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Thesis presented in partial fulfilment of the requirements for the degree of Master of Science in Natural Resources Management in the School of Natural Resources at Copperbelt University.

Supervisor:

Dr. Jane Kwenye
ABSTRACT

This study assessed the socio-economic determinants of profitability of Microthrissa moeruensis (chisense) fish trade and associated constraints among chisense fishers. In Zambia, studies focusing on socio-economic determinants of profitability of small pelagic fish species and associated constraints still remain rare. Therefore, to address this gap in the extant literature, this study focused on chisense fishers in Nchelenge district of Luapula province, Zambia. Data for this study was collected using a cross-sectional survey of 186 chisense fishers. A multistage snowballing sampling technique was used. Data was collected from 19th to 22nd June 2018 using a semi-structured questionnaire. Data analysis techniques included ordinary least squares regression analysis, descriptive statistics analysis and gross margins analysis.

Results of this study showed that the quantity of chisense sold ($\beta = 0.65$, $t = 10.65$, $\rho < 0.05$) and the purchase price of chisense ($\beta = 0.31$, $t = 5.23$, $\rho < 0.05$) had positive effects on profitability of chisense fish trade among fishers. The findings of this study further showed that the amount of capital invested had a negative effect on profitability among chisense fishers ($\beta = -0.31$, $t = -5.04$, $\rho < 0.05$). The results also showed that the mean gross margin was ZMK-59.43 indicating that fish trade among chisense fishers was not profitable. The findings of this study further showed that the major constraints associated with chisense fish trade included high cost of fuel, unstable prices for chisense, low catches and thefts. Other constraints included bad weather, lack of access to credit and illegal fishing activities.

The findings of this study suggest that in order for chisense fish trade to be profitable for fishers, the purchase price and quantity of chisense sold need to be sufficiently adequate to cover the costs incurred prior to fishing. It is also worth noting that large amounts of capital investments may not necessarily have a positive effect on profitability for chisense fishers as this may result in unrestraint use of chisense fish stocks. The results further suggest that chisense fishers are often prone to the risk of incurring losses given that they are faced with costs of essential inputs such as fuel despite having marginal chance of catching enough fish to cover costs. Furthermore, the constraints associated with chisense fish trade also affect revenue generation and profitability thereby reducing the economic viability of chisense fish trade among chisense fishers.

The study recommends that fisheries management measures should be strengthened in order to improve chisense catches and further reduce pressure on the available chisense fish stocks given
that the results of this study have shown that the quantity of chisense that fishers sell has a positive effect on profitability. An investigation into how the purchase prices for chisense are determined by fishers is further recommended given that the results of this study have shown that the price at which chisense is purchased has a positive effect on profitability. The optimum amount of capital required for investment also needs to be further investigated given that the results of this study showed that an increase in amount of capital can negatively affect profitability. Furthermore, an interrogation on how to reduce the cost of inputs such as fuels through use of alternative energy sources is recommended given that the results of the gross margin analysis of this study suggest that chisense fish trade is not profitable. Other measures recommended in order to avert constraints that affect chisense fishers include providing support for the establishment of rural based micro-financing in order to improve access to credit. There is also need to put in place measures that can reduce illegal fishing activities as well as provide innovative support that can improve access to information on the weather forecast and prevailing prices for chisense.
DECLARATION

I, declare that this piece of work titled “An assessment of socio-economic determinants of profitability of Microthrissa moeruensis (Chisense) fish trade and associated constraints among fishers - A case study of Lake Mweru-Luapula, Nchelenge District” is my own work and that all the resources used or quoted herein have been duly acknowledged by means of complete references. I have not submitted this work for the award of a degree at another university.

------------------------------------------------------------------ Date: -----------------------------
Evans Mutanuka
Author:

------------------------------------------------------------------ Date: -----------------------------
Dr. Jane Kwenye
Supervisor:
DEDICATION

This research project is dedicated to my Late mother Ms. Gabriella C. M’tonga for always encouraging me to work hard and believing in my abilities. I shall forever remain grateful for all the opportunities accorded to me MYSRIEP.
ACKNOWLEDGEMENTS

First and foremost, I wish to express my sincere gratitude to our Lord almighty for providing the strength and will to complete this research project amidst a lot of stress and pressure.

My profound and sincere gratitude goes to the Government of the Republic of Zambia and the WorldFish Centre (fish for trade project) for sponsoring my study and research.

My special gratitude goes to my supervisor Dr. Jane Kwenye for her guidance, patience, understanding and commitment to this research. Words alone are not sufficient to describe my indebtedness, I ask our God almighty to continue blessing you. Special thanks also go to Dr. Sloans Chimatiro for believing in my academic pursuits, facilitating my sponsorship and encouragement.

Sincere gratitude is also extended to Mr. Mweemba Chijoka, Mr. Stephen Kabwe, Mr. Keagan Kakwashía and Mr. Confred Musuka for your time, guidance and valuable comments during my data analysis.

I also wish to acknowledge the data collection assistants from Nchelenge Mr. George Chilufya, Mr. Ephraim Hamupi, Mr. Justine Mwewa, Mr. Kondwani Goma and Mr. Josphas Chilufya. I shall forever remain grateful for your commitment and dedication to this research. Furthermore, the chisense fishers that provided us the necessary information during our data collection are also thanked for their cooperation and valuable time.

Special thanks also go to my wife, Gift Musonda Mutanuka and our children Emmanuel Sizwe Mutanuka, Evans Chimwemwe Mutanuka Jr and Alinaswe Lloyd Mutanuka for your patience, support and understanding during the course of undertaking my research project that demanded a lot of my time.
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<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ACF</td>
<td>Agriculture Consultative Forum</td>
</tr>
<tr>
<td>ACP</td>
<td>African Caribbean Pacific</td>
</tr>
<tr>
<td>CPT</td>
<td>Common Property Theory</td>
</tr>
<tr>
<td>CSO</td>
<td>Central Statistical Office</td>
</tr>
<tr>
<td>DoF</td>
<td>Department of Fisheries</td>
</tr>
<tr>
<td>DRC</td>
<td>Democratic Republic of Congo</td>
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<tr>
<td>EAC</td>
<td>East African Community</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GM</td>
<td>Gross Margin</td>
</tr>
<tr>
<td>HLPE</td>
<td>High Level Panel of Experts</td>
</tr>
<tr>
<td>IAPRI</td>
<td>Indaba for Agriculture Policy Research Institute</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labour Organization</td>
</tr>
<tr>
<td>IUU</td>
<td>Illegal, Unreported, Unregulated</td>
</tr>
<tr>
<td>OLS</td>
<td>Ordinary Least Square</td>
</tr>
<tr>
<td>OVB</td>
<td>Omitted Variable Bias</td>
</tr>
<tr>
<td>SSA</td>
<td>Sub-Saharan Africa</td>
</tr>
<tr>
<td>TR</td>
<td>Total Revenue</td>
</tr>
<tr>
<td>TVC</td>
<td>Total Variable Costs</td>
</tr>
<tr>
<td>UNCTAD</td>
<td>United Nations Conference on Trade and Development</td>
</tr>
<tr>
<td>VIF</td>
<td>Variable Inflation Factor</td>
</tr>
<tr>
<td>WFC</td>
<td>World Fish Centre</td>
</tr>
<tr>
<td>WTO</td>
<td>World Trade Organization</td>
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<tr>
<td>ZMK</td>
<td>Zambian Kwacha</td>
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CHAPTER 1

1.0 Introduction

Fish trade which involves the distribution of fish and fish products from points of production to points of consumption or demand is an important source of income for fishers (Peluola, 2016). It is reported that fisheries support livelihoods of approximately 12 percent or over 800 million people worldwide (BIORES, 2015; FAO, 2016). Thus, it is sound to note that fishing remains fundamental in supporting livelihoods of fishers especially in rural settings. Studies conducted in the recent past have noted that profitability can be affected by socio-economic factors (Obayelu et al., 2016; Somanje and Muendo, 2016). Thus, an understanding of socio-economic factors that affect profitability in fish trade remains fundamental (Ali et al., 2008; Aworemi et al., 2010; Ume and Okoronkwo, 2013; Esiobu and Onubuogu, 2014; Tiri et al., 2014; Babalola et al., 2015; Bassey et al., 2015; Obayelu et al., 2016; Somanje and Muendo, 2016).

The socio-economic determinants of profitability for fish species in Zambia remains under-researched (Somanje and Muendo, 2016). This is the case for Microthrissa moeruensis (chisense), a small pelagic fish species whose total estimated production is 55,000 metric tonnes per annum (Molsa, 2009; Longley, 2014). This fish species is widely traded in its dried form throughout Zambia and the region (Molsa, 2009; Longley, 2014). Major markets for Microthrissa moeruensis fish species in Zambia include cities on the Copperbelt and the neighbouring Democratic Republic of Congo (DRC) with the DRC market having an estimated 60-75 per cent absorption capacity of the total quantity of Microthrissa moeruensis produced in Zambia (Longley, 2014).

The demand for Microthrissa moeruensis highlights the potential role that Microthrissa moeruensis fish trade can play in improving the livelihoods of fishers given that the number of fishers is on the increase in Zambia (DoF, 2014) and fisheries are considered critical for improving food security and poverty alleviation (FAO, 2005; Béné et al., 2010). This reinforces the need to understand the socio-economic determinants of profitability for fish species such as Microthrissa moeruensis. However, according to Longley (2014) and Mukuka and Shula (2015) Microthrissa moeruensis small scale artisanal fishing activities are seldom included in official fisheries statistics and surveys. This supports a note advanced by Somanje and Muendo (2006) that in Zambia there

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1Chisense is the local name for Microthrissa moeruensis fish species and the two terms will be used interchangeably in this study
is paucity of information on the socio-economic determinants of profitability for capture fisheries of which chisense is a part. Furthermore, an understanding of constraints associated with capture fisheries in Zambia also remains under-researched. This is undesirable given that Béné et al. (2010) notes that fish trade in Africa is faced with various structural challenges such as weaknesses in domestic markets, barriers to regional trade, infrastructure limitations, insecurity, and poor governance among others that affect its contribution to pro-poor impacts in sub-Saharan Africa (SSA). Thus, an understanding of socio-economic determinants of profitability and the constraints associated with Microthrissa moeruensis fish trade remains fundamental for decision makers’ ability to identify entry points for interventions. Moreover, FAO (2007) note that improving the provision of information that supports decision making not only helps to identify entry points for interventions but also improves knowledge on trade flows and their impact. Therefore, this study assessed the socio-economic determinants of profitability of Microthrissa moeruensis fish trade among fishers and associated constraints using a case study of Lake Mweru-Luapula fishery in Nchelenge district, Luapula province.

1.1 Problem statement

Fish trade has been identified as a potential engine for economic growth as well as a poverty alleviation tool with prospects to contribute significantly to addressing developmental challenges such as food security, poverty alleviation, economic growth and development in Sub-Saharan Africa (SSA). The measure of profitability and its determinants for individuals involved in fish trade can provide an indication of short-term sustainability (DANIDA, 1999). However, the socio-economic determinants of profitability of fish trade in Zambia remains under-researched (Somanje and Muendo, 2016) particularly for small pelagic fish species such as Microthrissa moeruensis. In the recent past, Somanje and Muendo (2016) conducted a study that assessed profitability of capture fisheries and its socio-economic determinants on the Barotse floodplains of Zambia. However, their study focused on larger fish species that included breams, bulldog and catfish species. Thus, studies focusing on assessing the socio-economic determinants of profitability in the fish trade of small pelagic fish species still remain rare. Moreover, fishing activities for small pelagic fish species such as Microthrissa moeruensis are seldom included in official fisheries statistic and surveys (Longley, 2014; Mukuka and Shula, 2015). An understanding of constraints associated with small pelagic fish species also remains poorly understood. Longley (2014) and
Mukuka and Shula (2015) reported that *Microthrissa moeruensis* small scale artisanal fishing activities are seldom included in official fisheries statistics and surveys.

Fish trade particularly in Africa is faced with various structural challenges that affect its contribution to pro-poor impacts in sub-Saharan Africa (SSA) (Béné et al., 2010). However, an understanding of constraints associated with *Microthrissa moeruensis* fish trade in Zambia still remains poorly understood. Therefore, to address this challenge, the study assessed the socio-economic determinants of profitability of *Microthrissa moeruensis* fish trade and associated constraints using a case study of Lake Mweru-Luapula fishery in Nchelenge district, Luapula province. The study focused on *Microthrissa moeruensis* fish species given that these species form part of the small pelagic fish species which remain under-researched in Zambia.

### 1.2 Significance of the study

Although fisheries resources have been recognized for their importance in contributing to economic growth and nutrition in Zambia, the socio-economic determinants of profitability of small pelagic fish trade that include *Microthrissa moeruensis* remain unclear (Longley, 2014). Lack of research on fish species such as *Microthrissa moeruensis* that provide various benefits to local communities especially in rural settings suggest the observed low investment in the fisheries sub-sector (Musumali et al., 2009). Therefore, an assessment of the socio-economic determinants of profitability of *Microthrissa moeruensis* fish trade and associated constraints will assist to provide information that will be helpful for identifying entry points for interventions. Tiri et al. (2014) notes that increasing real income for trade actors is often realized through an efficient market system. Therefore, a better understanding of the socio-economic determinants of profitability of *Microthrissa moeruensis* fish trade and associated constraints has potential to foster an efficient market system for *Microthrissa moeruensis* fish trade. Furthermore, information on the socio-economic determinants of profitability of *Microthrissa moeruensis* fish trade and associated constraints can help to provide policy guidance on *Microthrissa moeruensis* fish trade that can ultimately improve its performance and guide fisheries management and development programmes on the Mweru-Luapula fishery. This is particularly important for developmental partners and institutions charged with the mandate to manage and develop the fisheries sub sector. As noted by FAO (2007), provision of information that supports decision making does not only improves knowledge on trade flows and their impact, but also ensures the ability to identify entry points for interventions.
1.3 Overall objective

The overall objective of this study was to provide an understanding of the socio-economic determinants of profitability of *Microthrissa moeruensis* (chisense) fish trade among chisense fishers and associated constraints using a case study of Lake Mweru-Luapula fishery in Nchelenge district, Luapula province.

1.4 Specific Objectives

The specific objectives of the study were as follows:

i. To determine the socio-economic determinants of profitability of *Microthrissa moeruensis* (chisense) fish trade among chisense fishers.

ii. To examine the gross margins of *Microthrissa moeruensis* fish trade among chisense fishers.

iii. To investigate constraints associated with *Microthrissa moeruensis* fish trade among chisense fishers.

1.5 Research Questions

Based on the objectives of the study, research questions that were addressed in this study included the following:

i. What are the socio-economic determinants of profitability of *Microthrissa moeruensis* fish trade among the fishers?

ii. How profitable is *Microthrissa moeruensis* fish trade among chisense fishers?

iii. What are the constraints associated with *Microthrissa moeruensis* fish trade among fishers?

1.6 The Scope of the study

This study focused on assessing the socio-economic determinants of profitability of *Microthrissa moeruensis* fish trade and associated constraints using a case study of Lake Mweru-Luapula fishery in Nchelenge district, Luapula province. While various actors are involved in *Microthrissa moeruensis* fish trade this study focused on the fishers. Socio-economic determinants that were
considered in this study included the age of the chisense fishers, fishing experience of the chisense fishers, level of education attained, family size, purchase price of chisense, and amount of capital invested.

1.7 Limitations to the study

- This study was limited to the use of cross-sectional data. Given the limited time and resources, data was collected on operational costs, quantities of fish caught and sold on the last fishing day prior to the survey, as well as socio-economic factors and constraints at one point in time.
- Chisense fish trade does not involve the use of standardized weighing instruments such as weighing scales. Rather varied measuring methods and instruments such as improvised containers, buckets, and bowls are used. This form of trading arrangement can provide inconsistent data and does not provide the unit price for chisense. In order to overcome this challenge and establish the unit prices for each measuring instrument, prior measurements of the weight of chisense for each instrument were recorded as well as corresponding prices and local names. This approach helped in generating the average unit purchase prices of chisense for determining the gross margins.
- Most of the respondents were not able to provide written records of their expenses and incomes. As such operational expenses and earnings for the last fishing trip prior to the survey was sought. This information assisted in estimating the gross margins of chisense fishers on each fishing trip and was used to determine the revenue generated from chisense fishing on the last fishing trip.

1.8 Operational definition of Terms

**Socio-economic determinants of profitability:** These are attributes with potential to affect profitability thereby affecting fish trade of chisense fishers. They include but not limited to the age of the chisense fishers, fishing experience of the chisense fishers, highest level of education attained, family size, purchase price of chisense and amount of capital invested.

**Profitability:** This is an important micro-economic indicator of fishery performance and is the ability of individuals or fishers involved in chisense fish trade to earn profit. This was determined by computing the gross margins of chisense fishers.
Constraints in fish trade: These are factors that adversely affect fishing and fish trade activities thereby reducing the capacity of fisheries to contribute towards employment creation, increase income and improve the living standards of communities that rely on chisense fishing and fish trade.

Fish trade: This is an arrangement that facilitates the exchange of fish for money or other goods between producers, buyers and sellers of chisense fish. Fish trade facilitates the distribution of fish and fish products from point of production to point of consumption or demand. During the process of distribution, fish and fish products pass through various participants and points of exchange prior to reaching the final consumers.

Microthrissa moeruensis (Chisense): This is an indigenous silvery small pelagic fish species with flat bodies and can grow up to 47mm standard length.

1.9 Ethical considerations

Ethical standards as required by academic research were adhered to. Information was mainly collected from participants that were actively involved in the fishing and trading of chisense and was strictly confidential.

1.10 Thesis outline

This thesis consists of the following chapters:

Chapter One: Introduction - This chapter introduces the study by providing a brief description of the research that was conducted in this study. Specifically, the chapter presents the objectives of the study, the problem statement and the justification of the study. Also provided in this chapter is the scope of the study, the limitation of the study and the operation definitions of terms used in the study.

Chapter Two: Literature Review - This chapter provides a detailed analysis of existing literature that was used to inform this research study and focused on aspects of fish trade at the global, regional and national levels. Extant literature on socio-economic determinants of profitability, associated constraints as well as the model used for this study are also discussed in this chapter. The chapter concludes with a description of the proposed hypotheses that outlines the central argument for this study.
Chapter Three: Research methodology - This chapter provides a description of the methodology employed in this study. It also provides a description of the study area.

Chapter Four: Results - This chapter presents the findings of this study which include the demographic and socio-economic characteristics of the target population, socio-economic determinants of profitability of Microthrissa moeruensis fish trade among fishers, gross margin and constraints associated with Microthrissa moeruensis fish trade.

Chapter Five: Discussion - This chapter provides a discussion of the results of the study.

Chapter Six: Conclusion and Recommendations - This chapter draws some conclusions and provides relevant recommendations based on the findings of the study.
CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter presents a review of the extant literature that informed the empirical study and covers components that include the significant role that fisheries and fish trade plays at the global, regional and national level as well as the fish trade arrangements in Zambia. The chapter further presents the empirical model for the study and ends with an outline of associated constraints in fish trade.

2.1 Fish trade in small pelagic species\(^2\) and its significance at the regional and global levels

Trade in fish species including small pelagic species of which *Microthrissa moeruensis* (chisense) is a part, remains fundamental at the regional and global levels (Bene et al., 2010). Past studies have shown that fisheries and aquaculture contribute to improving food security and livelihoods of millions of people. For instance, Bene et al. (2007) reported that fish species account for at least 20 percent of protein intake for a third of the world’s population and the dependency is even higher in developing countries. According to FAO (2005) fish contributes about 32 percent of animal protein intake on average on the continent and as high as 70 percent in some countries.

Fish species such as chisense are also an important source of essential micro nutrients such as vitamins and minerals including zinc, iron and iodine, as well as, fatty acids (Kawarazuka, 2010; Beveridge et al., 2013; HLPE, 2014). Kawarazuka (2010) further noted that fish contributes to improved nutrition and increased household income through revenue generated from fish trade. It is also reported that Africans have a relatively high nutritional dependence on fish and a significant number of them depend on small-scale fisheries as a source of full-time, seasonal, part-time, or occasional income (Béné et al., 2010). Estimates show that about two and half million people engage in full-time fishing related activities across the African continent (FAO, 2005; WFC, 2009). Furthermore, Béné and Heck (2005) also noted that fish processing and trading provides both full- and part-time employment to between 6 and 9 million people in sub-Saharan Africa. Using a

\(^2\) *Microthrissa moeruensis* (Chisense) the fish species of interest for this research study is one of the small pelagic fish species.
(conservative) ratio of 1 to 5 for household size, it was estimated that 30 to 45 million people (men, women and children) in Africa depend indirectly on fish trade for their livelihoods (Béné and Heck, 2005). It has also been reported that about 95 percent of participants in fishing and fish processing in sub-Saharan Africa are artisanal operators who engage in fish trade locally (Overa, 2003; Gordon, 2005, Abbott et al., 2007).

Trade in fish species that include chisense also serve as important sources of food at both global and regional levels. For instance, Kawarazuka (2010) reported that global fish consumption has increased from an average of 10 kg per capita per year in the 1960s to over 16 kg per capita per year in the 2000s. In Africa, estimates indicate that more than 200 million people consume fish regularly (FAO, 2005). FAO (2016) also noted that in 2014, 87 percent of fish produced worldwide (146 million tonnes) was utilized for human consumption out of which 17 million tonnes or 17 percent of this fish was in dried, salted, smoked or other cured forms (FAO, 2016).

Estimates show that 36 percent of the fish produced globally enters international markets and was able to generate a trade value of US$144 billion in 2014 (UNCTAD, 2016). FAO (2006) also noted that more than 56 per cent of this trade originates in developing countries whose net trade income (export minus import) was valued at US$38 billion in 2014. Moreover, WFC (2009) reported that artisanal fish trade in species such as Microthrassa moeruensis (chisense) has the potential to provide an additional economic value of at least US$350 million per annum provided 50 percent of these traders improve their processing and marketing technologies.

While an important share of international fish trade consists of high-value species such as salmon, shrimp, and bream among others (FAO, 2016), small-pelagic fish species such as chisense are also emerging as important commercial fisheries in Africa and contributing substantially to the catches of the major water bodies (Kirema-Mukasa, 2012). Moreover, FAO (2018) reported that small pelagic inland fisheries of the African Lakes region contribute more than half of the global commercial inland fisheries catch, with an estimated production of between 787 236 and 791 028 tonnes. Thus, an understanding of factors that affect the profitability of trade in such fish species and the associated constraints is fundamental. However, these aspects remain poorly understood particularly in Zambia.
2.2 Fish trade in small pelagic species and its significance in Zambia

The significance of fish trade in small pelagic species which include *Microthrissa moeruensis* (chisense) are well recognized in Zambia (Molsa, 2009). For instance, Molsa (2009) noted that it is through fish trade particularly dried chisense and salted bream that traders have contributed to linking the Mweru-Luapula fisheries not only to the wider national economy of Zambia but also to the foreign export economy through export activities to Democratic Republic of Congo (DRC). This has further been confirmed by Kirema-Mukasa (2012) who noted that local and cross border fish traders conduct trade in sun dried chisense and supply the local and regional markets. Additionally, according to Molsa (2009) chisense has been estimated to contribute approximately 25 percent of the total annual catch from capture fisheries in Zambia and has been ranked second to the Tilapia species (Breams) in terms of production and that it constitutes more than 60 percent of the catch on Lake Mweru-Luapula. Moreover, Molsa (2009) reported that the majority of this produce is traded either locally or within the region. Estimates shows that fish exports to the DRC range between 60 and 75 percent of the fish caught on the Zambian side (Molsa, 2009).

It is further estimated that 300,000 people derive their livelihoods directly as fishers and fish farmers or indirectly as traders, processors and other service providers in Zambia (FAO, 2006). Furthermore, ACP (2008) reported that in 2004, 55,000 people were employed in the fishing industry as fishers, processors and traders out of which 25,000 were fishers and 30,000 constituted processors and traders in Zambia. Thus, fish trade in species such as *Microthrissa moeruensis* is an important source of livelihood for fishers in the country especially in the rural areas (FAO, 2016).

Fish trade in small pelagic fish species is also an important source of employment for women given that the bulk of fish in Zambia is distributed by private and individual traders of which a large number are women (ACF, 2009). Moreover, by making fish available, fish trade contributes to poverty reduction by ensuring a reliable and sustainable source of animal protein particularly for rural communities (ACF, 2009). It also contributes to economic growth through income generation and improved availability of fish (Kurien, 2005; Ahmed, 2003; Valdimarsson, 2003). Central Statistical Office (CSO) (2014) also reported that in Zambia the fisheries sub sector contributes 0.4 percent to the Gross Domestic Product (GDP) and 3.3 percent to the Agriculture GDP. Additionally, Mukuka and Shula (2015) also reported that fish contributes more than 50 percent of animal protein in the diets of Zambians.
Fish species such as chisense also provide important micronutrients such as vitamin a, iron, zinc and calcium, as well as, long-chain n-3 polyunsaturated fatty acids (LCn3PUFAs) such as ‘Omega-3 which are most ideal in the reduction of nutrient deficiencies (Kirema-Mukasa, 2012). According to Hansen et al. (1998) one of the most outstanding advantages of consuming fish species such as chisense over the larger fish is the wider range of nutrients it provides since it is eaten whole unlike the large ones. In a comparative study on species differences with respect to micronutrient content, Thilsted (2012) showed that the edible parts of small fish species are particularly rich in vitamins and minerals compared to the edible parts of cultured large fish species.

Despite the significance of fish trade in Zambia, particularly for those operating at small scale level such as chisense fishers, information on fish trade in such fish species still remains scant. According to Longley (2014) and Mukuka and Shula (2015) Microthrissa moeruensis small scale artisanal fishing activities are seldom included in official fisheries statistics and surveys. This supports a note advanced by Somanje and Muendo (2006) that in Zambia there is paucity of information on the socio-economic determinants of profitability for capture fisheries of which chisense is a part. Furthermore, an understanding of constraints associated with capture fisheries in Zambia also remains under-researched. This is undesirable given that Béné et al. (2010) noted that fish trade in Africa is faced with various structural challenges such as weaknesses in domestic markets, barriers to regional trade, infrastructure limitations, insecurity, and poor governance among others that affect its contribution to pro-poor impacts in sub-Saharan Africa (SSA). Thus, an understanding of the constraints associated with Microthrissa moeruensis fish trade remains fundamental for decision makers’ ability to identify entry points for interventions.

### 2.2.1 Fishers and the fish value chain actors in Zambia

Fish trade in Zambia is often initiated in fishing villages by migrant traders who buy fish from fishers and processors and later distribute the fish produce to designated fish markets in different towns of the country (DoF, 2016). According to Mukuka and Shula (2015) the main actors in the value chain of most fish species include producers (fishers or fish farmers), processors, traders (wholesalers and retailers) and consumers (Figure 2.1). At the small-scale level, fish producers sell directly to wholesalers or traders who later re-sell the fish to retailers and or the consumers (Mukuka and Shula, 2015). It is also common for producers to sell directly to consumers as shown in Figure 2.1. Large scale fish producers on the other hand usually have own marketing arrangements to sell their fish products in Zambia (Mukuka and Shula, 2015).
Regarding the structure of fish value chains for most fish species, Sievers and Saarelainen (2011) noted that producers are the starting point of most fish value chains. Similarly, Alam et al. (2012) also reported that fish producers are the first link in the fish marketing channels and supply of fish on the market. In rural areas of Zambia, fish production is a source of livelihood such that it is estimated that about 25,000 artisanal fishers derive their livelihood directly from fishing (ACP - Fish II, 2008). Thus, fish producers are important actors in the fish value chain.

Besides producers, processors are other important actors in the fish value chain for most fish species in Zambia. Processors are fundamental actors in that fish is highly perishable. Generally, fish processors often use different methods such as smoking and drying among others to preserve the fish and ensure quality and safety for the consumers (ILO, 2014; Kapute, 2008). In Zambia, sun drying is the commonly used method of processing small pelagic fish species such as chisense and this is done on the ground that has been smeared with clay and dried or on concrete slabs, canvas sheets and/or sandy beaches (Kirema-Mukasa, 2012). Overall, the prevention of losses at various stages during post-harvest along the fish value chain is also a role fish processors play (Kanyembo and Musuka, 2017). Moreover, it has been estimated that more than 50 percent
reduction in post-harvest losses can be achieved if fish processing technologies are improved in Africa (WFC, 2009). In Zambia fish processing is dominated by women which reveals their role in the regional economic activities.

Traders are also other important actors in the fish value chain for most fish species. Wholesale fish traders are actors who buy fish from fishers and or processors for re-sale to fish retailers. The retailers buy fish from wholesalers and in some instance directly from producers which they re-sell to consumers (Mukuka and Shula, 2015). Trade in fresh fish is dominated by men whereas trade in dried fish is dominated by women (Kirema-Mukasa, 2012). In Zambia fish processing and trade are important occupations resulting in 30,000 processors and traders operating in the fish subsector (ACP - Fish II, 2008). Consumers who are the other actors in the fish value chain buy their fish from producers or fish traders for own consumption (Mukuka and Shula, 2015).

While various actors are involved in the fish value chain, this study focused on the fishers. This study focused on fishers considering that they are the main actors involved in the exploitation and production of chisense and are key in ensuring that these resources are available to other actors along the value chain thereby contributing towards food security, poverty alleviation and economic growth. Moreover, Alam et al. (2012) noted that fish producers are the first link in the fish marketing channels and supply of fish on the market thus constituting an important group of actors to focus on.

2.3 Empirical model

Socio-economic factors remain fundamental in understanding determinants of fish trade profitability. Thus, past studies outline socio-economic factors including experience (years involved) in fish trading, age of fish traders, highest level of education attained, purchasing price of fish, size of household and amount of capital invested as determinants of profitability (Ali et al., 2008; Awoyemi et al., 2010; Ume and Okoronkwo, 2013; Esiobu and Onubugwu, 2014; Tiri et al., 2014; Babalola et al., 2015; Bassey et al., 2015; Obayelu et al., 2016; Somanje and Muendo, 2016). Drawing from past studies and guided by economic theory, the empirical model presented in equation one (1) was tested in this study. The model included age of fishers; level of experience; education level; purchase price of chisense; household size and amount of capital invested as determinants of profitability for chisense fishers. The model is as follows:
\[ Y = \beta_0 + \beta_1 \text{Age}(X_1) + \beta_2 \text{Lev}_\text{Exp}(X_2) + \beta_3 \text{Lev}_\text{Edu}(X_3) + \beta_4 \text{Pur}_\text{price}(X_4) + \beta_5 \text{Fam}_\text{Size}(X_5) + \beta_6 \text{Amo}_\text{Cap}(X_6) + e \]  

Where,

\( Y \) is the average gross margin for chisense fishers

\( \beta_0 \), is the intercept of the model

\( \beta_1 \ldots \beta_6 \) are coefficients to be estimated

\( X_1 \ldots X_6 \) are the explanatory variables namely age of fishers, level of experience, education level, purchase price of chisense, household size and amount of capital invested respectively

\( e \) = Error term, the error terms are assumed to be independent and normally distributed with mean zero and constant variance.

In the empirical model, the age of fishers is hypothesized to have a negative effect on profitability for chisense fishers while level of education is hypothesized to have a positive effect. The experience level and the purchase price of chisense are posited to also have a positive effect on profitability. Household size is hypothesized to have a positive effect on the profitability of chisense fish trade while amount of capital invested is also posited to have a positive effect. A discussion of the model variables based on past studies is provided next.

### 2.3.1 Explanatory variables for the empirical model

As presented in equation one (1) in the preceding section, explanatory variables for the study’s empirical model included age of fishers, level of experience, education level, purchase price of chisense, household size and amount of capital invested. A discussion of these variables is provided next.

#### 2.3.1.1 Age of fishers

Age is considered as a fundamental factor in ensuring that individuals participating in fish trade have the ability to make appropriate business decisions, are innovative and have vigour (Jatto et al., 2013; Tiri et al., 2014; Bassey et al., 2015). It is argued that individuals involved in fish trade should neither be too young nor too old and require enough strength to face the tedious tasks associated with fish trade (Esiobu and Onubuogu, 2014). Past studies that have explored the
relationship between the age of fish traders and profitability report that the age of fish trade participants has both positive and negative effect on profitability (Jatto et al., 2013; Esiobu and Onubuogu, 2014; Bassey et al., 2015; Somanje and Muendo, 2016). These findings entail that any increase in the age of the traders can either decrease (Tiri et al., 2014; Bassey et al., 2015) or increase profitability (Aworemi et al., 2010). For instance, in a study aimed at examining determinants of fresh fish profitability among fish traders in Nigeria, Bassey et al. (2015) found that age had a negative effect on profitability. This finding implied that for every increase in age, profitability was negatively affected and this was attributed to the lack of innovation, vigour and energy to withstand the rigor of fish trading amongst the elderly age groups (Bassey et al., 2015). Similarly, Tiri et al. (2014) also found that the age of fish traders had a negative effect on profitability. However, in a study conducted in Nigeria, Aworemi et al. (2010) found a positive relationship between age of fish traders and profitability. A similar finding was also reported by Somanje and Muendo (2016). Given that confounding results have been reported on the relationship between age of fish traders and profitability, examining this relationship for chisense fish trade in a Zambian context is fundamental especially that this relationship is still poorly understood in this setting.

2.3.1.2 Level of experience

Experience which is measured by the number of years in an enterprise such as fish trade has been found to be fundamental in fostering profitability based on the knowledge and skills acquired over time (Jatto et al., 2013). According to Esiobu and Onubuogu (2014) experienced individuals respond better to challenges they encounter in fish trade thereby enhancing profitability. The level of experience of fish traders has been reported to be an important determinant of profitability in fish trading activities and past studies have shown that experience has a significant positive effect on profitability (Ali et al., 2008; Tiri et al., 2014; Obayelu et al., 2016).

In a study aimed at assessing the performance and barriers to small-scale fish marketing in Nigeria, Tiri et al. (2014) found that the level of experience had a positive influence on the profitability of small-scale fish trading enterprises. In another study conducted in Nigeria, Obayelu et al. (2016) also reported that the level of experience had a positive effect on the profitability of fresh fish trading. These findings showed that an increase in the number of years a fish trader spends in fish trade related activities increases profitability (Esiobu and Onubuogu, 2014; Tiri et al., 2014;
Obayelu et al., 2016). Similar results were reported by Ume and Okoronkwo (2013), as well as, Bassey et al. (2015).

Commenting on the positive relationship between the level of experience and profitability, Esiobu and Onubuogu (2014) noted that an experienced marketer is more familiar with the problems associated with a particular enterprise and thus, is better placed to use new strategies to overcome challenges which would in turn fosters profitability. Similarly, Bassey et al. (2015) noted that the relationship between level of experience and profitability is attributed to the acquisition of sufficient knowledge through several years of participating in fish trading activities (Bassey et al., 2015). While past studies report on the relationship between level of experience of fish traders and profitability, this relationship is still poorly understood for chisense fish trade in a Zambian context.

2.3.1.3 Education level

Education level is considered as a determinant of profitability given that it provides the ability to adopt new ideas, innovation, technologies and practices, as well as, capacity to assimilate new information (Oladipo and Adekunle, 2010; Jatto et al., 2013; Esiobu and Onubuogu, 2014; Oparinde and Ojo, 2014; Tiri et al., 2014; Bassey et al., 2015). Past studies that examined the relationship between fish traders’ level of education and profitability of fish trade have shown that education level has a positive effect on profitability (Aworemi et al., 2010; Tiri et al., 2014; Obayelu et al., 2016). Esiobu et al., (2014) noted that exposure to high education level provides an added advantage in fostering profitability. Similarly, Obayelu et al. (2016) also noted that an increase in fish traders’ years of schooling leads to an increase in profitability.

Past studies conducted by Esiobu and Onubuogu (2014) and Tiri et al. (2014) also showed that fish traders’ education level had a positive effect on profitability. Similarly, Tiri et al. (2014) showed that the number of years of formal education attained by an entrepreneur was positively associated with increase in revenue by more than 11 percent. The findings of these studies provide empirical support for Lawal and Idega’s (2004) study in which it was argued that fish traders’ education level determined the strategies that they employ to solve marketing problems and adopt new innovations without difficulties thereby increasing profitability. Thus, the findings of past studies reveal the relationship between fish traders’ education level and profitability that will be explored in the current study for chisense fisher in a Zambian context. Examining this relationship
for chisense fishers in a Zambian context is fundamental given that this relationship is still poorly understood.

**2.3.1.4 Purchase price of chisense**

Past studies that have assessed purchase price as a determinant of profitability consider this factor to be fundamental. For instance, “Understanding costs and profit” (2013) opined that most businesses fail because their products are lowly priced thereby affecting their profitability. The purchasing price of fish is considered as an essential variable that can positively or negatively influence the profitability of a fish trading enterprise (Obayelu et al., 2016). Past studies that examined the relationship between the purchasing prices for fish and profitability found a negative effect on profitability (Babalola et al., 2015 and Obayelu et al., 2016). For instance, in a study conducted by Obayelu et al. (2016) the unit purchase price of fish was found to have a negative effect on profitability for wholesale traders. A similar finding was also reported in studies by Babalola et al. (2015) and Bassey et al. (2015).

The findings of past studies reveal the relationship between the purchasing price of fish and profitability thus, in the current study, the purchase price of fish (i.e. the price paid by the buyers to purchase chisense) will be explored. Examining the relationship between purchase price and profitability in a Zambian context is fundamental given that this relationship is still poorly understood.

**2.3.1.5 Household size**

Household size is considered as an important determinant of profitability given that it is a source of cheap labour (Esiobu and Onubuogu, 2014). Small-scale fishing activities can be labour intensive especially in post-harvest activities, thus labour contributions from other family members is imperative (Inoni and Oyaide, 2007). Oparinde and Ojo (2014) note that households with members who can assist in carrying out fish trading activities increases the opportunity of having increased profitability.

The relationship between household size of fish traders and profitability has been explored in past studies. Both negative and positive relationships between household size and profitability have been reported (Esiobu and Ounbuogu, 2014; Obayelu, 2016). Thus, past studies provide confounding results on the effects of household size on profitability. For example, in a study conducted by Esiobu and Ounbuogu (2014) household size was found to have a positive effect on
profitability. This finding implied that an increase in household size resulted in a positive effect on profitability and this was mainly attributed to a reduction in the cost of labour. However, Obayelu et al. (2016) reported converse results where the household size was found to have a negative effect on profitability. Given the confounding results on the relationship between household size and profitability, examining the effect of household size on profitability for chisense fishers in a Zambian context is fundamental given that this relationship is still poorly understood.

2.3.1.6 Amount of capital invested

The amount of capital invested in fish trade has been found to have an effect on profitability as it ensures that the purchase of basic requirements or inputs required to undertake a business or indeed fish trading activities is achieved (Tiri et al., 2014). Therefore, the amount of capital invested is posited to have an effect on profitability (Tiri et al., 2014; Obayelu et al., 2016). Past studies that have explored the relationship between the amount of capital invested and profitability report confounding results. Some studies report that capital invested has a negative effect on profitability (Tiri et al., 2014) while others report that capital invested has a positive effect on profitability (Obayelu et al., 2016). Studies that reported a positive relationship indicated that an increase in the amount of capital invested leads to an increase in profitability (Obayelu et al., 2016). Those that reported a negative relationship indicated that an increase in the amount of capital invested leads to a decrease in the profitability (Tiri et al., 2014). Given that confounding results have been reported on the relationship between the amount of capital invested and profitability, examining this relationship for chisense fishers in a Zambian context is fundamental given that this relationship is still poorly understood.

2.3.2 Dependent variable for the empirical model

The computation of gross margin as a measure of profitability remains fundamental. Past studies that have reported on profitability in fish trade have used different techniques to compute gross margin as a measure of profitability in fish trade (Obayelu et al., 2016; Somanje and Muendo, 2016). Drawing from past studies this study used gross margin as the dependent variable for the study’s empirical model in order to assess whether the explanatory variables outlined in sections 2.3.1 are determinants of profitability in chisense fish trade. In their study Somanje and Muendo (2016) used translog profit function and Cobb Douglas function in order to quantify how different
cost related variables and socio-economic factors affect gross margin. They used gross margin to assess the profitability of capture fisheries trade in the Barotse flood plains. Their study was able to show that gross margin was affected by interaction of price of capital and price of storage; price of labor and price of materials; price of storage and price of materials. Similarly, Obayelu et al. (2016) used gross margin as a dependent variable in a study aimed at examining determinants of profitability in a fresh fish marketing study. Explanatory variables that were assessed as determinants of profitability included age, level of experience, education level and unit price. Other variables included the number of sales outlets, proportion of household members and amount of capital invested. In this study, the method used by Obayelu et al. (2016) to compute the gross margins and assessment of socio-economic determinants of profitability was used. The approach used by Obayelu et al. (2016) was chosen for this study because it was appropriate for the phenomenal under study and has not been widely used in the Zambian context.

2.4 Constraints associated with fish trade

Past studies that have examined trade in various fish species note that fish trade is faced with various constraints (Udong et al., 2009; Oparinde and Ojo, 2014; Esiobu and Onubuogu, 2014; Tiri et al., 2014; Baba et al., 2015; Obayelu et al., 2016; Babalola et al., 2015). Constraints associated with fish trade affects its profitability and reduces its capacity to create employment and increase income generation (Obayelu et al., 2016). Past studies that have explored constraints associated with fish trade have reported a variety of factors. For instance, Baba et al. (2015) found that fish trade was faced with constraints that included shortages of supply, price fluctuations and post-harvest losses such as spoilage of fish while in transit. Babalola et al. (2015) reported that constraints associated with fish trade included severe high costs in preserving fish, huge initial expenses, inconsistent and unstable purchasing prices and high transportation costs. Similarly, Obayelu et al. (2016) highlighted high transportation costs, high initial capital base, shortages in fish supply, lack of market stalls, as well as, fines and levies from local government agencies as the main constraints that affected fish trade. Oparinde and Ojo (2014) also found that poor transport network, high cost of transportation, inadequate funds and storage facilities were major constraints affecting artisanal fish trading activities. Using Kendalls coefficient of concordance, Tiri et al. (2014) also found that the most important constraints that affected performance of small fish marketers were poor access to credit facilities, poor market infrastructures (such as storage and processing facilities) and poor record keeping. Other constraints included high rate of perishability
of the fish products, lack of access to useful information, poor environmental conditions of the market, and incidences of theft and burglary (Tiri et al., 2014).

In a study aimed at understanding the institutional and cultural constraints that affects women participation in fish trade and ultimately its performance, Udong et al. (2009) identified institutional constraints that included lack of infrastructure, financial assistance, market information and Government or NGO’s support. The cultural constraints included polygamy and patriarchy (Udong et al., 2009). Similarly, Esiobu and Onubuogu (2014) found that inadequate storage, lack of sufficient capital, price fluctuations, seasonality of production, inadequate price information, poor feeder roads and sheds were major constraints faced by fresh fish marketers in the Imo State of Nigeria. Further, Onemolease and Oriakhi (2011) found that artisanal fishers in selected riverine communities in the Delta state of Nigeria were faced with five (5) major constraints in their fishing activities that include: high cost of fishing inputs such as motorized boats, insufficient capital, storage problems, spoilage of fish caught and declining quantity of fish catch.

While the constraints associated with fish trade for various fish species are reported and vary in different settings, an understanding of constraints faced by chisense fishers in Zambia still remain poorly understood. Therefore, to address this gap in the extant literature, this study also examined the constraints that chisense fishers face using a case study of Lake Mweru-Luapula fishery in Nchelenge district, Luapula district.
CHAPTER 3

METHODOLOGY

3.0 Introduction

This chapter describes the research methodology that was employed in this study. The chapter begins by describing the study area and proceeds to provide details of the research design, sampling procedure, the survey instrument and the data analysis techniques used in the study. The chapter ends with descriptions of the tests of assumptions for the model used for this study.

3.1 Description of the study area

The Lake Mweru Luapula fishery situated in Nchelenge district, Luapula province constituted the study site for this research study. The fishery shares its geo-political boundaries with Nchelenge, Chienge, Kawambwa and Mwense districts. Nchelenge district lies on latitude 9° 21' 0" S and longitude 28° 44' 0" E (Maplandia, 2005) and has an estimated land area of 4, 090 km² with a population of 152, 807 representing a 15.4 percent share of the provincial population (CSO, 2010). Nchelenge district has the second highest population growth rate of 3.2 percent in the province and was selected for this study based on having the highest population density of 37.4 (CSO, 2010). Further, the district was purposively selected for the study due to the presence of villages with chisense fish landing sites and intensity of chisense fishing and trading activities.
Lake Mweru Luapula fishery lies on latitudes $8^0 28'$ and $9^0 31'$ South of the equator and longitudes $28^0 20'$ and $29^0 20'$ East of the Greenwich (Molsa, 2009). According to Molsa (2009) the lake has an estimated surface area of 4,650km$^2$, volume of 38km$^3$ and experiences low seasonal water levels in January and attains high levels in May. Two rivers that flow into it are the Luapula River from the south and Kalungwishi River from the eastern parts of the fishery. The main outflow is the Luvua River to the north into the Congo basin of DRC (Molsa, 2009).

Lake Mweru-Luapula fishery which is geo-politically shared between four districts namely Chienge, Nchelenge, Kawambwa and Mwense is sub divided into four strata whose boundaries do not necessarily match those of the districts (DoF, 2014). The four strata are described as geographical units that reflect differences in fish species composition (Bazigo, 1974) and they form the basis for statistical data collection mainly used by the Department of Fisheries in Zambia (DoF, 2014).

According to DoF (2014) stratum two (II) and three (III) situated in Nchelenge district are an open lake basin located on the southern half of Lake Mweru, surrounding Islands and at the point where the Luapula River flows into Lake Mweru. More specifically, stratum two (II) is the area that
covers the southern half of Lake Mweru and includes the entire Kalungwishi river delta to the north of Kashikishi into the lake to the waters north of Kilwa Island. Stratum three (III) includes the areas around Kilwa Island and the area from Kashikishi to the north of Shimulundu and all the swamps and waters west of that spot. This stratum also includes Mifimbo, a breeding site where fishing is not allowed located where the Luapula River flows into Lake Mweru as illustrated in figure 3.2. Fishing villages located within stratum II of the Mweru Luapula Fishery in Nchelenge district constituted the target area for this study. Stratum II was selected for this study as it lies within the geo-political boundaries of Nchelenge district which is the study area for this research and had the highest concentration of chisense fishers due to the prevailing weather conditions at the time of the study.
3.2 Research Design

A research design provides the conceptual structure within which a research is conducted and constitutes the outline of how data is collected, measured and analysed (Kothari, 2004). According to Rajasekar et al. (2006) research can be conducted using either quantitative or qualitative methods or a combination of both methods. This study applied quantitative methods and employed a cross section survey using semi-structured questionnaires to gather data. Quantitative methods were chosen given that the phenomena under study required the use of statistical and numerical techniques to investigate the phenomena. According to Given (2008) quantitative methods are a systematic empirical investigation of observable phenomena via statistical, mathematical or computational techniques. Quantitative methods emphasize objective measurements and the statistical or numerical analysis of data collected through surveys can be generalized across a group of people to explain a particular phenomenon (Babbies, 2010).

3.2.1 Target Population

According to Isotalo (2001) a population consists of a set of individual persons or elements of interest in conducting a research. It is also described as a group of individuals or elements sharing similar characteristics (Landry, 2010). The target population for this study were chisense fishers operating within stratum two of the Mweru-Luapula fishery in Nchelenge district, Luapula province. The target population was chosen given that fishers constitute the main actors and source of produce in the value chain of the chisense fish trade and therefore, served as an appropriate target population for the phenomena under study.

3.2.2 Sampling approach

In this study multi-stage purposive and snow ball sampling techniques were used to sample chisense fishers in fishing villages within stratum two of Nchelenge district. These techniques were adopted due to non-availability of a sampling frame for chisense fishers. In the first stage, eight (8) fishing villages were purposively selected within stratum two based on existence of chisense landing sites, availability of chisense fishers, and high intensity of chisense fish trading and processing activities. The fishing villages were chosen because they had the highest concentration of chisense fishers at the time of the survey and provided the best opportunity of finding chisense fishers in one location thereby enhancing the cost effectiveness of the study. The concentration of
the chisense fishers in the selected fishing villages was influenced by the windy weather condition at the time of the study. During these conditions chisense fishers tend to camp in specific fishing villages where their catch is landed and where their boats cannot be damaged due to heavy winds and waves.

In the second stage, snow ball sampling which involves referrals from initial subjects to generate more subjects (Dudovskiy, 2016) was used to sample survey participants. Specifically, the exponential non-discriminative snow ball method in which multiple referrals are provided by the nominated subjects until the required sample size is achieved (Dudovskiy, 2016) was used in this study. According to Dudovskiy (2016) and Elder (2009), in an event that the sampling frame or list of the target population is not available, a snowball sampling provides for an appropriate choice of sampling and is also cost effective. In this study, snowball sampling was used due to lack of a sampling frame for the target population and the high migratory nature of the target population. The high migratory nature of the target population was influenced by factors that included weather conditions and availability of chisense catches during any given period or season. As a result, these chisense fishers migrate from time to time in search of favourable conditions that allow them to participate in chisense fish trade activities. Given that snow ball sampling was used in this study each chisense fisher encountered was requested to introduce another fisher until all active chisense fishers in the selected villages were encountered.

3.2.3 Sample size

Green (1991) makes two rules of thumb for the minimum acceptable sample size to run a regression model. The first rule is based on whether the study aims to test the overall fit of the regression while the second rule is based on whether the study aims at testing the individual predictors within the model. For the first rule, a minimum sample size of \( n = 50 + 8K \) is recommended while for the second rule a minimum sample size of \( n = 104 + K \) is recommended where \( K \) is the number of predictors. If the study is aimed at testing for both scenarios described, the scenario that provides the largest sample size can be used (Green, 1991 in VanVoorhis and Morgan, 2007).

To determine the sample size for this study the confidence interval approach (Rose et al., 2015; Chi, 2015) was used:

\[
n = Z^2 \left( \frac{p \times q}{e^2} \right) \]

Equation (1)
Where:

\( n = \) sample size

\( z = \) standard error associated with the chosen confidence level

\( p = 0.5 \) (maximum variability of a population is estimated at 50\%)\(^3\)

\( q = (1 - p) \)

\( e = \) acceptable error of ±10\%: In this study the 90 \% confidence level (desired accuracy) was chosen and thus the acceptable error was ±10\%.

In order to obtain a sample size with a 90\% accuracy at 90 \% confidence level, the sample size was computed as:

\[
n = 1.645^2 \left(0.5 \times 0.5\right)/0.1^2 = 68
\]

Given that on-site surveys generally have a higher response rate in comparison to other forms of surveys (Chi, 2005). The expected response rate for the study was 50\%. Thus, assuming a response rate of 50 percent and an unusable rate of 10 percent, the minimum sample size for this study was \((68/0.4) = 170\).

The total number of respondents that participated in the survey in each of the eight (8) selected villages was determined by the available active chisense fishers encountered and willing to participate in the survey. Therefore, the sample sizes for the eight (8) fishing villages selected for this study were arrived at based on the chisense fishers encountered in the selected fishing villages and are as indicated in the Table 3.1 below. Based on the number of respondents encountered during the survey, a total of 186 respondents participated in the survey.

**Table 3.1 Selected fishing villages and sample sizes for each village**

<table>
<thead>
<tr>
<th>s/n</th>
<th>Fishing village</th>
<th>Sample size for each village</th>
<th>Percentage (%) sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Kabuta</td>
<td>38</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>Mulonda</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>3.</td>
<td>Mutabwa</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

\(^3\)The amount of variability in the population is estimated to be 50\%, which is widely used in social research. From a practical standpoint, most researchers will choose 50\% level of \( p \) because it results in the most conservative sample size (Burns and Bush, 1995).
3.2.4 Survey instrument development and pre-testing procedures

The initial survey instrument for this study was developed based on literature reviews and the objectives of the study. The survey instrument was reviewed for refinement by experts from the Department of Fisheries, Indaba for Agriculture Policy and Research Institute (IAPRI) and the Copperbelt University. The survey instrument was pre-tested twice on 28 respondents in four (4) fishing villages namely Chandwe, Yenga, Kalubuli and Kabuta. The first pre-test was undertaken in three (3) fishing villages namely Yenga, Kalubuli and Kabuta and was conducted from 23rd to 24th April 2018 after the lifting of the extended fishing ban for the period December 2017 to March 2018. The second pre-test was conducted on 15th June 2018 in Chandwe village prior to undertaking the main survey.

During the pre-test, the villages were selected on the basis of having chisense landing sites and intensity of chisense fishing, as well as trading activities at the time of the pre-test survey. The sample size for the pre-test was determined using the confidence interval approach (Chi, 2005). To obtain an 80% desired accuracy at the 90% confidence level, the required minimum sample size was \( n = 1.96^2 \times (0.5 \times 0.5)/0.2^2 = (25/0.9) = 28. \) The desired accuracy of 80% was chosen as the pre-test was not intended for any statistical analysis but rather to improve the structure, clarity and readability of the questionnaire prior to undertaking the actual survey.

Pre-testing of the questionnaire was done in order to improve clarity and readability of the questionnaire as well as test for validity and consistency of the survey instrument (Cooper and Schindler, 2006; Bolarinwa, 2015). Furthermore, pre-testing also provided an opportunity to train the enumerators on how to administer the questionnaire as well as have a better understanding of the ideal time to undertake the main survey given the nature of chisense fishing and trading activities in the study area.
Feedback from the pre-test surveys was discussed and reviewed after each pre-test survey and necessary comments noted and survey instrument adjusted accordingly. The survey instrument was also shared with experts from the Department of Fisheries, Indaba for Agriculture Policy and Research Institute (IAPRI) and the Copperbelt University experts for their input and further guidance. Feedback from the pre-tests and comments from experts from the aforementioned institutions was used to make improvements on clarity, readability and consistency of the survey instrument. After making the necessary improvements, the final survey instrument was prepared and administered in the main survey.

3.2.4.1 Survey instrument design

The survey instrument used in this study consisted of six (6) sections. The first section contained questions that focused on socio-economic characteristics of the respondents. This information was important as it constituted the independent variables for the study’s empirical model. The second component contained questions that focused on production seasons of chisense. This information was important to inform the trends and seasonality characteristics of chisense fishing. The third section focused on gross margins focusing on the last fishing trip prior to the survey. This information was important as it constituted the dependent variable for the study’s empirical model. The fourth section of the survey instrument focused on the coping strategies questions during the low chisense production seasons. These questions were important for garnering information on respondents’ other sources of income especially during the low chisense fish production.

The fifth section of the survey instrument focused on other sources of income during a one-year reference period ranging from June 2017 to June 2018. This information was also important in providing additional information on other sources of income in the preceding months other than low chisense production periods. The sixth and final section of the survey instrument contained questions that focused on the constraints associated with chisense fish trade and respondents’ suggestions on how to address the constraints. These questions were important for gathering information on constraints associated with chisense fish trade and respondents’ suggestions on how to address the constraints. A description of how variables in the study’s empirical model were measured is provided next.
3.2.4.1.1 Age of participants

Most studies that have explored age as a determinant of profitability have used the actual age of respondents (Jatto et al., 2013; Esiobu and Onubuogu, 2014; Bassey et al., 2015; Somanje and Muendo, 2016). In this study, age was obtained by recording the actual year of birth of the respondent and then age of respondent calculated in order to obtain actual age of the respondents and was measured as a continuous variable. The year of birth was recorded because during the pre-test surveys most respondents found it more comfortable to indicate year of birth rather than actual age.

Age = Number of years lived by the respondent

3.2.4.1.2 Level of experience of participants

Studies that have explored the level of experience as a determinant of profitability have measured the actual number of years one has been involved in an enterprise (Tiri et al., 2014; Obayelu et al., 2016). In this study, the experience of the respondent was measured by the respondent’s number of years spent in chisense fishing and trading activities. In the current study level of experience was measured in years as a continuous variable.

Level of experience = Number of years spent in chisense fish trade

3.2.4.1.3 Level of education of participants

Studies that have explored the level of education as a determinant of profitability have measured the actual number of years spent schooling (Aworemi et al., 2010; Tiri et al., 2014; Obayelu et al., 2016). In this study, a categorical measurement scale was used to determine the highest educational level attained by the respondents. A categorical measurement scale was used in order to increase the level of accuracy of the data from the respondents. This is because during the pre-test it was observed that most respondents had challenges remembering the number of years spent schooling but found it easier to indicate the grade or highest level of education attained.

Level of education = Respondents’ highest educational level

The education levels were categorised as: 00= None 01= Primary; 02 = Secondary; 03= Tertiary
3.2.4.1.4 Purchase price of chisense

Past studies that explored purchasing price as a determinant of profitability measured this variable using the unit purchasing price (Babalola et al., 2015 and Obayelu et al., 2016). In this study, the price at which chisense was purchased by the various buyers in the study area was explored. In this study the actual purchase price for chisense for the last fishing trip was measured in Zambian Kwacha (ZMK) as a continuous variable.

Purchase price of chisense = Actual price of chisense sold in Zambian Kwacha (ZMK)

3.2.4.1.5 Size of household

Size of household has been used in studies that examined the socio-economic determinants of profitability (Esiobu and Ounbuogu, 2014; Obayelu, 2016). Therefore, in order to ascertain the household size, actual number of persons living together in the respondent’s household was recorded. In this study, the number of persons living within the respondents’ household was measured as a continuous variable.

Household size = Number of persons living together in the respondents’ household

3.2.4.1.6 Amount of capital invested in chisense fish trade

The actual amount of capital invested has been explored as a determinant of profitability (Tiri et al., 2014; Obayelu et al., 2016). In this study, in order to ascertain the capital invested in chisense fishing, the actual amount invested by the respondents to procure fishing equipment and operationalize the enterprise was recorded. The actual amount of capital invested in chisense fishing in Zambian kwacha (ZMK) was measured as continuous variable.

Amount of capital invested = Actual amount of money invested in the chisense fishing in Zambian Kwacha (ZMK).

3.2.4.1.7 Gross margin (GM)

Various studies have applied budgetary analysis techniques to determine the gross margins as a measure of profitability by measuring the total revenue and associated costs (Bassey et al., 2015; Obayelu et al., 2016). In this study, the actual values for the unit purchase price of chisense, quantities of chisense sold, operational costs and revenue generated were used to determine gross margin of fishers involved in chisense fishing and trading activities. The gross margin was
measured as a continuous variable and constituted the dependent variable for the study’s empirical model and was measured using the following information:

- Actual values for quantity of chisense caught and sold
- Actual Amount at which chisense was purchased from fishers in Zambian Kwacha (ZMK)
- Actual operational costs of the fishing trip taken prior to the survey in Zambian Kwacha (ZMK)
- Actual revenue generated from chisense caught in Zambian Kwacha (ZMK)

Gross margins for chisense fish trade as specified under objective two (2) was computed using the following formula:

\[
\text{Gross Margin} = TR - TVC \]

\[ \text{Equation (2)} \]

Where,
TR = Total Revenue in Zambian Kwacha (ZMK) and
TVC = Total Variable Cost in Zambian Kwacha (ZMK)

### 3.2.5 Data collection procedures

An on-site survey was used to collect data for this study. Data collection was undertaken between 19th June and 22nd June 2018. This was after the extended fish ban (December 2017 to March 2018). This data collection period was chosen because it was the open fishing season period which increased the chances of encountering active chisense fishers.

The survey instrument for this study was administered by the researcher with the help of five (5) data collection assistants (enumerators). The enumerators were trained on how to administer the survey instrument prior to undertaking the actual survey. The two (2) pre-tests that were undertaken prior to the actual survey provided practical trainings to the enumerators on how to appropriately collect data for the study as well as familiarization with the survey instrument. Review meetings were conducted after each pre-test and necessary corrections or adjustments made to the survey instrument based on feedback from the pre-test surveys with regards the structure of the questionnaire and clarity of the questions. Prior to the actual survey, each of the selected villages was visited and assessed for conformity to the set criteria i.e. presence of active chisense fishers landing their catch in the village and chisense trading activities. During the assessment process prior to the survey, the village headmen and the fishers’ association leadership
in the targeted villages were informed of the intended survey and its purpose in order to obtain consent to conduct the surveys in the villages. After gaining consent, a schedule or dates when surveys could be conducted were agreed and preparation made accordingly. This was done in order to ensure that the chisense fishers would be available for the survey considering that the target population is highly migratory and only available at specific periods of the day when less preoccupied with their chisense fishing and trading activities.

On the actual dates of the survey, the survey team members were introduced to the target population (chisense fishers) by the village headmen or fisher association leadership. Each data collector was required to introduce themselves to the respondents and provide further explanation with regards the purpose of the survey and gain the respondent’s consent to participate in the survey. The questionnaires were then administered using a face to face method upon obtaining consent from the respondents. After completing answering questions in the questionnaire, each respondent was requested to introduce or direct the data collector to another chisense fisher/s they knew of. The procedures described above were repeated until all active and willing respondents were administered with a questionnaire. Once the enumerators were unable to encounter or to be introduced to new respondents, the team regrouped and ascertained that each part of the village was covered before moving to the next scheduled appointment or village. The response rate in all the selected fishing villages for the survey was 100 percent and a total of 186 respondents were encountered as illustrated in Table 3.2 below.

**Table 3.2 Survey dates and number of questionnaires administered**

<table>
<thead>
<tr>
<th>Date of survey</th>
<th>Total questionnaires administered</th>
<th>Villages covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-06-2018</td>
<td>51</td>
<td>Mutabwa, Mulonda and Kabuta</td>
</tr>
<tr>
<td>20-06-2018</td>
<td>30</td>
<td>Kafutuma and Lupili</td>
</tr>
<tr>
<td>21-06-2018</td>
<td>60</td>
<td>Chandwe</td>
</tr>
<tr>
<td>22-06-2018</td>
<td>45</td>
<td>Yenga and Mwanamweshi</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>186</strong></td>
<td></td>
</tr>
</tbody>
</table>
3.3 Data analysis procedures

3.3.2 Descriptive statistics

Descriptive statistics were computed in order to understand the characteristics of the study sample. Descriptive analysis was performed on the sample's socio-economic characteristics and the constraints associated with chisense fish trade.

3.3.3 Inferential statistics

Ordinary least square (OLS) was used to estimate parameters in the study’s empirical model. The OLS method corresponds to minimizing the sum of square differences between the observed and predicted values (Backward, 2009). Ordinary Least Square (OLS) was chosen for this study due to its ability to explicitly control other factors which simultaneously affect the dependent variable (Wooldrige, 2004).

3.3.4. Tests of assumptions

Prior to running a multiple regression analysis, there are assumptions that have to be met and tested. According to Backward (2009) the Gauss-Markov theorem, postulates that if the underlying system being modelled are linear, and the random variables representing the errors made by the ordinary least squares method are uncorrelated from each other, and if the distributions of these random variables all have the same variance and a mean of zero, then the least squares method is the best unbiased linear estimator of the model coefficients. In order to ensure that Gauss-Markov conditions were satisfied prior to estimating parameters in the empirical model, the following assumptions were tested; normality of errors, linearity of the predictors and the outcome variables, homoscedasticity and multicollinearity of the predictors. Additionally, the F-ratio was used to test the joint hypothesis as to whether the included variables exerted any significant influence on the dependent variable.

Normality testing for error is fundamental in statistical modelling that include regressions as they form the basis for validating the procedures used (Ghasemi and Zahediasl, 2012). Multiple linear regression analysis requires that the errors between observed and predicted values (i.e., the residuals of the regression) should be normally distributed (Garson, 2012). Normality tests can be assessed using significance test methods such as Shapiro-Wilk and Kolmogorov-Smirnov test or
K-S Lilliefors, as well as visual or graphical methods. In this study the significance test method was chosen as a supplement to the visual tests for normality due to the method’s ability to compare the sample distribution to the normal one. The visual test was also used through the generation of the frequency distribution (histogram) and the normal P-P plot (probability-probability plot). This allowed for a visual examination of the distribution of residuals, and any violation of the assumption of normality (Garson, 2012).

Testing for linearity is fundamental in regression models as these models assume linearity. The implication of not conforming to this assumption is that the results of the regression analysis will under-estimate the true relationship between the explanatory and outcome variables (Osborne and Water, 2002). Therefore, the test of this assumption is important as it accounts for the non-linear aspects of the relationship between variables. Several methods such as graphical methods, curve fitting with R squared difference test, ANOVA test of linearity, the correlation ratio, and Ramsey’s RESET test are used (Garson, 2012). In this study the graphical method was used as it allows for the visual examination of the residual plots.

The test of homoscedasticity is equally an important assumption that requires to be tested before running a regression model. Homoscedasticity implies that the variance of errors is the same across all levels of the explanatory variables (Osborne and Water, 2002). The test confirms whether the error terms along the regression are equal (homoscedasticity) or differ (heteroscedastic) (Garson, 2012). According to Garson (2012) the most common test of homoscedasticity are graphical methods, weighted least square regression, goldfield-quandt test, Glejser test, park test, Breusch-Pagan-Godfrey test and white paper test. In this study homoscedasticity was tested using graphical method due to its ability to allow visual examination of a plot of standardized residual (the errors). In an ideal situation, the residuals are randomly scattered around a horizontal line depicting a relatively even distribution (no pattern). However, when the residuals are unevenly scattered (with a pattern) around the horizontal line, it suggests a potential heteroscedasticity (Osborne and Water, 2002), thus violating the assumption of homoscedasticity.

Multicollinearity test is a fundamental test when running a multiple regression model. It is an unacceptable high level of inter-correlation among the explanatory variables such that the effects of the variables are inseparable (Garson, 2012). According to Garson (2012) inter-correlation among explanatory variables above 0.80 on a correlation matrix signals a potential problem. Furthermore, high multicollinearity is signalled by a high R-squared value. Multicollinearity can be checked using the correlation matrix and the Variable Inflation Factor (VIF). The correlation
matrix was chosen for this study because it is able to show the Pearson’s bivariate correlations among all independent variables and to which the magnitude of the correlation coefficients should be less than 0.80 (Garson, 2012).

The F-test is used when comparing statistical models that have been fitted to a data set in order to identify the model that best fits the population from which the data was sampled. The F-test of overall or joint significance is a fundamental test that indicates whether the regression model provides a better fit to the data (Frost, 2018). However, this overall significance test can further be complimented with other regression statistics such as the coefficient of multiple correlation or R-squared ($R^2$). According to Gujarati (2004) model accuracy can be determined by evaluating broad features of statistical results such as $R^2$ value and F value. According to Frost (2018) the $R^2$ value measures the strength of the relationship between the model and the dependent variable although, it is not a formal test for the relationship. The F test of overall significance is the hypothesis test for this relationship (Frost, 2018). Therefore, if the overall F-test is significant, it can be concluded that $R^2$ does not equal zero, and the correlation between the model and the dependent variable is statistically significant (Frost, 2018). The F-test was used for this study in order to test the joint hypothesis to show whether the included independent variables in the regression model exert any significant influence on the dependent variable. The study tested the null hypothesis that all the estimated coefficients are zero:

$$Ho: \beta_1 = \beta_2 = \ldots = \beta_6 = 0$$  \hspace{1cm} \text{Equation (3)}

$$H_A: \text{At least one of the } \beta_i \neq 0$$  \hspace{1cm} \text{Equation (4)}

Where:

$\beta_i$ = Are the estimated coefficients of the regression model
CHAPTER 4

RESULTS

4.0. Introduction

This chapter presents results for this study. The chapter begins by describing the demographic and socio-economic characteristics of the study sample and proceeds to present details of the gross margins for chisense fish trade and results of preliminary data analysis for testing quality of the data. The results of model fitness and appropriateness are presented next, followed by findings of the socio-economic determinants of profitability. The chapter ends by presenting results of constraints associated with chisense fish trade of the study sample.

4.1 Demographic and socio-economic characteristics of study sample

Results of the demographic and socio-economic characteristics of the study sample are presented in Table 4.1. Results of this study showed that majority of the respondents were males (89%). Those who were aged between 40-49 years (37%) were in the majority, followed by those who were aged between 50-59 years (28%) and 30-39 years (28%). Respondents that were less than 30 years old were in the minority (3%). The mean age for the respondents was 45 years old.

Respondents’ marital status showed that 81 percent of the total sample were monogamously married while only nine (9) percent were polygamously married. Those that were never married constituted 5 percent whilst divorcees were at 3 percent and the least were separated at just 1 percent. Majority of the respondents had a household size of between 5-9 persons (58%) followed by those with household size between 10-14 persons (29%), and between 0-4 persons (8%). Respondents with household size above 20 persons were in the minority (1%). The mean household size of the respondents was nine (9) persons.

Results of this study further showed that majority of the respondents had experience ranging between 0-10 years (49%) followed by those with experience between 11-20 years (32%) and those with experience between 21-30 years (11%). Those that had experience between 41-50 years were in the minority (2%). The mean level of experience was 13 years.
Table 4.1: Socio-economic and demographic characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency N=186</th>
<th>%</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>166</td>
<td>89.2</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>20</td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td><strong>Age (Years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 30</td>
<td>5</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>30 to 39</td>
<td>52</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>40 to 49</td>
<td>68</td>
<td>36.6</td>
<td></td>
</tr>
<tr>
<td>50 to 59</td>
<td>52</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>60 and above</td>
<td>9</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Mean Age</td>
<td></td>
<td>45</td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never married</td>
<td>9</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Monogamously married</td>
<td>151</td>
<td>81.2</td>
<td></td>
</tr>
<tr>
<td>Polygamously married</td>
<td>16</td>
<td>8.6</td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>5</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Widowed</td>
<td>4</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>Separated</td>
<td>1</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td><strong>Household size</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to 4</td>
<td>14</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>5 to 9</td>
<td>107</td>
<td>57.5</td>
<td></td>
</tr>
<tr>
<td>10 to 14</td>
<td>53</td>
<td>28.5</td>
<td></td>
</tr>
<tr>
<td>15 to 19</td>
<td>10</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>above 20</td>
<td>2</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Mean HH size</td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>3</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>93</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Junior secondary</td>
<td>61</td>
<td>32.8</td>
<td></td>
</tr>
<tr>
<td>Senior secondary</td>
<td>26</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Tertiary</td>
<td>2</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td><strong>Experience (Years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to 10</td>
<td>91</td>
<td>48.9</td>
<td></td>
</tr>
<tr>
<td>11 to 20</td>
<td>59</td>
<td>31.7</td>
<td></td>
</tr>
<tr>
<td>21 to 30</td>
<td>21</td>
<td>11.3</td>
<td></td>
</tr>
<tr>
<td>31 to 40</td>
<td>9</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>41 to 50</td>
<td>4</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>Mean experience</td>
<td></td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Mean price of chisense per kg (ZMK/kg)</td>
<td></td>
<td>3.65</td>
<td></td>
</tr>
<tr>
<td>Mean total income (ZMK)</td>
<td></td>
<td>667.94</td>
<td></td>
</tr>
<tr>
<td>Proportion of fishers who were involved in any other form of business</td>
<td>124</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>Proportion of fishers who belonged to fisher association</td>
<td>91</td>
<td>49</td>
<td></td>
</tr>
</tbody>
</table>

Source: Field data
Results of study also showed that half of the total sample’s highest level of education was primary education (50%). Respondents with junior secondary education constituted 33 percent of the total sample followed by those who attained senior secondary education (14%). Respondents with tertiary education were in the minority (1%). The findings of this study also showed that the mean price at which chisense was purchased by the buyers was ZMK 3.65 per kg or ZMK 70.63 per bowl and the mean income on the last fishing trip was ZMK 667.94.

Results of this study further showed that the mean capital investment in chisense fishing was ZMK 10,309.10 (Table 4.2) with the majority of the respondents investing between ZMK 1 and ZMK 5,000 (49%) followed by those who invested between ZMK 5,000 and ZMK 10,000 (21%). Respondents who invested between ZMK 50,000 and ZMK 200,000 were in the minority (2%).

Table 4.2: Capital Investment of respondents (n=179)

<table>
<thead>
<tr>
<th>Capital Invested (ZMK)</th>
<th>Frequency</th>
<th>Percent</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 5,000</td>
<td>91</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>5,000 to 10,000</td>
<td>39</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>10,000 to 15,000</td>
<td>10</td>
<td>5</td>
<td>10,309.1</td>
</tr>
<tr>
<td>15,000 to 20,000</td>
<td>18</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>20,000 to 50,000</td>
<td>19</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>50,000 to 90,000</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>100,000 to 200,000</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Source: Field data

The results of this study further showed that respondents experienced short periods of high catches in comparison to those with low to medium catch during the past 12 months prior to the study. The findings showed that respondents experienced four (4) months of low catches, two (2) months of medium catches and one (1) month of high catches\(^4\). Figure 4.1 and Table 4.3 presents results on catch trends as well as the mean number of months of low, medium and high chisense production prior to this study.

---

\(^4\)The long period of no fishing activities (5 months) was exacerbated by the extended annual fishing ban due to the cholera outbreaks that were reported in selected parts of the country.
Figure 4.1: Production trends for chisense fishing (2017-2018).

Table 4.3: Average number of months of low, medium and high production during the period June 2017- June 2018

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Std Dev</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>No fishing</td>
<td>4.97</td>
<td>11</td>
<td>3</td>
<td>1.65</td>
<td>2.71</td>
</tr>
<tr>
<td>Low catches</td>
<td>4.10</td>
<td>8</td>
<td>0</td>
<td>1.85</td>
<td>3.43</td>
</tr>
<tr>
<td>Medium catches</td>
<td>2.13</td>
<td>6</td>
<td>0</td>
<td>1.28</td>
<td>1.63</td>
</tr>
<tr>
<td>High catches</td>
<td>0.80</td>
<td>5</td>
<td>0</td>
<td>1.26</td>
<td>1.59</td>
</tr>
</tbody>
</table>

Source: Field data

Results of respondents’ other sources of income during low chisense production periods are presented in Table 4.4. The results showed that majority of the respondents were involved in farming as a source of income during low chisense fish production periods (70%) followed by those who operated small retail shops (7%) and those buying and selling fuel (paraffin) (7%).
Table 4.4: Other sources of income during low chisense production periods (n=91)

<table>
<thead>
<tr>
<th>Source of Income</th>
<th>Count</th>
<th>Column N %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farming</td>
<td>64</td>
<td>70.3</td>
</tr>
<tr>
<td>Small retail shops</td>
<td>6</td>
<td>6.6</td>
</tr>
<tr>
<td>Buying and selling fuel (paraffin)</td>
<td>6</td>
<td>6.6</td>
</tr>
<tr>
<td>Business</td>
<td>3</td>
<td>3.3</td>
</tr>
<tr>
<td>Mechanics</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Piece work</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Chisense trading</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Bricklaying</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Repairing bicycles</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Selling Talk time</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Other fishing</td>
<td>3</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Source: Field data

4.2 Gross margin of chisense fish trade

Results of the average gross margin based on respondents’ last fishing trip prior to the study survey are presented in Table 4.5. The results showed that the computed gross margin based on the average variable costs and income generated was ZMK-59.43. The results further show that variable costs constituted majority of the total cost of chisense fishing for all respondents (100%). The findings also showed that the cost of fuel particularly paraffin (Figures 4.2 and 4.3) were the major variable costs incurred in chisense fishing. The results further showed that fuel constituted 70 percent of the total variable costs with paraffin constituting 56 percent of the total cost of fuel. Petrol and oil constituted 42 percent and 2 percent of the total cost of fuel respectively. Other variable costs included costs of repairs and accessories (14%), cost of labour (9%), and other costs mainly cigarettes and cost of food (7%).
Table 4.5: Average gross margin from chisense fishing per fishing trip

<table>
<thead>
<tr>
<th>Cost items</th>
<th>Amount (ZMK)/fishing trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable costs</td>
<td></td>
</tr>
<tr>
<td>Mean cost of fuel</td>
<td>511.70</td>
</tr>
<tr>
<td>Mean cost of repairs and accessories</td>
<td>98.23</td>
</tr>
<tr>
<td>Mean for other costs and food</td>
<td>51.39</td>
</tr>
<tr>
<td>Mean Labour costs</td>
<td>66.05</td>
</tr>
<tr>
<td>Mean total variable cost (TVC)</td>
<td>727.37</td>
</tr>
<tr>
<td>Returns</td>
<td></td>
</tr>
<tr>
<td>Mean total income</td>
<td>667.94</td>
</tr>
<tr>
<td>Average gross margin (GM)</td>
<td>-59.43</td>
</tr>
</tbody>
</table>

Source: Field data

Figure 4.2: Percentage cost share of TVC.
4.3 Preliminary analysis for testing quality of the data

Prior to undertaking regression analysis, a necessary initial step was examining the quality of the data. In order to determine whether the data collected for this study was suitable to run the regression model, the data was tested for the assumptions of normality of errors, linearity of the predictors and the outcome variables, homoscedasticity and multicollinearity of the predictors. A discussion of the data examination results is presented next.

4.3.1 Test for normality

The test for normality of errors was conducted using the Shapiro-Wilk’s and Kolmogorov-Smirnov tests and visual methods (histogram and the normal P-P plot). Results of the Shapiro-Wilk’s and Kolmogorov-Smirnov tests showed inconsistencies (Table 4.6). While the Kolmogorov-Smirnov test met the assumption of normality (P > 0.05), the Shapiro-Wilk’s tests was unable to confirm (P < 0.05) the non-significance of the errors between observed and predicted values. On the other hand, a visual inspection of the histogram (Figure 4.4) and the normal P-P plot (Figure 4.5) showed that the errors are normally distributed. In Figure 4.4 the histogram shows a symmetrical, bell-shaped curve with a skewness of -0.959 that was close to zero. In Figure 4.5 the normal P-P plot followed the diagonal line suggesting that the errors between the observed and predicted values were normally distributed.
Table 4. 6: Shapiro-Wilk’s and Kolmogorov-Smirnov tests for normality results.

<table>
<thead>
<tr>
<th></th>
<th>Kolmogorov-Smirnov&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Shapiro-Wilk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
<td>df</td>
</tr>
<tr>
<td>Gross margin</td>
<td>.065</td>
<td>176</td>
</tr>
</tbody>
</table>

<sup>a</sup> Lilliefors Significance Correction

Source: Field data:

![Histogram](image_url)

Figure 4.4: Normality test using histogram.
4.3.2 Test of linearity

Visual results of the linearity test using a scatter plot are presented in Figure 4.6. The results showed that the relationship between the outcome and predictor variables was negatively linear thus, satisfying the assumption of linearity.
4.3.3 Test for homoscedasticity

Results of the homoscedasticity test are presented in Figure 4.7. The results showed that the variance of error terms was the same at all levels of the independent variables. The scatter plot shows a random dispersion around zero or the horizontal line indicating that the assumption of homoscedasticity has been met.
4.3.4 Test for multicollinearity

Results for the test of multicollinearity are shown in Tables 4.7. The results of the tests for multicollinearity for this study showed that all the predictor variables were not inter-correlated. An inter-correlation among explanatory variables above 0.80 signals a potential problem. Results of the multicollinearity test showed that no predictor variables had a value above 0.80 thus indicating that there were no multicollinearity problems.

Table 4.7: Correlation matrix showing multicollinearity test results

<table>
<thead>
<tr>
<th></th>
<th>Gross margin</th>
<th>Level of education</th>
<th>Capital invested</th>
<th>Age</th>
<th>Experience</th>
<th>Household size</th>
<th>Purchase price/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Margin</td>
<td>1</td>
<td>0.088</td>
<td>-0.134</td>
<td>-0.031</td>
<td>-0.0094</td>
<td>-0.13</td>
<td>0.221</td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
<td>1</td>
<td>0.133</td>
<td>-0.005</td>
<td>-0.023</td>
<td>0.021</td>
<td>0.003</td>
</tr>
<tr>
<td>Capital invested</td>
<td>-0.134</td>
<td>0.133</td>
<td>1</td>
<td>0</td>
<td>0.033</td>
<td>0.002</td>
<td>-0.022</td>
</tr>
<tr>
<td>Age</td>
<td>-0.031</td>
<td>-0.005</td>
<td>0</td>
<td>1</td>
<td>0.465</td>
<td>0.128</td>
<td>0.009</td>
</tr>
<tr>
<td>Experience</td>
<td>-0.094</td>
<td>-0.023</td>
<td>0.033</td>
<td>0.465</td>
<td>1</td>
<td>0.307</td>
<td>0.041</td>
</tr>
<tr>
<td>Household size</td>
<td>-0.13</td>
<td>0.021</td>
<td>0.002</td>
<td>0.128</td>
<td>0.307</td>
<td>1</td>
<td>-0.032</td>
</tr>
<tr>
<td>Purchase price/kg</td>
<td>0.221</td>
<td>0.003</td>
<td>-0.022</td>
<td>0.009</td>
<td>0.041</td>
<td>-0.032</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Field data
4.3.5 Examining model fitness and appropriateness

Prior to interpreting the results of the regression model, a necessary initial step is examining the fitness and appropriateness of the model. In order to determine whether the model used for this study was suitable to interpret the regression results, the model was tested for explanatory power of the included independent variables and model significance. The explanatory power of the model was tested by examining the value of the adjusted coefficient of determination ($R^2$) whereas, the model significance was tested through the examination of the F statistic. A discussion of the model examination results is presented next.

4.3.5.1 Diagnostic analysis of initial model for goodness of fit and appropriateness

Results of the adjusted coefficient of determination for the first model (Model 1) containing the specified socio-economic variables for this study are presented in Table 4.8. The results showed that the adjusted coefficient of determination was 0.062 indicating that 6 percent of the variation in the gross margin (profitability) was explained by the variations in the specified independent variables. Results of the F-statistic for the first model are presented in Table 4.9. The results show that the value of the F-statistics was statistically significant ($P < 0.05$). Although these diagnostic statistical results showed that all the independent or explanatory variables had a joint impact on the dependent variable, the values of the adjusted coefficient of determination and the F statistic suggest that the model had an Omitted Variable Bias (OVB).

Table 4.8: Results showing the explanatory power of model 1

<table>
<thead>
<tr>
<th>Model 1</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>Change Statistics</th>
<th>Source: Field data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.310a</td>
<td>0.096</td>
<td>0.062</td>
<td>394.032</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.096</td>
<td></td>
<td></td>
<td>2.809</td>
<td>6</td>
<td>159</td>
</tr>
</tbody>
</table>

a Predictors: (Constant), Purchase price/kg, Level of educational level, Age, Household size, Capital invested, Experience

b Dependent Variable: Gross Margin

Source: Field data

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Table 4.9: Model 1 results of the F test (ANOVA*)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>2616440.547</td>
<td>6</td>
<td>436073.424</td>
<td>2.809</td>
<td>.013b</td>
</tr>
<tr>
<td>Residual</td>
<td>24686536.23</td>
<td>159</td>
<td>155261.234</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27302976.78</td>
<td>165</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: Gross Margin  
b. Predictors: (Constant), Purchase price/kg, Level of educational level, Age, Household size, Capital invested, Experience  

Source: Field data

4.3.5.2 Regression model output for initial model

Regression analysis results of the initial model (Model 1) containing variables that specified the independent variables for this study are presented in Table 4.10. The results showed that only purchase price had a significant effect on profitability ($\beta = 0.22, t = 2.87, \rho < 0.05$). The other variables including age ($\beta = -0.10, t = 0.15, \rho > 0.05$), experience ($\beta = -0.07, t = -0.78, \rho > 0.05$), household size ($\beta = -0.11, t = -1.33, \rho > 0.05$), level of education ($\beta = -0.11, t = 1.39, \rho > 0.05$) and amount of capital invested by the respondents ($\beta = -0.14, t = -1.85, \rho > 0.05$) had no significant effect on profitability.
Table 4.10: Model 1 output (Coefficients*)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>Tolerance</td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>-327.962</td>
<td>227.372</td>
<td>-1.442</td>
<td>0.151</td>
<td></td>
</tr>
<tr>
<td>Purchase price</td>
<td>77.655</td>
<td>27.077</td>
<td>0.217</td>
<td>2.868</td>
<td>0.005</td>
</tr>
<tr>
<td>Age</td>
<td>0.621</td>
<td>4.041</td>
<td>-0.105</td>
<td>0.154</td>
<td>0.878</td>
</tr>
<tr>
<td>Experience</td>
<td>-3.007</td>
<td>3.854</td>
<td>-0.069</td>
<td>-0.78</td>
<td>0.436</td>
</tr>
<tr>
<td>Household size</td>
<td>-12.864</td>
<td>9.703</td>
<td>-0.105</td>
<td>-1.326</td>
<td>0.187</td>
</tr>
<tr>
<td>Capital invested</td>
<td>-0.003</td>
<td>0.002</td>
<td>-0.141</td>
<td>-1.846</td>
<td>0.067</td>
</tr>
<tr>
<td>Level of educational</td>
<td>17.567</td>
<td>12.571</td>
<td>0.106</td>
<td>1.397</td>
<td>0.164</td>
</tr>
</tbody>
</table>

Source: Field data: a Dependent Variable: Gross Margin

4.3.5.3 Correcting for Omitted Variable Bias (OVB)

Given the low values of the adjusted coefficient of determination and the F statistic, the initial model was corrected for OVB. This was done by including an omitted explanatory variable that had an effect on the dependent variable and other independent variables. The appropriate explanatory variable (quantity sold) was chosen based on economic theory.

4.3.5.4 Diagnostic analysis of the corrected model for fitness and appropriateness

Results of the adjusted coefficient of determination for the second model (Model 2) that included an additional explanatory variables (quantity of chisense sold) are presented in Table 4.11. The results showed that the adjusted coefficient of determination had improved from the initial 0.062 (Table 4.8) to 0.445 indicating that 45 percent of the variation in the gross margin (profitability) was explained by the variations in the specified independent variables. The results of the F-statistic for the second model are presented in Table 4.12. The results showed that the value of the F-statistic also improved from the initial 2.809 (Table 4.9) to 23.207 and was statistically significant ($\rho < 0.001$). These diagnostic statistical results showed that all the independent or explanatory variables had a joint impact on the dependent variable after correcting for OVB; thus, the model was of good fit.
Table 4. 11: Model 2 Summary

<table>
<thead>
<tr>
<th>Model 2</th>
<th>R</th>
<th>R²</th>
<th>Adjusted R²</th>
<th>Std. Error of the Estimate</th>
<th>Change Statistics</th>
<th>Change Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R Square Change</td>
<td>F Change</td>
</tr>
<tr>
<td>.682 a</td>
<td>.465</td>
<td>.445</td>
<td>290.76683</td>
<td></td>
<td>.465</td>
<td>23.207</td>
</tr>
</tbody>
</table>

Source: Field data

a. Predictors: (Constant), Experience, Purchase price, Level of education, Capital invested, Household size, Quantity sold (kg)
b. Dependent Variable: Gross margin

Source: Field data

Table 4. 12: Model 2 results of the F test (ANOVA a)

<table>
<thead>
<tr>
<th>Model</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Regression</td>
<td>11772343.386</td>
<td>6</td>
<td>1962057.231</td>
<td>23.207</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>13527255.498</td>
<td>160</td>
<td>84545.347</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>25299598.884</td>
<td>166</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: Gross margin

b. Predictors: (Constant), Experience, Purchase price, Level of education, Capital invested, Household size, Quantity

4.4 Socioeconomic determinants of profitability for chisense fishers

Results of the revised model (Model 2) for this study sample are presented in Table 4.13. The results showed that variables that had significant positive effects on profitability included quantity of chisense sold ($\beta = 0.65$, $t = 10.65$, $p < 0.05$) and the purchase price of chisense ($\beta = 0.31$, $t = 5.23$, $p < 0.05$). These results showed that a unit increase in the quantity of chisense sold would increase the profitability of chisense fish trade by ZMK 1.89 holding all other factors constant. Similarly, a unit increase in the purchase price of chisense would increase the profitability of chisense fish trade by ZMK 105.00 holding all other factors constant. The results further showed that amount of capital invested negatively affected profitability ($\beta = -0.31$, $t = -5.04$, $p < 0.05$) implying that a unit increase in amount of capital invested would lead to a decrease in profitability of chisense fish trade by ZMK 0.01 holding all other factors constant. The results also showed that household size ($\beta = -0.10$, $t = -1.70$, $p > 0.05$), level of experience ($\beta = 0.03$, $t = 0.48$, $p > 0.05$) and level of education ($\beta = 0.08$, $t = 1.32$, $p > 0.05$) had no significant effect on profitability. The variable age was excluded from the revised model since it had a tolerance value of zero (Table
4.14) implying that it could be perfectly predicted from the other predictor variables in the equation.

Table 4. 13: Model 2 output (Coefficients*)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>(Constant)</td>
<td>-826.503</td>
<td>168.882</td>
<td>-4.894</td>
</tr>
<tr>
<td></td>
<td>Household size</td>
<td>-11.708</td>
<td>6.877</td>
<td>-1.702</td>
</tr>
<tr>
<td></td>
<td>Quantity sold (kg)</td>
<td>1.893</td>
<td>.178</td>
<td>10.649</td>
</tr>
<tr>
<td></td>
<td>Level of education</td>
<td>12.188</td>
<td>9.270</td>
<td>1.315</td>
</tr>
<tr>
<td></td>
<td>Capital invested</td>
<td>-.007</td>
<td>.001</td>
<td>-5.041</td>
</tr>
<tr>
<td></td>
<td>Purchase price</td>
<td>105.275</td>
<td>20.133</td>
<td>5.229</td>
</tr>
<tr>
<td></td>
<td>Experience</td>
<td>1.273</td>
<td>2.644</td>
<td>.481</td>
</tr>
</tbody>
</table>

* Dependent Variable: Gross Margin

Source: Field data

Table 4. 14: Excluded Variables*

<table>
<thead>
<tr>
<th>Model</th>
<th>Beta In</th>
<th>T</th>
<th>Sig.</th>
<th>Partial Correlation</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tolerance</td>
</tr>
<tr>
<td>2</td>
<td>Age</td>
<td>. b</td>
<td>.</td>
<td>.</td>
<td>.000</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Gross margin
b. Predictors in the Model: (Constant), Experience, Purchase price, Level of education, Capital invested, Household size, quantity sold (kg)

Source: Field data:

4.5 Constraints associated with chisense fish trade among fishers

Results of the constraints associated with chisense fish trade among fishers are presented in Figure 4.8. The results showed that 20 percent of the total sample were constrained by the high cost of fuel followed by unstable prices for chisense (19%), low or poor catches (16%) and thefts (16%). Respondents who indicated bad weather as a major constraint constituted 13 percent of the total sample while 8% indicated lack of access to credit. The results further showed respondents who indicated illegal fishing activities were in the minority (6%).

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Figure 4.8: Constraints associated with chisense fish trade among fishers.
CHAPTER 5

DISCUSSION

5.0 Introduction

This chapter presents the discussion of the findings of this study. The socio-economic and demographic characteristics of the study sample are discussed first. This is followed by a discussion on the socio-economic determinants of profitability and the gross margin analysis. The chapter ends with a discussion on the constraints associated with chisense fish trade amongst fishers in the study sample.

5.1 Socio-economic and demographic characteristics of the chisense fishers

Results of this study showed that males were in the majority as chisense fishers (89%). This finding suggests that gender is an important social factor that influences the roles and responsibilities of males and females (Ojo, 2016). Results of this study are consistent with a study by Shettima et al. (2014) in which it was shown that male fishers constituted 100 percent of the study sample. The dominance of males in the artisanal fishery subsector has also been reported by Akpoko (2003) and Inoni and Oyaide (2007). Past studies have also attributed the dominance of male fishers in fishing due to the associated risks involved with off shore fishing activities (Onemolease and Oriakhi, 2011). In the case of the current study, chisense fishing is conducted at night on Lake Mweru Luapula (Jul-Larsen, 2003) thus, further reducing chances of women participation. The current study also showed that majority of women who participate in chisense fishing do not directly participate in the actual fishing rather they own the fishing equipment and employ men to do the fishing. This finding is consistent with a study by Medard (2001) in which it was shown that women who participated in fishing owned boats, nets or both and hired crew members.

A comparison of past studies and the current study suggest that off shore fishing and other forms of fishing that have risky attributes are dominated by males while, female participation is through ownership of equipment. On the other hand, fishing with minimal risky attributes particularly inshore fishing are more attractive for more female participation (Jiddawi and Ohman, 2002; Medard et al., 2002). For instance Medard et al. (2002) reported that females participated less in the offshore fishing activity because it required a lot of time, energy, and that it was very risky.
This maybe a potential reason for the dominance of males in chisense fishing reported in the current study given the risks associated with this form of fishing (off shore fishing) and since it is conducted at night.

Results of this study also showed that majority of the respondents were monogamously married (81%). This finding is consistent with results reported by Bassey et al. (2015) which showed dominance of married respondents among rural fishing communities. The aforementioned authors opined that the dominance of married respondents implied readily available labour for fishing related activities. The mean household size for the study sample was nine (9) persons indicating that the study sample had a large household size. According to Onemolease and Oriakhi (2011) and Esiobu and Onubuogu (2014) a large household size is an important source of labour. This could explain the large size households reported in this study.

The age of respondents in the current study showed that majority of them were aged between 40 and 49 years (36%) with the mean age being 45 years. This finding is in line with a study by Bassey et al. (2015) who found that the dominant age groups that participated in fish trading activities were 40 years and above. Similarly, Onemolease and Oriakhi (2011) also found that the average age of respondents involved in artisanal fishing was 44 years. However, Somanje and Muendo (2016) found that majority of respondents that were involved in fish trading activities on the Barotse flood plains were in the age group of 26-40 years. Nevertheless, results of this study suggest that chisense fishing was dominated by the elderly. The results further suggest that the elderly that are involved in chisense fishing may not have the ability to make appropriate business decisions, be innovative and have vigour to effectively participate in chisense fishing and trading activities as opined by Jatto et al. (2013), Tiri et al. (2014) and Bassey et al. (2015).

Results of this study also showed that experience in chisense fishing for the majority of the respondents ranged from 1-20 years (81%) with an average of 13 years of experience. This finding suggests that majority of the respondents had adequate knowledge about chisense fishing to enable them make informed decisions regarding chisense fishing. Additionally, this finding suggests that chisense fishers in the study area are familiar with problems associated with their fishing enterprises as suggested by Esiobu and Onubuogu (2014) and are therefore better placed to identify challenges or constraints that affect them.

Results of this study showed that majority of the respondents had lower primary and junior secondary education levels (57%). This finding is consistent with the findings of Somanje and
Muendo (2016) which showed that on average respondents in their study had primary education level. Similarly, Obayelu et al. (2016) also found that more than half of their total sample had primary education level (54%). Consistent with past studies, the findings of this study suggest that artisanal fishers tend to have low educational levels (Onemolease and Oriakhi, 2011). This study therefore supports the call to encourage acquisition of formal education in settings with fish trading activities (Obayelu et al., 2016).

Result of this study also showed that the mean amount of capital invested in chisense fishing was ZMK 10,309.10 thus, suggesting that chisense fishing required a substantial amount of capital outlay. Having obtained a similar finding in their study, Tiri et al. (2014) suggested the need to establish microfinance and micro-loan centres that could offer credit finance at low interest rates for artisanal fishers as well as encourage the participation of youth entrepreneurs in fish trade activities.

Results of this study also showed that the purchase price of chisense was unstable given that there were frequent fluctuations. Similar findings were also reported by Esiobu and Onubuogu (2014), Baba et al. (2015) and Babalola et al. (2015). Fluctuations in the purchase price of chisense suggests that profitability in chisense fishing is highly unpredictable. This calls for better management of fish marketing through the formation of cooperative societies by fish marketers in order to ease the challenges of fish price fluctuations (Baba et al., 2015).

5.2 Socio-economic determinants of profitability

Results of this study showed that profitability of chisense fish trade for fishers was significantly affected by the quantity of chisense sold, purchase price of chisense and amount of capital invested. Quantity of chisense sold had a positive effect on profitability ($\beta = 1.893$, $t = 10.65$, $\rho < 0.05$). This implies that for each unit increase in the quantity of chisense sold, the profitability of chisense would be increased by ZMK 1.89. This finding is consistent with Babalola et al.’s (2015) study in which the quantity of fish sold was found to have a significantly positive effect on profitability. The reported relationship between quantity of chisense sold and profitability suggest that in order for chisense fish trade to be profitable for fishers, the quantity of fish sold needs to be substantial for increased profitability.

The purchase price of chisense was also found to have a positive effect on profitability ($\beta = 105.275$, $t = 5.23$, $\rho < 0.05$). This finding implies that for each unit increase in the purchase price
of chisense, the profitability of chisense fish trade would be increased by ZMK 105.28. While the current study found a positive relationship between purchase price of chisense and profitability, past studies reported a negative relationship between purchase price and profitability (Obayelu et al., 2016; Babalola et al., 2015; Bassey et al., 2015). The variance in the results reported in this study and that of past studies could be explained by the differences in the target populations for the aforementioned studies. While the current study focused on fishers, past studies focused on retailers and wholesalers. A comparison of the findings of the current study and those of past studies suggests that depending on the value chain actors involved, the effect of purchasing price on profitability can vary. Results of past studies that focused on fish wholesalers and retailers, showed that purchase price negatively affected profitability given that it was a cost rather than a gain for these fish traders (Babalola et al., 2015; Bassey et al., 2015; Obayelu et al., 2016). In the case of the current study, the price at which fish is purchased determines the level of profitability and provides a gain rather than a cost for the fishers. Additionally, the results of this study suggest that in order for chisense fish trade to be profitable for fishers, the purchase price needs to be sufficiently high. This assertion is consistent with the observations made by “Understanding costs and profit” (2013) who noted that when products are lowly priced, they affect profitability and businesses are bound to fail.

Results of this study also showed that the amount of capital invested had a negative effect on profitability ($\beta =-0.007$, $t=-5.04$, $p<0.05$). This finding implies that for each unit increase in the amount of capital invested in chisense fishing, the profitability of chisense fish trade decreased by ZMK 0.01. Although similar results have been reported in past studies (Tiri et al., 2014), others report divergent results (Obayelu et al., 2016). Studies that reported a negative effect of amount of capital invested on profitability argued that an increase in the amount of capital invested led to reduced profitability due to unfavourable market conditions which reduced total revenue earned (Tiri et al., 2014). On the other hand studies that reported positive effects of amount of capital invested on profitability argue that the more the capital invested into the fish trade business, the higher the profits that accrued to them (Obayelu et al., 2016). The variance in the results reported in this study and that of past studies could be explained by the differences in the target populations for the aforementioned studies. While the current study focused on fishers, past studies focused on fish retailers and wholesalers.

Results of this study are consistent with the Common Property Theory (CPT) that was first outlined by Scott Gordon in 1954, and later developed into an analysis of the ‘tragedy of the commons’ by
Garrett Hardin in 1968 (Gordon, 1954; Hardin, 1968). The CPT theory suggests that unrestrained increases in the use of common pool resources will lead to over exploitation and resource collapse, a ‘tragedy of the commons’ (Hardin, 1968). Results of the current study have shown that low or poor catches and illegal fishing activities are among the major constraints faced by chisense fishers. This finding suggests unrestrained increase in the use of fisheries resources as noted by Hardin (1968). It has been noted that illegal fishing poses serious threats to fish stocks in lakes and oceans (WTO, 2017). It is worth noting that an increase in the amount of capital is likely to further result in an increase in the fishing effort thereby exerting more pressure on fisheries resources (common pool resource) which can also result in unrestrained increases in the use of fisheries resources. The consequence of unrestrained use of fisheries resources can thus result in profitability being negatively affected as revealed in the current study. This finding is consistent with the results reported by Tiri et al. (2014).

Although conventional theories such as ‘capital fundamentalism’ postulate that economic growth is directly related to levels of investment, the inland fisheries sector seem to challenge this theory (Gordon, 2005). Consistent with the views postulated by Gordon (2005), and in contrast with the theory of capital fundamentalism, the results in the current study suggest that an increase in the amount of capital invested will decrease profitability. It is worth noting that while results of this study also showed that large capital investment is required for chisense fishing, the negative effect of capital invested on profitability reported in this study suggests that large capital investment may not necessarily have a positive effect on profitability for chisense fishers in the study sample. The possible reason for the negative effect of amount of capital on profitability could therefore be explained by the effects of the CPT as postulated by Gordon (1954) and Hardin (1968).

Results of this study also showed that age, household size, level of experience, and level of education had no significant effects on the profitability for chisense fishers. Confounding results have been reported on the effects of age, household size, level of experience and level of education on profitability in other settings. For instance, past studies showed that age had a negative effect on profitability (Tiri et al., 2014; Bassey et al., 2015) while others reported contrary results (Aworemi et al., 2010; Somanje and Muendo, 2016). As was the case in the current study, an insignificant results on the effect of age on profitability was also reported by Mumba et al. (2012) in a study aimed at determining the effects of socio-economic factors on profitability of smallholder dairy farming.
Confounding results have also been reported on the effect of household size on profitability in the extant literature. Some studies reported that it had a positive effect on profitability (Esiobu and Ounbuogu, 2014) while others reported that it had a negative effect (Obayelu et al., 2016). Consistent with the current study, Mumba et al. (2012) found household size to have no significant effect on profitability. The effect of level of experience on profitability is also faced with confounding results in extant literature. Some studies reported a positive effect of level of experience on profitability (Esiobu and Onubuogu, 2014; Bassey et al., 2015) while other reported a negative effect (Aworemi et al., 2010; Tiri et al., 2014; Obayelu et al., 2016).

The current study could not establish the significant effects of age, household size, experience level and education level on profitability. This implies that for chisense fishers in the study sample, the aforementioned factors are not determinants of profitability.

According to Gujarati (2004) when determining model adequacy, an assessment of broad features of the results such as the adjusted coefficient of determination and the analysis of variance is imperative. The value of the adjusted coefficient of determination of 0.45 reported in this study indicated that 45 percent of the variation in the profitability of chisense fish trade was explained by the quantity of chisense sold, the purchase price and amount of capital invested in the study sample. The adjusted coefficient of determination takes the values between 0 and 1, and if the adjusted coefficient of determination is closer to 1, it indicates that the estimated equation of regression fits the data (Sarstedt and Mooi, 2014). Therefore, results of the adjusted coefficient of determination suggest that the observed data corresponded well with the fitted (assumed) model. Furthermore, results of the estimated F-statistic ($F_{6,160} = 23.21$, $p < .0001$) showed that there was a significant joint effect of the quantity of chisense sold, the purchase price and amount of capital invested on profitability.

### 5.3 Gross margin analysis

Profitability of chisense fish trade amongst fishers in the study sample was analyzed using gross margin analysis (Somanje and Muendo, 2016). The results showed that variable costs constituted the total cost for chisense fishing (100%). Similar results have been reported in past studies (Somanje and Muendo, 2016; Obayelu et al., 2016; Bassey et al., 2013). However, while in the current study the major variable cost was fuel (70%), the cost of purchasing fish constituted the major cost in the aforementioned past studies (Somanje and Muendo, 2016; Obayelu et al., 2016;
Bassey et al., 2013). The differences in the major costs could be because in the current study the target population was fishers whereas in past studies the target populations were fish retailers and wholesalers.

Past studies showed that fish trading was profitable for retailers and wholesalers (Bassey et al., 2013; Somanje and Muendo, 2016; Obayelu et al., 2016). However, in the current study, results showed that chisense fish trade for fishers was not profitable as revealed by the mean gross margin of ZMK -59.43 reported in the preceding chapter. The negative mean gross margin implied that chisense fishers in the study sample incurred more costs than what they were able to earn. This could be attributed to a number of factors that may include seasonality and reduced catch rate for single units. According to Molsa (2009) reduced catch rate for single units and for effort (number of nets, boats, fishing time) was an indication that there was potential for economic overfishing thus, decreasing profitability of commercial fisheries. Furthermore, FAO (2010) noted that economic overfishing takes place when the level of fishing effort is considered far too great in order for the fisheries to acquire the maximum rent that is obtainable from the catches. This implies that the rate at which fish are being harvest is so high that the increase in the profitability of fishing goes down. Thus, persistence of this level of harvesting would result in further decrease in profitability (Molsa, 2009).

Results of this study further showed that on average most respondents experienced one (1) month of high catches, two (2) months of medium catches, four (4) months of low catches and four (4) months of no fishing (fishing ban period) prior to the study. This finding suggests that chisense fishers spent more time fishing without catching enough to sustain their businesses. This was further shown by the low/poor catches that was considered as a major constraint by 16 percent of the total study sample.

Unstable prices as a result of catch fluctuations could also explain the negative mean gross margin reported in this study. This is particularly common in small scale fisheries whereby when there is excess production or low demand for fish, fishers are still compelled to sell their catch even when there is little chance of making any profit (Molsa, 2009).

A comparison of the findings of the current study and those of past studies suggests that depending on the value chain actors involved, profitability in fish trade can vary for different actors along the fish trade value chain. Additionally, this study has shown that fishers are at more risk of incurring losses given that they are faced with costs of required inputs such as fuel despite having marginal
chance of catching enough to recover costs. On the other hand, past studies showed that retailers and wholesalers who buy or purchase fish from fishers can avoid incurring costs when fish is unavailable or when purchase prices are too high (Bassey et al., 2013; Somanje and Muendo, 2016; Obayelu et al., 2016).

5.4 Constraints associated with chisense fish trade among fishers

Results of this study showed that chisense fishers are faced with a number of constraints that include high cost of fuel, unstable purchase prices for chisense, low or poor catches, theft, bad weather conditions, lack of access to credit and illegal fishing activities. High costs of inputs that include fuel have also been noted in past studies (Oladeji and Oyesola, 2002; Onemolease and Oriakhi 2011; Jim-Saiki et al., 2014). The implication of having high costs of inputs is inability to save earnings from fishing for reinvestment (Jim-Saiki et al., 2014). In the current study the cost of fuel was identified as a major constraint and the results showed that paraffin used for lighting tilley lamps for attracting fish constituted 56 percent of the total cost of fuel. This cost if reduced could significantly improve profitability. This can be achieved by exploring efficient means of attracting fish without the use of paraffin by for instance using solar powered lamps. This form of technology is readily available in Zambia and is being used for Kapenta fishing, (a similar pelagic fish species to chisense) on Lake Itezhi-itezhi.

Unstable purchase prices for chisense was also found to be a major constraint affecting chisense fishers in the current study. Similar findings are reported in past studies (Baba et al., 2015; Babalola et al., 2015; Esiobu and Onubuogu, 2014). The complexities that are attributed to unstable fish prices can be viewed from the perspective of fish prices’ inability to follow normal agribusiness trends (Molsa, 2009). According to Molsa (2009) fish prices tend not to follow the same trends observed in other agribusinesses noting that this is a challenge in the marketing of fish especially in the event of excess production or low demand which may results in reduced prices. Other past studies have attributed the challenge of unstable purchase prices to the high perishability characteristic of fish products and also a lack of storage and preservation facilities that affect the marketing of fish (Medard, 2002). These challenges of high perishability, lack of storage and preservative facilities ultimately result in the quick sell of fish products regardless of the prevailing purchase prices (Medard, 2002). The aforementioned challenges coupled with fluctuations in production trends, unpredictable and bad weather pattern reported in the current study, and low
investments in fisheries (post-harvest technologies and infrastructure) as observed by Musumali et al. (2009) may also perpetuate unstable prices for chisense.

A comparison of findings from past studies and that of the current study suggests that planning for improved profitability can pose a serious challenge for those involved in chisense fish trade particularly the fishers due to unstable fish prices. Although policy changes such as ensuring price stability have been proposed by Babalola et al. (2015), enforcement of such policies may be problematic in the face of a free market economy. Others have proposed formation of strong cooperative societies by fish marketers in order to address some of the problem associated with price fluctuations (Baba et al., 2015).

Low/poor catches of chisense was also revealed as one of the major constraints encountered by chisense fishers in the current study. Results of this study showed that chisense fishers experienced more months of low to medium catches in comparison to only one (1) month of high catches or high chisense production. Similar findings have been noted in past studies (Esiobu and Onubuog, 2014; Onemolease and Oriakhi, 2011; Jim-Saiki et al., 2014). Onemolease and Oriakhi (2011) opined that poor catches may pose a serious limitation to economic returns there by aggravating the poor living conditions of fishers. Jim-Saiki et al. (2014) attributed poor returns of investment in fishing to depleted fish stock that results in low/poor catches.

Theft of equipment used for chisense fishing such as tilley lamps and marine engines was also noted as a major constraint faced by chisense fishers. Constraints associated with theft have also been reported in past studies (Tiri et al., 2014; Shettima et al., 2014). Shettima et al. (2014) opined that theft renders fishermen helpless and their efforts worthless. It is therefore imperative that efforts in enhancing security measures are heightened in order to reduce loss of property by fishers as a result of thefts.

Bad weather conditions was also revealed as one of the major constraints encountered by chisense fishers in the current study. Effects of bad weather has also been reported in past studies (Shettima et al., 2014). In their study Shettima et al. (2014) ranked breeze leading to bad weather as the highest constraint and indicated that this phenomena made it difficult for fishers to catch fish and also resulted in the instability of boats on the waters during fishing. Similar risks can be deduced for chisense fishers which can affect income earnings from chisense fishing and ultimately profitability.
Lack of access to credit was also revealed as a major constraint which limits capital required for investment in chisense fish trade. Studies by Oladeji and Oyesola (2002) and Onemolease and Oriakhi (2011) also noted lack of access to credit as a factor that limited the investment profile for fishers. Onemolease and Oriakhi (2011) suggested pooling of financial resources amongst the community members in order to ameliorate the constraints imposed by lack of or inadequate finance. Lack of access to credit reported in the current study area could be due to the high risks associated with chisense fishing as demonstrated by the negative mean gross margin which implied that chisense fishing was not profitable. Additionally, the fluctuations in chisense production levels with an average of one (1) month of high production further demonstrated this risk which can result in high loan repayment defaults. It is therefore imperative that further interrogations are made on how to reduce the risks associated with chisense fish trade especially for fishers in order to create an attractive market for credit service providers.

Illegal fishing was also identified as one of the constraints that affects chisense fishers in the current study. This has also been noted in past studies (Alam and Thompson, 2001; Mehanna, 2008; Pedroza-Gutiérrez and López-Rocha, 2016). Alam and Thompson (2001) revealed that one of the constraints that limited the expansion of productivity on the rivers and estuaries was illegal fishing activities as a result of poor implementation of fisheries laws. Additionally, Pedroza-Gutiérrez and López-Rocha (2016) also reported that illegal, unreported, and unregulated (IUU) fishing and the ineffectiveness of institutions to control the actions of all actors allowed destructive strategies toward the fisheries resources. Furthermore, WTO (2017) noted that illegal fishing poses serious threats to fish stocks in lakes and oceans particularly in the Eastern African Community (EAC) that directly affects small-scale fisheries to economically survive. The authors associated illegal fishing with revenue losses as a result of foregone licensing fees, taxes and other charges. Illegal fishing is also viewed as a threat to food security given that it leads to over-exploitation of fishery resources (lack of fish species, promotion of black market for fish that ultimately distort prices) (WTO, 2017).
CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

The final chapter of this thesis presents the conclusion and recommendations based on the findings of this study. The conclusions drawn from the findings of the study are discussed first, followed by recommendations.

6.1 Conclusion

Considering that there is paucity of empirical studies on the socio-economic determinants of profitability in fish trade in the study area, this study examined the socio-economic determinants of profitability in chisense fish trade amongst chisense fishers on the Lake Mweru-Luapula in Nchelenge District of Luapula Province. Additionally, the study also undertook an analysis of the gross margins for chisense fish trade as well as an assessment of the associated constraints amongst chisense fishers in the study sample.

Results on the socioeconomic characteristics of the study sample showed that chisense fishing was male dominated and that majority of the respondents were monogamously married and generally elderly with large household sizes. The results further revealed that most of the respondents had low education levels although the level of experience was substantially high. It can therefore be concluded that the elderly and less educated individuals may not be in a position to be innovative albeit having sufficient experience in fishing and that the large household sizes provide a source of readily available labour.

The amount of capital required to invest in chisense fishing was equally high while the production of chisense in the study area exhibited seasonal fluctuations making chisense fishing unpredictable and planning a challenge. It can therefore be concluded that the amount of capital required as capital can be a barrier to entry into the chisense fishery. Moreover, lack of access to credit was also revealed as one of the constraints faced by the chisense fishers. On the other hand, the seasonal fluctuations of chisense production revealed in this study may also have an effect on the flow of income and profitability for chisense fishers.
The findings of this study suggest that in order for chisense fish trade to be profitable, fishers need to have good catches as well as appropriate purchase prices that cover the cost of fishing. The amount of capital invested in chisense fishing on the other hand needs to be optimal so as not to over or under capitalize in chisense fishing for guaranteed profitability.

The analysis of the gross margin for chisense fish trade revealed that it was not profitable for most fishers. Fuels constituted the largest cost components incurred by chisense fishers in the study sample. It can therefore be concluded that a reduction in costs of fuels particularly paraffin would improve the profitability of chisense fish trade amongst fishers.

The major constraints associated with chisense fish trade included: high costs of inputs such as fuel, unstable purchase price for chisense, low or poor catches, theft, bad weather, lack of access to credit and illegal fishing activities. It can therefore be concluded that these constraints affect revenue generation and profitability and ultimately reduce the economic viability of chisense fish trade among fishers.

Based on the findings of the study, the following policy, management and research recommendations are suggested:

6.2 Recommendations

- There is need to further explore the use of alternative energy that could be used for lighting to attract chisense during fishing in order to reduce the costs of fuel particularly paraffin. The results of the gross margin analysis in this study have shown that paraffin used in the lamps for attracting chisense constituted the largest cost share for chisense fishers. Therefore a reduction on this would greatly enhance the profitability of chisense fish trade. A much cheaper and clean energy technology used for lighting to attract pelagic fish species is currently available and being used on Lake Itezhi-tezhi in Zambia. It should further be a matter of policy to promote and support the use of clean and green energy sources on the environment.

- There is need to investigate how chisense fish prices are determined and build capacity amongst the chisense fishers on how to set the appropriate purchase prices for chisense that would ensure improved profitability of chisense fish trade. Results of the gross margin analysis for this study have shown that most fishers incur more costs than what they earn from selling their fish. Therefore, it should be a matter of Government policy to promote
and support programmes that will enhance improved profitability and income generation for agro based produce that includes fish products.

- There is need to investigate the optimum amount of capital required to invest in chisense fishing in order to avert the risk of over capitalization which can ultimately result in decreased profitability. The results of this study showed that an increase in amount of capital could reduce profitability.

- Policies should be put in place by the Government to promote and support the establishment of rural based micro-financing mechanisms that can provide affordable credit at competitive lending rates. Results of this study have shown that access to credit was a major constraint that affects chisense fishers in the study sample.

- There is need to ensure that fisheries management measures are strengthened through the provision of adequate budgetary support for law enforcement and sensitization programmes in order to curb illegal fishing activities. The study revealed illegal fishing as a constraint amongst the chisense fishers in this study and further attributed illegal fishing to low or poor catches experienced by fishers. Strengthening management measures would essentially result in having only those fishers that are compliant and in possession of fishing licenses to fish thereby reducing the fishing effort and pressure on chisense fish stocks.

- Policies should be put in place by the Government that promote and encourage the use of Information and Communication Technologies (ICT) in order to avert existing information gaps particularly on prevailing fish prices and weather forecast information that affect the operations of chisense fishers as revealed in the study.

- Policies should be put in place by the Government that promote and encourage the participation of the more productive age groups particularly the youths in chisense fishing considering that the majority are elderly as revealed by this study.

- There is need to further investigate the seasonality of chisense fishing and its impact on the income for chisense fishers. This is critical considering that the results of this study showed that chisense fishers experience prolonged period of low chisense production.

- There is need to further investigate the efficacy of implementing the annual fishing ban for chisense fishers. The results of this study suggested that chisense fishers experience long periods of low chisense production as such implementation of the fishing ban for chisense fishers further perpetuates long periods of not catching fish. Rather, enforcement of regulations such as use of appropriate fishing gear and limiting the number of lights used
for fishing should be considered. This is critical in ensuring that the catch of chisense fishers and quantities sold are sufficient to cover costs incurred which would ultimately improve the profitability for chisense fishers.

- There is need to interrogate the high dropout rate of pupils in the study area and deliberately put in place a policy to promote adult literacy programmes given the low levels of education reported in this study.
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Appendix 1: Survey Instrument

SOCIO- ECONOMIC DETERMINANTS OF PROFITABILITY IN CHISENSE FISH TRADE AND ASSOCIATED CONSTRAINTS RESEARCH QUESTIONNAIRE

Dear respondent (Ethics statement),

I Evans Mutanuka holder of student ID 16100805 is conducting a survey on the socio-economic determinants of profitability in chisense fish trade and associated constraints as part of my MSc studies at the Copperbelt University. The survey is being used to collect data for my MSc thesis that is focused on determining the socio-economic determinants of profitability of chisense fishers and associated constraints in Nchelenge District. Data collected through this survey will only be used for research purposes and will help to come up with policy recommendations to improve benefits from chisense fish trade. We hope that you will be free to provide accurate information. Please feel free to ask any questions or raise any issues you might have. You can terminate this interview at any point should you wish so. I will share the findings of my study for your information and further action if need be. Thank you for your participation.

Date of Interview

Name of Enumerator

GPS coordinates

Estimated distance from main fish market or trading centre to fishing Village in Km _________________

<table>
<thead>
<tr>
<th>Country</th>
<th>Province</th>
<th>District</th>
<th>Stratum</th>
<th>Fishing Village</th>
</tr>
</thead>
</table>

77
SECTION 1: THIS SECTION FOCUSES ON THE SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENT

(1) What is your gender? (Use codes below) __________________

(2) What is your marital status? (Use codes below) _________________________

(3) What is your highest level of education? (Use codes below) ________________

<table>
<thead>
<tr>
<th>Codes for QUESTION 1</th>
<th>Codes for QUESTION 2</th>
<th>Codes for QUESTION 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = Male</td>
<td>1 = never married</td>
<td>00=None</td>
</tr>
<tr>
<td>2 = Female</td>
<td>2 = monogamously married</td>
<td>01=Sub-standard A; Grade 1</td>
</tr>
<tr>
<td>3 = polygamously married</td>
<td>01=Sub-standard B; Grade 1</td>
<td>08=Form 1</td>
</tr>
<tr>
<td>4 = divorced</td>
<td>02=Standard 1; Grade 2</td>
<td>09=Form 2</td>
</tr>
<tr>
<td>5 = widowed</td>
<td>03=Standard 2; Grade 3</td>
<td>11=Form 4</td>
</tr>
<tr>
<td>6 = separated</td>
<td>04=Standard 3; Grade 4</td>
<td>12=Form 5</td>
</tr>
<tr>
<td>7 = cohabiting</td>
<td>05=Standard 4; Grade 5</td>
<td>19= Master’s degree &amp; above</td>
</tr>
<tr>
<td>06=Standard 5; Grade 6</td>
<td>07=Standard 6; Grade 7</td>
<td>13= Form 6 Lower</td>
</tr>
<tr>
<td>14= Form 6 Upper</td>
<td>15= College Student</td>
<td>16=Undergraduate student</td>
</tr>
<tr>
<td>17=Certificate/Diploma</td>
<td>18= Bachelor’s Degree</td>
<td></td>
</tr>
</tbody>
</table>

(4) What is the size of your household? Number of Males_______________ Number of Females_______________

(5) For how long have you been involved in chisense fish trade (Experience level)? (Number of years or year started)____________________

(6) What is the monetary value of the capital you invested in the chisense fish business? (Amount in ZMK) ______________

(7) Do you belong to any fisher association? (0 = no, 1 =yes) ______________

(8) In which year were you born? __________________________

SECTION 2: THIS SECTION FOCUSES ON THE HIGH AND LOW PRODUCTION SEASONS

(9) Indicate the production levels of chisense during the reference period of **June 2017 to June 2018**
**Table 2.1 Chisense production levels**

<table>
<thead>
<tr>
<th>Codes for question 9:</th>
<th>None =0</th>
<th>Low= 1</th>
<th>Medium=2</th>
<th>High = 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 2017</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Aug 2017</td>
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<tr>
<td>Sept 2017</td>
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<td></td>
</tr>
<tr>
<td>Oct 2017</td>
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<tr>
<td>Nov 2017</td>
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<td></td>
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<td></td>
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<tr>
<td>Dec 2017</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Jan 2018</td>
<td></td>
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<tr>
<td>Feb 2018</td>
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<td></td>
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<td></td>
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<tr>
<td>March 2018</td>
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<td></td>
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<tr>
<td>April 2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June 2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SECTION 3: THIS SECTION FOCUSES ON THE GROSS MARGINS FOR CURRENT CHISENSE FISHING PERIOD** *(Please note that the questions in Table 2.2 below refer to information on your last fishing trip prior to this interview)* Please provide responses to the questions in the spaces provided in the table below.

**Table 2.2 Current Chisense fishing gross margins**

<table>
<thead>
<tr>
<th>S/N</th>
<th>Item</th>
<th>Quantity (Number of bowls or any other container)</th>
<th>Unit (Use codes below)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>What is the quantity of chisense you caught from your last fishing trip?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>What is the quantity of chisense you sold from your last fishing trip?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Where did you sell or where do you intend to sell your chisense from your last fishing trip (main chisense market)?</td>
<td>1= Locally(with village/district) 2=Outside the district</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>If chisense was sold locally, at what price did you sell the chisense from your last fishing trip?</td>
<td>Amount in ZMK per bowl</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>If Chisense was sold outside the district, at what price did you sell the chisense from your last fishing trip?</td>
<td>Amount in ZMK per bowl</td>
<td></td>
</tr>
</tbody>
</table>
15. If not all chisense caught was sold, what did you do with the chisense that was not sold?

- Home consumption = 1
- Pay off debt = 2
- Others specify = 3

16. How much fuel did you use during your last chisense fishing trip? *(indicate amount paid and quantity bought)*

<table>
<thead>
<tr>
<th>Fuel type</th>
<th>Amount (ZMK)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petrol (lts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil (ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paraffin (Bottles of 750ml)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

17. Do you own fishing equipment?

- No = 0 (go to question 19)
- Yes = 1 (go to question 18)
- Some equipment = (go to question 18 and 19)

18. What type of equipment (s) do you own?

- Engine = 1
- Boat = 2
- Chisense fishing net = 3
- Tilley Lamps = 4

19. If you hired or rented equipment, indicate how much you paid for each type of equipment on last fishing trip?

<table>
<thead>
<tr>
<th>Type of equipment</th>
<th>Amount Per Day</th>
<th>Amount Per week</th>
<th>Amount Per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

80
<table>
<thead>
<tr>
<th>Question</th>
<th>Response Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 How much did you spend on labour during your last chisense fishing trip? (Amount in ZMK)</td>
<td></td>
</tr>
<tr>
<td>21 What is the size of your crew?</td>
<td>Males___________  Females______________</td>
</tr>
<tr>
<td>22 Did you utilize any household family labour during your last chisense fishing trip?</td>
<td>No = 0  Yes = 1  (If “No” go to question 27)</td>
</tr>
<tr>
<td>23 Kindly indicate where family labour was utilized (Use codes: indicate all applicable categories)</td>
<td>1 = Fishing  2 = Processing  3 = Selling  (Trading)  4 = Processing and selling</td>
</tr>
<tr>
<td>24 Kindly indicate the relationship with the family member(s) who provided labour during your last chisense fishing trip? (Use codes: indicate all applicable categories)</td>
<td>1 = Spouse  2 = Child (own/step)  3 = Parent/Parent in-law  4 = Brother/sister  5 = Other relatives</td>
</tr>
<tr>
<td>25 Did you pay your family member(s) that were involved in providing labour during your last chisense fishing trip?</td>
<td>No = 0  Yes = 1  (If “No” go to question 26)</td>
</tr>
<tr>
<td>26 Kindly indicate how much you paid for family labour during last chisense fishing trip? (Amount in ZMK)</td>
<td></td>
</tr>
<tr>
<td>27 How much did you spend on mantles during your last fishing trip? (Amount in ZMK)</td>
<td></td>
</tr>
<tr>
<td>S/N</td>
<td>Item</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>28</td>
<td>How much did you spend on food during your last fishing trip? (Amount in ZMK)</td>
</tr>
<tr>
<td>29</td>
<td>How much did you spend on other repairs and accessories (nipples, glass, vaporizers etc.) during your last fishing trip? (Amount in ZMK)</td>
</tr>
<tr>
<td>30</td>
<td>What other costs did you incur during your last fishing trip? (Kindly specify type of costs and amount)</td>
</tr>
<tr>
<td></td>
<td>OTHER COSTS (specify)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>How many days did you fish in the last one (1) week?</td>
</tr>
</tbody>
</table>

**Codes for Question10 and 11(Measuring Unit)**

1 = Small Bowl  
2 = Medium Bowl  
3 = Large Bowl  
4 = Any other (Take weight)

**SECTION 4: THIS SECTION Focuses on Coping Strategies During Low Chisense Production Periods/Seasons** *(The questions in Table 2.3 refer to information during low chisense fish production periods)*

**Table 2.3 Coping strategies during low chisense fish production period**

| S/N | Item                                                                 |  |  |
|-----|----------------------------------------------------------------------|  |  |
| 32  | Do you continue to fish for chisense during low production periods? | No=0  
Yes=1  
(If “no” go to question 37) |  |  |
| 33  | Do you reduce or maintain the same operational costs during low production periods? | Reduce cost = 1  
Maintain same operational costs = 2 |  |  |
| 34  | In the event that you are unable to catch enough to recover costs, do you still pay for labour? | No = 0 (go to question 35)  
Yes = 1 (go to question 36) |  |  |
| 35  | If “no” what happens to the labour costs? | Forfeit (not pay) = 1  
Pay later = 2 |  |  |
| 36  | If “yes” how do you pay for labour? | Borrow = 1 |  |
From other savings = 2

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
</table>
| 37 Do you undertake any other income generating activity during low production periods? | No = 0 (go to question 39)  
Yes = 1 (go to question 38) |
| 38 If “yes” what income generating activities do you engage in during low production periods? (*specify*) |                   |
| 39 If “no” how do you earn income? (*specify*) |                   |

**SECTION 5: THIS SECTION FOCUSES ON YOUR OTHER SOURCES OF INCOME DURING THE PERIOD JUNE 2017 TO JUNE 2018**

**Table 2.4 Other sources of income**

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
</table>
| 40 Do you have any other sources of income?   | No = 0  
Yes = 1  
(If “No” go to section 6) |
| 41 Did you grow any crops?                    | No = 0  
Yes = 1  
(If “No” go to question 43) |
| 42 How much income was generate? (*Amount in ZMK*) |                   |
| 43 Did you sell any Livestock?                | No = 0  
Yes = 1  
(If “No” go to question 45) |
<p>| 44 How much income was generate? (<em>Amount in ZMK</em>) |                   |</p>
<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Answer</th>
<th></th>
</tr>
</thead>
</table>
| 45 | Did you engage in other type of fishing apart from chisense?              | No = 0  
Yes = 1  
(If “No” go to question 47) |   |
| 46 | How much income was generate? *(Amount in ZMK)*                          |                 |   |
| 47 | Did you receive any remittance?                                         | No = 0  
Yes = 1  
(If “No” go to question 49) |   |
| 48 | How much income was generate? *(Amount in ZMK)*                          |                 |   |
| 49 | Did you pay out any remittance?                                         | No = 0  
Yes = 1  
(If “No” go to question 51) |   |
| 50 | How much was paid out? *(Amount in ZMK)*                                |                 |   |
| 51 | Did you engage in any other form of business?                            | No = 0  
Yes = 1  
(If “No” go to question 53) |   |
| 52 | Specify type of business and how much income was generated?              | Type of business *(Amount in ZMK)* |   |

**SECTION 6:** THIS SECTION FOCUSES ON THE CONSTRAINTS YOU FACE IN CHISENSE FISH TRADE AND YOUR SUGGESTIONS ON HOW TO ADDRESS THE CONSTRAINTS. (Please complete the table below in terms of constraints associated with chisense fish trade and your suggested solutions. Kindly rank the constraints provided by respondent in the table below starting with the most severe constraint.)
(53) What are the five (5) major constraints that you experience in chisense Fishing and suggested solutions?

<table>
<thead>
<tr>
<th>Constraints</th>
<th>Suggested solutions (if any)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st CONSTRAINT</td>
<td></td>
</tr>
<tr>
<td>2nd CONSTRAINT</td>
<td></td>
</tr>
<tr>
<td>3rd CONSTRAINT</td>
<td></td>
</tr>
<tr>
<td>4th CONSTRAINT</td>
<td></td>
</tr>
<tr>
<td>5th CONSTRAINT</td>
<td></td>
</tr>
</tbody>
</table>

- END OF INTERVIEW THANK YOU FOR YOUR TIME -

Reference No. ________________________________