishermen are aware of current laws and regulations on illegal activities | 117 (36%) | 27 (8.3%) | 20 (6.2%) | 132 (41%) | 28 (8.6%) |
| Income diversification can be an effective approach | 142 (44%) | 21 (6.5%) | 8 (2.5%) | 149 (46%) | 4 (1.2%) |
| Current regulations can mitigate dwindling fisheries resources | 162 (50%) | 11 (3.4%) | 11 (3.4%) | 138 (43%) | 2 (0.6%) |
| Current Laws and regulations are easy to understand | 139 (43%) | 55 (17%) | 24 (7.4%) | 84 (26%) | 22 (6.8%) |
| Inadequate approaches to enhance compliance is a major cause of dwindling fish stocks | 150 (46%) | 13 (4.0%) | 7 (2.2%) | 151 (47%) | 3 (0.9%) |
| Government explore sustainable approaches to enhance compliance | 185 (57%) | 13 (4.0%) | 14 (4.3%) | 90 (28%) | 22 (6.8%) |
| Current approaches are punitive and counter productive | 156 (48%) | 44 (14%) | 28 (8.6%) | 90 (28%) | 6 (1.9%) |
| Total | 2,435 (42%) | 1,054 (18%) | 329 (5.6%) | 1,537 (26%) | 477 (8.2%) |

Table 4 shows Spearman's Rank correlation coefficients between stakeholders' responses to fisheries regulations and fisheries management strategies. A positive correlation occurs when the 'agree' frequencies tend to occur together with 'strongly agree' frequencies. When correlation coefficients tend towards zero it indicates respondents who agree while coefficients tending towards one (i.e. above 0.5) represent respondents who strongly agree. By contrast, a negative correlation occurs when correlation coefficients are below zero and 'disagree' frequencies and 'strongly disagree frequencies' tend to occur together.

According to the findings, the respondent strongly agreed (r=0.714) that current laws and regulations are easy to understand but they were ineffective (Table 4). The respondents strongly agreed (r=0.801) with the statements that some of the regulations such as arrests and prosecutions were too punitive and counterproductive. In addition, the respondents strongly agreed (r=0.897) that aggregated production is a good alternative livelihood initiative and an effective approach to income diversification. Even though, the respondents strongly agreed (r=0.896) that fishermen are aware of current laws and regulations on illegal activities, they are forced by economy to violate income diversification approaches. However, the respondents agreed (r=0.235) that current regulations can prevent fisheries resources losses if the government explores sustainable approaches to enhance compliance. This reveals that respondents have a high level of awareness and a positive attitude (of both the fisheries policies and the management strategies). The strong agreement that diversifying income sources for the fishing community can aid in the conservation of the lake's fisheries resources implies that the fishermen are aware of the immediate economic benefits of complying or violating a regulation, but are forced to violate due to economic conditions. In theory, the fisher community near Lake Victoria is considered the poorest in all sectors of the economy (Aura, et al., 2020). Interaction with the policies, whether through reading

or participation in policy formulation and implementation, results in awareness. This can be accomplished through trainings and other forms of communication provided by enforcing agencies or officers on the various regulations and implementation strategies. According to Downing *et al*. (2013), awareness has been shown to improve compliance. Fisheries regulation awareness and implementation strategies influence stakeholder perceptions, which in turn influences compliance and effectiveness. This is based primarily on the assumption that people's perceptions influence their behavior (Ghambi & Mzengera, 2016). When people perceive a policy to be favorable and acceptable to them, there is a high likelihood that they will develop and adhere to behavior that will improve adherence to the regulations.

In connection with the inefficiency of enforcement by Beach Management Units (BMU), the respondents strongly agreed (r= 0.652) that right management strategies to enhance compliance is a major cause of dwindling fish stocks. Besides, the respondents moderately agreed (r= 0.551) that few women and youth are participating in BMU current approaches to compliance. Moreover, the respondents strongly agreed (r=0.904) that closed season only work well under an alternative livelihood model because most fishermen are forced by the hard economy to violate income diversification approaches. Since the BMU concept is regional and was adopted by the tree riparian states, the Lake could also be suffering from the Tragedy of Common since it is not clear how much effort has been made by the riparian countries and the level of compliance by the fisherfolk in those countries.

**Table 4:** The Spearman's Rank correlation coefficients between stakeholders' responses to fisheries regulations and fisheries management strategies. Correlation coefficients are significant at α= 0.05

| Fisheries regulations | Fisheries management strategies | Spearman's Rank Correlation Coefficient | Correlation Significance |
|---|---|---|---|
| Current Laws and regulations are easy to understand | Current approaches are ineffective | 0.714 | <0.001 |
| Current regulations can mitigate dwindling fisheries resources | Government explores sustainable approaches to enhance compliance | 0.235 | <0.001 |
| | | 0.801 | <0.001 |
| Regulations on arrests and prosecutions are too punitive | Current approaches are punitive and counter productive | 0.897 | 0.021 |
| Aggregated production is a good alternative livelihood initiative | Income diversification can be an effective approach | | |
| Co management (BMU) is inefficient in enforcement | Inadequate approaches to enhance compliance is a major cause of dwindling fish stocks | 0.652 | 0.022 |
| Regulations on closed season works best under the alternative livelihood model | Fishermen forced by economy to violate income diversification approaches | 0.904 | <0.001 |
| Co management (BMU) is inefficient in enforcement | Few women and youth are participating in BMU current approaches to compliance | 0.551 | 0.012 |
| Fishermen are aware of current laws and regulations on illegal activities | Fishermen forced by economy to violate income diversification approaches | 0.896 | <0.001 |

**4.4 Relationship between types of punitive measures and compliance with fisheries regulations in Lake Victoria in Busia County**

The stakeholders' responses to question whether types of existing punitive measures guarantee compliance to fisheries regulations were examined using responses ranked: Don't know, False and True, against types of existing punitive measures. The frequencies of responses show that the majority of stakeholders responded True (Table 5). The results show a statistically significant ($p<0.001$) association between types of existing punitive measures and compliance to fisheries regulations. The null hypothesis tested was that the types of punitive measures and compliance to fisheries regulations are independent was rejected.

**Table 5:** The types of existing punitive measures, responses ranked on a three-point Likert scale (Don't know, False and True) and frequencies of stakeholders' responses to question whether punitive measures guarantee compliance to fisheries regulations. The significance level, $\alpha = 0.01$, Chi-square test statistic $=62.44$, degree of freedom $= 8$ and p value $= 0.000$

| Punitive Measures | Don't know | False | True |
|---|---|---|---|
| Closed seasons | 5 | 55 | 264 |
| Fish landing areas restrictions | 2 | 32 | 290 |
| Fishing areas restrictions | 8 | 14 | 302 |
| Fishing methods restrictions | 5 | 8 | 311 |
| Gear size restrictions | 6 | 19 | 299 |

Punitive implementation strategies such as arrests and prosecutions, confiscation and destruction of gear (and catch) were shown to be ineffective. According to the participants of focus group discussion, such measures give authorities, particularly beach guards, far too much power, which they (enforcing officers) frequently abuse.

'*Instead of using the laws to protect the fishermen, the officers have taken advantage of these powers to harass and punish the fishermen*' one participant stated.

This could be one of the reasons for the low levels of legal compliance. According to Ghambi and Mzengera (2016), punitive laws such as arrests and prosecutions have a low success rate in resource conservation and management, which agrees with the results of the present results. This applies to most resources and is not unique to fisheries. They give the reason that when resource users are discouraged from using the resource, they tend to over utilize or be destructive to the resource. This is especially true for fisheries resources, which fishermen regard as a free and open resource that they should exploit without restriction. Such 'restrictions' (in this case, fisheries policies and laws) should therefore be negotiated and made clear to resource users. Closed seasons are one of the strategies investigated in the current study and are viewed as restrictive by focus group discussion participants. Because fishermen are arrested for violating these regulations, they regard them as restrictive and punitive, and thus are unwilling to follow them. Furthermore, punitive policy implementation strategies have been shown to elicit "retaliatory" behavior among resource users, to the resource's detriment (Hare, 2020; Hind, 2015). Although respondents in the current study did not express this explicitly, some of their responses alluded to it. This is not only counterproductive in terms of conservation, but it may also reduce the gains (albeit minor) made (Moberg *et al.*, 2021), thus far in the conservation of the lake's fisheries resources. As a result, the use of alternative measures such as negotiated voluntary weekend fishing bans implemented by fishermen in Busia County, as previously discussed, is a possibility. Better compliance levels could be achieved when combined with other strategies such as alternative livelihoods, training, and capacity building. The main goal should be to make fishermen own and embrace the policies and strategies, as well as to make them believe that the goal is to improve the fisheries and thus their

livelihoods, rather than to discourage them from accessing the fisheries. This can be accomplished through stakeholder mapping and engagement at various levels in a clear and structured manner as suggested by Ghambi & Mzengera, (2016) and Moberg *et al.*, (2021).

In their study, Catedrilla et al. (2010) contended that the effectiveness of any policy (including fisheries policies) is heavily dependent on the implementation strategy used. While difficult economic conditions (exacerbated by the COVID-19 pandemic) may be one of the causes of noncompliance, the fisher community should also be encouraged to protect the lake as a condition for using it. This approach would make conservation strategies more effective (McClanahan & Abunge, 2019; Schewe et al., 2019). This has also been observed to work under the current voluntary weekend fishing bans implemented by Busia County fishermen. Such consultative and negotiated management approaches can be used to encourage compliance with and adherence to recommended fisheries laws and policies as reported by Ghambi & Mzengera, (2016). This is especially true given the findings of the current study, which revealed the ineffectiveness of all strategies considered punitive and prohibitive to fishermen. According to the study's findings, stakeholders are aware of fisheries policies and implementation strategies. What is less clear is the reason for respondents' general agreement that the strategies and laws are ineffective in conserving the lake's fisheries.

**4.5 The relationship between categories of alternative livelihoods and compliance with fisheries regulations**

In this section, the categories of alternative livelihoods considered as an alternative for fishing include: Aggregated horticulture farming, aggregated dairy and poultry farming and aggregated aquaculture farming. The association between these alternative livelihoods was established using chi-square test on independence.

**4.5.1 The relationship between aggregated horticulture farming as alternative livelihoods and compliance with fisheries regulations**

The stakeholders' responses to question whether aggregated horticulture farming as an alternative livelihood to fishing can enhance compliance to fisheries regulations were examined using responses ranked: Don't know, False and True, against fisheries regulations on gear size, fishing areas, closed seasons and fishing methods. The frequencies of responses show that the majority of stakeholders responded True (Table 6). The results show that there is statistically significant ($p<0.001$) association between aggregated horticulture farming as alternative livelihood and compliance with fisheries regulations (Table 6). The null hypothesis that the aggregated horticulture farming as alternative livelihood and compliance with fisheries regulations are independent was rejected.

Agriculture is done mostly for subsistence, and the product is not sold on the market. This clearly demonstrates that poverty among fishermen may be due to lack of meaningful and viable alternative income sources. As a result, such alternatives could either reduce their reliance on fishing or force them out of the industry entirely. This may also encourage them to follow fisheries regulations. Because of the favorable conditions described earlier in the document, horticulture

may be viable alternative in Busia County. Because of the favorable climate, soil, and ready market for farm products due to the proximity to the Ugandan border, agriculture is a profitable and viable alternative to fishing within the county. The government can help by providing an enabling environment for the county's fishermen to venture into crop and animal production.

**Table 6:** Areas of fisheries regulations, responses ranked on a three-point Likert scale (Don't know, False and True) and frequencies of stakeholders' responses to question whether aggregated horticulture farming as an alternative livelihood to fishing can enhance compliance to fisheries regulations. The significance level, $\alpha = 0.01$, Chi-square test statistic $=30.35$, degree of freedom = 6 and p value = 0.00003

| Areas of Fisheries regulations | Don't Know | False | True |
|---|---|---|---|
| Gear size | 13 | 71 | 240 |
| Fishing areas | 10 | 14 | 300 |
| Closed seasons | 8 | 20 | 296 |
| Fishing methods | 9 | 37 | 278 |

**4.5.2 The relationship between aggregated dairy and poultry farming as alternative livelihoods and compliance with fisheries regulations**

The stakeholders' responses to question whether aggregated dairy and poultry farming as an alternative livelihood to fishing can enhance compliance to fisheries regulations were examined using responses ranked: Don't know, False and True, against fisheries regulations on gear size, fishing areas, closed seasons and fishing methods. The results show that the highest frequencies of responses fall under True. The chi-square test of independence confirms that there is a statistically significant (p < 0.001) association between aggregated dairy and poultry farming as

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alternative livelihood and compliance with fisheries regulations (Table 7). The null hypothesis that the aggregated dairy and poultry farming as alternative livelihood and compliance with fisheries regulations are independent was rejected. Based on the results, dairy and poultry farming were reported to be of the greatest potential in the county.

**Table 7:** Areas of fisheries regulations, responses ranked on a three-point likert scale (Don't know, False and True) and the frequencies of stakeholders' responses to question whether aggregated dairy and poultry farming as an alternative livelihood to fishing can enhance compliance to fisheries regulations. The significance level, $\alpha = 0.01$, Chi-square test statistic $=21.38$, degree of freedom $= 6$ and p value $= 0.0016$

| Sectors of Fisheries regulations | Don't Know | False | True |
|---|---|---|---|
| Gear size restriction | 2 | 32 | 290 |
| Fishing areas | 8 | 14 | 302 |
| Closed seasons | 5 | 8 | 311 |
| Fishing methods | 6 | 19 | 299 |

**4.5.3 The relationship between aggregated aquaculture farming as alternative livelihoods and compliance with fisheries regulations**

The stakeholders' responses to question whether aggregated aquaculture farming as an alternative livelihood to fishing can enhance compliance to fisheries regulations were examined using responses ranked: Don't know, False and True, against sectors of fisheries regulations. The results show that the highest frequencies of responses fall under True. The chi-square test of independence confirms that there is a statistically significant ($p < 0.001$) association between aggregated

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aquaculture farming as alternative livelihood and compliance with fisheries regulations (Table 8). The null hypothesis that the aggregated aquaculture farming as alternative livelihood and compliance with fisheries regulations are independent was rejected.

**Table 8:** Areas of fisheries regulations, responses ranked on a three-point likert scale (Don't know, False and True) and frequencies of stakeholders' responses to question whether aggregated aquaculture farming as an alternative livelihood to fishing can enhance compliance to fisheries regulations. The significance level, $\alpha = 0.01$, Chi-square test statistic $=94.79$, degree of freedom $= 6$ and p value $= 0$

| Areas of Fisheries regulations | Don't Know | False | True |
|---|---|---|---|
| Gear size | 32 | 33 | 259 |
| Fishing areas | 2 | 32 | 290 |
| Closed seasons | 5 | 55 | 264 |
| Fishing methods | 5 | 8 | 311 |

This agreed with the reports of Munguti et al., (2021), which suggested that another viable option for relieving pressure on Lake Victoria's fisheries is aquaculture (both in general and in Busia County). The elaborate support systems set up by the county government in the aquaculture sector in Busia County make it conducive and with great potential for the youth. The Aqua Park concept, for example, encourages aggregated aquaculture production, which increases the chances of success while also improving fish farmers' capacity and providing technical, policy, and monetary support. Odende *et al.*, (2021) argued that the concept is an ideal model for youth involvement in aquaculture.

However, lack of knowledge and awareness of fish marketing programs among fishermen and other sector players is of particular interest. This is because marketing is linked to value addition and post-harvest fish handling (Kimiywe, 2015). The study's high post-harvest losses and limited value addition may be explained by the porous nature of the border and non-compliance with fish safety to and from the county. This is exacerbated by the effects of the Busia trans- border market, which receives and sells fish from distant areas (including Uganda) (Heck et al., 2004). The market also allows some fish to be exported to countries such as Congo and Rwanda. This has impacted the local fish market, particularly in Busia County. Based on this, it can be assumed that the fishermen are not interested in venturing into and learning about markets outside of the county. This, combined with a lack of information on marketing (and markets), could explain the respondents' lack of knowledge and awareness. Due to the low level of catches from the lake (Aura et al., 2020), it is also possible that traders have shifted their focus to fish from distant areas such as Lake Turkana and Uganda and are less interested in local sources. The imported frozen Tilapia from China is another factor in the fish marketing sector (Ogello et al., 2021). This imported fish has flooded the Kenyan fish market (although the extent of the impact on Busia is not very clear) and has affected the process of locally produced fish (Ogello et al., 2021). This can be addressed by providing incentives, policies, and assistance to aquaculture and the fisheries sector as a whole. This can help to increase local production and fill the supply gap in the local fish market. The COVID-19 pandemic hampered most small-scale fish traders' access to fish (and markets) (Aura et al., 2020). This could have also impacted traders in Busia and other parts of the country.

# CHAPTER FIVE

## SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

### 5.1 Introduction

This chapter contains the summary of major findings on the perceptions of fisher folks towards the types of fisheries management strategies and fisheries regulations; the relationship between types of punitive measures and compliance with fisheries regulations; and the relationship between categories of alternative livelihoods and compliance with fisheries regulations. The chapter also contains conclusion and recommendations, including areas for further research.

### 5.2 Summary of findings

The findings for perceptions of fisher folks towards the types of fisheries management strategies and fisheries regulations revealed that about 44 percent of total respondents agreed that closed seasons work better under the alternative livelihood model. This was supported by correlation results where the respondents strongly agreed (r=0.904) that closed season only work well under an alternative livelihood model because most fishermen are forced by the hard economy to violate income diversification approaches.

Additionally, about 43 percent of total respondents agreed that aggregated production was a good alternative livelihood initiative. Correlation results showed that respondents strongly agreed (r=0.897) that aggregated production is a good alternative livelihood initiative and an effective approach to income diversification. However, the majority of respondents (70 percent) agreed that low compliance was a leading factor in the dwindling of Lake Victoria's fishery stocks. Correlation results revealed that respondents strongly agreed (r= 0.652) that inadequate approaches to enhance compliance is a major cause of dwindling fish stocks.

The results showed a statistically significant association between types of existing punitive measures and compliance to fisheries regulations seemingly, types of existing punitive measures may guarantee compliance to fisheries regulations.

The alternative livelihoods: Aggregated horticulture farming, aggregated dairy and poultry farming and aggregated aquaculture farming showed a statistically significant association with compliance to fisheries regulations. This implies alternative livelihoods may guarantee compliance to fisheries regulations.

## 5.3 Conclusion

The findings of this study have revealed that indeed, the stakeholders are aware of the various fisheries regulations and the management strategies related to them. They also have a generally positive attitude towards these regulations and strategies. Despite this positive attitude and evidence of knowledge by the stakeholders in the sector, the results have revealed that the policies and the implementation strategies are not effective in conserving the fisheries resources of the Lake Victoria. In addition, inadequate approaches to enhance compliance is a major cause of dwindling fish stocks. This necessitate the need to enforce existing punitive measures in order to improve compliance to fisheries regulations. Moreover, the latter can be further improved by aggregated production, which include aggregated horticulture farming, aggregated dairy and poultry farming and aggregated aquaculture farming. These are good alternative livelihood initiatives and effective approaches to income diversification, which can reduce over relying on fisheries resources for livelihoods.

**5.4 Recommendations**

1. There is need for capacity building so that stakeholders can be aware of the various fisheries regulations and the management strategies for effective conservation of fisheries resources.

2. Existing punitive measures should be enforced in order to improve compliance to fisheries regulations.

3. The fisher folk must be trained on aggregated production as alternative livelihood initiatives to promote income diversification.

**5.5 Contibution to body of knowlegde and areas for further study**

The current study has revealed the perceptions of the various stakeholders within the fisheries sector in Busia County on the various fisheries management strategies. It has also revealed the possible alternative livelihood activities that can be used to reduce pressure on the lake by encouraging compliance among the fishermen and this can be used by future researchers in formulating their research ideas. The present study was limited to only one riparian county, and the dynamics of operations may vary among counties. This is particularly true because some of the fisheries functions are devolved and each county could have unique laws for the conservation of fisheries resources in Lake Victoria. Future research should cover all the riparian counties to bring out variances.

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**APPENDIX I. STUDY QUESTIONNAIRE**

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## SECTION A: INTRODUCTION AND INFORMED CONSENT

This survey questionnaire aims to gather information that forms a study being undertaken by Timothy Odende, a student at Maseno University, Kenya. The aim of this study is to assess the implementation strategies of fisheries policies and their contribution to effective management of fisheries resources in Lake Victoria, in Busia County, Kenya, with the objective of generating useful information that can be used by policy makers, government institutions and all stakeholders in a bid to protect the lakes dwindling resources from imminent collapse. The information that you will provide will confidential and will only be used for educational purposes. Your cooperation in this study is therefore highly appreciated.

**Consent given Yes= [   ]   No=0 [  ]**

**(If yes, proceed to the next question; If no, find out the reason and terminate the interview.)**
**Instructions**
(a)     Please tick in the bracket that corresponds to your response.
(b)     In case of multiple responses, tick all applicable responses in their respective brackets.
(c)     Use translation to Kiswahili or Local language for respondents who do not speak or understand English.

## SECTION B: PRELIMINARIES

| Interview start time (hh: min): | Geopoints |
|---|---|
| Interview stop time  (hh: min): | Date of Interview |
| County: | Name of fish landing beach |
| Enumerator name: | Enum Tel: |

## SECTION C: DEMOGRAPIC AND SOCIO-ECONOMIC BACKGROUND

| C.1Resp_ Name (Optional) | C.2 Resp Age (Years) | C.3 Reso Gender | C.4 Marital status | C.5 Resp Educational Level | C.6Resp' Partner Educational Level | C.7H/H size | C.8 Occupation | C.9 Spouse Occupation | Ethnic groups |
|---|---|---|---|---|---|---|---|---|---|
| | | [1] Male [2] Female | [1] Single [2] Married [3]Widowed [4]Separated/ Divorced | [1] None [2] Primary [3] Secondary [4] Certificate [5] Diploma [6] Undergraduate [7] Postgraduate | [1] None [2] Primary [3] Secondary [4] Certificate [5] Diploma [6] Undergraduate [7] Postgraduate | | [1] Fisherman [2] Fish trader/fish monger [3] Self employed/artisan [4] Civil servant [5] Business person [6] Other (specify) | [1] Fisherman [2] Fish trader/fish monger [3] Self employed/artisan [4] Civil servant [5] Business person [6] Other (specify) | [1] Luo [2] Luhya [3] Suba [4] Somali [5] Kikuyus [6] Kisii [7] Kalenjins [8] Other (specify) |

Portraying respondents' perception towards the existing regional, national and local fisheries laws and regulations and approaches for administering fisheries resources management strategies. Please rate the following statement in regard to your degree of agreement. Using a scale of 1 to 5; where: where 1 is Strongly Disagree and 5 Strongly Agree, please indicate your level of agreement with the following statements

| Fisheries regulations/approaches | Strongly Disagree (1) | Disagree (2) | Neutral (3) | Agree (4) | Strongly Agree (5) |
|---|---|---|---|---|---|
| Regulations on arrests prosecutions are too punitive | | | | | |
| Co management (BMU) is inefficient in enforcement | | | | | |
| Aggregated production is a good alternative livelihood  initiative | | | | | |
| Few women and youth participating on BMU current approaches to compliance | | | | | |
| Income diversification can be an  effective approach | | | | | |
| Current  regulations can mitigate dwindling fisheries resources | | | | | |

| | | | | |
|---|---|---|---|---|
| Current laws and regulations are easy to understand | | | | |
| Inadequate approaches to enhance compliance is a major cause of dwindling fish stocks | | | | |
| Government explore sustainable approaches to enhance compliance | | | | |
| Current approaches are punitive and counter productive | | | | |

**SECTION E: EFFECTS OF PUNITIVE MEASURES ON COMPLIANCE TO FISHERIES REGULATIONS**

Using a scale of 1 to 3 where: 1 Don't know, 2 False and 3 True, please indicate your level of agreement with the following statements: Punitive measures guarantee compliance to fisheries regulations in Lake Victoria in Busia County, Kenya

| Punitive measures | Don't know (1) | False (2) | True(3) |
|---|---|---|---|
| Gear size restriction | | | |
| Closed fishing areas | | | |
| Closed seasons | | | |
| Restriction of fishing methods | | | |
| | | | |

## A). Aggregated horticulture farming as an alternative livelihood to fishing

Using a scale of 1 to 3 where: 1 Don't know, 2 False and 3 True, please indicate your level of agreement with the following statements: Aggregated horticulture farming as an alternative livelihood to fishing can enhance compliance to fisheries regulations in Lake Victoria in Busia County, Kenya

| Fishing regulations | Don't know (1) | False (2) | True(3) |
|---|---|---|---|
| Gear size | | | |
| Fishing areas | | | |
| Closed seasons | | | |
| Fishing methods | | | |

## B). Aggregated dairy and poultry farming as an alternative livelihood to fishing

Using a scale of 1 to 3 where: 1 Don't know, 2  False and 3 True, please indicate your level of agreement with the following statements: Aggregated dairy and poultry farming as an alternative livelihood to fishing can enhance compliance to fisheries regulations  in Lake Victoria in Busia County, Kenya

| Fishing regulations | Don't know (1) | False (2) | True(3) |
|---|---|---|---|
| Gear size | | | |
| Fishing areas | | | |
| Closed seasons | | | |
| Fishing methods | | | |

**C). Aggregated aquaculture farming as an alternative livelihood to fishing**

Using a scale of 1 to 3 where: 1 Don't know, 2  False and 3 True, please indicate your level of agreement with the following statements: Aggregated aquaculture farming as an alternative livelihood to fishing can enhance compliance to fisheries regulations  in Lake Victoria in Busia County, Kenya

| Fishing regulations | Don't know (1) | False (2) | True(3) |
|---|---|---|---|
| Gear size | | | |
| Fishing areas | | | |
| Closed seasons | | | |
| Fishing methods | | | |

**THANK YOU FOR YOUR PARTICIPATION**

**APPENDIX II: KII INTERVIEW**

1. Name: (Optional)

2. Organization:

3. What is the core mandate of your organization concerning the effective management of fisheries resources in Lake Victoria?

4. What are the major challenges in carrying out your core functions?

5. To what extent are fisheries the primary or sole source of income for this community?

6. Do you conduct any training concerning effective management of fisheries resources in Lake Victoria?

7. How do you ensure that all policies in relation to fisheries resources of Kenya's waters of Lake Victoria are fully implemented?

8. Do you carry out inspection to ensure adherence policies related to fisheries resources of Kenya's waters of Lake Victoria?

9. Lake Victoria fisheries resources are increasingly dwindling due to destructive anthropogenic activities despite the existence of fisheries policies that are supposed to protect the lake, why is this the case? In your opinion, what can be done to enforce the law governing the effective management of fisheries resources in Lake Victoria,

## APPENDIX III: FOCUS GROUP DISCUSSION

1. Perceptions of fisher folks towards the types of fisheries management strategies and fisheries regulations.

2. Types of punitive measures and compliance with fisheries regulations.

3. Categories of alternative livelihoods and compliance with fisheries regulations.

## APPENDIX IV: ENUMERATOR TRAINING AGENDA

February 06, 2021

Royal City Garden, Milimani, Kisumu

<u>WORKSHOP AGENDA</u>

| | |
|---|---|
| **9:00 am -09: 30 am** | **Registration** |
| 9:30 am -10: 00 am | Welcome, Survey objectives and training overview |
| ` | Mr. Timothy Odende |
| | (Msc. Candidate, Maseno University) |
| **10:00 am -10: 30 am** | **Health Break** |
| 10:30 am -11: 00 am | Instructions for completing questionnaire and key rules to remember |
| 11:00 am -13: 00 pm | Questionnaire review (All participants) |
| **13:00 pm -14: 00 pm** | **Health Break** |
| 14:00 pm -16: 00 pm | Pilot test on Smart phones, (ODK Suite) (All participants) |
| 16:00 am -16: 20 am | **Health Break** |
| 16:20 am -16: 40 am | Logistics for data collection |
| 16:40 am -17: 00 am | Final comments and workshop evaluation |