STATUS AND CONTRIBUTION OF FISH FARMING UNDER ECONOMIC STIMULUS PROGRAM IN KITUI CENTRAL SUB-COUNTY, KITUI COUNTY

BY

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DECLARATION

This thesis is my original work and has not been submitted for award of master's degree in any other university.

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DEDICATION

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ABBREVIATIONS AND ACRONYMS

AAK	Aquaculture Association in Kenya
ASALs	Arid and Semi-Arid lands
CCIGs	Community Common Interest Groups
CCRF	Code of Conduct for Responsible Fisheries
CIDP	County Integrated Development Plan
DFID	Department for International Development
EIA	Environmental Impact Assessment
ERPARDP	Economic Recovery Poverty Alleviation and Regional Development Program
ERS	Economic Recovery Strategy
ESP	Economic Stimulus Program
FAO	Food and Agricultural Organization
FFEPP	Fish Farming Enterprise and Productivity Program
GoK	Government of Kenya
ILRI	International Livestock Research Institute
KEBS	Kenya Bureau of Standards
KFDA	Kenya Fisheries Development Authority
KMFRI	Kenya Marine and Fisheries Research Institute
KNBS	Kenya National Bureau of Statistics
KWS	Kenya Wildlife Service

LIFDCs	Low Income Food Deficit Countries
MCS	Monitoring Control and Surveillance
MoFD	Ministry of Fisheries Development
MoLFD	Ministry of Livestock and Fisheries Development
NEMA	National Environment Management Authority
NGOs	Non-Governmental Organizations
PRSP	Poverty Reduction Strategy Paper
SPMC	Stimulus Project Management Committee
SPSS	Statistical Package for Social Sciences
SRA	Strategy for Revitalizing Agriculture
TISA	The Institute for Social Accountability

Definitions of Terminologies:

Adoption: Refers to a process composed of learning, deciding and acting over a period of time.

Extension: Refers to essential education of disseminating agronomic techniques and skills to farmers with the aim of bringing about positive behavioral changes among farmers.

Food security: Refers to the degree of food availability, access to food, stability of food supply and utilisation.

Household: Refers to a person or group of persons generally bound by ties of kinship who live together under a single roof or within a single compound and who share a common way of life in that they are answerable to the same head and share a common source of food.

Livelihoods: Refers to peoples means to secure the necessities of life which are highly dynamic and shaped by a variety of different factors and forces that are themselves shifting constantly.

Status: Refers to a situation at a particular time during a process.

ABSTRACT

In 2010, the Economic Stimulus Program (ESP) was initiated by the Government of Kenya with the aim of encouraging aquaculture in Kenya. Kitui Central Sub- County benefited with 200 fish ponds under ESP. However, their status is not known in terms of production, challenges and the contribution of fish farming to household wellbeing. To address this, a sample of sixty (60) fish farmers were used from the targeted 200 fish farmers who benefited from the Government's support. The primary data collected using pre-tested structured questionnaires were coded, organized and analysed. Chi square and regression analysis were carried out to generate percentages, frequencies, Pearson's correlation and multiple regression tables. Results showed that lack of information, lack of sufficient water , lack of adequate funding, poor pond management and lack of quality fingerlings predicted fish farming significantly ($P<0.05$). This study also established that there is a strong positive correlation ($r = 0.73$, $P < 0.05$) between fish farming and household wellbeing. This was by more household assets, fees payment, improving household income, better health care and diet diversity as well as putting idle land to use. From the study, the policies and frameworks influencing fish production in the study area were; the policy on formation of groups, registration of farms, training of farmers and pond management policies. There was a significant association ($\chi^2 = 65.423$, $p< 0.05$) between policies, frameworks and fish farming. The study also revealed that the main fish farming stakeholders were; ESP officers, group members, fisheries department in the County and Government Ministry. The study recommends that stakeholders increase the number of extension officers in order to reach every fish farmer. In addition the County Fisheries Department of Kitui should ensure support to fish farmers for sustainability of projects after Government subsidies are terminated.

Key words; **aquaculture, status, livelihoods, Economic Stimulus Program**

CHAPTER ONE

INTRODUCTION

1.1 Background Information of the Study

Aquaculture entails the propagation and rearing of aquatic species in controlled or selected environments as defined by National Aquaculture Act of 1980 (FAO, 2007). Aquaculture is an important fisheries sub-sector of the Agricultural sector that has substantial potential to significantly contribute to food security, poverty reduction, employment creation and reduction of pressure on capture fisheries and contributes to conservation of wild fish diversity. Moreover, it is an enterprise that can easily be integrated into small-holder farming systems (MoFD, 2008), thus contributing to efficient land utilization. Global fish production continues to outpace world population growth and aquaculture is the fastest growing food production system globally, with an 8.8% increase in production of animal products per year since 1985 (FAO, 2007).

Millions of people around the world find a source of income and livelihood in the fisheries and aquaculture sub-sector. Most recent estimate indicates that 58.3 million people were engaged in the primary sector of capture fisheries and aquaculture in 2012 (FAO, 2014). Budak, (2010), forecasts that the annual increase in seafood consumption will be about 1.5kg per person in 2020, which would make the demand for seafood products considerably higher than it is now and more than 10 million metric tons of additional seafood would be consumed each year.

In 2014, global total capture fishery production was 93.4 million tons of which 81.5 million tonnes was from marine waters and 11.9 million tonnes from inland waters. China remained the major producer followed by Indonesia, the United States of America and the Russian Federation. Production from aquaculture in 2014 amounted to 73.8 million tonnes with China accounting for 45.5 million tonnes or more than 60% of the global fish production from aquaculture. Other major producers were India, Viet Nam, Bangladesh and Egypt.

Aquaculture was introduced to sub-Saharan Africa in the 1950s' with the main objectives of improving nutrition in rural areas, generation of additional income, diversification of activities to reduce risk of crop failures and the creation of employment in rural areas (Hecht,2006). In addition, FAO (2015) noted that in Africa, aquaculture production has increased by 56% in volume and more than 100% in value between 2003 and 2007. This growth was driven partly by increasing prices for aquatic products along with the emergence and spread of small and medium scale aquaculture enterprises. Moreover, a significant investment in cage culture accompanied with the expansion of large commercial ventures, some of which produce high value commodities for overseas markets, contributed to this growth in aquaculture (FAO, 2010).

Egypt dominates aquaculture production in Africa (FAO, 2015).In East and North Africa, some countries have invested heavily in capacity building and infrastructure development for aquaculture. Several countries in sub-Saharan Africa including Angola, Ghana, Mozambique, Nigeria, Uganda and United Republic of Tanzania, have also experienced good growth in aquaculture (FAO, 2010). In other countries in Sub-Saharan Africa like Cameroon Rwanda Zimbabwe Zambia, Mozambique, Madagascar and Uganda, growth has been held back by persistent bottlenecks such as access to good-quality feed, seeds, civil strife and market strikes (Macharia et. al, 2000). However, African governments have demonstrated increasing support for aquaculture, presumably anticipating benefits for economic growth, food supply and security as well as in the form of poverty alleviation (FAO, 2010). In addition, it has been shown that about 43% of the African continent has the potential for Tilapia, African Catfish and Carp culture (Ridler and Hishamunda, 2001).

Fish farming was first introduced in Kenya by colonialists in the early 1900 through the introduction of trout (*Oncorhynchus mykis*) in rivers for sport fishing (Ngugi et al., 2007). This progressed into static pond culture of species such as Nile tilapia (*Oreochromis niloticus*), Common carp (*Cyprinus carpio*) and African Catfish (*Clarias gariepinus*) in 1920s' (Maar et al., 1966). In 1954, the department of fisheries was started and a programme of stocking dams and ponds was initiated in western Kenya . According to Ngugi et al., (2007), the government popularized fish farming in 1960s' through the "eat

more fish campaign", as a result of which fish farming spread in many parts of Kenya including areas of non-fish eating communities. However, the number of productive ponds declined in 1970s' mainly because of inadequate extension services, lack of quality fingerlings and insufficient training for extension workers. Until mid-1990s', fish farming in Kenya followed a pattern similar to that observed in many African countries which is characterized by small ponds, subsistence level of management and very low levels of production (Ngugi et al., 2007).

The Kenyan aquaculture industry has experienced slow growth for decades until 2009, when the government funded Economic Stimulus Program (ESP) that increased fish farming nationwide. The ESP coordinated by the Ministry of Fisheries Development was introduced through the 2009/2010 budget with the aim of stimulating the long term growth and development of Kenya's economy through rapid creation of business opportunities and jobs (MoFD, 2010). The program focused on sectors of the Kenyan economy that would generate maximum benefits, restore confidence and assist the business community, while protecting the livelihood of the poor and creating jobs to the youth (GoK, 2009). This programme had key objectives of boosting the country's economic recovery as well as turn around the economy to the envisioned Medium Term Growth Plan. The program invested in long term solutions to the challenges of food security, expanding economic opportunities in rural areas for employment creation and promoting regional development of equity and social stability (Manyala, 2011).

Under the ESP, large investments were undertaken in 27 key sectors of the economy, fisheries/aquaculture being one of them. According to a study conducted by Mwangi (2008), the government took keen interest in fisheries due to its potential and has given it the priority it deserves. His sentiments are confirmed by the government's incorporation of fish farming in the ESP to help jump start the economy by providing food and income to the rural inhabitants, eradicating poverty and creating jobs to the poverty stricken areas (GoK, 2009). The programme targeted areas with high population, small farmlands, mass poverty with low incomes and fluctuating farm productivity, but with water available to sustain the programme.

In 2010, the Ministry of Fisheries Development rolled out the Fish Farming Enterprise Productivity Programme (FFEPP) under the ESP and the Economic Recovery Poverty Alleviation and Regional Development Programme (ERPARDP). Phases 1 and 2 of the FFEPP were implemented in 2010 under the ESP and ERPARDP respectively (Maina et al., 2014). The main activity of both phases was to establish fish ponds in selected regions in the country in order to promote commercial aquaculture. This was executed through the provision of extension services where farmers were trained in order to improve nutrition, alleviate poverty and create over 120,000 employment opportunities (TISA, 2010).

Two hundred fish ponds were constructed for each of the 140 selected political constituencies (Charo et al., 2010) at an estimated cost of KSh 1.12 billion (KSh 8 million per constituency (GoK, 2012). Ponds were constructed by the willing youth within the benefiting constituency. Fish farmers who were selected as beneficiaries were funded with KSh. 40,000 to construct a pond, provided with 1000 fingerlings of monosex tilapia per fish pond and 15kg of fish feeds. During the second phase (2011/2012) financial year, additional 100 fish ponds were constructed in each of the first 140 constituencies and an additional 20 new constituencies benefited with 300 fish ponds each making a total of 48,000 ponds countrywide (Mwamuye et al., 2012). The government therefore expected a huge improvement in fish production. By the year 2013, the government had constructed over 48000 fish ponds all over the country under its ESP. However, most of the fish farmers are yet to realize their returns due to various challenges that they have faced (Kimathi et al., 2013).

In Kitui County, majority of the residents derive their livelihoods from agriculture (Kitui county Government, 2010-2015). Most of the farmers in the county are smallholders and the family is the source of labour in the agricultural production systems. Crop farming plays a key role in poverty reduction, food security and creation of employment opportunities in the county. The main food crops produced are cereals including maize, millet and sorghum, pulses like green grams, beans, cowpeas and pigeon peas; root crops include cassava and sweet potatoes. The local people depend mostly on rain fed agriculture which has disappointed many farmers due to unreliable rainfall characterised

by prolonged drought leading to crop failure. This has necessitated the need for alternative livelihood, like fish farming, beekeeping (apiculture) and poultry farming.

Fish farming in Kitui County begun in 1980s' but on extensive levels whereby the fish farmers did very little in terms of pond management practices (Mutambuki, 2014). When the government introduced fish farming in over 140 constituencies in Kenya under ESP, farmers in Kitui County jumped at the offer in what promised to revolutionalize fish farming (Otieno, 2011). Fish farming techniques in Kitui have been a sojourn of trials and error over many years in the arid area. The first phase of ESP 2009/2010 financial year was implemented through the Ministry of Agriculture under the Kitui District Fisheries Department currently the Kitui County Fisheries Department. This time, Kitui County had five sub-counties, namely Kitui East, Kitui West, Kitui Central, Mwingi South and Mwingi West. In 2009/2010 financial year, Kitui Central and Kitui East benefited with 100 fish ponds each while Kitui West benefited with 200 fish ponds. During the 2011/2012 financial year, Kitui Central and Kitui East Sub-Counties benefited with additional 100 fish ponds each while Mwingi South and Mwingi West benefited with 300 fish ponds. In addition, Kitui Rural and Mwingi Central sub-counties each benefited with 100 fish ponds. During the 2012/2013 financial year, three constituencies, Kitui Rural benefited with 10 fish ponds while Mwingi Central benefited with 15 fish ponds. This brings to total of 1,230 fish ponds in Kitui County under the ESP programme (Kitui County Fisheries, (2013-2017).

Fish farming improves the lives of its citizens through enhancing the sectors' contribution to wealth creation, increased employment for youth and women, food security and improvement of the economy through foreign exchange earnings of fish exports (ESP, 2009). However, the hasty uptake of fish farming in Kitui County under the ESP came with its fair share of setbacks, including access to markets and market information, policy, legal and institutional frameworks, lack of access to water, poor human capabilities, lack of skills for stakeholders, quality and adequate seed availability (National Aquaculture Strategy and Development Plan, 2010-2015). In addition, most of the fishponds have performed below expectation as a result of inadequate and high cost of inputs and lack of technical expertise (FAO, 2015).

1.2 Statement of the Problem

There is a renewed interest in aquaculture in Kenya, a fact contributed by the government's initiative on ESP. Farmers in aquaculture potential areas across the country turned to fish farming as a way of producing high quality fish either for their families or for extra income. The small scale farmers in some selected 140 constituencies have been the government's target, with the introduction of 48,000 fish ponds at a cost of over 15 million US dollars across the country. As a result, the contribution of aquaculture in fish production to the economy increased enormously.

However, despite the government's effort to promote aquaculture, the projects did not perform as expected, and most farmers in Kenya and Kitui County slowly adopted the fish farming projects. In addition, not all fish ponds constructed were stocked with the 1000 tilapia fingerlings. The beneficiaries of the project had the responsibility to purchase and install the polythene pond liners. Some of the farmers were not able to meet these requirements by the time the ESP program funding came to close (Musyoka and Mutia, 2016). There are many cases where farmers eventually abandoned their ponds even before the first harvest. Mwamuye et al., (2012) and Munguti et al., (2014) found that most farmers who are still holding on to the venture are yet to realize their returns due to challenges they are faced with. That notwithstanding, very little has been done to establish the status of fish farming in Kitui, and more so the effect of ESP on fish farming in the county. It is against this backdrop that this study was conducted in order to investigate the status of fish farming under ESP in Kitui Central sub-county Kitui County, as well as determine why this initiative on fish farming has suffered from slow adoption and non-sustainability.

Previous studies have not looked at the effect of fish farming under ESP since its implementation in 2009/2010. For example, Shitote et al., (2012), looked at the challenges facing fish farming development in Western Kenya, Mutambuki, (2014) looked at marketing strategies of commercial fish farming under ESP in Kitui County and Musyoka and Mutia, and (2016) looked at the status of fish farming development in arid

and semi-arid counties of Kenya in Makueni. This study is set to bridge the gap in knowledge by trying to find out the status and contribution of fish farming under ESP.

1.3 Justification of the Study

The government, together with non-governmental organizations and the community, has invested a lot in terms of finances, labour and infrastructure towards fish farming but the projects are failing. Many of the fish ponds that were initiated under the ESP in Kitui Central sub-county are being abandoned or have been abandoned, while other ponds have a low output in terms of harvest. Demand for fish in Kitui is very high but supply is low as evidenced by the high prices of fish in Kitui market. Kitui central receives more rainfall than other parts of the County hence fish farming is expected to perform better in this area.

Kitui Central sub-county benefitted from 200 fish ponds and their status is not known in terms of production, challenges and the contribution of fish farming to household wellbeing. To bridge this gap, a thorough understanding of the factors affecting fish farming, role of stakeholders, policy frameworks in fish farming and the contribution of fish farming to household wellbeing, was a necessary task to be undertaken.

Therefore, this research sets the scene for further research as it aims to identify key areas that should be focused on to assist in developing the fish farming sector in Kitui County and in Kenya as a whole. The study findings will also assist any organisation aiming to encourage growth of fish-farming sub-sector in Kitui County as it will help them in understanding some of the challenges that face fish farming in Kitui County. The research will hopefully contribute towards the development of fish farming in Kitui County. This research presents lessons from farmers who are attempting to eke out a livelihood from small scale fish farming with or without government support. It illustrates some of the successes and challenges of the activity and offers insight to future fish farming success for farmers willing to attempt it. To the existing farmers it provides an eye opener on their weaknesses. This research will enable the government and other development partners to get information which will help them make informed decisions in future and refocus on how best to support the fish farming industry for sustainability.

1.4 Objectives of the Study

1.4.1 Overall Objective

The overall objective of the study was to evaluate the status and contribution of fish farming under Economic Stimulus Programme (ESP) in Kitui Central sub-county, of Kitui County.

1.4.2 Specific Objectives

1. To identify factors influencing fish farming in Kitui Central sub-county of Kitui County.

2. To determine the contribution of fish farming to household wellbeing (income, employment) in Kitui Central Sub-county.

3. To determine the policies and legislative frameworks influencing fish farming in the study area.

4. To identify the roles and responsibilities of fish farming stakeholders/actors in the study area.

1.5 Research Questions

1. What are the factors influencing fish farming in Kitui Central sub-county Kitui County?

2. What is the contribution of fish farming to household wellbeing specifically income and employment in Kitui Central sub-county Kitui County?

3. What are the policies and frameworks influencing fish farming in the area?

4. Who are the fish farming stakeholders/actors in the study area and what are their roles?

1.6 Assumptions of the Study

The researcher assumed that all respondents understood the questions in a consistent way and that the questions were seeking for information that respondents have and could answer. The researcher also assumed that the respondents read and understood the instructions since the instructions were as clear as possible. It was also assumed that no respondents failed to identify themselves freely since they were informed that the research findings were for academic purposes. It was also assumed that the research instrument provided reliable results.

1.7 Limitations of the Study

Limitations are influences that the researcher cannot control. They are those characteristics of design or methodology that impact or influence the interpretation of the findings from your research. Marshall and Rossman (2011) noted that, there is no research that can be designed without certain limitations. Several limitations were encountered during this study.

The first limitation to this study was that aquaculture is an infant sector in the county and hence, some data was difficult to find or was not available. There is also little relevant academic literature on the topic of this study as it is a relatively new field of study especially to Kitui County. However, for any gaps, necessary data for the study were filled in during the interview process. The second limitation was that the researcher was not able to get all the stakeholders so as to be interviewed in depth but was only able to interview two groups of stakeholders mainly the fish farmers who benefited from ESP program and the County fisheries officers in Kitui Central sub-county. Due to insufficient human resource, the research could not get information on time since the officers were out of office for field visits leaving only one who may not have been able to meet all the needs for various clients who visits their offices. This caused delays in getting the right information. Lastly, a lot of money has been spent on internet during the research work owing to the fact that this research was not sponsored hence the researcher had to invest from own savings and from well-wishers.

1.8 Scope of the Study

The study was mainly concerned with the status and contribution of fish farming after ESP in Kitui Central Sub-county of Kitui County. The study population comprised of fish farmers who benefitted from the ESP in Kitui Central sub-county.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the status of fish farming after ESP. The literature is from journals, articles and other published studies. The chapter is comprised of five sections; the status of fish farming in Kenya, fishing activities in Kitui County, factors influencing fish farming activities in Kitui County, contribution of fish farming to household wellbeing, policies and legislative frameworks influencing fish farming and the roles and responsibilities of fish farming stakeholders. The reviewed literature focuses on studies about the status and contribution of fish farming globally, regionally and locally. The purpose of this chapter is to ensure a thorough understanding of the topic, identify potential areas for research, identify similar work done within the study area, compare the previous findings, critique existing findings, identify gaps that the current study aims at bridging and finally suggest further studies.

2.2 Status of Fish Farming in Kenya

Ngugi et al., (2007) noted that Kenya is endowed with numerous aquatic resources with aquaculture potential. The study continues to reveal that the country has varied climatic and geographical regions, covering part of the Indian ocean coastline, a portion of the largest fresh water lake (Lake Victoria) and several large rivers, swamps and other wetlands, all of which support abundance of native aquatic species. However, since its introduction under ESP, fish farming has not made much further progress and in many cases it has even declined resulting in the abandonment of fish ponds by discouraged farmers.

A study done in Makueni County in Kenya by Musyoka and Mutia (2016) found out that only 15.3% of the fish farmers had their fishponds operational, 11.3% of the ponds being partially abandoned and a massive 73% of the farmers having completely abandoned the project. The study further revealed that the greatest challenges which directly caused the huge numbers of pond being abandoned were lack of pond liner, lack of finance and

inadequate water. The study further found out that farmers are being faced by a major challenge of lack of feeds and fingerlings which are essential for continued aquaculture production. A large number of potential fish farmers have never stocked their ponds because of inability to afford the pond liners which were being sold at an average of KES 70,000.This led them either to abandon the project or purchase cheap poor quality pond liner which got torn soon and the farmers abandoned their ponds. Maina et al., (2017), found out that, Kibwezi sub-County had experienced a 57% drop in fish farming projects since the introduction of ESP, where farmers have abandoned the fishponds. Based on this study, it was apparent that fish farming had not attained its expected rate of adoption in the sub-county. Other studies by Howard and Omlin (2007) show that fish farming in Kenya is still underdeveloped with an annual production of only 1,000 tonnes. They attributed this low production to abandonment of fish ponds in some regions like Western Kenya where abandoned fish ponds became a breeding place for mosquitoes leading to increase in malaria infections.

2.3 Fishing activities in Kitui County

Kitui County offers a conducive environment for the growth and production of fish species like Nile Tilapia (*Oreochromis niloticus*), the African Catfish (*Clarias gariepinus*) and Common carp (*Cyprinus carpio*) among others. The Kiambere Dam and other dams comprising of the seven forks, Tana River and Athi River forms the highest potential for capture fisheries resources in the county. The fishing system involved in the capture of fish include gillnets, line and hooks, beach seine and seine nets, and traditional traps (ukuono), which forms the greatest capture methods for capture fisheries in the county. Riverine fisheries mainly in the Tana and Athi rivers is also practiced where the fishers use traditional traps, gillnets, seine nets, rod-lines and hooks. The riverine fisheries include tilapia, catfish, eels, black bass and haplochromis (Kitui County Government, (2013-2017).

The county also has many earth dams in which community common interest groups embark on the management of the fisheries resources at dam level. In the effort to enhance the fisheries resource base for the Communities Common Interest Groups

(CCIGs), Kitui County Ministry of Fisheries developed a programme of rehabilitating and restocking earth dams in the county. However, the capacity to retain water during adverse drought was a major challenge. The fishers use traditional traps, gillnets, seine nets, rod-line and hooks to capture the fish. Foot fishers are commonly found in this system of production and the fish species caught include tilapia, cat fish, barbus and mud fish.

Under the ESP program, fish farming was identified as one of the strategies to increase fish production as well as one of the most current and futuristic ways of enhancing the supply of fish. Consequently, fish farming became an avenue to increase and sustain fish production in the county. Farmers were recruited to venture into fish farming through this program. The farmers undertook the management of fish ponds throughout the growth period. The system of production in fish ponds include partial or complete harvesting. The partial harvesting system includes the use of seine nets, scoop nets, rod-line and hooks while the complete harvesting system involves total draining of water from the ponds. The culture system adopted by farmers in the county includes monoculture (rearing of single species) and polyculture (rearing of more than one species) where tilapia and catfish are reared singly or in the same pond at the same time respectively (Kitui County Government, 2013-2017).

2.4 Factors Influencing Fish Farming

There are various factors suspected to influence fish farming in Kitui Central sub-county. Oloo, (2011) found out that aquaculture farmers under the ESP program are faced with various challenges including access to technical information, predatory animals and lack of support from government extension services. These challenges have been a major impediment to the development of fish farming in Kenya. This situation results from lack of resources and technical staff (GoK, 2011). Mwamuye et al., (2012) also cites inefficient dissemination of technology to farmers as one of the key challenges of aquaculture in Kenya. Gitonga et al., (2004), noted that inadequate supply of certified quality fish feed and fingerlings have been a longstanding hurdle to the growth of aquaculture in Kenya. Munyiri, (2013) noted that majority (69%) of the ESP beneficiaries agreed that community members who are not adequately trained on various aspects of

fish farming slow down the implementation process, while 47% strongly agreed that most of the community members are illiterate and have no skills to facilitate effective implementation of ESP. This showed that the community's inadequate capabilities negatively influenced ESP implementation in Kitui central and Kitui west constituencies, Kitui County. It was reported that poor participation of the community members had negatively affected the implementation of ESP, and this mainly led to the community not owning the projects and thus affecting implementation and sustainability. Mutambuki, (2014) study in Kitui County established that inadequate training was a major factor affecting competence in marketing of commercial fish farming under ESP. In Kitui, there are no earlier studies done on the factors influencing fish farming and performance of fish farming supported by ESP. This therefore necessitated the need to conduct a study on the status of fish farming projects in Kitui Central sub-County, Kitui County.

2.4.1 Gender and Fish Farming

Medina and Baconguis, (2012) stated that participation of women and youth throughout the project life cycle is very important for effective implementation and sustainability of food based projects. These authors' advocate for women capacity building, provision of credit facilities and technology development among others for successful implementation of food based projects. A study by Rodgers, (2003) in New York noted that men control most of the resources in the households and are risk takers and hence influence decision making in commercial ventures of most households in Africa. In addition, Onzere (2013) in a study in Nyeri County indicated that women make a major contribution to economic development of their households in the rural areas. A case study in Bangladesh by Sultana, et al., (1998) indicated that there is an increasing role of women in fisheries. Initially, fishing was an occupation done only by Hindu men, and some old and windowed women who caught fish for household consumption. However, owing to the high levels of poverty, currently any poor woman irrespective of religion, age or marital status can be found catching shrimp fry in the coastal area. A study by Branch et al., (2002) in South Africa, showed that most of the fishers were males and that about one third of the fishers in rural areas were women. This study also found that female headed fisheries were more successful compared with those headed by men. This was because mostly fish ponds are constructed within the homesteads and females being homemakers,

they constantly attend their ponds compared to their male counterparts who have other economic activities far from homesteads hence their ponds were not well managed.

A study done in Nankanga Camp of Kafue District in Zambia by Chikopela, (2014), found out that fish farming was male dominated as 77% of fish farmers were males and only 23% were females. In another study done in Ashanti region in Ghana by Abdoulie, (2010), it was shown that 96% of the fish farmers were males with only 4% being females. Other studies done in Kenya by Maina et al., (2014) in Mwea irrigation scheme in Kirinyaga County, found out that men formed 90% and females 10% of the total fish farmers. This disparity was attributed to the fact that one of the conditions for participation in the Fish Farming Enterprise Productivity Program (FFEPP) was that the farmer had to own the land and majority of registered land owners in Kenya are men.

Musyoka and Mutia (2016), surveyed fish farming in Makueni County and found out that majority (69.5 %) of the respondents were males with only 29.2 % representing the females. This difference was attributed to the same reason of land ownership which is controlled by men. In a similar study, Maina et al., (2017) found out that females represented 10% of the fish farmers in Kibwezi in Makueni County. Research findings by Rose, (2013) in a study in Embu North District indicated that 50.9% of the respondents were males and 49.1% were females while Mutambuki et al., (2011) found out that 30.5% of fish farmers were females in a study done in Kitui County. In addition Ngwili et al., (2015) showed that majority of farmers 80% were males in Kiambu and 74% were males in Machakos. Other studies by Kimathi et al., (2013) showed that majority of respondents were males who represented 72% while women comprised of 27% of the total sampled fish farmers in Tigania East, Meru county.

Research findings by Kathambi, (2013) in North Imenti Constituency, Meru County, established that the majority of respondents were males represented by 55.6% while females formed 44.4% of the respondents. This showed that there were more males than females CDF staff managing the ESP projects. Esther and Kangiri, (2016) found out that, majority of the individuals involved in the management of the projects were males comprising of 97.7% of the respondents while 2.3% were females in Kiambu County.

This was an indication that women were few in the management of the projects which could be attributed to social cultural aspects. Mwanyumba, (2010) in his research in Taita district, Wundanyi location found out that most of the fish farms workers were women.

Shitote found out that majority 71.4% of fish farmers were male while females were 28 .1% in western Kenya. This showed that males participated more in fish farming than females. All the above studies show that fish farming under the ESP programme was predominantly controlled by men. This study is set to uncover the possible gaps on how gender influences fish farming projects for improvement of livelihoods in the study area.

2.4.2 Age and Fish Farming

A study by Chikopela (2014) in Nankanga Camp of Kafue District in Zambia showed that 59% of the household heads were aged below 50years and only 25% were above 61 years. Therefore, majority of the household heads were below 50years, which were regarded as potentially productive farmers with the capacity to adopt new farming practices. In Ashanti region Ghana, Abdoulie, (2010) found out that the youngest age bracket of 31-41years contributed 20% of the fish farmers, 42-49yearrs accounted for 28%, 51-57years represented 32% while the oldest fish farmers of 61-75years represented 20%. Another study by Mwajiande and Lugendo, (2015) in Tanzania, showed that most (69%) of the interviewed fish farmers were within the range of active age from 18-50 years. Chenyambuga et al., (2011) study in Tanzania reported that majority of fish farmers belong to the active working age group of 25-50 years. Manus and Singas, (2014) study in Salamaua of Morobe Province in Papua New Guinea, showed that majority of farmers (96%) were found to be relatively young (ages between 18-35 years) and were observed to be the most active farmers.

Other studies done in Kenya by Maina et al., (2017) in Kibwezi, Makueni County, found out that 71% of fish farmers were within the age bracket of 30-59 years. Rose, (2013) in Embu North District showed that 82.6% of the respondents were in the age bracket of 31-60 years. In another study by Ngwili, (2015) done in Kiambu and Machakos Counties, fish farming was found to be practiced by a relatively larger proportion (61.7% in Kiambu and 69.4% in Machakos) of farmers below fifty years of age. However, results in

a study by Maina et al.,(2014) done in Mwea irrigation scheme in Kirinyaga county, showed that fish farming was carried by farmers across all age categories, with majority of them being below 50years of age. Musyoka and Mutia, (2016), in a study done in Makueni County, found out that about 58% of fish farmers interviewed were over 45 years of age. The minority 0.5% were between 16-25 years while youth below 35 years represented 9.9% indicating that youth were not fully involved in the ESP Programme. In Pakistan, a study by Muddassir, et al., (2017) showed that majority (70.45%) of the respondents belonged to middle age group (30-50 years) followed by old age group above 50 years who accounted for 16.03% while the young age groups of up to 30years were represented 14.4% of the respondents.

2.4.3 Marital Status and Fish Farming

According to a study by Chikopela, (2014) in Nankanga Camp of Kafue District in Zambia, 68.3% of the fish farmers were married while 31.7% were single. Research findings of a study done in Kenya by Rose (2013) in Embu North District, indicated that majority (77%) of respondents were married while 33% were single. In another study done in Makueni County Kenya by Musyoka and Mutia (2016), the married had the greatest representation of 91.7% of the fish farmers' population in the entire county. It was further observed that men control the land units ownership and family income in most homesteads. However, most of the labour in the fish ponds was done by the females despite the males owning the ponds. A study by Syandri, et al., (2016) on marital status of respondents showed that majority of the fish farmers (79.16%) were married while 16.25% were single and 4.58% were widowed in Lake Maninjau of Indonesia. Studies by Shitote et al 2013 showed that majority of fish farmers 79.4% were married, 6.3% single, 12.2% windowed and 2.1% were separated in Western Kenya .Their study established that family responsibilities forced most of non fish farmers to venture into fish farming as a way of raising income to support their families. This study therefore, will establish the influence of marital status on fish farming under ESP in Kitui central Sub-County, Kitui County.

2.4.4 Family size and Fish Farming

Rose, (2013) working in Embu North district, found that 43.5% of the fish farmers had 3-5 members, those below 3 members contributed 24.2%, 6-8 members accounted for 22.4% while households with over 8 members contributed 9.9% of the total fish farmers. This study mirrors findings by Chikopela, (2014) in Zambia where the family size of households engaged in fish farming ranged from one member to eighteen members. Further, the author found that most (62%) of the households had members between 4-9 persons while only 7% of the respondents had 13 household members. The study revealed that household size has a bearing on family labour as most rural households depend on family labour for agricultural production; the larger the family size, the more family labour. Similarly, a study by Manus and Singas, (2014) found out that about 82.5% of the fish farmers had small (up to 4 members) and medium (5-7 members) family sizes. The current study intents to investigate whether the family size of the household have any influence on fish farming projects sponsored by the Government under ESP in Kitui Central Sub-County, Kitui County.

2.4.5 Level of Education and Fish Farming

A study in Tangail District in Bangladesh by Rahman et al.,(2015) observed that 16.67% of fish farmers did not have any formal education, 28.33% had primary level of education, 40% had secondary level of education, 11.67% had high school level while only 3.33% had a university degree and above. They concluded that, overall, fish farmers in the study district were literate persons. Kimenye, (2001) in Mbeere District, Kenya showed that formal education was positively correlated to the ability to adopt farming technologies. Farmers with a higher level of formal education were more likely to adopt fish farming than those with lower levels of formal education. The author attributed this to the fact that much of the fish farming technologies were communicated to farmers through pamphlets, newsletters, trainings and seminars, which are in English. Hence a farmer with formal education was likely to attend seminars and also read, comprehend and apply the information packaged in English documents used to transfer technology in fish farming.

Similarly, a study conducted by Rose, (2013) in Embu North District, showed that 39.1% of fish farmers engaged in fish farming had primary education while 47.8% had secondary education. The study indicated a positive correlation between fish farming and level of education. This implied that farmers with a high level of education could understand technologies involved in fish farming. In addition, results of a study by Ngwili et al., (2014) showed that 23.8% and 16% of fish farmers in Kiambu and Machakos Counties respectively, had not completed primary education while 25.2% and 45.3% of the farmers had attained a minimum of primary school education. This study showed that the percentage of fish farmers who had completed primary level of education was highest for the fish farmers under ESP program in the two counties.

A study conducted by Shitote et ., al. 2013 in Western Kenya showed that majority (61.7%) of fish farmers had primary education, 26.0% had secondary education while 12.3% had tertiary education .This study indicated that fish farming was practiced by farmers with primary education in Siaya County in Western Kenya. These study findings contrasts those of the study by Maina et al., (2014) in Kibwezi, Makueni County that found 58.4% of fish farmers had attained at least secondary level of education. This study aims at establishing whether the level of education of the fish farmers has any influence on the status of fish farming projects under ESP in Kitui central sub-County.

2.4.6 Access to Pond Liners and Fish Farming

According to Munguti et al., (2014), soil texture must be considered when selecting the pond site.. These authors recommend that the bottom of the fish pond, the banks and the dyke must contain enough clay or silt, to prevent seepage and make the reservoir hold water. Bryan et al., (2000) also recommended that farmers should use ultraviolet-treated liners to prevent damage from solar radiation hence prevent water loss through seepage. However, ultraviolet-treated liners are too expensive for the majority of fish farmers. This is supported by findings of Musa et ., al. (2012) in a study done in Western Kenya where majority (93%) of fish farmers had earthen ponds, 2 % having pond liners and 5% with both earthen and liner ponds. Similarly, Musyoka and Mutia (2016) study in Makueni County, showed that 73% of the fish farmers who completely abandoned the fish

farming projects, indicated pond liner as the main challenge facing fish farming in Makueni county. The study further revealed that ESP was only funding the cost of pond construction, supply of 1000 fingerlings and supply of 15kg of fish feed per pond, but not the pond liners. Therefore, majority of farmers managed to construct the ponds and were not able to purchase the pond liner. Thus, unable to afford the liners, some farmers bought normal polythene papers which were not UV treated and could not sustain a single production cycle due to damage by solar radiation. Similarly, research findings by Ngwili et al., (2014) in Kiambu and Machakos Counties, found out that the major challenge in acquiring the pond liners was the high cost of UV treated liners, which were costing KES 30,000 for a 300 m^2 liner and most fish farmers could not afford.

2.4.7 Access to Water and Fish Farming

Water is a very essential factor in fish farming and according to Carballo (2008), sites for establishment of fish farms should be selected only where water of the required quantity and quality is available at the times needed for operating the farm. Preference should be given to sites where gravity water supply to the main farm is possible. Nasser et al., (2012) reported that water quality and quantity in fish ponds is very important in fish production. Water is the culture environment that gives physical support to fish and other aquatic organisms. Nasser et al., (2012), further reported that fish ponds water quality and quantity is very vital to fish production. He indicated that the following instructions be followed carefully; water for fish farming should neither be too acidic or alkaline, water should contain enough dissolved oxygen, water should not be hard, pond water should not be muddy or with offensive color, should be free from pollutants like detergents, oils and petrochemicals, the PH level should be between 6.8 and 9 since when PH level is low (acidic), the water tests sour and prevents phytoplankton growth. In case the water PH becomes acidic, the pond should be limed using agricultural lime. Low oxygen in fish ponds is noted when the fish come up to grasp air and when the water has offensive color. When these signs are detected, immediate action should be taken by stopping fertilization, reducing feeding rate, changing water and replacing it with oxygenated water as well as removing thick mud from bottom of pond from time to time.Water for

fish farming can be sourced from several sources including rainfall, streams, ground water and agricultural irrigation schemes (Behrendt, 1994).

Jacobi (2013) did a research in Kisumu and Homa Bay Counties and revealed that the main challenges in fish farming were predators, water scarcity, marketing and poor management. Rose, (2013) showed that 47.8% of her respondents indicated that water temperature is a great factor when considering construction of a fish pond in Embu North District. The study further showed that most (40.4%) of the respondents obtained water for their ponds from streams, 42% from wells, 30% from springs while 14.9% obtained water from other sources. Munyiri, (2013) showed that the key infrastructure that was required in the implementation of ESP projects was water. This finding was supported by majority of the Stimulus Project Management Committee (SPMC) members (92%).

Kitui being an ASAL region, water is expected to be a major problem. However, this has not been confirmed. Studies from similar socio-economic and ecological zones in Makueni County by Maina et al., (2017), showed that 45.6% of fish farmers obtained water from permanent rivers, followed by 31.5% who obtained water from piped water. The study further observed that rainwater was not a common option of filling fishponds. This study therefore seeks to investigate whether access to water affected the adoption of fish farming in Kitui central Sub-County.

2.4.8 Access to Extension Services and Fish Farming

Rose, (2013) defines Fisheries extension services as the dissemination of the educational advances of institutions to persons unable to take advantage of such in a normal manner. The author further notes that agricultural extension departments are the most important public service institutions with the widest range of responsibilities for agricultural and rural development. According to Adu (2005), the first stage towards the adoption of an innovation is to become aware that it exists and that awareness does not just mean that an innovation exists, but that it has the potential of practical relevance to the farmers. In this regard, agricultural extension provides a vehicle of technology transfer by initiating the development, transfer and diffusion process of innovation (Abalu, 1998).

Quagrainie et al., (2009) observes that in Ghana, the directorate of fisheries and the ministry of agriculture provides free extension services and other technical services to fish farmers which included production of fingerlings for sale at the government operated fish hatcheries. Agbamu, (2000) noted that clamors for high productivity in fish farming can be achieved not only by coming up with improved technology, but by properly organized and adequate extension services. This is when the impact of improved technology can have the desired effects on fish farmers.

According to Oladebo, (2004) in Nigeria, the responsibilities of an extension worker are to help farmers make efficient use of the available resources to meet the nations' food needs. An agricultural extension service promotes the determination of technical choice for specific agricultural population and area. This is by making farm diagnosis, articulate needs of the rural farmers as well as identifying target domains and arousing their interests in their problems. In Kenya, a study conducted by Ngugi and Manyala (2004) showed that one of the biggest constraints facing aquaculture development is the lack of extension staff and infrastructure to deliver technical knowledge to rural smallholders. The study further reveals that technical aspects of constructing even small fish ponds of the appropriate size and depth, and ensuring that they will have suitable sources of water, filtration and aeration is complex, requiring significant education and extension support. Their study concluded that aquaculture extension services which are provided mainly through the Fisheries Department have been found to be too inadequate to disseminate the improved aquaculture technology packages throughout the country. Kimathi et al., (2013) observed that in Tigania, Meru County, 58.3% of the fish farmers claimed that rarely had the extension officers visited them. Further, 3% claimed that they had never been visited by an extension officer. This was attributed to low staffing of technical officers in the study area and lack of funds to facilitate their movement.

2.4.9 Access to Quality Fingerlings and Fish Farming

Musyoka and Mutia, (2016) found out that 59.3% of the farmers in Makueni County not only lacked reliable supply of quantity fingerlings, but also the quality was a challenge. The authors noted that since the ESP programme was initiated, there was a problem of

fish fingerlings supply. This was attributed to the fact that the ESP project was a countrywide exercise and by that time, very few fish hatcheries had the capacity to meet the huge fingerlings demand across the country. Munguti et al., (2014) noted that farmers had given up fish farming because they encountered huge losses after stocking their ponds with low quality fingerlings and using substandard feed. Stocking fish ponds with fingerings of unknown genetic stock has also been identified as a major constraint to aquaculture production in Kenya (Barasa et. al., 2014, 2016).

2.4.10 Access to Good Quality Fish Feeds and Fish Farming

According to Munguti et al., (2014); Craig and Helfrich (2002); Munguti and Charo (2011), fish feed is a key component in any fish farming venture because fish nutrition accounts for 40-50% of the total variable production costs on the fish farm. However, in Kenya today, one of the most pressing challenges in aquaculture is the unavailability of efficient and inexpensive farm made feed for different stages of fish development (Munguti and Charo, 2011).The study further concluded that for optimum fish production in Kenya, the feed industry must be improved to provide quality and affordable feed to fish farmers. In addition, appropriate feed formulation techniques and processing technologies must be communicated to the farmers and commercial feed processors. In another study by Ngwili et al., (2015) done in Kiambu and Machakos Counties, it was observed that formulated fish feed was mainly supplied by the Government. However, majority of the farmers complained of inadequate supply of feeds implying that the GoK was not a reliable source and therefore farmers were forced to purchase inorganic fertilizers and supplementary feeds like maize bran and fish meal from the local market.

2.4.11 Challenge of Predation and Fish Farming

According to a study by Kimathi et al., (2013) in Tigania, Meru County, majority (81.1%) of the respondents claimed that predators were a big problem in their fish farms. These predators included Kingfisher birds, frogs, crocodiles and people (thieves). Similarly, Shitote et al., (2013) reported that 88.3% of fish farmers were affected by predators and predation was a serious threat to fish farming in Siaya County, Western Kenya. The study further indicated that the major predator was Kingfisher birds while

others were human being, crabs, snakes and frogs. Maina et al., (2017) also found that one of the main challenges faced by fish farmers in Kiambu and Machakos Counties was predators, where the Kingfisher was the main predator bird reported by 68.4% of the farmers. Other predators were vultures and snakes. The authors further revealed that frogs caused competition for feed with fish leading to stunted growth of fish. In addition, a study by Musyoka and Mutia (2016) in Kibwezi, Makueni County, indicated that birds were their main fish predators which affected fish farming.

2.4.12 Access to Knowledge on Fish Pond Management Practices and Fish Farming

Shitote et al., (2013) found out that pond management was a serious problem facing fish farmers in Siaya County, Kenya. Their findings revealed that majority (95%) of the respondents faced serious difficulties in managing their ponds. These fish farmers cited problems like drying of fish ponds during drought, lack of quality fingerlings and siltation of the ponds, poor pond maintenance and poor security. According to Bryan et al., (2000), water quality is critical to the beneficial use of pond water, plays a critical role in determining the types and number of fish species to live in the pond as well as their growth and survival rates. Many parameters of water quality vary seasonally, and these changes are normal and accepted. Water can be tested for many parameters like temperature, dissolved oxygen, PH, ammonia, and hardness. Routine testing of water quality helps to identify problems before they become too serious to cause death of fish. El Sayed (2006), reported that pond conditions, seed supply, availability of fish species and operating techniques should be taken into consideration in determining how much should be reasonably stocked. In addition, data from previous years are taken as factors determining stocking density for the following year. According to Johnston (2013), the most common feeding mistake is overfeeding, which occur any time fish are eating more than they need. This can make fish sick and produce excessive waste that strain the limit which can be biologically reduced, resulting in decline of water quality. It is recommended that fish should not be fed more than three times per day.

2.5 Contribution of Fish Farming to Household Wellbeing (Income and Livelihood Changes).

The importance of fresh water fish farming to livelihoods is supported by Zezza and Tascoti (2010), who state that fish farming may have a role to play in addressing issues of food insecurity, which are bound to become increasingly important with the secular trend of urbanization of regions. Fish farming provides a substantial share of income for the urban poor and those groups of households to which it constitutes an important source of livelihood. In Malawi, a study by Dugan et al., (2006), found out that the income of households owning fish ponds was 1.5 times higher than that of households without fish ponds. The study further observed that through employment and income generation from aquaculture and subsequent higher purchasing power, fish farming households often manage to improve their diets through increased food security.

According to DFID (1999), livelihoods can be described as people's means to secure the necessities of life. Livelihoods are highly dynamic and shaped by a variety of different factors and forces that are themselves shifting constantly (Russell et al., 2008). The improvement of livelihoods of people in developing countries is the main mission of many public and governmental institutions, and is successful when communities experience increased well-being and reduced vulnerability through higher incomes, improved food security and more sustainable use of natural resources. Aquaculture of low-trophic level is one way of improving livelihoods in developing countries (FAO, 2012). This was further supported by studies of Russell et al., (2008) who described aquaculture households as being among the more livelihood-secure among communities in Malawi. Fish consumption is higher in small islands, developing states and Low Income Food Deficit Countries (LIFDCs) from tropical Asia and sub-Saharan Africa (FAO, 2012). According to FAO, (2009), fish adds value to water from a farming system standpoint, by converting agricultural and household waste into food when used as feed. To the household, fish adds to the basket of goods produced on the farm. It diversifies the livelihoods option and as an additional enterprise, serves as a fallback plan for food or for

cash, if other enterprises provide low yields or fails. However, it does add to the complexity of farm management and therefore can increase risk (FAO, 2009).

According to a study on financial analysis of fish farming by Gachucha et al., (2014), in Kisii County, Kenya, it was shown that fish farming is a profitable enterprise compared to maize crop farming since the farmers realized positive returns for two subsequent years. Maina et al., (2014), evaluated fish production and marketing in Mwea District, Kenya and the results of the study showed that the mean number of fish harvested by self-funded fish farmers was higher than that of the farmers funded by government under ESP program. The authors further observed that the fish farmers under ESP projects sold higher proportion of fish volumes compared to self-funded fish farmers mainly to neighbors and friends at the pond site. However, the study revealed that the self-funded fish farmers consumed higher proportions and sold excess fish volumes to markets and institutions. This implied that greater experience of fish farming of the self-funded fish farmers had established markets beyond their neighbors.

The study of Maina et al., (2014), further observed that farmers in ESP projects had larger ponds than the self-funded farmers. This was attributed to the fact the government constructed ponds measuring 300 m^2 for the farmers participating in the ESP project. In addition, the government stocked 1000 fingerlings in each fish pond and provided the farmers with only 15kgs fertilizer. The findings of the study by Maina et al., (2014) further revealed that self-funded farmers fertilized their ponds more times per month than those under government support and also changed water in the fish ponds more often than the fish farmers under the ESP project. However, fish production was longer for the fish farmers under FFEPP compared to that of self-funded farmers. This prolonged production period had positive implications on profitability and sustainability of the project. Mutunga (2015), in Matungulu, Machakos County, found out that most (86.67%) of the respondents agreed that pond fish farming can make an important contribution to poverty alleviation by addressing problems of poverty and food security, and a further 9.7% strongly agreed to the contribution of pond fish farming to poverty alleviation.

2.6 Stakeholders Roles and Responsibilities in Fish Farming

Nyandat and Owiti (2013), found out that the stakeholders in fish farming includes fish farmers, fish feed producers, seed/fingerling producers, aqua-shop owners, county directors of fisheries, extension workers, researchers, the national fish farmers association, training institutions and regional bodies. The study further noted that the role of stakeholders is to implement sound management practices of fisheries as well as contribute knowledge and data to support long term sustainability of fisheries. The role of Community Based groups, producer associations, Non-Governmental Organizations and other stakeholders in development of the fisheries sector was to participate in marketing, financing and research, with a view to create an enabling environment for investment, improve production, trade and commerce (MoFD, 2008). A study done by Yongo et, al.,(2007) in Gucha, Meru and Taita-Taveta in Kenya, showed that stakeholders involved in fish farming activities included the ministry of fisheries and development, the Aquaculture Association in Kenya (AAK), local universities, large scale farmers, feed manufacturers, Aqua shops and other Non-Governmental Institutions performing different activities.

According to MoFD (2008), the Government will maintain its role as a facilitator in encouraging investment, promoting the development and management of fisheries, trade and commerce. Moreover, the ministry of fisheries development will have the overall responsibility for the fisheries sector and its development. This responsibility includes fisheries policy development, licensing fishing, development of marine and fresh water fisheries, promotion of fish quality assurance, value addition and marketing as well as development of the Exclusive Economic Zones. Rothuis et al., (2011), argued that different stakeholders play a role in the Kenyan aquaculture sub-sector. These are input suppliers (feeds and technical materials), hatcheries, artisanal processors, local markets, value chain supporters such as credit providers and government agencies, and of course the fish farmers themselves. Also included are industrial processors and export markets.

The ministry of fisheries development works in close collaboration with other ministries in an effort to better coordination and decision making processes for improved service

delivery. The government also strengthens MCS capacity by provision of modern equipment, skill and resources cooperate with the other regional and international organizations for effective and efficient operations. The government will further establish the Kenya Fisheries Development Board with the responsibility for development of fisheries related infrastructure and to raise funds in support of management, research and development. The government is also mandated with restructuring of Kenya Marine and Fisheries Research Institute (KMFRI) to promote and coordinate demand driven fisheries research (MoFD, 2008).

According to Munyiri (2013), a vast majority of ESP beneficiaries (81.3%) indicated that the government was the sole provider of funds to be used in the implementation of Economic Stimulus projects in the community. However, (6.3%) of them indicated that both the government and donors provided the funds. This showed that the government was the single most important financier to the establishment of the ESP projects in Kitui central Sub-County. This study will establish the various stakeholders in fish farming and their roles in Kitui Central Sub-County, Kitui County.

2.7 Policies and Legislative Frameworks Influencing Fish Farming

In the case of fisheries and aquaculture, good governance means developing a responsible and well-regulated policy and institutional environment at national and local levels that involves communities and that recognizes the importance of local needs and expertise in research, education, development, planning, implementation, monitoring, evaluation and regulation (FAO, 2013). In 1979, the Kenya Marine and Fisheries Research Institute (KMFRI) was established by the Science and Technology Act (Cap 250), with the mandate for fisheries research. The principal statute that regulates and governs fisheries today is The Fisheries Management and Development Act No. 35 of 2016. Before this Act, several regulations have been made to cater for the rapid changes in the fisheries sector. With the creation of the fully fledged Ministry of Fisheries Development, in 2013, there was need for comprehensive policy and legislation to support the fisheries management, research and development in a coordinated and rational manner.

The Fisheries sector in Kenya has operated without a fisheries policy since independence and the policy direction in Kenya from 1963 after independence until the 1970s was improving the living standards of people. The policy direction has been articulated in various government documents such as Sessional papers, Development plans, Policy Framework papers and lately, the Poverty Reduction Strategy Paper (PRSP) and vision 2030. One of the earliest policy documents in Kenya was the Sessional Paper No 10 of 1965 on Africa Socialism and its application to planning in Kenya (GoK, 1995). The paper prioritized the elimination of poverty, ignorance and disease. Later, the Sessional Paper No. 1 of 1986 on "Economic Management for Renewed Growth", Sessional paper on Economic Recovery and Sustainable Development to the year 2010 and industrial transformation to the year 2020.

In all these policy documents, poverty has been manifested to include low and unreliable income, poor health, low level of education and literacy, insecurity and uncertain access to justice, disempowerment and isolation from mainstreaming of socio-economic development. The Poverty Reduction Strategy Paper (PRSP) has five basic components and policy objectives; to facilitate sustained and rapid economic growth, to improve governance and security, to increase the ability of the poor to raise their income, to improve the quality of life of the poor and to improve equity and participation.

Today Fisheries Management and Development Act No. 35 of 2016 has been implemented to oversee the success and sustainability of fisheries department. The main objective of the proposed fisheries policy is to create an enabling environment for a vibrant fishing industry based on sustainable resource exploitation, providing optional and sustainable benefits, alleviating poverty and creating wealth, taking into consideration gender equity. Objectives that address aquaculture include; promoting the development of responsible and sustainable commercial aquaculture, recreational and ornamental fisheries and encourage efficient and sustainable investment in the fisheries sector which is both key to successful aquaculture development

The fisheries policy is anchored on two recent sectorial strategies; the strategy for the ministry of fisheries development to create a favourable legal and regulatory framework

for the sustainable development of the sub-sectors including a favourable environment for the creation of a semi-autonomous fisheries institution under the ministry and the Strategy for Revitalizing Agriculture (SRA) 2004-2014, which recognizes the importance of fisheries.

The Ministry of Fisheries and Livestock Development facilitates the creation of Fisheries Board to coordinate all aspects of fisheries development and management of all players in the sector. The board of Kenya Fisheries Development Authority (KFDA) shall have optimal stakeholders' representation including the Department of Fisheries (DoF), Kenya Marine and Fisheries Research Institute (KMFRI), Kenya Wildlife Service (KWS), National Environment Management Authority (NEMA), public universities, private sector and civil society and other stakeholders (GoK, 2005). This study is set to investigate whether the above mentioned policies had any influence on fish farming in Kitui Central sub-County.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter describes the research design, methodology and tools used in the study on the impact of fish farming under ESP in Kitui Central sub-county, Kitui County. The chapter covers the following sections: study area, research method, sampling procedures, sampling instruments, validity and reliability of the instruments, data collection, data analysis and ethical considerations.

3.2 Study Area

The research was carried out in Kitui Central sub-county, Kitui County. The study population included fish farmers who benefitted from the ESP of the government under the Fish Farming Enterprise and Productivity Programme (FFEPP).

Kitui County is situated in the former Eastern province of Kenya and borders TaitaTaveta County to the South, Makueni County to the West, Machakos to the North West, Tana River to the East and Embu and Tharaka Nithi to the North. The county has eight sub-counties namely: Kitui Central, Kitui South, Kitui East, Kitui Rural, Kitui West, Mwingi North, Mwingi West and Mwingi Central.

Kitui County covers an area of 30,570.30 Km^2 of which 6,369 Km^2 is occupied by Tsavo East National Park (Kitui County Government, (2013-2017). According to 2009 population census, it has a total population of 1,012,709 comprising of 205,492 households (KNBS, 2009).The human population growth rate is 2.1% (MOLFD, 2013). In addition, Kitui County has high poverty levels (63%) and high age dependency ratio of 100:1089. This necessitates the need for various livelihood support activities, like introduction of aquaculture under ESP to alleviate this high poverty levels and households to have economic gains from aquaculture.

The local people depend mostly on rain fed agriculture mainly crop farming of maize and small scale mixed farming of maize, beans, millet, vegetables, dairy farming, poultry

farming and fish farming. The government introduced the ESP aquaculture projects whose aim was to improve nutrition, alleviate poverty and create over 120,000 employment opportunities (TISA, 2010), to poverty stricken areas in Kenya, like Kitui County.

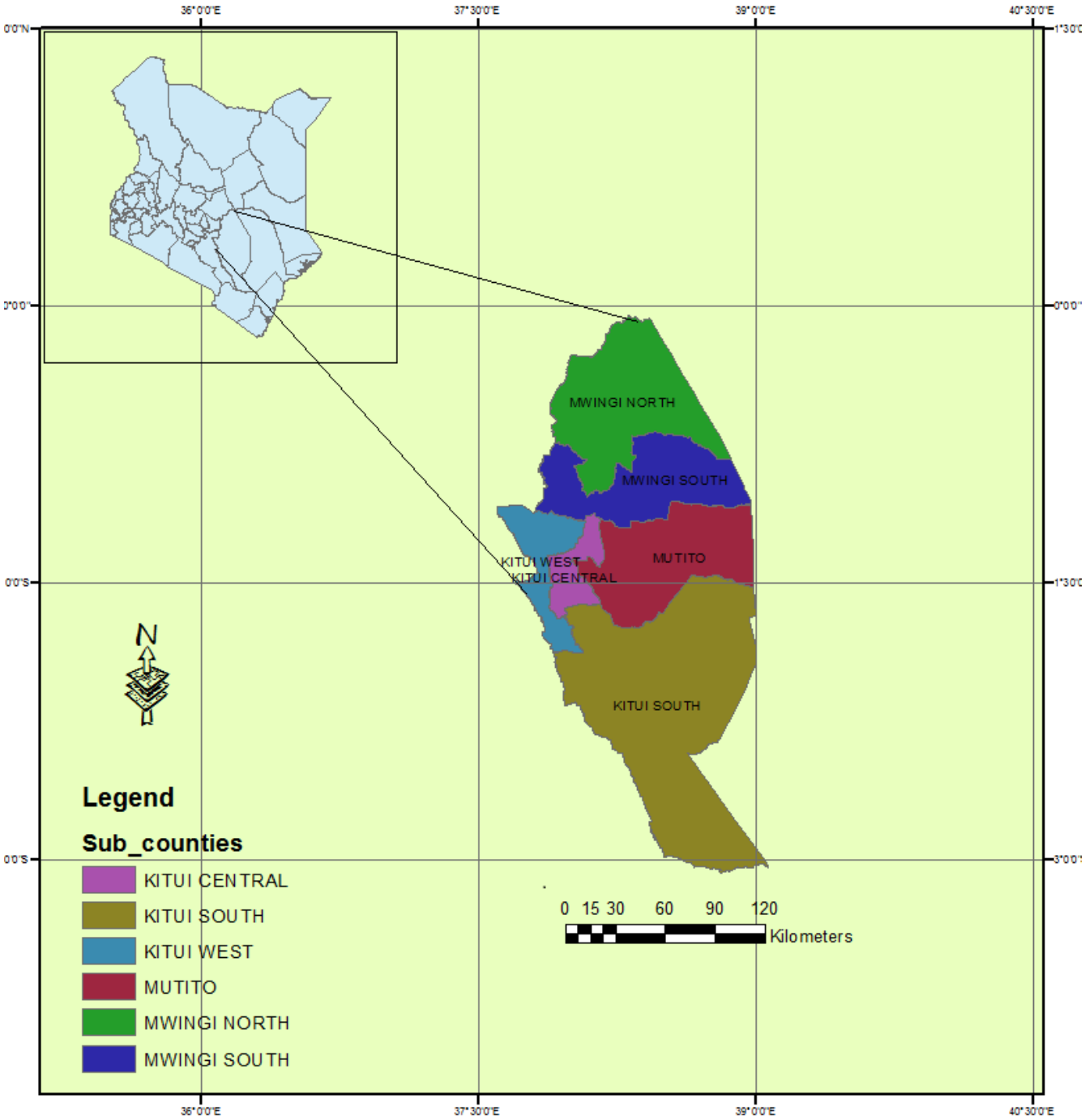

Figure 3.1: Map of Kitui County showing the various sub-counties. Source: ILRI 2010.

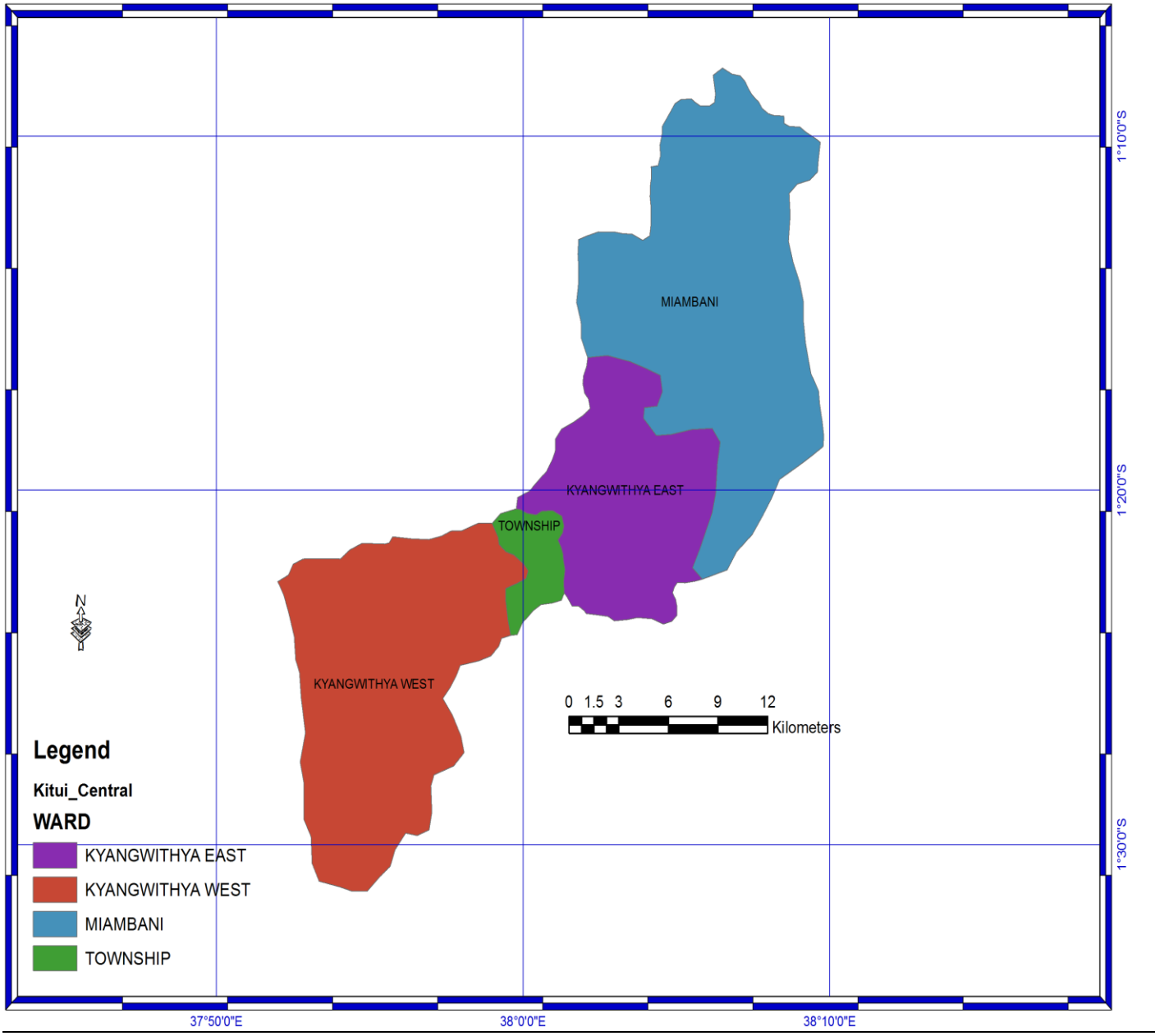

Figure 3.2: Map of Kitui Central Sub-county showing the different wards: Source: ILRI 2010.

Kitui Central sub-county, where this research was done has four political wards namely; Miambani, Township, Kyangwithya West and Kyangwithya East. Kitui Central sub-county has a total population of 131,715 distributed as follows: Miambani (22,164), Township (26, 016), Kyangwithya West (22, 121), Mulango (28, 573) and Kyangwithya East (32, 841. (Kitui County Government, 2013-2017).The local inhabitants are mainly

the Kamba community. The main economic activities are agriculture mainly crop farming of maize and small scale mixed farming of maize, beans, millet, vegetables, dairy farming; poultry farming and fish farming.

The study area was chosen for this research because Kitui Central sub-county has the highest concentration of fish farmers in Kitui County. Kitui Central, Mutito hills and Yatta Plateau receive more rainfall than the other parts in the county, which is attributed to their high altitude between 600m and 900m. The rainfall pattern is bi-modal with long rains in March to May, which is usually very erratic and unreliable. Short rains occur in October to December and are more reliable with average annual rainfall of between 200mm and 600mm and mean monthly temperatures of between 19^0C and 35^0C (MoLFD, 2013). Rainfall is the main source of water for all aquatic organisms like fish

3.3 Analytical Methods

The study adopted a descriptive research method which focused on individual fish farmers as the unit of analysis (Kothari, 2004). Simple random sampling was used to select the respondents from the targeted farmers in the study area to participate in the study. The researcher considered farmers whose fish ponds were still functional and those who have abandoned their fish ponds. A record of fish farmers who benefitted from 2009 /2010 ESP was obtained from the Kitui Central sub-county fisheries offices in Kitui. The researcher targeted a population of 200 fish farmers under ESP in Kitui Central sub-county, Kitui County.

3.4 Sampling Procedure

The simple random sampling technique was applied to select the sample. The department of Fisheries provided a list of farmers who benefited from ESP. The list indicated that 200 fish farmers were engaged in the ESP in Kitui Central sub-county with Miambani having 44, Township 58, Kyangwithya West 46, and Kyangwithya East 52. For each ward, the total number of ESP farmers was stratified and this resulted to a total number of 184 fish farmers. A sample from each ward was then randomly selected. The total number of successful ESP farmers to be interviewed was 60 which represented 30% of

the 200 target fish farmer's population. This was in line with the suggestion by Mugenda and Mugenda (2009) that 30% of the population is deemed to be sufficient for statistical analysis in research work.

3.5 Sampling Instrument

A semi-structured questionnaire was used to collect data. This was because most farmers were able to read and write without assistance and this ensured unbiased responses. The farmers who were not able to read and write were aided in understanding the questions.

3.6 Validity of the instrument

Orodho (2002) defines validity as appropriateness, meaningfulness and usefulness of the inferences a researcher makes. Kothari (2001), further defines validity as the extent to which a test measures what the researcher actually wishes to measure and how well a test measures what it is purposed to measure. To ensure that the instrument was valid, the researcher sought assistance from the University supervisors. In addition, pilot testing of the research instrument was done with 5 respondents from Kitui Rural sub-county as their information was not required for statistical analysis.

3.7 Reliability of the instrument

According to Cozby (2001), reliability refers to participants actual score on an instrument which is influenced by both their true score and error. In the study, 54 randomly selected fish farmers willingly participated in the survey and 6 fish farmers didn't participate due to unavoidable circumstances like sickness and commitment to social obligations or being uncooperative. The acceptance score was calculated by dividing the number of respondents who participated in the survey with the calculated sample size.

$$\text{Acceptance Score} = \frac{\text{Number of participants in the survey}}{\text{Sample Size}}$$

$$54/60 = 0.88$$

Where 54 is the number of participants and 60 is the sample size.

Therefore the acceptance score of the instrument was 0.88. This score was deemed adequate and reliable.

3.8 Data Collection

Primary data was collected by survey using a semi-structured questionnaire. This was in line with Sherri (2010), who noted that a questionnaire is an important research tool in socio-economic survey. The questionnaires for fish farmers were structured with both open-ended and closed questions. Respondents were randomly selected from the identified ESP fish farmers. For each aspect, the information was collected through observation by the enumerator and by asking the farmers. Each individual respondent was allowed to fill only one questionnaire and the respondents were given a period of four days after which the researcher collected the filled questionnaire.

A response rate of 54 was obtained and 6 respondents out of the 60 did not fill the questionnaires. The researcher, therefore, adopted the response rate of 54 fish farmers. Secondary data was obtained from the records of Kitui County fisheries offices. A questionnaire guide for secondary data was prepared and given to two of the key Informants, who were the enumerators for the study, and successfully helped to administer the questionnaires. Additional secondary data was obtained from books, journals and articles.

3.9 Analytical Procedures

According to Mugenda and Mugenda (2003), data analysis is the process of bringing meaning to raw data obtained from the questionnaires. The survey data was then used to compare the various study variables. All the questionnaires were numbered and the responses in the questionnaire were coded and edited. The coded information from the questionnaires was fed to the computer using SPSS. Which offers extensive data handling capabilities and numerous statistical analysis procedures that analyze small to large data sets to enable both descriptive and inferential statistics like regression analysis (SPSS, 2002).

3.10 Descriptive Statistics

Descriptive statistics provided information on the status of fish farming. Pearson moment correlation tests and multiple regression models were used to establish the factors that influence the status of fish farming in the study area. Results were presented in correlation matrices and multiple regression tables for the variables. This involved establishing the coefficient (r) values for the independent variables against the dependent variable (status of fish farming). The status of fish farming was established by relating the state of the fish ponds with the factors influencing fish farming in the area of study. The main descriptive statistics used involved percentages and frequencies. Inferential and regression analysis involved the use of Chi-square and Pearson's moment correlation.

3.11 Multiple regression models

Multiple regression models are analytical tools in which the outcome variable (Yi) is predicted from a combination of each predictor variable (Xi) multiplied by its respective regression coefficient (βi). In this study, multiple regression models were used to analyze the relationship between factors influencing fish farming and the status of fish farming in the study area.

This multiple regression model can be summarized as:

$Y_i = \beta_0 + \beta_1 (x_1)i + \beta_2 (x_2)i + \beta_3 (x_3)i + \ldots + \beta_K (x_K)i + \varepsilon_i$ (i)

Where:

Y_i = Variable Yi is designated as the "dependent variable."

β_1, β_2……. β_K are coefficients of the variables, X_1, X_2 ……, X_K used for each independent cross check variable in the model.

In this model, the coefficients (β's) are non-random values but of unknown quantities.

The noise terms ε_1, ε_2, ε_3, …, ε_n are random and unobserved and it is further assumed that these ε‟s are statistically independent, each with mean 0 and (unknown) standard deviation σ (Field, 2006).

Therefore, the fitted multiple regression models were:

$Y_i = \beta_0 + \beta_1 (x_1)i + \beta_2 (x_2)i + \beta_3 (x_3)i + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_K (x_K)i$ (ii)

In this model; Yi: status of fish farming

X_1: Gender of the Household head

X_2: Age of the Household head

X_3: Level of Education of household heads

X_4: Marital status of household heads

X_5: Family size of households

X_6: Access to extension services

X_7: Access to credit

X_8: Access to quality fingerings

X_9: Access to adequate water

X_{10}: Access to quality feedstuff

X_{11}: Pond management skill

X_{12}: Training of household heads

X_{13}: Predation and fish farming

3.12 Ethical consideration

A data collection permit was obtained from the South Eastern Kenya University in order to carry out data collection upon approval of the proposal. The research exercised due diligence while collecting data to ensure privacy and confidentiality of the information given by the respondents. The researcher ensured full liaison with the respondents in case clarity on certain information was required.

CHAPTER FOUR

RESULTS OF THE STUDY

4.0 Socio-Economic Parameters in relation to Fish Farming

The demographic and socio-economic information considered for this study included; gender of the household head, level of education, marital status, age, family size, access to extension services, access to credit facilities, access to markets, availability of water and quality of the fingerlings.

4.1 Gender and Fishing Farming

The respondents selected for the interviews were either the owners of the fish ponds or the individuals who took part in pond management. This condition was put in place to ensure that the respondents would give accurate information on pond management and other aquaculture practices. The respondents were categorized in two; those whose fish ponds were functional and those who had abandoned their fish ponds in relation to gender as shown in Table 4.1.

Table 4.1: Current status of Fish Farming based on Gender of the Household heads

Status of Fish ponds	Gender				
	Male	Female	Total	(χ^2)	P<.05
Abandoned	31 (57.4%)	7 (13.0%)	38 (70.4%)	4.555	0.000*
Functional	13 (24.1%)	3 (5.5%)	16 (29.6%)		
Total	44 (81.5%)	10 (18.5%)	54 (100.0%)		

***Significant at p<0.05**

Fish farming in the study area was majorly dominated by the males (81.5%) while the females only constituted 18.5%. The chi-square (χ^2) test showed a significant difference

between the male and female adopters of fish farming. This is attributed to the fact that males own land and also dominate in decision-making as they are mostly the head of the households. Fish farming was introduced in 2009/2010 financial year, however, a majority (70.4%) of the households had non-functional fish ponds compared to those whose ponds were functional (29.6%). This finding concurs with those of Chikopela, (2014), Maina et al., (2014) and Musyoka and Mutia (2016) that fish farming is dominantly carried out by male farmers.

4.2 Age of the Household Head and Fish Farming

In this study, the fish farmers were classified into three age groups namely: 18-35 years, 35-60 years and above 60 years as shown in Table 4.2

Table 4.2: Current status of Fish ponds in relation to Age of the Household heads

Status of Fish ponds	Age group					
	18-35 years	>35- 60 years	>60Years	Total	(χ^2)	P<0.05
Abandoned	3 (5.6%)	35 (64.8%)	0(0)	38(70.4%)	2.687	0.021*
Functional	4 (7.4%)	12 (22.2%)	0(0)	16(29.6%)		
Total	7 (13.0%)	47 (87.0%)	0(0)	54(100.0%)		

***Significant at p<0.05**

The fish farming was largely (87.0%) adopted by the farmers aged between 35-60 years. This finding concurs with the findings of Chikopela, (2014); Mwajiande and Lugendo, (2015); Maina et al., (2014) and Musyoka and Mutia (2016), who revealed that fish farming is carried by productive farmers and were able adopt new farming practices and innovations. Further, Chi-square (χ^2) test established a significant difference between age groups and fish farming. The majority of the adopters was in their prime and most productive age and probably had a stable income that enabled them to invest in fish

farming to increase income for their households. In addition, these respondents had many years of experience in agricultural production, thus used their skills and experience to diversify their agricultural and dietary practices. These farmers were followed by farmers in the age bracket of 18-35 years. This was attributed to the fact that these farmers were youthful and flexible in decision-making. Therefore, they could understand new innovations better than their older counterparts and would venture into new commercial agricultural enterprises despite the risks and challenges involved. The study showed that there were no old farmers (>60 years) who were involved in fish farming in the study area. This could be attributed to the fact that the old persons tend to stick to their traditional ways of farming and they are not risk takers. In addition, fish farming is expensive and technical and old farmers prefer to do what they know best rather than adopt new agriculture ventures and innovations that would strain their meager resources and energy.

Abandonment of fish farming was highest (64.8%) among the middle-aged famers compared to younger farmers. This could be attributed to the fact that these farmers could evaluate the profitability of the fish farming and make concrete decisions to adopt other agricultural enterprises with relative advantages over fish farming in Kitui Central sub-county, Kitui County.

4.3 Level of Education and Fish Farming

The farmers were classified into three categories depending on their levels of education namely primary, secondary and tertiary levels as shown in Table 4.3.

Table 4.3: Current Status of Fish ponds in Relation to level of Education of the Household heads

Status of Fish ponds	Levels of education					
	Primary	Secondary	Tertiary	Total	(χ^2)	P<0.05
Abandoned	11 (20.4%)	18 (33.3%)	0 (0.0%)	29 (53.7%)	2.687	0.023*
Functional	6 (11.1%)	10 (18.5%)	9 (16.7%)	25 (46.3%)		
Total	17 (31.5%)	28 (51.8%)	9 (16.7%)	54(100.0%)		

***Significant at p<0.05**

Most fish farmers (51.8%) had attained secondary level of education. This group of farmers had adequate education to better comprehend trainings on fish farming technologies in pamphlets and other materials written in English, compared to those who did not go beyond primary level. This was followed by the farmers who had attained the basic primary education (31.5%). Fish farmers with tertiary level of education were few (16.7%). Further, Chi-square (χ^2) test established a significant difference between the levels of education and the adoption of fish farming. This finding is in agreement with Kimenye (2001); Rose (2013) and Maina et al., (2014) who found out that there were positive correlation between level of education and adoption of fish farming.

However, the rate of abandoning the fish farming production was common among farmers with secondary education (33.3%), followed by those with primary education (20.4%). This could be attributed to the fact that those with secondary education had skills to venture into other agricultural practices in addition to fish farming while those with primary education had limited choices due to inadequate skills so they preferred to continue with fish farming. The rate of abandonment of the fish farming was zero among those with tertiary levels of education. The likely explanation is that they understood the principles and concepts of fish farming which enabled them to have sound management practices in fish farming and remained in business for long. Further, they had alternative

sources of employment that made them have enough capital to venture into new innovations in fish farming.

4.4 Marital Status of Respondents and Fish Farming

The researcher hypothesized that marital status of the respondents could influence fish farming. These results are tabulated in Table 4.4 below.

Table 4.4: Current status of Fish ponds in relation to Marital Status of the household heads

Status of Fish ponds	Marital status					
	Single	Married	Divorced/Separated/Widowed	Total	(χ^2)	P<0.05
Abandoned	7(13.0%)	28(51.8%)	3(5.6%)	38(70.4%)	19.187	0.000*
Functional	13(24.0%)	3 (5.6%)	0 (0.0%)	16(29.6%)		
Total	20(37.0%)	31 (57.4%)	3 (5.6%)	54(100%)		

***Significant at p<0.05**

Married farmers were the majority (57.4%) in fish farming. This is attributed to the fact that these farmers were more serious and committed to income generating farm activities to support the family needs and wants. In addition, these farmers had secure land ownership and they felt confident in their investments. Further, the family members provided labour for the labour-intensive fish farming enterprises. This finding concurs with those of Chikopela (2014), Rose (2013) and Musyoka and Mutia (2016) who found out that married farmers highly adopted fish farming under ESP.

However, the married farmers had the highest percentage of abandoned fish ponds (51.8%). This could attribute to the fact that married couples were likely to have greater financial commitment in catering for their families and non-profitable fish ponds were a great constrain. The rate of adoption of fish farming by the single farmers was also

relatively high accounting for 37.0%. However, the rate of abandonment of the fish farming was relatively low (13.0%) for the single farmers. This could be attributed to consistency and inflexibility associated with single farmers. In addition, the category of divorced /separated / widowed had the lowest (5.6%) adoption rate of fish farming, with zero functional fish ponds. This low rate of adoption and total abandonment of fish farming could be associated with psychological disturbances and upset amongst these farmers. In addition, once these farmers make decisions, they are not firm to ensure constant flow of income, accounting for the total abandonment of the fish farming amongst these farmers. In addition, the Chi-square (χ^2) test showed that there was significant difference in marital status and the ability to adopt fish farming in the study area.

4.5 Family Size and Fish Farming

The respondents were asked to indicate their family sizes. Table 4.5 below shows the distribution of the respondents by family sizes and the current status of the ponds.

Table 4.5: Current status of fish ponds in relation to Family size of the households

Status of Fish ponds	Family size				
	0-4 persons	>5- 15 persons	Total	(χ^2)	P<.05
Abandoned	21 (38.8%)	17 (31.5%)	38 (70.4%)	3.261	0.000*
Functional	13 (24.1%)	3 (5.6%)	16 (29.6%)		
Total	34 (62.9%)	20 (37.1%)	54 (100.0%)		

***Significant at p<0.05**

The majority (62.9%) of fish farmers had small family sizes of less than four members. This could be attributed to the fact that small sized families have low family expenses and could allocate their extra income to investment in other ventures such as fish farming. This concurs with the findings of Rose (2013), who found out that small sized households had high chances of adopting fish farming compared to large sized families. This research finding, however, contradicts that of Chikopela (2014) who found out that

adoption of fish farming was high among large sized households in Zambia due to availability of cheap family labour which reduced the cost of production.

However, the rate of abandonment of fish farming was high (38.8%) among the small sized families compared to the large sized families. This could be associated to the fact that the large sized families lacked extra income to indulge into other commercial ventures. In addition, the influence of family size on fish farming in the study area was supported by Chi-square (χ^2) test which showed a significant difference in the status of fish ponds between small and large families in relation to fish farming.

4.6 Access to Extension Services and Fish Farming

The respondents were asked to indicate whether they attended trainings organized by Ministry of Fisheries Development and or any other relevant service providers. The relationship between fish farming and access to extension services is shown in Table 4.6 below.

Table 4.6: Current Status Fish ponds in relation to access to Extension Services

Status of Fish ponds	Access to Extension services				
	Yes	No	Total	(χ^2)	P<.05
Abandonment	32 (59.3%)	6 (11.1%)	38 (70.4%)	10.071	0.028*
Functional	13 (24.0%)	3 (5.6%)	16 (29.6%)		
Total	45 (83.3%)	9 (16.7%)	54 (100.0%)		

***Significant at p<0.05**

Access to extension services for fish farming in the study area was good; with about 83.3% of the fish farmers having access to extension services. The survey revealed that the extension services were received from mass media through TV/radio, other farmers, extension officers of the ministry of fisheries, development partners, NGOs, books and journals. This contradicts the findings of Kimathi (2013) who observed that extension

services were poor among the fish farmers in Tigania in Meru County which contributed to low adoption rate of fish farming in Meru region.

However, the rate of abandonment of the fish farming was high (59.3%) among farmers who had access to extension services compared to those who didn't have (11.1%). This could be associated with problems affecting the fish ponds, like lack of quality fingerlings, lack of adequate water and destruction of the fish pond liners in the study area. In addition, the Chi-square (χ^2) test showed a significant difference in the status of fish ponds between those farmers who had access to extension services and those without access to extension services in the study area.

4.7 Access to Credit Facilities and Fish Farming

The respondents were asked to indicate how they raised money to carry out fish farming management practices including access to credit facilities.

Table 4.7: Current Status of Fish ponds in Relation to Access to Credit Facilities

Status of Fish ponds	Access to Credit				
	Yes	No	Total	(χ^2)	P<.05
Abandoned	31 (57.4%)	7 (13.0%)	38 (70.4%)	19.057	0.000*
Functional	3 (5.6%)	13 (24.0%)	16 (29.6%)		
Total	34 (63.0%)	20 (37.0%)	54(100%5)		

***Significant at p<0.05**

Table 4.7 shows that most (63.0%) of the fish farmers had access to credit facilities. This implied that the fish farmers had enough funds to cater for the initial costs of starting fish ponds, maintenance and purchase of the fish farming inputs like the ultra-violet treated pond liners and the fingerlings. This finding concurs with those of Munguti et al. (2014) and Musyoka and Mutia (2016) who found out that there was a positive correlation

between access to credit and adoption of fish farming among farmers in Kibwezi sub-county, Makueni County. However, the farmers with access to credit had the highest (70.4%) rate of abandonment of the commercial fishing farming ventures. This could be attributed to the low level of harvest and or withdrawal of government subsidies. In addition, a substantial number (37.0%) of the fish farmers had no access to credit facilities. This implied that they faced financial constraints in adopting and maintaining the fish ponds. However, most of these fish farmers (24.0%) continued with the fish farming as a business venture compared to those fish farmers who had access to credit facilities (5.6%). The Chi-square (χ^2) test established that there was a significant difference between the farmers with access to credit facilities and those with limited access to credit facilities.

4.8 Access to Quality Fingerlings and Fish Farming

The current research also sought to know whether the fish farmers under ESP in the study area had access to quality fingerlings. The farmers were classified into two categories; those who had access to quality fingerlings and those with no access to quality fingerlings as shown in Table 4.8 below.

Table 4.8: Current Status of Fish Ponds in Relation to Access to Quality Fingerlings

Status of Fish ponds	Access to Quality Fingerlings				
	Yes	No	Total	(χ^2)	P<.05
Abandoned	0 (0.0%)	16(29.6%)	16 (29.6%)	16.897	0.000*
Functional	23 (42.6%)	15 (27.8%)	38 (70.4%)		
Total	23 (42.6%)	31(57.4%)	54(100%)		

***Significant at p<0.05**

The majority (57.4%) of fish farmers had no access to quality fingerlings compared to farmers who had access to quality fingerlings (42.6%) for their fish farming business.

This finding shows that availability of quality fingerlings was a major factor that could have contributed to sustainability of the fish farming projects in the study area. This is supported by the fact that no abandonment of the fish farming was recorded among farmers with access to quality fingerlings compared to 29.6% of farmers who abandoned and had no access to quality fingerlings. In addition, the Chi-Square (χ^2) test established that there was a very significant difference between fish farmers with and without access to quality fingerlings. This finding is in agreement with those of Munguti et al., (2014) and Musyoka and Mutia (2016), who found out that access to quality fingerlings was a limitation to fish farmers in Kibwezi Sub-county of Makueni County.

4.9 Access to Adequate Water and Fish Farming

The respondents were asked to indicate their sources of water for their fish ponds and whether the water was adequate or limited. The results are shown in table 4.9 below.

Table 4.9: Current Status of Fish Ponds in Relation to Access to Adequate Water.

Status of Fish ponds	Access to Adequate Water				
	Adequate water	Limited water	Total	(χ^2)	P<.05
Abandoned	20 (37.0%)	18 (33.4%)	38 (70.4%)	11.024	0.237
Functional	6 (11.1%)	10(18.5%)	16 (29.6%)		
Total	26 (48.1%)	28 (51.9%)	54		

***Significant at p<0.05**

Scarcity of water affected 51.9% of the fish farmers while 48.1% of them had access to adequate water. In addition, the Chi-Square (χ^2) test established that there was no significant difference between the fish farmers with access to adequate water and those without. This study established that the rate of abandonment of fish farming in Kitui Central sub-county was high at 37.0% for fish farmers with access to adequate water,

though insignificant differences were reported between farmers who had access to adequate water and those without. This implied that there are other contributory factors influencing abandonment of fish farming rather than water availability. This contradicts findings of Jacobi (2013), who studied fish farming in Kisumu and Homa Bay Counties and found out that access to quality water for fish farming was a major challenge in these areas.

4.10 Access to Quality Feeds and Fish Farming

The research hypothesized that fish farming could be influenced by access to adequate and quality feeds. The respondents were asked to indicate the sources of feeds for their fish ponds and whether the feeds were adequate or limited and of good quality. The results are shown in Table 4.10 below.

Table 4.10: Current Status of Fish Ponds in Relation to Access to Quality Feeds

Status of Fish ponds	Access to Quality Feedstuffs				
	Adequate Feeds	Limited Feeds	Total	(χ^2)	P<.05
Abandoned	12 (22.2%)	26 (48.2%)	38 (70.4%)	7.003	0.002
Functional	4 (07.4%)	12 (22.2%)	16 (29.6%)		
Total	16 (29.6%)	38 (70.4%)	54(100%)		

***Significant at p<0.05**

Scarcity of quality feeds affected 70.4% of the fish farmers while 29.6% of them had access to adequate quality feeds. In addition, the Chi-Square (χ^2) test established that there was significant difference between the fish farmers with access to adequate and quality feeds and those without. This study established that the rate of abandonment of fish farming in Kitui Central sub-county was high at 48.2% for farmers with limited access to fish feeds and hence the failure of the ESP fish

farming projects could be attributed to limited access to quality fish feeds. This implied that the limited access to adequate and quality feeds was a major contributing factor that influenced abandonment of fish farming among other factors.

4.11 Pond Management Skills of the Fish Farmers

Fish pond management skills can influence the success of any fish farming project. Therefore, this study hypothesized that skills in pond management of the respondents could influence fish farming. The relationship is shown in Table 4.11 below.

Table 4.11: Current Status of Fish Ponds in Relation to Pond Management Skills

Status of Fish ponds	Pond Management Skills				
	Skills	No Skills	Total	(χ^2)	P<.05
Abandoned	7 (13.0%)	31 (57.4%)	38 (70.4%)	5.243	0.001*
Functional	11 (20.4%)	5 (9.2%)	16 (29.6%)		
Total	18 (33.4%)	36 (66.6%)	54(100%)		

***Significant at p<0.05**

Majority (66.6%) of the fish farmers had no skills in pond management. The Chi Square test indicated that there was a significant difference in the status of fish ponds between the fish farmers who had skills in pond management and those who did not have skills in pond management. This concurs with research findings of Shitote et al., (2013) who found out that skill in fish pond management are crucial for successful fish farming.

4.12 Training of the Fish Farmers

The researcher hypothesized that training in pond management and fish farming of the respondents could influence fish farming. The relationship is shown in Table 4.12 below.

Table 4.12: Current Status of Fish Ponds in Relation to Training

Status of Fish ponds	Training				
	Training	No Training	Total	(χ^2)	P<.05
Abandoned	16 (29.6%)	22 (40.7%)	38 (70.4%)	9.004	0.003*
Functional	9 (16.7%)	7 (12.9%)	16 (29.6%)		
Total	25 (46.3%)	29 (53.7%)	54(100%)		

***Significant at p<0.05**

The research found out that majority (53.7%) of the respondents had not received any training on fish farming especially in fish pond management. The Chi-Square test indicated that there was a significant difference between the farmers who had been trained on fish farming especially in fish pond management and those who had not. This could be a contributory factor to the high percentage of farmers who had abandoned fish farming. Training of fish farmers enhances the understanding of the concepts, theories and techniques in fish farming.

4.13 Predation and Fish Farming

Fish predation in ponds can influence fish farming. Therefore, the current study also sought to know the impacts of predation on fish farming and the relationship is shown in Table 4.13 below.

Table 4.13: Current Status of Fish Ponds in Relation to Predation

Status of Fish ponds	Predation				
	Predation	No Predation	Total	(χ^2)	P<.05
Abandoned	30 (55.6%)	8 (14.8%)	38 (70.4%)	6.012	0.007*
Functional	12 (22.2%)	4 (7.4%)	16 (29.6%)		
Total	42 (77.8%)	12 (22.2%)	54 (100%)		

***Significant at p<0.05**

Majority (77.8%) of the fish farmers identified predation of the fish by birds like Kingfisher was challenge. In addition, the respondents claimed that the birds destroyed

the pond liners. The Chi-Square test showed a significant difference between the fish farmers who had their fish preyed on by predators and those who had no such cases. This research finding agrees with the findings of Kimathi et al., (2013); Shitote et al., (2013) and Maina et al., (2017) who found out that predation by birds and frogs were a major challenge in fish farming in Tigania East District, Makueni County and Western Kenya respectively.

4.14 Factors influencing fish farming in Kitui Central sub-county

The study also aimed at establishing the factors influencing fish farming in Kitui Central sub-county, Kitui County. Pearson moment correlation tests and multiple regression models were used to establish the factors that influence fish farming in the study area. The results are presented in correlation matrix and multiple regression tables for the variables. This involved establishing the coefficient (r) values for the independent variables against the dependent variable (adoption of fish farming). The adoption of fish farming was established by relating the status of the fish ponds in the area of study.

4.14.1 Results of Correlation Analysis

Table 4.14 shows the correlation and coefficients of the variables used in the correlation for Kitui Central sub-county. The results are based on the objective to address the determining factors of adoption of fish farming to food security and income generation of the households.

Table 4.14: Correlation Matrix for Factors influencing fish farming Kitui Central Sub-County

Variable	Age	Gender	Education	Marital status	Family size	Water	Training	Extension	Credit	Pond Mgt	Fingerlings
Age	1.000										
Gender	.184	1.000									
Education	-.063	-.036	1.000								
Mar. Status	-.116	.263	.214	1.000							
Family size	-.275	.325	.054	.489**	1.000						
Water	.180	-.113	.008	-.012	-.335	1.000					
Training	.164	.248	-.011	-.273*	-.324	.244	1.000				
Access to extension	.173	.554	-.122	-.188	.171	-.265	.017	1.000			
Access to credit	-.161	-.366	-.398	-.118	-.191	.125	.238	.137	1.000		
Pond Mgt	.262	.173	-.063	-.571	-.391	-.261	.661*	.166*	.566*	1.000	
Access to quality fingerlings	-.221	-.264	-.354	.671	.118	-.305	.164	.017	.661	.155	1.000

***Significant at p<0.05.**

The correlation matrix shows that most variables had either negative or positive correlation with insignificant influence over each other. However, training, access to extension services and credit had positive and significant influence that enhanced pond management by the household. This implied that fish farmers who attended trainings on fish farming and had access to extension services improved their knowledge of fish farming and could manage their ponds well and address any constraint that they faced. In addition, access to credit had positive and significant influence on pond management as it enabled the fish farmers to purchase the necessary inputs required for the fish farming venture.

4.14.2 Results of the Regression Analysis

Table 4.15: Parameter Estimates for Factors affecting Adoption of Fish Farming

Explanatory Variable	Parameter Estimate (β)	Wald Statistic	Exp (β)	P-Value
Constant	0.764*	34.23	3.243	.032
Gender of house hold head**	-0.381	0.104	0.552	.483
Age of respondents	-0.203	0.142	0.703	.612
Education of the respondents	1.126	1.253	1.673	.096
Marital status of respondents	2.345	.816	.508	.002*
Family Size of respondents	-2.272	2.421	2.216	.9687
Training of respondents	4.323*	2.045	1.005	.001*
Skills of respondents	1.120*	2.502	2.784	.089
Access to water	2.56	1.210	3.212	.065
Access to extension	1.035	1.512	1.12	.407
Access to credit	1.432	1.327	.630	.001*
Access to fingerlings	2.214*	32.344	2.912	.003*
Access to Feedstuffs	3.122	12.1111	4.132	.002*

Note: $\chi 2$ = 32.39*; -2LL= 105.521; Overall Statistics= 68.7%; *Significant at p<0.05; HHH – Household Head

The adopted multiple regression models were good as it explained 68.7% of the total variation in the adoption of fish farming. It further showed how each parameter change would change the adoption of fish farming. The model was chosen since the factors act independently in influencing the adoption of fish farming in the regression model.

Gender of the farmer plays an important role in determining adoption of innovations and technological advancements in agriculture among other fields for livelihood support. The multiple regression tests established that the influence of gender on adoption of fish farming was negative and insignificant. This implied that males own land and also dominate in decision-making as the head of the households hence adoption of fish farming did not necessarily depend on gender. This further supports that fish farming is male dominated in Kitui Central sub-county. This concurs with findings by Rodgers (2003) that those men, who control most of the resources in the households and are risk takers, influences decision making in commercial ventures of most households in Africa. This is also in agreement with the findings of Chikopela (2014); Abdoucie (2013); Maina et al., (2014) and Musyoka and Mutia (2016) that male farmers dominantly engage in fish farming compared to their female counterparts.

Education enhances proper understanding of concepts and working principles of innovations and technological advancements. The study revealed positive influence of education (highest level of education reached or the number of years spent in school) on the adoption of modern aquaculture in Kitui Central Sub-county, although it was insignificant. This explains why the farmers who attained secondary school education and above adopted the fish farming project. This is in agreement with the findings of Kimenye (2001) and Maina et al., (2014), who revealed that there is a positive correlation between the number of years of schooling (level of education) and the adoption of fish farming. In addition, the positive influence of education of the farmers is likely to be accountable for the zero percent of abandonment amongst the farmers with higher levels of education. This implied that these farmers understood the workability of the fish ponds and maintenance principles, hence, they could face limited challenges in the management of the fish ponds.

Marital status had a positive and significant influence on the adoption and sustainability of aquaculture in Kitui Central sub-county. This concurs with the findings of Chikopela (2014); Rose (2013); and Musyoka and Mutia (2016), who revealed that married farmers adopted the fish farming more than the single or divorced farmers. Married farmers adopted modern aquaculture compared to either single farmers or other farmers faced with challenges of being divorced, separated or widowed. This implied that these farmers were distracted from concentrating on fish farming ventures compared to their married farmers who felt more satisfied and confident in decision making helpful to efficient fish farming.

Training of the farmers had a very positive and significant influence on fish farming. This concurs with findings of Kimathi (2013), who found out that training of farmers improves their understanding of technical aspects of fish farming and how to solve the challenges in fish farming. This implied that trained farmers gained knowledge and understanding of fish farming. This is associated with skills that the trained farmers gained during the training and any unanswered and disturbing questions about fish farming were highlighted by the trainers. The untrained farmers had difficulties in making the right judgments and decisions in maintaining the fish ponds.

Access to credit has a positive and significant ($p \leq 0.001$) influence on fish farming in Kitui Central sub-county in Kitui County. This is in agreement with findings of Munguti et al., (2014) and Musyoka and Mutia (2016) who found out that there was a positive correlation between access to credit and adoption of fish farming amongst farmers. This means that households in Kitui Central sub-county with access to credit income were more likely to adopt the capital-intensive fish farming. Credit facilities is a source of funding that can be used to purchase fish pond liners, quality fingerlings, fish feeds although the money can be diverted to other emerging priorities for maintaining the household economy. Households with limited access to credit were likely to be faced with financial constraints in maintaining the adopted capital intensive fish farming.

Access to quality fingerlings had positive and significant ($p=0.003$) influence on fish farming. This is in agreement with results of a study by Munguti et al., (2014) and Musyoka and Mutia (2016), who found out that access to quality fingerlings leads to

successful fish farming. This implied that households in Kitui Central sub-county with access to quality fingerlings for the fish farming ventures invested and continued with fish farming with ease. Under good pond management, fish farming by these farmers was likely to be more profitable and farmers felt confident with fish farming as they were assured of good production. In contrast, farmers with limited access to quality fingerlings failed to adopt the fish farming or abandoned the fish farming if little profits or losses are incurred in the project.

Access to adequate and quality feedstuffs to the fish farmers positively and significantly (p=0.002) influenced fish farming in the study area. This is attributed to the fact that for sound fish production, the nutritional requirements of the fish have to be met. In the ASALs, sources and supply of adequate feedstuffs is quite a challenge as noted by Mwangi, (2008). This implies that the fish take longer to mature or have stunted growth and could not fetch good market prices. This could be a contributory factor to the high rate of abandonment of the fish farming in the study area.

4.16 Contribution of Fish Farming to Household Wellbeing

The study sought to establish the contribution of fish farming to household wellbeing (income) in Kitui Central sub-County, Kitui County. Using Chi-Square (χ^2), the reasons shown in table 4.16 were established as to why the farmers were adopting fish farming in Kitui Central sub-county, Kitui County.

Table 4.16: Contributions of Fish Farming to Household wellbeing

Gender of House Hold Head	Food security	Income Generation	Dietary Diversification	Utilizing Idle land	Total	(χ^2)	P<0.05
Male	18(33.3%)	14(25.9%)	8 (14.8%)	4 (7.4%)	44 (81.5%)	4.255	.5255
Female	7 (13.0%)	3 (5.6%)	0 (0.0%)	0 (0.0%)	10 (18.5%)		
Total	25 (46.3%)	17(31.5%)	8 (14.8%)	4 (7.4%)	54(100%)		

The farmers practicing fish farming appreciated that there were economical benefits of engaging in commercial fish farming ventures. Households practicing fish farming in the study area attained food security (46.3%), especially the male headed (33.3%) compared to female headed households (13.0%). In attaining food security, it implied that the fish from fish ponds was used for home consumption for family members providing safe and adequate supply of food. Male household heads, being the bread winners of most households engaged in fish farming, indicated that their families had attained food security. In addition, substantial adopters (31.5%), with a low percent of the female fish farmers (5.6%) appreciated better income was generated upon venturing in fish farming compared to other agricultural enterprises like cereal production or animal husbandry. This agrees with the ESP program objective of empowering communities through increasing their income and improving food security in the entire country.

Other benefits that the male fish farmers appreciated were dietary diversification (14.8%) and partly utilization of idle land (7.4%) the farmers have in their farms. This implied that there was reduced pressure on the common sources of animal proteins, like beef, mutton or poultry meat and proper utilization of fragile land probably used to lie idle. The study revealed that no female headed household engaged in fish farming to diversify their dietary requirements or utilize any idle land in their farms. However, the Chi-Square (χ^2) test value was insignificant ($p<0.5255$) implying that there was no significant difference between the benefits of fish farming amongst the male and female fish farmers in Kitui Central sub-county. Thus the farmers were using fish farming to utilize idle lands in their farm lands, improve income generation, and diversify dietary needs and to attain of food security in Kitui Central Sub-County County.

The researcher also sought to find out whether there is variation in the levels of income between fish farmers who had functional ponds and those who had abandoned fish farming. Table 4.17 shows the Chi-Square (χ^2) test results of the levels of income (average money accruing from the fish farming per year) of the fish farmers in Kitui Central sub-county.

Table 4.17: Variations of Income Levels (KES) among the Fish Farmers

	Functional Ponds	Abandoned Ponds	Total	(χ^2)	P<0.05
M	0.0% (0.00/=)	31 (54.4%)	31 (54.4%)	15.689	.001*
	3.7% (<100, 000/=)	0.0% (<100,000/=)	2 (3.7%)		
	16.7% (>100, 000 – 200,000/=)	0.0% (>100, 000 – 200,000/=)	9 (16.7%)		
	3.7% (>200, 000/=)	0.0%(>200, 000/=)	2 (3.7%)		
F	0.0% (0.00/=)	13.0% (0.00/=)	7 (13.0%)		
	3.7% (<100, 000/=)	0.0% (<100, 000/=)	2 (3.7.0%		
	1.9% (>100, 000 – 200,000/=)	0.0% (>100, 000 – 200,000/=)	1 (1.9%)		
	0.0% (>200, 000/=)	0.00% (>200,000/=)	0 (0.00%)		
Total	16 (29.6%)	38 (70.4%)			

*** Significant at p<0.05**

Table 4.17 shows that male fish farmers (24.1%) had better income accruing from the fish farming venture compared to the female fish farmers (5.6%). This is likely to be attributed to the fact that male farmers are firm in making decisions to manage their investments. In addition, the analysis shows that both male and female farmers (29.6%) with functional fish ponds had good income accruing from the fish farming ventures. This implies that if fish farming is fully supported and constraints minimized, the farmers can adopt fish farming as an income generating agricultural enterprise. Most famers (70.4 %) had abandoned fish farming and no income was realized from the abandoned fish ponds. This is an indicator that the fish ponds were not suitable for fish farming due to one reason or another. The Chi-Square (χ^2) test shows that there was a significant difference between income accruing from functional and abandoned fish ponds in the study area.

Further, the researcher sought to know whether the adoption of fish farming had influence and impacts on other livelihood parameters, like health care, education and

asset ownership of the households. Table 4.18 shows the results of the other impacts of the income generated from the adopted fish farming in the study area.

Table 4.18: Influence of adopted fish farming on other livelihood parameters of Households

Livelihoods Parameter	Quality				
	Better	Same	Worse	Total	(χ^2)
Healthcare	21 (38.9%)	21 (38.9%)	12 (22.2%)	54 (100%)	12.465*
Education	22 (40.7%)	28 (51.9%)	4 (7.4%)	54 (100%)	
Asset Ownership	30 (55.6%)	19 (35.2%)	5 (9.2%)	54 (100%)	

The analysis shows that adoption of fish farming influenced and improved livelihood quality interms of health care, education of the children and the ownership of assets. This implied that the income that acrrued fron the functional fish ponds was used to cater for the family needs, like health care and education of their children. The surplus income was also used to purchase assets for the households, which had the greatest influence at 55.6%.

For some households, income levels remained the same for the livelihood quality parameters. This is likely to be contributed by the fact that the fish farmers realized income that could only cater for the expenses incured. This implied that in the initial stages of fish production, fish farmers could not break even. This is attributed to the fact that fish farming is a new venture and the farmers lacked the necessary skills and training to do profitable fish farming. This is supported by earlier findings of this study that training and skills of pond mangement influenced fish farming in the study area.

A small proportion of the fish farmers had their other livelihood quality parameter of health care, education and asset ownership worsen. This is attributed to the fact that the fish farming ventures are capital intensive and takes longer period for feasible production to be realized. This implied that the households heads spent their income from other sources or loans and never realized profitable production, hence, losses were incurred. The losses incurred were great to the extent that their effects were greatly felt as they affected and worsened the catering for education, health care and even ownership of assets. This is suspected to be due to poorly performing fish ponds and long payback period. In addition, the Chi-Square ($\chi 2$) test showed that there was significant difference between the extent of the influence of fish farming on health care, education and asset ownership between the households engaged in fish farming in the study area.

4.16: Policies Influencing Fish Farming

Fish farming like any othe farming activity is likely to be influenced by agricultural and marketing polices as they impact on the farm inputs and marketing of the fish farming products. The researcher carried out analysis to find out the extent of policy awareness, by the stakeholders and the results are presented in Figure 4.1 below.

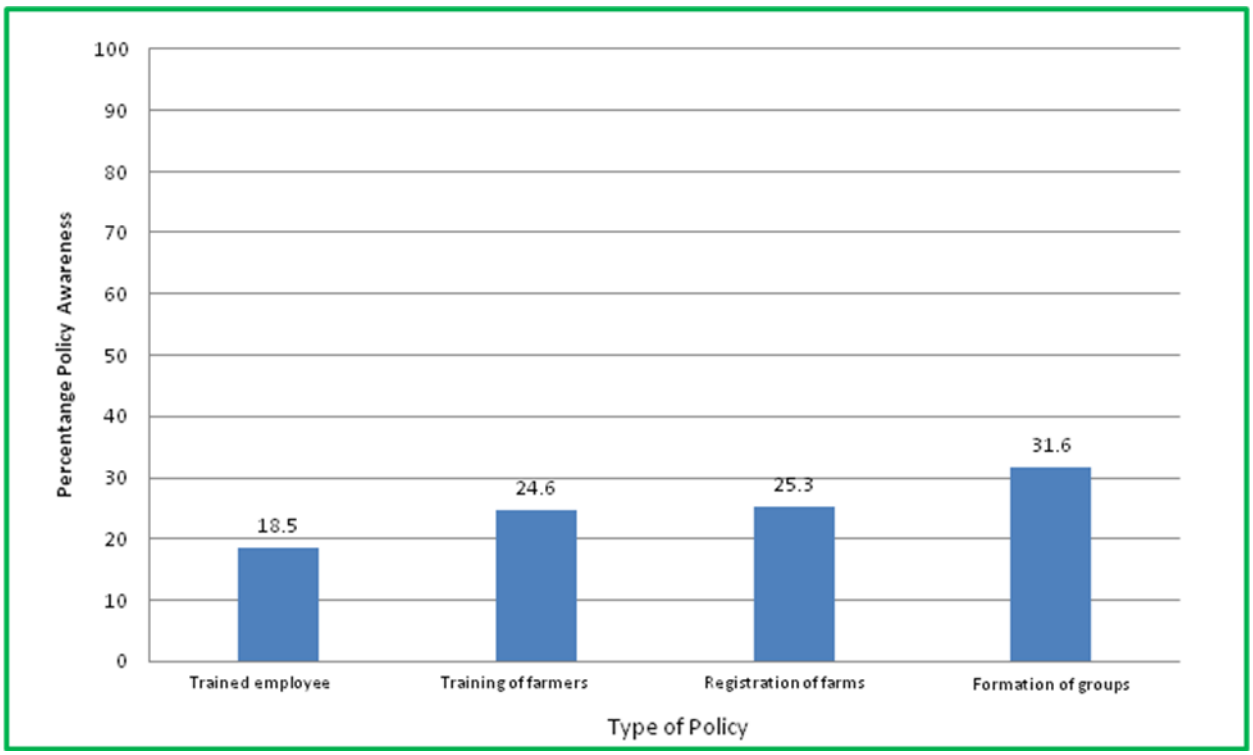

Fig 4.1: Some of the stipulated policies on fish farming.

A majority (31.6%) of the respondents indicated that they were aware of the policy on formation of groups. This was followed by those who were aware of the policy registration of farms (25.3%) and those who were aware of training of farmers (24.6%). The least were those who reported that they were aware of the policy on training employees on pond management.

In order to test the relationship between policies/frameworks and their impacts on fish farming, Chi-Square was used and the results are shown in table 4.19 below.

Table 4.19: Chi-square tests for the Relationship between Policies and Frameworks and Fish Farming

	Value	Df	P<.05
Pearson Chi-Square(χ^2)	62.423[a]	4	.000
Likelihood Ratio	7.642	4	.000
Linear-by-Linear Association	19.111	1	.000
N of Valid Cases	54		

Significant at p< 0.05

Chi-square (χ^2) test revealed that there was a significant association between policies and frameworks and fish farming in the study area.

4.17 Fish Farming Stakeholders / Actors

The last objective for this study was to establish the various fish farming stakeholders / actors and their roles in Kitui Central Sub-County, Kitui County. To achieve this objective, the study sought to establish the source of support for the farmers. This was achieved by asking the farmers which people provided them with assistance on matters of fish farming. The results are shown in Figure 4.2.

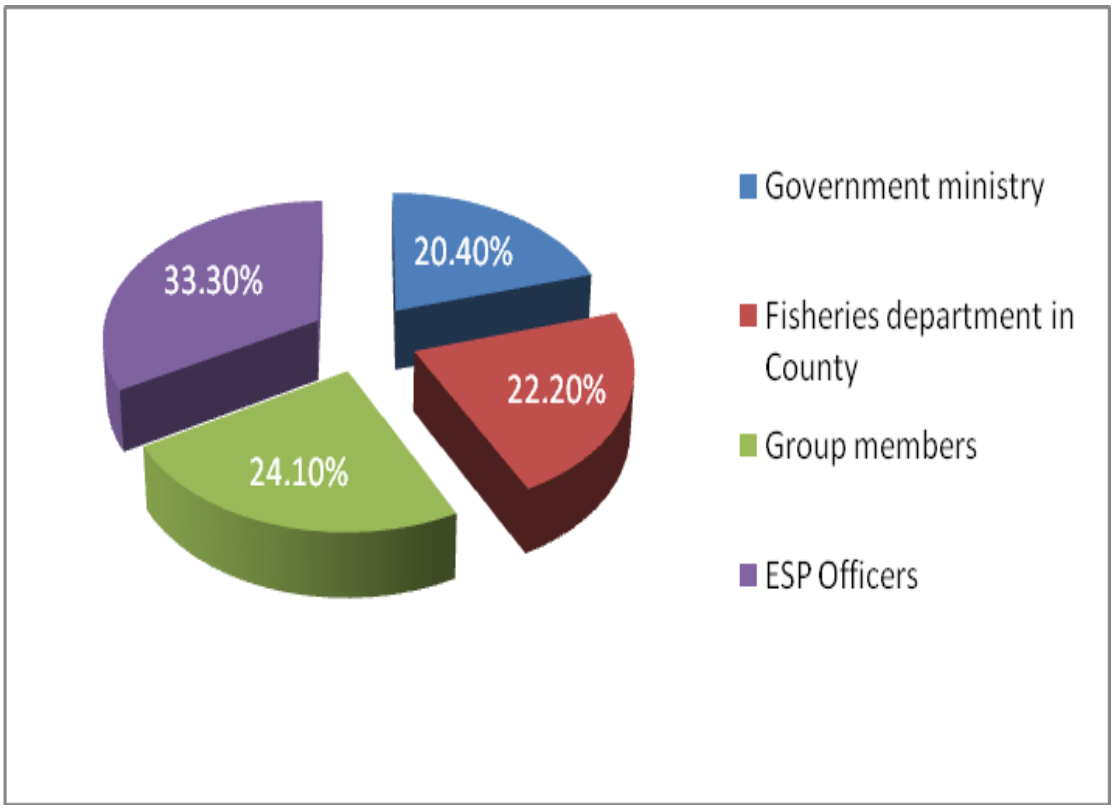

Figure.4.2: Stakeholders on fish farming.

From the results in Figure 4.2, the main stakeholders in fish farming from Kitui Central Sub-county include ESP officers (33.3%), group members (24.1%), County Fisheries Department (22.2%) and the National Government through the MoLFD (20.4%). These results show that ESP officers were the main stakeholders in fish farming. Further, the study sought to establish the role (s) played by each category of fish farming stakeholders in Kitui Central Sub County. In order to obtain the right information, the researcher sought assistance from the Kitui county fisheries offices and the results are presented in table 4.20 below.

Table 4.20: Fish Farming Stakeholders and their Responsibilities from Kitui Central Sub-County.

Stakeholders/Actors	Role and responsibility in fish farming
National Government	• Finance • Ensure enabling environment for aquaculture development (appropriate policy, legislation)
County Ministry of Fisheries (County Director and the Sub-County Directors)	• Implementation of ESP projects. • Offer extension services to farmers to ensure implementation of ESP projects.
Agro-vet shops	• Sell inputs required in fish farming projects
ESP officers from National fisheries research institutes.	• Offer technical support (on-farm trials) on fish breeding, seed raising, pond management among others.
Training/and learning institutions (colleges and universities)	• Provision of relevant training for all stakeholders.
Fish traders	• Work together with fish farmers in standardization of fish prices. • Engage fish farmers to ensure they produce market driven products. • Ensure supply of fish to the consumers.
Fingerling producers	• Propagate fingerlings and sell to farmers.

Self help groups (Fish farmers cluster groups, women merry go-rounds)	• Capacity building of cluster groups. • Establish proper mechanisms for flow of information. • Form cluster groups that carry out economic activities to generate money for the members. • Acquire loans from lending institutions so as to finance their projects.
Financial institutions such as (Banks, cooperative unions, micro-finances and money lenders).	• Provide loans to individuals and groups who have security to support the loan. • Educate its member on relevant issues concerning budgeting, planning and record keeping.
Faith based organizations	• Instill morals among their members to ensure a healthy living in the community. • Carry out projects that generate income for their organizations and members.

CHAPTER FIVE

DISCUSSION

5.1 Discussion of the Study Findings

This study established that the factors influencing fish farming in Kitui Central Sub-county, Kitui County includes; lack of Information (64.8%), lack of sufficient water for fish farming (63%), lack of adequate funding (57.4%), pond management (53.7%) and lack of quality fingerlings (51.8%) among others. It was also revealed from the regression results that all these factors predicted fish farming significantly ($P<0.05$). These results agree with a study by Mwangi (2008) who argued that inadequate training programms for fish farmers and extension workers leads to lack of information and has retarded the growth of the fisheries sector. The inadequacy in provision of extension services has been a major challenge to the development of fish farming in Kenya. He further argued that the demand for fingerlings to stock the fast-growing number of fishponds has skyrocketed from 1 million to 28 million in less than a year, forcing the government to rely heavily on the private sector. Because of this scenario, there is no significant growth in fish farming industry and the farmer is left confused by the many extension officers who visit and give varying information.

MoFD (2011) indicated that quality seed (fingerlings) and lack of enough funds are also among the problems facing the aquaculture sector. This is because, commercially produced fingerlings are hard to come by and when available they are expensive and out of reach of most farmers. Despite governmental efforts to improve existing fish breeding centers, this huge annual demand for fingerlings cannot be attained unless further development by the private sector. In addition, the quality of the fingerling supplied needs to be ensured. To achieve good quality seed fish, aquaculture experts have encouraged measures to obtain same-sex fingerlings using sex reversal and hybridization techniques. However, such initiatives are still unpopular among fish farmers due to the technical knowledge and facilities required. Therefore, these are some areas that private investors could venture in, to support fish farming in Kenya. So far, the Kenyan government through the aquaculture working group which brings together researchers,

fisheries officers, fish farmers, Kenya Bureau of Standards (KBS), and other stakeholders, has certified fish hatcheries nationwide and are in the process of drafting seed fish quality standards, which are expected to solve the problems of substandard seed fish in the aquaculture market.

The results of this study have also revealed that fish farming had a significant contribution to the household wellbeing (income) of households in Kitui Central Sub-county, Kitui County. This was by improving household income (38.9%) and putting idle land to use (24.1%). The harvested fish was sold to the market as indicated by 63% of the respondents as well as used for home consumption (37%). This ended up improving the livelihood of the fish farmers and diversifying the diets of the families. Other benefits from fish farming included; more household assets (50.6%), fees payment (40.7%), better health care (38.9%) and diet diversity (33.3%). It was also established that there is a strong positive correlation ($r = 0.73$, $P < 0.05$) between fish farming and household wellbeing. These results agrees with FAO (2012) report which indicated that, fish farming is one of the ways of improving livelihoods in developing countries. Russell, (2008) also argued that fish farming households in Malawi were among the more livelihood-secure households.

The results of this study have also established that the policies and frameworks influencing fish production in Kitui Central Sub county includes; formation of groups, registration of farms, training of farmers and pond management policies. The policy developers were National Government, county fisheries department, fish farmers groups and ESP officers. There was also a significant association ($\chi^2 = 65.423$, $p< 0.05$) between policies and frameworks and fish farming. These results agree with those of Mwangi (2008) who argued that there are no comprehensive policies and legislation on fish farming. Because of this, policy makers have accorded low priority to fish farming as an economic activity. Subsequently, the sector has operated without a comprehensive policy and legislation. This has reduced management and research effectiveness, discouraged investment in fish farming and constrained production and growth.

This study further revealed that fish farming stakeholders/actors in Kitui Central Sub-County area were; ESP officers (33.3%), group members (24.1%), fisheries department in the County (22.2%) and the National Government ministry (20.4%). Therefore, from the current study, ESP officers were the majority stakeholders in fish farming. The role of the stakeholders include; provision of fingerlings (33.3%), training of farmers (24.1%), provision of fish feeds (22.2%) and provision of funds to construct fish ponds (20.4%). These results agree with those of Rothuis et al., (2011) who argued that, different stakeholders play a role in the Kenyan aquaculture sub-sector. These are input suppliers (feeds and technical materials), hatcheries, artisanal processors, local markets, value chain supporters such as credit providers and government agencies, and of course the fish farmers themselves. Also included are industrial processors and export markets.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions of the study

From the results of this study, the following conclusions can be made;

i. There is a great potential for small holder aquaculture in Kitui central sub- county, however research is needed to develop and manage this potential for high production and sustainability of aquaculture.
ii. Fish farming is capable of creating employment, improving food security and hence uplifting the living standards of the people.
iii. Necessary inputs such as fish feeds, fingerlings, extension services and credits to start fish farming should be made available and at affordable costs.
iv. Indeed, the increased interest in aquaculture following the ESP is a testimony that much more can be achieved when stakeholders work together.

6.2 Recommendations of the study

This study recommends the following;

i. Aquaculture stakeholders should increase the number of extension officers in order to reach every fish farmer.

ii. The Fisheries Department in Kitui County should ensure further research and capacity development in the area of fish feeds and the management of feeding for optimal output.

iii. The County Fisheries Department of Kitui should ensure training of farmers on feed formulation in order to cut down the cost of buying the costly and yet poor quality feedstuffs in the market.

iv. The Kitui County Fisheries Department should plan for construction of an Hatchery plant for breeding of fingerlings for her farmers.

v. The County Government of Kitui through the Department of Fisheries should renovate the abandoned ponds to ensure continuity of the Governments agenda on creation of employment to the youth and livelihood improvement to citizens through fish farming.

vi. The National Government through the County Development of Fisheries of Kitui needs to liaise with Micro financial institutions for provision of loans and credit to fish farmers to ensure support for sustainability of projects after Government subsidies are terminated.

vii. A need exists to create linkages and collaborations among all stakeholders (research institutions, universities, non-governmental organizations civil society, government officials and policy makers) by creating a strong forum for exchange of information of fish farming in the dry lands.

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Appendix I: Transmittal letter

Joyce Makasi Nzevu,

South Eastern Kenya University,

Agricultural Resources Management,

P.O Box 1094 Kitui.

TO WHOM IT MAY CONCERN

Dear Respondent,

RE: PERMISION FOR DATA COLLECTION

I am a University student pursuing a research study for MS in agricultural resources management. The title of my project proposal is "The status of aquaculture under the economic stimulus program in Kitui central sub county, Kitui County".

The purpose of this letter is to request you to take part in this research study by filling in the questionnaire attached. I take this early opportunity to assure you that the information hereby collected will only be used purely for this academic purpose and not for any other purpose whatsoever.

Kindly note, any information given here will be treated with utmost confidentiality.

Thank you

Yours faithfully,

Joyce MakasiNzevu.

Appendix II: Questionnaire

STATUS AND CONTRIBUTION OF FISH FARMING UNDER ECONOMIC STIMULUS PROGRAM IN KITUI CENTRAL SUB-COUNTY, KITUI COUNTY

Please indicate your willingness to participate in the research and respond to the questionnaire.

Yes ( ) No ( )

Questionnaire/Household Number ------- ------- Date of the interview: ---- /------ /---- ---

Name of the interviewee ----------

Please take a few minutes to answer the following questions as honestly as possible.

Section A: Demographic information.

1. Age of respondent in years……18-35 ☐ 35-60 ☐ <60 ☐
2. Gender of respondent Male Female
3. Level of education of the respondent ☐ ☐

Primary ☐ Secondary ☐ College/ Polytechnic ☐ University. ☐

4. Marital status of the respondent?

Single ☐ Married ☐ Divorced/Separated/Widowed. ☐

5. Number of household members…….

a) 0-4 years…..……b) .5-15 years…….. ..c) More than 15 years.....

6. What is the current state of your fish pond?

Functional ☐ Abandoned ☐

Section B: Factors influencing fish farming;

7Do you get information about fish farming?

Yes ☐ ☐ No

8 If yes, where do you get information/training from?

Extension officers ☐ istrict Fisheries Officers I☐elopment Partners e.g. NGOs ☐

☐Fish Framers Groups or forums ☐ Books and Journals ☐ TV/Radio ☐

9 Do you always have sufficient water for fish?

Yes ☐ No ☐

10 Mention some of water sources?

Streams ☐

Rain ☐

Tap water ☐

Borehole ☐

11 What is the main problem you face/faced concerning fish farming? In terms of;

Lack of extension services ☐

Pond management ☐

Low funding ☐

Lack of quality fingerings ☐

Lack of credit facilities ☐

Lack of knowledge and information ☐

Predators ☐

12 Do you face the problem of predation?

( ) Yes ☐ ( ) No ☐

Section C: Household wellbeing (income)

13 Why did you start fish farming?

Improve household income ☐ Provide food for home consumption ☐

To put idle land into use. ☐ Government initiative/effort ☐

Others …… ☐

14 How many fish do you keep per unit time /in a year?

Below 500 ☐

5001-1000 ☐

10001-Above ☐

`15 How much is your total harvest per unit time

16 How is the harvested fish utilized? In terms of

a Sell to market ☐

Home consumption ☐

Give to neighbors ☐

a) Home consumption (in kgs)……

b) Fish sold to the market.(in kgs).....

17 Is fish farming your main source of income?

Yes ☐ No ☐

18 If NO, please state your other sources of income apart from fish farming and the value per month.

Others sources of income	Value in kshs

19 How many paid employees do you have in your farm?in the range of

1-2 ☐

3-4 ☐

5and above ☐

20 How many of the employees are assigned to the fish farming

1-2 ☐

3-4 ☐

5and above ☐

21.What type of protein do you and your family consume? Indicate changes

Type of protein	Before aquaculture times/week	to date

Meat		More/less/same
Fish from market		More/less/same
Omena		More/less/same
Beans		More/less/same

22 What is the status of livelihood quality?

Indicate the change in terms of better, worse and same.

LIVELYHOOD QUALITY	SITUATON NOW COMPARED TO BEFORE AQUACULTURE
Diet diversity	Better/Worse/Same
Healthcare	Better/Worse/Same
Payment of school fees	Better/Worse/Same
Possession of household assets	Better/Worse/Same

24 The change of income levels accrued from fish farming

Income level before ESP among the fish respondents	Income level after ESP among the respondents	Show the change

Section D: Policies and Frameworks of fish farming.

25. Are there any stipulated policies on fish farming under ESP?

Yes ☐ No ☐

26. How did you qualify to benefit from ESP support?, indicate as follows

☐

Accessibility to water

Availability of registered farm ☐

Belonged to a cluster group ☐

Trained farmer ☐

27. Can you state the components of County fisheries department in Kitui County in order of their seniority?.....
.....
.....

Section E: Stakeholders/actors of fish farming.

28. Which year did you start fish farming

Before ESP ☐

With ESP ☐

29. What sources of support do/did you receive for fish farming?

ESP pond (…….) ESP feed (……)

ESP trainings (……..) ESP fingerings……

If the farmer receives/received ESP support; what is his/her source of information?

( ) Promotional activities ( ) Extension officers

( ) Other farmers ( ) Media

27 Do you get any assistance to access markets from the government?.....
.....

☐ Yes ☐ No

28 If yes, who gives the assistance?

……
……
.

29 State the name of the institution and type of assistance received for fish farming

……

……

30. State the groups of people involved in implementation of ESP IN Kitui Central Sub-County

……

……

.

THANK YOU.