

**IMPACT OF SMALL-SCALE AQUACULTURE ON POVERTY
REDUCTION AND FOOD SECURITY IN NYAMAGANA
DISTRICT**

By

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A Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of
Master of Science in Natural Resource Management of the University of Dodoma

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CERTIFICATION

The undersigned certifies that, he has read and hereby recommends for an acceptance by the University of Dodoma a dissertation entitled: “*Impact of Small-Scale Aquaculture on Food Security and Poverty Reduction in Nyamagana District*” in partial fulfillment of the requirements for a degree of Masters of Science in Natural Resource Management at the University of Dodoma.

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Prof. Abiud Kaswamila

(Supervisor)

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DEDICATION

This work is dedicated to my father, the Late Cyprian Nchangwe, my lovely mother Mondesta Nchangwe and my beloved guardians Mr. and Mrs. Fumbuki Lubasa who made a wise choice to me in my life and always given me advice to move on. Almighty God blesses them all.

ABSTRACT

This study was conducted to assess the impact of small-scale aquaculture on food security and poverty reduction in Nyamagana District. Four streets namely Lwanima, Mkuyuni, Sweya and Luchebele were involved. Purposive sampling was used to select 6 key informants. Small-scale fish farmers were randomly picked in each street leading to a sample size of 100 respondents. Field physical visit, questionnaire survey, interview, and documentary review were used in data collection. Collected data were analyzed by using SSPS software and Microsoft Excel. Major findings of the study indicated that annual average income to fish farmers increased from year to year. Likewise, the contributions of aquaculture to food security indicated that, 79% of the respondents acknowledged that, fish farming contributed to food security. However, the study has established that, majority of fish farmers faced challenges which include unavailability of quality seeds and feeds, inadequate capital, unskilled workers, inadequate Government support and lack of awareness. The study similarly reported the main suggestions to fish farmers were financial support, provision of seed and feed, extension services and market for fish. Lastly the study concludes that to achieve effective aquaculture development, good cooperation between research institutions, government authorities and small-scale fish farmers, it is very important to identify critical factors such as the existing low quality seeds and poor quality feeds.

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LIST OF ABBREVIATIONS

DAOs	District Agriculture Officer
DFOs	District Fisheries Officer
FAO	Food and Agriculture Organization
FETA	Fisheries Education and Training Agency
ICLRM	International Center for Living Aquatic Resources Management
IDRC	International Development Research Centre
LVEMP	Lake Victoria Environment Management Project
MCC	Mwanza City Council
NACA	Network of Aquaculture Centers in Asia-Pacific
OECD	Organization for Economic Co-operation and Development
ROERA	Robert Elpidius Rajabu Group
SSA	Sub- Sahara Africa
UNICEF	United Nations Children's Fund
URT	United Republic of Tanzania
USAID	United States Agency for International Development

CHAPTER ONE

INTRODUCTION

This chapter provides background information to the study .The chapter is divided into eight sub sections namely: introduction, background to the problem, statement of the problem, objectives of the study, research questions, and significance of the study and organization of the work.

1.1 Background Information

Aquaculture evolved thousands of years ago as an activity with origins and goals similar to the other animal husbandry activities (Tucker *et al.*, 2008). That is, the methods were developed to provide animal protein when local human population growth or overexploitation of accessible wild population, made it difficult to obtain foods by hunting or fishing (Tucker *et al.*, 2008).

Poverty reduction lies at the core of the global development challenge (Bhalla, 2002). Many of the world's most prominent aid organizations cite poverty reduction as their overreaching goal (Deaton, 2002). This problem is a serious, since the international development community cannot be held accountable for poverty reduction without a clear sense of the scale of the problem an understanding of where poverty is most prevalent (Chandy *et al* 2009).

Poverty eradication has since become the overreaching objective of the development, as reflecting in the internationally agreed development goals , including the Millennium Development Goal, which set the target of having global extreme poverty by 2015 (Chen *et al.*, 2008)

It was not until after World War II that, aquaculture gained much attention as a potentially large scale industry (Carballo *et al.*, 2008). In 1980, world aquaculture production (excluding plants) was approximately 5 million tonnes which was approximately 7% of total world food fish supply (Tucker *et al.*, 2008). The global trend of aquaculture development gaining importance in total fish supply has remained uninterrupted. Farmed food fish contributed a record 42.2 percent of the total 158 million tonnes, of fish produced by capture fisheries (including for non-food uses) and aquaculture in 2012 (FAO, 2014).

Aquaculture in Sub-Sahara Africa countries dates back to the 1920s, when trout breeding was introduced into Kenya and Madagascar, and later into Tanzania. In the late 1950s and early 1960s development agencies began to promote small- scale fish farming in Africa, as a means of improving the quality of life for poor farmers (Kalinga, 1991). These early attempts to transplant into Africa technologies and systems developed elsewhere did not adequately consider local biological, agricultural or socio- economic realities and therefore largely failed to achieve the hoped-for benefits (Costa-Pierce *et al.*, 1992).

However, in spite of this long history, aquaculture still remains marginalized, with limited contribution to national economies (FAO, 2012b). Aquaculture in SSA contributes 0.63 percent and 34.95 percent to total world and African aquaculture production, respectively (FAO, 2012b).

Modern freshwater aquaculture in Tanzania started back in 1949 when the rainbow trout were introduced in the Northern and Southern Highland regions (URT, 2009).

To date, it has not done any better. In this regard the Government assisted the community through provision of fingerlings, technical and financial assistance. This system continued to post-independence (URT, 2009). In the early 1970s, international donor funded projects were responsible for establishing an estimated 8,000 - 10,000 ponds producing about 2,000 tons of fish per year. The number of fish ponds fell to less than 1,000 by 1985 due to poor management, inappropriate technologies, inadequate extension efforts, poor marketing and infrastructure instability (Ogello *et al.*, 2013). Culture practices in The United Republic of Tanzania include ponds, small tanks and the single raceway. The average size of the ponds is 150 m², covering a total of 211.5 ha (FAO, 2005).

1.2 Statement of the Problem

Fish farming in most part of Tanzania is practiced as standalone activity, which can be a risky venture, because of economic factors such as the price instability (Ogello *et al.*, 2013). There are a total of 14, 100 fish ponds scattered all over the country with differing potential from one area to another (FAO, 2005). Local community and private sectors have continued to be involved in small-scale fresh water aquaculture. Small-scale aquaculture offers many benefits including employment, increase income, food security and livelihood to local communities.

According to STREAM (2001), it is extremely difficult to estimate the contribution of this type of aquaculture production, since dispersed production data do not appear in official statistics and the product is typically consumed or traded locally. As pointed out by Tacon (2001), small-scale aquaculture is “an important domestic provider of much needed high-quality animal protein and other essential nutrition

(generally, at an affordable prices to the poorer segments of the community)”. Aquaculture can also benefit the landless from utilization of common resources, such as finfish cage culture and use enhancement in communal water bodies (Tacon, 2001).

Fresh water small-scale aquaculture is common in Nyamagana District (Nchangwe, Pers Obs). However, the extent to which small-scale aquaculture has contributed to food security and poverty reduction is not known in detailed. Therefore, the aim of this research is to provide more in detailed.

1.3 Objectives of the Study

1.3.1 General Objective

The main objective of the study was to assess the contribution of small-scale aquaculture on poverty reduction and food security in Nyamagana District.

1.3.2 Specific Objectives

- i. To assess contribution of small-scale aquaculture, on household income of small-scale aquaculture farmers in Nyamagana District,
- ii. To assess the contribution of small-scale aquaculture on food security of small-scale aquaculture farmers in Nyamagana District,
- iii. To assess the challenges and opportunities of small-scale aquaculture farmers in Nyamagana District, and
- iv. To suggest ways of improving small-scale aquaculture in Nyamagana District

1.4 Research Questions

- i. To what extent, has small-scale aquaculture managed to improve farmers' income and food security in Nyamagana District?
- ii. What were the challenges facing small-scale aquaculture in Nyamagana District?
- iii. Does the practice have opportunities for an increased income and food security among small-scale farmers in Nyamagana District?
- iv. What are the suggestions, which could make the practice beneficial to the small-scale farms in Nyamagana District?

1.5 Significance of the Study

The study will contribute to different ways of improving aquaculture industries, in order to increase production and productivity and promote efficient usage of aquaculture resource base, for improvement of livelihood but also help the community to understand the significance of aquaculture, in relation to poverty reduction and encourage them to participate in aquaculture activities.

This study will also raise awareness among local people and other stakeholder to overcome the problems and challenges facing the management of aquaculture practices. It will provide an understanding and suggestions, which may be useful to the government, non-government organizations, planners and policy makers, to boost aquaculture development in the country. Also the study will be important to form data base for further study.

1.6 Organization of the Dissertation

The study consists of five chapters. Chapter two provides a review of relevant literature pertinent to small-scale aquaculture. Chapter three outlines the research methodology employed in the study. Chapter four presents and discusses the findings obtained from the study. Chapter five provides conclusion, recommendations and area for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter represents a review of the literature related to small scale aquaculture, food security and poverty reduction. It covers the theoretical review of the research includes definition of key terms, theoretical framework and policies related to the study. Empirical review covers on the reviews of the research related to the topic investigated, knowledge gap and conceptual framework According to Kothari (2004) insists that, the researcher must examine the available literature to get himself acquainted with the selected problem.

2.2 Definition of Key Terms

2.2.1 Aquaculture

The term 'aquaculture' covers all forms of cultivation of aquatic animals and plants in fresh brackish and saltwater (Carballo et al., 2008). Aquaculture has the same objective as agriculture, namely, to increase the production of food above the level that would be produced naturally (FAO, 2005).

Aquaculture is referred to as fish farming. Typical species that are found in aquaculture systems include oysters, salmon, trout, hard and soft-shell clams and other shellfish. It can take place in natural water bodies such as ponds, lakes, marshland or brackish water and the ocean. It can also be conducted in man-made tanks, commonly found in fish hatcheries.

(<http://fishery.about.com/od/BenefitsofAquaculture/a/Aquaculture-What-Is-Aquaculture.htm>)

2.2.2 Poverty

Poverty can be defined in different ways in relation to its causes, its context, its consequences and the ways it is related to phenomena that can be influenced. In this study poverty is defined as the flipside of well-being, it is bad life, it is ill-being. Poverty is seen as a multidimensional lack of resources and conditions to achieve satisfaction of physical, social and psychological or self-actualization needs. (UNICEF, 2010). Western definition since World War II has defined poverty in monetary terms, using levels of income or consumption to measure poverty (Grusky *et al.*, 2006)

Poverty is pronounced as deprivation in well-being; where well-being can be measured by an individual's possession of income, health, nutrition, education assets, housing, and certain rights in society such as freedom of speech. Indeed, poverty is lack of opportunity, powerlessness and vulnerability (World Bank, 2012).

2.2.3 Food Security

According to IICA's (2009), defined food security, as the existence of the necessary conditions for human beings to have physical and economic access, in socially acceptable way, to food that is safe, nutritious and in keeping with their cultural preferences, so as to meet their dietary needs and live productive and healthy lives. Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2008).

2.2.4 Poverty Reduction

Poverty reduction is any process which seeks to reduce the level of poverty in a community .Poverty reduction efforts may also aimed at removing social and legal barriers to income growth among the poor (World Bank, 2012).

Poverty reduction is often used as a short-hand for promoting economic growth that will permanently lift as many people as possible over a poverty line (Owen B, 2009). Poverty reduction is more than a one-dimensional objective entails many different kinds of change; there is no universally applicable way to add up the reduction of poverty, affecting different people in different circumstances in different places over time (Owen B, 2009).

2.3 Theoretical Framework

This study adopts a Sustainable Livelihoods Approach get a clear understanding of how economic activities may contribute to poverty reduction. This approach is one of a number of analytical frameworks which deal with the dynamic dimensions of poverty and well-being. This is achieved by establishing a list of assets which poor individuals, households and communities deploy to maintain well-being. The main distinguishing feature of the approach is that it considers the poor people especially in rural areas, that they manage a complex range of assets and activities to sustain themselves.

According to the Sustainable Livelihood Approach a livelihood is considered to have three main components. According Robert Chambers and Gordon Conway (1992) a livelihood comprises the capabilities, assets (stores, resources, claims and access)

and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term.

In this particular context of aquaculture, this framework informs us that activities which people undertake to sustain themselves may contribute to sustainable livelihoods and hence, to poverty reduction. The people in Nyamagana District are also engaged in small-scale fish farming with a view to ensure food security and the reduction of poverty. The extent, to which this has taken place, is actually the main objective of this research.

2.4 Tanzania Policy Review

2.4.1 National Aquaculture Policy

Aquaculture is managed under the Fisheries Policy of 1997, the Fisheries Act No. 6 of 1970 that was amended to Act No. 22 of 2003 and the Principal Fisheries Regulations, 2004 (URT, 2003). The fisheries sector has a lot of economic and social significance to the country as it contributes greatly towards poverty alleviation and food security. The overall goal of the National Fisheries Policy is to promote conservation, development, sustainable management of the fisheries resources for the benefit of the present and future generations. Main objective are: to promote small-scale, semi-intensive aquaculture system with simple technologies and low capital investment. To promote the sound utilization of the ecological capacity of water based area as a means to promote diversification of income sources and diet.

And promote effective farm and fish health management practice favoring hygienic measures and vaccines (URT, 2003).

2.4.2 National Water Policy of 2002

Water is a basic natural resource for socio – economic development. It is fundamental for various socio – economic development activities such as industrial production, irrigated agriculture, livestock keeping, mineral processing, hydropower production, navigation and recreation and tourism. The fisheries sector has a lot of contribution of economic and social significance to the country as it contributes greatly towards poverty alleviation and food security. Freshwater is a basic natural resource which sustains life and provides for various social and economic needs. The main sector issue and concern is water availability of acceptable quality. The policy stated the principles and procedures for managing the quality and conservation of water resources as well as improving and protecting the ecological systems and wetlands (URT, 2002).

2.4.3 National Environmental Policy of 1997

Resources which belong to everyone easily become the care of no one. The ownership of land and resources, access to, and the right to use them are of fundamental importance, not only for a more balanced and equitable development but also to the level of care accorded to the environment. It is only when people can satisfy their needs, have control of their resources base, and have secure tenure to land that the longer - term objectives of the environmental protection can be satisfied (URT, 2007).

2.4.4 Land Policy of 1995

The Land Policy of 1995 aimed to promote and ensure a secure land tenure system to encourage the optimal use of land resource, for agricultural development and facilitate broad based social and economic development, without upsetting or endangering the ecological balance in the environment, Thus ensure that, land is put to its most productive use to promote rapid social and economic development of the country, promote sound land information management and protect land resources, from degradation for sustainable development (URT, 2012).

2.5 An Overview of Aquaculture in the World

The practice of raising fish is centuries old with a rich history of techniques and scientific advance (Colin, 2011). In the period 1970–2008, the production of food fish from aquaculture increased at an average annual rate of 8.3 percent, while the world population grew at an average of 1.6 percent per year (FAO, 2010). It now provides about half of all fish for human consumption. This can benefit poor people by improving their food security and nutrition, creating jobs, stimulating economic growth and offering greater diversification of their livelihoods (The World Fish, 2008).

The vast majority of aquaculture takes place in Asia. In 2002, over 70% of worldwide aquaculture production was in China alone (Kathryn *et al.*, 2004). Most farmed fish and shellfish are grown in traditional small-scale systems that benefit local communities and minimize the environmental impact (Kathryn *et al.*, 2004). Utilizing simple culture technologies and minimal inputs, these systems have been used for centuries. According to Edwards, (2000) aquaculture production is also

skewed geographically with. Asia producing over 90% of global products, dwarfing Africa and Latin America at less than 0.5% and 2%, respectively. In China, with 67% of global aquaculture production, inland aquaculture production has increased at least fivefold in the past decade.

World aquaculture production continues to grow, albeit at a slowing rate. According to the latest available statistics collected globally by FAO, (2014) world aquaculture production attained another all-time high of 90.4 million tonnes (live weight equivalent) in 2012 (US\$144.4 billion), including 66.6 million tonnes of food fish (US\$137.7 billion) and 23.8 million tonnes of aquatic algae. “Food fish” includes finfishes, crustaceans, molluscs, amphibians, freshwater turtles and other aquatic animals (such as sea cucumbers, sea urchins, sea squirts and edible jellyfish) produced for the intended use as food for human consumption.

According to FAO, (2014) which estimates that, world food fish aquaculture production rose by 5.8 percent to 70.5 million tonnes in 2013, with a production of farmed aquatic plants (including mostly seaweeds) being estimated at 26.1 million tonnes. In 2013, China alone produced 43.5 million tonnes of food fish and 13.5 million tonnes of aquatic algae.

The overall growth in aquaculture production remains relatively strong owing to the increasing demand for food fish among most producing countries (FAO, 2014). However, aquaculture output by some industrialized regional major producers, most notably the United States of America, Spain, France, Italy, Japan and the republic of Korea, has fallen in recent years (FAO, 2014). The availability of fish imported from

other countries where production costs are relatively low, is seen as a major reason for such production falls.

FAO 2010, report that, despite the long tradition of aquaculture practices in a few countries over many centuries, aquaculture in the global context is a young food production sector, that has grown rapidly in the last 50 years or so.

2.6 Aquaculture in Africa

Aquaculture is a relatively new economic activity in Africa. In 2010, total production in Africa was 1.29 million tons⁵; 72% of which was produced by Egypt, currently the 8th largest producer in the world (FAO, 2012a).

With supportive policies and investments, other African countries can replicate the Egyptian success. For the first time there are large operations in SSA producing more than 1,000 tons annually in addition to the more market driven small-scale aquaculture businesses. The production in SSA increased six-fold from 55,690 tons in 2000 to 359,790 tons in 2010 (FAO, 2012a).

Egypt dominates the aquaculture production in Africa. In the near 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, growth has been held back by persistent bottlenecks such as access to good- quality feed, seeds and markets. However, Africa 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).

Small-scale farmers in Malawi currently engaged in pond aquaculture, fish farming contributes on average 10% to total household income (Dey *et al.* 2007 and Andrew *et al.* 2003). According to Tacon (2001), “little or no hard statistical information exists concerning the scale and extent of rural or small-scale aquaculture development, within most developing countries and LIFDCs or concerning the direct/indirect impact of these and the more commercial-scale farming activities and assistance projects on food security and poverty alleviation”.

It is estimated, that employment from aquaculture per country ranges between 18000 and 30000 jobs (Satia, 2011). The number will increase if temporary employment is added, as in the case of Madagascar, it jumps to an additional 60000 jobs. In the Near East and North Africa region, it is estimated that more than 86000 people are employed, of whom 70 percent are from Egypt, the region’s largest producer. In western Africa and some southern African countries, fish processing, retailing and the local trading of fish are mainly carried out by women (Krouma, 2011).

Although the potential of aquaculture to reduce poverty and hunger has been recognized in Africa, growth in the sector has up-to-now been limited, providing less than 2% of fish production. In Eastern and Central Africa, the slow growth has been caused by a number of limiting factors, including a development focus on poor

farmers, a lack of focus on the entire fish value chain (feed, seed, processing and marketing), as well as weak governance and policy environments.

(<http://www.worldfishcenter.org/our-research/ongoing-projects/african-aquaculture-development-beyond-the-fish-farm>).

2.7 History and General Overview of Aquaculture in Tanzania

Available records suggest that, aquaculture was first introduced in Tanzania in late 1940s. It is being estimated that the industry produces about 9500 tons of fish annually, from more than 14,740 ponds scattered all over the country (URT, 2010). Aquaculture in the United Republic of Tanzania has a vast but as yet untapped potential. The industry is dominated by freshwater fish farming in which, small-scale farmers practice both extensive and semi-intensive fish farming. Small fish ponds of an average size of 10 m x 15 m (150 m²) are integrated with other agricultural activities such as gardening and animal and bird production on small pieces of land (FAO, 2005).

The total number of people involved in the aquaculture sub sector is about 17,100, with 14,100 involved in freshwater fish farming and about 3,000 in seaweed farming. The industry is dominated by integrated freshwater fish farming whereby each farmer owns an average of one small fish pond (FAO, 2010). The United Republic of Tanzania is currently estimated to have a total of 14,100 freshwater fishponds scattered across the mainland (FAO, 2005).

The aquaculture sub- sector has a great potential for expansion, especially due to the fact that, demand for fish is increasing as a result of population growth and stagnant

production from capture fisheries, both at global and domestic levels. The export drives for fish and fish products, would most likely lead to aquaculture development in the country. It is being estimated that, more than 50 percent of land in the country is suitable for fish farming (URT, 2010).

The contribution of the aquaculture sector to the national food security and economic development is still insignificant. Annual farmed fish production is extrapolated at 1 522.80 tonnes. This is about 0.435 percent of the average annual fish landings which is around 350 000 tonnes. The impact on poverty alleviation is therefore also insignificant. However, the possibility of an adverse impact on the environment is minimized since it is still at subsistence level (FAO, 2005).

2.7.1 Colonial Time

Aquaculture in Tanzania started back in 1949, when the rainbow trout were introduced in the Northern and Southern Highland regions (URT, 2009). In this regard, the Government assisted the community through provision of fingerlings, technical and financial assistance. This system continued to post-independence. Water reservoirs constructed for use in homes or for livestock, irrigation and factories or for flood-control were stocked with tilapia. This practice started in 1950 and by 1966, 50 percent of the reservoirs in the country had been stocked by the Fisheries Division (URT, 2009).

2.7.2 Post-Independence

In 1967 the government launched a national campaign on fish farming which was unsuccessful; again due to improper management. According to reports from FAO

(2005), 8,000 fishponds had been constructed in The United Republic of Tanzania by 1968. However, some of the ponds were too small in size (at times as small as 20 m²) and with a very low production probably resulting from poor management. In 1972, aquaculture was for the first time given some importance in the fisheries policy and it was included in the Fisheries Policy. Although always aquaculture was perceived as a low economic sector, several small aid projects have been directed towards the development of aquaculture in the country but have not had the expected success.

2.8 Linkage between Aquaculture, Food Security and Poverty Reduction

Aquaculture remains a growing vibrant and an important production sector for high-protein food and it comprises diverse systems of farming plants and animals in inland and coastal areas, many of which have relevance for the poor (FAO, 2001).

Already many of the world's poorest billion particularly people in Asia and Africa, get a substantial portion of the animal protein in their diet from fish (The World Fish, 2008). For many of these people fish also provides a major source of livelihood. With targeted investment to better manage fisheries and develop aquaculture, we can substantially increase these benefits (The World Fish, 2008).

According to Tacon, (2001) the benefits of aquaculture in rural development relate to health and nutrition, employment, income, reduction of vulnerability and farm sustainability (FAO, 2001) pointed out that aquaculture in small farmer systems provides a high quality animal protein and essential nutrients, especially for nutritionally vulnerable groups, such as pregnant and lactating women, infants and pre-school children. It also provides this protein at prices generally affordable to the

poorer segments of the community; also it creates ‘own enterprise’ employment, including jobs for women and children, and provides income through sale of what can be relatively high value products.

2.9 Conceptual Framework

The conceptual framework (see Figure 1) shows the relationship between the cause, problem and effect, it describe how the development of aquaculture caused/depend on the availability of hatcheries and affordable quality cultured seeds and feed, enough skilled personnel for providing extension services, adequate knowledge and skill for farmers to practice aquaculture, capacity of farmers to adopt and adapt appropriate technologies of aquaculture, diagnosis and treatment of fish diseases, access of farmers to credit facilities for development, access of information and marketing of the product and conducting research, the presence of these will result into employment, increase income, protein source, food security, healthy families through these also poverty will be reduce and increase food security in the community.

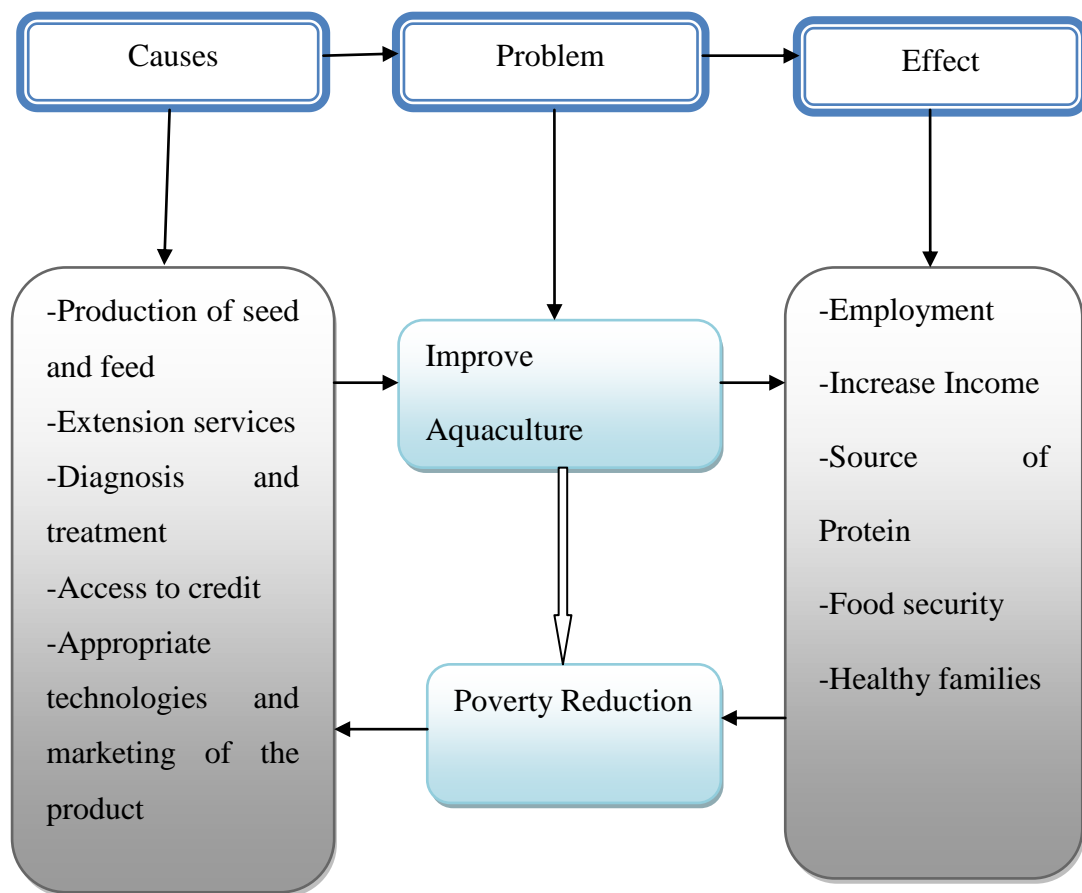


Figure 1: Conceptual Framework
Source: (Researcher, 2015)

2.10 Knowledge Gap

Despite the prepositions portrayed in the frame work of the current study the review of literature showed that, there was no research evidence to support the contribution of small scale farmers on poverty reduction and food security in the District. However, little data exist on small-scale farmers in the contribution poverty reduction to small scale farmers. The current study therefore, sought to bridge this knowledge gap, by assessing the fish farmer’s income, aquaculture contribution on food security to fish farmers, challenges facing fish farmers and suggestions to improve the situation. The study specifically aimed at assessing the impact of small-scale aquaculture on poverty reduction and food security in Nyamagana District.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides an overview of the research methodology adopted in this study. The chapter begins with specifying the research design that was used and justifies the reasons behind the use of this design. Also the chapter identified the area of the study and selection criteria, targeted population, description of the study area, sampling procedure/size and the research methods that were employed in data collection. It further provides information on the data analysis techniques and it ends with a discussion on issue related to the validity and reliability of data.

3.2 Research Design

The study was conducted through cross-sectional design whereby data were collected at a single point in a time, without repetition from a sample selected. According to Kothari, (2004) research design is needed because it facilitated the smooth sailing of the various research operations, thereby making research as efficient as possible by yielding maximal information with minimal expenditure of effort, time and money. This design helped to organize ideas in a form whereby was possible to look for errors and inadequacies.

3.3 Study Area Selection and Criteria

The study was conducted in four streets within Nyamagana District. These areas were selected due to presence of local communities who practiced small scale aquaculture and there were a large number of fish farmers. Other criteria for picking these streets include their engagement in small-scale fish farming, representation of

administrative boundaries (Wards) and challenges facing small- scale aquaculture farmers (Nchangwe, pers, obs).

3.4 Targeted Population

Population refers to the total number of subjects or the total elements of interest to the researcher (Kothari, 2004). The target populations for this study were the small-scale fish farmers, nearby local the community in the streets and key informants such as Ward and Village Executives, Extension Fisheries and District Fisheries Officer as well several institutions related to the study were considered.

3.5 Description of the Study Area

3.5.1 Location

The study area is administratively in Nyamagana District. Nyamagana District comprises the northern half of the city of Mwanza. It is bordered to the north and west by Lake Victoria, to the south by the Ilemela District, and to the east by the Magu District. The Latitude and Longitude of Nyamagana District is -2.5163312 and 32.8990853 respectively. According to the 2012 census, the population of the Nyamagana Municipal Council was 363,452 (MCC, 2008).

3.5.2 Climate and Topography

The study area were the characterized by gently undulating granites and granodiorite physiographic, with isolated hill masses and rock inselbergs. It is also characterized by well- drained sandy loamy soil generated from course grained cretaceous. It experiences between 700 and 1000mm of rainfall per year, falling in two fairly distinct seasons i.e. between the months of October and December and between February and May (MCC, 2008).

3.5.3 Land Use and Vegetation

Fishing were the main activities performed in this area, agricultural activities include urban farming, vegetable production, fish farming and activities such as cassava, sweet potatoes, vegetable cultivations were carried out, also settlements, economic and commercial activities are performed, recreational areas, religious and cultural activities (MCC, 2008).

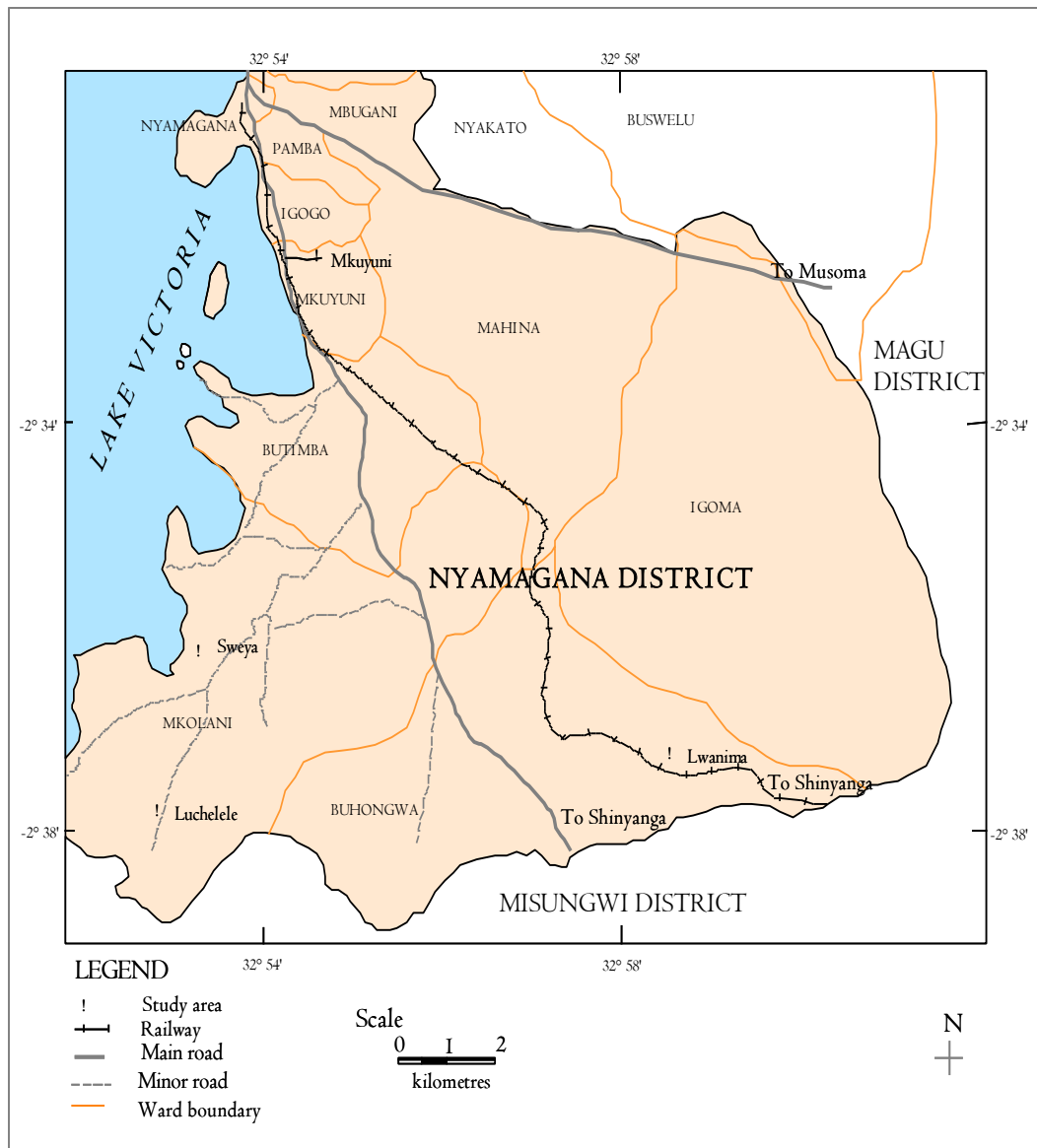


Figure 2: A Map Showing a Study Area

Source: Mwanza City Council Master Plan, 2008

3.6 Sampling Procedure and Sample Size

3.6.1 Sampling Procedures

The study has used random and purposive sampling to select representatives. Kothari (2004) defines sampling as the technique to be employed in selecting the representative item, or participants from the population under investigation. Random samples were drawn from small-scale aquaculture farmers and the communities at the streets. Random sampling selected is over other than sampling methods because it provides equal chance for every members/fish farmers, to be included in the study (Krishnaswami, 2003).

According to Kothari (2004), a purposive sampling is a deliberate selection of a particular unit of the universe to constitute the sample that represents the universe; particularly it tends to possess the individuals according to certain purpose such as experts and experienced people in the study. For this study, the purposive sampling was used to select District Fisheries Officer, Ward and Village Executive Officers, Fisheries Extension Officer, Institutions and Non- Governmental Organization representatives. According to Bernard (2002), the researcher has to decide what need to be known and sets out to find people, who can and are willing to provide the information by virtue of knowledge or experience.

3.6.2 Sample Size

Sample size refers to a number of items to be selected from the population to make a sample. It suggested that, a minimum of 30 samples has to be included in sampling when statistical analysis is adopted (Saunders *et al.*, 2000). Sample of 29, 21, 26 and 24 representative were selected from Lwanima, Mkuyuni, Sweya and Luchebele

Street respectively, making a total of 100. The sample shows variations within the streets because of the nature of population and the distribution of fish farmers in a given street, and the sample size was sufficient and manageable to the researcher, also 6 key informants were included (Table 1 below). The choice of sampling was done because it helped the researcher to reduce cost, save time, labor efficient and results in a higher level of accuracy.

Table 1: The Composition of Sample

Category of Respondents	No. of Respondents
District Fisheries Officer	1
Extension Fisheries Officer	1
Ward and Street Executive Officer	2
Institutions	1
Non government organization	1
Fish farmers	100
Total	106

3.7 Data Collection Methods

The study employed various data collection methods such as, direct observation, questionnaire survey, interview and documentary review. Both primary and secondary data were collected qualitatively and quantitatively in the study. The details were as follow:

3.7.1 Physical Visits

Field visits were done in collaboration with street leaders. Also, where necessary, photographs were taken to assess situation on the ground on such as feeding style, source of water, and the sizes of the farms as well as the real situation of the pond.

3.7.2 Questionnaire Survey

The study used questionnaires (appendix 1 below). The questionnaires had open and closed question. Open ended questions have the advantage of giving respondent room to give their own views and comments, without being influenced by the researcher as opposed to closed ended ones while, closed - ended questions ask the respondents to choose from a list of responses and are good, in collecting quantitative data and simplify data analysis (Malhotra, 2009). Aspect of questionnaires included small-scale aquaculture farmers' socio- economic characteristics, income, aquaculture and food security, challenges, and suggested ways to improve aquaculture activities.

3.7.2.1 Pre- Testing

Pretesting involved five members two research assistants and three aquaculture farmers selected randomly in three streets who were enough and able to provide answers, which used to correct some of the questions in questionnaires. An aim of testing questionnaire was to assess whether the questions contained were clear to respondents and the average time used for interview. Pre- testing helped to make necessary corrections, deletions, addition and changes in questions and to minimize imperfection. According to Krishnaswami (2003), pre-testing refers, to a trial administration of the instrument to a sample of respondents before finalizing it.

3.7.2.2 Training of Research Assistants

Two research assistants were selected based on their level of education background, the preferable level of education was form four and above because they had a skill and knowledge, compared to low level of education and also familiarity with the

concern community/aquaculture farmers. One day training for assistants was conducted based on acquiring data skill such as interviewing respondents and guiding the respondents to fill questionnaires. The use of local research assistants aimed at reducing researcher biases; also helped in minimizing fear to local community due to the fact that, they were known hence, encouraged openness and confidence of the respondents.

3.7.2.3 Questionnaire Administration

During field work face to face questionnaires were administered by the researcher and research assistants to aquaculture farmers. The researcher helped respondents to fill the questionnaire where necessary, so as to make clarification on complex issues which gave a guarantee to the researcher that, the questionnaires were delivered to the intended respondents also questionnaires were translated in Swahili language.

3.7.3 Interviews

Semi structured interview (Appendix 2,3 and 4) was used to get information from Districts Fisheries Officers, Fisheries Extension Officers, Ward and Village Executive Officers and Officers from related Institutions or Non-Government Organization. Semi structured interview, have been preferred over the structured because the former allowed more probing to seek clarification and elaboration of the participants own ideas, aspirations and feelings while generating detailed ‘rich’ context qualitative data (Long, 2007). Key issues addressed included, a number of aquaculture farmers in the District, methods used in farm construction, size of ponds (width, depth, amount of fish required according to size of farm), source of seeds and feed, challenges and suggestions.

3.7.4 Documentary Review

Secondary data were obtained through review of various published and non-published documents from District and Ward fisheries report, village and farmers, journals and books report.

3.8 Data Analysis

Data analysis was done by editing, omission of errors, coding, categorizing to ensure that accuracy of data and finally, entered into the Statistical Package for Social Science (SPSS) version 16.0 and Ms Excel 2007. Information from questionnaire was entered into a prepared code book before entering data into SPSS; this was used to convert the information obtained from each subject, into a format that SPSS could recognize. The detailed data analyses according to the methods used in data collection were as follows;

3.8.1 Questionnaire Survey

The edited and coded data obtained through questionnaire was subjected to analysis by using statistical package for social sciences (SPSS) version 16 and MS excel. Responses were summarized into a number of different categories for entry into SPSS, the categories were identified after observing through the range of responses received from the respondent, and then each response categories were assigned number. The SPSS software was used because of its quality in data analysis (Kothari, 2004).

3.8.2 Key Informants Interview

The qualitative data collected through interviews and physical visit were analyzed based on identified themes or topics. The aim was to reduce the total content of qualitative information to a series of variable. Several social science researchers have pointed out that, qualitative data analysis has no one right way to proceed with analysis (Hesse-Biber and Leavy, 2004). Thus, before interview data were analyzed, the responses were categorized into various classes which are called categorical variable (Kombo and Tromp, 2006). By using impressionist summary technique the researcher recorded the key issues of the interview, summarized the key findings from the frequent responses, and provided explanation, interpretation and conclusion of the findings (Kombo and Tromp, 2006).

3.9 Reliability and Validity of Data

Saunders *et al.*, (2000) suggest that, reliability and validity are the two most important quality control objects in research design. Therefore, it is important the researcher results are reliable and valid.

3.9.1 Reliability

Reliability is a matter of whether a particular technique is applied repeatedly to some objects would yield the same results each time (Babbie, 1990). Reliability of data collected, was ensured by the use of different methods and tools during data collection including; interviews, questionnaires, and review of secondary data. Pre-testing of the questionnaire before actual data collection, to determine their clarity and relevance to the objectives of the study also increased reliability. Reliability was also ensured by the use of appropriate sampling techniques including random sampling and the selection of appropriate sample size.

3.9.2 Validity

Validity refers to the degree to which a study accurately reflects or assesses the specific concept the researcher is attempting to measure (Krisnaswami, 2003).

Validity is a measure of accuracy and whether the instruments of measurement are actually measuring what they were intended to measure (Kothari, 2004). In this study, validity was attained in various ways. First, by the use of random sampling which helped to reduce biasness and second edited data helped to identify errors and remove them, hence improved the validity of the findings of the study.

CHAPTER FOUR

RESULTS OF THE FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the findings and discusses them. The chapter is divided into five main sections. Section one gives the demographic characteristics of the respondents, section two is about the contributions of the small-scale aquaculture on income. Section three is on the contribution of the small-scale aquaculture on food security. The fourth section highlights the challenges and last section gives suggestions on how to improve small-scale aquaculture for income enhancement and food security.

4.2 Demographic Characteristics of the Respondents

This section provides the outline of the respondents, by considering the demographic and socio-economic characteristics of the respondents and these include; sex, age, education level, marital status and main economic activities.

4.2.1 Sex of Respondents

Results have shown that, the majority (84.8%, n=100) of respondents were males while 15.82% were females. This could have happened by chance; however, males tend to dominate and speak for their household issues than the female in the study area and in most cases men were the owners of the ponds while women managed the ponds. Research findings clearly show that over 90% of respondents in Mkuyuni and Lwanima were males, compared to about 70% from Luchebele and Sweya. On the other hand, about 20% of respondents in Luchebele were females compared to between 4.2% and 7.7% of the respondents from Mkuyuni and Lwanima.

Table 2: Demographic characteristics of respondents

Variable	Variables	Respondents (%)				Average %
		Luchelele n= 29	Sweya n= 21	Mkuyuni n= 26	Lwanima n= 24	
Sex	Male	72.4	76.2	92.3	95.8	84.18
	Female	27.6	23.8	7.7	4.2	15.82
Age	18-37	48.3	47.6	27	8.3	32.8
	38-57	48.3	47.6	53.9	45.8	48.9
	Above 58	3.4	4.8	19.2	45.8	18.3
Education	Informal	10.3	0	11.5	0	5.45
	Primary	17.2	38.1	42.3	50	36.9
	Secondary	37.9	57.1	42.3	50	46.83
	Higher	34.9	4.8	3.8	0	10.88
Marital status	Single	51.7	42.9	26.9	8.3	32.45
	Married	48.3	47.6	61.5	91.7	62.28
	Divorce	0	9.5	11.5	0	5.25
Economic activities	Fishing	51.7	33.3	42.3	41.7	42.25
	Small-scale farming	34.5	19	38.5	33.3	31.33
	Petty trade	6.9	38.1	7.7	8.3	15.25
	Other activities	6.9	9.5	11.5	16.7	11.15

Source: Field survey, 2015

4.2.2 Age of Respondents

Respondents of various age groups were included in this study. The youngest age group was that of 18 years, but others were above 58 years of age. Nearly half of respondents (48.9%) were aged between 38-57 years, while 32.8% were aged between 18-37 years. Respondents above 58 years accounted for 18.3% of the total.

Therefore, from Table 2 it is evidenced that nearly half of the respondents belong to an economically active category of the productive age. These are groups that can invest in fish farming.

4.2.3 Education level of Respondents

With respect to education, research findings show that 46.8% of respondents had secondary education while 36.9% had attained primary education. Respondents who had higher learning education accounted for 10.88% and those with informal education made up the remaining 5.45% (Table 2). Study findings have shown that, most of the respondents had secondary education due to the presence of primary and secondary schools in the study area and was affordable to all. In addition the study areas are also close to urban areas.

4.2.4 Marital Status of Respondents

Table 2 also shows that 62.28% of the respondents were married compared to 32.45% who were single and 5% divorced. Majority were married because traditionally, people who live in these areas had a culture of being married at a young age of even 20 years.

4.2.5 Economic Activities of Respondents

Respondents to the study area are engaged in fishing (42.25%) as their main economic activities due to the fact that, they lived very close to Lake Victoria and others (31.33%) are engaged in small scale fish farming. Table 2 also shows that an average of 15.25% of the respondents is engaged in petty trade as their major economic activity. However, the majority of these petty traders are found in Sweya

street village. Higher percentage of respondents in Sweya engaged in petty trade (38.1%) can be explained by the presence of number of workers and fisherman around the area who require services provided by petty traders. Other activities accounting for 11.15% include vegetable vendors, livestock keeping, boat building and repair works.

4.3 Contribution of Small-Scale Aquaculture on Household Income

4.3.1 Fish Farmers Average Income from 2011 - 2014

The contributions in terms of on household cash income were investigated. According to field data the average income increased and varied among these streets as shown in Table 3. Overall, the average income was Tshs 3,625,000/per annum equal to 302,083/ per month when compared to the minimum wage of Tanzania Tshs 310,777 with effect from July 2015 (http://www.the_citizen.co.tz). Therefore, the findings of this study show that amount realized from aquaculture is comparable to the minimum wage in the country.

From an observation most interviewed small-scale farmers revealed that income obtained from aquaculture, was used in a variety ways where in most cases it contributed to reduction in non-income poverty through access to education and food security. Furthermore, an interview with the District Fisheries Officer it was revealed that, there were 79 fish farmers in the District and they used fish farming to generate extra income for the households.

Table 3: Average Income to Small-Scale Fish Farmers from 2011-2014

Village	Farmers Average income (Tshs.) per year					Average income (%)
	2010	2011	2012	2013	2014	
Luchelele n= 29	1,200,000	1,850,000	2,900,000	3,750,000	4,800,000	3,625,000
Sweya n = 21	900,000	1,420,000	2,800,000	3,400,000	4,750,000	3,317,500
Mkuyuni n =26	533,000	980,000	1,650,000	2,700,000	3,400,000	2,315,750
Lwanima n =24	750,000	980,000	1,780,000	2,400,000	2,560,000	2,117,500

Source: Field survey, 2015

4.3.2 Fish Farmers' Annual Average Income

Data from the District Fisheries Office have shown that, the annual average income per person per year to fish farmers increased, from a range Tsh.1,500,000 - 2,500,000 in 2012 to Tshs.3, 500,000 – 4,500,000 in 2014 as shown in Table 4. The District Fisheries Officer reported that despite of the fact that the fish farmers' annual average income increased usually they sold their product at a low cost. It has also been found that there was unequal price of farmed fish and lake fish whereby the price offered for farmed fish reported to be low.

Table 4: Secondary Data from District Fisheries Office

Years	No. of farmers	Average Income per person per year (Tshs)
2012	29	1,500,000 – 3,000,000
2013	33	2,500,000 - 3,500,000
2014	68	3, 500,000 – 4500,000

Source: District Fisheries Office, 2014

Generally, field results and secondary data indicate that fish farmer's average income increases from year to year as shown in Table 3 and 4 respectively.

4.4 Contributions of Aquaculture on Food Security to Small-Scale Fish Farmers

Achieving food security is an important aspect of general development objectives such as poverty alleviation and food security. To be food secure, households and individuals need to have food available to them, access to food, and also the ability to fully utilize it once was consumed (USAID, 1995), indirectly, aquaculture has contributed to an increase in food security by providing opportunities for employment and income generation for the local communities. More than 500 million people in developing countries reportedly, depended on fisheries and aquaculture for their livelihood (FAO, 2010). In the context of the study, food security is limited to provision of protein, income and employment.

Respondents to this study had different opinion on the contribution of aquaculture to food security. Figure 3 shows that majority of 79% acknowledge that aquaculture has a contribution to food security. Only 11% of the respondents reported that there was no contribution.

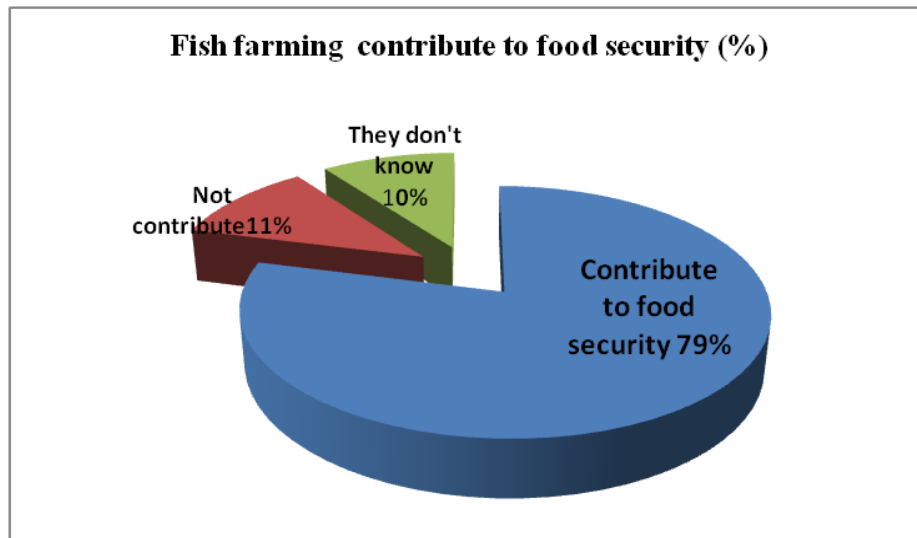


Figure 3: Contribution of Small-Scale Fish Farmers on Food Security
Source: Field Data, 2015

Aquaculture contributed to food security of employment opportunities, income generation and provision of protein (Figure 4). Muir *et al.*, (2005) found that, a well planned aquaculture development program has the potential to create jobs, improve food protein and enable small-scale farmer's income flow.

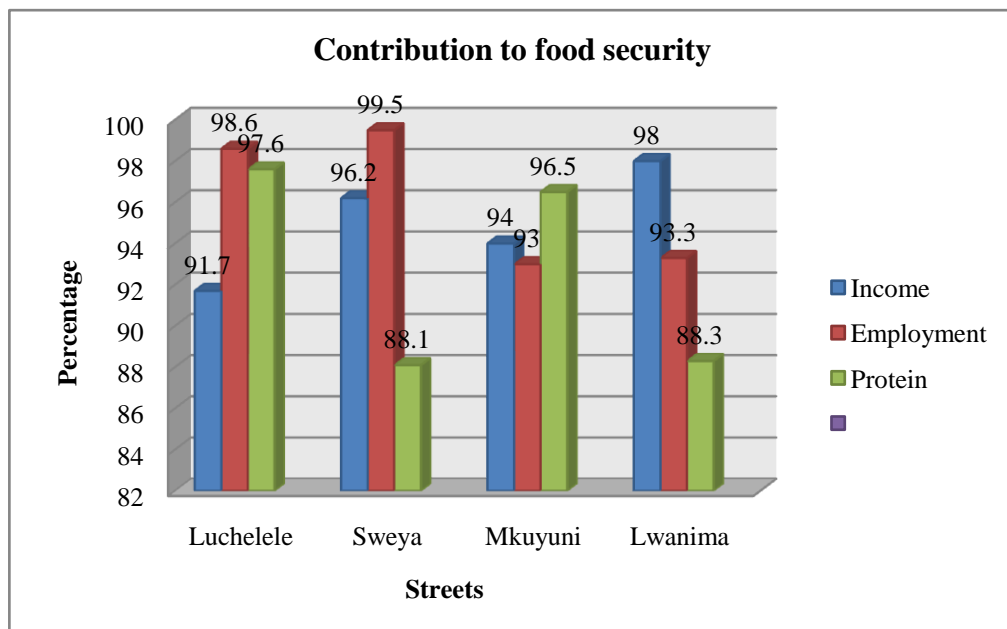


Figure 4: Small-scale aquaculture contribution to food security
Source: Field Data, 2015.

4.4.1 Creation of Employment Opportunities

Aquaculture enterprises could create new jobs and remove seasonality in labor demand. Muir *et al.*, (2005) reported that, employment opportunities are possible also on fish farms through job creation in activities such as seed supply networks, marketing chains and manufacturing, repair shops, and other aquaculture support services. This study has found that, respondents access employment opportunities either as owners or as full-time farm workers, managers and technicians at small-scale fish farms. At the street level results have shown that, most respondents (99.5 %, n=26) from Mkuyuni Streets reported that fish farming created employment to them, normally they spent most time to take care for farms. An interview with respondents from Mkuyuni women group revealed that they agreed to establish fish farms in *Mtaa wa Sokoni* whereby most of them employed in the farm.

Table 5 below shows people employed in aquaculture activities. Out of the total of 94 people involved in the practice 11% were females. This express that female were engaged to small extent in aquaculture. In most families male dominate fish farming activities while female responsibilities is to take care fish farms , this create inferiority to females to own the pond or to be engaged in fish farming production. Aquaculture can therefore provide part-time jobs to women who are the key managers of household resources directed at consumption (Muir *et al.* 2005).

Table 5: Employment in Aquaculture

Streets	No. of fish farmers in the street	Employees		Total
		Male	Female	
Luchebele	29	21	4	25
Sweya	21	16	3	19
Mkuyuni	26	24	2	26
Lwanima	24	23	1	24
Total	100	84	10	94

Source: Field survey, 2015

4.4.2 Income Generation

Aquaculture also generated income to fish farmers; this is explained previously at Table 3 above.

4.4.3 Food Protein

According to the FAO (2010), over one billion people worldwide rely on fish as their primary source of animal protein. Fish are a great source of protein and minerals, low in saturated fats and a good source of essential fatty acids, a combination for good health (USAID, 1995). Aquaculture can contribute to improve food security and nutrition through various channels. For example, local food supplies can be improved through by an increase of the availability of a low-cost fish. Increasing the quantity and variety of fish and other foods consumed by the poor will reduce under-nutrition within rural communities (Tacon, 2001).

Most respondents in all streets pointed out that, aquaculture provided fish protein to them, at the street level 97.7% of them from Luchebele revealed that farmed fish

played partly as a source of protein. This study has observed that, they opted to do fish farming for the purpose of getting food protein because the fish from Lake Victoria is not enough. They did not sell all of their fish; some of it was used at home for consumption, thus obtaining protein supplements. The same argument is supported by Na-Nakorn and Brummett (2009). Through aquaculture protein requirements and fish consumption needs of the populations can be adequately met.

On the other hand respondents from Sweya (88.1%) and Lwanima Streets (88.3%) shows that provisions of fish protein were small in percentages compared to other streets from Luchelele and Mkuyuni were 97.6% and 96.5% respectively. This is because villages with low food protein in percentage participating to small extent in fish farming activities compared to villages with higher percentage. For example most of respondents in Sweya streets are engaged in petty trade as their main economic activities.

4.5 Challenges Facing Small- Scale Aquaculture Farmers

Challenges hindering the production of fish were mainly shortage of seeds and feed, inadequate capital, shortage of skilled workers, lack of awareness and poor government support (Table 6). Okwu *et al.*, (2011) pointed out that, there are many constraints hindering efficient production of fish by farmers, the most serious ones being high the price of fish feeds, an acute shortage of seed, lack of skilled workers needed for daily production routine and lack of capital needed for expansion of the business.

Table 6: Challenge Facing Small-Scale Fish Farmers

Variables	Responses in percentage (%)				Average in (%)
	Luchelele n = 29	Sweya n = 21	Mkuyuni n =26	Lwanima n =24	
Shortage of seed and feed	95.6	74.1	94.2	100	91
Inadequate capital	100	100	99.7	64.2	91
Shortage of skilled workers	93.1	62	84.6	87.5	81.8
Lack of awareness	96.6	90.4	73	54.2	78.6
Poor Govt. support	65.5	85.7	65.4	87.5	76

***Multiple responses Source: Field Data, 2015**

4.5.1 Shortage of Seed, Feed and Inadequate Capital

Results at Table 6 above show that, (91% each) shortage of seeds, feed and inadequate capital were challenges facing small scale aquaculture farmers. Shortage of seeds and feed showed as challenge when they wanted to stock and re-stock their ponds, for production, the specific feeding materials, size and time required to feed the fish. At street level respondents from Lwanima show that, 100% of them experienced shortage of seeds and feed, and currently, the situation of fish farming was likely to run off.

During an interview the District Fisheries Officer reported that, lack of quality seeds and feeds hindered the production of fish in the study area, the available seeds not grown-up well at a specific time, it takes more time to mature. Also farmers used locally feed by grinding different ingredients without a specific ratio. Many of them in the study area tried to find cheaper feeds that were manufactured locally. Findings

are similar to that of Munguti *et al.*, (2014) which indicated that, inadequate supply of certified quality feed and seed fish has been a longstanding hurdle to the growth of aquaculture industry. Also fish willingness to spawn and the quality of sperm and eggs produced was greatly affected by the quality of feed.



Plate 1: Fish Farmers use locally produced feed in Mkuyuni Street.

Photo by: Hussein, May 2015

Apart from shortage of seed and feed, inadequate capital to fish farmers to invest in production was the major barrier to development and success for aquaculture. This study has found that, the source of capital was stated as challenge hindering aquaculture development, specifically, from Luchelele and Sweya streets compared to other streets.

According to the secretary from Butimba women group fish farmers reported that, majority of fish farmers in the study area had either no partnership with bank institutions or friendly banking regulations, which could support them to establish and expand production. Furthermore, fish farmers were asked if they had financial support provided by government, Non-government and private organizations. Overall findings have shown that most of respondent obtained capitals from their own savings while some of fish farmers with access to financial services from government and non- government was relatively low. This finding are more likely with Ikotun, (2002) who sampled fish farmers in Oyo State, where only 5 per cent of the sampled fish farmers had a access to bank credit while 73.2 per cent used personal savings. Table 7 below shows financial support received by small- scale fish farmers.

Table 7: Financial Support Received by Small-Scale Farmers

Financial support					Total
	Luchelele n =29	Sweya n =21	Mkuyuni n =26	Lwanima n =24	(%)
Private	79.3	81	100	100	90.1
Non-Government	3.4	0	0	20.8	6.1
Government	0	0	3.8	0	1

Source: Field data, 2015

A group leader from ROELA reported that, they received money from LVEMP to support fish farming production which was used to establish hatchery site, small milling machine to produce fish feeds located in Nyegezi (Nchenge) and launch commercial fish farm located in Luchelele.



Plate 2: Hatchery Pond Established by ROELA Group After they Received Money from LVEMP. Nyegezi (Nchenge Street).

Photo by: Author, May 2015

4.5.2 Shortage of Skilled Workers

The results showed that, 81.8% of the respondents identified lack of skilled workers needed for daily production as a challenge (Table 6 above). Most of the respondents in these areas were not well equipped with aquaculture knowledge due to the lack of a direct advice from the extension officers, who were expected to be in touch with farmers regularly. It seems that Luchebele (93.1%) lead towards shortage of skilled workers in the study area. One respondent from Sweya stated that, the need for an extension and advisory services to the farmers was very suitable and should be intensified.

4.5.3 Lack of Awareness on Aquaculture

Lack of awareness to aquaculture is a challenge, particularly for individuals who have no previous experience in fish farming. Study findings at Table 6 shows 78.55 %, (n=100) of the respondents revealed that, inadequate awareness of aquaculture skill was a factor that hindered aquaculture investment, particularly at street level respondents from Luchehele (96.6% n =29) were the most affected by an adequate information. This implied that, they not have sufficient information to fish farming activities when they want to establish and invest in fish farming activities. Many farmers with good land that could be put into profitable aquaculture were not even aware of this potential.

The Fisheries Extension Officer reported that insufficient funds in the government expenditure on extension and aquaculture training had reduced the access of farmers' technology and market information.

4. 5. 4 Poor Government Support

Field data show that, lack of Government support was another challenge to fish farming activities as shown in Table 6 above. An average of 76% (n=100) of the respondents from the four visited streets, stated the lack of Government support as an obstacle when they decided to engage in farming activities. Lwanima street perceived as the mostly affected by this challenge (87.5%, n=24). The reason was that many responsive and investments were for commercial in the street. An interview with fish farmer's women group from Mkuyuni reported that there was no coordination on promoting aquaculture through many institutions, which include the Government, research institutions, NGOs and among others. This had not facilitated

aquaculture growth because farmers were left confused by many different extension officers who visited and gave them varying information.



Plate 3: Fish farms in Mkuyuni (left) and Luchebele (right) Lack Skill and Technology.

Photo by: Hussein, May 2015

4.6 Suggestions on Improving Small Scale Aquaculture

Respondents from the study sites revealed different suggestions for the improvement of fish farming as presented in Table 7 above including financial support, provision of seed and feed were pointed out to be the most important desired for improving fish productivity as well as frequency extension services and market for fish. This study are similar to that of Okwu *et al.*, (2011) found out that, an improvement in markets, credit facilities, quality seeds and extension service are the most intervention desired for improving fish productivity.

Table 8: Small-Scale Fish Farmers' Suggestions to Improve Aquaculture

Suggestion measures	Responses (%)				Average (%)
	Luchelele	Sweya	Mkuyuni	Lwanima	
	n =29	n =21	n = 26	n =24	
Financial support	96.6	100	100	100	99.2
Provide feed and seed	84.1	85.2	100	91.6	90.2
Frequency extension service	92.4	93	98	98.8	95.6
Market for fish	93	95	89	70.8	87

* Multiple responses

Source: Field data, 2015.

4.6.1 Financial Support

In all surveyed streets (Table 7 above), respondents mentioned financial support (99.2%, n =100) as the most items required for their development in fish farming. Respondents from Sweya, Mkuyuni and Lwanima streets (100%, n =21, 26 and 24 respectively) showed that financial support needed because most fish farmers in these areas employed in commercial fish farming. Ward Executive Officer reported that, financial aid and credit facilities from any institution are required to support and improve small-scale farming. Furthermore, it could help to reduce poverty and increase food security in the area.

4.6.2 Provision of Feed and Seed

Results of the study have shown that 90.2%, (n =100) of the respondents suggested on provision of feed and seeds in the area. The suggestions given by respondents from Mkuyuni 100% (n =29) as shown at Table 7 above appeared to be profound because this street involve active groups of fish farmers and have been practicing

farming activities for several years. One respondent from ROELA group reported that, for an aquaculture to grow sustainably and meet its potential for food and income, they needed improved seed and feed technologies as well distribution mechanisms. This study is likely to be similar with that of Neely *et al.*, (2008) who stated that selective breeding for growth improvement in fish also will improve feed retention.

4.6.3 Frequency Extension Services

In all surveyed streets, respondents (95.6%, n=100) pointed out that an adequate aquaculture extension services, could result to aquaculture growth and development also played an important role in poverty alleviation in their families. Respondents from Lwanima Street (98.8%) revealed that, extension services are most needed compared to other streets in the study area. The presence of skilled workers could help fish farmers to sustain productivity growth and translate it more for better jobs.

An interview with LVEMP staff officer showed that, efficiency in dissemination of technology to farmers was required. Frequency extension services are a key factor to small-scale farmers' development. These are similar to that of Yemi *et al.*, (2012) has reported that the need for extension and advisory services to the farmers was very suitable and should be intensified.

4.6.4 Market for Fish

Respondents in all surveyed streets suggested that, there was a need to improve market for farmed fish (87%, n =100) as shown in Table 7 above. Sweya street (95%) appeared to be the leading to demand market for farmed fish because they had no viable market to sell their product.

An interview with the Ward Extension Officer reported that, fish produced by small-scale fish farmers were sold directly to the local community, either to individuals or nearby markets. Prices offered for fish in the local markets also were reported to be low as middleman involved in transactions passed on the costs of transportation to the farmers. A major concern was the irregular supply of farmed fish and the preference of wild fish by consumers rather than cultured fish. This is agreed by Okechi (2004), who reported that in many countries particularly in Africa, aquaculture is almost entirely for subsistence, with a little surplus production being sold at the rural market.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This Chapter presents the final section in the study. It includes the summary of the major findings, conclusions reached, recommendations for improving small-scale aquaculture and point out suggestions for further research.

5.2 Summary of Study

This study, aimed at assessing the impact of small-scale aquaculture on poverty reduction and food security. Specifically it targeted to assess the contribution of income to small-scale fish farmers, the contribution of food security to fish farmers. Furthermore, the study indentified the challenges faced in fish farming activities and fish farmers' suggestions.

The study used both qualitative and qualitative approaches. The two approaches facilitated the data collection and analysis of data and the results were presented in terms of descriptive statistics. The study employed field physical visit, questionnaire survey, interview and documentary review for collection techniques. The study was conducted in Nyamagana District and four streets were involved namely Luchelele, Sweya, Mkuyuni and Lwanima.

The findings of this study identified that the average income of small-scale fish farmers increased from one year to year. Apart from that the income obtained from aquaculture was used in a variety ways where in most cases reduced poverty through access to education and food.

The results also show that small-scale aquaculture led to an increase of food security by providing opportunity for employment, income and food protein to local communities. Moreover, the study has revealed that there are challenges hindering efficient production of fish, the most serious are shortage of seed and feed, inadequate capital, lack of awareness on aquaculture and poor government support. Finally, the study findings came up with some suggestions for improving small-scale aquaculture which financial support, provision of feed and seed frequency extension services and provision of viable markets that can be used to sell fish from aquaculture production.

5.3 Conclusion

Small-scale aquaculture contributed to the alleviation of poverty, through household farming of fish for domestic consumption and income, employment of the poor as service providers or workers on fish farms of wealthier farmers as well indirectly provided low cost fish for the poor and urban consumers. However, no statistical information existed concerning the direct or indirect impacts of fish farming on poverty.

It was also identified that, small-scale fish farming was carried out by family members by using a largely non-cash system in which there was a need for capital. From observations, it was established that in some streets, the fish farm were allocated close to the Lake and water was not of good quality as indicated by activities such as bathing and washing that took place in streams along Lake Victoria.

It also emerged from extension fisheries officer that, farmers had given up fish farming because they ran into huge losses after stocking their ponds, with a low-quality fingerlings and the unavailability of a low quality of feeds.

5.4 Recommendations

In order to achieve effectiveness and efficiency in aquaculture practice and development the following measures are supposed to be taken into consideration.

- Good cooperation between research institutions, government authorities and small-scale fish farmers is very important to identify critical factors such as the existing low quality seeds, unavailable feed, unskilled workers and lack of awareness which could help to improve small-scale aquaculture in the District.
- The Government should play a more significant role to motivate fish farmers, by increasing extension services and providing training support (technical) that are needed by farmers. Provision of viable markets for selling fish products is most desirable.
- Team work among DFO's and DAO's to combine agriculture and aquaculture which would improve food supply, increase income and become able to withstand shocks, and in the long run would decrease the risk to production, increase farm sustainability and in general boost small-scale farmers' development.
- The key challenge for the small-scale aquaculture always differs with other sectors and usually neglected by the government, hence inclusion of these sectors into policy is a key to sustaining and enhancing their development impact.

- In addition, the establishment of demonstration ponds in each street, one or two fish farmers to be chosen where issues are to be studied and designed with a specific improvement measures that could be applied or put in place to other fish farms. Likewise, to establish hatchery ponds in the district where fish farmers might able to get a quality seeds for farming would work well for the farmers.
- Finally, Mwanza City Council needs to review land use planning and re-locate a portion suitable for farming activities in the District. For example, this should include efforts to secure rights for landless group or minorities in the District.

5.5 Suggestion for Further Research

This research provides a foundation for further research on small-scale aquaculture in Nyamagana District. Further research could focus on assessment of the quality and tolerant seed that can be relevant for fish farming practice in Nyamagana and Ilemela District. Also research can be conducted to evaluate fish farming production and marketing practices under small-scale farming systems, research should be undertaken to examine the influence of gender role in aquaculture development.

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APPENDICES

Appendix 1 Questionnaire for Small-scale fish farmers

Dear Respondent,

This questionnaire is designed to help the researcher to collect data on the assessment of the impact of small-scale aquaculture on poverty reduction and food security in Nyamagana and Ilemela District. Kindly respond to the question attached, as accurately as possible. The information provided will be treated as confidential. The researcher will not reveal or expose the identity of the respondents under any circumstances.

Questionnaire number.....

Date.....

Name of street.....

Part A: Person Details

1. Sex of respondents

- (i) Male
- (ii) Female

2. Age of respondent (in years)

18-37	38-57	Above 58

3. Marital status

- (i) Single
- (ii) Married
- (iii) Divorce
- (iv) Widow

4. Education level

- (i) No formal
- (ii) Primary
- (iii) Secondary
- (iv) Above

Part B: Small-scale Aquaculture Farmer's Income

5. When did you start aquaculture activities? (years)

6. What is the size of your pond in..... m²

7. What is your daily average yield..... in kg, amount sold per month.... and price per kg is Tshs.

8. Do normally benefit from aquaculture activities? Yes or No

If yes, what are the benefits (mention at least three)

- (i)
- (ii)
- (iii)

If no, what could be the reason (mention at least three)

- (i)
- (ii)
- (iii)

9. Where do you sell your fish?

Local market External market

10. What are the trends of your average income from small-scale aquaculture activities for last 5 years?

Years	2010	2011	2012	2013	2014
Income(Tshs)					

Part C: Challenges and Opportunities of Small- Scale Aquaculture Farmers

11. Aquaculture farming associated with challenges? Yes or No, if what are the challenges (mention at least three)

- (i)
- (ii)
- (iii)

12. Does the practice possess opportunities? Yes or No, if yes what are the possible opportunities (mention at least three)

- (i)
- (ii)
- (iii)

13. Do you normally get extension services? Yes or No,if yes, at what
Frequently /month?,..... do you think the frequency is
appropriate?
Yes or No

14. Have you received credit facilities to facilitate aquaculture activities?
Yes or No, if yes, from which Institutions? (Mention at least three)

- (i)
 - (ii)
 - (iii)
- what was the value.....TZS.

Part D: Small-Scale Aquaculture Farmers and Food security

15. Do you think aquaculture is helpful on food security to local community?

If yes, how.....

.....

Part E: Suggestion for Improving Small-Scale Aquaculture

16. What can be done to improve small-scale aquaculture for income enhancement? (mention at least three)

(i)

(ii)

(iii)

Appendix 2 Checklist for District Fisheries Officer

- Number of aquaculture farmers in the District
- Workshop, meeting and Seminars conducted
- Collaboration among fisheries office and ponds owner
- Challenges
- Suggestion

Appendix 3 Checklist for Extension Fisheries Officer

- Methods used in farm construction
- Size of pond (width ,depth, amount of fish required according to size of farm)
- Source of seeds and feed
- Days to visit fish ponds per week
- Challenges
- Suggestion

Appendix 4 Checklist for Ward and Village Executive Officers

- Benefits
- Collaboration with farmers
- Challenge
- Suggestion

Thanks