FACTORS THAT HAVE CONTRIBUTED TO THE LOW ADOPTION OF POND FISH FARMING IN LUKHONGE SUB COUNTY.

BY

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DECLARATION

I **WAMIMBI AKIM** declare that this research proposal is my own original work unless otherwise cited, and where such has been the case reference has been stated and that the same higher education.

Signature..... Date. 22/11/2024

APPROVAL

This dissertation has been submitted for examination with the approval of my supervisor.

MR DRAMADRI GERALD AFAYO

Signature..... Date. 22/01/2024

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DEDICTION

I dedicate this research to my beloved Father, brothers, sisters for their endless support and always being there for me in terms of financial, moral and spiritual support towards the success of this course.

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ABSTRACT

Aqua culture used to be one of most practiced enterprise in lukhonge Sub County with important economic impact on many resource-poor farming families. Many factors limit production and profitability, with hundreds of millions of dollars spent yearly on buying fish alone, but little is known about the cause of low adoption of fish farming, with experts agreeing that they are variable and frequently significant. The recent years many families engaged in fish farming but suddenly many families abandoned the enterprise without clear reasons. Lukhonge Sub County is a low land area in Mbale characterized with many swamps and streams which have become under-utilized and yet the farmers who practice the enterprise reveal its profitability. The study was conducted on the low adoption of pond fish farming in lukhonge sub county Mbale district. The study design was a cross sectional research design and a sample size of 112 respondents was adopted using purposive sampling technique. Data was collected using questionnaire that was designed for both farmers and stakeholders and presented in form of frequency tables and charts both pie charts and graphs The findings revealed that there are clear low adoption of fish farming in lukhonge sub county. However, effects of low adoption of pond fish farming included the following flooding in the area, low incomes in farmers, rural urban migration and others. It was concluded that, efficient adoption of fish farming in a near future can only be achieved with effective farmers' education as a foundation.

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A LIST OF ACRONYMS

EAC, East African Community

FAO, Food and Agriculture Organization

FTA, Food Tech Africa

TCP, Technical Cooperate Programme

SSA, Small Scale Aquaculture

MAAIF, Ministry of agriculture animal industry and fisheries

NGO, Non-government organization

CHAPTER ONE

INTRODUCTION

1.0 Background

Aquaculture is the industrial farming in fresh or salt water of fish, mollusks, crustaceans and plants.

Aquaculture is rapidly increasing its annual global harvest and seems to offer hope for increased food production. However, for some of the more than 210 farmed aquatic animal and plant species, particularly salmon and shrimp, the methods currently used require high energy inputs and can cause environmental degradation similar to industrial/chemical agriculture or factory farming of livestock. These include loss of natural habitat, loss of genetic diversity, and replacement of self-reliant indigenous fisheries with multinational corporations. Pollution from concentrated sewage can smother the benthic (bottom dwelling) organisms, over-fertilize the water and lead to toxic algae blooms. (A single fin fish farm may output as much daily sewage as a small city.)

High stress overcrowding contributes to epidemic disease remedied by routine vaccinations and antibiotic treatments, cultivating drug resistant pathogens and impacting other aquatic wildlife. High concentrations of pathogens/parasites on the farm can infect the natural environment threatening local species; escaped domesticated farm fish can threaten local species with extinction through genetic pollution.

AQUACULTURE IN EAST AFRICA

Aquaculture has the potential to make a significant contribution to food security and income generation. Dutch private companies, knowledge institutes and ministries are involved in various aquaculture projects throughout Africa. In a number of countries belonging to the East African Community (EAC) there is currently insufficient knowledge at governmental as well as at private sector level about: the fish value chain, inter-linkages of the value chain across East African countries, the potential for sustainable aquaculture development in the region, business opportunities for Dutch companies, and possible linkages to the FoodTechAfrica (FTA) project. Therefore the present study has been requested and financed both by the Dutch Ministry of Economic Affairs and the FTA consortium. The linkages and interdependency of the fish and/or aquaculture value chain across the four EAC countries (Tanzania, Rwanda, Kenya and Uganda) have been analyzed. The biggest fish consumers are Uganda, Tanzania and to a lesser extend Kenya. In order to maintain present levels of fish consumption in these countries, considerable additional quantities of fish are required through aquaculture. In EAC countries, considerable quantities of Tilapia are being fished and traded regionally. Trade in Tilapia is mainly price driven. This implies a potential risks for the development of tilapia aquaculture since aquaculture fish has to compete with wild catch and with imports. With stagnating wild catches and the strong increase in demand, competition between wild and cultured tilapia is considered to be a temporarily situation. To stimulate the regional production of farmed fish, the EAC put a high import duty of 25% on fish from outside the EAC. However, only where the internal production cannot fulfil the total demand, import of cheap (pelagic) fish is becoming important. As well as fish, imported fish feed from outside the EAC is charged with an import duty (20%). The import duty on feed will encourage local feed manufacturing (within the EAC), but is presently a constraint in absence of locally produced high quality starter and grow-out feeds. Aquaculture across the countries concerned is a modest industry, and at the present speed of development cannot cope with the expected strong increase in demand for fish and fish products. Therefore, considerable efforts are required in order to accelerate the development of aquaculture in the EAC. Among the main bottlenecks are the availability of high quality feed, access to investment and running capital, knowledge for sustainable high productive fish culture systems, and good quality fingerlings. A coordinated approach involving different public and private actors in the EAC region and from the Netherlands is essential in order to realize the aquaculture potential in the EAC. The identified interventions include transfer of technology and capacity building at various levels, the development of simplified recirculation aquaculture technology for small holders, improved quality monitoring and control of fish feeds, and policy influencing to

encourage governments to (temporarily) reduce import duties on high quality fish feeds. These interventions are preferable addressed through a concerted Food Security program focused on aquaculture. Any future capacity building interventions should address the proper linkage between education & research and the professional sector.

Aquaculture is one of the world's fastest growing food-producing sector, with Development, expansion and intensification occurring in practically every region (Subasinghe et al. 2009). The increase in global per capita fish consumption from 9.0 kg in 1961 to 20.5 kg in 2018 (FAO 2020) indicated an improved preference for fish and increased demand for fish as a source of high-quality nutrients. More, the declining fish stocks and the leveling off of Production from capture fisheries, with most fishing areas currently at maximum potential, are signals that capture fisheries alone cannot meet the growing human demand for fish. Aquaculture is thus hoped to bridge the supply-demand gap (Subasinghe et al. 2009). In Africa and Uganda in particular, fish accounts for more than 63% of protein consumed by Ugandans, with an annual er capita consumption of 12.5 kg in 2013, higher than the African average of 10.1 kg at that time (Adeleke et al. 2021).With a population estimate of 44.3 million people and a projected Population of 74.5 million by 2040 (UNDESA 2019), Uganda currently requires at least 908,200 tons of fish per year for the local market and will require at least 1,527,300 tons by 2040 if Ugandans are to consume fish at the global average per capita fish consumption level of 20.5 kg (FAO 2020). In order to satisfy both the local and the international markets, Uganda will need to invest more and expand its aquaculture industry. In this review, we present Uganda's Aquaculture industry, highlighting the farmed species, production systems, trends in production, Challenges, and the sector's potential for development.

Materials and methods

The focus of this review was primarily analytical, descriptive, and qualitative. The data was gathered from a survey of published literature and studies on aquaculture, with a focus on Ugandan aquaculture, by searching the online databases and visiting websites of relevant Institutions. Relevant literature was obtained from peer-reviewed journals and institutional Websites such as those of Uganda's Ministry of Agriculture Animal Industry and Fisheries (MAAIF),

Uganda Bureau of Statistics (UBOS), and the Food and Agriculture Organization (FAO), among others.

Fish farming in Uganda

Results show that the aquaculture industry in Uganda is divided into three main sectors: Smallholder fish farmers, medium-scale commercial fish farmers, and large-scale commercial fish farmers. Nile tilapia (Oreochromis niloticus) and African catfish (Clarias gariepinus) are the dominant species in all sectors. Common carp (Cyprians carpio) and red belly tilapia (Tilapia zillii) are two more fish species that are also produced, but on a smaller scale (Kasozi et al. 2017, Adeleke et al. 2021). Until recently, aquaculture production in Uganda was mostly based on pond culture system, but with the development of commercial fish farms, various Victoria and Kyoga, has now spread to other lakes and rivers (Mbowa et al. 2017, Musinguziet al. 2019). Cage aquaculture was promoted by the government of Uganda as a development priority to boost aquaculture production amidst stagnating capture fisheries (Kasozi et al. 2017, Mbowa et al. 2017). The predominant fish species grown using cage culture is Nile tilapia. The

Most common cage technology is the low-volume, high-density cages of 8 m^3 with a stocking rate of 200–400 fingerlings/m^3, although large-sized cages of various shapes and sizes are now common, especially among large-scale commercial farmers. The system is based on hatchery-produced fry and the use of pelleted feed (Kasozi et al. 2017).

In terms of production, Uganda is Africa's third-largest aquaculture producer, behind Egypt and Nigeria, and the second-largest in Sub-Saharan Africa (Adeleke et al. 2021).Total production increased from as low as 31 tons in 1984 to 123,897 tons in 2020. Before 2012, African catfish was the main species produced in the ponds. African catfish became widely accepted and common among fish farmers due to the improved breeding technology among hatchery operators, the characteristic rapid growth rate of catfish, and the ability to feed on the organic matter available at household level. In addition, catfish are also predominant in all the water systems in Uganda, particularly water catchments linked with swamps (Rutaisire J. 2007). However, with the advent and intensification of Nile tilapia cage aquaculture in the country and the international market position that attracted investors' interest in tapping this market, production of Nile tilapia has overtaken that of catfish (Figure 2). Nile tilapia is currently the most farmed culture species in the country, whose production has consistently remained above that of African catfish since 2016, with production in 2020 estimated at 37,488 tons for African catfish and 86,011 tons for Nile tilapia (Figure 2). Although common carp was one of the first fish species introduced into aquaculture in Uganda,

1.1 Problem statement

many developing countries in the world for example Finland Japan, Chain and many other African countries are developing due to fish export. Much as Uganda is a land locked country, the only way to compete with those countries is to practice fish farming. It is of the view of the researcher to find out factors that have contributed to the low adoption of production in lukhonge Sub County.

1.2 Justification

Comparing the past years and the present time, there has been rampant low ih production due to a number of factors including limited access to improved and highly yielding fish species. However, farmers and extension should be aware that; Fish farming can be carried out in natural water bodies and in artificially made ponds. It is the key source of protein and the returns are

easily realized compared to other enterprises
Therefore, this research was of great importance as it pointed out the factors affecting low fish adoption and suggested solution to them in order to restore the high production as it used to be.

1.3 Objectives

1.3.1 Main objective.

To find out how fish farming can improve the livelihood of the people in lukhonge Sub County.

1.3.2 Specific Objectives:

To assess the level of fish farming in lukhonge sub County
To analyze the challenges faced by fish farmers in lukhonge sub county.
To establish possible strategies towards adoption of fish farming in lukhonge sub county.

1.4 Research questions.

1 How do people of lukhonge sub-county relates to fish?

2. What is the key factor hindering adoption of fish farming in lukhonge Sub County?

3. What measurescanbe put in placetoenhanceadoptionof fishfarming in lukhongesub-county?

1.4 Significance of the study.

The results of the study was to benefit the farmers, extension workers, Agricultural researchers, and they would get to know and how to address some factors that led to the low adoption of fish farming and be able to put measures to revive its production. Therefore, the results of the study would benefit. The farmers to understand that fish farming earns the country some foreign exchange and income to themselves (farmers).
Extension workers to perform their roles in order to encourage farmers to maximize production with minimum costs.
Agricultural researchers in the improvement of better fish species which are more adaptable, faster growth rate and other characters and appreciate the yields from the farmers.

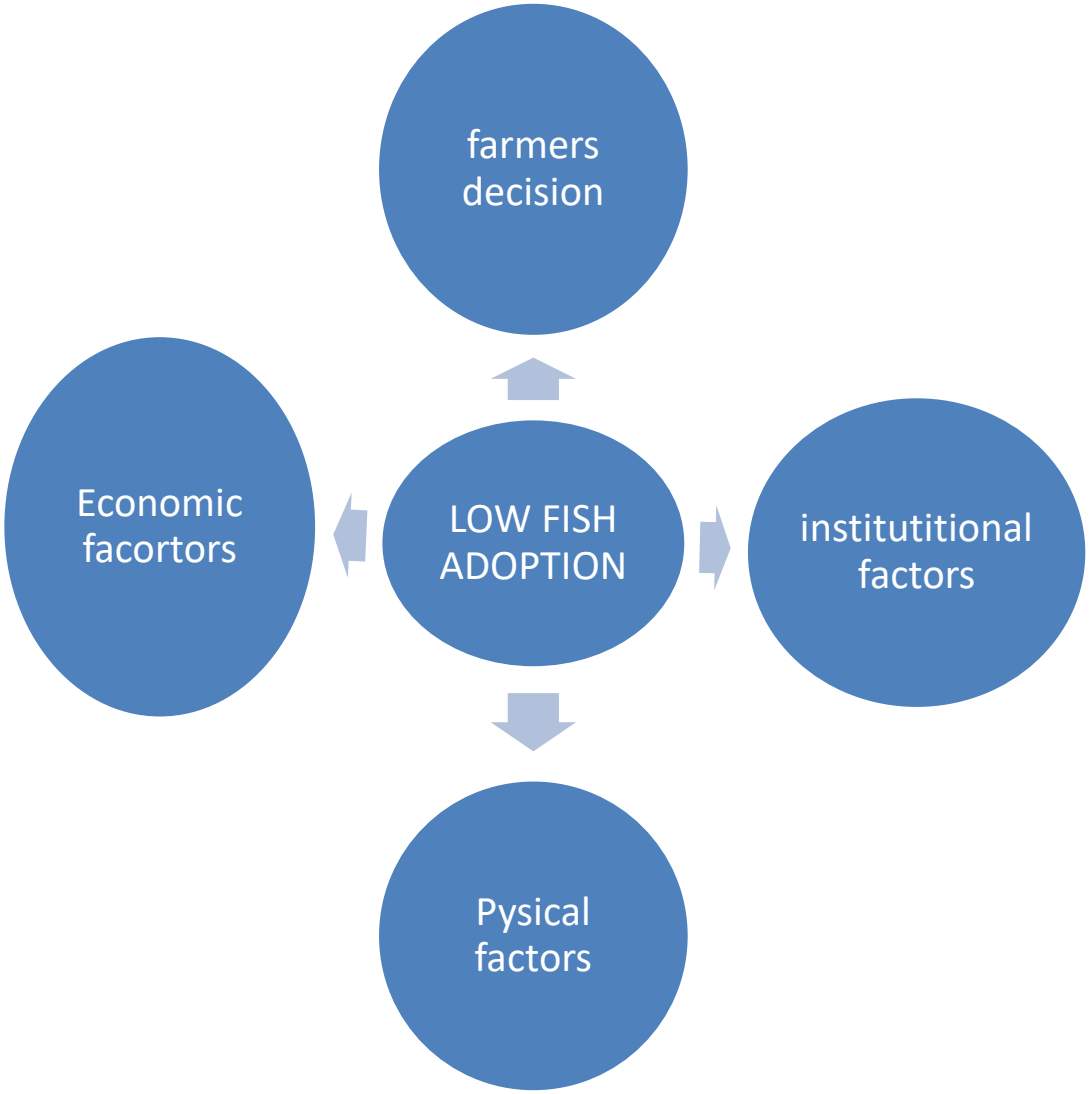
1. SCOPE

This study was conducted in Eastern Uganda in Mbale district, Lukhonge Sub-County in

December 2023. The research is mainly to concentrate on the people (farmers) rearing fish, those who reared and failed, and also those who just wish to rare fish.

1. 6 Theoretical frame work

The conceptual models derived from variables are put to test in order to establish the significance of the proposed relationship. The variables considered in this research are economic, institutional, physical and social variables.


farmers decision
Economic facortors
LOW FISH ADOPTION
institutitional factors
Pysical factors

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Varieties of fish reared in Uganda

According to Uganda Bureau of Statistics (UBOS), and the Food and Agriculture Organization (FAO), among others. Results show that the aquaculture industry in Uganda is divided into three main sectors:
Smallholder fish farmers, medium-scale commercial fish farmers, and large-scale commercial fish farmers. Nile tilapia (Oreochromis niloticus) and African catfish (Clarias gariepinus) are the dominant species in all sectors. Common carp (cyprinids carpio) and red belly tilapia (Tilapia Zillii) are two more fish species that are also produced, but on a smaller scale (Kasozi et al. 2017, Adeleke et al. 2021).
The Nile Perch). (*Lates niloticus*is locally known as "Tempura", especially in the central region. It weighs up to 80 kilograms. In Uganda, it is a native species to Lake Albert where it is locally known as Gur, and the River Nile below Murchison Falls. It was introduced into Lakes Kyoga and Victoria basins in the mid-1950s, but its presence in Lake Victoria was first noted in 1960. Although 'the Nile Perch was introduced into Lake Victoria in the early 1960s, it took more than 10 years to get fully established in the new ecosystem. Nile perch on Gaba landing site
Singida Tilapia the Singida Tilapia (*Oreochromis esculentus*) is locally known as "Ngege". It is a critically endangered species of cichlid endemic to the Lake Victoria basin, including some of its satellite lakes such as Lake Kyoga. Its common name refers to Lake Singida, but this population is the result of an introduction that happened in the 1950s. It is among the oldest types of fish in Uganda. Due to the introduced predatory Nile perch (*Lates niloticus*) and the highly competitive Nile tilapia (*Oreochromis niloticus*), it has become very rare .The Nile Tilapia (*Oreochromis niloticus*) is a species of tilapia, a cichlid fish native to the northern half of Africa and the Levante area (Lowe-McConnell, 1988). Numerous introduced populations exist outside its natural range. The Nile Tilapia reaches up to 60 cm in length, and can exceed 5 kg.
Semutundu Cat fish The Semutundu Catfish (*Bagrus dogmas*) is locally known as "Semutundu" and a species of the bagrid catfishes, i.e. the genus *Bagrus*. In Uganda, it is widely distributed in the Rift Valley Lakes Edward, George, Albert, Victoria and the Nile system. It is grey-black above, creamy white below. It lives in both shallow and deep water. It feeds on insects, crustaceans, mollusks and fish. Takes any live or dead bait fished on or near the bottom.
Silver Cyprinid
The Silver Cyprinid (*Rastrineobola argentea*), also known as the Lake Victoria Sardine, is locally known as "Mukene". It is a small species of pelagic, freshwater ray-finned fish in the carp family (Cyprinid) from East Africa, and can grow to a length of 9 cm (3.5 in).Marbled L
The Marbled Lungfish (*Protopterus aethiopicus*) is a lungfish of the family Protopteridae. It is found in Eastern and Central Africa, as well as the Nile region. In Uganda, it lives in the Nile basin, including lakes such as Albert, Edward, Victoria, Nabugabo, and Kyoga. It is locally known as "Emamba". Mudfish are locally known as "Ensonzi". They are a kind of catfish common in East African swamps. Once caught, they are individually rolled up and several of them in a row are put on a stick and then smoke dried. They are mostly put in ground nut soup to add a flavor of fish. Sprat is locally known as "Enkejje" in the central region. It is fished near the

shore. Several of them in a row are put on a stick, dried and sold in markets. Sprat is usually fried and eaten as source but mostly prepared in ground nut soup.
Clarias Catfishes (*Clarias*) are a genus of the family Clarinda, the air breathing catfishes. They are locally known as "Emalle". Elongate Tiger Fish
The Elongate Tiger Fish (*Hydrocynus forskahlii*), locally known as Ngassa, is found in the Nile and Lake Albert. It is an open water predator often found near the surface and in fast flowing water. It forms shoals and feeds on fishes, preferring long-bodied fish, as they are easier to swallow. It also takes insects, grasshoppers and snails. Cannibalistic. Silver with long and slender profile. Tail fin forked with bright red color, rest of fins uniformly grey. Regularly takes spinners retrieved at high speed across fast-flowing water. It is used by fishermen as live bait for Nile Perch. African Tiger Fish. The African Tiger Fish (Hydrocyanic) is locally known as Wagassa. It grows up to 105 cm long and 28 kg in weight. It has long gill rakers. The tips of adipose and dorsal fins black. The forked edge of its tail fin is black. It prefers warm, well-oxygenated water in larger rivers and lakes. All but the largest fish form roving schools of like-sized fish; aptly described as fierce and voracious. It feeds on whatever prey is most abundant. The Niger Barb (*Barbus bynni bynni*) grows up to 82 cm in length and 4 kg in weight. It is confined to the Nile and lakes that are, or were once, connected to the Nile. It feeds on crustaceans, insects, mollusks and organic debris. Lake Victoria Squeaker (*Synodontis Victoria*), also locally known as Wahrindi, is a species of upside-down catfish. It grows up to 35 cm in length and 1.5 kg in weight. It has one strong dorsal spine and spines within the pectoral fins, which are long and serrated. The spines can be locked at right angles to the body as a form of self-defense. It squeaks when caught or distressed. It is found mostly near soft bottoms of the water bodies and close to banks. Near waterfalls, it is found in slower flowing water. The fish of the shallow, faster water are generally of a lighter greyish-green color, whilst the fish of the deeps are a darker, blacker color. The Pebbly Fish or Silversides (*Alestes baremoze*) is locally known as Angara. It grows up to 43 cm in length, and 500 g in weight. It is silver colored with blue-grey black and white belly, greyish fins with orange colors on the lower lobe of the tail fin. It is caught with spinners, spoons and fly. It also takes float fished dough and termites. The Electric Catfish (*Malapterurus electricus*) occurs in the Nile (exclusive of Lake Victoria). It grows up to 1 meter in length and 20 kg in weight, and lives in rocky waters or roots and favors sluggish or standing water. It is most active at night, feeding mainly on fish stunned by electric shocks. The electric organ, capable of discharging 300–400 volts, is derived from pectoral muscle and surrounds almost the entire body. It is used both for prey capture and defense. Forms pairs and breeds in excavated cavities or holes.

2.3 General challenges fish farmer face

Although the importance of aquaculture in the region is widely recognized, it is still a long way from meeting the present or future demands for fish and much remains to be addressed. The development of production systems that can meet these demands face a number of major challenges, some of which are discussed below. Dadzie (1992) asserted that the main constraints to aquaculture in Eastern Africa are biological, infrastructural and economical. The inability of the region to tap its natural aquaculture potential is also affected by limitations on the quality of

aquatic organisms farmed, the technologies employed to harness the potential of these farmed species and the inability of farmers to economically invest and operate aquaculture enterprises. These constraints loosely translate into inadequate supply of quality seed, lack of affordable quality feed, inadequate and inappropriate technical advice/information, and use of inappropriate production systems: in short, the "big five" omnipresent constraints – lack of access to quality and affordable feed, seed, information along with access to optimal markets (Mushi et al., 2005; Mwanja et al, 2005a). Clearly in Eastern Africa, as throughout the region, these traditional challenges remain. Most small-scale production remains unplanned, using inappropriate production systems and methodologies. To address this gap, government extension services are inadequate to provide the services required by farmers. The seed is of poor quality, the feed, if used, is based on home and farm by-products since most farmers cannot afford to buy milled feeds on regular basis. There is, therefore, a need for aquaculture research to tackle these concerns/constraints and generate solutions targeted specifically for smallholders.

2.3.1Specific challenges that apply to Uganda include:

The lack of fish culture tradition, land tenure issues, in some cases lack of successful stories/examples of aquaculture production and farming systems (Rutaisire et al., 2009) and lack of critical mass to meet the necessary threshold for aquaculture to blossom. As a result, most fish farming is in the form of subsistence small-scale production practiced together with a multitude of other equally small-scale farming activities including both crop and livestock husbandry. It is important to have aquaculture technologies that can be integrated into these mixed agriculture farming systems with little or no specialized management skills required. As small-scale farmers produce largely for subsistence, g classified as rural poor rural who own and manage low input–low output systems on a non-monetary basis (Rutaisire et al., 2009, Mwanja et al., 2005a), any aquaculture systems extended to this category of farmers must, at least in the initial phase, rely on non-monetary means to access the required inputs and technical advice. Critically tied to this challenge is the issue of land tenure. Small-scale farmers may not own land but may either rent, share crop, or farm on public or communally-owned land. Under these conditions, land security and ownership are weak and do not allow farmers to engage in expansive or long-term investments. With this high degree of uncertainty, these farmers generally only engage in annual food crops which allow for maximum mobility if needed. Therefore plans to develop and improve aquaculture production for these farmers, who tend to be scattered over great distances, need to take in consideration such

The lack of the necessary guidelines and management skills/technologies had been highlighted by several recent proposals for large-scale investment in mar culture. Without a planning framework (e.g. allocation of areas for various uses such as aquaculture, fisheries, tourism,

transport, biodiversity conservation, industry, urban development and energy), coastal protection and conservation can be significantly challenged. In order to help resolve the most fundamental issues that now constrain sustainable mar culture development in East Africa, drawing up national Mari culture development plans that integrate both poverty alleviation and natural resource management strategies are needed, and must be complemented by development of targeted Mari culture guidelines that promote environmental sustainability as well as economic viability. The increasingly erratic and unpredictable climate is also proving to be a major challenge for small-scale aquaculture (SSA) in East Africa. Climate change is expected to disrupt ecosystems and hence aquaculture productions on a devastating scale in the years ahead. Global warming and the consequent increase in water temperature are already impacting significantly and negatively on aquaculture in the region. Differential warming between land and oceans and between polar and tropical regions are already affecting the intensity, frequency and seasonality of climate patterns (e.g. El Niño) and extreme events (e.g. floods, droughts, storms) are affecting the stability of marine and fresh water resources adapted to or affected by these events (FAO, 2008). This has unpredictable consequences for aquatic production. The smallholder group of farmers normally does not have the safeguards to depend on, guard against or ameliorate such natural calamities (World Food Centre, 2009). In East Africa, floods and drought are now major concerns as they affect aquaculture in terms of destroying ponds, with fish escaping into the wild, or causing drying out of previously permanent water sources. The growth of the SSA sector in the region is limited principally by an inadequate knowledge base on the use of farm-made feeds. In addition, small-scale farmers are constrained by the availability of animal manure because of the free range nature of animal husbandry and the cost of inorganic fertilizers, thus the need to focus on appropriate farm-made feeds (FAO, 2007). Several issues related to feed and fertilizer that the aquaculture industry will have to address in the near future include the following: the use of conventional protein sources; adherence to the tough national environmental protection measures as well as stringent food safety requirements; the quality standard imposed by the governments on raw materials, additives and feeds at national, regional and international levels; the safe and appropriate use of aqua-feeds produced by small-scale manufacturers as well as support to improve their production technology; development of on-farm feeding strategies and practices for improved utilization of agricultural and terrestrial by-products; and capacity building of small-scale farmers to make more effective farm-made feeds. In Eastern Africa, we are only beginning to see the production at a commercial scale of complete formulated feed. Fish feed factories producing floating pellets have been established in Kenya and Uganda, and similar plans are underway in Rwanda. But the key challenge to fish feed manufacturers in the region will be finding an appropriate substitute to fish meal which is continually increasing in price due to the demand on the same source for several uses including human food. Most of the fish meal used in Eastern Africa comes from capture fisheries of small minnow-like pelagic. On-farm made feed (pellets) made by a fish Manufactured floating feed (pellets) farming group Prastreneo bola argentea found in Lake Victoria. This species locally known in Tanzania and Kenya as Dagaa and in Uganda as Mukene has growing regional market

where it is increasingly been used as human food. Most farmers make partial harvests of their ponds over a period of several months. While partial harvesting is good from the biological production point of view it can cause problems especially in mixed-sex tilapia ponds because of the prolific nature of these fish (Veverica et al., 2001). Large fish are removed first, thereby leaving the slowest growers as brood stock, and skewing the sex ratio towards female, leading to the accumulation of a large biomass of fingerlings whose growth virtually ceases as the pond has reached its carrying capacity. At this stage, farmers fail to distinguish between large fingerlings and stunted females. These has led to disappointment and discouragement from continuing with aquaculture as farmers have been unable to breakeven and have to abandon the ponds. Another big challenge to SSA is the level, quality and cost of technical advice/information. While there are many professors and researchers in the region in this field, there are very few extension agents accessible to small-scale fish farmers. Many agents who are working within the local government authorities are normally involved with planning and administration of the sector, and may not be necessarily be exposed to the field nor have the necessary competence required to guide such farmers. The few good agents are usually busy advising the emerging commercial fish farmers; such services are too costly for typical small-scale farmers. As aquaculture continues to grow and mature as an industry where the place of the small-scale subsistence fish farmer is uncertain, the importance and need for reliable information and data to ensure a sustainable growth of the sector are also recognized. Currently, data collected from the farmers are not uniform mainly because data sheets or record sheets that farmers have are not the same. There is a need to have better species level reporting as well as an agreement on definitions and standards. A particular problem identified is the lack of reliable data on the contribution of small-scale producers. A leading challenge to SSA, given its dependence on public support, concerns policy for aquaculture development in the region. There are no appropriate policies in place as compared to policies concerning capture fisheries. Some policies focus on regulation and control of aquaculture and none on support and promotion of the enterprise. The sector which is not there yet in most countries is simply over-regulated. Many policies in the past have also failed starting with rural livelihood approaches, the predominant public support systems for SSA, and the non- commercial focus of such policies have failed aquaculture take-off in the region. Like all other agricultural production enterprises, aquaculture has also suffered from the impact of the constantly shifting macroeconomic policies at local, region and global levels. Fingerling production, inadequate extension services, farmer perceptions, and unfavorable post-

Independence government policies are reported to be hindering the growth of aquaculture (Adeleke et al. 2021). Since 2012, production of red belly tilapia has not been reported and the Species appears to have been abandoned by farmers. Red belly tilapia has not been Popular among fish farmers due to its slow growth rate (Kasozi et al. 2017).

3.4Solution to the challenges

Most of the study area farms were found to culture Tilapia and Carps . The present study's findings agree with the conclusion of Aziz and Hossain (2002) regarding suitable aquaculture

species of the hilly area. Thus, the study suggests continuing aquaculture with the mentioned species of fish in the study area. Challenges of quality seed and feed, technical guidance and marketing. In addition, this approach eliminates the challenge of production system planning and construction as this shall be done at public cost on a scale large enough to lower the costs and that allows farmers to lease and own suitable commercial production units at nominal fees. This approach is also important as it creates the critical mass needed especially regarding to inputs and supplies and for marketing farm produce .The challenge of land tenure and poorly constructed production systems can equally be addressed through this concept of aquaculture parks where small-scale farms would be set up and managed on sites with well-planned and engineered units, and leased to small-scale farmers at nominal fee. One novel project generated with support from FAO Technical Cooperation Programme (TCP) Assistance in Uganda concerns small-scale privately-owned and operated rural hatcheries (Mwanja et al., 2005b). This approach has changed way quality fish seeds are produced, distributed and made available to rural smallholder fish farmers. Quality seed of Nile tilapia and African catfish can now be produced and made readily available through such set up, a departure from the usual system of ineffective public production and public distribution of seed. Among the features include private ownership and operation of the hatchery, technical training of hatchery operators that enable them to serve as primary service provider, hatchery operator as nucleus or center to service a pre-determined minimum number of farmers. Where possible, a seed credit system with a built-in buy back system of market- size fish in exchange for for seeds is put in place including a monitor system for seed quality from the nucleus hatchery operator. In Kenya, working with European partners, a project on using small cages that are easy to moor and move when needed was developed and piloted in Kenya, Uganda and Ethiopia. Known as the BOMOSA Cage Culture fish farming systems, the project was intended for small- scale fish production in ponds and temporary water bodies and also using a holistic approach to address the challenges facing SSA such as the lack of quality seed, feed, technical information, market, and for some areas, the lack of fish eating culture in a manner that is simple and cheap to apply at small-scale level (Waidabacher, 2006).

2. 5 Measures.

Despite the many challenges to SSA, there are also many opportunities in the region.

One is the increased demand for fish against the backdrop to stagnated and/or collapsed fisheries from the wild. This means that farmers can make money producing and marketing their fish with reduced competition. The Eastern African region has a record of fast human population growth, with 8 countries with combined population at 219 million in 2008 (Hub and Kent, 2008). With the growth of fish demand, there has been almost exponential growth in value of the fish locally, regionally at premium markets giving commercial small-scale producers a second opportunity to maximize production based on scarcity of supply. A third and clear opportunity for small- scale aquaculture producers is the availability of serene or near serene systems hardly been tapped for aquaculture production such as coastal and marine environment, the many streams and minor lakes, the temporary water bodies including communal water provided with the required infrastructure for commercial aquaculture production which can then attract the required services and inputs to support farmers address the common

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Materials

I will use questionnaires in which the local people and extension workers will fill in, interview method, papers and pens also will be used during notice taking of the important information camera will be used for taking photos

3.2 Area of study

The study will be carried out in lukhonge sub-county in Mbale district. Lukhonge sub-county is comprised of four parishes which include; Namawanga, Nabweye, Nanbwa, waninda. Lukhonge is a current sub county which was from Bukiende.

3.4 Topography

Lukhonge is a moderately low land where swamps majorly seasonal ones do exist particularly during rainy season and such areas are left unproductive. This areas can be used for fish production than leaving them unutilized.

3. Climate

There is heavy rainfall March to May, from May to July the area received moderate rains, from August to November the area received heavy rains and lastly from December to February the area received hot and dry climatic conditions. The area is covered with green with annual crops characterized of green color in the months of May to September

3. Soils

the soils black in color in lower parishes and brown in the upper parishes

3.7 Land tenure

Most of the land is divided into plots and a few number of people are having approximately larger size of land but not making an acre.

3.8 Land holdings

a number of farmers have at least small pieces of land of which are rendered un fit for crops during rainy seasons so fish farming could be the best option.

3.9 Population

the area has less population participating in fish farming as most of them say that inputs for fish farming and knowledge is limited.

3.10 Socio economic activities

The cereal growing, trading and the growing of legumes and pulses crops such as G .nuts, beans etc. are dominated in the area because they are traditional crops which most farmers at least have knowledge.

3.11.0 Methodology

3.11Research design

The research was descriptive cross sectional survey. The research drew
from both the quantitative and qualitative approaches in order to get the attention of a bigger number of respondents and data collected.

3.12Target population

the target population was mainly fish farmers, and the entire community basically the parents

since they could own land.

3. Sampling

3.12.1Selection of the parishes

the three parishes will be selected randomly from five parishes namely; namawanga, nambeye, waninda, nambwa, nekombe.

3.12.2 Selection of the respondents'

i. **Farmers:** These farmers was randomly selected from each parish. The opportunity was given only to those who are able to read and write both lumasaba and English.

ii. Extension workers: Two respondents namely; cooperative assistant and agricultural assistant in charge of lukhonge sub-county will be used.

iii. Interviewees: One farmer from each of the parishes was selected preferably a prominent farmer.

3.13.0Research tools

In order to find out the factors contributing to low adoption of fish farming, the researcher selected more dependable and reliable tools namely; questionnaires and oral interviews with the respondents.

3.13.2 Questionnaires

The questionnaires were designed for the farmers and extension workers who could read and write English.

3.13.1 Farmer's questionnaire

As instructed by the researcher, the main aim of this questionnaire was to find out their views on what has caused low adoption and if possible solutions could be suggested.

These were 14 questions of which four were open ended structured and the rest were closed structured question. They tricked and wrote appropriate responses that applied the question.

3.13.2Extension worker's questionnaires

The researcher administered the questionnaire on the extension workers. There will be 8 questions of which 3will be open ended structured questions and the other five will be objective type questions.

3.13.3 Oral Interviews

Interviews was restricted to prominent farmers each from a parish. The items consisted of set question (questionnaires) which will be administered to farmers by the researcher. There will be a good relationship in which the views will be given, expressed willingly and freely.

3.13.4 Observation

Observation was carried by the researcher as i travelled across the parishes. The observation will be made as i move across the parishes and as i access the fish ponds in the area and i also access fish in the markets within the sub county.

3.14 Data analysis.

Data which will be collected will be analyzed and interpreted by descriptive means by the use of frequency tables, percentages and line graphs and others.

3.1 Limitation to the study

the researcher will have loved to carry out the investigation in all the five parishes of the sub co unty but because of the large area and long distances apart from one another, it will be carried out in only four easily accessible parishes. Transport issues, issues of funds tend to be the limiting factors as far as the research is concerned

CHAPTER FOUR

4.0 PRESENTATION, ANALYSIS AND INTERPRETATION OF FINDINGS

4.1 Introduction

This chapter presents research finding, analysis and interpretation based on the specific objectives stated earlier as thus;To find out the economic importance's of fish farming in lukhonge Sub County, To determine the factors responsible for the low adoption of fish farming in lukhonge Sub County, To determine the measures to be taken to improve fish farming in lukhonge sub county Mbale district.

4.2 Presentation of the Background information

Information was sought on demographic factors and these included age, gender, education level, farming expirenence,main occupation among others. The details of these are presented in the ensuing sections.

4.2.1 Gender of respondents

The study established the gender distribution of respondents within their categories and the results are presented in table 4.0

Table 4.0gender of the respondents

Gender	Frequency	Percentage
Males	80	73
Females	30	27
Total	112	100

Primary source data

The results were also further represented on a pie chart as shown below for better understanding and interpretation.

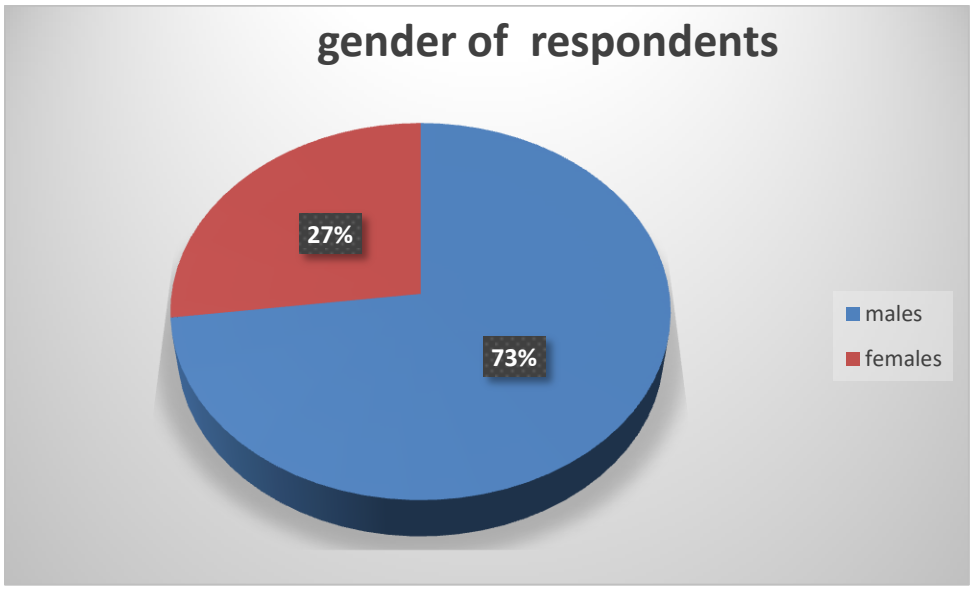


Figure4.2.1 gender of respondents

Figure 4.2.1, shows that majority of the respondents 82 (73%) were males while the remaining 30(27%) were females. This implied that more males participated in the study compared to females. This implied that more male were active in various activities of Agriculture compared to females. This pointed to the fact that most females do not have self esteem and equal opportunities to enable them get involved in livelihood improvement activities while male on the other hand due to gender and disability stereotypes have some assets to support their economic activities.

4.2.2 Age distribution of respondents

The study also collected information on the ages of respondents. These were categorized using a range of years as shown in Figure 4.1.

Table 4.1showing age of respondents in lukhonge of respondents	**Frequency**	**Percentage**
21-30	**47**	**42**
31-40	**35**	**32**
41-50	**19**	**17**
51 and above	**10**	**9**
Total	**112**	**100**

Primary source data

Table 4.2.2 indicates that the majority 47 (42.3%) of the respondents were aged 21-30 years. These were followed by 35 (31.5%) of the respondents that were aged 31-40 years and 19 (17.1%) were aged 41-50 years. The least 10 (9%) of the respondents were aged 51 and above years. The findings above signified that most of the fermers interviewed were still in the youthful and productive age. These would make them benefit from the research.

4.2.3 Level of education

The researcher requested the respondents to indicate their highest level of education; the reason for this request was to help in understanding how their education level shaped level of involvement in fish farming and its effect on their livelihood improvement.

Table 4.2.3: Education level of Respondents

Education level	**Frequency**	**Percent**
Totally illiterate	30	27.0
Primary	15	13.0

Secondary	40	36.0
Tertiary	15	13.0
University	12	11.0
Total	**112**	**100.0**

Primary source data.

Table 4.2.3 shows that a significant number of respondents constituting 40 (40.5%) had obtained secondary level education, followed by 30 (26.8%) who where not educated.Furthermore, 15 (13.4%) of the respondents had completed primary level as their highest education level while 15 (13.4%) respondents had received tertiary education. The remaining 12(10.7%) respondents had been educated to university level. This meant that majority respondents that got involved in the study were literate, having attained different education levels.

The results were also further represented on a pie chart as shown below for better understanding and interpretation.

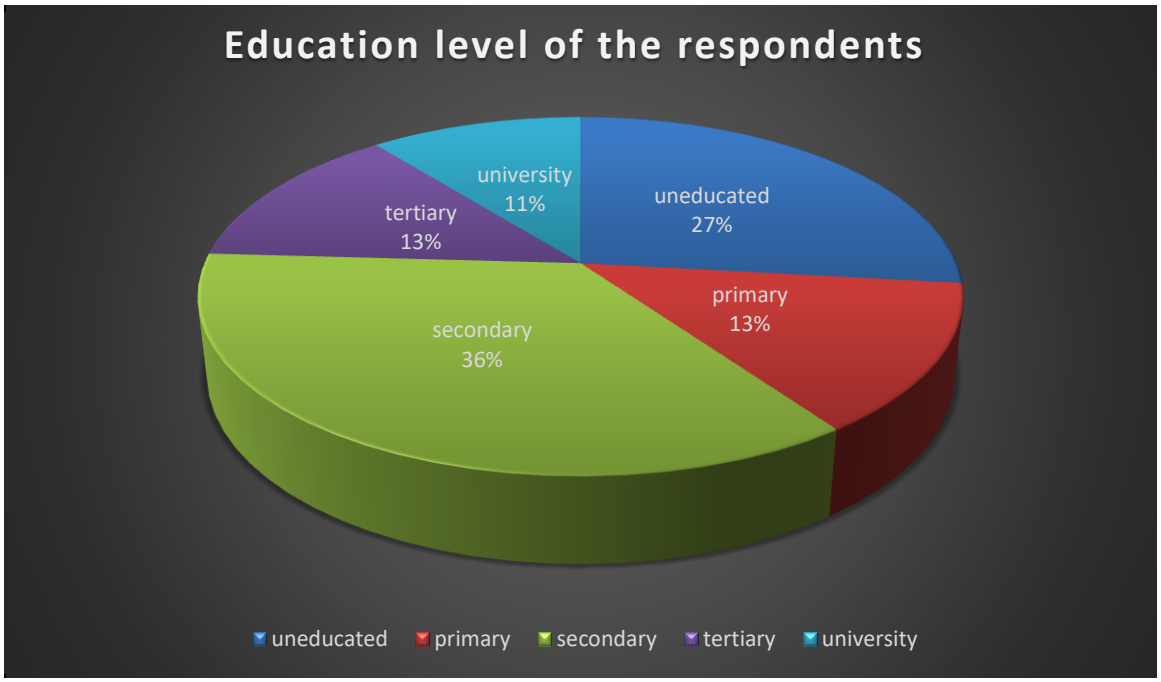


Figure 4.2.3 Education level of respondents

4 .2.4Main occupations of fish farmers

The respondents were asked to give their responses on the main occupation and the results are as represented below in the table 4.3.

Table 4.3 Main occupations for fish farmers in lukhonge Sub County.

Main occupations for fish farmers	**Frequency**	**Percentage**
Civil servants	**8**	**8**
Subsistence farming	**74**	**78**
Commercial farming	**1**	**1**
Boda-Boda riders	**2**	**2**
Others	**23**	**11**
Total	**112**	**100**

Primary source data.

The results were also further represented on a bar graph as shown below for better understanding and interpretation.

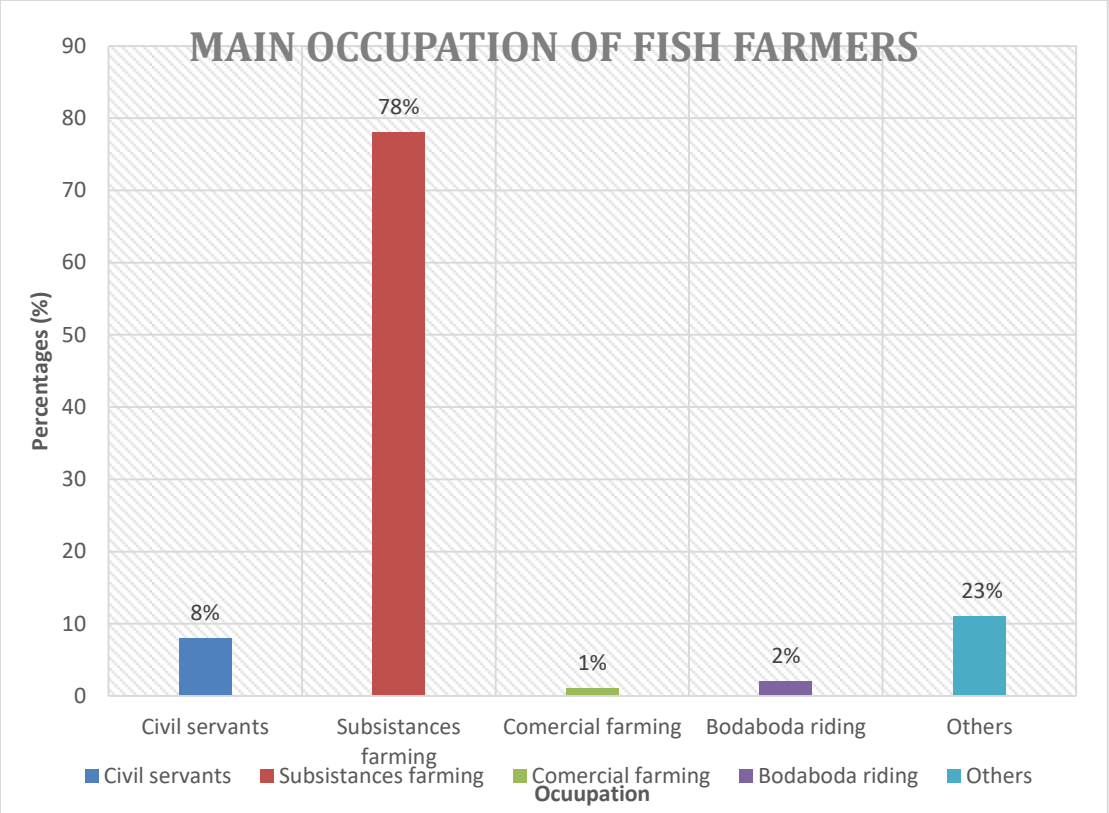


Figure 4.2.4: Main occupations for fish farmers

From Figure 4.2.4, the study results reveal that 78% of the respondents were engaged in commercial farming, 8% engaged in subsistence farming, one % were civil servants employed in government agencies, 2% were Boda-Boda riders and the rest (23%) were engaged in other activities such as administrators and managers in private firms. This implies that the survival of most respondents' depended mainly on commercial farming activities such as maize cultivation, Irish potato growing and apple growing.

4.3.0: To find out the economic importance of pond fish farming to the people of lukhonge sub county Mbale district.

In the first objective, respondents were asked to provide their responses on the economic importance of fish farming in lukhonge sub county Mbale District and the results that emerged were presented below.

4.3.1Fish farming growing involvement in lukhonge Sub County

From figure 4.4 the study results revealed that **26 percent** practice fish farming and the remaining 74 percent were non fish farmers. This implied that few farmers were involved in pond fish farming in lukhonge Sub County, Mbale district

Table 4.3.1 fish farming involvement in lukhonge Sub County.

Irish potato growers	**Frequency**	**Percentage**
FISH FARMERS	**08**	**26**
NON FISH FARMERS	**29**	**74**
Total	**37**	**100**

Primary source data.

The results were also further represented on a pie chart as shown below for better understanding and interpretation

Fish farming involvement in lukhonge Sub County

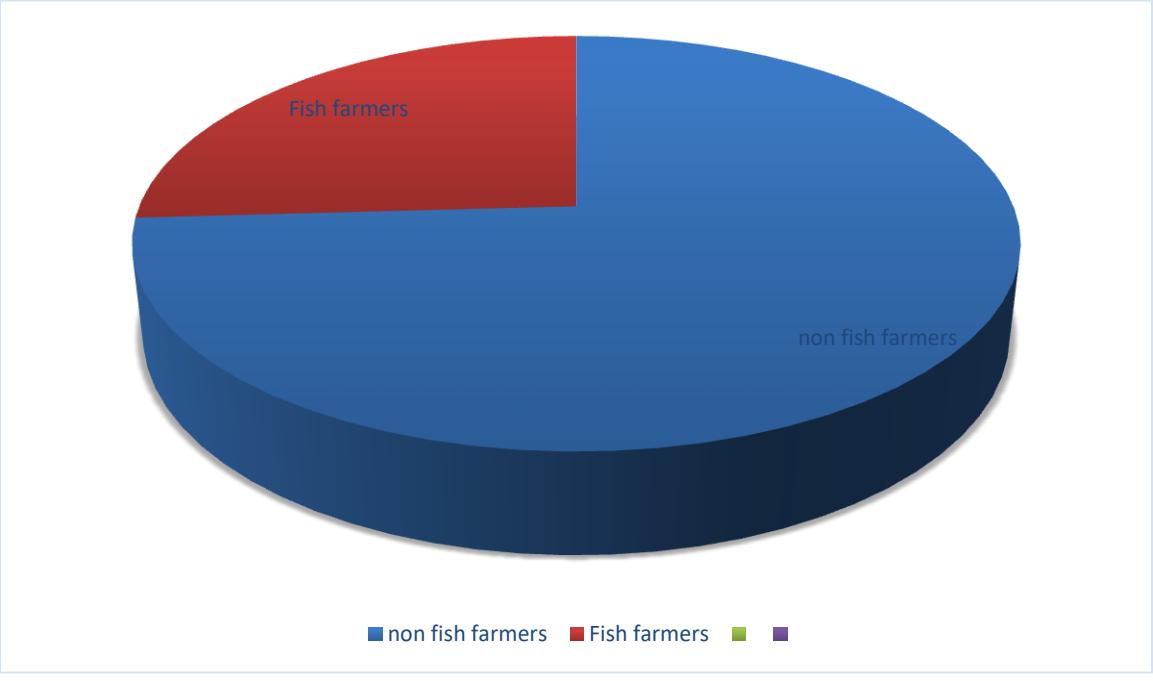


Figure 4.3.1 Fish farmers

4.3.2 Species of fish reared by farmers in lukhonge sub county, Mbale district.

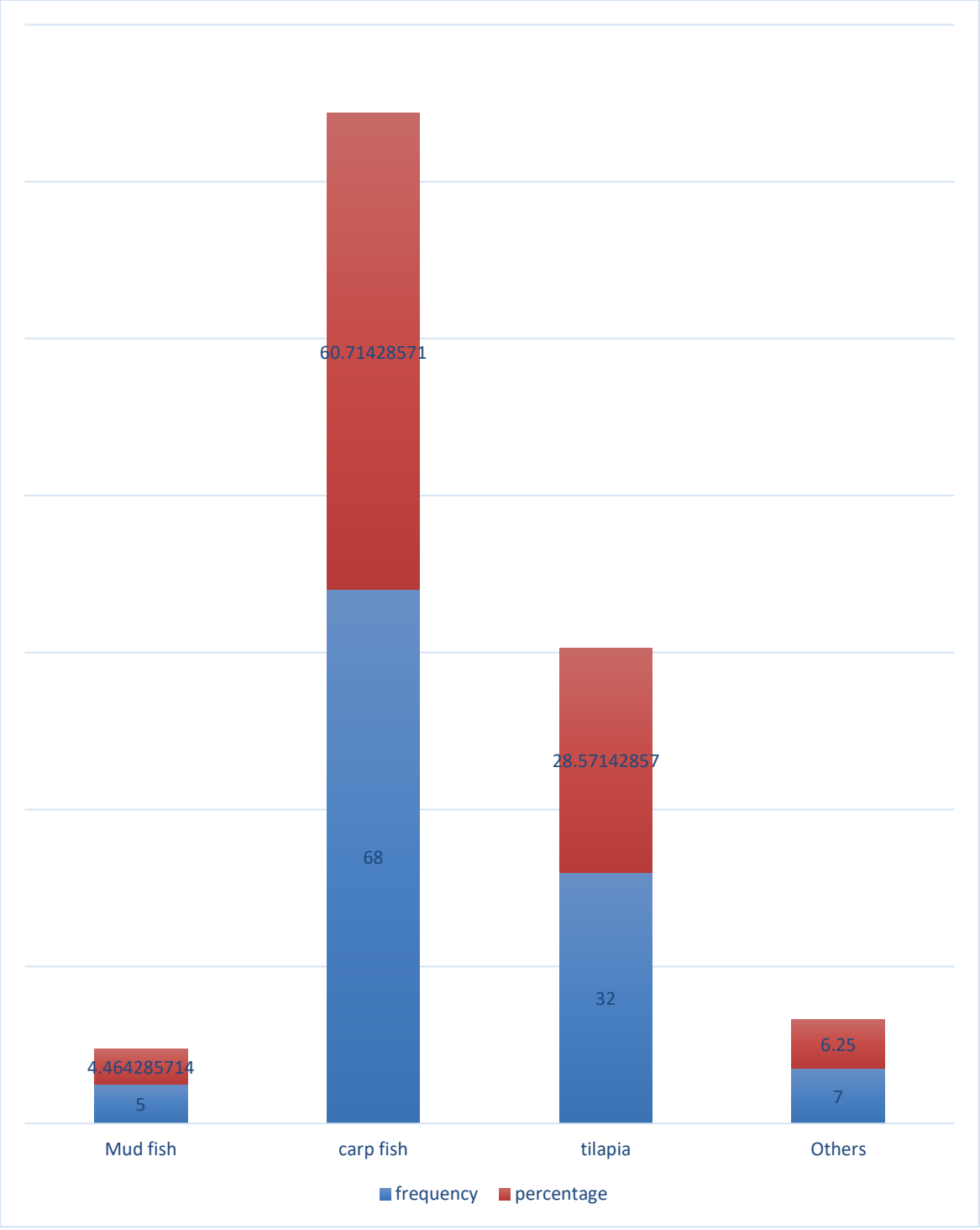
From table 4.5 the respondents were asked to give their responses on the species of fish species reared in lukhonge Sub County. The results revealed that 68(61%) reared carp fish, 32(29%) reared tilapia, 5(4.5%) reared mud fish, 7(6.3%) reared other. This implied that most farmers reared carp fish and mud was the least grown variety.

Table 4.3.2 Species of fish cultured by farmers in lukhonge Sub County.

Species of reared	Frequency	Percentage
Mud fish	5	4.464285714
Carp fish	68	60.71428571
Tilapia	32	28.57142857
Others	7	6.25

Primary source data.

The results were also further represented on a combined bar graph as shown below for better understanding and interpretation.


60.71428571
28.57142857
6.25
4.464285714
68
32
5
7
Mud fish
carp fish
tilapia
Others
frequency
percentage

4.3.3 Period of fish production by farmers in lukhonge Sub County.

Respondents were asked to give the number of years they have been producing fish in lukhonge sub county, Mbale district as shown in table 4.6

Table 4.6 periods of fish production in years

Period of fish production(in years)	Frequency	Percentage
Below 5	**5**	**5.4**
6-10	**7**	**7.6**
11-15	**20**	**22.0**
16-20	**25**	**27.0**
Above 21	**35**	**38.0**
Total	**92**	**100.0**

Primary source data.

The results were further represented on the pie chart as shown from figure 4.6 for easy interpretation and comprehension.

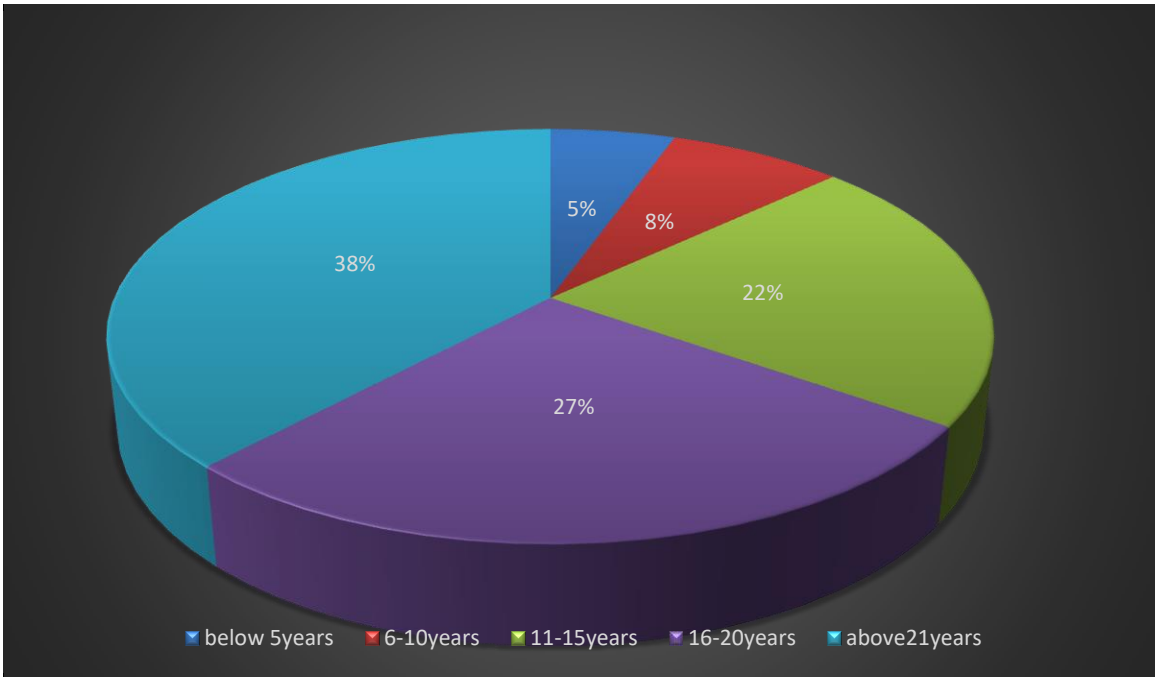


Figure 4.3.3 period of fish production among farmers of lukhonge sub county (in years

From figure 4.6 the study shows that 5(5%) of the farmers have been producing fish below 5years, 7(8%) have been producing for 6-10years, 20(22%) have been producing for 11-15years, 25(27%) have been producing for 16-20years and 35(38%) have been producing fish above 21years.This implied that many farmers were engaged in fish production as seen on the figure 4.6 above.

4.3.4Economic importance of pond fish farming in lukhonge Sub County.

The respondents were asked to give their views on the economic importance of fish farming in lukhonge Sub County and this was done effectively through questionnaires; which were given to different farmers. Results are shown in the table below.

Table 4.7: Economic importance of pond fish farming.

Economic importance	Frequency	Percentage
Food	57	62
Employment	8	9
Income	08	20
Diversification	18	9
Total	91	100

Primary source data.

The results were also further represented on a pie chart as shown below for better understanding and interpretation.

ECONOMIC IMPORTANCE OF FISH FARMING

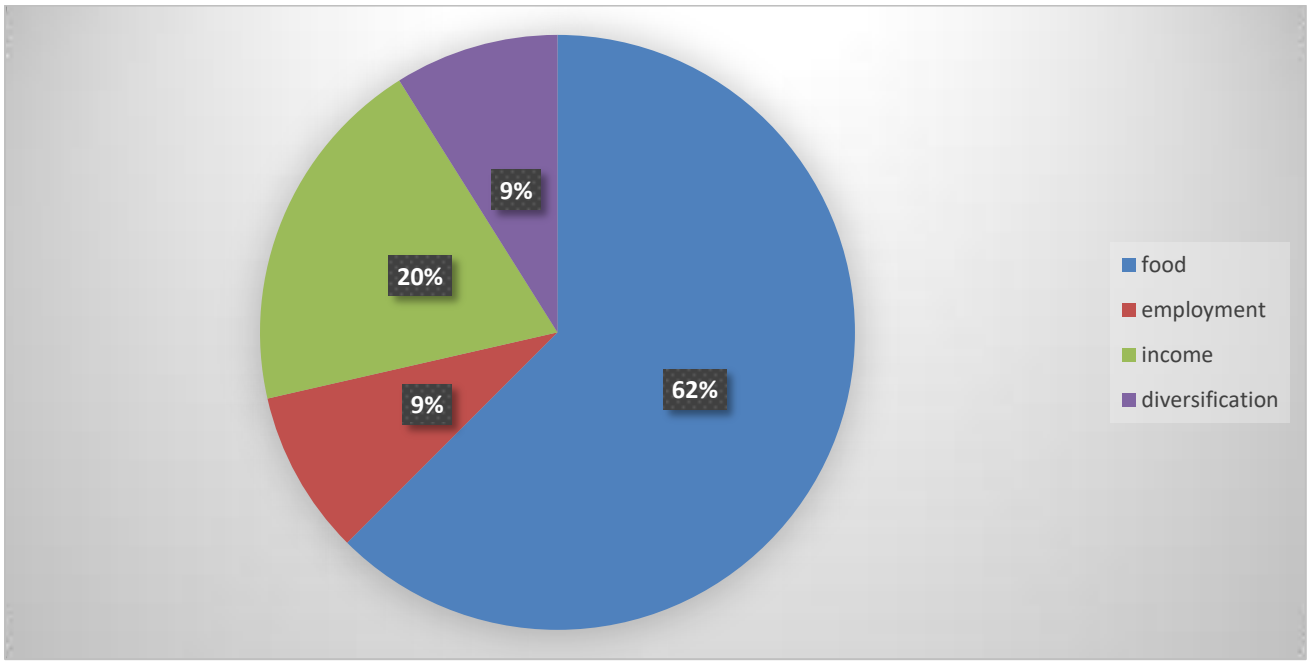


Figure 4.3.5: Economic importance of fish farming in lukhonge sub county Mbale district.

From Figure 4.9; 57(62%) of the respondents reported that, fish farming is the source of food in lukhonge sub county. According to the findings it was found that being source of food it is the reason as to why most farmers engage in fish farming in lukhonge sub county,

18(20%) of the respondents reported that, it is agricultural diversification.

Furthermore; 8(9%) of the respondents reported that it is a source of income in lukhonge sub county and the remaining 8(9%) of the respondents reported that it is for employment.

4.0 Hindering factors towards fish farming adoption lukhonge Sub County.

The respondents were asked give views on some factors which have denied them to take imitative towards fish farming and this was done effectively through questionnaires.

Hindering factor	Frequency	Percentage
Diseases	48	71
Perishability	18	08
Other factors	34	12
Total	100	100

Primary source data.

Hindering factors towards fish farming adoption

The results were further represented on the pie chart as shown from figure 4.2.1for easy interpretation.

From figure 4.9.1: 71% of the farmers reported that increased fish diseases hinders fish farming adoption,8 percent perishability of fish and fish products limits adoption of fish farming8% and 12percen of farmers reported that other factor are responsible for low fish adoption in lukhonge sub county. This implied that of lack capital is the major limiting factor towards fish farming adoption. (FAOSTAT data, 2006).

4.4.1: Most disease causing agents for fish in lukhonge Sub County.

The respondents were asked to state the most disease causing agents for fish in lukhonge Sub County. This was effectively done through questionnaires which were given to the chairpersons of different villages to give the farmers who provided their responses as shown in the table below.

4.4.1 Most disease causing agents for fish in lukhonge sub county.

Disease causal agents	Frequency	Percentage
Virus	**7**	**8.8**
A biotic	**25**	**31.2**
Bacteria	**8**	**10.0**
Others	**40**	**50.0**
Total	**80**	**100**

Primary source data.

, the field findings revealed that 7(8.8%) of the farmers reported that fish diseases are caused by viruses, 25(31.2%) reported that fish diseases are caused by abiotic factors, 8(10.0%) are bacterial diseases and 40(50%) reported that the other factors are responsible for fish diseases which was the highest percentage reported by the famers in lukhonge sub county, mbale district.

This implied that fish diseases are caused by many causal agents seen from the results reported from different farmers which are in with lukhonge Sub County.

4.4.2Quantity of fish per pond harvested by the farmers under normal conditions.

The respondents were asked the number of kilograms they harvested per each pond under normal situation; the results are as shown below in the table 4.9.2

Table 4.2.2: Quantity harvested per pond under disease free condition.

Number of kilograms	**Frequency**	**Percentage**
0-100	**50**	**57.0**
101-300	**25**	**28.0**
Above 300	**3**	**3.0**
Total	**78**	**100**

Primary source data.

The results were further represented on the pie chart as shown from figure 4.7 for easy interpretation and comprehension.

V vv vv Quantity harvested per pond under disease free condition

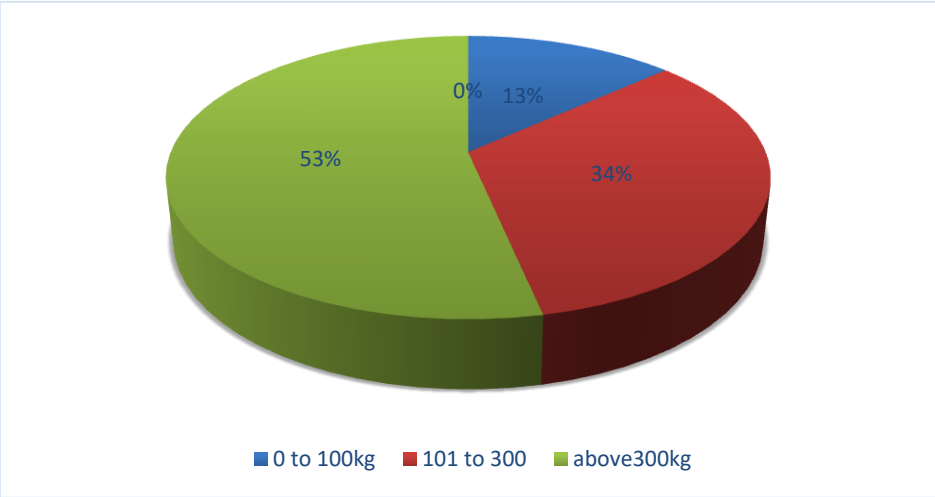


Figure 4.4.2: Number of kg harvested by the farmers whose ponds are not affected diseases.

Figure 4.4.2;shows that 10(13%) respondents who were not attacked with late blight harvested 5-20bags per 1hectare, 25(34%) reported that they got 21-35bags per 2hectares and 40(53%) respondents said harvested 36 and above per 4hectares.

4.4.3 Quantity of fish harvested per pond under abnormal condition by fish farmers in lukhonge Sub County.

The respondents were asked to state the number kilograms harvested per pond under abnormal condition; the results are as presented in table 4.9.3

Table 4.4.3

Kilograms harvested	Frequency	Percentage
50kg	50	57
51 to 100kg	25	28
101 to 200kg	10	11
300kgs	3	3.4
Total	88	100

Primary source data.

The results were further represented on the pie chart as shown from figure 4.7 for easy interpretation and comprehension.

Quantity of fish harvested per pond under abnormal condition by fish farmers in lukhonge Sub County

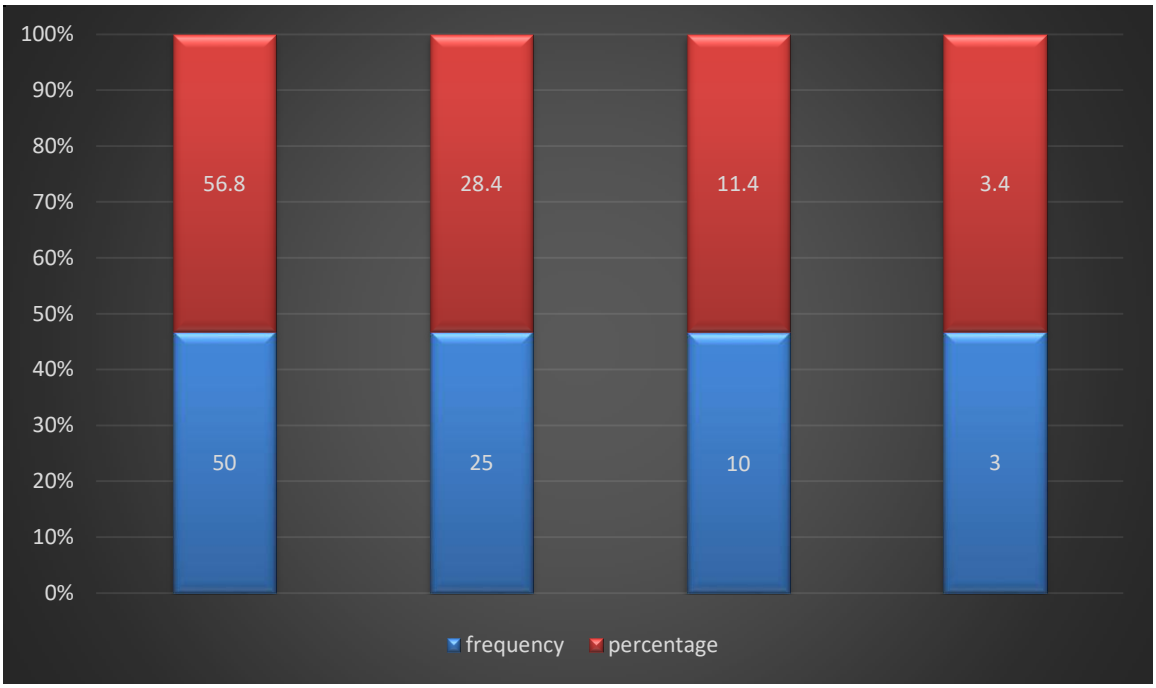


Figure 4.4.3: Number of kilograms harvested per pond under abnormal conditions.

Figure 4.9.3;shows that 10(13%) respondents reported that disease affected ponds yielded less than fifty kilograms, 25(34%) reported that they got 100kg per pond and 40(53%) respondents said harvested less than 100 and above per 4hectares.

4.4.4 Signs that fish are having ill health

The respondents were asked to give their responses on how fish behave when they are diseased and the responses were given in the table below.

Table4.4.4: how fish behave when ill health in lukhonge sub county.

How fish behave when ill health.	Frequency	Percentage
Low feeding.	20	27.0
Body colorings	35	47.0

Thermo gapping	**15**	**20.0**
Others	**5**	**6.0**
Total	**75**	**100**

Primary source data.

The results were further represented on the bar graph as shown from figure below for easy interpretation and comprehension.

The results were further represented on the bar graph as shown from figure 4.9.4 for easy interpretation and comprehension.

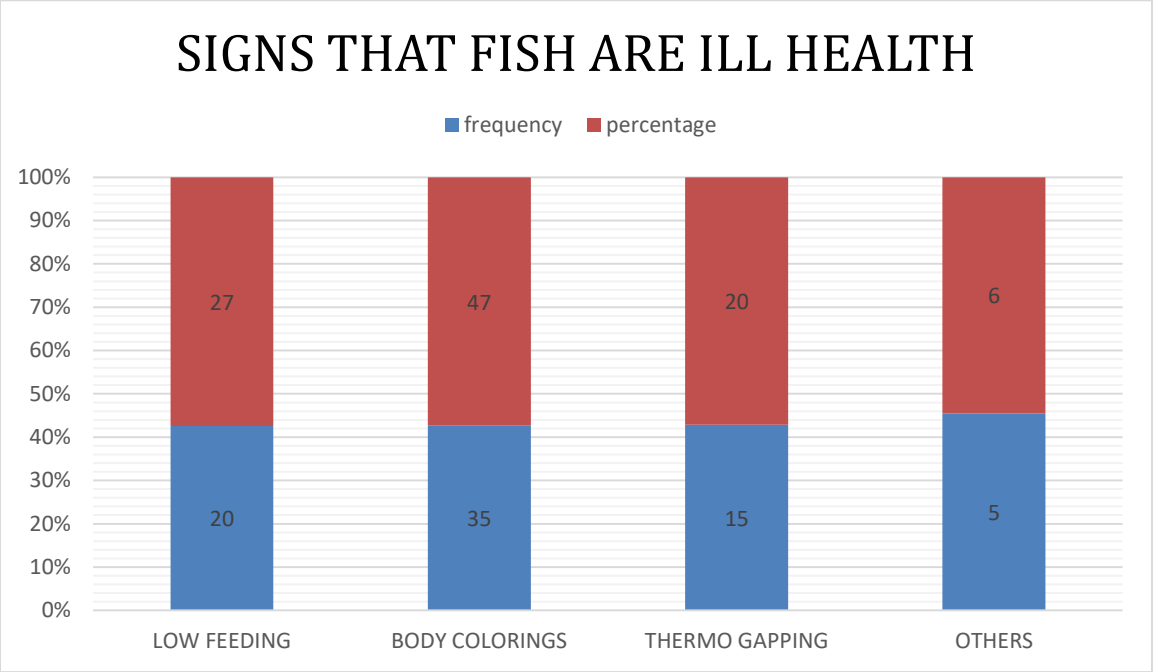


Figure 4.4.4:Sign that fish are not healthy

4.4.4Figure: signs that fish are ill health

Figure , Shows that majority of the respondents 35(47%) reported that body colorings are common in fish ,20(27%) reported that there is low feeding ,15(20%) revealed that there is thermo gapping and the remaining 5(6%) reported that other factors other than the above are responsible for diseases in a pond.

4.4. 5Most common methods used in disease management in fish ponds in lukhonge Sub County.

Farmers were asked to give some of the most common methods used in disease management in ponds and this was done by use of face to face interaction by selected farmers.

Table4.4.5method mostly used to control diseases in fish ponds.

Method mostly used to manage late blight disease	**Frequency**	**Percentage**
Chemical management	**75**	**67**
Biological management	**5**	**5**
Cultural management	**15**	**13**
Others	**17**	**15**
Total	**112**	**100**

Primary source data.

The results were further represented on the pie chart as shown from figure for easy interpretation and comprehension

Most common methods used in disease management in fish ponds in lukhonge Sub County

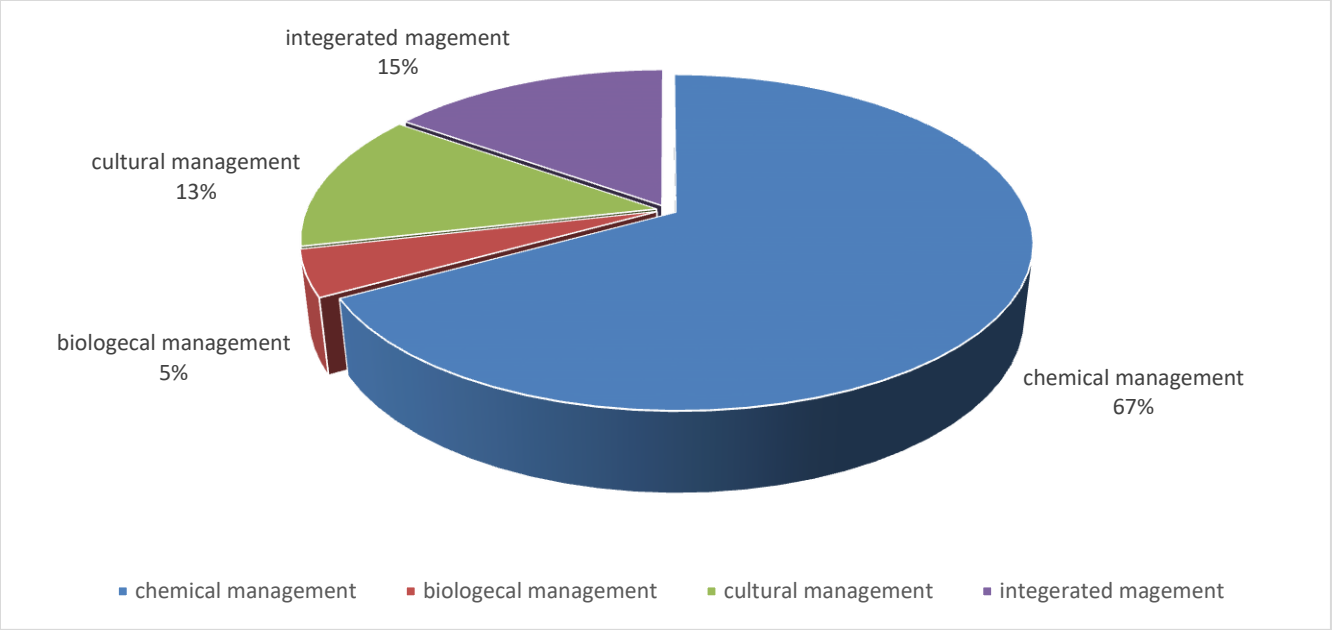


Figure 4.5.5.: method mostly used by farmers to manage fish disease in lukhonge Sub County

4.**5.0** What measures have to be put in place to increase the adoption of pond fish farming in lukhonge sub county Mbale district.

The respondents were asked to give views on what measures should be put in place to enhance the adoption of pond fish farming and results were given in the table below.

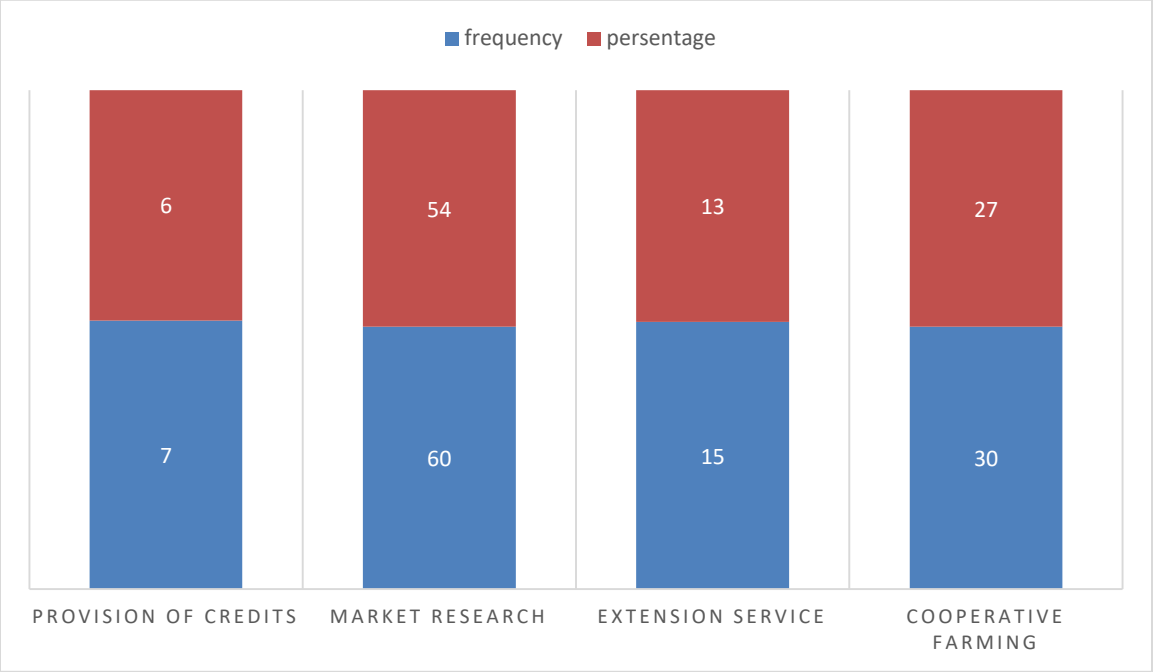
Table 4.5.0measures to be put in place to enhance adoption of fish farming

Measure to be under taken	Frequency	Percentage
Provision of credits	**7**	**6**
Market research	**60**	**54**
Extension service	**15**	**13**
Cooperative farming	**30**	**27**
Total	**112**	**100**

Primary source data.

The results were further represented on the bar graph as shown from figure. for easy interpretation and comprehension.

Measures to be put in place to enhance adoption of fish farming



CHAPTER FIVE

5.0 DISCUSSION OF RESULTS

This chapter presents the discussion of the findings from the research carried out in Benet Sub County, Mbale district. Results of economic importance of fish farming, yield losses due to diseases and measures to enhance fish farming in Lukhonge Sub County.

5.1: Economic importance's of fish farming in lukhonge Sub County.

Fish farming was initiated many years ago in lukhonge Sub County. Increased production was first reported on 7th December, 2014 in the sub county. Later on, it was reported in different parts of the sub county; 57(62%) of the respondents reported that, disease attack was one of the limiting factor reducing yields in lukhonge sub county. According to the findings it was found that diseases has been the major cause of of low harvests in lukhonge Sub County since they started rearing fish and this is in line with Global tuber yield losses due to this menace are estimated at €12 billion [Haverford et al. (2009)]

More; 18(20%) of the respondents reported that, other factors limiting fish production include limited capital, limited skills and others.

Furthermore; 8(9%) of the respondents reported that low productivity has resulted into low income, flooding, reduced government revenue and others. Many factors other than disease cause yield instability in lukhonge Sub County, including low soil fertility, water stress and frost. However, diseases are important and late blight is considered the most important (Bisht et al. 1997; Fontem & Aighewi 1993; Haverkort & Bicamumpaka 1986; Higiro & Danial 1994; Khan et al. 1985).

5.2: yield losses in ponds due to disease attack in lukhonge Sub County.

The Eastern African region has a record of fast human population growth, with 8 countries with combined population at 219 million in 2008 (Hub and Kent, 2008). With the growth of fish demand, there has been almost exponential growth in value of the fish locally, regionally at premium markets giving commercial small-scale producers a second opportunity to maximize production based on scarcity of supply. A third and clea

5.3 measures to enhance fish farming in lukhonge Sub County.

One is the increased demand for fish against the backdrop to stagnated and/or collapsed fisheries from the wild. This means that farmers can make money producing and marketing their fish with reduced competition. Opportunity for small- scale aquaculture producers is the availability of serene or near serene systems hardly been tapped for aquaculture production such as coastal and marine environment, the many streams and minor lakes, the temporary water bodies including communal water provided with the required infrastructure for commercial aquaculture production which can then attract the required services and inputs to support farmers address the common .Farmers reported that with many opportunities available to boost aquaculture, the government has to strengthen on education research, extending credits to fish farmers among others have to enhanced if fish farming is to be increased.

6.0: CONCLUSIONS AND RECOMMENDATIONS

The chapter presents the conclusions and recommendation of the findings in Lukhonge Sub County, Mbale district.

6.1: Conclusions

Three points are of primary concern when evaluating aquaculture sector in lukhonge Sub County. First, capital is crucial if fish farming is to enhance in lukhonge sub county mbale district are widely used but there is great variability in usage patterns, even within a small geographic area. Second, cultivar resistance should be more commonly utilized. Third, farmer education is crucial for better management of ponds is very important.

On a short-term basis, optimization of the natural water sources should be considered because it is rather cheap to start compared to where artificial ponds are made. Fish farmers in the lukhonge sub county are used to practice fish farming in ponds but construction of artificial ponds is crucial because productivity will only be increased if more ponds are constructed.

The use of resistant species can benefit all types of farmers – from subsistence farmers to large businesses normally associated with the chip industry. Nevertheless, one would expect that what all farmers, regardless of type, would like to have is a resistant species with excellent

commercial features. Certainly, this constitutes a challenging issue that breeders have to face if expanded usage of resistance is to be achieved.

Finally, efficient adoption of fish farming in a near future can only be achieved with effective farmers' education as a foundation. The lack of knowledge about benefits of fish farming and limited education levels of farmers in developing countries impose major constraints on the understanding contributions of diversifying agriculture. Technology transfer and implementation are not easily accomplished. Thus, educational programs aiming at improving fish farming and productivity in lukhonge Sub County should be a priority for funding agencies and research institutions.

6.2: Recommendations

Further research is recommended to determine the effect of diseases on the fish healthy and how productivity of fish farming can be enhanced. This recommendation comes from the findings that fish farming has significantly decreased in the Lukhonge Sub County. This was mainly contributed to low farmers income thus poverty. Therefore the limited knowledge farmers are having is not enough to boost fish farming. There is need by the government through the ministry of agriculture together with Non-Government Organizations (NGO) to provide equipment's to the farmers to enhance adoption of fish farming so sensitizing them on the benefits of fish farming.

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APPENDICES

Dear respondent

I,WAMIMBI AKIM a student of Busitema University in the faculty of science and Education pursuing bachelors of Education Agriculture Double Main.

This questionnaire is purely set to facilitate a study on "**The factors for the low adoption of pond fish farming in lukhonge sub-county Mbale district.**

Please may I take a few minutes of your precious time and help me answer these questions. Your responses will be used for academic purposes only and will be treated with utmost confidentiality.

In this section, you are kindly requested to tick against that alternative response that fits your opinion or to give a brief essay for the case of structured questions.

SECTION (A)-Demographic Aspects

I. Age

21-30 years.....

31-40 years.....

41-50years.....

51 and above years.....

2. Gender

Male.....

Female.....

3 Qualification academically

Primary.....

Secondary.....

Tertiary.....

University.....

4.Main occupation of respondents

Civil servants.....

Commercial farmers.....

Small scale farmers.....

Boda Boda riders.....

Others.....

SECTION B: How farmers relates to fish in lukhonge county.

5. Do you personallypracticepondfishfarming?

6. Whichfishspecies do u rear on your farm?

Mud fish

Carp fish

Tilapia

Others.

7. How long have been involved in the enterprise of fish farming.

6-10 years.

11-15 years

16-20 years

Above 20 years

8. How do farmers who engage in fish farming in your communitybenefit?

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SECTION C: Hindering factors towards adoption of pond fish sub-county

9.What are the key factor that have hindered pond fish farming in lukhonge sub-county?

Diseases

Perishability of fish

Others.

I0. Since diseases are major limiting factor to wards adoption of fish farming, what are the major agents for fish diseases in lukhonge County?

A.....

B.....

C.....

D.....

Not sure

11. Whch quantity do harvest in case diseases do no attacks your pondson the farm?

0-100kg

100-300kg

Above 300kg

12. Which quantity do you harvest per pond in case disease outbreak happens.

A.less than 50 kg

B. 51-100kg

C. 101-200kg

D. 300kg and above.

13. Which signs do fish show when I'll healthy.

A. Low feeding

B. Body colourings

C. Thermal gapping.

D. Others.

Section D: Measures that can be employed to enhance adoption of fish farming in lukhonge sub county

14. What are some of the measures that can be employed to enhance adoption of fish farming in lukhonge sub-county.

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