EFFECTS OF WATER HYACINTH INVASION OF LAKE VICTORIA ON WOMEN'S HOUSEHOLD ACTIVITIES, KARACHUONYO, HOMA BAY COUNTY, KENYA.

A Thesis Submitted in Partial Fulfilment of the Requirements for The Award of the Degree of Master of Development Studies (MDS) in The Faculty of Social Sciences of St Paul's University

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AUGUST 2019

DECLARATION

This dissertation is a product of my own work and is not the result of anything done in collaboration. It has not been previously presented to any other institution. I agree that this dissertation may be available for reference and photocopying, at the discretion of the University.

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RECOMMENDATION

I confirm that the work reported in this dissertation was carried out by the student under my supervision.

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DEDICATION

I dedicate this dissertation to my beloved family; Wycliffe, Jane, Mike, and Beryl for their support during the entire project.

ACKNOWLEDGMENT

I thank the Almighty God for giving me the strength and wisdom as I undertook this research. I also appreciate the advice and effort of my supervisor, Rd. Felix M'mboyi. I thank my family for their encouragement and priceless love. May God bless you all.

ABSTRACT

Since the encroachment of water hyacinth weed on the fringes of Lake Victoria, there has been a systematic disruption in the economic and social lives of those who live in the adjacent areas. This is because of the fact that they have over the years relied heavily on the proceeds of fishing to make a living. Therefore, the purpose of the study was to assess the effects of water hyacinth invasion on women's livelihoods in Karachuonyo, Homabay County in Nyanza region of Kenya. The objectives of the study included the following: to determine the economic effects of water hyacinth on women's household activities; to assess the effects of water hyacinth on women's access to education; to determine the effects of water hyacinth on women's access to health and to discuss the effects of water hyacinth on women's access to social interaction in Karachuonyo Sub County of Homa Bay County. The study was guided by the Gender and Development Theory (GAD) which describes how women are involved in development but do not derive any benefit whatsoever. The researcher used a sample size of 383 respondents who were females and they were selected using purposive sampling. Data were collected from both primary and secondary sources which included Focus Group Discussion (FGD) guide, Key Informant Interviews (KII) guide, and an unstructured questionnaire. Data were analyzed using both qualitative (content and trend analysis) and quantitative (SPSS) methods. Quantitative data was presented in form of tables and graphs while qualitative data was used to support the statistical information. Ethical considerations were observed whereby the researcher obtained a research permit from NACOSTI and ensured confidentiality to the respondents. In the research findings, it was established that indeed water hyacinth affected women's livelihoods, especially concerning their income source and health. However, it was also established that women's livelihoods were not significantly affected when it comes to education and social interactions. It is expected that the research results will be of benefit to both the national and county governments, non-state actors and scholars, who will take note of the findings and use them to build and widen their scope of knowledge.

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ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
BMU	Beach Management Unit
CEO	Chief Executive Officer
GAD	Gender and Development
GDRR	Gender Disaster Response and Resilience
NACOSTI	National Commission for Science**,** Technology, and Innovation
LANESCO	Lake Nyanza Environmental and Sanitation Conservation
LVEMP	Lake Victoria Environmental Management Project
LVFO	Lake Victoria Fisheries Organisation
LVO	Lake Victoria Authority
LVWRP	Lake Victoria Water Resource Project
NARO	National Agricultural Research Organisation
NGO	Non-Governmental Organization
NEP	National Environmental Policy
NEAP	National Environmental Action Plan
NEMA	National Environment Management Authority
NRBAP	Nile River Basin Action Plan
WH	Water Hyacinth
WID	Women in Development

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This chapter entails the background of the study; statement of the problem; the purpose of the study; the research objectives; research questions that guided the study; the significance of the study; delimitations and limitations of the study; basic assumptions of the study and finally definitions of significant terms used in the study.

1.2 Background of the Study

According to the Uganda National Water Development Report (UNWDR, 2005), Lake Victoria, being the second largest freshwater lake in the world, is a suitable source of livelihoods that rely on the lake for food, energy, drinking water, transportation, irrigation. Besides, the lake is also used as a repository for human, agricultural and industrial waste. In fact, so vital is the lake that three million people living in the catchment fully depend on the waters of Lake Victoria. Statistics estimate that the annual fish catch from Lake Victoria ranges between 400,000 to 500,000 metric tonnes, which generates over US S300-400 million. Out of these, fishing directly employs 100,000 people while over 2 million are indirectly involved in the fishing activities.

Since the early 1990s, the lake has been a subject to tremendous transitions that have had a far-reaching damage to its sustainability; some of the major threats that have caused the substantial damage to the lake include: huge decline in biodiversity and apparent disappearance of vital species; changes in biomass; changes in fisheries; deteriorating water- quality; increased discharge of industrial and human waste into the lake; poor land-use systems; mismanagement and destruction of the wetlands and the invasion of the water- hyacinth weed. All these threats have significantly altered the utility of the lake and as a result, those people who have been accustomed to it have found it very difficult to adjust because of the biting social and economic effects that these threats have come up with.

One of the far-reaching threats to the lake over the years is water hyacinth. Originally from South America, water hyacinth is one of the world's most prevalent invasive aquatic plants. It has become naturalized in many warm areas of the world. Water hyacinth has invaded freshwater systems in over 50 countries on five continents; it is especially pervasive throughout Southeast Asia, the southeaster United States, central and western Africa, and Central America (Bartodziej & Weymouth, 1995; Brendonck *et al.,* 2003; Lu *et al.*, 2007; Martinez Jimenez and Gomez Balandra, 2007).

In Africa, the water hyacinth was first reported in Egypt in 1879. It is considered one of the most noxious weed species in tropical West Africa (Food and Agriculture Organization (FAO), 2000). Water hyacinth has spread over a great part of tropical and subtropical Africa. The plants are thought to have been introduced in Sudan and then into the River Congo, and that tributaries of the Congo may have extended the plant during floods. Since the 1940s, the plant has infested many African countries and has become a major challenge to the continent in terms of the conservation of its aquatic ecosystems (Mendonca 1958; GISD 2005). According to Republic of Uganda, (2005), the history of the weed in Kenya dates back to the 1990s. He states that the weed is said to have originated from an ornamental pond in Rwanda then into River Kagera, which flows into a tributary of Lake Victoria.

From Rwanda, the weed followed the Kagera River into the Ugandan side of the lake in about 1988. Two years later, it found its way to the Tanzanian side of the lake in 1990 and eventually to the Kenyan side of the lake in 1992. Right from the time it was first witnessed in Kenya, the weed has exponentially spread not only on the Kenyan side but on the entire shoreline of the lake in East Africa. The weed is now considered a great threat to the life forms of the lake and those who depend on it. Nature and negative impacts of the water hyacinth creates urgent need to manage it. Indeed, the prolific spreading of this exotic weed is adversely impacting on the biological diversity, fish breeding, and access to fishermen's landing sites, water supply, and lake transport, and hydro-power generation. The weed also provides suitable habitats for vectors of various human diseases (for example malaria). In addition, due to its high rate of

evapotranspiration, the water-hyacinth causes drying up of the riparian wetland zones, thus enabling non-wetland species to invade.

Until the glaring effects of water hyacinth (*Eichhornia crassipes*) were visibly manifested in all spheres of life around the Lake Victoria belt, (Yongo, Outa, & Ngodhe, 2017; Oladimeji, Abdulsalam, Muhammed-Lawal, Adefalu, & Adepaju, 2016), no one gave serious thought on the noxious weed. The water hyacinth problem is now compounded and affects all persons living around the lake, whether fisher folk or just adjacent agrarian communities. The immediate casualties are fisheries, water supply, human health, transport, agriculture and loss of biodiversity (Osumo, 2001). Water hyacinth, therefore, is seen to pose serious environmental and socio-economic problems in the use and management of water resources (2003; Makhanu, 1997). In addition to significant impact, socio-economic and environmental impacts, water hyacinth has been found to negatively affect water quality especially in Lake Victoria (Njiru, Othina, Getabu, Tweddle, & Cowx, 2002).

Based on projections from the 2009 Kenya Population and Housing Census, Homa Bay County has an estimated population of 1,038,858 persons consisting of 498,472 males and 540,386 females by the end of the year 2012. This population is projected to rise to 1,177,181persons in 2017. Of this total, 564,843 will be males while 612,338 will be females. Women account for 52 percent of the population. Despite this majority status, the role of women in economic development is still downplayed. Men still control the means of production. Women cannot access credit for significant investment requiring a title deed as collateral as land title deeds remain under control of men. This is despite common knowledge that women are most productive especially in agriculture where they devote much of their time working on the land. The level of gender awareness remains low and this is attributed to the fact that women have accepted the cultural construct where they come second.

Culturally, women are not empowered to make serious decisions unless it is in consultation with their men. Audits reveal that even in women groups, women still prefer men in leadership. Higher education is still prioritized for men even though perceptions are changing. To address

this gender imbalance, it will require that women are given some control over land and other economic assets. New agriculture technologies will need to be disseminated to women given they are the ones involved most in farming. In addition, vigorous campaigns will have to be conducted through Barazas to sensitize men about women rights as stipulated in the new constitution. Affirmative action in employment will have to be scaled up beyond the public service to include all employers. Furthermore, equal opportunity in education will have to be guaranteed to eliminate differences in education outcomes which have served to confine women to the less rewarding sectors of the economy.

Just like other 'natural' disasters such as earthquakes, floods, famine, and drought, water hyacinth effects are first highly socialized, and secondly, create more gendered vulnerabilities and violence (Bradshaw, 2013). Both women and men are consumers, exploiters and contribute to the management of natural resources. When natural resources are negatively affected by environmental disasters, women suffer severely because of their daily interaction and dependency on the resources. Generally, women involvement in management, maintenance, and conservation of natural resources such as water is an integral part of their livelihoods which is important for collective and community consumption.

Women too have higher knowledge of their local environment. However, access to, control and use of natural resources are highly gendered, with women highly disadvantaged in most cases due to gender division of labour. This is also true as the impact of environmental degradation on women and men differ significantly (Bradshaw, 2013). Even though it has not been adequately reported in many studies, there indeed exists a correlation between water hyacinth menace and women's livelihoods. (Kateregga and Sterner, 2007). This happens when the women who derive their livelihoods through fish selling, become disadvantaged when the weed inhibits fishing activities in the lake. As a result, their economic empowerment is significantly reduced. It is against this background that the research sought to examine the contribution of water hyacinth to the vulnerability of women in the fisherfolk communities in Karachuonyo Sub-County of Homa Bay County.

1.3 Problem Statement

The presence of Water Hyacinth weed in Lake Victoria has become an economic challenge that is now inhibiting the socio-economic livelihoods of the fisherfolk communities in Homa Bay County. Since its advent, many of the households in the county are now being compelled to shift from fishing activities to subsistence agriculture to sustain their livelihoods. This shift has significantly disadvantaged the small-scale women entrepreneurs who are now being forced to seek alternative livelihoods to maintain their families. This scenario has been worsened by the partial failure of both the national and the county governments to effectively respond to the challenge.

Studies conducted in ponds and satellite lakes in the Lake Victoria basin in March 2000 to ascertain the presence of water hyacinth and its effect to the communities and the environment found out that in all the ponds where water hyacinth was found, the communities experienced varying problems, for example, at Bukabwa pond in Tanzania, the weed had resulted in a serious water shortage and fishing in the ponds was no longer possible (Ndunguru et al., 2005). Water hyacinth in Dunga area in Kenya where the raw water intake for KIWASCO is situated has turned the water green due to high concentration of algae, and black as a result of the rotting hyacinth. This has made the treatment of the water very challenging and expensive for KIWASCO making the water at times unsuitable for drinking and other domestic use, forcing the company to at times shut down the plant when the raw water quality changes as a result of the dense matt of the weed at the intake point (Odiwuor, 2013).

The water hyacinth weed menace has threatened the fish stock in the lake hence reducing their breeding and nursery grounds. At the same time, most parts of the fish landing sites have been blocked by the floating water plant and as a result, the fishermen are forced to land far from where they are used to. This inconvenience ends up delaying access to markets and increased costs for the Homa Bay communities. As a consequence, this invasion of the lake by the hyacinth weed has rendered many people, especially fisherfolk women, unemployed as the small business activities they undertake around the lake have been negatively affected.

Women and men experience the effects of water hyacinth differently and gender roles, power balance, and relations can influence capacity as well as a vulnerability when disasters strike (2014; Becker, 2011; Bari, 1998). As much as both women and men are equally at risk of negative consequences of disasters, women are always in a more disadvantaged position in the event of a disaster (Gokhale, 2008). Available data on gendered effects of natural disasters, though limited, have indicated that women are more affected than men. In extreme circumstances, women have a high likelihood to die than men, purely on account of social and cultural reasons and existing gender norms, rather than biological ones.

In Homa Bay County, the main source of livelihood is fishing. Division of labour is pronounced in that whereas the men do the fishing in the deep waters, the women buy the fish and sell it in markets and hotels. Women are thus at the mercy of men when it comes to the intricate of the business. Unless men do adequate fishing in the lake, women may not get access to profits to improve their economic prowess. Therefore, hyacinth weed has disadvantaged the fishing activity, which is done by men and as a result, the women's economic power has suffered a setback. Therefore, this research sought to find out how the water hyacinth weed has affected women's livelihoods in Homa Bay County, Nyanza region, Kenya.

1.4 Purpose of the Study

The purpose of the study was to assess the effects of water hyacinth on women's household activities in Homa Bay County, Nyanza region of Kenya.

1.5 Research Objectives

1.5.1 Main Objective

To assess the effects of water hyacinth on women's household activities in Homa Bay County, Nyanza region of Kenya.

1.5.2 Specific Objectives

- To determine the economic effects of water hyacinth on women's household activities in Homa Bay County.
- To examine the effects of water hyacinth on women's access to education in Homa Bay County.
- To assess the effects of water hyacinth on women's health in Homa Bay County.
- To establish the effects of water hyacinth on women's social interaction in Homa Bay County.

1.6 Research Questions

- What are the economic effects of water hyacinth on women's household activities in Homa Bay County?
- What are the effects of water hyacinth on women's access to education in Homa Bay County?
- In which way does water hyacinth affect women's access to health in Homa Bay County?
- What are the effects of water hyacinth on women's social interaction in Homa Bay County?

1.7 Significance of the Study

The study was important because it acts as a sensitization tool by providing information to the public about the risks and vulnerability that water hyacinth has caused to the communities living around Lake Victoria. Secondly, with evidence from the findings of the study, the public will find a renewed focus to engaging their public authorities especially the county government to allocate resources towards improving resilience on water hyacinth effects.

While knowledge on the gendered impacts of natural hazards such as water hyacinth remains limited, understanding of the context of the events affecting women is still extremely limited. The study was thus meant to provide a rich description and offer an opportunity for the plight

and voices of women's experiences in such. The study served to bridge the research gap on limited advance and robust sampling that some policymakers (national and county governments) and project designers need to be convinced a 'problem' exists. This will trigger more prioritization for both county and national government in resource allocation to mitigate the effects of water hyacinth, control infestation of the weed and the regeneration of the important aspects of water hyacinth that can be commercialized or be of socio-economic benefit to women. The evidence provided will be essential for use of targeted approaches to address women and girls' specific interests, vulnerabilities and needs. Policies and government programmes at all levels can be influenced to focus on specific resources and services targeting women and girls' vulnerable effects of the water hyacinth.

The study puts a case for Gender Disaster Response and Resilience (GDRR), which needs to be taken seriously as a cross-cutting issue and a key development concern. This study will provide social intelligence to the development agencies and humanitarian aid agencies that will influence their decision to commit to social investment in different sectors for the population to improve resilience on water hyacinth. This study strives to focus the need of those working in development to understand that Gendered DRR (GDRR) is primarily a development, not a humanitarian issue. The development and humanitarian agencies need to see water hyacinth as an imminent disaster, not just as a risk to development, but design their projects to disaster risk as a long-term development goal.

1.8 Scope and Delimitations of the study

This study was conducted at Karachuonyo, Homa Bay County in Nyanza Region of Kenya. Furthermore, the study dwelt on the issue of social and economic effects of the weed on women. Women were chosen for the study because of their vulnerability when economic challenges strike the community. At the same time, the study narrowed down to economic effects, access to education and gender roles because these are the areas that women are worst affected by the hyacinth challenge.

1.9 Basic Assumptions of the Study

While conducting the study, it was assumed that the respondents' responses would be independent and would reflect the true perception of the effects of water hyacinth on the livelihood of women in Karachuonyo, Homa Bay County.

1.10 Definition of Terms

Hyacinth: A tropical floating aquatic plant having spikes of large blue flowers; troublesome in clogging waterways.

Pollution: According to Bei (2017), pollution is the introduction of contaminants into the natural environment that causes adverse change. Pollution can take the form of chemical substances or energy, such as noise, heat or light. Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants. Pollution is often classed as point source or nonpoint source pollution. In 2015, pollution killed 9 million people in the world.

Riparian Zone: A riparian zone or riparian area is the interface between land and a river or stream.

Encroachment: In this study, it will interpret to mean the uncontrolled advance of water hyacinth into the fishing grounds.

Livelihood: A person's livelihood refers to their "means of securing the basic necessities -food, water, and shelter and clothing-of life". In this study, livelihood will be defined as a set of activities, involving securing income, food, fodder, raw materials and the capacity to acquire above necessities working either individually or as a group by using endowments (both human and material) for meeting the requirements of the self and his/her household on a sustainable basis with dignity. The activities are usually carried out repeatedly. For instance, a fisherman's livelihood depends on the availability and accessibility of fish.

1.11 Summary

Freshwater bodies constitute a vital component in many people's livelihoods in many human societies in the world. Water hyacinth has invaded freshwater systems in over 50 countries on five continents and changes to its density have the potential to affect other ecological and human communities in areas where it is established either positively or negatively. The hyacinth, since

its introduction in Kenya has been a menace to the riparian communities, causing several problems. However, the range of problems with water hyacinth infestation is in general terms widely known, the real extent of the influence on the socioeconomic status and welfare of the women who depend on the affected water has not been well quantified and documented. The purpose of this study was to determine the influence of water hyacinth on the livelihoods of women of the community around Lake Victoria and focused on Karachuonyo Sub County in Homa Bay County.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Chapter two is a review of literature from previous studies in the area of water hyacinth and its influence on the livelihood systems of the communities around the freshwater bodies in general and in specific on women's livelihoods. This chapter presents the theoretical review, empirical review, and conceptual framework. This chapter seeks to identify the gaps in research on the influence of the water hyacinth on the livelihoods of the communities, specifically around Homa Bay County, Karachuonyo Sub County.

2.2 Theoretical Review

2.2.1 Gender and Development Theory (GAD)

The Gender and Development (GAD) theory emerged in the 1980s to reinforce the gaps and merge the various feminist ideas and the reflections and experience of implementing and propagating the Women in Development (WID) theory. GAD gave a dualistic view of gender and development as opposed to the initial gender development paradigms that focused on women and somehow neglected or obscured men's contribution or influence. GAD seeks to impact both man and woman and promotes equal participation and benefit for both sexes from development. The emphasis is laid on the equality of 'benefit' and 'control'.

The proponents of the theory recognized that women may be involved in development but they do not necessarily benefit from it. The focus of GAD is not exclusively on women but the manner in which gender relations allocate specific roles, expectation and responsibilities between women and men, which in most cases is to the detriment of women. Development in essence is about deep and crucial changes to relations affecting gender inequality within a given society. Special attention is also paid to the oppression of women at the family or private spheres of their lives. The focus of GAD is on the social gender relations, for instance, the division of labour between women and men in society and further seeks to address issues of access to and control of resources and power. From the GAD approach, it became possible to understand that the gender division of labour assigns women "triple roles" in society. However, the gender division of labour is dynamic and differs in operation from one society and culture to another.

The ways the roles of women are analyzed and valued have an impact on the way development projects prioritize some things. For instance, men involved in planning may not make the provision of child-care a priority yet this is an important factor in ensuring that women make good use of development opportunities to benefit themselves. GAD, unlike other approaches lays emphasis on both the productive and reproductive role of women, and further points that it is the responsibility of the state to support the social reproduction role of caring and nurturing for children that is mostly performed by women. Development in effect is treated as a complex phenomenon which has political, economic and social factors as influencers, instead of being a stage or state of development. From the GAD perspective, development transcends merely the economic wellbeing and encompasses the social and mental wellbeing of an individual. The GAD analysis highlights the necessity for women to organize themselves into a more effective political voice for them to strengthen their legal rights and have an increase in the number of women in decision making.

In summary, GAD requires the women to develop agency and resultantly their voices will be amplified. The inherent capabilities will lead to the functioning and enable them to benefit and control the outcomes in development. This GAD theory is relevant and appropriate to this study which in essence is examining the contribution of water hyacinth invasion of Lake Victoria to women empowerment. On emphasizing GAD in current context of the study means, supporting women to control means of livelihood such as fishing and fishing trade without being asked for undue incentives such as sex for fish, being intimidated, relegate participating in selling small fish with low potential for higher income, and again using nearly all their income on food and getting clean water for domestic use. From GAD approach, the fisherfolk women should be amplified through participation in decision-making avenues and management of beach management units (Sarker, 2006).

2.2.2 Women Empowerment Theory

Women Empowerment Theory is majorly clouded on dimensions of empowerment and potential operationalization. Empowerment for women is demonstrated at four levels: at individual level, at the household level, in the community, and within the larger societal context. At household level, economic empowerment comprises women's control over income, relative contribution to

support the family and access to and control of family resources. At community level, economic empowerment is exhibited through access to employment, their ownership of land and other assets, access to credit and markets, and women's representation in local trade associations (Mayoux, 2000; Mayoux, 2001). At societal level, economic empowerment of women is operationalized through being represented in high decision level employment opportunities, high paying jobs, number of women managers especially chief executive officers (CEOs) and with represented economic interests at macro-economic levels such policies as well as national and sub-national budgets (Kishor, 2000b; Sen, 1999).

Social culturally, at the household level, women empowerment means women's freedom of movement, absence of discrimination against daughters, and a distinguished commitment towards educating daughters. At the community level, the women are said to be socio-culturally empowerment through their visibility of women in access to social spaces, access to modern transportation, voluntarily participation in social networks and extra-familial groups, and a radical shift in patriarchal norms (Kabeer, 2001). For instance, deliberate preference for sons, as well as the female youth being symbolically represented in myth and ritual. At societal level, the socio-cultural empowerment is visualized through the lens of women's literacy and access to a broad range of educational options, positive depiction, and imaging of women in the media and more recently social media; through highlighting their roles and contributions (Tembon & Fort, 2008).

At individual and familiar level, the empowerment of women, at the HH level, is symbolized through participation in intra-household decision making, control over sexual relations and decisions related to childbearing, use of contraceptives, and access to safer abortion (Bennett, 2002). Socio-economic empowerment, at household level, is further demonstrated through when women are allowed and control the selection of the marital partners, and right time marry based on freedom of choice and be free from sexual and gender-based violence at household level (Kishor, 2000a). For the community, empowerment for women should entail progressive shift in marriage and kinship systems which imply greater autonomy, value for women such as delayed marriages, reduction in dowry and bride price payment practice, and increased acceptance of

divorce as well as local campaign against sexual and gender-based violence (Kabeer, 2001). At the broader arena, socio-cultural empowerment could be defined by developing trends in marriage, and options for divorce, and religious, legal, and political support or absence of active opposition to such shifts, existence of systems that allow for accessible, available and affordable of contraception, reproductive health services and safe abortion (Kishor, 2000b).

Women are considered to be empowered politically when at the household level; they are in possession of knowledge of political system and means of access to the same, support for political engagement at the domestic level and the ability to exercise the right to vote (Mehra, n.d). Within the context of the community, political empowerment of women entails the involvement of omen in the local political campaigns/system, specific female candidates or legislation receiving support and women being represented in the local government bodies. At societal level, women are politically empowered when there is representation of women in national and regional bodies of government, when they have strength as a voting bloc and when the interests of women are effectively represented in lobbies and interest groups (Malhotra, Schuler, & Boender, 2002).

This study reveals that women are relatively disempowered and they enjoy somewhat lower status than that of men in spite of many efforts undertaken by the government. The gender gap exists regarding access to education and employment. Household decision making power and freedom of movement of women vary considerably with their age, education and employment status. It is found that acceptance of unequal gender norms by women are still prevailing in the society. Fewer women have final say on how to spend their earnings. Control over cash earnings increases with age, education and with place of residence. A large gender gap exists in political participation too. The study concludes by an observation that access to education and employment are the only enabling factors to empowerment.

2.3 Empirical Review

2.3.1 The Nature, Origin, and Spread of the Hyacinth Weed

According to Woomer (2016), the water hyacinth is an all-season, flexible, floating, freshwater plant that has its origins in South America and classified as *Eichhornia Crassipes*. This plant

falls under the family of *Pontederiaciae*, which has eight other genera. It grows concurrently with other water-based including *silvinia molesta*. Furthermore, it is one of the most productive plants on earth. Its unique features include high productivity and tolerance of a wide range of ecological conditions. These features give the water hyacinth a strong competitive ability and enable it to multiply rapidly; often at the expense of its neighbours. The widespread distribution of the water hyacinth is partly attributed to its attractive, purple flower, prompting its establishment in many botanic gardens during the late century prior to its recognition as a noxious weed.

Additionally, the water hyacinth is known to have few natural predators outside its native home. Ankinyenyu (2002) states that the weed's ecological advantage is anchored on its surface area; it has a thin, wall capsule root containing up to forty small seeds. On average, the water hyacinth weighs twenty-five kilograms per square meter or twenty-five tons per hectare. Since by composition the plants are 95 percent water, they contain 12.5 tons of dry matter per hectare or 237.5 tons of water per hectare. It has a high capability of rapid, vegetative reproduction. This is coupled with a remarkable survival mechanism during the period that the seed remains viable. It also has a great ability to survive extreme drought conditions. All these factors combined have made it very successful in invading numerous water systems throughout the world.

This weed has created many problems which have either short-term effects or severe long-term repercussions on both the environment and the people. The water hyacinth is widespread throughout the world. It was first clearly spotted in southeast Brazil, although it was already widespread in Central and South America. Several conditions were reported in 1929 from Demarara, Guyana, New Granada, Ecuador, and Buenos Aires in Argentina. In Africa, the water hyacinth was first introduced in Egypt, sometime between 1879 and 1882, and in Natal in the 19th century. It was reported in Southern Rhodesia in 1937 and near Congo (Zaire) in 1952 (Akinyeyu, 2002).

The weed was spotted in Khartoum in 1958. By 1981, the weed was already widespread in Ethiopia, Madagascar, Mozambique, Natal, Eastern Cape, the Okavango Basin in Botswana, Zambia (Kafwe Reservoir), Angola, Guinea, and Senegal. The major river basins infested by the

water hyacinth are those of the Kagera, Lagone, Niger, Senegal, Zambezi rivers, and their tributaries. The water hyacinth is thought to have been brought to the African continent as a decorative plant by early travelers. In East Africa, the water hyacinth is thought to have entered Lake Naivasha in Kenya between 1982 and 1983 but was out-competed by *Silvinia molesta*. It was subsequently spotted on the Ugandan side of the Lake Victoria in 1988. Two years later, it was spotted on the Tanzanian side, and then the Kenyan side in 1992. Since then, the spread of the water hyacinth has been shocking. In 1992, it was a mere passing interest. It has grown so rapidly that in some parts of Lake Victoria, it covers an area of a thousand hectares. Consequently, it has come to occupy center stage in the debate about the management of Lake Victoria waters (Ankinyeyu, 2002). In Kenya, the areas most affected by the weed are Kisumu Bay, Dunga beach, Nyakach Bay, Homa Bay, Asembo Bay, Kendu Bay, Usenge Bay, Port Victoria, Budalangi, Marenga, Kalungu, Bala, Sango Rota, Uyoma and Sio Port.

2.4 The overall effects of Water Hyacinth

2.4.1 Arguments in Support and against Hyacinth Weed

Water hyacinth has accrued largely negative effects on the people where it has afflicted. To illustrate the effects, usefulness and outcomes, several names have been used to refer to it by those who have been affected by it, these names include: 'The Demon,' Blue Devil,' 'Terror of Bengal, ‘Curse of Bengal,’ 'Million Dollar weed,' and 'Cinderella of the plant world." and ‘Ford’. The weed has accrued a couple of problems which relate to use and management of water resources to the extent of threatening the entire ecosystem. The water-hyacinth infestation has serious, adverse implications for the economic, social and political relations of the three East African countries (Dash, 2019).

Several people have come out strongly to argue that the weed has positive effects and that it should be left alone or harnessed for the sake of income generation. It has been argued by these pro hyacinth advocates that the water hyacinth should be viewed as a resource. For them, the weed can be harnessed as raw material for basket weaving and furniture making. Others aver that it might change the fish diversity of the lake by leading to a reversal of the dominance of the lake waters by the Nile perch and promotion of the return of other fish species such as tilapia. In fact, as early as 1917, the water hyacinth was recommended for use as fertilizer and was later

considered to be a valuable source of potash (Pabari, 2002). In Malaysia, the use of the weed as a vegetable during wartime has been reported.

Furthermore, some people state that the more important uses of the water hyacinth have been as cattle and pig feed, compost, source of energy and pollutant removers. In the southern states of the U.S.A., it has also been used as green food for poultry and ducks. It has also found use in producing fibres and pulp for paper. A number of chemical compounds have been obtained from the water hyacinth as fuel in Indian villages. The water hyacinth can also be used for soil structure improvement since it can purify water naturally and it is a source of natural fuel. Moreover, it is argued that there is inherent value in the water hyacinth and therefore it deserves to be left alone. However, these arguments are usually defeated in the face of the cost benefits of the weed, especially on livelihoods in third world countries like Kenya; their negative ones outweigh the perceived benefits.

Largely, the weed has accrued effects that are more negative, to begin with, its interference with the fishing activities of the lake communities is blatant. This is because Lake Victoria provides a livelihood to more than a third of the entire population living around it, most of who are dependent on fishing. In fact, put plainly, the lives of the inhabitants revolve around Lake Victoria (Atieno, 1999). At the regional level, since the three East African countries share the lake, there have been economic repercussions as a result of the encroachment of the weed; considerable revenue is also generated for the national economies of the three countries from the fish exports, as a result, the economic benefits are diminished largely. The water hyacinth problem has long term effects on the economy because the foreign exchange to the country keeps on dwindling because the fish cannot be exported as it was before the weed encroached the lake. Since countries relate largely based on economic interests, such a situation has very serious economic implications for the relations of the East African countries.

Furthermore, the hyacinth interferes with fishing activities because it impedes the access of boats to fishing grounds and landing beaches. It also harbours snakes and crocodiles and therefore makes fishing a dangerous activity. It interferes with fish breeding since the dense mat reduces light penetration and oxygen supplies to the waters of the breeding grounds. In places where

fishing activities have become impossible, whole communities have had to move to areas not yet infested by it. This is because with the increase of the water hyacinth there is a drastic decline in fishing activities since often the fishing boats are trapped in the water hyacinth mats. And since the population does not decrease there is a higher demand for fish (Atieno, 1999).

The situation in Kenya is replicated in both Uganda and Tanzania, with whom they share the lake. It should be noted that the fisheries of the three countries are highly valued as a source of food, employment for the population and revenue for the government. In Kenya it is estimated that the fishing business has been reduced by 70 percent because of the problem of the water hyacinth. It was reported that at least 52 fishing boats have been marooned and the fishermen have been forced to fish from the rivers where fishing has been reduced drastically. Tanzania's fishing industry was hit hard by the water-hyacinth infestation. During certain seasons, the fishermen from Ukwere islands cannot move to Mwanza to deliver fish to processors. This has led to heavy post-harvest losses for the fishermen and a reduction in the foreign earnings of the country. The water hyacinth has seriously disrupted lake transport. Ports such as Kisumu and Port Bell are often blocked. It has choked important waterways and landing sites. Docking of steamers is now regularly delayed. This has serious implications for trade and economic activities in the East African region and is hampering the economic integration of the East African Common Market. This rendered many people jobless (On'gan'ga & Munyrwa, 2010).

Water hyacinth also interfered with the operation of the hydropower production of the Owen Falls Dam in Jinja Uganda as it clogs the water intake. At the time, the dam had a potential of 2700 MW. However, very often the turbines had to be shut down for cleaning and maintenance since the screens covering the cooling systems were covered by the water hyacinth. As a result, losses of up to 15 MW were experienced. It is worth noting that production of power does not only have implications on the power supply in Uganda but also in Kenya, which imports Ugandan hydroelectric power. Further, the water hyacinth has interfered with the water supply for urban and industrial use. The water hyacinth also led to the loss of tourist revenue as many beach resorts are now scenically unattractive and are closed to activities such as yachting and swimming which previously attracted tourists to places like Kisumu. In stagnant waters around the lakes such as in the wetlands, the polluted water has become a breeding ground for malaria-

carrying mosquitoes and for bilharzia-carrying snails. This has further added to the health problems of the local communities. (On'gan'ga & Munyrwa, 2010).

This study focused on women who, because of the societal customs and practices, are usually the most disadvantaged when it comes to any negative effect on households. Women are the drivers of the livelihoods in these areas; the fishing activities begin and end with women; the men embark on fishing endeavours in order to enable women at home to cook for the family; therefore, a study of the effects of hyacinth on the livelihoods cannot ignore the place and role of women in this menace.

2.4.2 Women's Livelihoods

In Sub-Saharan Africa, fishing activities are highly gendered and with a clear division of labour. The men mostly are involved in the fishing while women do processing, drying and retail selling. Empirical evidence has shown that there is an association between the fishing communities in low-income countries and vulnerability to HIV infection. Transactional sex has been quoted as the motivator for HIV related challenges within the community. This control of the means of production by men, the power dynamics and poverty make it very hard for women to negotiate safe sex and consequently infecting the women and affecting the communities. Using qualitative methods, gathered data on gendered drivers of transactional sex among fisherfolk and how this predisposes more people to HIV related risks as a result of these transactions.

Samples for the Focus Group Discussion, Semi-structured interviews, and the observation were categorized as men and women directly involved in fishing, and men and women who are just indirectly involved. Findings showed that power differences between the partners of opposite sex in transactional sexual encounters shape individual ability to negotiate for safer sex. Furthermore, the context and motivation for irresponsible sexual behaviours could be varied and mostly, mediated by economic need and social position of both sexes. The study deduced that women were more susceptible to vulnerability as the negotiations for fish trade and sometimes transactional sexes are highly influenced by entrenched gendered power structures (MacPherson, et al., 2012).

Camlin, Kwena & Dworkin (2013) characterized forms of mobility among women in the fish trade in Nyanza. The research described the spatial and social features of beaches and assessed characteristics of the 'sex-for-fish' economy and how it impacted on HIV prevention. The study was largely qualitative. The participatory observation was done to 6 beaches described as the most attractive to migrants and sampled some individuals for in-depth semi-structured interviews. The study found female fish traders were often migrants and are highly mobile. This predisposes them to high risk of HIV acquisition and transmission and entrenchment of the behaviour of sex for fish with Jaboya fishermen (Camlin, Kwena, & Dworkin, 2013). This has serious implication on women's livelihoods. Women who are mobile are not likely to be settled to do meaningful socio-economic activities, they are likely to be less trusted with leadership at BMUs and are mostly treated as commodities that further entrenches patriarchy and abuse of women. They are less likely going to be involved in environmental conservation due to mobility but would withstand the worst of environmental disasters such as water hyacinth.

2.4.3 Economic Effects of Water Hyacinth Invasion on Women's Livelihoods

Economically, for biodiversity, water hyacinth is blamed for eutrophication and blocking some sunlight which has attracted unquantifiable ecological effects (Rahman, 2007). Internationally, studies on water hyacinth and effects have been studied. In North-Central Nigeria along River Niger, Oladimeji et.al, (2016) carried out the economic analysis and assessed the effects of water hyacinth (*Eichnoria crassipes*) on artisanal fisheries activities. The study revealed that most fisher folks were largely youthful, aged below 45 years with cumulative average experience of 15 years in fishing expedition. There was high statistical significant at 99% confidence level on the variations of fish caught in water hyacinth infested and water hyacinth free waters indicating that infestation of water hyacinth has an effect. All the production functions and parameters between water hyacinth infested and water hyacinth free settlements were found to be statistically significant (Oladimeji et.at,.2016). An integrated approach of controlling water hyacinth was proposed to strengthen the inadequacies of a single method.

Wawire (2003) considered the impact of water hyacinth on the productivity, profitability and species composition of the Lake Victoria Fishery, Kenya. The study found that water hyacinth infestation led to a reduced fish catch, net benefits, and change in fish species composition. Between the years 1996-1999 when water hyacinth intensity was highest and increased fishing costs by 35% and decreased net income by 52%. The benefits of water hyacinth were only noted on non-commercialised species but very little or negative benefits for three major commercial fish species. The study recommended need to develop a suitable surveillance and control system for water hyacinth to ensure its impacts and economic risks are minimized (Wawire, 2003).

Marian (2011) examined the impact of water hyacinth on the fishing industry. The study was concentrated at Winam Gulf, Kisumu and applied use of GIS and Remote Sensing to show the spread and pattern of invasion of water hyacinth (2000-2010). Secondary data was used to show the impact of water hyacinth on fishing industries. The study found that the area covered by water hyacinth at Winam Gulf in the year 2nd December 2000 was 531.99 Ha while on 14th December 2010, the mat had covered 37,000 Ha. Secondly, fish production was greatly hampered with fish processing plants closed down and water transport operators being locked out of business due to Water Hyacinth (Marian, 2011).

Lake Victoria experienced decreased catchability of fish and attributed it to the mats of water hyacinth which blocked access to fish areas and caused increased costs, for instance frequent purchase of materials (Kateregga & Sterner, 2009). This finding is further buttressed by Mbula (2016) whose study findings indicated that the fish catchability for *Tilapia renderi* was high in November to April, a period when the water hyacinth coverage was extremely low at about 6.3 % in the Kafubu River in the Copper belt Province of Zambia. On the contrary, it was established that fish catchability was moderate in the period of August to October when the water hyacinth coverage by respondents in the study was high, at 37.8% (Mbula, 2016).

Water hyacinth is a disaster but provides an opportunity for recycling, invention, and sustainable environmental conservation as it contains water. Ideas have been floated on how to utilize water hyacinth commercially such as use of water hyacinth mat created in the lake as tourist attraction.

2.4.4 Social Effects of Water Hyacinth Invasion on Women's Health

On Kenyan based studies, the water hyacinth has been considered from a scientific and more environmental-oriented perspective. Yongo, Outa and Ngothe (2017) compared the water quality parameters, fish species diversity and abundance in the water hyacinth infested and non-infested areas. The study finds water hyacinth infested areas to have high fish species diversity (2.00) and evenness (0.93) in distribution. Whereas the study mentions water hyacinth weed sometimes blocks the waterways and landing beaches preventing boats from docking, resulting in longer fishing hours, and increase in use of fuel for motorboats and consequently higher fish prices. The study does not give a position as to whether the water hyacinth has net positive effects or otherwise (Yongo, Outa, & Ngodhe, 2017). Further, the study deduces that water hyacinth infested areas are prone to water-borne diseases for humans. Yongo, et.al, (2017) study focuses on fish species diversity and abundance thus fails to associate this with socio-economic externalities associated with this especially with women.

Mojola (2011) examined the association between the roles of the eco-social environment in shaping HIV risk. The paper argued that changing ecological environment of Lake Victoria, mapping onto a gendered economy, social construction of fisher folk's sexual relationships and sexual mixing patterns had an unexplained influence on the HIV risk mitigation. Further, Mojola (2011) demonstrated the impact of disrupted lake and fish ecology on fishermen's sexual, domestic and economic partnership and normalization of 'sex for fish' economy. The ethnographic study equally explored the consequences of fishermen's relative with wealth and involvement in transactional relationships with schoolgirls and women along the Lake (Mojola, 2011).

The study was however limited as it focused on the individual level HIV prevention strategies and ignored the eco-social context of individual sexual decision making. Kwena, Bukusi and Ng'ayo (2012) findings corroborated the Mojola (2011) finding on prominent role of transactional sexual relationships in disempowerment of women. Women are vulnerable and thus

their wish to sell fish in the market and securing the rights to purchase the fish caught sets at risk to Jaboya sex predators (Kwena, Bukusi, Omondi, and Ng'ayo, 2012).

Respondents from Adusuazo, in Ghana, on the other hand, reported that water hyacinth invasion brought about the reduced frequency of school attendance as an effect of water hyacinth invasion. They reported their children could stay in the house for weeks or months depending on the span of the invasion period until the rains washed the weeds downstream or communal labour was organized to remove them from the designated routes. Water hyacinth invasion brought about students' lateness to school. This occurred when they had to use their hands to remove and pave way through the weeds that had blocked their access routes, thus slowing down their movement on the river to school. The reduced frequency of school attendance and lateness were reported by parents to have affected the academic performance of children (Honlah, 2019).

Most women are engaged in small and microeconomic businesses and since they do not have access and control of resources, they practice table banking so as to get capital to finance their businesses. This table banking requires one to be present and since water hyacinth has invaded their meeting location, that is, along the beaches as they buy and sell the fish, most of these women lack capital for their businesses (Mbula, 2016).

From this research, the majority of the women's social life has been negatively affected by the water hyacinth invasion. The effect on women's social activities such as table banking has a huge impact on women's economic development.

2.4.5 Ecological Effects of Water Hyacinth Invasion on Women's Livelihoods

Villamagna and Murphy (2009) described water hyacinth (*Eichhornia crassipes*) as having significant ecological effects. Firstly, water hyacinth has an impact on water quality. It alters water clarity and decreases phytoplankton production, dissolved oxygen, nitrogen, phosphorus, heavy metals and concentration of another contaminant. Effects of water hyacinth on ecological communities are definitely non-linear. The ecology is permeated with various invertebrates, said to increase, due to bolstered habitat heterogeneity and structural complexity moderated by water

hyacinth and sometimes decrease due to reduction in phytoplankton (food) availability. Thirdly, the fish food chain is highly disrupted and thereby reducing the numbers harvested.

Invasive species are widely accepted as one of the leading causes of biodiversity loss and can have significant effects on resource availability and can suppress or enhance the relative abundance of native species, without necessarily being the driving force behind community change. Water hyacinth has a direct impact on aquatic systems water flow by slowing it by 40 to 95% in irrigation channels that may cause severe flooding. This could have a detrimental effect on the ecology of the system (A Bhattacharya, et. Al, 201-2015).

From this research, it is evident that water hyacinth invasion causes enormous water loss through evapotranspiration, that alters the water balance of the entire region and it also causes the impediment to water flow, which increases sedimentation, causing flooding and soil erosion.

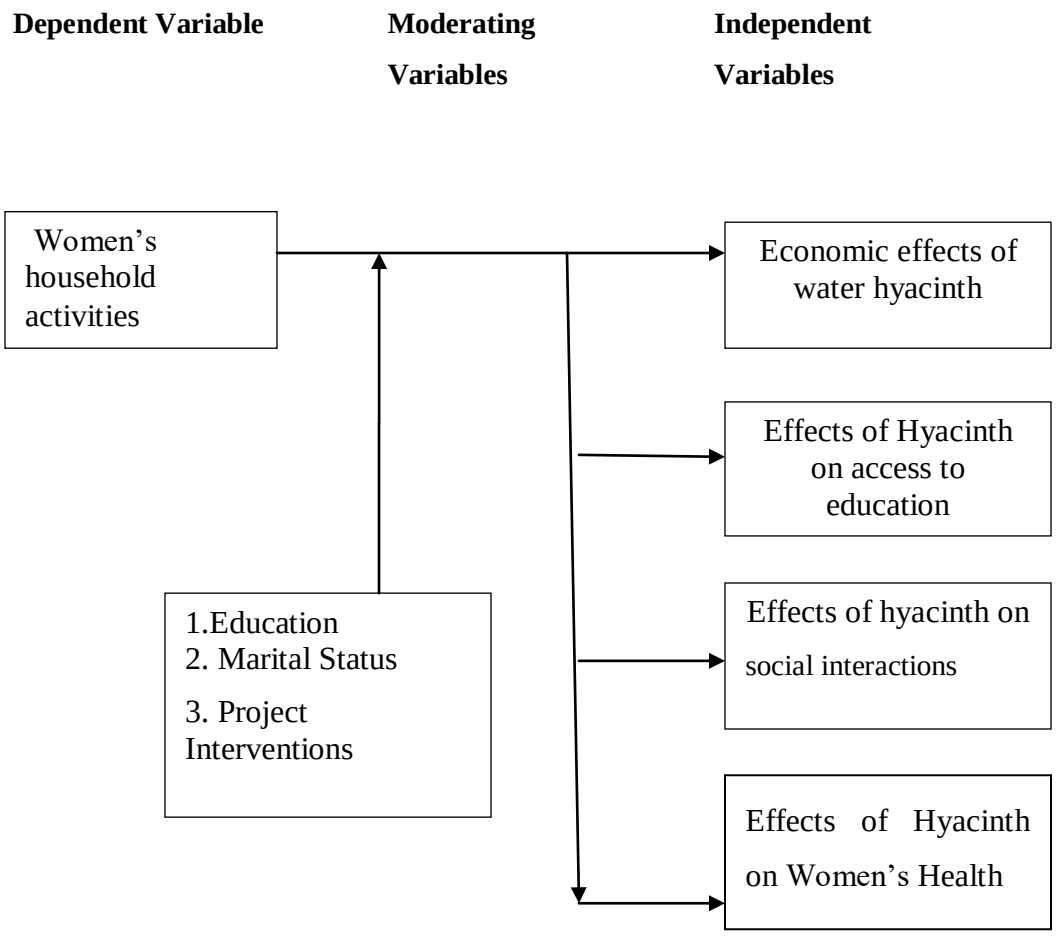
2.4.6 Research Gap

A significant number of the reviewed studies dwell on the effects of water hyacinth from a general perspective; whereas some of the studies examine the issue from a regional perspective, other studies do examine the effects from an environmental perspective. As such, the nexus between and how it affects livelihoods, especially those of women in Homa Bay County have not been addressed by the studies. It is this gap that the study inherently intends to fill by examining the effects of the hyacinth weed on women's household activities.

2.5 Conceptual Framework

Figure 2.1 below presents the independent, moderating and the dependent variables.

Figure 0.1 Conceptual Framework



According to this study, the dependent variable is women's household activities. Women play a seminal role in development of livelihoods but their recognition is benign. However, their role is always constant whether as mothers or sisters or daughters in the homes in Homa Bay County. The moderating variables include education, marital status, and project interventions; if these are implemented, then the effects will be reduced because these factors will accelerate the solutions to the problems that bedevil the households adjacent to the lake. Lastly, the dependent variables are the economic effects, effects on education and effects on social interactions. In the final end,

education and social interactions are usually the greatest casualties when it comes to the hyacinth infestation. The study thus conceptualizes the combination and joint interaction of the mentioned independent and moderating variables on the fisherfolk women's livelihoods which is the main variable of interest.

2.6 Summary

The preceding sections reviewed both theoretical and empirical literature related to the main objective areas of the study. From the empirical review, it was noted that water hyacinth has spread in various parts of the African continent. This noxious weed has created many problems to the communities living around the water bodies infected by the water hyacinth.

Theoretically, this study referred to two theories, namely: Gender and Development (GAD) theory and women empowerment theory. The emphasis of the GAD theory was on equality of 'benefit' and 'control' while the women empowerment theory focuses on the empowerment of women at four levels, namely: individual level, household level, community level, and the larger societal level.

Water hyacinth has been seen to have various effects that include, economic, social, and ecological. This weed has also been seen to be useful in some ways, namely: in art/craftwork such as manufacturing of art paper, crafts, ropes, furniture, and other things creates employment and increase of income. These studies depicted the economic potential of hyacinth utilization.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

Chapter three discusses the research design, target population, sampling and sampling techniques, research instruments, validity, and reliability of the research instruments, data collection, and data analysis techniques.

3.1 Research Design

The research design is the overall plan for collecting and analyzing data (Polit and Hungler 1998). The research design refers to the researcher's overall plan for obtaining answers to the research problem. It is associated with the structural framework of the study and concerns, the planning of the implementation of the study in order to reach the goals set out (Burns & Grove 2001). The research design also provides the guidelines and instructions to be followed when addressing the research problem (Mouton 1996). This study adopted a mixed-study design approach. Understanding cross-cutting thematic issues such as gender that is externally caused by natural disasters requires a mixed-study approach (Creswell & Plano, 2011).

According to (Creswell & Plano, 2011), a mixed-methods is defined as a process that focuses on collecting and analyzing data that is mixed; both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problem than either approach alone. According to Punch (2014), such a study is well placed to benefit from both quantitative and qualitative methods of data collection and data analysis. This facilitated clear understanding of associations and relationships between the proposed dependent variable and the three-independent variables through both statistical and non-statistical analysis arguments (Punch, 2014).

3.2 Study Area

Homa Bay County is one of Kenya's 47 counties (devolved government units) resting on a latitude $0^{o}15'$ South and $0^{o}52'$ South and between longitudes 34^{o} East and 35^{o} East. Homa Bay is expansive with a water area of 1,227 km^2 and aggregate area of landmass and water being 4,267.1 km^2. The county's population was estimated at 1,038,858 persons disaggregated as

498,473 males and 540,386 females in 2012 projected in Kenya Demographic Census 2009 (KNBS, 2009). The population is youthful and comprising of 48.8 percent who are aged 0-14 years while 27.5 percent comprises of youth aged 15-29 years.

3.3 Target Population

The study targeted the communities living along Lake Victoria who are affiliated to beach management units (BMUs). The population adequately helped in addressing the research problem of women within the fisherfolk communities of the shores of Lake Victoria that border shores and landing sites that have highly been infested by water hyacinth. The community perspective helped in understanding how water hyacinth invasion of the lake has contributed to women vulnerability in the targeted area.

The research took cognizance of the fact that the effects of water hyacinth are externalized to the agricultural uplands within Karachuonyo. The focus of the study was to sample women who live in the villages in close proximity to the lake, 3 km radius. The purposive sampling was selected to identify the potential respondents to be admitted into the study. For precision and quality sampling, the Beach Management Units (BMUs) were requested to provide a list of members from which the sample was drawn. The targeted functional BMUs were 44, distributed as 10 for East and 34 for West Karachuonyo (Kenya National Bureau of Statistics, 2013).

Table 0.1 Target Population

	Cluster BMU	**Number**	**Placement**	**Distant from Kendu Bay Centre**
1	Rakwaru BMU	10	East Karachuonyo	6-8 km from Kendu Bay town
2	Kobiero BMU	11	Upper West Karachuonyo	7 km South of Kendu Bay town
3	Kodero BMU	11	Middle West Karachuonyo	12-14 km from Kendu Bay
4	Homa Line BMU	12	Lower West Karachuonyo (Kanaam)	19-22 km from Kenya Bay
	Total	**44**		

Source: Based on the Reconnaissance Visit of Homa Bay, Karachuonyo (December 2017)

3.3.1 Sample Size Determination

Based on projections from the 2009 Kenya Population and Housing Census, Homa Bay County has an estimated population of 1,038,858 persons consisting of 498,472 males and 540,386 females by the end of the year 2012. This population is projected to rise to 1,177,181persons in 2017. Of this total, 564,843 will be males while 612,338 will be females (CIDP, 2013-2017).

The statistical table is a testable and standardized way of selecting the samples. The assumption was that the targeted women were greater than 100,000 and because of their wider spread, the study assumed a confidence level of 95%, therefore, the estimated number of respondents was 383 constituting female respondents.

Table 0.2 Statistical Table for Sample Size Determination

Population	**Margin of Error**			**Confidence Level**		
	10%	5%	1%	90%	95%	99%
100	50	80	99	74	80	88
500	81	218	476	176	218	286
1,000	88	278	906	215	278	400
10,000	96	370	4,900	264	370	623
100,000	96	383	8,783	270	383	660
1,000,000+	97	384	9,513	271	384	664

Source: Adapted from (Krejcie & Morgan, 1970)

3.4 Data Collection

Two sets of data were gathered: quantitative data which will be collected through semi-structured questionnaire and qualitative data that was gathered through focused group discussions (FGDs) and key informant interviews (KIIs) guides.

3.4.1 Primary and Secondary Data Study Tool Designs

The study used three tools (semi-structured questionnaire, KII and FGD guides, and unstructured observation guide). The semi-structured questionnaire contained questions based on the research questions. The questions were varied with most questions polling on either level of satisfaction or degree of agreement. The main advantage of using the semi-structured questionnaire is that a large number of people can be reached relatively easily and economically.

While designing the data collection tools, utmost care was taken to ensure that respondents fully understood the questions and were not likely refused to be answered, lied or tried to conceal useful information. The tools were organized and worded in a simple manner that encouraged respondents to provide accurate, unbiased and complete information. The tools were therefore designed in a manner that makes it easy for respondents to give the necessary information; and also, to allow for sound analysis and interpretation of data. Secondary data derived from reports on the areas especially related to effects of water hyacinth on the social aspects of the community was extracted and presented accordingly. There was an unstructured observation on the beach line and the BMU centres.

3.5 Pilot Testing

The questionnaire was pilot-tested on a sample of 10 respondents drawn from Lake Naivasha which has similar characteristics as the study location. The respondents were encouraged to make comments and suggestions concerning the instructions, clarity of questions asked and their relevance (Mugenda and Mugenda, 1999). The results from the piloting were used in validating the instruments by revising the items that were not clear.

3.5 Validity and Reliability Analyses

3.5.1 Validity

Validity entails testing if the research tool has the ability to measure what it was intended to measure. When an instrument is valid, it could be considered reliable from their data but is not obvious for the case of reliability implies validity (Creswell & Plano, 2011). The questions have to be understood in the way that was the purpose from the researcher, it has to be answered in the way that was thought from the researcher and the answer must be interpreted by the researcher in the way intended by the respondent. Therefore, in construction of the instrument items, the researcher used simple English language that was easily comprehensible to the respondents. An effort was made to ensure that the items were clear and precise without any ambiguity, ensuring that the items addressed the objectives of the study adequately. The instruments were given to the supervisor and other research experts at St. Paul's University for expert judgment and review of content and face validity.

3.5.2 Reliability

Reliability is how the findings of the study could be repeated without compromising the notion of the study and the questions (Creswell & Plano, 2011). Reliability analysis was conducted on the semi-structured tool to establish the value of Cronbach Alpha which must exceed 0.7 for reliable data. The test-retest approach was used. According to Mugenda and Mugenda (2003) this approach involves administrating the same instrument twice on the sample group of the subject at different times. The questionnaire was pilot-tested on a sample of 10households drawn from Lake Naivasha which had similar characteristics as the area of study. After two weeks the same questionnaire was administered to the same population and correlated. A Pearson correlation coefficient of 0.8 was achieved.

3.5.3 Measurements of Variables

This sub-section describes how the dependent, independent and moderating variables were measured. All the constructs were measured using inferential statistics which makes inferences and predictions about a population based on a sample of data taken from the population in question. The items were systematically placed to measure the independent and dependent scales for final even though this might insignificantly introduce a bias. The justification is that some respondents are just implementers and placing the scales randomly would compromise the validity and reliability of the instrument. The scales for predictor and criterion variables were distinctively placed from each other. The study measured the following variables as stated in table 3.3:

Table 0.3 Measurement of Variables

Variable	Sub-Variables
Dependent Variable	
Women's livelihoods	• Women mobility
	• Decision-making power
	• Autonomy
	• Ownership of Household assets
	• Awareness of processes of fighting water hyacinth and deliberations
	• Freedom from domination
	• Participation in public protest and BMU leadership campaigns or local political campaigns
	• Contribution to family income
	• Reproductive rights
	• Exposure to information
	• Participation in Development Programmes
Independent Variables	
Social Effects (V1)	• Change in feeding habits
	• Time spent on searching for clean water
	• Quality of water for use
	• Prevalence of rape and sexual exploitation
	• Reduced social interactions
Economic Effects (V2)	• Water business (water vending costs, volume of water for use,)
	• HH budget forgone to finance clean water
	• The estimated loss of income from fish business
	• Cost of health care
Ecological Effects (V3)	• Size of fish harvested
	• Recreation
Moderating variable	• The education level of women • Marital Status • Community Project Interventions on Water Hyacinth

Source: Researcher's Own Constructs

3.6 Data Analysis

The data analysis entailed validation of findings using quantitative and qualitative data sources. The research has proposed to marry both quantitative and qualitative approaches to build a convergent design (Palinkas, Aarons, Horwitz, & et al, 2011). The data will be analysed through descriptive analysis.

3.6.1 Qualitative Data Analysis

The qualitative data was analyzed through content and trend analysis to gather data from composite variables and how they are constructed for the dependent variables. Qualitative data obtained from the open-ended questions in the questionnaires and key informant interviews were extracted, common themes identified, organized and then discussed under the main objective areas of the study.

3.6.2 Quantitative Data Analysis

Upon completion of data collection, the data was cleaned for the elimination of ambiguities or inconsistencies. The data entry sheet was designed on Ms Excel 2010 and transferred to Statistical Package for Social Scientists (SPSS). Data analysis involved interpretation and inferences from the analysis in answering the research questions. The data was presented through tables and figures.

3.7 Ethical Considerations

Approval was obtained from National Commission for Science, Technology, and Innovation (NACOSTI) for the research permit and authorization. All the participants were informed of their voluntary informed consent before participating and their right to withdraw from the study at any level. The consent form was filled once the participants have been explained for about the research and why their participation is necessary, how it will be used and to whom it will be reported. Other ethical issues arising from researching particular communities marginalized because of their age, culture, race, gender, sexuality, socio-economic standing or religion. All the respondents were assured of their confidentiality and anonymity on the data collected. The research, therefore, was conducted within the context and boundaries of the selected methods, theories, and research paradigms, and ensures that the data collected and analyzed are

generalizable, reliable, valid and normally distributed for good interpretation and statistical inference.

3.8 Summary

The study area was Karachuonyo Sub County in Homa Bay County. This study adopted a mixed-study design approach that is, the use of quantitative and qualitative approaches, in combination. The target population was women living around Lake Victoria and are members of the Beach Management Units (BMU's).

The sample size was 383 for women and data was collected through an unstructured questionnaire, Focus Group Discussion Guide, and Key Informant Interview guide. Qualitative data was analyzed through content and trend analysis and were used to support the quantitative data while quantitative data was analyzed through SPSS and presented through tables and figures.

CHAPTER FOUR: RESEARCH FINDINGS AND ANALYSIS

4.1 Introduction

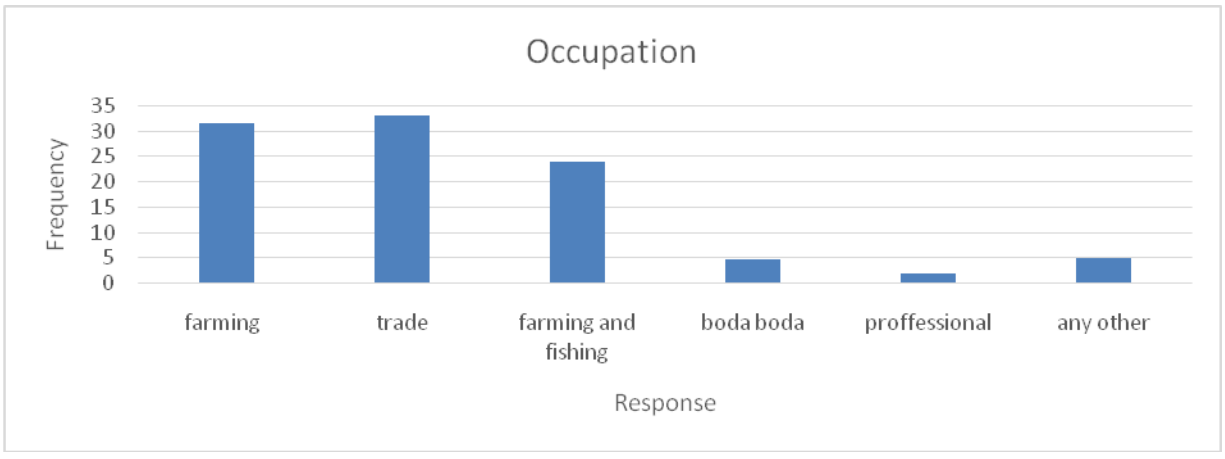
This chapter presents the data as collected in the field and goes ahead to discuss the findings. A total of 383 respondents were selected for the study. All the questionnaires were administered, duly filled and returned. This chapter begins by presenting the demographic characteristics of the respondents then proceeds to discuss the findings under three main headings based on the set objectives, they include: the economic effects of water hyacinth on women's household activities in Karachuonyo Sub County, Homa Bay County; the effects of water hyacinth on women's access to education in Karachuonyo Sub County, Homa Bay County; the effects of water hyacinth on women's health in Karachuonyo Sub County, Homa Bay County; the effects of water hyacinth on women's social interaction in Karachuonyo Sub County, Homa Bay County. The data was mainly qualitative; therefore, analysis adopted a quantitative approach where charts, figures, and tables were used in aiding descriptions.

4.2 Demographic Characteristics of Respondents

4.2.1 Occupation

The study also wanted to find out the occupation, what the respondents engaged in, to meet their livelihoods. This was considered important because hyacinth affects people's income in great ways. The responses are as shown in figure 4.1 below

Figure 0.1 Occupation



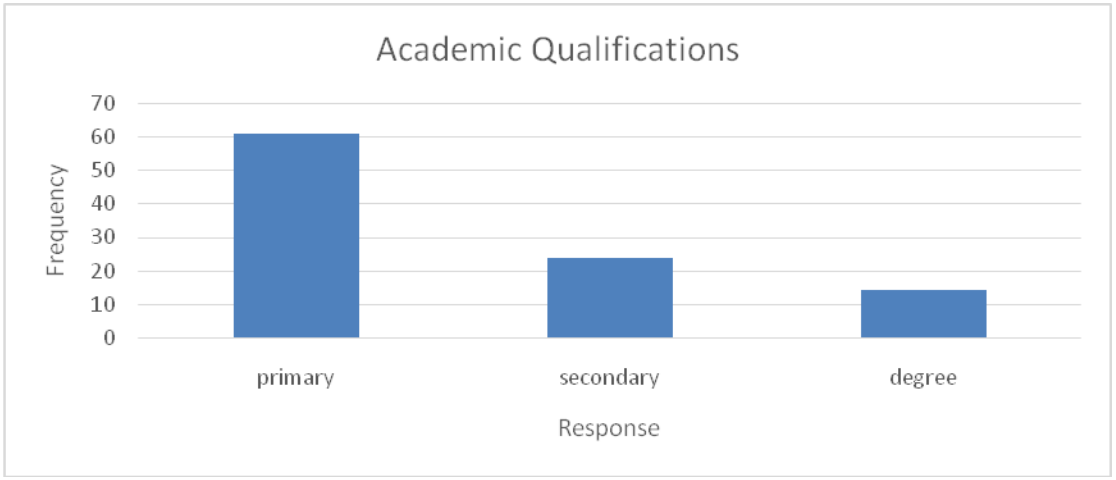
Source: Field results, 2019

A majority of the respondents, 33%, engage in trade while another 23.85% engage in both fishing and farming. Another 31.35% engage in farming while 4.8% are engaged bodaboda business. The least, 2% and 5% engage in professional and other unspecified businesses respectively. Therefore, the implication here is that the respondents were well suited to answer the questions sufficiently given that most of their economic activities revolved around the rural areas and as such fishing affect them either directly or indirectly.

4.2.2 Academic Qualifications

This considered an important parameter in measuring the level of dependency on fishing or possession of an extra source of income emanating from the qualifications one had. The Figure 4.2 below presents the findings.

Figure 0.2 Academic qualifications



Source: Field results, 2019

From the figure 4.2 above, a majority of the respondents, 61% had attained primary level education while 23.8% had secondary education while 14.3% had attained a degree. Therefore, this implied that the level of education was restricted to secondary and primary, hence a majority of the respondents did not possess extra qualifications and so an indication that they depended fully on fishing and were as such affected by water hyacinth.

4.2.3 Age

Age was also considered as an important variable since the older had experienced the economic activity before the invasion of water hyacinth and were as such better placed to state the changes that have been brought by the hyacinth. The age is presented in table 0.1 below:

Table 0.2 Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19-24	9	42.9	42.9	42.9
	25-30	1	4.8	4.8	47.6
	Above 30	11	52.4	52.4	100.0
	Total	21	100.0	100.0	

Source: Field results, 2019

From the table 4.2 above, a majority of the respondents, 52.4% were aged above 30. Another 42.94% were aged between 19-24, while only a paltry 4.8% were ranging between 25-30. This was considered as a sufficient representation for the study.

4.3 Economic Effects of Water Hyacinth on Women's Activities

4.3.1 Ways Women Meet their Needs

The respondents were asked to state how they meet their needs. This was considered as important for the research because it would be an accurate pointer to their livelihoods. The results are presented in table 4.3.

Table 0.3 Ways you meet your needs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	.3	.3	.3
	Employment	42	11.0	11.0	11.2
	Business	300	78.3	78.3	89.6
	Dependant	40	10.4	10.4	100.0
	Total	383	100.0	100.0	

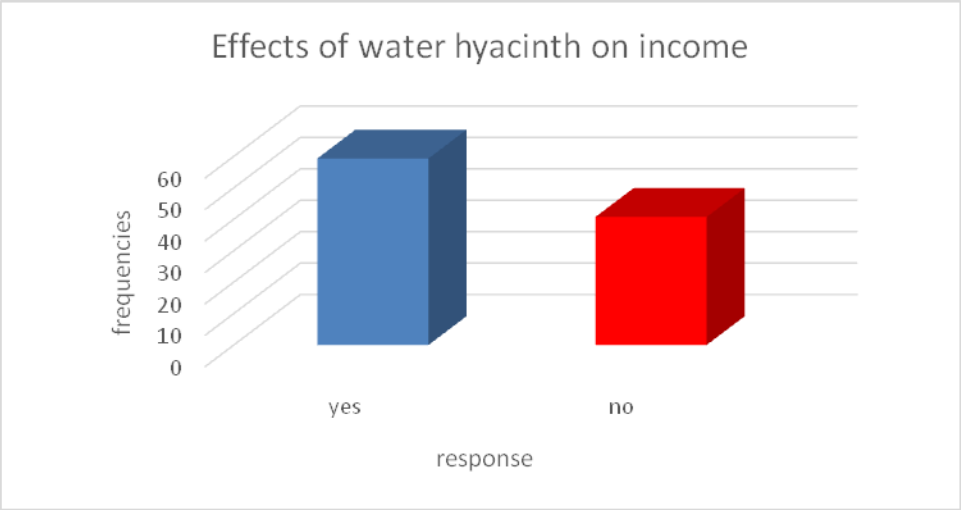
Source: Field results, 2019

From the table 4.3 above, a majority of the respondents, 73.8% did indicate that they were engaged in business as a way of meeting their needs, 10% of the respondents also indicated that they are dependants while the remaining 11% indicated that they were informal employment. This was a clear indication that the respondents had their livelihoods revolving around business. However, there is a deduction that the 10% who are dependent on the other two categories of people, that is an indication that the effects of water hyacinth cascade from those who are in business to those who are employed.

4.3.2 Effects of the Hyacinth Weed on Sources of Income

Here, the respondents were asked to indicate whether water hyacinth has affected their source of income. The intention was to establish the extent to which their economic lives have been disrupted since the intrusion of the weed. At the same time, the question was aimed at finding out whether the residents understand the nexus between water hyacinth and economic livelihoods.

Figure 0.3 Effect of the Hyacinth on Sources of Income



Source: Field results, 2019

From the figure 4.3. above, it was apparent that the majority of the respondents, 59.3% attested that the weed has affected their source of income while the remaining 40.7% answered in the negative. Asked further, those who answered in the affirmative indicated that since the weed penetrated to their fishing grounds, the amount of fish that was harvested significantly declined. As a result, their daily returns were significantly reduced. However, those who indicated in the negative averred that after the weed became prevalent, they were forced to quickly adjust by seeking alternative sources of income hence so far, the weed has not affected their sources of income.

These findings are in sync with those of Akinyi (1999) which revealed that the people living adjacent to the lake have their livelihoods derived from the lake. Even the businesses run by the people are fishing related; they sell merchandise to fishermen, which mean their businesses solely rely on the proceeds from fishing. The inference is that fishing was a major determinant of their lives and as such, water hyacinth systematically disrupted their lives because of even those in businesses, their ventures income was significantly diminished because of the act that generally, there was economic decline because of the weed.

4.3.3 Alternative Sources of Income

Here, the respondents were required to indicate whether they have alternative sources of income to cushion them from the adverse effects of the invasion of hyacinth weed. The results are tabulated below in table 4.4.

Table 0.4 Alternative Sources of Income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	108	28.2	28.2	28.2
	No	275	71.8	71.8	100.0
	Total	383	100.0	100.0	

Source: Field results, 2019

The results revealed that a majority of the respondents, 71.8% indicated that they do not have an alternative source of income while a paltry 28.2% did indicate that they have an alternative source of income. Asked about the alternative sources of income that they have adopted, the respondents cited bodaboda and taxi business as the major alternative ventures that they were forced to perform in order to earn a living. These results lead to the aversion that indeed the water hyacinth was a major disruption in the economic livelihoods of the residents of Karachuonyo Sub County, Homa Bay County.

Therefore, the finding that most of them lacked an alternative source of income means that they are affected by the weed. On'gan'ga (2010) indicated that the weed significantly reduced the income levels; since the fishermen could not fish as much as enough, the women who are dependent on the proceeds of fishing had their sources of income cut off, most of the women usually buy fish from the fishermen then sell it locally. In fact, the selling of fish to consumers is usually the main preoccupation of these women. However, they indicated that after the amount of fish went down, they no longer make profits as they used to; furthermore, it was noted that these women had to supplement their sources with the selling of other vegetables and groceries, which was not as profitable to them. According to Ogera (2018), in 2013, the Kenyan fishery industry in Lake Victoria landed 140,000 tonnes of fish, mostly Nile perch, whitebait and tilapia.

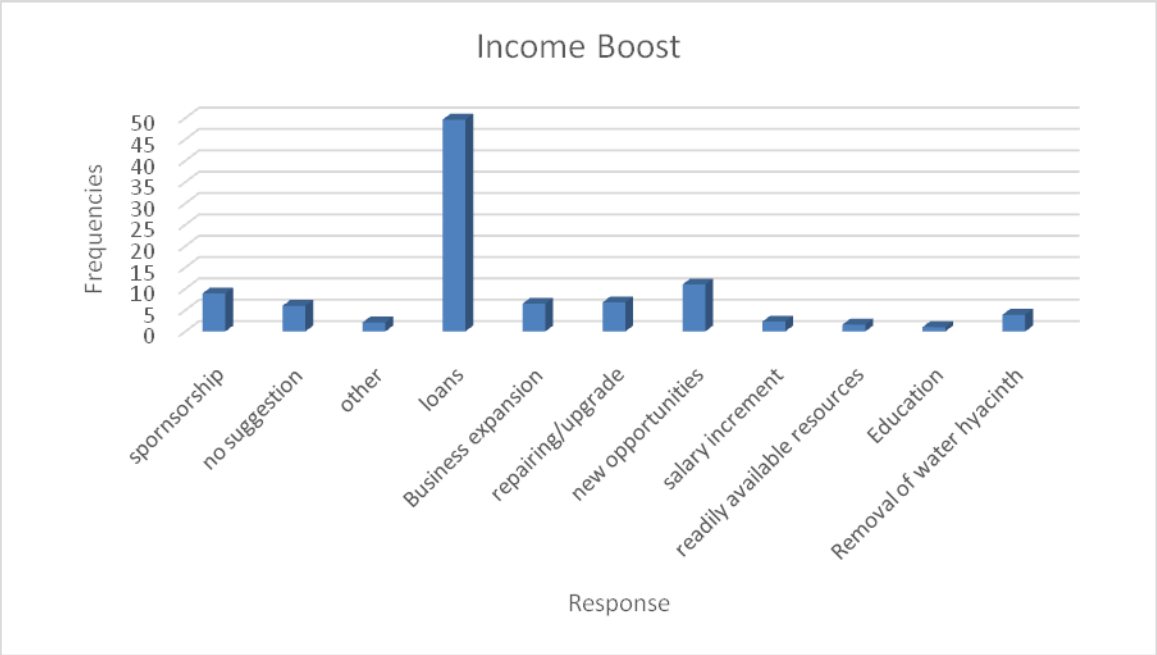
By 2016, the figure was down to 98,000 tonnes. At the market in Kisumu, the gap between local demand and the lake's supply is filled by frozen tilapia fillets- imported from China. The incongruity makes fishmongers cry foul.

According to Kamau (2015), reduced fish stock over time recorded second from water pollution as a negative impact of water hyacinth proliferation in the lake. This is as a result of decreased fishing grounds, polluted waters making it unfit for fish consumption, and blocked waterways making movement in water a challenge. Majority of those who indicated reduced fish stock were fishermen due to the nature of their work. They further pointed out that water hyacinth had led to destruction of their fishing nets raising the cost of doing business with increased investment in fishing nets.

4.3.4 Ways in which women income can be boosted

This question was intentioned to solicit information regarding whether the residents have any thoughts about what strategies can be embraced in order to boost their income after the systematic disruption of their livelihoods by the water hyacinth weed. The results are presented in figure 4.4:

Figure 0.4 Income Boost



Source: Field results, 2019

From figure 4.4 above, the respondents gave several strategies that they thought could be used to boost their income. A majority of them, 49% stated that they believe loans would be able to enable them to boost their income. At the same time, 11% stated that they need new opportunities. Others stated as follows: 8.95% sponsorships, 6.5% business expansion, 3.9% removal of water hyacinth, 1.0% education, 2.3% new opportunities, 26% repairing and upgrading roads and 6% readily available resources. Only 265 of the respondents gave no response. It was thus apparent that there was a general view among the residents that a wide array of measures were needed to help alleviate them from poverty that was occasioned by the weed. These measures could emanate from the County government since it has been given functions by the constitution of Kenya to promote economic development. Furthermore, the National government could intervene by allocating funds to groups which engage in businesses. The non-state actors which also deal with the effects of the weed include NGO's and CBO's.

At the policy level, it was established that there have been efforts which have been undertaken by the National government aimed at addressing the sporadic proliferation of the weed. In a bid to solve the water hyacinth menace, the government established the Lake Victoria Environmental

Program (LVEMP). The program received funding by the Global Environmental Facility (GEF) and the World Bank. According to On'gen'ga (2010), the GEF is a mechanism for international co-operation for the purpose of providing new and additional grants and concessional funding to meet the agreed global environment benefits in climate change, biological diversity, international waters, and ozone layer depletion. Because it is being funded by GEF, LVEMP is expected to provide for or facilitate consultations with, and participation of major groups and local communities throughout the project cycle.

The participation of the community is therefore paramount for success and sustainability. The project has specific activities targeted at the community. The idea is to empower the local communities to manage the activities and eventually own the project targeted at them. In fact, according to Lovei (2018), who is the project manager of the Environmental and Natural Resources Global, there cannot be effective environmental management without improving the livelihoods of millions of people who live and work in the catchment. All environmental interventions are underlined by broader goals of poverty reduction and sustainable growth. For this to be attained, involvement of women is key.

However, this approach of all-inclusivity of gender has not been happening. In this connection, the objectives of the Lake Victoria Environmental Management Project include as part of its preparatory activities, stakeholders consultation and local community participation in decisions concerning the objectives of the development programme, its design, implementation and management have not been met because initially all discussion concerning the management of Lake Victoria began at high levels ignoring the fact that the communities living around Lake Victoria have a major role to play. At the same time, the involvement of women in these programs has not been guaranteed. In fact, these programs need to involve women fully if they want to meet their objectives.

Some of the major activities engaged in by the group are; hyacinth control and management mechanisms and Chemical control among. However, due to the possible negative effects of herbicides, the use of chemicals was deferred until further tests are carried out and agreed upon.

This approach was adopted by the three East African countries which share the lake. They agreed that all herbicides used in the water hyacinth control programme shall be acceptable to the Association (IDA), be used sparingly in strictly selected and confined areas; be handled by persons trained in their safe and appropriate handling and establish a mechanism for careful monitoring of their use.

Technically, the program has engaged in policy and technical activities aimed at reducing the effects of the weed; LVEMP decided to appoint a committee of experts - three from each country, to conduct further reviews and advise on the use of herbicides in controlling the water hyacinth. The committee of experts reviewed a wide range of literature, documents and research findings on the possible use of herbicides. The committee submitted a report to International Panel of Scientists (IPS) entitled 'A Review of Herbicides Used in the Control of Water Hyacinth' with Recommendations on Possible Use in Lake Victoria. The International Panel of Scientists recommended that it was then inappropriate and unacceptable to use herbicides for the control of the water hyacinth in Lake Victoria. The International Panels Scientist and Regional Policy Steering Committee (RPSC) report was further discussed at their fifth meeting in Kisumu, Kenya on 14-15 September 1998, but they were of the opinion that the report was non-committal and did not state whether or not herbicides should be used in the control of the water hyacinth in Lake Victoria. Members of RPSC were against the use of herbicides for fear that the herbicides may also harm those who depend on water from the lake for drinking and cause contamination of the fish market and other living organisms in the Lake.

The cause of disagreement was the use of herbicides, it was directed that the use of herbicides should be deferred until further research on the efficacy, safety to health and environmental friendliness of the recommended chemical compounds was done by the three countries. This was to be followed up by the national secretariats of Lake Victoria Environmental Management Project. The committee further recommended that other stakeholders including the European Union should be invited to participate in the research activities on the use of herbicides in the control of the water hyacinth in Lake Victoria. This is mainly because the European Union is a major importer of fish from Lake Victoria. The European Union involvement will also give the

findings an international perspective. Because no conclusive research has been done, there is a general atmosphere of uncertainty on the use of the chemical methods despite the fact that it was the first method agreed upon as early as 1993. The emerging question, therefore, is whether the available funding meant for the management of the weed will be used in a desperate attempt to justify the chemical method while other options are available.

According to the reports that were presented by the EAC Secretariat Commission Meeting of Experts, Tanzania reported that it had constructed three additional weevils rearing units, two in Mwanza and one in Mara. One in Kagera is still under construction. Tanzania also reported that the steering committee of water-hyacinth control has met several times. Kenya reported that the Kenya Agricultural Research Institute (KARI) has established a weevil rearing unit at Kibos Research Station in Kisumu. KARI has released the weevils at 40 sites in Lake Victoria and plans are underway to establish more units. It is also in the process of developing micro-herbicides (fungal pathogens) for use against the water hyacinth. This will include the use of two weevil species *neochetinaei chhorniae* and *n. bruchi*. They are perhaps the most widespread natural enemies of the water hyacinth in Africa. The adult beetles feed on the leaves, which increases transpiration and places the plant under stress. Eggs are laid on the leaves and feed on plant tissues. This creates further stress on the opportunity for the establishment of pathogens as the larvae pupate on the roots in the water high weevil population would result into small hyacinth plants that do not flower and hence set no seed. Secondly, the speed of vegetative reproduction is greatly decreased and the lifetime of a plant is reduced by thirty to fifty percent with the result. Therefore, a holistic effort is need which begins from the policy level to state and non-state actors which will reverse the dwindling fortunes of the people of Karachuonyo Sub County.

4.4 Effects of Water Hyacinth on Education

4.4.1 Effect of Water Hyacinth on Education Access

This question was framed to discern whether the weed had had effects on education. Since education is the surest determinant of the future of the generations, it has a central place to play when it comes to the livelihoods of the people. The responses were tabulated in table 4.5:

Table 0.5 Effect on Access to Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	191	49.9	49.9	49.9
	no	192	50.1	50.1	100.0
	Total	383	100.0	100.0	

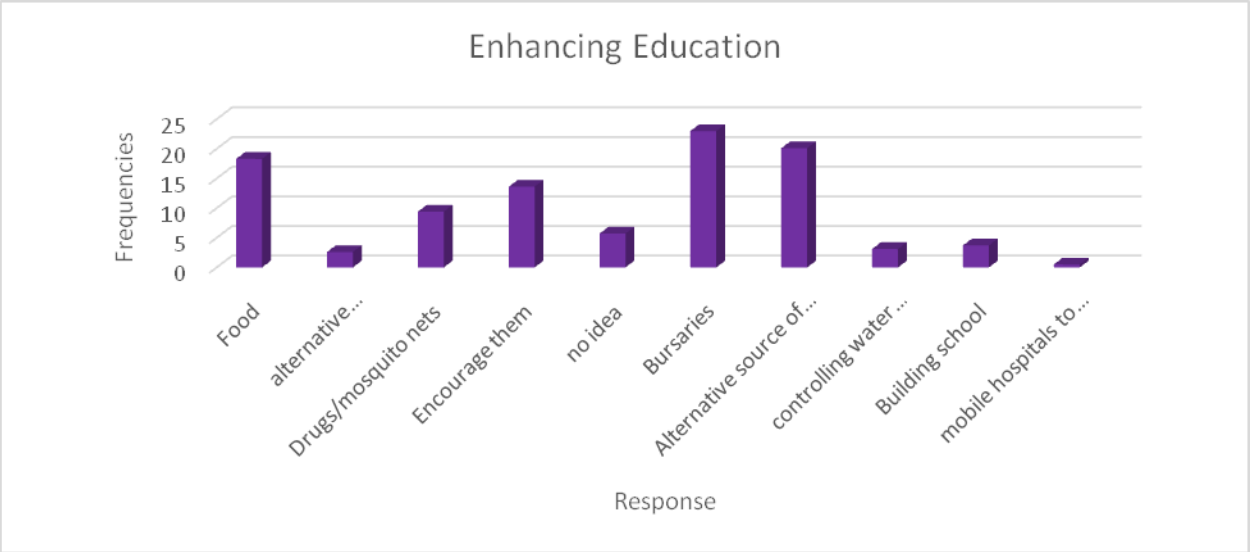
Source: Field results, 2019

As to whether education has affected their education, the response rate was almost equal, from 49.9% and 50.1% who agreed and disagreed respectively. Those who stated in the affirmative explained that since their sources of income had gone down, that made it difficult to take their children to school and as such, many children dropped out of school. However, those who answered in the negative, who constituted the majority, averred that education was not affected because there were bursaries by the CDF (Constituency Development Fund) and the County Government which help their students attend secondary school while the Free Primary Education ensured that pupils went to school for free, all they were required to do is to buy them uniform. Education is the alternative to the reduced proceeds of fishing. Therefore, both the national and county government is supporting free education and the county offers bursaries to children to pursue their education.

4.4.2 Accessing Education to Counter the Effects of Hyacinth Invasion

Since a good number of respondents, 49.9% had attested that education has been affected by the hyacinth weed, the respondents were further asked to state what could be done to enhance access to education. The responses were presented in the table 4.5 below:

Figure 4.5: Enhancing Education



Source: Field results, 2019

The respondents gave several recommendations as follows: 23.0% stated that bursaries should be enhanced to ensure students attend school, 20.1% stated that there should be an alternative source of income which will put money in the pockets of the parents hence enabling them to meet school fees needs, 18.3% noted that there should be food being given to pupils so that when they are in school, they concentrate and are not distracted, 13.6% stated that both parents and pupils need to be encouraged to take education seriously and that there should be student mentorship programs where they are talked to on how to overcome their challenges. The remaining respondents cited alternative transportation, distribution of nets, controlling the weed, building more schools and mobile hospitals at 2.6%, 9.4%, 3.1%, 3.7% and 5% respectively. Only 5.7% of the respondents cited that they have no idea of what can be done. Education can be enhanced by providing incentives to both parents and pupils by making it more accessible and affordable. For example, lunch programs can encourage attendance because in some cases, the lack of food is usually a cause of student absenteeism. The parents will also feel obliged to allow pupils to attend school because they will be sure that there are no extra responsibilities that will accrue in doing so.

4.4.3 How Education can Improve Women's Income

To establish the extent to which the residents valued education, the respondents were asked to state how education can improve their lives. They gave several responses as presented in the table 4.6 below:

Table 0.6 Improving Income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Equip with knowledge	218	56.9	56.9	56.9
	Business diversification	25	6.5	6.5	63.4
	Employment	114	29.8	29.8	93.2
	proper utilization	26	6.8	6.8	100.0
	Total	383	100.0	100.0	

Source: Field results, 2019

A majority of the respondents, 56.9% indicated that education equips people with knowledge that is critical for decision making and at the same time which can enable on one get a job, another 29.8% affirmed that education has the capability of enabling a person to diversify his or her business because one is able to understand business dynamics such as demand and supply, marketing and financial management among others, these skills are able to make a person to diversity his business enterprise and make the right business decisions and choices.

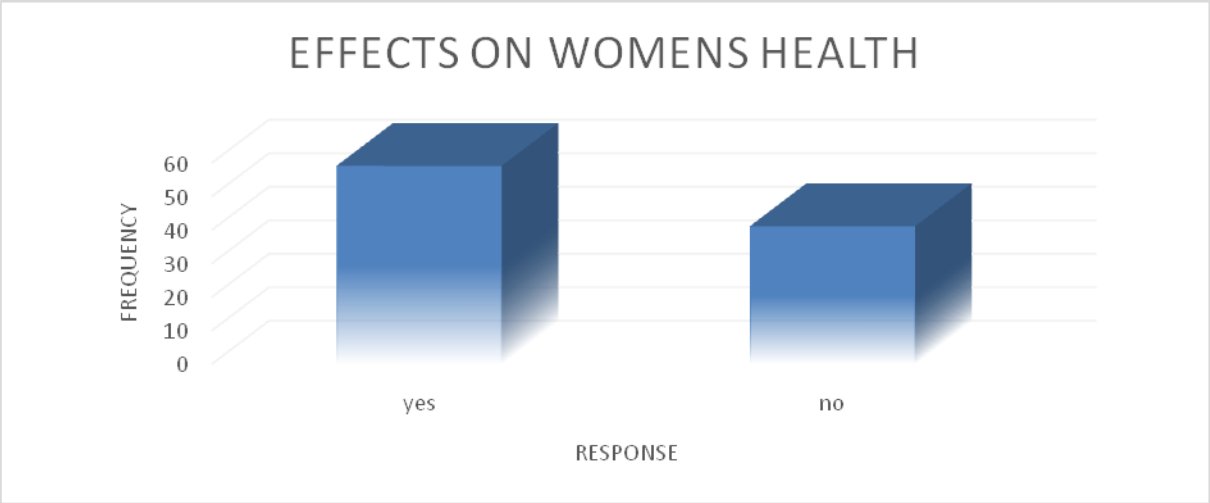
These findings underscore the fact that education is the nerve centre of the development of a society; without investments in education, the future of a community cannot be guaranteed. In fact, if the menace of water hyacinth is to be contained, an investment in education will accrue the best benefits; education will reduce the literacy levels among the people in the community, once people are literate, they will have skills that they can utilize to empower them. Secondly, education will reduce the dependency ratio among the people in the sense that once people have acquired education, they will think about how to empower themselves and not to depend on their

siblings. Lastly, education will lead to informed decision making; people who are educated tend to make better decisions about their health, their social life, and even their economic life. Most importantly, education has the potency of emancipating women from the socio-cultural barriers which limit their growth.

4.5 Effects of Water Hyacinth Invasion on Women's Health

The respondents were required to state whether water hyacinth has affected women's health. This is because the weed brought many adjustments to the society in general and so the intention was to ascertain the effects on women's health, who happen to be the most vulnerable group of the society. The responses were presented in figure 4.6:

Figure 0.6: Effects on Women's Health



Source: Field results, 2019

A majority of the respondents, 59% stated in the affirmative while 41.0% in the negative. This aversion was an affirmation that just like other sectors of the livelihoods of the people like education and income source, women's health has also been negatively affected. There is thus a linkage between the encroachment of the hyacinth weed and increase in diseases and health problems.

Additionally, women are affected especially when it comes to their domestic work; in a study by Kamau &Kunyua (2015), it was established that pollution of lake water lists high among other negative impacts water hyacinth has caused to the community. This can be attributed to the

significant role the lake has on the community as a source of water for household use, for consumption as well as industrial use. Excessive growth of water hyacinth in the lake brings about eutrophication of lake water making it less suitable for use, especially for domestic purposes. This further complicates the social roles given to women and young girls who have to travel long distances to access and fetch water from sections of the lake that seem easily accessible and where water appears cleaner. The study also established that proliferation of water hyacinth in the lake is also significantly attributed to community activities along the lakeshores that lead to pollution of the lake through influx of nutrients in the lake, a condition that creates conducive environment for hyacinth rapid growth.

4.6.1 Health Conditions Associated with Water Hyacinth Invasion

The respondents were asked to state the health conditions that have come with the hyacinth invasion. The responses were presented in table 4.7:

Table 0.7 Conditions Associated with Hyacinth

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	.3	.3	.3
	Infertility	25	6.5	6.5	6.8
	human papilloma virus	23	6.0	6.0	12.8
	Gonorrhoea	94	24.5	24.5	37.3
	Other	161	42.0	42.0	79.4
	Malaria	79	20.6	20.6	100.0
	Total	383	100.0	100.0	

Source: Field results, 2019

From the table 4.7 above, 24% of the respondents averred that the health condition that has come with the weed was gonorrhoea, 6.5% others stated infertility while another 6.0% stated HPV, 20% malaria and a majority of the respondents, cited other health conditions that were not stated

above. These findings are an indication that the invasion of water hyacinth has been accompanied by a myriad of health problems. Asked further, those respondents who indicated that the weed is associated with gonorrhoea explained that in a bid to make ends meet after their fortunes were diminished by the weed, women in the area resort to commercial sex ventures. These activities put them at risk of contracting sexually transmitted diseases of which gonorrhoea is the most contracted. Those who linked the weed with malaria indicated that the weed-covered the lake water that is adjacent to the settlements hence acting as a breeding ground for mosquitoes which spread malaria.

Water hyacinth in the lake creates a conducive breeding environment thus the increased incidents of malaria and bilharzia diseases been recorded over time. Though listed least, at 4% among negative impacts water hyacinth has brought to the community. Majority of those affected are children, and their families have had to incur huge costs in accessing medical treatment. Cases of mortality of under 5yrs old children from these parasitic diseases have been recorded.

These findings relate with those of Kamau & Kinyua (2015) which examined how water hyacinth affects residents of Dunga village. It was found out that in an underdeveloped community like Dunga Village, where no appropriate water supply means are present, children and women suffer the burden of fetching water for the household. In Dunga for example; children continue to play the huge responsibility of fetching water and firewood. The search for water for household use brings with its significant challenges for children, among them, being exposed to disease-causing organisms, drowning in the lake, and limited study time for school-going children. Other negative impacts brought about by water hyacinth are reduced activities in the lake such as recreation activities like swimming, sports like boat racing, and local tourism as a vibrant economic activity for some members of Dunga community had also been hard hit by water hyacinth invasion of the lake.

Additionally, the increased cost of fishing has not only affected the fishermen but has also pushed the cost impact to the consumer who now has to dig deeper into the pocket to part with much more than usual. This has, directly and indirectly, affected the behavior of some community members as they seek to cope with the increasing cost of survival. Cases of young

women engaging in prostitution in exchange fish to feed their families have been reported to be on the rise. Crimes such as petty robbery by young men have also been reported to be on the increase. Intake of illicit brews and related substance abuse by vulnerably idle men, women and youths is evidently present within Dunga community. These behaviors have had a negative effect on people's health.

4.6.2 Access to health facilities

In a bid to find out how the residents respond to their health problems; the respondents were asked to state the facilities that they usually visit when faced with health problems. The responses are tabulated in table 4.8

Table 0.8 Access to Health Facilities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Hospital/Health centre	332	86.7	86.7	86.7
	Chemist	51	13.3	13.3	100.0
	Total	383	100.0	100.0	

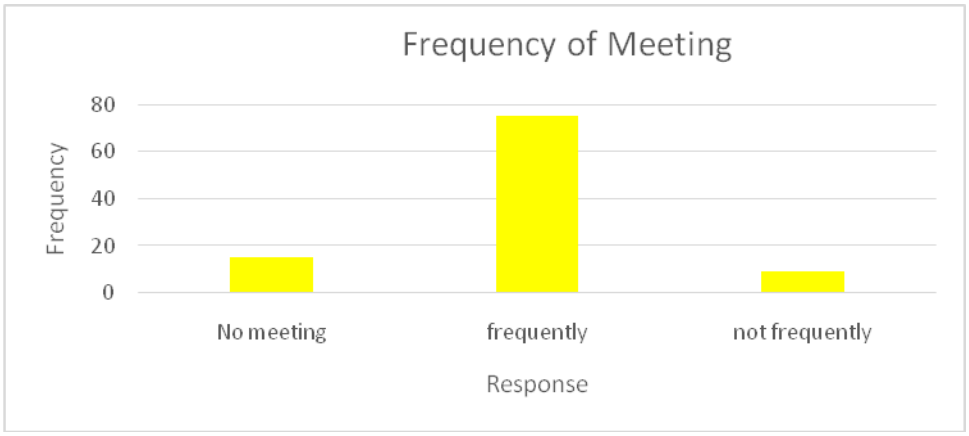
Source: Field results, 2019

From the table 4.8 above, it was established that a majority of the respondents, 86.7% usually visit health facilities such as hospitals or health centres for medical diagnosis and medication. A paltry 13.3% indicated that they visit chemists to get drugs suggesting that they do not get comprehensive medical examination.

4.7 Effects of Water Hyacinth on Social Interaction

The research had proceeded with the assumption that water hyacinth affects the social interaction of the people of Karachuonyo Sub County. The findings contradicted this assumption as presented in figure 4.7 below:

Figure 0.7 Frequency of Meeting



Source: Field results, 2019

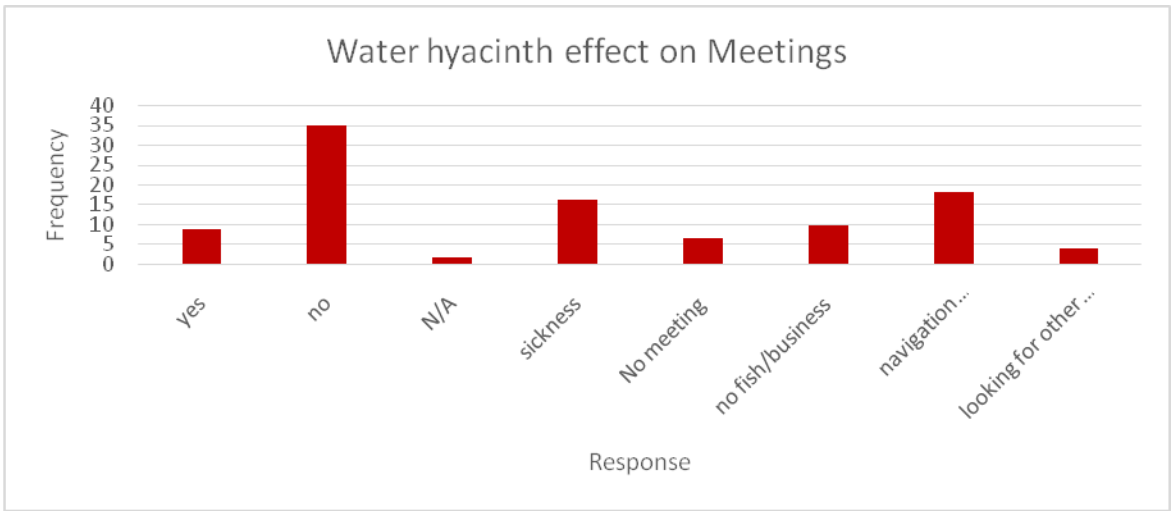
From the responses in the above table, it was noted that the weed did not interfere with their social lives as indicated in the 74.9% of the respondents who affirmed that they usually meet

frequently. Only 15.4% stated that there were no meetings and a paltry 9.4 indicated that they no longer meet frequently. This finding leads to the conclusion that to a large extent, social interactions were not affected, however, to a small extent, they were affected.

4.7.1 How Water Hyacinth invasion has Affected Meetings with Friends

The researcher wanted to establish further the nature and form of the interactions that take place and whether these interactions have negatively been affected by water hyacinth. The results are presented in figure 4.8:

Figure 0.8 Water Hyacinth Effect on Meetings



Source: Field results, 2019

Asked about how the weed has affected their meetings with friends, a majority of the respondents, 35% averred that they had in no way been affected as they still continued to interact both physically and through communication devices and social media. Only 8.6 indicated that their meeting with friends had been affected negatively. Those who stated that they had been affected went further to elaborate that there were no meetings, 6.5%, no fish business, 9.7%, there were navigational difficulties, 18% and that they were looking for other opportunities and friends other than the older ones.

4.7.2 Importance of Social Meetings in the Community

In a bid to uncover the importance of social relationships and how they have been affected by the invasion of the water hyacinth weed, the respondents were asked to state the value of friendships. The responses were tabulated table 4.9 below:

Table 0.9 Importance of Meetings to Friends

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	.5	.5	.5
	improves fish trading	6	1.6	1.6	2.1
	Catch up	87	22.7	22.7	24.8
	Exchange of ideas	153	39.9	39.9	64.8
	Not important	44	11.5	11.5	76.2
	no meeting	22	5.7	5.7	82.0
	no access to land	2	.5	.5	82.5
	Trade	63	16.4	16.4	99.0
	intermarriage	4	1.0	1.0	100.0
	Total	383	100.0	100.0	

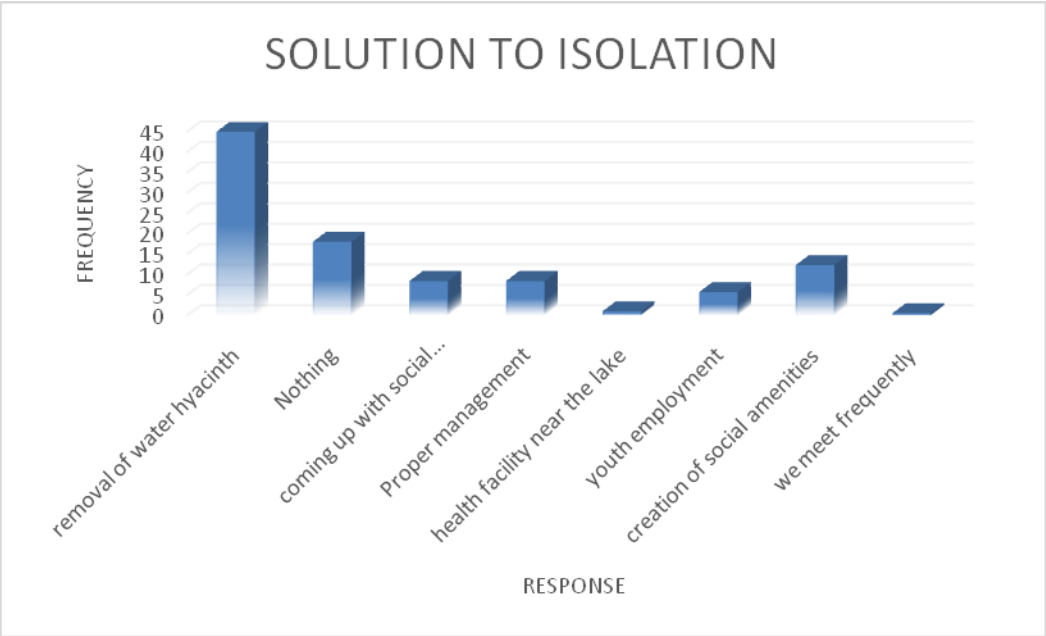
Source: Field results, 2019

From the responses tabulated in table 4.9 above, a majority of the respondents, 39.9% attested that friends are very important because they provide a platform to exchange ideas about many issues, key among them being how to adjust to the effects of water hyacinth and device new coping mechanisms. At the same time, 22% of the respondents stated that friends help to catch up while 11.5% stated that friends were not important. The rest cited trade and intermarriage as the benefits of friendship at 16.4% and 1.0% respectively. Therefore, for the people living across the lake, water hyacinth has the potency of limiting their interactions because the weed inhibits even movement of boats and at times, it could trap them in the lake. This leads to fear of crossing the lake and thus limits social interactions. The interactions could be in form of family meetings, friendship meetings or even self-help group meetings.

4.7.3 What can be done to resolve the Isolation brought about by the inability to meet

Further, the researcher wanted to get ideas about how social interactions can be intensified. Therefore, the respondents were asked to state how the problem of inability to meet can be resolved. Their responses are in the figure 4.9 below:

Figure 0.9 Solutions to Isolation due to Hyacinth



Source: Field results, 2019

A majority of them, 44.9% indicated that the root cause of the problem, which is the weed itself, needs to be addressed. Therefore, they posited that the solution lies in removing the weed. Surprisingly, a whopping 18% stated that nothing should be done while another 12.3% cited the creation of social amenities as a way of solving the problem. Others cited social functions, proper management, health facility near the lake and youth employment at 8.4%, 8.4%, 5.7%, and 12.3% respectively as a way of resolving issued brought about by the inability to meet.

According to Omollo (2018), among other solutions, there could be alternatives to the water hyacinth by turning it into a business; for example, he cites a CBO called Dala Rieko Women's Group which harnesses the weed into an income-generating activity. In fact, according to Odidi (2014), there are many business opportunities that can be harnessed from the weed. Although water hyacinth is seen in many countries as a weed and is responsible for many of the problems

outlined earlier in this project report, many individuals, groups and institutions have been able to turn the problem around and find useful applications for the plant. The plant itself, although more than 95% water, has a fibrous tissue and a high energy and protein content, and can be used for a variety of useful applications. In settlements where water hyacinth has destroyed economy (fishing and river transport) population can reorient to manufacturing of art paper, crafts, ropes, furniture and other things from water hyacinth which will positively influence to reduction of unemployment and increase of income (Lindsey and Hirt, 1999). As a readily available resource, water hyacinth has been used in several small cottage industries in the Philippines, Indonesia and India for paper, rope, basket, mats, shoes, sandals, bags, wallets, vases, etc. (Ndimele et al.2011, Patel 2012).

The House and Building Research Institute in Dhaka has carried out experimental work on the production of fibre boards from water hyacinth fibre and other indigenous materials (Haider, 1989). According to Haider, 1989, chopped water hyacinth stalks are reduced by boiling and then washed and beaten. The pulp is bleached and mixed with waste paper and a filter agent such as china clay and the pH is balanced. The boards are floated in a vat on water and then finished in a hand press and hung to dry. The physical properties of the board are sufficiently good for use on indoor partition walls and ceilings. In the Philippines, water hyacinth is dried and used to make baskets and matting for domestic use. The key to a good product is to ensure that the stalks are properly dried before being used. If the stalks still contain moisture then this can cause the product to rot quite quickly. In India, water hyacinth is also used to produce similar goods for the tourist industry. Traditional basket making and weaving skills are used. Eden (1994) considers the requirements for large-scale production of charcoal briquettes from water hyacinth.

This is an idea which has been proposed in Kenya to deal with the rapidly expanding carpets of water hyacinth which are evident in many parts of Lake Victoria. The proposal is to develop a suitable technology for the briquetting of charcoal dust from the pyrolysis of water hyacinth. The project is still very much at the idea stage and both a technical and a socio-economic study are planned to evaluate the prospects for such a project. It is suggested that a small-scale water hyacinth charcoal briquetting industry could have several beneficial aspects for the lakeside communities. Water hyacinth fulfils all the criteria deemed necessary for bioenergy production –

it is perennial, abundantly available, on-crop plant, biodegradable and has high cellulose content; however, its strong disadvantage is that it has over 90% water content which complicates harvesting and processing. The biomass can be subjected to biogas production to generate energy for household uses in rural areas (Chuang et al.2011).

Experiments in China show that mixing biomass of water hyacinth with pig manure leads to a much higher biogas production than by using pig manure alone (Lu et al.2010). It can also be used for producing ethanol, but technical and logistical challenges need to be overcome before the commercial-scale ethanol production becomes a reality because of the high tissue water content (Ndimeleet al.2011). The use of water hyacinth for digestion in a traditional digester presents some problems. Water hyacinth has very high-water content and therefore harvesting effort yields a low reward in terms of organic matter for conversion to biogas (Gopal 1987).

Most of the experiments have used a mixture of animal waste and water hyacinth. There is still no firm consensus on the design of an appropriate water hyacinth biogas digester. Water hyacinth can be used to aid the process of water purification either for drinking water or for liquid effluent from sewage systems. In a drinking water treatment plant water hyacinth have been used as part of the pre-treatment purification step. Clean, healthy plants have been incorporated into water clarifiers and help with the removal of small flocs that remain after initial coagulation and floc removal or settling (Haider 1989). Equally, water hyacinth has been reported as an aid in water purification through conversion of toxic ammonia to usable nitrates as well as capacity to absorb heavy metals and organic compounds from water body (Simeonet al., 1987; Cowx and Welcome, 1998; Ingole and Bhole, 2002).

In sewage systems, the root structures of water hyacinth (and other aquatic plants) provide a suitable environment for aerobic bacteria to function. Aerobic bacteria feed on nutrients and produce inorganic compounds which in turn provide food for the plants. The plants grow quickly and can be harvested to provide rich and valuable compost. Water hyacinth has also been used for the removal or reduction of nutrients, heavy metals, organic compounds and pathogens from water

4.8 Summary

As to whether the water hyacinth has an economic effect on women's household activities, it has been demonstrated that indeed women's economic activities have been largely affected since the invasion of the weed. However, it was also revealed that they were actively engaged in mitigating measures to cushion them from these adverse economic effects like seeking alternative sources of income. The second objective was to find out the effects of water hyacinth on women's access to education. Some stated that since their sources of income had gone down, that made it difficult to take their children to school and as such, many children dropped out of school. However, the majority averred that education was not affected because there were bursaries by the CDF (Constituency Development Fund) and the County Government which help their students attend secondary school while the Free Primary Education ensured that pupils went to school for free, all they were required to do is to buy the uniform.

The research also sought to establish the effects of the weed on women's health; on this, it was established that many diseases came up after the invasion of the weed and negatively affected women in the area, particularly those who reside adjacent to the lake. Lastly, was to examine the effects of water hyacinth on women's social interaction; it was indeed established that women's interaction was greatly reduced because of the inaccessibility of the lake to cross over and engage in welfare meetings and associations.

CHAPTER FIVE: SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

Chapter five contains a summary of findings as per the objectives of the study, conclusion, recommendations, contributions to the body of knowledge and suggestions for further research

5.2 Summary

The study sought to investigate the effects of Water hyacinth on women's livelihoods in Karachuonyo Sub County, Homa Bay County. A total of 383 respondents were issued with self-administered questionnaires and all the questionnaires were returned. The questionnaires had demographic characteristics and questions based on the four objectives of the study, which included the following: the economic effects of water hyacinth on women's household activities; the effects of water hyacinth on women's access to education; the effects of water hyacinth on women's health and the effects of water hyacinth on women's social interaction in Karachuonyo Sub County Homa Bay County.

Regarding the first objective, it was established that water hyacinth affected women's economic activities in several ways. First, the invasion of the weed led to diminished fishing grounds and as a result a decrease in fishing activities. These women whose economic life revolves around selling fish were seriously affected forcing them to seek alternative sources of income. These alternative sources of income included trading, bodaboda and taxi business in order to meet their daily needs. As to whether water hyacinth has affected access to education, it was established that it has affected to a low extent but to a large extent, the weed has not affected education. This was attributed to the fact that both primary and secondary education, especially in day schools, is affordable and they also get complimentary financial support to meet the school fees needs from kitties such as CDF (Constituency Development Fund) and County government bursary funds.

As to whether water hyacinth has affected women's health in Karachuonyo Sub County, Homa Bay County, it was established that to a large extent it has affected their health. This is because apart from the direct effects of the weed, such as those of the encroachment of the lake, hence making a perfect breeding ground for mosquitoes, the indirect effects revolve around the adjustments that the people have been led into in a bid to survive, key among the effects on

health was sexually transmitted diseases which include gonorrhoea and HPV which have been prevalent because of commercial sexual activities involving those who have been forced by adverse economic circumstances that came about as a result of water hyacinth.

Lastly, as to whether women's interactions have been affected as a result of the weed, it was established that by and large, the weed has not altered significantly social interactions. However, to a small extent, women's meetings, interaction forums, table banking has been affected by the weed. However, it was also established that the women had put a wide array of measures to boost their interactions. Therefore, water hyacinth continues to be a dictator of the livelihoods to the people of Karachuonyo both socially and economically.

5.3 Conclusion

The research was aimed at demonstrating how the invasion of water hyacinth has affected women's livelihood in Karachuonyo sub-county, Homa bay County. As to whether the water hyacinth has an economic effect on women's household activities, it has been demonstrated that indeed women's economic activities have been largely affected since the invasion of the weed. However, it was also revealed that they were actively engaged in mitigating measures to cushion them from these adverse economic effects like seeking alternative sources of income. The second objective was to find out the effects of water hyacinth on women's access to education. Some stated that since their sources of income had gone down, that made it difficult to take their children to school and as such, many children dropped out of school. However, the majority averred that education was not affected because there were bursaries by the CDF (Constituency Development Fund) and the County Government which help their students attend secondary school while the Free Primary Education ensured that pupils went to school for free, all they were required to do is to buy pupils uniform.

The research also sought to establish the effects of the weed on women's health; on this, it was established that many diseases came up after the invasion of the weed and negatively affected women in the area, particularly those who reside adjacent to the lake. Lastly, was to examine the effects of water hyacinth on women's social interaction; it was indeed established that women's

interaction was greatly reduced because of the inaccessibility of the lake to cross over and engage in welfare meetings and associations.

Therefore, based on these findings, it behoves both the state and non-state actors to establish practical steps both at the policy level and practical levels to ensure that women's livelihoods are not adversely affected by the weed as this will go down a long way in ensuring that there is improvement of livelihoods in the society.

5.4 Recommendations

Based on the study findings, several recommendations both at policy level, academic level and at the implementation level have been conceived. They include the following:

- The government to prioritize the effects of water hyacinth and come up with measures to cushion women from the economic ramifications
- Collaboration by state and non-state actors towards eradicating the weed
- More research to be done on the weed in order to establish how it can be utilized to uplift the lives of women e.g. as a raw material for making fertilizer
- The women living adjacent to the lake be supported to diversify their sources of income by the government and NGO's: the government and NGOs should come in and encourage the residents not only to rely on fishing activities but also embrace the plant as of economic importance. This can be achieved if the government can establish cottage industries that can harvest the plant and use its use in the processing of board are sufficiently good for use on indoor partition walls and ceilings.
- Women be empowered to start businesses
- Sensitization of the women be done on the negative effects of engaging in casual sexual activities
- More health facilities be built focusing on prevention of diseases rather than just treatment
- The county government passes laws which will accelerate economic development in the county

- More studies be done focusing on the effects of the weed on other aspects of life such as the development of infrastructure and on business enterprises.
- The possibility of converting water hyacinth to biogas should also be embraced. Conversion of other organic matter, usually animal or human waste, is a well-established small and medium scale technology in a number of developing countries, notably in China and India.
- A collaborative approach involving all the countries that share the Lake
- Establishment of a research centre which is dedicated towards funding measures that will curb the spread of the weed
- Policies should be put in place towards addressing the menace holistically.

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APPENDICES

Appendix 1: Introduction Letter

IRENE KHASANDI KHABUCHI
ST. PAUL'S UNIVERSITY
NAIROBI CAMPUS
EMAIL: mdsnrb794913@spu.ac.ke
27th February, 2019

Dear Sir/ Madam,

RE: EFFECTS OF WATER HYACINTH INVASION ON WOMEN'S LIVELIHOODS IN KARACHUONYO, HOMABAY COUNTY, NYANZA REGION OF KENYA.

I am a Masters student at St. Paul's University, Nairobi Campus and as part of the requirement of a Masters in Development Studies; I shall be conducting a research on the effects of water hyacinth invasion on women's livelihoods in Karachuonyo, Homabay County, Nyanza region of Kenya.

I kindly request that you find time to fill the questionnaire attached. The research is for academic purpose only. Your responses will be highly confidential and your participation in this research will be highly appreciated.

Warm Regards,
Irene Khasandi Khabuchi.

Appendix 2: Questionnaire

QUESTIONNAIRE

Dear respondent,

My name is Irene Khasandi Khabuchi, a master**'s** student. I am carrying out a research titled ***'The Effects of Water Hyacinth Invasion on Women's Household Activities in Karachuonyo, Homa Bay County'.*** I kindly request you to help me collect the relevant data by filling this questionnaire. Any response given will be used for the purpose of research only:

Section A: Demographic information

1. Kindly indicate your age

   Below 18 years ☐ Btw 19-24 years ☐ Btw 25-30 years ☐ above 30 years
2. Gender: Male ☐ Female ☐
3. Academic qualifications:
   Primary ☐ Secondary ☐ Degree ☐ Other ☐
4. What is your occupation? Farming ☐ Trade ☐ Fishing ☐
   Both Farming and Fishing ☐ Bodaboda ride ☐ Professional ☐ Any other ☐
5. Type of family
   a) Monogamous ☐ Polygamous ☐ Single Parent ☐ Other ☐

   (Explain) _____
6. Tell me your sub-county/ place of residence _____

Economic effects of water hyacinth on women's activities

7. Tell me ways by which you meet your needs or you get your daily bread

8. Has the invasion of the lake by water hyacinth affected your sources of income? Yes ☐ No ☐
   If no, move to the next question. If yes, explain

9. Do you have alternative sources of income apart from fishing? Yes ☐ No ☐
   If yes, explain. If no, move to the next question

10. Are there organizations that support your financial needs? Yes ☐ No ☐
    If yes, explain. If no, move to the next question

11. Tell me other ways by which your income can be boosted.

Effects of water hyacinth on education

12. Has hyacinth invasion affected your ability to acquire education? Yes ☐ No ☐
    If yes, explain. If no, move to the next question.

13. Tell me how access to education can be enhanced during this hyacinth invasion.

14. Tell me how education can improve your health

15. Tell me how education can improve your income

16. Tell me how education can improve your relationship with others

Effects of water hyacinth invasion on people's health

17. Do you think women's health has been affected since the hyacinth encroached fishing grounds? Yes ☐ No ☐
    If yes, explain. If no, move to the next question.

18. Which health conditions are associated with water hyacinth invasion in the area?

    Infertility ☐ Human papilloma virus ☐ Gonorrhoea ☐

    Other ☐ (specify)…….

19. Are there organizations that support women with health condition? Yes ☐ No ☐
    If yes, how do these organizations help women? If no, move to question 20

20. Tell me ways by which these health problems can be addressed.

21. In case of health problems, where do you get help?

Effects of water hyacinth on social interaction

22. Tell me how frequent you meet since hyacinth invasion of the lake**.**

23. How has water hyacinth affected your meetings with friends?

24. Tell me how important those meetings are to you and to your friends

25. Tell me what you think can be done to resolve this isolation or separation brought about by your inability to meet as frequent as possible.

THANK YOU

Appendix 3: Focus Group Discussion Guide

I am a Masters student at St. Paul's University, Nairobi Campus and as part of the requirement of a Masters in Development Studies; I shall be conducting a research on the effects of water

hyacinth invasion on women's livelihoods in Karachuonyo, Homabay County, Nyanza region of Kenya.

I kindly request that you find time to fill the questionnaire attached. The research is for academic purpose only. Your responses will be highly confidential and your participation in this research will be highly appreciated.

Please tick one option that best applies to you from the alternatives below:

1.0 I consent to the interview/discussion ☐

2.0 I don't consent to the interview/discussion ☐

If the choice of the respondent is 1.0 above, proceed with interview

1. Mapping of the Water hyacinth problem:
    a. What is the history of WH in the area?
    b. The areas mostly affected by water hyacinth in (sub-county, location, sub-location)
2. Impact of the problem:
    c. Would you consider water hyacinth as beneficial or a problem to the community?
    d. Why do you think water hyacinth is a problem or beneficial?
    e. What activities in the communities are mostly affected by or concerned about Water Hyacinth in the area?
    f. Are the problems associated with water hyacinth?
        i. Social? (e.g. affecting how people live) explain
        ii. Economic? E.g. touching on people's livelihoods/incomes (explain)
        iii. Environmental? E.g. affecting the ecosystem (explain)
3. How would you wish to be engaged in the water hyacinth control initiatives?
4. Which are some of the projects in place or implemented before on water hyacinth? (Date of project commencement and duration of the project; what is the general trend of WH problem? what impact - Increase/Decrease/No change/No knowledge?)
5. What are the suggestions for a priority WH-management project?
6. Collaboration and recommendations

g. What suggestions do you have to improve the management of WH in your county?
h. What are the available opportunities for communication and information-exchange mechanisms on water hyacinth problems?
i. What suggestions do you have for improving interregional/inter-county control of water hyacinth?

7. Which control methods have you heard about?
8. Which other ideas do you suggest for initiatives to establish long-term framework using lessons from awareness and knowledge of the water-hyacinth problem?
9. What are some of the specific constraints you would anticipate in the implementation process?

Many thanks for your participation

Appendix 4: Key Informant Guide

I am a Masters student at St. Paul's University, Nairobi Campus and as part of the requirement of a Masters in Development Studies; I shall be conducting a research on the effects of water

hyacinth invasion on women's livelihoods in Karachuonyo, Homabay County, Nyanza region of Kenya.

I kindly request that you find time to fill the questionnaire attached. The research is for academic purpose only. Your responses will be highly confidential and your participation in this research will be highly appreciated.

Please tick one option that best applies to you from the alternatives below:

1.0 I consent to the interview/discussion ☐

2.0 I don't consent to the interview/discussion ☐

If the choice of the respondent is 1.0 above, proceed with interview

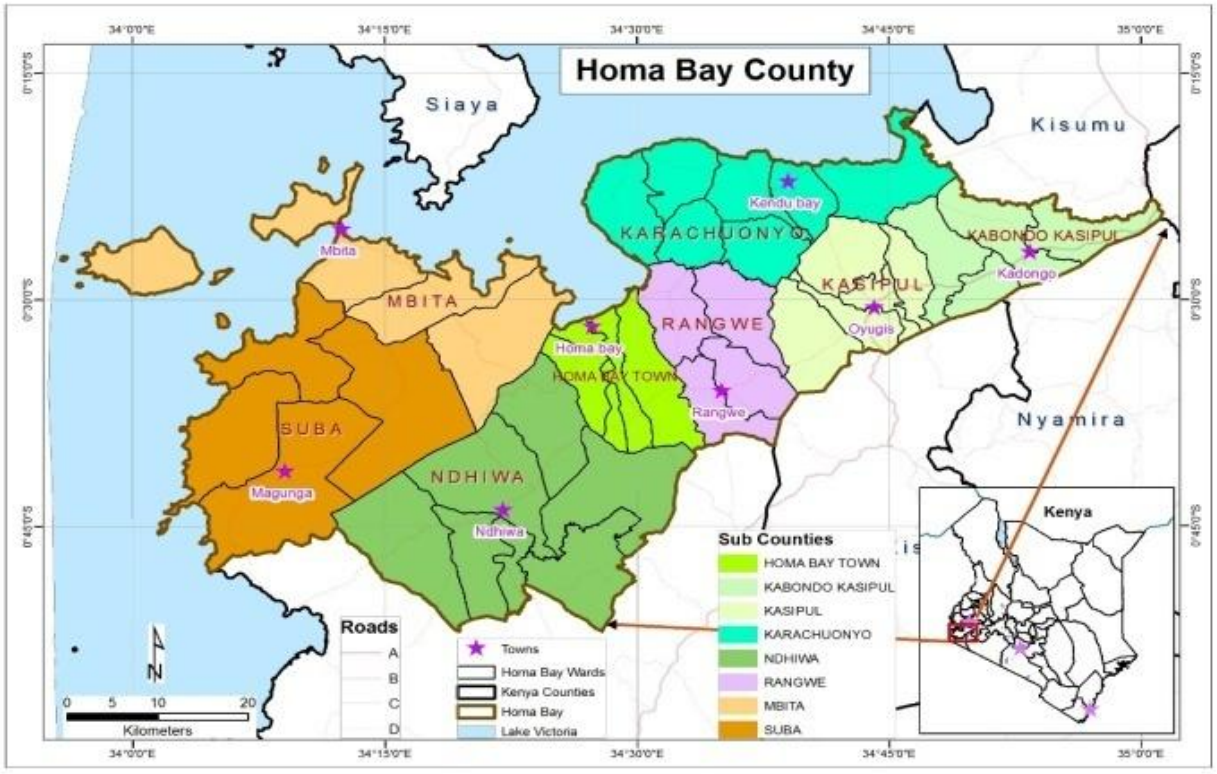
10. Mapping of the Water hyacinth problem:
    j. What is the history of WH in the area?
    k. The areas mostly affected by water hyacinth in (sub-county, location, sub-location)
11. Impact of the problem:
    l. Would you consider water hyacinth as beneficial or a problem to the community?
    m. Why do you think water hyacinth is a problem or beneficial?
    n. What activities in the communities are mostly affected by or concerned about Water Hyacinth in the area?
    o. Are the problems associated with water hyacinth?
        iv. Social? (e.g. affecting how people live) explain
        v. Economic? E.g. touching on people's livelihoods/incomes (explain)
        vi. Environmental? E.g. affecting the ecosystem (explain)
12. How would you wish to be engaged in the water hyacinth control initiatives?
13. Which are some of the projects in place or implemented before on water hyacinth? (Date of project commencement and duration of the project; what is the general trend of WH problem? what impact - Increase/Decrease/No change/No knowledge?)
14. What are the suggestions for a priority WH-management project?
15. Collaboration and recommendations

p. What suggestions do you have to improve the management of WH in your county?
q. What are the available opportunities for communication and information-exchange mechanisms on water hyacinth problems?
r. What suggestions do you have for improving interregional/inter-county control of water hyacinth?

16. Which control methods have you heard about?
17. Which other ideas do you suggest for initiatives to establish long-term framework using lessons from awareness and knowledge of the water-hyacinth problem?
18. What are some of the specific constraints you would anticipate in the implementation process?

Many thanks for your participation

Appendix 5: Map of Homabay County



Source: Government of Kenya, 2013

Appendix 6: Work Plan

	FEBRUARY	**MARCH**	**APRIL**	**MAY**
Proposal Corrections				
Obtaining a research permit from NACOSTI				
Data Collection				
Complete writing of Dissertation				
Dissertation Corrections				
Dissertation Submission				

Appendix 7: NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION RESEARCH AUTHORIZATION