PERCEPTION ON FOOD INSECURITY AND COPING STRATEGIES AMONG FISHING COMMUNITIES LIVING IN HOMA BAY COUNTY, KENYA

BY

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DECLARATION

Declaration by the student

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Declaration by the Supervisors

This thesis has been submitted for examination with our approval as University supervisors.

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DEDICATION

This thesis is dedicated to my dear family, friends, students, the School of Environmental Studies, the Department of Applied Environment Social Sciences and the entire staff of the University of Eldoret and all those who have an interest in this area of study.

ABSTRACT

Fishing communities living along the shores of Lake Victoria have developed coping strategies to counter the daily life threatening challenges linked to food insecurity by adopting efficient technologies for food production, distribution, and storage. Homa Bay County is characterized as highly populated, less resilient to climate change, has a rapidly growing population with high population density and falling food production. Poverty levels in Homa Bay county stands at 48% compared to the National poverty indicator at 45%.The purpose of this study was to assess food insecurity among fishing communities in Homa Bay County, Kenya. The specific objectives of the study were to investigate the factors causing food insecurity, to examine the impacts of food insecurity, to investigate the extent of food insecurity and to identify coping strategies adopted by the fishing communities in order to minimize the negative impacts of food insecurity. Descriptive survey research design was adopted .The target population was 354,956 persons and sample size was 399 households. Data was collected using questionnaires, Key informant interviews, observations and document analysis. Men accounted for (63.7%) of the sample population with a majority of the respondents falling within the age of (18-25) years and 42.1% having a secondary school level of education. The reliability of the research instruments was ascertained using Cronbach's alpha coefficient through a pilot study. The DFID Sustainable Livelihoods Framework and the Tragedy of the Commons theories were used to conceptualize how people operate within a vulnerability context that is shaped by different factors and to explore the problems linked to the overuse and degradation of natural resources. Poverty and rapid population growth were most prevalent factors causing food insecurity in the county manifesting in other socio-economic outcomes such as poor nutrition, health, and education.357 respondents had experienced food shortages, 177 household children had experienced malnutrition related diseases such as kwashiorkor and marasmus and 84 respondents had migrated from their homes. Child labour was widely practiced. The study concluded that Food insecurity remains a major concern in Homa Bay County and recommended the residents to engage alternative sources of livelihoods to ease pressure on fisheries resources.

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LIST OF ACRONYMS

CBNRM	Community-based natural resource management
CP	Cleaner production
CPR	Common-pool Resources
DFID -	Department for International Development
GLICA	Great Lakes Invitational Conference Association
GoK	Government of Kenya
HIV	Human Immunodeficiency Virus
M	Million
MOHEST	Ministry of Higher Education, Science and Technology
MPAs	Marine Protected Areas
MT	Metric Tones
NACOSTI	National Council of Science, Technology and Innovation
NP	Nile Perch
NTZs	No Take Zones
PICTs	Pacific island countries and territories
RBM	Rights Based Management
RoK	Republic of Kenya
SPSS	Statistical Package for Social Sciences
SRES	Special Report on Emission Scenarios
USDA	United States Department of Agriculture

DEFINITION OF TERMS

Food security – Food security means having, at all times, both physical and economic access to sufficient food to meet dietary needs for a productive and healthy life (Fabre & Zimmermann, 2017).

Food insecurity – Food insecurity is a state related to the availability of food supply, group of people, as well as individuals' access to it (Unit, 2017).

Fishing communities – A fishing community is a community that is substantially dependent on, or substantially engaged in, the harvest or processing of fishery resources to meet social and economic needs; the fishing vessel owners, operators, crew and fish processors that are based in such a community (Prytherch, 2016)

Coping strategies – Coping strategies refers to specific efforts, both behavioral and psychological, that people employ to master, tolerate, reduce, or minimize stressful events. It is the adaptation of new techniques or alteration of regular behavior executed to deal with stressful experiences (Farzana et al., 2017).

El Niño – Are large-scale ocean-atmosphere climate interaction linked to a periodic warming of sea surface temperatures across the central and east-central Equatorial Pacific (Oceanservice.noaa.gov, 2015).

La Niña – Are episodes that represent periods of below-average sea surface temperatures across the east-central Equatorial Pacific (Oceanservice.noaa.gov, 2015).

Shores of Lake Victoria – This refers to the area along the edge of Lake Victoria mostly inhabited by the fishing communities (Kairu, 2001)

Traditional food-ways - This refers to the cultural, social, and economic practices relating to the production and consumption of food through sustainable harvesting, management, cultivation, and preparation of a wide range and astonishing number of food species for subsistence, well-being, nutrition, health, taste, food security and livelihoods (Brulotte & Di Giovine, 2016).

Metal silo - A cylindrical structure, constructed from a galvanized iron sheet and hermetically sealed, killing any insect pests that may be present (Tefera et al., 2011).

The Tragedy of the Commons (Hardin, 1968) - refers to a collective action problem wherein commonly owned or shared resources are exploited to the point of severe degradation or destruction (Thiele, 2014).

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I wish to express my sincere gratitude to my supervisors Dr. Mark Kiptui and Dr. Christopher Saina for their time and guiding comments, in spite of their busy schedules. I owe many thanks to the University of Eldoret for giving me an opportunity to carry out this study. Finally, appreciation goes to all my colleagues and friends for the support and encouragement.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Poverty and food insecurity have profound implications for health and welfare (Riches, 2016). Food insecurity has for a long time been attributed to be a major cause of heath related problems to millions of people (Smith et al., 2017). Food insecurity is a state related to the availability of food supply, group of people, as well as individuals' access to it (Unit, 2017). Food insecurity is not an inequality limited to developing countries but rather manifests itself globally and locally (FAO & UNICEF, 2017); nearly a billion people across the world experience the effects of food insecurity. Food security is achieved when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (Cheeseman, 2016).

108 million people are reported to be facing a global food crisis (Whelan, 2016). World household food insecurity has increased the level of poverty among the world population (Maitra & Rao, 2015).Several countries require special attention in terms of food security and nutrition analysis and monitoring, as well as the delivery of humanitarian assistance (Anderson, 2017). Over the last 40 years, the numbers of hungry and malnourished people around the world have hovered between 800 million and 1.2 billion people (Fao.org, 2015). Volatile fuel prices are a threat to the viability of the livelihoods of fishing communities (Abernethy et al., 2010). According to the World Bank statistics, the number of poor in the Sub- Saharan region increased by 9 million, with 413 million people living on less than US$1.90 a day which is likely to increase to nearly 9 out of 10 extreme poor by 2030 if this the trend continues (World Bank Group, 2014).

According to the United States Agency for International Development (USAID), food security means having, at all times, both physical and economic access to sufficient food to meet dietary needs for a productive and healthy life (Fabre & Zimmermann, 2017). On a global scale, one in seven people do not have access to adequate food (Godfray et al.,2010). The USDA (United States Department of Agriculture) defined food insecurity as, limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways (NASS, 2017). Food insecurity and the loss of soil nutrients and productive capacity in Africa are crucial issues in light of the rapidly growing African population and high levels of food insecurity (Lotter, 2015). Africa is making slow progress in achieving international hunger targets (Agriculture Organization, 2014). The region has been afflicted by conflict and natural disasters and one in four people remain under nourished in sub-Saharan Africa (AHHSDIS, 2014). Fishing communities are often recognized as being amongst the poorest in developing countries (Kurien, 2015). Interventions targeted at improving resource status are seen as central in the fight against poverty (Mills et al., 2011).

Food insecurity problem in the Lake Victoria region is multi-dimensional (Foran et al., 2014), it arises from a number of causes which constraint food availability, or limit local people's access to it. Poverty is the primary cause of food insecurity in Kenya (Kimani et al., 2014). The 2007/08 United Nations Human Development Report noted that almost 24% of Kenyans are living on less than one dollar a day (Uddan.blogspot.com, 2015).High global food prices and low purchasing power for significant proportion of the Kenyan population is due to high level of poverty (Fao.org, 2015). Drought in ASAL of Kenya has brought about a decline in crop and livestock production amongst households

(Gichure, 2017). The World Food Programme reported that due to the effects of the post election turmoil, 50% of farmers were not sufficiently prepared for farming (Ariga & Jayne, 2010).

Lake Victoria is the largest lake in Africa measuring; (68,800 km^2) and is the eighth largest lake in the world by volume (Saundry & Boukerrou, 2012). Tanzania, Uganda, and Kenya share Lake Victoria and its resources. Approximately 30 million people live in the riparian region and the catchment, with about two million of these depending directly or indirectly on fishing activities (Nunan & Onyango, 2017). While the Sustainable Development goal number one spells out its obligation to eradicate extreme poverty and hunger (Holden et al., 2017); recent facts indicated that in East Africa, under nutrition is a major problem with close to 50% of young children being stunted (United Nations Standing Committee on Nutrition, 2015). The economic review of agriculture 2007 indicates that 51% of the Kenyan population lack access to adequate food (Ochieng, 2015). Every year over 500 million people globally die of hunger and hunger-related diseases (Sharma et al., 2018). About six million children under the age of five; that is one child's dies approximately every six seconds (Gibson, 2012). In February 2009, the government of Kenya announced that 10 million Kenyans were food insecure and declared food insecurity a national emergency (Datta & Njuguna, 2009). Descriptions of childhood trauma and life-changing violence were linked with severe food insecurity (Chilton et al., 2014).

Homa Bay County is located on the southern shores of Lake Victoria in the former Nyanza Province (Ong'ayo et al., 2018). The old Homa Bay District was previously ranked as one of the poorest districts in Kenya, with over 70% of its population

categorized as living below the poverty line (Fiorella et al., 2015). The 2012 AIDS Indicator Survey found that approximately 1 out 4 adults in Siaya and Homa Bay counties were living with HIV (NASCOP, 2014). The county has been ranked as having the highest rate of HIV/AIDS in Kenya, with the prevalence rate of over 25%, that's 1 in 4 children (Emmanuel, 2015). Most of the residents of Homa Bay County rely on fishing for subsistence (Okello, 2017). One of the affirmed policy goals of the Government Kenya was to improve the quality of life of its citizenry (Mwanzia & Strathdee, 2016). The Government Kenya clearly spelled out the policy objectives for the fishery, giving sufficient attention to food security concerns (Alila & Atieno, 2006). They include goals to achieve increased per capita fish consumption through the production of low-cost protein food (fish) (Njiru et al., 2008).

The other objectives were to generate employment prospects and incomes in fishing, fish processing, and trading and to enhance the living conditions of the fishermen and their families by maximizing economic benefits to them (Kenya Human Rights Commission, 2014). The final objective was to maximize foreign exchange earnings from fish exports. If these stated objectives of the government are achieved in equal measure, the fishery is expected to contribute significantly towards food security for the lakeside community (Munguti et al., 2014). The link between food insecurity and the economic activities of various communities worldwide is well documented (Béné et al., 2016). Therefore, this study examined the perceptions of food insecurity on the fishing community along the shores of Lake Victoria in Homa Bay County.

1.2 Problem Statement

Fisheries have been a key contributor to food security and economic stability particularly around areas such as lakes, rivers, and deltas (Teneva et al., 2018). Surprisingly, this has not been the case in the area around Lake Victoria (Fiorella et al., 2014). Although Lake Victoria is recorded as the largest lake in Africa (Balirwa, 2017), food insecurity is reported to be a major problem particularly for the local fishing communities around the area (Godfray et al., 2010). Fish and fishery products play a significant role in the human diet (Blakistone et al., 2016), however, poor fish processing and preservation technologies practiced along Lake Victoria in Homa Bay county disposes fish to spoilage caused by microbial activity (Onyango et al., 2017).

There are many challenges facing the food sector in Homa Bay County (Nagata et al., 2015). The County boasts of abundant water resources because of its proximity to Lake Victoria, but as its population grows and climate change leads to water shortages, the county's water demands will increasingly exceed the freshwater sources (Homa Bay County Government, 2013). The county is characterized as highly populated and less resilient to climate change (Midega et al., 2015). The combined effects of climate change and rapid population growth are increasing food insecurity, environmental degradation, and poverty levels in the county (Carley & Christie, 2017). Agriculture is the lifeline of the community's economy, employing over 50% of the residents (Maitima et al., 2010).

Smallholder farming is the dominant land-use practice, accounting for 86.8% of the cultivated land (RoK, 2005). Degradation of upstream catchment mainly due to agricultural expansion associated with population growth is already impacting water availability (KNBS & UNICEF, 2013). Subsistence farming is dependent on family

labor, and food consumed by the residents is sourced from their own farm produce. Largely traditional farming practices with little or no use of hybrid seeds, modern fertilizer or updated planting techniques are used (Nagata et al., 2012). This results to poor yields every year, thus making the community food insecure. In 2005, Homa Bay recorded annual cereal production of 41,520 MT (Metric Tons) compared with its cereal demand of 47,819 MT (Datta & Njuguna, 2009).

Food insecurity is directly linked to poverty (Faught et al., 2017); therefore, reducing poverty is a key element to enhancing food security (Pfeiffer et al., 2017). The poverty level in Homa Bay county stands at 48% compared to the National poverty indicator at 45% (Kandagor & Nyandoro, 2018).Homa Bay County is characterized by a rapidly growing population, high population density, falling food production, and little resilience to climate change (Hope et al., 2015). These factors play a major role in increasing food insecurity, environmental degradation, and poverty levels in the area. The prevalence and demographics of food insecurity are not adequately quantified for Homa Bay County. The primary reason for this research was to assess the factors, impacts, extent and coping strategies to food insecurity on the livelihoods in the fishing community along the shores of Lake Victoria in Homa Bay County.

1.3 Objectives

1.3.1 General Objective

The general aim of the study was to analyze perceptions of food insecurity and coping strategies among the fishing community living along the shores of L. Victoria in Homa Bay County.

1.3.2 Specific Objectives

The specific goals of this study were to:

1. Identify the factors causing food insecurity within the fishing community.
2. Assess the impacts of food insecurity on livelihoods of the populace of the fishing community.
3. Evaluate the extent of food insecurity amongst members of the fishing community.
4. Identify coping strategies adopted by the fishing community to minimize the negative impacts of food insecurity.

1.4 Research Questions

1. What are the factors that bring about food insecurity within the fishing community living along L. Victoria in Homa Bay County?
2. What is the extent of food insecurity among members the fishing community living along L. Victoria in Homa Bay County?
3. What are the impacts of food insecurity on the livelihoods of the members of the fishing community?
4. How do the members of the fishing community cope with the shocks and stresses of food insecurity?

1.5 Justification of the Study

Agriculture is the leading income contributor to households and it plays a crucial role to food and nutrition security in Homa Bay County (Chipeta et al., 2015). According to the 2009 Kenya Population and Housing Census, the employed population in the County stood at about 393,374 representing about 79.5% of the labour force of which 74% are employed in the agricultural sector (GOK, 2014). Fish production in Lake Victoria is

artisanal, employing mainly gill nets, baited long lines, traps and seine nets (Otieno, 2011). Food insecurity is linked to low productivity due to factors such as extreme weather, climatic shocks, unsustainable natural resource management, high prevalence of HIV/AIDS (21.7%) and limited access to farm inputs (GOK, 2013).

There is a strong correlation between health and productivity (Kwena et al., 2017). Homa Bay County has a high prevalence of HIV/AIDS (27.1%) leading to high morbidity (GOK, 2013), thus an urgent need to tackle the high incidence of the HIV/ AIDS that is particularly affecting the fish value chain. Water availability is also a limiting factor in crop and livestock production. Only 13.3% of the land under irrigation, despite the County's huge potential to irrigate as it borders the largest freshwater lake in Africa, Lake Victoria (GOK, 2015). Decline in fish stocks has led to grave consequences with regards to both economics and nutrition; hence, all fishing communities are vulnerable to food insecurity (Kayanda et al., 2017).

Farmers in Homa Bay County experience post-harvest losses due to rudimentary storage methods (Boaz et al., 2017); over 90% of farmers use traditional production and storage methods which limit their output. Food losses occur in the field, during harvesting, processing and in storage due to the lack of access to modern methods for harvesting, processing and storage (Tefera, 2016). Expensive farm inputs limit agricultural productivity in the County, as most of the farmers are not in a position to afford the expensive inputs (McKague et al., 2018); this is further exacerbated by climate risks resulting in scarcity, high demand and consequently higher prices of inputs. This study aimed to fill the gaps in existing literature on the factors and impacts of food insecurity in Homa Bay County.

1.6 Significance of the Study

Findings from the study will create a better understanding of the causes, extent, impacts and possible solutions to food insecurity in Homa Bay County. Policy makers and other relevant stakeholders will also benefit from this research thesis during the formulation of strategies to mitigate the negative impacts of food insecurity. Finally, the output of this study will assist in providing appropriate advice on coping strategies to food insecurity.

1.7 Scope of the Study

The study only targeted members of the fishing communities living along the shores of Lake Victoria in Homa Bay County.

1.8 Theoretical Framework

This study was guided by the theory of the "Tragedy of the Commons" and the DFID Sustainable Livelihoods Framework Theory.

The "Tragedy of the Commons"

The Tragedy of the Commons (Hardin, 1968) refers to a collective action problem wherein commonly owned or shared resources are exploited to the point of severe degradation or destruction (Hardin, 1968; Hardin, 2014). The theory describes a situation in a shared-resource system where individual users acting independently according to their own self-interest behave contrary to the common good of all users by depleting or spoiling that resource through their collective action (Grafton et al., 2017). The metaphor "Tragedy of the Commons" refers to the problems of overuse and degradation of natural resources including the destruction of fisheries, the over harvesting of timber, and the degradation of water resources (Thiele, 2014). Commons is taken to mean any shared and

unregulated resource such as the fish stocks in the case of a fishing community (Grainger & Costello, 2016).

The livelihoods of most county residents in Homa Bay depends on fisheries and rain-fed small-scale farming, practices that are highly vulnerable to environmental degradation and the effects of climate change (KNBS & SID, 2013). Rapid population growth places enormous pressure on natural and environmental resources such as fisheries, forests, water, and land (KNBS, 2012). Already scarce resources such as fisheries and farmland must be subdivided amongst more people, resulting in overexploitation (Homa Bay County Government, 2013). Fish stocks are dwindling due to overfishing and changing water temperatures (Brander et al., 2017), and people living in lowlands are frequently displaced due to flooding. As the county's population increases, these pressures on resources will be magnified (Homa Bay County Government, 2013) hence the application of the theory of the tragedy of the commons.

DFID Sustainable Livelihoods Framework

The DFID sustainable livelihood framework sets out to conceptualize how people operate within a vulnerability context that is shaped by different factors like the shifting seasonal constraints (and opportunities), economic shocks and longer-term trends (Agarwala et al., 2014). It also addresses how people draw different types of livelihood assets or capitals in different combinations influenced by the vulnerability context, a range of institutions and processes and how they use their asset base to develop a range of livelihoods strategies to achieve desired livelihood outcomes (Alhassan, 2011). The status of the global marine fisheries evaluated using the frameworks of conflict, food security and vulnerability (McClanahan et al., 2015) shows existing trends which suggest a possibility of greater

food insecurity and fisheries conflicts due to issues such as: declining fishery resources (Emery et al., 2017); a North–South divide in investment; changing consumption patterns; increasing reliance on fishery resources for coastal communities; and inescapable poverty traps created by low net resource productivity and few alternatives (McClanahan et al., 2015).

Homa Bay County performs below the national average on most socio-economic indicators (UNDP, 2010). The county scores a 0.46 on the Human Development Index (HDI)—a composite measure of development that combines indicators of life expectancy, educational attainment and income (Homa Bay County Government, 2013). This is below the national average of 0.56. Poverty is prevalent in the county and manifests itself in other socio-economic outcomes such as poor nutrition, health, and education, as well as a lack of access to basic services (KNBS & UNICEF, 2013). This brings about the need for the sustainable livelihood framework to create an understanding of the factors causing food insecurity, the impacts and extent of food insecurity in the fishing community in Homa Bay County and the need for alternative sources of livelihoods as coping strategies to the negative effects of food insecurity. Figure 1.1 below shows the DFID sustainable livelihood framework guiding sheet.

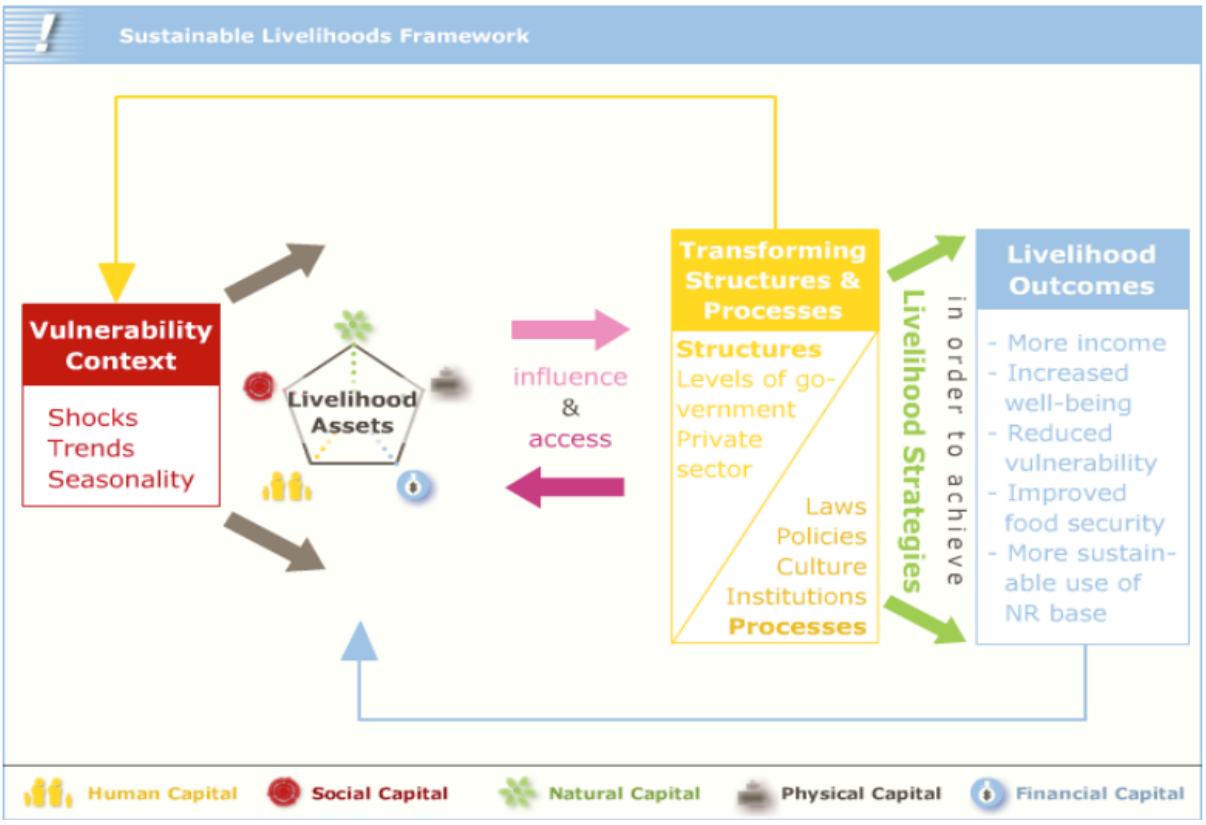

Figure 1.1: The DFID sustainable livelihood framework guiding sheet

Data Source: (Malleson et al., 2008)

1.9 Conceptual Framework

Impacts of food insecurity were the independent variables while the coping strategies to the negative impacts of food insecurity were the dependent variables. The causes of food insecurity were the intermediate variables. There was a link between factors causing food insecurity and impacts of food insecurity. This led to the need for coping strategies and sustainable livelihood options against the negative impacts of food insecurity. The majority of Homa Bay County residents is poor and depends on fishing and fisheries activities for their livelihoods.

The Tragedy of the Commons theory (Harding, 1968) explains the problems of overuse and degradation of natural resources including the destruction of the Lake Victoria

fisheries due to the overharvesting of fish (Thiele, 2014).The rapid population growth and high population density of Homa Bay County places enormous pressure on the Lake Victoria fisheries due to high demand for fish, resulting in the overexploitation of fish and unstable fish prices (Homa Bay County Government, 2013). Fish stocks are dwindling due to overfishing and changing water temperatures, this significantly affects the fishing community leading to food insecurity caused by the over reliance on the fisheries (KNBS & SID, 2013).

The DFID sustainable livelihood framework conceptualizes how people operate within a vulnerability context that is shaped by different factors. It also addresses how people draw different types of livelihoods combinations influenced by the vulnerability context and how they use their asset base to develop a range of livelihoods strategies to achieve desired livelihood outcomes (de Stagé et al., 2002).Food insecurity in Homa Bay County is caused by factors such as poverty, rapid population growth, seasonal bans on fishing, climate change, over reliance on one source of food and unstable fish prices (KNBS & UNICEF, 2013). The decline in fishery resources due to overexploitation worsens food insecurity and fisheries conflicts in the fishing community, thus creating the need for sustainable livelihood options (Emery et al., 2017). The high poverty level in Homa Bay County manifests itself in other socio-economic outcomes such as poor nutrition, health, and education, as well as a lack of access to basic services (KNBS & UNICEF, 2013). The DFID sustainable livelihood framework was useful in creating an understanding of the factors causing food insecurity, assessment of their impacts and evaluation of the extent of food insecurity in the fishing community in Homa Bay County. The framework also assisted in coming up with alternative sources of livelihoods as coping strategies and

sustainable options to the negative effects of food insecurity (Malleson, 2008). Figure 1.2 below shows the conceptual framework for this study and how it works.

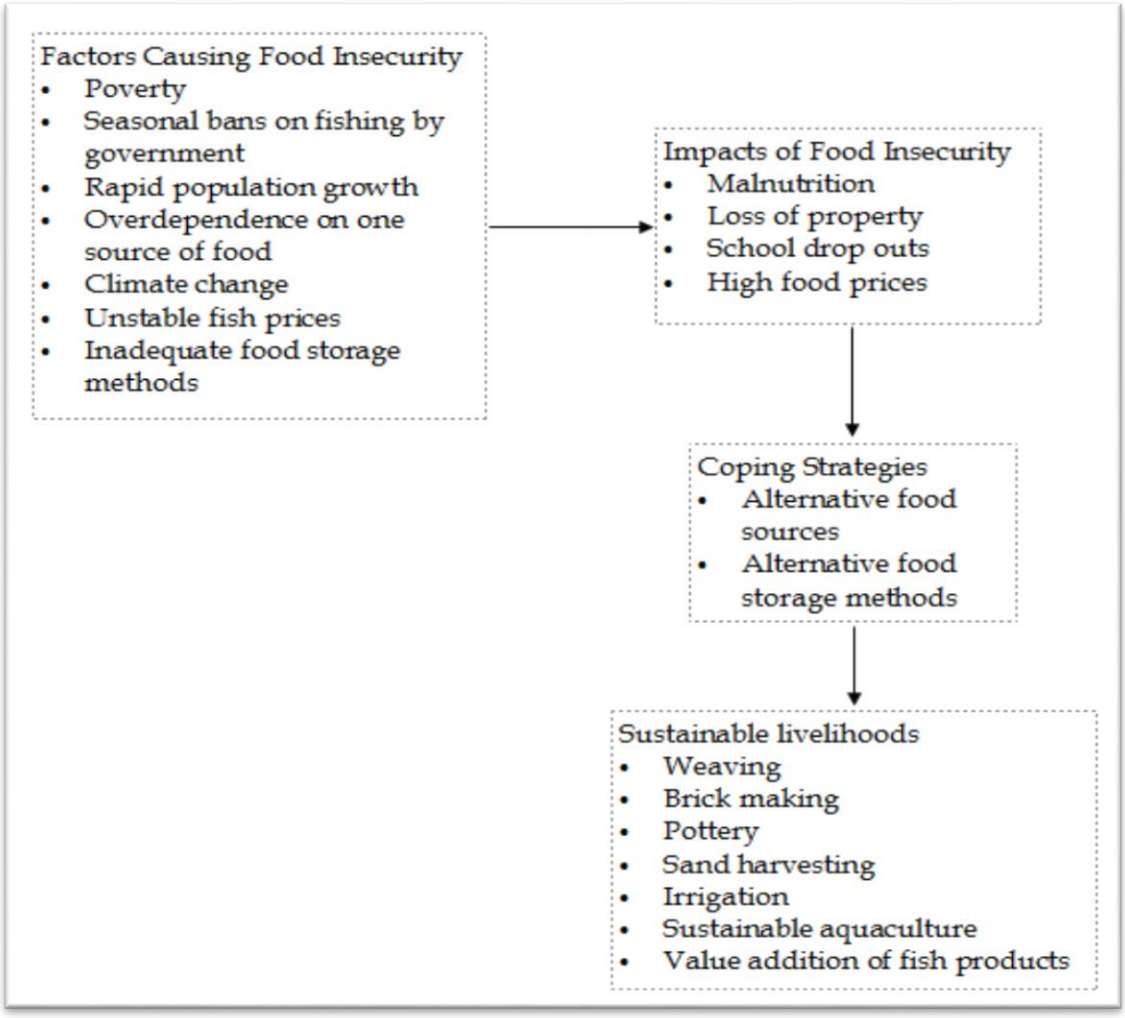

Figure 1.2: Conceptual Framework

(Author's perspective, 2018) guided by the DFID Sustainable Livelihoods Framework and the "Tragedy of the Commons".

CHAPTER TWO

LITERATURE REVIEW

2.1 Global Food Insecurity

Global trade is a key factor to the shift in sustainable fisheries (Asche et al., 2015). Sustainable utilization of natural resources is regarded as an important component of ecological resilience (Mondal & Dalai, 2017). Unfortunately, many of the world's wild-capture fisheries have experienced diminished biological abundance leading to fishery collapse (Branch et al., 2011) hence resulting to food insecurity within fishing communities. Land degradation is a global problem affecting at least a quarter of the global land area (Lal et al., 2012); it seriously undermines the livelihoods, especially of the poor, in all agro-ecologies across the world (Nkonya et al., 2011). World food insecurity can be attributed to the price inflation of the world staple foods (Trostle, 2010). Climate change has greatly influenced world household food insecurity (Tumushabe, 2018). El-Ninos and La- Ninas hamper sound crop production in Latin America and the Sub-Saharan Africa (Nayioma, 2016). Other factors contributing to increased household food insecurity in the world include: Shift to more non-agricultural technology (Conteh et al., 2013), politics, environmental degradation, insecurity and high population growth (Barrett, 2010).

Fish is a mainstay of food security for Pacific island countries and territories (PICTs) (Charlton et al., 2016). However, there’s a shortfall in coastal fish available for food security in the Pacific Islands (Teh et al., 2016). Poverty partially augments due to the increasing costs and over-exploitation; yet coastal populations increasingly rely on fisheries despite of the increasing costs (Belhabib et al., 2015).There was a projected 21%

drop in annual landed value, 50% decline in fisheries-related jobs and a total annual loss of US$311 million in the whole economy of West Africa (Lam et al., 2012). In Southeast Asia trans-boundary conflicts such as fighting for fishing grounds affects fishing along the shores hence leading to food insecurity (Pomeroy et al., 2016).

The level of hunger in the world remains unacceptably high with 795 million people still going hungry, more than one in four children affected by stunting and 9% of children affected by wasting (Von Grebmer et al., 2015). The global population is expected to grow from the present 6.8 billion people to about 9 billion by 2050 (Garcia & Rosenberg, 2010). Haiti is a major market for U.S. rice, accounting for about 10 percent of U.S. rice exports and generating around $200 million in revenue for the U.S. rice industry (Cochrane et al., 2016). Haiti is also a country with significant food insecurity with over 6 million Haitians, or roughly 60 percent of the population not capable of meeting daily caloric intake standards (Parent et al., 2015). Over half of the country's population is undernourished, and 24% of children under 12 suffer chronic malnutrition (Katz, 2010).

There is a direct relationship between household crowding and food insecurity (Ruiz-Castell et al., 2015). Household size is directly associated to disparities in job satisfaction (Sweke et al., (2016) which is a potential cause of food insecurity. 62% of Inuit families in the Canadian Arctic reside in crowded households, placing them at risk of food insecurity (Tse et al., 2016), because of the great likelihood of reducing the size of children's meals in such households. Recent household income and expenditure surveys, and socio-economic surveys, have demonstrated that subsistence fishing still provides the great majority of dietary animal protein in the region (Bell et al., 2015). Greater fish

consumption is needed to combat prevalent non-communicable diseases (Allen et al., 2017).

Fishery resources are an important source of proteins, vitamins and micronutrients, particularly for many low-income populations in rural areas (Béné et al., 2015). Fish and fish-related products are amongst the most highly traded commodities globally (Bellmann et al., 2016). The proportion of globally harvested fish that are internationally traded has steadily risen over time (Crona et al., 2016). Sustainable use of these resources is important for future global food security and has garnered significant public policy attention (Grafton et al., 2017). Studies show that Island dwellers highly depend on coastal resources for their food and livelihoods (Roeger et al., 2016).Fishers devote an average of 27 years fishing, investing an average of 12 hours per day and earn a regular income of 15–20 dollars (Shivakoti, 2013). It is estimated that by 2020, tuna fish will be expected to supply 12% of fish required by the Pacific and 25% by 2035 (FAO, 2015). Limited attention has been given to fish as a key element in food security and nutrition strategies, as a result, the tremendous potential for improving food security and nutrition embodied in the strengthening of the fishery and aquaculture sectors is missed (Béné et al., 2015).

Inland capture fisheries and aquaculture contribute over 40% to the world's reported finfish production from under 0.01% of the total volume of water on earth (Lynch et al., 2016); the main limitation is the valuation of services provided by inland fish. Safeguarding global food security for an increasing population remains a major challenge (Prakash, 2011). This is particularly true due to the increasing food prices paired with growing income levels and changing demand patterns in the developing world (Grote,

2014). Climate change and the existence of more frequent and dangerous natural disasters has increased the susceptibility of rural farm families, this has negatively affected agricultural production (Grote, 2014).

Traditional food products represent a growing segment in the European food market (Vanhonacker et al., 2013), consumer acceptance of innovations in traditional food products are linked to the perceived impact of the novelty on the old character of the resulting food product. Traditional food-ways are not only critical to food sovereignty in emerging and developing countries, but also to food security, eco-touristic development, small-scale food specialty markets, and local health approaches (Quave & Pieroni, 2014). Marketing strategy for traditional food products is often based around their strong connection with their production region and claims of a lesser environmental impact due to being grown in the agricultural area for which they were selected (Cerutti et al., 2013).

2.2 Food Insecurity in Africa

Various African countries experience devastating effects of household food insecurity (Connolly-Boutin et al., 2016); Cameroon in West Africa (Benzekri et al., 2015), Egypt in Northern Africa (Breisinger et al., 2015), Ethiopia in the Eastern Africa (Belay et al., 2017), and South Africa in the extreme Southern Africa (Fisher et al., 2015). Previous studies identify West Africa as one of the most vulnerable regions to climate change (Kates et al., 2012). Climate change could lead to substantial reduction in marine fish production and a decline in fish protein supply in the West African region by the 2050s under the Special Report on Emission Scenarios (SRES) A1B (Lam et al., 2012). With global economic decline (Rosser & Rosser, 2018), high food prices have affected South Africa despite the fact that the country produced a bumper harvest in 2007/2008 farming

season (Rangasamy, 2011). The contribution by fishing activities towards promoting food security and income generation in rural areas of South Africa is debatable (Moyo & Sill, 2014).

The World Food Programme (WFP) describes Cameroon as a food insecure country (Sharma et al., 2016) and further demonstrates that food intake in households is lower now than in the early 1980s. 19% of young children in the country are underweight, and infant mortality rate is on the rise (WHO, 2015). Egypt produces half of the 20 million tons of wheat that it consumes with irrigation and imports the other half and is also the world's largest importer of wheat (Asseng et al., 2018). Regardless of the average food production; the country is exposed to the escalating food prices due to its wheat imports (Ianchovichina et al., 2014). The population of Egypt is currently growing at 2.2% annually, and projections indicate that the demand for wheat will triple by the end of the century (Mellor, 2014). The total population of Ethiopia is more than 90 million, about 10% of Ethiopia's citizens are chronically food insecure and this figure rises to more than 15% during frequent drought years (Endalew et al., 2015), the deteriorating situation of food security in Ethiopia is caused by population pressure.

Analysis of societal dimensions is increasingly receiving attention in social–ecological resilience research (Moshy et al., 2015). Local vulnerability of households was examined in two communities in the east coast of Zanzibar with focus on food security (Makame et al., 2015). Households that are solely depend on natural resources through farming, fishing, livestock and poultry farming, are more vulnerable to food insecurity as these activities face considerable uncertainties associated with climate change and variability as well as other stressors (Makame et al., 2015). As the demand for fish and fisheries

resources increases in urban areas associated to the expanding tourism industry, the price for fisheries resources also increases(Andreyeva et al., 2010).

There is a decline in commercially valuable fish species in southern Lake Malawi (Hara& Njaya, 2016). Rights Based Management (RBM) could be the best hope for moving towards sustainable fisheries management in the southern Lake Malawi (Njaya, 2018) (Southeast and Southwest Arms) area while recognizing the need for a broad human rights approach for fishing communities (Ngochera et al., 2018). An index of economic vulnerability was developed and used in Congo to explore vulnerability and chronic poverty in isolated rural communities (Cariolle & Goujon, 2013). High vulnerability of full-time fisher folk was highlighted and mobility identified as a key factor to vulnerability. A difference-in-differences model was applied to estimate the impact of three different Community-Based Natural Resource Management (CBNRM) governance regimes on wealth, food security and child health (Pailler et al., 2015). Differential impacts of CBNRM on wealthy and poor populations were considered (Stone & Nyaupane, 2014). Significant improvements were observed in household food security in CBNRM areas compared with non-CBNRM areas (Suich, 2013). However, wealthy households benefited more from CBNRM than poor households and CBNRM benefits appeared to increase with longer periods of implementation (Pailler et al., 2015). Analyses of cash flows within established fishery indicate that fishing activities bring significant income to the fishing communities (Battersby, 2016). Small-scale fisheries are viewed as a viable alternative to more common forms of food procurement and natural resource use (Purcell & Pomeroy, 2015).

Lake Victoria supports Africa's largest inland fishery (Nyamweya et al., 2016) and its greatest treasured product is the Nile perch, much of which is exported but whose average size and stock biomass had rapidly decreased by 50% due to overfishing (Mkumbo & Marshall, 2015). The importance of food standards in global agricultural trade is increasing strongly (Khoury et al., 2014), but the effects are uncertain (Maertens & Swinnen, 2006). Lake Victoria supports an estimated 25 million people living along the Basin, with a projected gross economic product of US$3–4 billion yearly, mainly from subsistence agriculture and fishing in Kenya, Uganda, Tanzania, and parts of Rwanda and Burundi (Mailu et al., 2000). Fish exportation has given rise to arguments; of concern is the direct linear relationship between perch exports and troublingly high rates of malnutrition along the lake's shores (Geheb et al., 2008). Around 80% of the Nile perch harvest is processed and exported primarily to Europe, Asia, Israel, the Middle East, and the United States (Kelly, 2018). Infestation by water hyacinth has brought social, economic and environmental hitches to the people living along the lake basin (Yongo et al., 2017).

2.3 Food Insecurity in Kenya

The development of Lake Victoria fishery has had an impact on the food security situation for lakeside communities (Fiorella et al., 2014). Kenya is one of 34 countries with the highest burden of child malnutrition in the world (Bhutta et al., 2013). Machakos and Makueni counties in Kenya are associated with historical land degradation, climate change, and food insecurity (Bukania et al., 2014). Chronic malnutrition or stunting among children under five years old is affected by several household environmental factors, such as food insecurity, disease burden, and poverty (Shinsugi et al.,

2015).Kenya has been facing severe food insecurity problems in recent years (Nayioma, 2016). This was depicted by the lack of acess to food in right amounts and quality to a high percentage of the population. In 2008, an estimated 1.3 million people in rural areas and 3.5 – 4 million in urban areas were food insecure (WHO, 2010). The current food insecurity problem is attributed to several factors, including the frequent droughts in most parts of the country, high costs of domestic food production due to high costs of inputs especially fertilizer (Sadauskaite, 2014).

The heightened vulnerability to food insecurity during the 2007/2008 was as a result of the post election violence in Kenya which led to the displacement of a vast number of farmers in the high potential agricultural areas (Kimani-Murage et al., 2014).Despite attempts to increase food production and enhance food security, it is worth noting that only 18% of Kenya's territory is suitable for farming (Kagwiria et al., 2017). It is estimated that the 2006 floods affected 700,000 people in the country; most of them cut off from food help due to impassable roads (Nayioma, 2017). These forms of displacements of people make them vulnerable to household food insecurity (Grote & Warner, 2010). The 2008 post-election violence disrupted the March/April agricultural production (Kamunyan et al., 2013). Climate is a key input of rain-fed agriculture (Omoyo et al., 2015), its variability and change has been the most important determinant of crop yields in Kenya and other parts of the world. Erratic rainfall has exacerbated household food insecurity in the country (Icheria, 2012).

Marine Protected Areas (MPAs) or No Take Zones (NTZs) have positive effects on biomass, species diversity and habitat (Costello & Ballantine, 2015). Stakeholder involvement is critical in MPA management and it can be achieved only if the

community perceives the benefits of its conservation (Huang, 2015). In Kwale County, a range of food security indicators have provided good information on the benefits of the MPAs to the surrounding communities (Ahmed, 2017). Households that rely on tourism and other activities in the area the most food secure compared to those that totally depend of fisheries activities for their livelihood (Makoti, 2014).

For many years, fishing has been an important source of livelihood for many Kenyans (Linus, 2012). Both genders are involved in this industry but each performs a different role (Fiorella et al., 2014). This includes, fish harvesting by the male and fish processing and marketing by the female (Okello et al., 2017). In most fishing economies, there is the fish-for-sex menace that cannot be side lined in studies dealing with socio-economic factors of fishing communities. Fishers perceive that the challenges faced in the fishing industry are attributed to the decline in the Kenyan economy (Okello et al., 2017). In (the former) Nyanza Province, Kenya (Fiorella et al., 2015), HIV incidences are said to be highest (26.2%) in the beach communities along Lake Victoria (Camlin et al., 2013). The fish-for-sex phenomenon in small-scale fisheries has obvious links to HIV/AIDS (Kwena et al., 2012). The income earned by the fishers from fishing activities is not sufficient to meet their daily expenses (Okello et al., 2017). This desperation for money and fish has a clear link to food insecurity in the fishing economy (Beveridge et al., 2013). Female fish traders are often migrants to beaches and also highly mobile (Leidich et al., 2018) and are at a high risk of HIV acquisition and transmission via their exchange of sex for fish with *jaboya* fishermen (Camlin et al., 2013).

The Lake Victorian Nile Perch (Lates niloticus) industry in Kenya is said to be the most important in the fisheries sub-sector and generates significant levels of revenue to the

national economy besides creating employment opportunities along the value chain (Wairangu, 2015). From a socio-economic point of view, the greatest impact has been in the commercialization of the fishery and development of an export and fishmeal industry based on Nile perch and '*dagaa*', which together constitute over 90% of fish of Lake Victoria (Nunan, 2014). In 2012, fish production from Lake Victoria-Kenyan waters reached 118,992 metric tons with an ex-vessel value of USD 136 million (Wairangu, 2015). Benefits of industrialization of the fishery include foreign exchange earnings to the country and higher value of the fishery (Johnson, 2010).

The main products from processing are chilled or frozen NP fillets exclusively destined for the export market leaving behind huge amounts of by-products (Wairagu et al., 2016). Solid waste management remains a daunting task for the fishing communities living along the Lake Victoria Basin (Juma et al., 2014). Agricultural and fishing activities along the shores of the lake generate considerable amounts of organic waste (Majale & Mireri, 2014). Utilization of by-products and cleaner production could help reduce the reported negative effects of improper waste disposal of thick waste by the plants to the environment, human and animal lives (Wairangu, 2015). Information on the utilization of by-products and cleaner production is very important as the industry plays a significant function in the economic and social development in Kenya (Wairagu, 2016); this improves and attracts export market. Nile Perch processing plants should adopt measures on successful utilization of the byproducts and integrate CP in their operations (Parfitt et al., 2010).

Fisheries policy objectives ought to recognize the role of fish in improving food security locally (Candel & Biesbroek, 2018), but the need to maximize foreign exchange has

superseded the interest for domestic food security. The importance of fish in national food security has been reduced in two ways: one, food has become less available especially to non-fishing communities in the lake region, Secondly; there is limited and declining access by lakeside communities to fish (Garcia & Rosenberg, 2010). The industrial and domestic demand for fish has also increased pressure on the Lake, leading to unsustainable fishing and rising fears of long-term food insecurity (Jacobi, 2013). The fishing sector is dominated by people who exhibit qualities of uneducated men and women (Rugar et al., 2015). There's a positive relationship between the correlation coefficient for years of schooling and income accruing from sales of fish (Rugar et al., 2015). The lack of professional skills in the industry has an impact on the socio-economic aspects of the fishing community (Mozumder et al., 2018).

1.4 Challenges of Food Insecurity

2.4.1 An Underdeveloped Agricultural Sector

95% of the food in Sub-Saharan Africa is grown under rain-fed agriculture (Raju et al., 2016). Food production is vulnerable to unfavorable weather conditions (Iizumi et al., 2015) and an overall deterioration in farm input investment including fertilizers, seeds, and technology adoption (Muzari et al., 2012). The major challenge to food security in developing countries is an underdeveloped agricultural sector (Hallam, 2011). This is characterized by over-reliance on primary agriculture, infertile soils, minimal use of peripheral farm inputs, environmental degradation, extensive food crop loss both pre- and post- harvest, minimum value addition and product differentiation, and inadequate food storage and preservation that result in significant commodity price fluctuation (Tour,

2016). The soils continue to degrade leading to a decrease in the efficiency of the farms (Lal, 2015).

Soil fertility depletion in Africa is further caused by limited approval of fertilizer replacement strategies and soil and water conservation measures (Tully et al., 2015); the decline in the use and length of uncultivated periods; expansion of agricultural production into marginal and delicate areas; and the removal of vegetation through overgrazing, logging, development, and domestic use (Nicol et al., 2015). Other causes include rapid population growth, limited access to agriculture-related technical assistance, and lack of knowledge about proper soil fertility management practices leading to expansion into less-favorable lands (Fikire et al., 2014). A principal amount of the food is lost during pre- and post-harvest losses (Sheahan &Barrett, 2017). The tropical climate makes foods produced in Sub Saharan Africa vulnerable to pests and diseases (Campbell et al., 2016). Poor management and storage further increase the post-harvest losses (Kumar & Kalita, 2017). Organization of the African agricultural system is further complicated by the existence of diverse, heterogeneous systems of marketing and sale of agricultural food products (Salami et al., 2010).

2.4.2 Barriers to Market Access

Fish consumption is a lifestyle in fishing communities influenced by individual and communal perceptions (Andrew et al., 2016). Fish is an important component in the human diet (Tacon & Metian, 2013), but its production is not likely to keep up with demand (Thurstan et al., 2014). Access to markets is the second hurdle that communities have to overcome (Lawrence & Tar, 2010). The problem is poor infrastructure and barriers to market penetration caused by limited resource base, lack of information, lack

of or weak support institutions and inadequate policies in place among other factors (Badr et al., 2015). Poor infrastructure confines the markets to which farmers can profitably take their produce by increasing the cost of transportation, and hence also acts as a barrier to market penetration (Ndegwa, 2015).

Other obstacles include market standards, limited information, requirements for large initial capital investments, limited product differentiation, and handicapping policies (Azechum, 2017). This extremely subjective process has worked traditionally (Ströh de Martínez et al. 2016). However, when the same farmer wants to sell the produce to high-end markets, then prejudiced standards no longer work (Belasco & Scranton, 2014). The farmer is obligated to meet equitable principles such as size, quantity, and quality (Whitehead et al., 2016). The quality side of the standards is of primary concern and gets more rigid where the food product is for export (Lee et al., 2012). The other aspect of the problem is the variation in the standards between markets (Kassie et al., 2015).

Fish markets vary necessitating a farmer to identify the market before production (Das et al., 2013). The markets are not static and quantities required, and sometimes the standards also vary, this increases the farmers' risk (Conceição et al., 2016). Apart from the fact that measures in themselves provide a bottleneck as to the crop and amount thereof that a farmer can produce, rules also put a strain as to who can produce (Singh et al., 2017). Lastly, Africa's high export costs limit farmer's contact to the international markets (Minot, 2014). To meet the standards, there is a need for information, capital, technology and expertise that the smallholder farmers have no capacity to reach without external assistance (Harvey et al., 2014).

The four focal elements of food security are availability, stability, utilization, and access (Napoli et al., 2011), however, only the first aspect is regularly addressed in simulation studies (Wageh et al., 2017). Concern for the negative impacts of staple food price fluctuations limits the extent to which governments in low-income countries are willing to liberalize their agricultural markets (Gilbert et al., 2010). Such price variations could lead to high transactions costs for poor consumers in the short run and low growth in the long run (Van et al., 2018). Rapidly expanding global trade in the past three decades has lifted millions of people out of poverty (Brown et al., 2017). Trade has also reduced manufacturing wages in high income nations and made whole industries uncompetitive in some communities, escalating nationalist politics that tried to stop or reverse extra trade expansion in the United States and Europe (Brown et al., 2017).

2.4.3 Effects of Globalization

Globalization is a notion that allows countries to gain from capital flows, technology shift, cheaper imports and larger export markets in the long term (Hirst el al., 2015). However, the effect of globalization on any country depends on that country's level of economic development, structures in place during the implementation stage, the flexibility of its financial system (Beeson, 2014). Globalization has three scopes; the first refers to the multiplication and intensification of economic, political, social and cultural linkages among people, organizations, and countries at the world level (Steger, 2017). The second dimension is the tendency towards the general request for economic, institutional, legal, political and cultural practices (Pieterse, 2015). This is interconnected to the first dimension in that increased linkages generate a need for corporate institutions and rules (Claessens & Yurtoglu, 2012). The third dimension is the emergence of

significant spillovers from the behavior of persons and societies to the rest of the world (Beeson, 2014).

Due to the interrelation of the varying aspects, policies made in one country are bound to have effects on another (Walsh, 2017). With globalization comes liberalization of markets (Coleman, 2016). The food security threat is caused by liberalization brought about by the dumping of heavily subsidized produce in third-world countries and premature exposure of upcoming industries to authentic competition from producers in developing and developed countries (Astou, 2015).In addition, most profits are repatriated by transnational companies reducing the potential for poverty reduction to direct employment alone (Karnani, 2016). In most cases, the pay is low because the national policies do not protect the laborers (Astou, 2015).

2.4.4 Disease and Infection

Food insecurity is common among HIV-infected populations in resource-rich and resource-poor countries (Vogenthaler et al., 2013). Diseases such as malaria, tuberculosis, and HIV/AIDS not only reduce the man-hours available to agriculture and household food acquisition but also increase the burden of the family in acquiring food (Soko et al., 2015). Depression and food insecurity are prevalent among people with HIV (PLHIV) and contributes to poor HIV outcomes (Palar et al., 2015). In Sub-Saharan Africa, HIV and AIDS is the leading cause of adult mortality and morbidity (Kharsany & Karim, 2016). FAO estimates that the epidemic will claim the lives of 20 percent or more of the population working in agriculture in many Southern African countries by 2020 (FAO, 2015). More than two-thirds of the whole population of the 25 most affected countries resides in rural areas, affecting agricultural production as well as farm and

domestic labor supplies (Muyanga & Jayne, 2014). Lack of resources also makes it harder for HIV-affected households to supplement their diet through the purchase of more nutritious and varied foods (Young et al., 2014). The effect of malnutrition on food security is further exacerbated by the fact that individuals affected by disease and infection, have greater nutritional requirements (WHO, 2016).

2.4.5 Food Storage Technologies

Continuing population and consumption growth will mean that the worldwide demand for food will rise for at least another 40 years (Godfray et al., 2010). Spoilage of food products is due to chemical, enzymatic or microbial activities (Rawat, 2015). One-fourth of the world's food supply and 30% of landed fish are lost through microbial activity alone (Ghaly et al., 2010). Traditional storage practices in developing countries cannot guarantee safety against key storage pests of staple food crops like maize, leading to 20–30% grain losses, mostly because of post-harvest insect pests and grain pathogens (Eziah & Afreh-Nuamah, 2015). Smallholder farmers end up selling their grain soon after harvest then purchase it back at an expensive price just a few months after harvest, hence falling in a poverty trap (Tefera & Abass, 2012). Food preservation is necessary for increasing shelf life and maintaining nutritional value, texture and flavor (Yildirim et al., 2017). Apart from causing quantitative losses; pests in stored grain are also linked to aflatoxin contamination and poisoning (Alshannaq & Yu, 2017). The ever-growing world population and the need to store and transport food from one place to another where it is needed create the need for proper food storage technologies (Tian et al., 2016). In the past salting, drying, smoking, fermentation and canning were the approaches used in prevent fish spoilage and extending its shelf life **(**Gómez-Sala et al., 2016**).**

Growing competition for land, water, and energy, in addition to the overexploitation of fisheries, will affect our ability to produce food, as will the urgent requirement to reduce the impact of the food system on the environment (Rasul, 2016). Proper handling, pretreatment and preservation techniques can improve the quality fish and fish products and increase their shelf life (Djenane & Roncalés, 2018). Low-cost drying technologies are usually suitable for rural farming areas (Eke, 2014). This is because they required low initial capital; they are easy to operate with no complex electronic/mechanical protocol, and effective in promoting better drying kinetics (Zhang et al., 2017). Such drying technologies include fluidized bed, spouted bed, infrared, solar, simple convective and desiccant drying (Esmailie et al., 2015). Metal silo are a valid option and have been proven effective in protecting stored grains from attack by storage insect pests (Abass et al., 2014).

2.4.6 Water Hyacinth

Eichhornia crassipes, also commonly known as common water hyacinth, is an aquatic plant indigenous to the Amazon basin, and is often an extremely problematic invasive species outside its native range (Sahota et al., 2016). Many of the wild population of fish in Africa are under serious threat from invasive alien species like the water hyacinth (Thieme et al., 2017). The South American water hyacinth species (*Eichhornia crassipes*) has a history of global invasions (Kriticos & Brunel, 2016) which includes the 1904 introduction into the Sacramento-San Joaquin Delta, California. Despite the implementation of a biological control programme in South Africa, water hyacinth still remains the worst aquatic weed (Coetzee & Hill, 2012).

An assessment of the social, economic and environmental impacts of water hyacinth in the Lake Victoria Basin was conducted (Güereña et al., 2015). Surveys exposed the negative social impacts of water hyacinth which include; lack of clean water, increase in vector-borne sicknesses, and migration of communities, social conflict and trouble in accessing water points (Villamagna & Murphy, 2010). Significant economic impacts readily perceived by communities in the basin included reduced fish catches (Malik, 2007), increase in transportation expenses, complications in electricity generation and water abstraction, fewer tourists, blockage of irrigation canals and environmental impacts such as deterioration in water quality, water loss through evapotranspiration, siltation, increased likelihood for flooding and a decline in the diversity of aquatic life (Sharma et al., 2016).

2.4.7 Outdated Fishing Technologies

There is a rising concern on the impacts of fishing on ecosystems and fisheries production (Garcia et al., 2012); a well-adjusted harvesting would more efficient to mitigate the adverse ecological effects of fishing while supporting sustainable fisheries. Over 1 billion people are estimated to lack necessary dietary energy and at least double that number suffers from micronutrient deficiencies (Barrett, 2010). In Bangladesh, only 6% of the daily food intake is animal food, fish plays a crucial role in the Bangladeshi diet, providing more than 60% of the animal food source food, representing a crucial source of micro-nutrients, and possessing an extremely strong cultural attachment (Belton et al., 2011).

Rice is the mainstay diet in Bangladesh making up to 60% of the daily food intake (Béné et al., 2015). But, many nutrients such as vitamins A and C, iron, calcium, zinc and

iodine are not found in rice and have to be obtained from other sources (Mann & Truswell, 2017). Small indigenous fish are a vital influence to the diet of the rural poor in Bangladesh, where more than 30,000 children go blind each year from vitamin A deficiency and 70% of women and children are iron-deficient (Ahmed, 2017). Overfishing and the deterioration of natural habitats have resulted in a decline in the small indigenous fish of Bangladesh (Shamsuzzaman et al., 2017).

Brazil is on the path to achieving several of the Millennium Development Goals which is attributed to bold and innovative government policies supported by new forms of popular involvement in social policy (Fukuda-Parr, 2016). However, poor policies have significantly affected household food security (Frelat et al., 2016). The problem arises when the focus on systems, structures and institutions is put above that of the people themselves (De Souza et al., 2015). The World Bank, the World Trade Organization, the World Food Program, the Millennium Challenge, The Alliance for a Green Revolution in Africa, the U.S. Department of Agriculture, and industrial giants like Yara Fertilizer, Cargill, Archer Daniels Midland, Syngenta, DuPont, and Monsanto, carefully avoid addressing the root causes of the food crisis (Holt-Giménez, 2008). The scarcity of food is caused by economic, environmental and social factors such as crop failure, overpopulation and poor government policies are the main cause of food scarcity in most countries (Satterthwaite et al., 2010).

2.4.8 Climatic Changes

Climate change effects are spatially variable and developing countries are considered more vulnerable than developed countries due to their lower capacity to adapt to these conditions (Cheeseman, 2016). Climate change results in fundamental alterations to

ecosystem structures and functions (Oliver et al., 2015). In both fresh and marine water bodies, changes in salinity, oxygen levels, currents and circulation are observed (Deutsch et al., 2015); however, their consequences are often difficult to distinguish from damage caused by overfishing and pollution. These climatic changes have significant effects on aquatic ecosystems (Barange et al., 2014).

In the North East Atlantic, there is evidence of algal blooms and rapid poleward shifts in plankton and fish species within their ranges (Barton et al., 2016). Modification in the abundance, productivity, community composition, distribution and migration of freshwater aquatic species are all being detected (Bishop et al., 2017). Decreased availability of food causes stunted growth of marine species (Poloczanska et al., 2016). Reduced thermal movement of the water also affects water quality by allowing pollutants to build up in upper layers of the water and has led to increased intensity of mercury and other contaminants in fish (Miara et al., 2018). In various areas, local extinctions of freshwater and diadromous species are occurring (Heino et al., 2016). Global warming may have substantial negative impacts on agricultural yields, particularly in developing countries (Karfakis et al., 2011). This poses a risk to rural households who are likely to become vulnerable to food insecurity (McLeman & Hunter, 2010). An econometric model can be used to inform decision makers on the likely impacts of global warming on the food security based on conditions of different households' types, their geographic distribution and factors influencing households' ability of self-reliance (Karfakis et al., 2011).

Rise in atmospheric temperatures can have dramatic impacts on agricultural productivity, farm incomes and food security (Hatfield & Prueger, 2015). Observational data and

output from 23 global climate models was used to show a high probability (>90%) that growing season temperatures in the tropics and subtropics by the end of the 21st century was to exceed the most extreme seasonal temperatures recorded from 1900 to 2006 (Johansen, 2017). Historical examples have been used to illustrate the magnitude of damage to food systems caused by extreme seasonal heat and showed that the short-run events could become long-term trends without sufficient investments in adaptation (Kumar et al., 2017).

Fishing is one of the most dangerous professions in the world (Rezaee et al., 2016). This is not only due to the wide range of non-fatal injuries that the fish harvesters get while at sea, but also the bad weather and other poor climatic factors (Hayman et al., 2010). Coastal and small island communities in Southeast Asia face day-to-day threats from the impacts of climate change and climate-related risks (Hiwasaki et al., 2015). Thousands of fishermen die every year around Lake Victoria because of intense night-time thunderstorms (Thiery et al., 2016). Weather factors are an intrinsic part of fish harvesters' operating environment and consider the most dangerous situations at sea to be associated with weather-related factors; Wind speed, sea surface temperature, and darkness are some of the most substantial environmental factors with respect to severity level of fishing occurrences (Rezaee et al., 2016). However, communities use local materials and approaches to avert and/or mitigate such hazards, and adjust to and prepare for them (Hiwasaki et al., 2015).

2.4.9 Overfishing

Millions of people depend on marine fisheries for food and livelihoods, on the other hand, global marine fisheries are severely degraded (Arias & Pressey, 2016). Estimates

from the Food and Agriculture Organization show that approximately 30% of assessed fish stocks are overfished (FAO, 2014). Overfishing threatens food security and livelihoods (Smith et al., 2010). Overfishing is exacerbated by illegal, unreported, and unregulated fishing (Arias & Pressey, 2016). Unlawful fishing is estimated to signify about 20% of the world's reported catch (Pauly & Zeller, 2016) due to omissions of catches from recreational fisheries, discarded by-catch and from illegal fishing. Illegal, unreported, and unregulated fishing threatens the productivity of ecosystems, and the socio-economic stability of fishing communities (Pramod et al., 2014). Fisheries overexploitation may lead to vicious cycles that create progressive environmental degradation and social conflict when people try to maintain or intensify their catches as the yields of earlier fishing methods decline (Brashares et al., 2014).

2.5 Food Insecurity Coping Strategies

A coping strategy is a response to severe reaction or shock, It can also be defined as the process of strategically selecting acts that individuals and households in an inferior socio-economic position use to restrict their expense or earn some added income to enable them to pay for the necessities (food, clothing, shelter) and not fall too far below their society's level of welfare (Davies, 2016). Due to varying degrees of wealth among households, different coping behaviors are adopted by families at different poverty levels (Becquey et al., 2010). The general tendency is that the lower the household asset status, the more likely the family would engage in negative responses such as selling off productive assets such as farm implements (Hoddinott, 2006) to cope up with food insecurity. Other common coping strategies rely on less preferred/inexpensive food; borrowing food, or relying on help from friends or relatives; gathering wild food, hunting or harvesting

immature crops; consuming seed stock held for the next season; household members to eat elsewhere; limiting portion size at meal times; restricting adult consumption in favor of little children; reducing the number of meals consumed in a day; skipping entire days without eating and begging from neighbors or friends (Mjonono et al., 2009). Increased reliance on coping strategies is associated with lower food availability and the higher the weighted sums of coping strategies, the more a household is food insecure, (Maxwell & Caldwell, 2008).

CHAPTER THREE

METHODOLOGY

3.1 Research Design

This research adopted a descriptive survey research design. Both quantitative and qualitative data were collected to help achieve the objectives of the study. The WHO states that there are three pillars that determine food security: food availability, food access, and food use and misuse. The FAO adds a fourth pillar: the stability of the first three dimensions of food security over time (Barrett, 2010). The Food Insecurity Multidimensional Index (FIMI) was used in the study to synthesize the four dimensions of food insecurity (Napoli et al., 2011)

The qualitative measures of food security aimed at evaluating the extent and severity of food insecurity and hunger through the use of questions aimed at eliciting information on; level of anxiety concerning food budget or supply, perceptions that either quantity or quality of food is not enough, reduced food intake in adults and reduced food intake in children. Closed ended and Likert scale questions were used to determine the severity of food insecurity and classified as belonging to one of four separate categories as; food secure, moderate food insecure, severe food insecure or extremely severe. The Coping Strategies Index (CSI) is a context-specific indicator of food insecurity that counts up and weights coping behaviors at the household level (Maxwel et al., 2008).

3.2 The Study Area

Homa Bay County is on the southern shore of Winam Gulf of Lake Victoria, in western Kenya (KNBS, 2010), it covers an area of 3,154.70 Km^2 and lies at an elevation of about 3921 ft. Homa Bay County has eight sub counties namely; Homa Bay town, Mbita, Ndhiwa, Kasipul, Rangwe, Karachuonyo, Kabondo and Suba (KNBS & SID, 2013). The population is growing rapidly with a population density of 302.7 per km^2 and a population of 955,060 people out of the current Kenyan population of 37,919,647(KNBS & UNICEF, 2013). The livelihoods of most county residents depends on fisheries and rain-fed small-scale farming, practices that are highly vulnerable to environmental degradation and the effects of climate change (UNDP, 2010).The county has 40 wards, but the ones along the shores of Lake Victoria are only 15 (KNBS, 2010). These 15 wards formed the study area for this research not only because of their close geographical proximity to Lake Victoria, but also because they are home to the fishing community. Figure 3.1 below shows a map of Homa Bay County with the wards sampled highlighted.

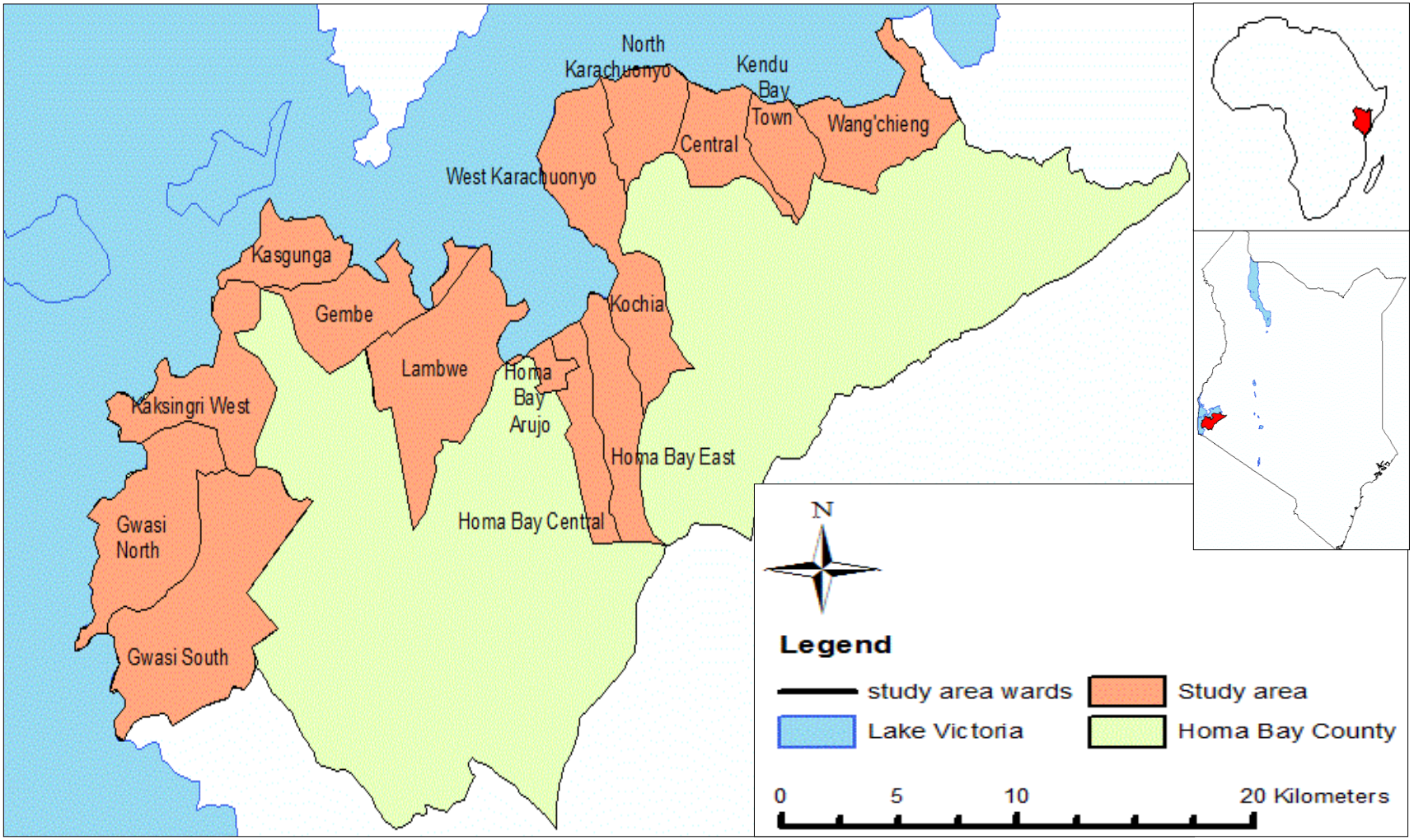

Figure 3.1: Map showing the position of Homa Bay County

[Modified from Hansen *et al.* (2013)]

3.3 Target Population

The target population of this study was all the residents of 15 wards living along the shores of Lake Victoria. The total population of the fifteen wards was 354,956 people (KNBS, 2010). These were the members of the community dependent on or engaged in fishery related activities to earn their livelihoods. Table 3.1 below shows the population of each of the 15 wards along the shores of L. Victoria in Homa Bay County as documented by (KNBS, 2010).

Table 3.1: Population of wards along the shores of L. Victoria in Homa Bay County

No.	Name of Ward	Size (km^2)	Total population
1	Wang'chieng'	95.4	33,336
2	Kendu Bay Town	46	20,371
3	Central Karachuonyo	37.3	13,409
4	North Karachuonyo	58.3	23,614
5	West Karachuonyo	50.2	26,069
6	Kochia	68.9	26,554
7	Homa bay East	69.2	20,858
8	Homa Bay Central	25.9	22,781
9	Homa Bay Arujo	13.3	19,768
10	Lambwe	14.2	22,315
11	Gembe	94.1	19,046
12	Kasgunga	74.7	19,653
13	Kaksingri West	104.2	22,021
14	Gwasi North	125.2	30,598
15	Gwasi South	206.9	34,563
	TOTALS	**1083.8**	**354,956**

3.4 Sample size and Sampling Procedure

A list of all the names of the fifteen wards within the study area was obtained from the Kenya Bureau of Statistics census report. The table of random numbers was used to select five out of fifteen wards to form the study sample (Rand.org, 2001). The random number tables are composed of the digits from zero (0) through nine (9), with the approximately equal frequency of occurrence (Rand.org, 2001).These five sample wards met satisfactorily the sampling needs for this study (which is 30% of the fifteen wards) as stated by (Mugenda & Mugenda, 2003). The total population of the five wards selected using the random numbers tables was obtained from Table 1 above then substituted in the formula for determining sample size as provided for by (Ellen, 2012). Shown below is the formula by (Ellen, 2012).

$n = N / (1+ N * e^2)$

Where:

N = population size

n = sample size

e = significance level (0.05)

Therefore:

$n = 115959/ (1+115959*0.05^2)$

$= 398.6249$

≈ 399

Table 3.2 below was extracted from Table 3.1 above showing wards generated through the random numbers tables. Proportion allocation procedure was used to obtain the specific sample size within each of the five wards that was used during the study. The

larger the populations size in a given ward, the larger the sample proportion allocation for that sample location (Ott & Larson, 1992).

Table 3.2: Wards identified from table of random numbers

No.	Ward	Population	Sample size
1	Wang'chieng’	33336	115
2	Gembe	19046	66
3	Kochia	26554	91
4	North Karachuonyo	23614	81
5	Central Karachuonyo	13409	46
	Total	**115959**	**399**

3.5 Data Collection Instruments

Quantitative and qualitative data was collected from the selected respondents using structured questionnaires and key informant interviews. Observations were captured via photographs and document analysis was used to collect secondary data.

3.5.1 Questionnaire

Structured questionnaire were used in the study. The questionnaire consisted of closed-ended questions. The first part of the questionnaire aimed to gather demographic data from the respondents while the second section comprised of closed ended and Likert scale questions. These scales ranged from ‘strongly agree’ (5) to ‘don’t know’ (1). The sample questionnaire is provided in Appendix I.

3.5.2 Key Informant Interviews

Key informant interviews were held with a chief or assistant chief, government officials and representatives from non-governmental organizations working in the study area. These interviews expounded precisely on issues such as the perceptions by residents on food insecurity. It also focused on the perceived impacts of food insecurity and apparent mitigation measures to food insecurity. The sample informant interview schedule is provided in Appendix II.

3.5.3 Observations

The data collected through observations was captured in photographs and was used to backup the information provided by the questionnaires and interviews.

3.5.4 Document Analysis

Additional information on the subject matter was acquired from journals, web articles, public records and books. Data from these sources was filtered to make ensure relevance and accuracy.

3.6 Validity and Reliability of the Research Instruments

3.6.1 Validity

Validity of research instrument is defined as the degree to which the instrument measures what it is intended to measure (Kember & Leung, 2008). The questionnaires were designed to efficiently address all the aspects of the study. To ascertain the validity of the questionnaires, a panel of experts verified that the questions reflected the concepts under study. The experts were the research supervisors and peer reviewers. Corrections were made where necessary.

3.6.2 Reliability

Reliability is a way of assessing the quality of the measurement procedure used to collect data (Kimberlin & Winterstein, 2008). It ensures that any instrument used for measuring experimental variables gives the same results every time. The reliability of the questionnaires was ascertained using the Cronbach's alpha coefficient which considers any value above 0.7 to be an appropriate threshold (Mugenda & Mugenda, 2003).

Cronbach's alpha is a measure of internal consistency or how closely related a set of items are as a group (Cronk, 2017). To test the internal consistency, you run the Cronbach's alpha test using the reliability command in SPSS, as follows: RELIABILITY /VARIABLES=q1 q2 q3 q4 q5 (George & Mallery, 2016). A high coefficient indicates that the items are consistently measuring the same underlying construct (Brown, 2014).

To ensure reliability of the data collection tool, a pilot study was conducted in an area with similar characteristics to that of the study area. The internal consistency technique was used for reliability testing in the pilot study. 40 respondents from Homa Bay Central Ward participated. The calculated Cronbach's Coefficient alpha for the pilot study stood at 0.724. This met the threshold provided for by Mugenda & Mugenda (2003).

3.7 Data Collection Procedure

Questionnaires were distributed to the selected respondents and the respondents were allocated a day to fill them. They were encouraged to provide honest feedback and assured of confidentiality. Authorization and permit to conduct research was obtained from the National Council of Science, Technology and Innovation (NACOSTI), a government agency in the Ministry of Higher Education, Science and Technology

(MOHEST) in Kenya. The questionnaires were later collected and data analysis commenced. The research permit is provided for in Appendix 4.

3.8 Data Processing and Analysis

The data acquired from the field was cross-examined for mistakes or ambiguities. It was then extracted and stored in Microsoft Excel. To facilitate the data processing exercise, the data was coded and entered in the latest version of SPSS. A master codebook was designed to ensure that all the questionnaires were coded uniformly. The data from the questionnaire was subjected to computation by simple statistics such as frequencies, totals, percentages, tabulations and cross-tabulations and presented in form of tables, graphs and charts.

CHAPTER FOUR

RESULTS

4.1 Demographic characteristics of the sample population

The demographics information of the sampled population included; gender, marital status, age range, respondent's main source of income, food preference, sources of preferred food and level of education. Table 4.1 shows the demographic characteristics of the sample population.

Table 4.1: Demographic characteristics of the sample population

		Percentage
Gender	Male	64.7
	Female	36.3
Marital	Single	25.6
Status	Married	60.4
	Separated	3.8
	Divorced	1.8
	Widowed	8.5
Age Bracket	18-25	28.1
	26-30	20.3
	31-35	23.3
	36-40	13.8
	Above 41	14.5
Main Source	Farming	30.0
of Income	Fishing	41.0
	Small Business	28.0
Food	Vegetables	8.0

Preference	Maize	7.5
	Fish	82.0
	Meat	1.8
	Yams	0.3
	Rice	0.5
Sources of Preferred Food	Lake	82.0
	Farms	18.0
Level of Education	No education	14.3
	Primary	39.8
	Secondary	42.1
	Diploma	2.5
	Bachelors Degree	1.3

4.2 Causes of Food Insecurity

4.2.1 Poverty

The study investigated the extent to which poverty caused food insecurity within the study area. It also tested whether or not poverty had a role in causing food insecurity within the study area. 1 (0.3%) of the total 399 respondents had no idea whether poverty caused food insecurity. However, 5 (1.3%) strongly disagreed, 7 (1.8%) disagreed, 79 (19.8%) agreed while 307 (76.9%) strongly agreed. The results are represented in Table 4.2 below. In reference to poverty, plate 4.1 below shows a habitable home in North Karachuonyo ward.

Table 4.2: Poverty and food insecurity in the study area

ITEMS	FREQUENCY	PERCENT
Didn't know	1	0.3
Strongly disagreed	5	1.3
Disagreed	7	1.7
Agreed	79	19.8
Strongly agreed	307	76.9
TOTAL	**399**	**100**

Plate 4.1: Photograph of a habitable home in North Karachuonyo ward

4.2.2 Government bans on fishing

The study investigated the extent to which seasonal bans on fishing by the government played in causing food insecurity within the study. Based on the results from the questionnaires, 3 (0.8%) of the total 399 respondents did not have a clue on whether seasonal ban on fishing by the government caused food insecurity within the study area. 12 (3.0%) out of the total 399 respondents strongly disagreed, 52 (13.0%) disagreed, 233

(58.4%) agreed while 99 (24.8%) strongly agreed. The results are represented in Table 4.3 below.

Table 4.2: Government bans on fishing and food insecurity in the study area

ITEMS	FREQUENCY	PERCENT
Didn't know	3	0.8
Strongly disagreed	12	3.0
Disagreed	52	13.0
Agreed	233	58.4
Strongly agreed	99	24.8
TOTAL	**399**	**100**

4.2.3 Population growth

The study investigated the extent to which rapid population growth caused food insecurity within the study area. The findings from the 399 questionnaires show that 2 (0.5%) had no idea on whether rapid population growth caused food insecurity or not. However, 9 (2.3%) strongly disagreed, 49 (12.3%) disagreed, 189 (47.4%) agreed whereas 150 (37.6%) strongly agreed. The results are represented in Table 4.4 below.

Table 4.3: Population growth and food insecurity in the study area

ITEMS	FREQUENCY	PERCENT
Didn't know	2	0.5
Strongly disagreed	9	2.3
Disagreed	49	12.3
Agreed	189	47.4
Strongly agreed	150	37.6
TOTAL	**399**	**100**

4.2.4 Dependence on one source of food

The extent to which dependence on one source of food caused food insecurity within the study area was investigated. In addition, the study tested whether or not dependence on

one source of food caused food insecurity within the study area. The findings show that 1 (0.3%) respondent did not know whether dependence on one source of food caused food insecurity within the study area. However, 149 (37.3%) strongly disagree, 148 (37.1%) disagreed, 39 (9.8%) agreed, while 62 (15.5%) strongly agreed. The results are represented in Table 4.5 below.

Table 4.4: Dependence on one source of food and food insecurity in the study area

ITEMS	FREQUENCY	PERCENT
Didn't know	1	0.3
Strongly disagreed	149	37.3
Disagreed	148	37.1
Agreed	39	9.8
Strongly agreed	62	15.5
TOTAL	**399**	**100**

4.2.5 Climate change

The study tested whether or not drought and poor rainfall patterns caused food insecurity within the study area. The research also investigated the extent to which climate change caused food insecurity within the study area. The findings indicated that 3 (0.8%) respondents did not know whether or not climate change caused food insecurity. 3 (0.8%) strongly disagreed, 11 (2.8) disagreed, 149 (37.3%) agreed, while 233 (58.4%) strongly agreed. The results are represented in Table 4.6 below. Plate 4.2 below shows a photograph of Awach Tende stream in Central Karachuonyo.

Table 4.5: Climate change and food insecurity in the study area

ITEMS	FREQUENCY	PERCENT
Didn't know	3	0.8
Strongly disagreed	3	0.8
Disagreed	11	2.8
Agreed	149	37.3
Strongly agreed	233	58.4
TOTAL	**399**	**100**

Plate 4.2: Photograph of Awach Tende stream in Central Karachuonyo

4.2.6 Inadequate fish storage methods

This study tested whether or not inadequate fish storage methods caused food insecurity within the study area. It also made strides towards investigating the extent to which

inadequate fish storage methods caused food insecurity within the study area. The findings showed that 14 (3.5%) of all the 399 respondents who answered the questionnaires strongly disagreed, another 14 (3.5%) disagreed, 104 (26.1%) agreed while 267 (66.9%) strongly agreed. The results are represented in Table 4.7 below.

Table 4.6: Fish storage methods and food insecurity in the study area

ITEMS	FREQUENCY	PERCENT
Strongly disagreed	14	3.5
Disagreed	14	3.5
Agreed	104	26.1
Strongly agreed	267	66.9
TOTAL	**399**	**100**

4.2.7 Unstable Fish prices

This study also investigated the extent to which unstable fish prices caused food insecurity in the study area. It also went on to address the question on whether or not unstable fish prices caused food insecurity in the study area. The results showed that 1 (0.3%) of the 399 respondents did not know whether unstable fish prices caused food insecurity. However, 11 (2.8%) strongly disagreed, 9 (2.3%) disagreed, 152 (38.1%) agreed while 226 (56.6%) strongly agreed that it did. The results are represented in Table 4.8 below.

Table 4.7: Unstable fish prices and food insecurity in the study area

ITEMS	FREQUENCY	PERCENT
Didn't know	1	0.2
Strongly disagreed	11	2.8
Disagreed	9	2.3
Agreed	152	38.1
Strongly agreed	226	56.6
TOTAL	**399**	**100**

4.2.8 Other factors causing food insecurity in the study area

The research investigated other factors apart from those in the Likert scale set of questions that might have caused food insecurity among the members of the fishing community. The findings from the questionnaires showed that 110 (27.6%) of the 399 respondents stated that poor infrastructure contributed to food insecurity in the area. However, 71 (17.8%) mentioned that illiteracy was the contributing factor while 25 (6.3%) blamed bad fishing gears. Other 40 (10.0%) respondents pointed out that high food prices caused food insecurity while 118 (29.6%) were for high crime rate. 13 (3.3%) of the respondents felt that unemployment was a factor while 3 (0.8%) stated that migration as a contributing factor. Figure 4.1 below shows other factors causing food insecurity.

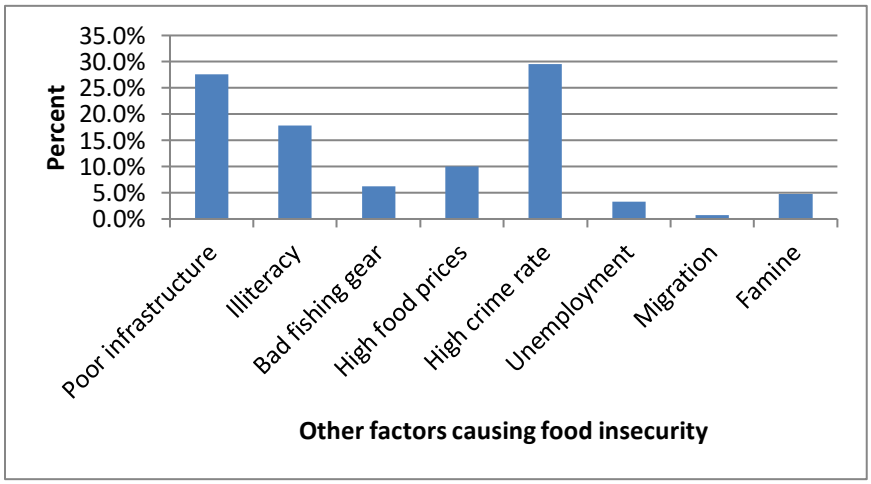

Figure 4.1: Other factors causing food insecurity

4.2.9 Over fishing

The research investigated whether or not over fishing caused food insecurity in the study area. The results showed that 173 (43.4%) of the 399 respondents stated that over fishing caused food insecurity. However, 226 (56.6%) believed that over fishing does not cause food insecurity. The results are represented in Figure 4.2 below.

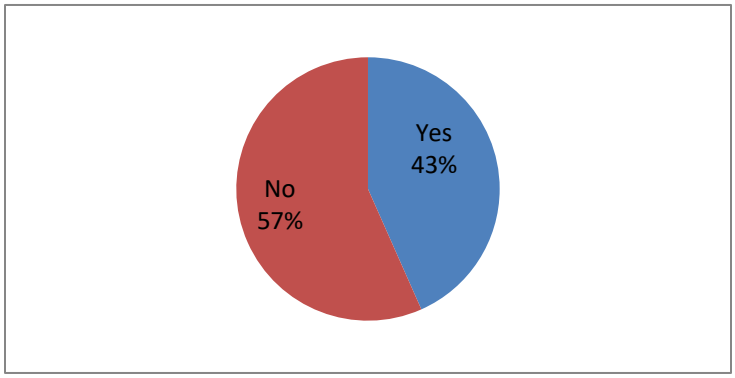

Figure 4.2: Perceptions on over fishing as a cause of food insecurity

4.2.10 Out-dated fishing technologies

The study showed that 4 (1.0%) of the 399 respondents had no idea of whether or not their fishing gears and technologies were out-dated and ineffective. 3 (0.8%) respondents strongly disagreed and20 (5.0%) disagreed. However, 173 (43.4%) respondents agreed while 199 (49.9%) respondents strongly agreed. The results are represented in Table 4.9 below.

Table 4.8: Outdated fishing technologies and food insecurity in the study area

ITEMS	FREQUENCY	PERCENT
Didn't know	4	1.0
Strongly disagreed	3	0.8
Disagreed	20	5.0
Agreed	173	43.4
Strongly agreed	199	49.9
TOTAL	**399**	**100**

4.2.11 High fishing gear prices

The research investigated whether or not the prices of quality fishing gear were high and if this had an effect on the impacts of food insecurity at the household level. Out of the 399 respondents 5 (1.3%) disagreed, 14 (3.5%) strongly disagreed, 12 (3.0%) disagreed, 110 (27.6%) agreed while 258 (64.7%) strongly agreed. The results are represented in Table 4.10 below.

Table 4.9: High fishing gear prices and food insecurity in the study area

ITEMS	FREQUENCY	PERCENT
Didn't know	5	1.3
Strongly disagreed	14	3.5
Disagreed	12	3.0
Agreed	110	27.6
Strongly agreed	258	64.7
TOTAL	**399**	**100**

4.2.12 Extent of Food Insecurity

The second objective of this study was to determine the extent or levels of food insecurity amongst members the fishing community living along L. Victoria in Homa Bay County.

4.2.13 Extent of food shortage

Results of the study indicated that 357 (89.5%) respondents had experienced food shortages. 42 (10.5%) respondents stated that they had never experienced food shortages.The results are represented in Figure 4.3 below.

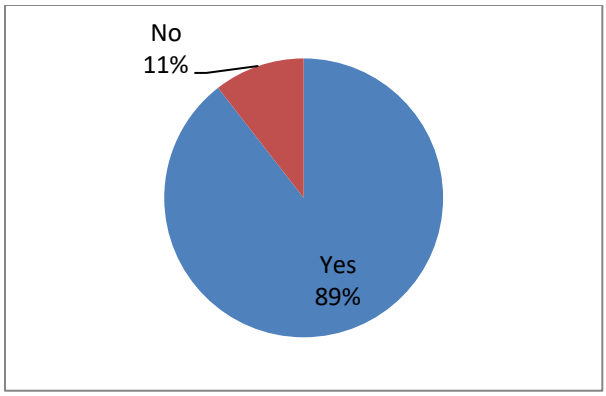

Figure 4.3: Experiences of food shortages in the study area

4.2.14 Experiences of food shortages in the sudy area

Out of the 357 respondents who experienced food shortages, 32 (9.0%) indicated this happened on a daily basis. 87 (24.4%) respondents experienced food shortages every week, while 57 (16.0%) did monthly. 58 (16.2%) experienced food shortage (quarterly) every three to four months. Lastly, 123 (34.5%) experienced food shortages annually. The results are represented in Figure 4.4 below.

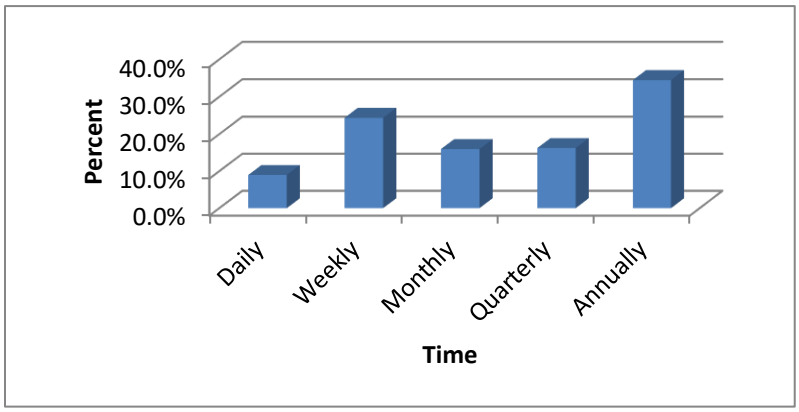

Figure 4.4: Experiences of food shortage

4.2.15 Borrowing and lending of food

The findings showed that 298 (74.7%) out of the 399 respondents had eaten at their neighbors' place under due to lack of food in their households while 101 (25.3%) said they never did.The results are represented in Figure 4.5 below.

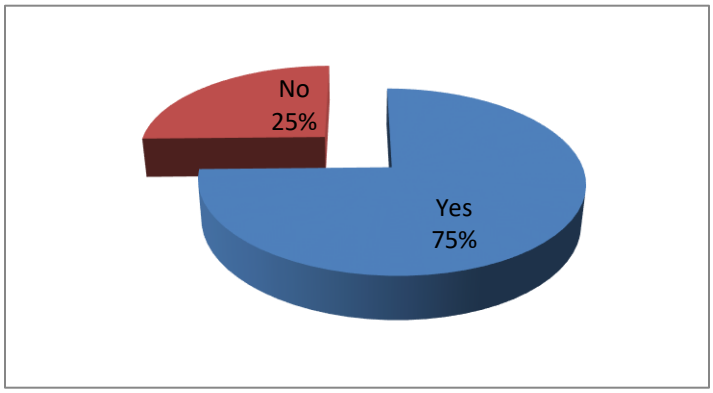

Figure 4.5: Eating at the neighbors house

The results also showed that 331 (83.0%) out of 399 respondents had hosted their neighbours for meals (when the neighbours did not have enough food at their places) while 68 (17.0%) had never shared their meals out. The results are represented in Figure 4.6 below.

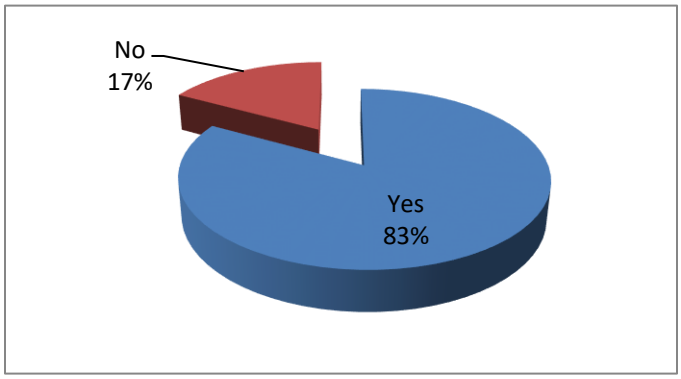

Figure 4.6: Hosting neighbors for meals in the study area

The research investigated how frequent the 331 respondents hosted their neighbors for meals. The results showed that 7 (2.1%) helped out their neighbors on a daily basis, 72 (21.8%) did so every week, while 109 (32.9%) hosted their neighbors every month. However, 52 (15.7%) came to the rescue of their neighbors every three to four moths (quarterly) while the remaining 91 (27.5%) hosted their neighbors' annually. The results are represented in Figure 4.7 below.

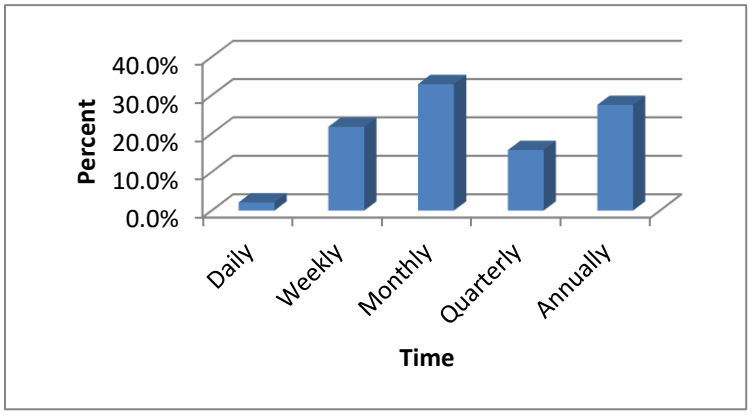

Figure 4.7: Frequency of hosting neighbors for meals in the study area

4.2.16 Storage of food in granaries

The findings indicate that 190 (47.6%) of the 399 respondents had been able to store enough food to last them past the tough times of food insecurity. However, 209 (52.4%) stated that they had never stored enough food to last them that long. The results are represented in Figure 4.8 below.

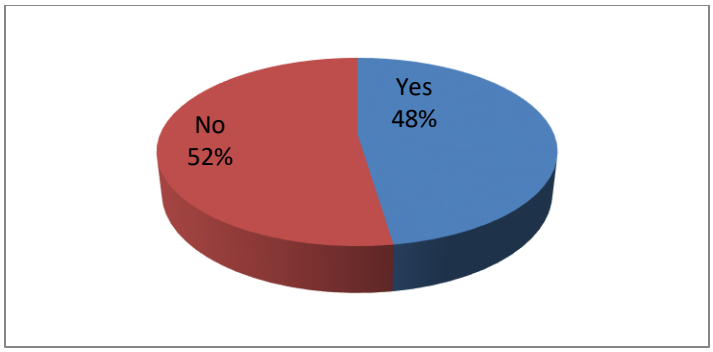

Figure 4.8: If respondents stored enough food

4.2.17 Consumption of traditional foods

The findings showed that 386 (96.7%) consumed traditional vegetables and cereals such as the black nightshade, amaranth, sorghum, millet, and cassava during the periods of food insecurity while 13 (3.3%) stated that they had not tried out traditional foods under the same conditions. The results are represented in Figure 4.9 below.

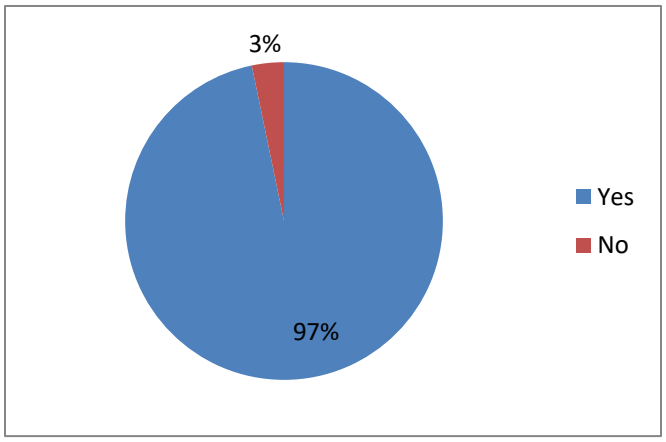

Figure 4.9: Consumption of traditional foods due to food insecurity

4.3 Impacts of Food Insecurity

Findings showed that 177 (44.4%) household heads stated that their children had experienced malnutrition related diseases such as kwashiorkor and marasmus. 11 (2.8%)

mentioned educational challenges such as dropping out of school and poor performances of their children as impacts of food insecurity and 96 (24.1%) stated increased crime incidences such as robbery and household break ins. Economic challenges (16.3%), migration (6.3%) and other factors (6.1%) were also amongst the impacts felt as represented in Table 4.11 below.

Table 4.10: Impacts of food insecurity

ITEMS	FREQUENCY	PERCENT
Health risks	177	44.4
Educational challenges	11	2.8
Crime	96	24.1
Economic challenges	65	16.3
Migration	26	6.3
Others	24	6.1
TOTAL	**399**	**100**

4.3.1 Malnutrition

Findings of the study showed that 156 (39.1%) of households had a member or members of their households who suffered from either kwashiorkor or marasmus. However, 243 (60.9%) respondents stated that no member of their families had been ill due to malnutrition. The results are represented in Figure 4.10 below.

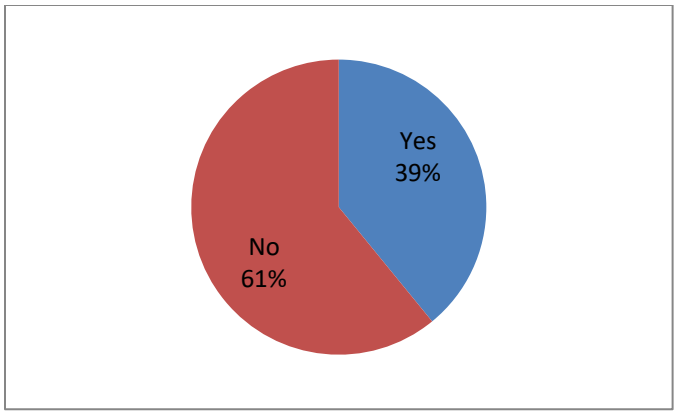

Figure 4.10: Households health and malnutrition related illnesses

4.3.2 Malnutrition related deaths

The research sought to find out if the respondents knew anyone who died due to malnutrition illnesses in the neighbourhood. 140 (35.1%) out of the 399 respondents had lost a relative due to kwashiorkor or marasmus whereas 259 (64.4%) did not .The results are represented in Figure 4.11 below.

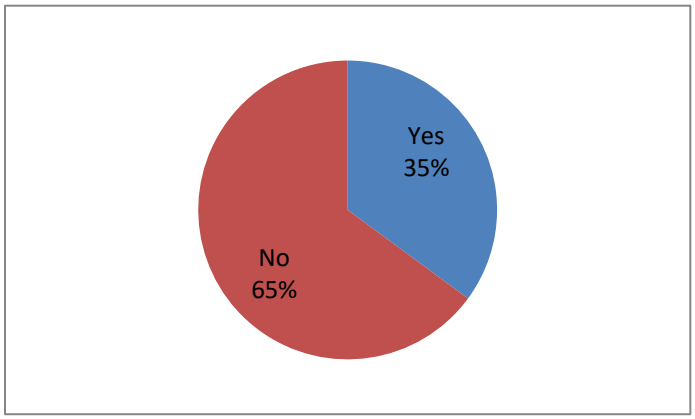

Figure 4.11: Death due to malnutrition illenesses

4.3.3 Migration

The results showed that 84 (21.1%) of the 399 respondents had migrated from their homes to other areas on several occasions due to food insecurity. However, 315 (78.9%)

respondents had never migrated due to food insecurity. The results are represented in Figure 4.12 below.

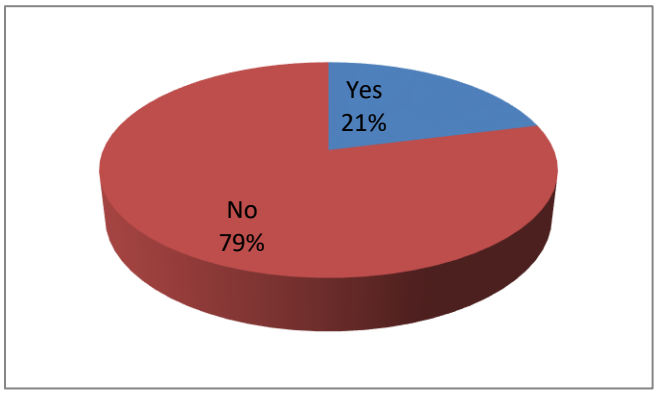

Figure 4.12: Migration due to food insecurity

The research further tested the number of migratory occasions of the 84 respondents who had been forced to move due to food insecurity. 40 (47.6%) had migrated once, while 22 (26.2%) and 5 (6.0%) had migrated twice and thrice respectively. 17 (20.2%) respondents indicated that they had migrated four times or more. The results are represented in Figure 4.13 below.

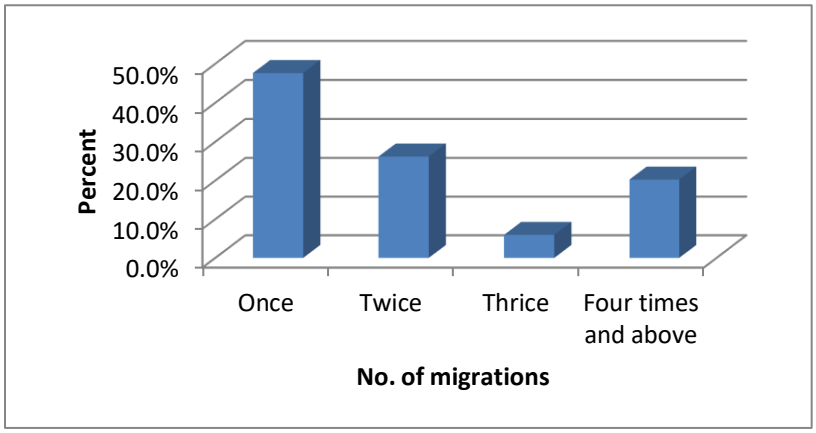

Figure 4.13: Migratory occasions by the respondents

4.3.4 Loss of property

340 (85.2%) of the 399 respondents asserted to have lost their property in ways such as death of domestic animals like donkeys due to lack of pastures, loss of household items through theft and some respondents sold their property to raise money for food. However, 59 (14.8%) held that they had never lost their household properties or wealth as a result of food insecurity. The results are represented in Figure 4.14 below. Plate 4.3 below shows a photograph of a dead donkey in Gembe ward.

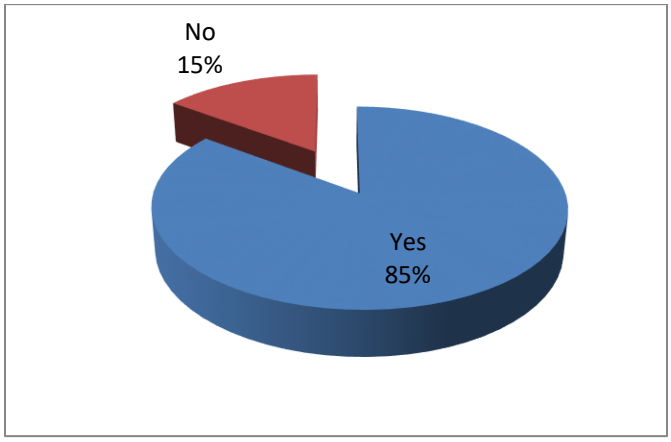

Figure 4.14: Loss property/wealth due to food insecurity

Plate 4.3: A photograph of a dead donkey in Gembe ward

4.3.5 Fluctuation of food prices

The researcher aimed to find out whether or not food insecurity caused a fluctuation in food prices. The findings indicated that 385 (96.5%) of the 399 respondents agreed to this whereas 14 (3.5%) were for a contrary opinion. The results are represented in Figure 4.15 below.

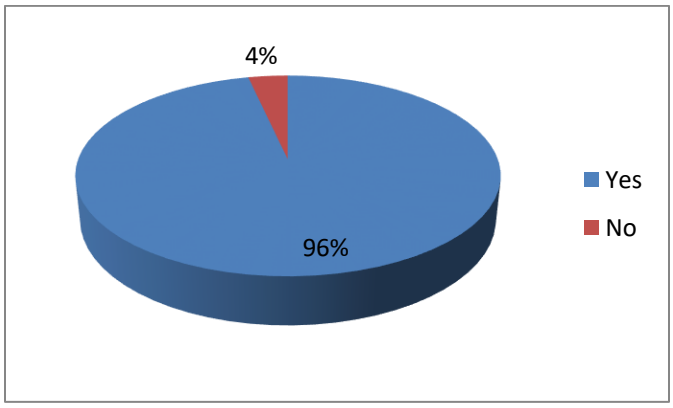

Figure 4.15: Food insecurity and fluctuation of food prices

4.4 Coping Strategies to Food Insecurity

The fourth objective was to identify coping strategies adopted by the members of the fishing community to minimize the negative impacts of food insecurity. The research examined a number of strategies that the members of the fishing community apply in order to mitigate the negative impacts of food insecurity within the study area. This was obtained through Likert scale questions in the questionnaires. The issues addressed in this in the Likert scale questions included: child labour, skipping meal for some days, skipping meals during the day, malnutrition, loss of property, food prices and climate change.

4.4.1 Child labour

The findings showed that 46 (11.53%) out of the 399 respondents stated that their children always worked for neighbors, while 101 (25.31%) mentioned that this happened often. However, 158 (39.60%) stated that it happened sometimes, 54 (13.53%) pointed out that it took place rarely while 40 (10.03%) stated that their children never worked at the neighbors. The results are represented in Figure 4.16 below.

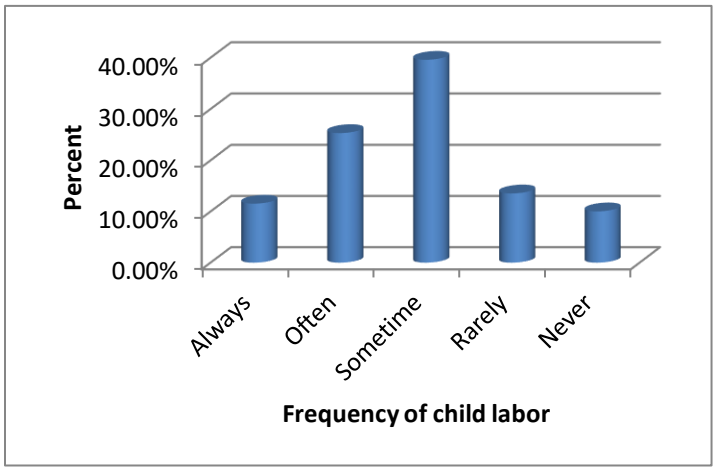

Figure 4.16: Child labour as coping strategy to food insecurity

4.4.2 Skipping meals for some days

The results showed that 23 (5.8%) of the 399 respondents affirmed that they skipped meals for some days, while 105 (26.3%) revealed that this happened often. However, 189 (47.4%) stated that it happened sometimes, 66 (16.5%) pointed out that it took place rarely while 16 (4.0%) confirmed that they never starved themselves for days as a technique to the negative impacts of food insecurity. The results are represented in Figure 4.17 below.

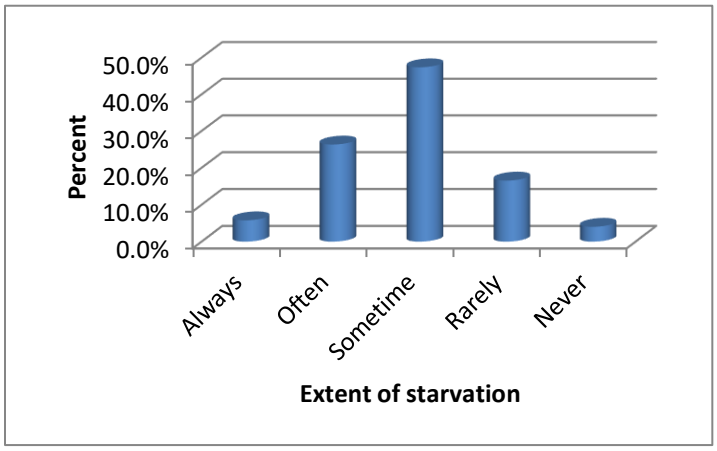

Figure 4.17:Prolonged starvation as a coping stratergy

4.4.3 Skipping meals during the day

The research tested whether or not the respondents skipped lunch or supper during the day as a remedy to the negative impacts of food insecurity. This study also investigated the rate of happenings this event. The results showed that 8 (2.0%) of the 399 respondents affirmed that they always skipped meals, while 75 (18.8%) revealed that this happened often. However, 222 (55.6%) stated that it happened sometimes, 68 (17.0%) pointed out that it took place rarely while 26 (6.5%) confirmed that they never skipped

meals in some days as a remedy to the negative impacts of food insecurity. The results are represented in Figure 4.18 below.

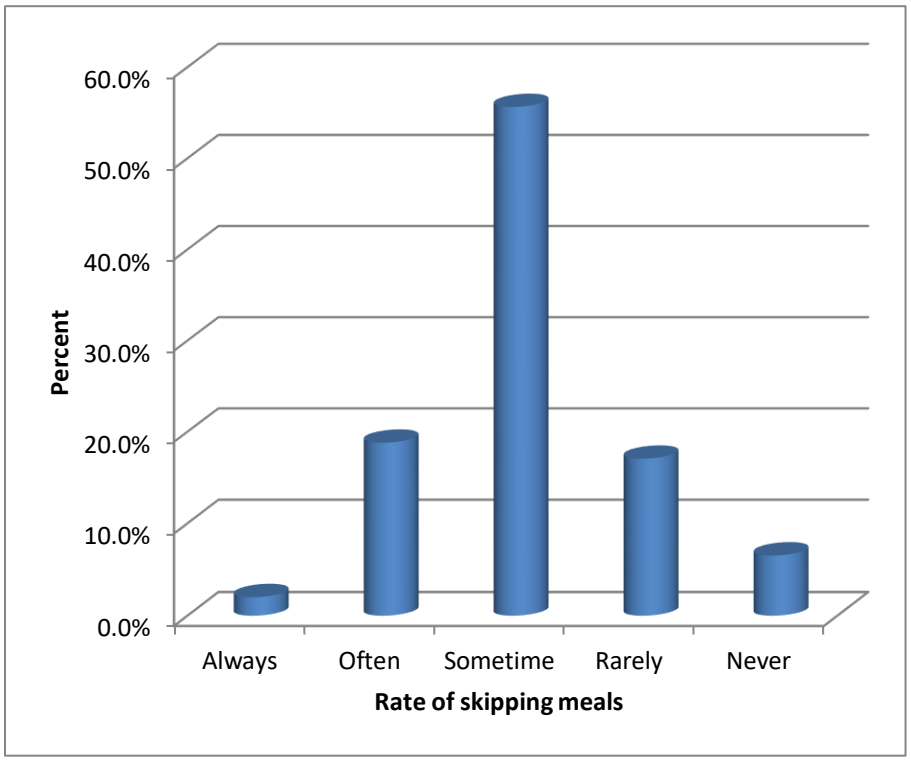

Figure 4.18: Skipping meals during the day as a coping stratergy

4.4.4 None-fishing activities

The fishing community resorts to the following coping strategies to mitigate against the impacts of malnutrition and malnutrition related illnesses, loss of property as a result of selling their possessions to raise money for food and to also cope with the effects of unstable food prices. This was obtained through the opinions of the respondents within the study area. The findings indicated that 86 (21.6%) of all the 399 respondents mentioned sand harvesting as the other copping strategy while 31 (7.8%) were for weaving. However, 202 (50.6%) cited farming as their alternative coping strategy as the remaining 13 (3.3%), 9 (2.3%), 30 (7.5%), 1 (0.3%), 11 (2.8%), 7 (1.8%) and 9 (2.3%)

respondents went for pottery, early marriage, other business activities, migration, brick making, food aid and mining respectively. The results are represented in Table 4.12 below.

Table 4.11: None-fishing activities as coping strategies

ITEMS	FREQUENCY	PERCENT
Sand harvesting	86	21.6
Weaving	31	7.8
Farming	202	50.6
Pottery	13	3.3
Early marriage	9	2.3
Other business activities	30	7.5
Brick making	11	2.8
Food aid	7	1.8
Mining	9	2.3
TOTAL	**399**	**100**

4.4.5 Most effective way of reducing food insecurity

The researcher asked the 399 respondents to suggest the most effective method of reducing food insecurity within the fishing community. The results show that 103 (25.8%) respondents stated irrigation as the ultimate solution to food while 47 (11.8%) felt that youth employment would solve the food insecurity problem. The remaining 8 (2.0%), 11 (2.8%), 133 (33.3%), 60 (15.0%), 22 (5.5%) and 15 (3.8%) respondents stated that lowering food prices, getting food aid, investing in modern fishing technology, growing of drought resistant crops, family planning and investing on education were most effective method of reducing food insecurity in the region respectively. The results are represented in Table 4.13 below.

Table 4.12: Most effective method of reducing food insecurity in the study area

ITEMS	FREQUENCY	PERCENT
Irrigation	103	25.8
Youth employment	47	11.8
Lowering of food prices	8	2.0
Food aid	11	2.8
Investment in modern fishing technology	133	33.3
Growing drought resistant crops	60	15.0
Family planning	22	5.5
Investing on education	15	3.8
TOTAL	**409**	**100**

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This chapter sought to examine and compare findings of the study to those of similar studies.

5.2 Causes of food insecurity

Poverty was a major cause of food insecurity in the study area. This was strongly agreed to by 307 respondents out of the total sample size of 399. This study was in agreement with the perspectives of (Belhabib et al., 2015) on the role of poverty in increasing food insecurity. Homa Bay County performs below the national average on most socio-economic indicators. Poverty is prevalent in the county and manifests itself in other socio-economic outcomes such as poor nutrition, health, and education, as well as a lack of access to basic services. The poverty level of the county residents is linked to their purchasing power. These findings therefore agree to those of a similar study which indicated that high global food prices and low purchasing power for significant proportion of the fishing communities is attributed to their high levels of poverty (FAO, 2015).

332 respondents deemed that the seasonal bans on fishing by the government played a key role in causing food insecurity while a 16.8% of the sampled households either disagreed or had no idea of the role of seasonal bans. These findings show that households experience seasonal food insecurity during the banned period of fishing (Rahman et al., 2018). Homa Bay County residents highly depend on small scale rain fed agriculture and fishing activities for subsistence and for their livelihood, during the

seasonal bans, households become food insecure due to the lack of a supplemental source of income (Gore, 2017) especially for the women fisher folk. The high popuation density of Homa Bay county has led to reduced average fish size and stock biomass by 50% as a result of overfishing (Mkumbo & Marshall, 2015) hence the need for seasonal bans on fishing.

The rapid population growth in Homa Bay County is a chief cause of food insecurity as agreed to by 339 of the respondents. High popuation of Homa Bay County has increased pressure on the fisheries resources due to the high demand for fish and fishery products to meet the nutritional needs of the fishing community. This emphasizes the significance of Sustainable utilization of natural resources, also regarded as an important component of ecological resilience (Mondal & Dalai, 2017).The results of this study are also in accordance to the views of Barrett (2010) on the impacts of high population growth on food security (Barrett, 2010). High population growth as in the case of Homa Bay has a direct connection between household crowding and food insecurity (Ruiz-Castell et al., 2015); this in the long run leads to poor nutrition and skipping of meals.

According to 297 respondents, over dependence on one source of food was not a cause of food insecurity. On the contrary, these respondents felt that high population and high poverty levels were the reasons behind their dependence on fish and other locally available food groups. This study agrees to similar studies showing that Island dwellers highly depend on coastal resources for their food and livelihoods (Roeger et al., 2016). It however contrasts with studies that suggest households that are solely dependent on natural resources through farming, fishing, livestock and poultry farming, are more

vulnerable to food insecurity as these activities face considerable uncertainties associated with climate change and variability as well as other stressors (Makame et al., 2015).

382 respondents perceived that food insecurity was as a result of climate change. These households mainly practice small scale farming and fishing, and the poor rainfall and increased water temperatures significantly affect their livelihoods. Findings of this study concur with those of a similar study which explained that erratic rainfall had exacerbated household food insecurity in the country (Icheria, 2012). The findings are also in harmony with those of study that showed the effects of climate change in both fresh and marine water bodies including the changes in salinity, oxygen levels, currents and circulation (Deutsch et al., 2015); however, their consequences are often difficult to distinguish from damage caused by overfishing and pollution. The frequent droughts and unreliable rainfall in most parts of Kenya is one of the driving factors for food insecurity (FAO, 2015).

Inadequate fish storage methods were perceived by 371 respondents as a cause of food insecurity. The reason behind this insight was the fact that the respondents consumed all the fish they had harvested within a short while to avoid spoilage. Most of their fish also spoiled because of poor handling and storage due to the high perishable nature of fish and fishery products. This study was in agreement with other studies that put emphasis on the need for proper handling, pretreatment and preservation techniques to improve the quality of fish and fish products and to increase their shelf life (Djenane & Roncalés, 2018). The fishing community in Homa Bay requires low-cost drying technologies for fish preservation to avoid losses due to spoilage caused by microbial activity (Eke, 2014), since smallholder farmers sell their produce soon after harvest then purchase it back at an

expensive price just a few months after harvest, consequently falling in a poverty trap (Tefera & Abass, 2012).Poor storage practices in developing countries cannot guarantee safety against key storage pests of staple food (Eziah & Afreh-Nuamah, 2015).

Unstable fish prices were perceived by 378 respondents to have been the cause of food insecurity in the wards bordering Lake Victoria. The prices of fish fluctuate over time depending on fish availability. High demand for fish leads to high fish prices thus making fish unaffordable since most Homa Bay County residents live below the poverty line. The water hyacinth in Lake Victoria also plays a significant role in augmenting the fish prices. It leads to reduced fish catches, increased transportation expenses, deterioration in water quality, water loss through evapotranspiration, siltation, increased likelihood for flooding and a decline in the diversity of aquatic life (Sharma et al., 2016). This further leads to elevated fish prices and as a result increases food insecurity. The variation in standards between markets is a key contributor to the elevation of food insecurity; for that reason, challenges in the fishing industry such as unstable fish prices can be attributed to the weakening Kenyan economy (Okello et al., 2017).

5.3 Extent of Food Insecurity

The study findings showed that 357 respondents had experienced food shortages. The frequency of food shortage experienced in households varied from; daily in 32 households, weekly in 87 households, and monthly in 57 households, quarterly in 58 households and annually in 123 households. The study is in conformity with a similar study by Von Grebmer et al., (2015) which stated that level of hunger in the world remains unacceptably high with 795 million people still going hungry, more than one in

four children affected by stunting and 9% of children affected by wasting (Von Grebmer et al., 2015).

298 out of the 399 respondents either borrowed or assisted a neighbor with food and 331 out of the 399 respondents had hosted their neighbours for meals each at varied frequencies. 209 respondents stated that they have never had sufficient food for their consumption so as to store some in their granaries. Food shoortages and food insecurity can be attributed to the high costs of domestic food production due to great prices of inputs for instance the cost of fertilizer (FAO, 2015). 386 households often consumed traditional vegetables and cereals such as the black nightshade, amaranth, sorghum, millet, and cassava to counter the effects of food insecurity. This attributes the traditional food-ways as not only critical to food sovereignty in emerging and developing countries, but also to food security, eco-touristic development, small-scale food specialty markets, and local health approaches (Quave & Pieroni, 2014).

5.4 Impacts of food insecurity on livelihoods

177 household heads stated that their children had experienced malnutrition related diseases such as kwashiorkor and marasmus, 11 mentioned educational challenges such as dropping out of school and poor performances of their children and 96 stated increased crime incidences such as robbery and household break ins. 140 out of the 399 respondents had lost a relative due to kwashiorkor or marasmus. These findings show that the decline in fish stock and unstable fish prices has a health effect on residents of Homa Bay County. These findings concur that greater fish consumption is needed to combat prevalent non-communicable diseases (Allen et al., 2017). Malnutrition and malnutrition related illnesses due to the poor food consumption patterns and consumption of

nutritionally incomplete diets, therefore, the study agree that high fish prices lower protein intake among the fishing communities hence susceptibility protein deficient ailments (Camlin et al., 2013) and that fishery resources are an important source of proteins, vitamins and micronutrients, particularly for many low-income populations in rural areas (Béné et al., 2015). Homa Bay County has been ranked as having the highest rate of HIV/AIDS in Kenya, with the prevalence rate of over 25%, that's 1 in 4 children (Emmanuel, 2015). This further emphasizes on the need for nutritionally balanced diets for the patients

84 of the 399 respondents had migrated from their homes to other areas on several occasions due to food insecurity. The number of migratory occasions of the 84 respondents varied between once and four times. Migration increases competition for land, water, and energy, in addition to the overexploitation of fisheries, this eventually affects the ability to produce food sustainably (Rasul, 2016). This study concurs with similar studies on effect of migration on agricultural production; an example is the heightened vulnerability to food insecurity during the 2007/2008 as a result of the post election violence in Kenya which led to the displacement of a vast number of farmers in the high potential agricultural areas (Kimani-Murage et al., 2014). The violence disrupted the March/April agricultural production (Kamunyan et al., 2013) making people vulnerable to household food insecurity (Grote & Warner, 2010).

Food insecurity is linked to the loss of property or wealth. 340 of the 399 respondents asserted to have lost their property such as death of their donkeys due to lack of pastures, loss of household items through theft and some sold their property to raise money for food. Drought and other climate change effects impact food and pasture availability. High

atmospheric temperatures can have dramatic impacts on agricultural productivity, farm incomes and food security (Hatfield & Prueger, 2015). There's need for sustainable livelihood solutions for fishing communities who are vulnerable to food insecurity (McLeman & Hunter, 2010).

5.5 Coping Strategies to Food Insecurity

This study established that child labour (though illegal) was widely practiced in the fishing community through assigning children to work in neighbours farms to help mitigate the adverse impacts of food insecurity. The findings showed that 46 out of the 399 respondents children always worked for neighbors, 101 often worked ,158 worked sometimes, 54 rarely worked and 40 (10.03%) never worked at the neighbors farms for food. A majority number of households skipped meals for some days as a coping strategy at varied frequencies. 23 of the 399 respondents skipped meals for some days, 105 often, 189 sometimes, and 66 rarely while 16 never skipped meals for some days as a technique to mitigate the negative impacts of food insecurity. Skipping meals during the day, especially lunch was a common phenomenon in 222 households. This study was in agreement with the findings by Mjonono et al., (2009) which showed that skipping entire days without eating was a common coping mechanism to food insecurity within households (Mjonono et al., 2009).

Members of the fishing community resorted to small scale farming (202), sand harvesting (86),weaving (31), pottery (13), early marriage (9), other business activities (30), migration(1), brick making(11), food aid(7) and mining(9) as coping strategies to mitigate against the impacts of malnutrition and malnutrition related illnesses, loss of property as a result of selling their possessions to raise money for food and to also cope

with the effects of unstable food prices. These coping strategies demonstrate that demand for food aid is a serious consequence of food insecurity (FAO, 2015), the high dependency on food aid takes away the abilities of people (such as members of the fishing community) out of the production cycle. There is a strong correlation between health and productivity (Kwena et al., 2017), hence the need for alternative and sustainable sources of livelihoods for the fishing community to ensure health and well being.

5.5.1 Most effective way of reducing food insecurity

Investment in modern fishing technology can be an effective method to reducing food insecurity within the fishing community. Irrigation, growing drought resistant crops andyouth employment is also key ways to diminish impacts of food insecurity. Investing on education and stabilizing food prices will also be of great benefit to the fishing community. It is necessary to pay attention to societal experiences (Moshy et al., 2015). Fishery management and organization problems create potential risk to both the access of fish, and other foods, for lakeside communities (Abila, 2000).The government should partner with the private sector to solve fisheries issues (Pomeroy et al., 2016). Rights Based Management (RBM) holds the best hope for moving towards sustainable fisheries management in the southern Lake Malawi (Hara & Njaya, 2016).

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

The major factors that caused food insecurity in the study area included; poverty (96.7%), seasonal bans on fishing by the government (83.2%), rapid population growth (85.0%), dependence on one source of food (74.4%), climate change (95.7%), inadequate fish storage method (93.0%) and unstable fish prices (94.7%). Impacts of food insecurity included; Food shortages, migration, malnutrition, fluctuation of food prices, unstable fish prices and loss of property or wealth. 90.0% respondents' children worked for money for food at the neighbours farms and homes', 96.0% skipped meals for some days as a coping strategy, 93.5% skipped lunch or supper during the day as a coping mechanism and 50.9% mentioned farming (in its various forms) as their alternative coping strategy.

6.2 Conclusions

The study concluded that Food insecurity remains a major concern in Homa Bay County. The key factors that caused food insecurity included; poverty, seasonal bans on fishing by the government, rapid population growth, dependence on one source of food, climate change, inadequate fish storage method and unstable fish prices and markets. Factors such as poverty, climate change, increased temperatures and rainfall variability negatively impacts on crop and fish production (Hatfield & Prueger, 2015).The extent of food insecurity was moderate; however, some members of households within the fishing community suffered from malnutrition and malnutrition related diseases that were directly linked to food insecurity. Over dependence of one source of food is the main

cause of malnutrition and malnutrition related illnesses since a single food group is not nutritionally complete (Blakistone et al., 2016).

The study further concluded that if the population growth in Homa Bay County remains high, the demand for fish will continue to outpace fish production (Homa Bay County Government, 2013). Simultaneously, the pressure on the fisheries resources will increase leading to overexploitation of fisheries resources. Migration was a common phenomenon as a response to food insecurity and a large number of members lost their household properties due to food insecurity. There were fluctuations in food prices and health risks were highly linked to the food insecurity. Most households desired satisfying their need for food before any other thing. This showed that the need for food was superior to other needs within the fishing community. The poverty level in Homa Bay County will also persist if the fishing community does not engage in alternative sources of livelihood (Pfeiffer et al., 2017).

6.3 Recommendations

In order to improve the households' food insecurity in Homa Bay County, the following may be the major areas of intervention.

i. The county government should build a storage facility for fisheries products to reduce post-harvest loses due to lack of fish storage facilities. The fisheries department at the county level should also train the fisher folk on value addition of fishery products to increase value and shelf life.

ii. The County Fisheries Department should create awareness on the importance of seasonal bans on fishing activities and ban on fishing gears in order to change the perceptions of its residents on seasonal bans as a cause of food insecurity.

iii. The fisher folk should be educated and encouraged to practise environmentally friendly livelihood options like alternative methods of fish farming, for instance on cage or pond culture, this will help reduce pressure on the natural fish stocks and also create self employment opportunities to the community hence improving livelihoods thus eradicating poverty and food insecurity.

iv. The county government should encourage its residents to have sustainable sources of livelihoods by encouraging them to practice weaving, pottery and basketry to supplement their income hence escape food insecurity.

6.3.1 Further Research Recommendation

i. Studies should be conducted on the socio-economic impacts of fish exportation on the livelihoods and well being of the local fishing communities.

ii. Studies should be carried out to determine the effects of climate change on food insecurity in fishing communities.

iii. Both the County and National governments should map out and protect fish breeding grounds from any fishing activity to allow for growth and recruitment of fish.

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APPENDICES

Appendix I: Questionnaire

My name is Brian Ambale. I am a student from the University of Eldoret doing a study on food insecurity among members of the fishing community living along the shores of L. Victoria in Homa Bay County as a part of my MSc degree. I am requesting you to fill the questionnaire. The information obtained shall be exclusively confidential. The researcher will use this information for academic purposes. Please do not write your name or any other detail that the researcher can use in this questionnaire to identify you. Please respond to all questions to the best of your knowledge and ability.

Section A

Background Information

1.What is your gender?

Female ☐ Male ☐

2.What is your marital status?

Single ☐ Married ☐ Separated ☐ Divorced ☐ Widowed ☐

Other ☐ (specify) _____

3.What is your age range?

18-25 ☐ 26-3 ☐ 31-35 ☐ 36-40 ☐ 41 and above ☐

4.What is your main source of income?

Farming ☐

Fishing ☐

Small business ☐

Others ☐ please specify _____

5.What is the staple food in this area and what is its source?

Food	**Source**

6.What is your highest academic level?

Primary ☐ Secondary ☐ Diploma ☐ Bachelor degree ☐

Master's degree ☐ PhD ☐ None of the above ☐

Section B

Causes of Food Insecurity

7.Do you think the following factors cause food insecurity? Tick where appropriate.

ITEM	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**	**Don't Know**
Poverty					
Seasonal bans on fishing by the government					
Rapid population growth					
Over dependence on one source of food					
Climate change					

Inadequate fish storage methods					
Unstable fish prices					
Overfishing					
Out-dated fishing gears					
High cost of modern fishing gears					
Water hyacinth					
Fish exportation					

8.State any other factor that may cause food insecurity.

_____

_____

_____

9.Apart from fish, name any other food in the area that has been involved in reducing food insecurity.

_____

Extent of Food Insecurity

10. Do you have regular access to food?
    Yes ☐ No ☐
11. Do you ever experience food shortages?
    Yes ☐ No ☐
12. If your answer to question 14 above is 'Yes', then how often do you experience food shortages?
    Daily ☐ Weekly ☐ Other, specify _____

13. What do you do to leftover food? Tick where appropriate.

    Preserve ☐ Throw away ☐

14. Have you ever eaten at a neighbors' place?

    Yes ☐ No ☐

15. Have you ever experienced hunger? Tick where appropriate.

    Yes ☐ No ☐

16. Has your neighbor (have your neighbors) ever eaten at your place because they did not have food?

    Yes ☐ No ☐

17. If 'Yes' is your response to question 17 above, then how frequent did you neighbour(s) eat at your place?

    Daily ☐ Weekly ☐ Other, specify _____

    _____

18. Have you ever stored enough food to last your household a month?

    Yes ☐ No ☐

19. Have you ever consumed traditional foods due to the lack of an alternative food item?

    Yes ☐ No ☐

20. Please estimate the extent of food insecurity in your household.

    ☐ Very severe

    ☐ Severe

    ☐ Moderate

    ☐ No experience

21. What are the manifestations of food insecurity in your household?

    _____

    _____

22. How has fishing contributed to reducing food insecurity in this area?

    _____

    _____

Impacts of Food Insecurity

23. What impacts of food insecurity have you experienced in your household?

    _____

    _____

    _____

24. Have any of your children ever quit school for fishing?

    Yes ☐ No ☐

25. Do you make sufficient income from fishing?

    Yes ☐ No ☐

26. Has any member of your family ever suffered from malnutrition illnesses?

    Yes ☐ No ☐

27. Do you know someone in your neighbourhood that suffered from malnutrition illnesses in the last 12 months?

    Yes ☐ No ☐

28. Do you know of anyone who died due to malnutrition illnesses in the neighbourhood?

    Yes ☐ No ☐

29. Have you ever migrated to other areas due to food insecurity?

    Yes ☐ No ☐

30. If your answer to question 28 is 'Yes', then how many times have you migrated?

    Once ☐ Twice ☐ Thrice ☐ Other, specify _____

31. Has your family ever lost property or wealth due to food insecurity?

    Yes ☐ No ☐

32. Do you think that food insecurity brings about significant food prices fluctuation?

    Yes ☐ No ☐

Coping Strategies of Food Insecurity

33. Rate the following statements depending on your experience linked to food insecurity.

ITEM	Always	Often	Sometimes	Rarely	Never
My/Our children had to work for neighbors to get money for food					
I/We skipped meals for some days					
I/We skipped lunch or supper in some days					

34. State other coping strategies that the fishing community resorts to when faced with food insecurity.

    _____

    _____

35. Suggest the most effective method of reducing food insecurity in the region.

    _____

    _____

Appendix II: Interview Schedule with Key Informants

My name is Brian Ambale. I am a student from the University of Eldoret doing a study on food insecurity among members of the fishing community living along the shores of L. Victoria in Homa Bay County as a part of my MSc degree. I am requesting you to be an interviewee for this study. The information obtained shall be exclusively confidential. The researcher will use this information for academic purposes.

Please respond to all questions to the best of your knowledge and ability.

Chief/assistant chief/village elder/chairperson of fishing group/Government officials

1.Name…….....

2.Gender

Male ☐ Female ☐

3.How long have you been living in this ward?

4.What are your opinions on food insecurity in this area?

5.In your opinion what are the indicators of food insecurity among fishing communities in wards along the shores along the shores of L. Victoria in Homa Bay County?

6.What are the causes of food insecurity in fishing communities living in the wards that are along the shores of L. Victoria in Homa Bay County?

7.What challenges have you experienced as a result of food insecurity in the wards along the banks along the shores of L. Victoria in Homa Bay County?

8.According to you, who are the most affected households by food insecurity within you locality?

Women ☐ Men ☐ Children ☐ Other _____

9.Have there been cases reported to your office that are related to food insecurity?

10. In your opinion, what are the coping strategies employed by the fishing community of your location to cushion themselves against food insecurity?
11. What is the government policy on food insecurity in the area?
12. In your opinion, has the government or any other organization intervened to cushion the residents of this ward against the effects of food insecurity?
13. What do you think can be done to minimize or eliminate food insecurity among the fishing communities in the area?

Appendix III: Random Numbers Tables

11164	36318	75061	37674	26320	75100	10431	20418	19228	91792
21215	91791	76831	58678	87054	31687	93205	43685	19732	08468
10438	44482	66558	37649	08882	90870	12462	41810	01806	02977
36792	26236	33266	66583	60881	97395	20461	36742	02852	50564
73944	04773	12032	51414	82384	38370	00249	80709	72605	67497
49563	12872	14063	93104	78483	72717	68714	18048	25005	04151
64208	48237	41701	73117	33242	42314	83049	21933	92813	04763
51486	72875	38605	29341	80749	80151	33835	52602	79147	08868
99756	26360	64516	17971	48478	09610	04638	17141	09227	10606
71325	55217	13015	72907	00431	45117	33827	92873	02953	85474
65285	97198	12138	53010	94601	15838	16805	61004	43516	17020
17264	57327	38224	29301	31381	38109	34976	65692	98566	29550
95639	99754	31199	92558	68368	04985	51092	37780	40261	14479
61555	76404	86210	11808	12841	45147	97438	60022	12645	62000
78137	98768	04689	87130	79225	08153	84967	64539	79493	74917
62490	99215	84987	28759	19177	14733	24550	28067	68894	38490
24216	63444	21283	07044	92729	37284	13211	37485	10415	36457
16975	95428	33226	55903	31605	43817	22250	03918	46999	98501
59138	39542	71168	57609	91510	77904	74244	50940	31553	62562
29478	59652	50414	31966	87912	87154	12944	49862	96566	48825
96155	95009	27429	72918	08457	78134	48407	26061	58754	05326
29621	66583	62966	12468	20245	14015	04014	35713	03980	03024
12639	75291	71020	17265	41598	64074	64629	63293	53307	48766
14544	37134	54714	02401	63228	26831	19386	15457	17999	18306
83403	88827	09834	11333	68431	31706	26652	04711	34593	22561

Source: (Rand.org, 2001)

Appendix IV: Research Permit

NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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when replying please quote

9th Floor, Utalii House
Uhuru Highway
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NAIROBI-KENYA

Ref: No. **NACOSTI/P/17/77050/16219**

Date: **4th April, 2017**

Brian Ambale
University of Eldoret
P.O. Box 1125-30100
ELDORET.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Impacts of food insecurity and coping strategies employed by the fishing community living along the shores of Lake Victoria in Homa Bay County,"*** I am pleased to inform you that you have been authorized to undertake research in **Homa Bay County** for the period ending **4th April, 2018.**

You are advised to report to **the County Commissioner and the County Director of Education, Homa Bay County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Homa Bay County.

The County Director of Education
Homa Bay County.