

**CONTRIBUTION OF SMALL SCALE FISH FARMING  
SUBSECTOR TO RURAL INCOME GENERATION  
IN THULAMELA MUNICIPALITY IN LIMPOPO  
PROVINCE, SOUTH AFRICA**

by

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DECLARATION

I MOATLADI JACOB PHOSA declare that this assessment entitled “Contribution of Small Scale Fish Farming sub-sector to Rural income generation in Thulamela Municipality - Limpopo Province, South Africa” is hereby submitted for the Master`s Degree in Development at the University of Limpopo, Turfloop Campus Graduate School of Leadership, has not been previously submitted at this or any other institution. It is my own effort in design and all materials contained therein have been acknowledged by means of complete references.

.....  
Signature

.....  
Date

## DEDICATION

I dedicate this work to both my beloved late parents, Mr Lazarus Phosa and Mrs Mary Phosa who took care of me from birth until their last moment on earth. May their souls rest in peace.

I also dedicate this work to my beloved wife, Milly and my two sons, Lebogang and Kamogelo for the support they gave me throughout this difficult journey.

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## ABSTRACT

The purpose of this study was to investigate the contribution of small-scale fish farming sub-sector to rural income generation in Thulamela Municipality in Limpopo Province, South Africa. The study applied a qualitative method to collect data from individual respondents of same characteristics using the semi-structured interview involving 15 small scale fish farmers. The findings from the study revealed that in terms of gender, more men were participating in the fish farming sector than women. About 73 percent of the total participants were men as compared to 27 percent of women participating in fish farming. In terms of age, a large proportion of farmers were men and women within the age range of 41-50 years and above 50 years who participated more actively in fish farming than other age groups. The results revealed some challenges and constraints characterised by theft of fish by community members, fish-eating birds or predators, poor access to funding, expensive fish feed, unavailability of fish feed, shortage of land, lack of proper infrastructure, and insufficient water supply during the drought period. As part of recommendations, some interventions should be developed to address the constraints and challenges revealed in the study. Small-scale fish farmers should be assisted to have access to proper infrastructure, boreholes to supplement available water during the dry season, fish feed, the agricultural market, land and other resources for fish farming.

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## CHAPTER ONE

### 1.1 Introduction

Ahmed & Toufique (2015:2305) indicate that fish farming in Mymensingh plays an important role in the local economy, contributing to food production, livelihood opportunities, income generation, poverty alleviation, and social transformation.

The above statement is an indication that in Bangladesh fish farming has made some advancement in improving the lives of the ordinary people.

In Africa, according to Britz, Hara, Weyl, Tapela and Rouhani (2015:1), the fishing sector is dominated by small-scale fisheries and provides income for over 10 million people engaged in fish production, processing and trade, and contributes to the food security of 200 million people. Small scale fish farming sector contributes positively towards improving rural livelihoods through income generation. Tapela, Britz and Rouhani (2015:24) point out that some people fish solely for subsistence and sell their surplus catch at R5 for fish the size of the palm whereas others sell at R10 for the bigger fish. Following this, the price has recently increased to R10 for both sizes of fish.

According to Hlophe (2015:10), tilapia fish species and catfish are commonly known in most African countries for improving rural livelihoods. These are the types of fish species that are available and easy to handle for rural people and this influences the momentum on fish farming activities. One strategic behaviour that has been found to be pervasive in rural Africa is income diversification (Onyeiwu & Liu, 2011:5). Hussein and Nelson (2016:10) emphasise that diversification may be important to maintain livelihoods by providing flexibility among sources of income, in case primary activities fail. Diversification of water use through integrated fish-crop farming could become an ideal way to generate income for rural people through the utilisation of available local resources. Thakur, Mohanty, Singh and Patil (2015:75) noted that additional income could be generated from fish culture in the small ponds and from the horticultural crops grown on the bunds. Lehane (2013:3) indicates that

diversification also increases overall land productivity, by utilising farm by-products as aquaculture feed and water from aquaculture sites as a means of irrigating crops. This type of farming may be ideal when practised on a small scale as secondary activity with fish raised in ponds and the rich water from those fish ponds used to irrigate crops to minimise input costs.

The study is about the investigation on the contribution of small-scale fish farming sub-sector to income generation in the Thulamela Municipality, Limpopo Province. The study objectives are to investigate the contribution of small-scale fish farming in order to generate income; to investigate which fish species contribute to income generation; and to make recommendations on how small-scale fish farming can contribute in income generation in the Thulamela Municipality in the Limpopo Province.

## 1.2 Research problem

The most pressing problem in Limpopo and many other predominantly rural provinces in the developing world is poverty (Musyoki, 2012:3). According to Musyoki (2012:3), the only source of income for many poor women is the meagre government grants they share with their extended families. Chitiga-Mabugu, Nhemachena, Karuaihe, Motala, Tsoanamatsie and Mashile (2013:4) observed that Limpopo (59%) and Eastern Cape (57%) reported the highest percentages of grant income recipients respectively, which implies that these two provinces have the highest levels of poverty.

Poor rural and urban communities often experience various challenges in their own unique settings including lack of income opportunities (Chitiga-Mabugu et al, 2013:3). According to Hossain (2012:36), the problem is that hungry people are trapped in severe poverty where they lack the money to buy enough food to nourish themselves. Sawada (2012:11) maintains that income generation activities targeting the poorest people could reduce rural poverty through new non-farm business entries and expansion of existing businesses in poverty-stricken areas. On-farm sources of income tend to be more important for the African countries, where the

share ranges from 59% to 78% of the total income (Davis, Winters, Carletto, Covarrubias, Quinones, Zezza, Stamoulis, Azzarri & Diguseppe, 2010:51).

Chitiga-Mabugu et al. (2013:5) indicate that there is a great need to provide income generating activities especially targeted to the poor rural and urban communities. According to Lehane (2013:3), aquaculture presents an opportunity to diversify income and protect against market fluctuations in the prices of agricultural products. Townsley (2013:72) emphasises that the role of aquaculture in poverty alleviation centres on the potential role of aquaculture as an activity that can be taken up by the poor to generate income and create employment. In view of the statements made by various authors, it is evident that the introduction of small scale fish farming especially in rural areas may become the ideal way to generate income.

### 1.3 Purpose of the study

The rationale for conducting the study was to investigate the contribution of small-scale fish farming sub-sector in generating income in the rural areas of Thulamela Municipality in the Limpopo Province. .

Britz (2015:624) highlights that fishing for livelihood purposes by poor communities remains a marginalised activity and is often portrayed as poaching. Furthermore, he indicates that fishing in rural areas was perceived as an illegal activity because rural people in the province were not exposed to the fishing activities as something that can contribute positively to their livelihoods. Limpopo is one of the landlocked provinces within South Africa with its inhabitants having no access to marine fishing activities. A study by Britz (2015) suggests that the development of inland fisheries policy needs to be realised in order to promote small-scale fish farming practices to enhance rural income generation. It further expatiates that the fish farming subsector has the potential to become a sustainable endeavour towards the remarkable contribution to improve rural livelihoods through income generation.

Britz (2015:265) further indicates that such a policy [Fisheries policy] should be based on a development-orientated, co-management approach, and should be aligned with existing national policies and legislation as well as the relevant

international agreements and conventions. The fish farming policy principles will provide guidance to affected communities so that they drive their own development initiatives.

It is on this basis that the study has to be undertaken in order to establish the role of small scale fish farming in generating income for rural communities of the Limpopo Province.

#### 1.4 Significance of the study

Martin, Lorenzen and Bunnefeld (2013:737) assert that fishing forms a greater proportion of income, employment and food security for the poor and is important in households with poor quality farm land. The statement above shows the significance of the small scale fish farming subsector to rural inhabitants and the benefits that fish farming can bring to them.

The final results of this study will benefit rural inhabitants by encouraging them to utilise available resources in an integrated manner which could bring significant change to uplift their living standards. Furthermore, the results of this study will also provide guidance to the policy makers in the Aquaculture Sector to take informed decisions on the mechanisms with which to support small scale fish farming in the Limpopo Province. The University of Limpopo will also benefit from this study through publishing the findings of this document to disseminate fish farming knowledge to its stakeholders.

#### 1.5 Aim of the study

The aim of the study is to investigate the contribution of small scale fish farming subsector for generating income in rural areas of Thulamela Municipality in Limpopo Province

#### 1.6 Research Objectives

- To determine the contribution of small scale fish farming for income generation in Thulamela Municipality Limpopo Province.

- To determine the fish species that contribute to income generation.
- To make recommendations on how small scale fish farming can contribute to income generation in Thulamela Municipality Limpopo Province.

## 1.7 Research questions

- How does small scale fish farming contribute in generating income in Thulamela Municipality?
- Which fish species are most preferred for income generation?
- What recommendations can be made on how small scale fish farming can contribute to income generation in Thulamela Municipality?

## 1.8 Definition of concepts

### 1.8.1 Small-Scale project

Sowman (2006:61) defines a small-scale project as an operation or operations that operate on low technology and is labour intensive.

### 1.8.2 Fish farming

According to Nguka, Shitole, Wakhungu and China (2017:11658), fish farming is the raising of fish commercially in the tanks or enclosures usually for food production.

### 1.8.3 Rural areas

Warren and Smalley (2014:5) describe rural areas as settlements that are largely accepted to be those in which population density is lower than a typical setting where access to basic services is often impeded by sometimes great distances.

### 1.8.4 Income

In this study, the concept income refers to the increase in purchasing power through the sale of a product (Kawarazuka & Be'ne', 2010:343).



## 1.8.5 Aquaculture

According to South African Department of Agriculture, Forestry and Fisheries (2017), aquaculture is the farming of aquatic organisms including fish, molluscs, crustaceans and plants in controlled or selected aquatic environments, with some form of intervention in the rearing process to enhance production such as regular stocking, feeding, protection from predators, etc.

## 1.9 Research methodology

### 1.9.1 Research design

According to Ma (2015:567), methodology can be defined as a general research paradigm that outlines how a research project is to be undertaken and, among other things, identifies the specific methods to be used. Edmonds and Kennedy (2013:3) define a research design as the actual structure or framework of investigations, conceived so as to obtain the answer to research questions or hypothesis. Maxwell (2013) defines a research design as a plan or protocol for carrying out or accomplishing a scientific experiment. This research design provides the researcher with the whole information on the plan to be executed for the data collection and analysis in the study.

The research paradigm for this study is anti-positivist. According to Ma, (2015:567), anti-positivists hold that social phenomena are multi-layered and deserve multiple interpretations. The study applies a qualitative method to collect data through the interviewing of individuals of same characteristics using semi-structured interview. The research study uses an exploratory research design by which the researcher visits individual participants with common characteristics to collect rich information or data to address the research questions.

The study applies a qualitative approach to conduct the research. The study applies a qualitative method to collect data through semi-structured interview as a research instrument. The research method was designed as an exploratory tool where the

researcher contacted individual participants with common characteristics to collect rich information or data.

The research design for this study is exploratory research design. This is so because it is the most appropriate method for this research where the researcher obtains first-hand information directly from the research participants through direct personal interview. This means that the exploratory method has an advantage on the study due to the fact that the researcher may use instruments such as tape recorder and video to capture information directly from the respondents which assist when analysing and interpreting the data necessary when the researcher writes the study report.

The exploratory research design is appropriate for this study because the researcher may also have access to a direct conversation with the participants to get more verbal follow-ups on research questions around issues that need more clarity.

### 1.9.2 Sampling

Gentles, Charles, Ploeg, and McKibbin (2015:1772) indicate that sampling refers to an act, process, or technique of selecting a representative part of a population for the purpose of determining parameters or characteristics of the whole population. The study will use purposive sampling method with a purpose to collect a homogenous sample. Anney (2014:277) describe purposive sampling as a technique mainly used in naturalistic inquiry studies, and defined it as selecting units (e.g. individuals, groups of individuals, or institutions) based on specific purposes associated with answering a research study's questions. This is the sampling technique that will enable a researcher to collect specific information for a specific purpose from the respondents with similar characteristics and have knowledge of a specific topic of the study.

Fifteen individual small scale fish farmers operating in the Thulamela Municipality will be interviewed using the semi-structured interview to obtain relevant information on the study topic.

### 1.9.3 Data collection

According to Ma (2015:567), qualitative data are the kind of information gathered in a non-numeric form. In this study, data will be collected through interview as a method to collect rich data. The researcher will capture data using instruments such as voice recorders that will assist when analysing.

### 1.9.4 Data analysis

Data will be collected and analysed through the thematic content analysis method where coding for categories such as events, description and behaviour will be applicable. The analysis of data will also be done by comparing codes looking for consistency, differences and patterns. Quantifiable data will be analysed using the NVIVO Software package.

### 1.9.5 Reliability, Validity and Objectivity

According to Zohrabi (2013:258), validity is concerned with whether the research is believable, true and that it evaluates what it is supposed to or purports to evaluate. The validity of the instruments which will be used to collect the information will firstly be used in a pre-test or pilot trial to test its performance. Zohrabi (2013:258) indicates that generally, researchers use different instruments to collect data, therefore the quality of these instruments is very critical because the conclusions researchers draw are based on the information they obtain using these instruments. In this instance, the reliability and validity of the same instrument will manifest itself when the same results are yielded during the repeat of the data collection process using the same instrument.

Rosendahl, Zanella, Rist and Weigelt (2016:26) state that research committed with 'strong objectivity' could objectively contribute more realistic elements to pro-poor governance than research based on neutral but weak objectivity. This study will apply fairness and impartiality that will generate research results that are valid.

### 1.9.6 Bias

According to Smith and Noble (2014:2), bias refers to an inclination or prejudice for or against one person or group, especially in a way considered to be unfair. The research work will not be biased but will remain impartial in order to achieve objective results.

### 1.9.7 Ethical considerations

According to Patel (2012:3) ethical consideration is the use and acknowledgement of morals, ethics, and principles on human subjects for all professions. The researcher will practice ethics in such a way to honour that all participants have the right of informed consent, the right to anonymity, the right to confidentiality and the right to discontinue taking part in the research. The study will observe all these ethical processes.

The study will consider the rights of the participants. This means that the participant's consent to participate in the research study will be respected. In other words, information collected from participants will remain secret and undisclosed to other people. The research study will also make sure that the source of the information remain anonymous in order to protect the participant's identity.

### 1.10 Conclusion

The research study investigates the contribution of small scale fish farming subsector for generating income in the rural areas of Thulamela Municipality - Limpopo Province.

The qualitative research method will be used in the research study through use of the semi-structured interview to collect primary data. Data will be captured by videos and tape recorders to enable the researcher to retrieve and analyse it with ease. Purposive sampling method with a purpose to collect homogenous data will be adopted for the selection of study participants. The researcher will have access to a

direct conversation with the participants in order to allow for verbal follow-ups on research questions around issues that will need more clarity. Fifteen individual small scale fish farmers operating in the Thulamela Municipality will be interviewed to obtain study information.

Data collected for the study will be analysed through the thematic content analysis method where coding for categories such as events, description and behaviour will be applied. This will also be augmented by comparing codes in search for consistency, differences and patterns in the data.

## CHAPTER TWO

### 2. LITERATURE REVIEW

#### 2.1 Introduction

The purpose of this chapter is to provide a review on the existing literature with regards to the performance and history of the small scale fish farming subsectors at the global, continental, country, provincial and municipal levels. This chapter further reviews the literature on existing small scale fish farming in Limpopo Province, specifically for income generation in Thulamela Municipality and other rural areas of the province.

Literature study further covers the review on the types of fish species cultured, production systems that are very effective for farmers to utilise for fish farming and the preferred types of fish species as well as their distribution. The challenges that small scale fish farmers experience that hamper the success of the subsector, the regulatory system, policies and frameworks that govern the sector are also evaluated.

#### 2.2 Introduction to Legislative Frameworks

According to Subasinghe, Soto and Jia (2009:5), aquaculture needs an enabling policy environment to grow in a sustainable manner and to be integrated into the

agro-ecosystems. Food and Agricultural Organisation (2014:71) indicates that in this instance, due to the fact that fish farming is a common practice in the developing countries, such countries need to develop proper regulatory frameworks to strengthen the sector.

The Department of Agriculture, Forestry and Fisheries (2013:7) indicates that a large number of laws and policies that presently apply to the sector involve different government authorities with uncoordinated legal frameworks and over-regulation which is currently hampering development of the sector. This means that for the fish farming or aquaculture sector to operate well in Limpopo Province, there should be harmonisation of different fragmented pieces of legislations with various government departments and consolidation to become reasonably sound legislations that can support the development of fish farming.

Hishamunda and Ridler (2006:411) assert that obtaining regulatory approval for fish farming has been judged “very difficult” by farmers of all species, and by far the most onerous hurdle. Ellender and Weyl (2014:12) indicate that Invasive Alien Species (IAS) are a recognised threat to South Africa’s biodiversity and their management is a high priority in national legislation such as National Environmental Management Biodiversity Act (Act 10 of 2004) and National Environmental Management (Act No. 107 of 1998). A *one stop shop* will be very much appropriate to deal effectively with applications for approval from different categories of farmers to speed up the process.

Hauck (2007:638) emphasises that government laws and policies are expected to secure sustainable development, and the use of natural resources at the same time should promote justifiable economic and social development. The sustainability of the small scale fish farming sub-sector is guided and promoted highly by regulatory frameworks that stipulate various regulations around the usage of natural resources. Like any other sector that exists to contribute to the economy of the country, the small scale fish farming subsector as well is being regulated in order to utilize its resources in a sustainable manner. Compliance forms a major part of success in all efforts that the sector applies in order to accomplish its objectives of generating income for sustainable livelihoods.

Future existence of the small scale fisheries subsector requires protection from the government in order to promote its sustainability in terms of resource use. Green, Gregory & Munro (2009:1) show the importance of legislation in indicating that fish farms in countries like Scotland are required by legislation to be registered, keep records of all live fish movements, and submit these records to the Fish Health Inspectorate”.

According to Britz et al. (2015:49), there are relevant national legislations such the National Water Act (NWA), National Environmental Management Act (NEMA) and the National Environmental Management and Biodiversity Act (NEMBA) which can be used to guide and protect the small scale fisheries subsector.

### 2.3 Southern African Development Community Protocol on Fisheries

According to the Southern African Development Community: Protocol on Fisheries (2001:2), SADC recognises the important role of fisheries in the social and economic well-being and livelihood of the people of the region, in ensuring food security and alleviating poverty. Therefore, to support national initiatives taken and international conventions for the sustainable use and protection of the living aquatic resources and aquatic environment of the region, SADC Member States signed the Protocol on Fisheries in 2001. In signing this Protocol the Member States agreed to harmonise their domestic legislation with particular reference to fisheries and the management of shared resources, to take adequate measures to optimize fisheries law enforcement resources and thus protect aquaculture and the aquatic environment and safeguard the livelihood of fishing communities.

The SADC Protocol on Fisheries (2001:8) indicate the objectives of the Protocol to promote responsible and sustainable use of the living aquatic resources in order to safeguard the livelihood of fishing communities and generate economic opportunities for nationals in the region.

## 2.4 Relevant Legislative Frameworks in South Africa

### 2.4.1 National Environmental Management Act (NEMA) (Act No. 107 of 1998) Notice 994 of 2013

The Environmental Impact Assessment guideline for aquaculture in South Africa: Notice 101 of 2013 within NEMA provides guidance on the environmental authorisation process for aquaculture activities. It also provides a generic framework of good environmental management practices in the sector. The implementation of this guideline assists with the creation of an environmentally responsible and more sustainable aquaculture industry. According to the Department of Environmental Affairs (2012:13), the guideline has been designed to provide a clear pathway towards better managing potential aquaculture impacts and to ensure that aquaculture development takes place within the environmental legal framework.

The Department of Agriculture, Forestry and Fisheries is recognised for the role that it has played in providing strategic direction for the development of the aquaculture industry, while the Department of Environmental Affairs is acknowledged for creating a platform through which a more sustainable aquaculture sector can be developed (DEA: 2012:6). (National Environmental Management Act (NEMA) (Act No. 107 of 1998)

### 2.4.2 Marine Living Resource Act (Act No. 18 of 1998)

The Marine Living Resource Act (Act No. 18 of 1998) indicates that in terms of fishing rights, no person shall undertake commercial fishing or subsistence fishing, engage in operating a fish processing establishment unless a right to undertake or engage in such an activity or to operate such an establishment has been granted to such a person by the Minister. On subsistence fishing, the Minister may, in order to achieve the objectives contemplated in section (2) of the Constitution, by notice in the *Gazette*:

- (a) establish areas or zones where subsistence fishers may fish; and
- (b) after consultation with the Forum, declare:
  - (i) a specified community to be a fishing community, from which



inhabitants may be declared to be subsistence fishers; or

(ii) any other person to be a subsistence fisher; or

(iii) any other fishing or related activity or the exercise of any other right in

that area or zone to be prohibited. No subsistence fishing permit shall be transferable except with the approval of and subject to the conditions determined by the Minister.

(Marine Living Resource Act (Act No. 18 of 1998).

#### 2.4.3 National Environmental Management: Biodiversity Act (Act No.10 of 2004)

The Act provides for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act, 1998; the protection of species and ecosystems that warrant national protection.

In addition to those activities defined in terms of section 1 of the Act as restricted activities, the following activities are hereby prescribed as restricted activities:

- (i) The release of a specimen of a listed invasive fresh-water fish species, or of a listed invasive fresh water invertebrate species into a discrete catchment system in which it already occurs.
- (ii) Catch and release of a specimen of a listed invasive fresh-water fish or listed invasive fresh-water invertebrate species.

According to the Threatened or Protected Species (2013) (TOPS), an aquaculture project involving a threatened or protected species of fish or shellfish would therefore require authorisation. Regulations (GNR. 388 of 16 April) regulate the permit application process. The permit system within the fish farming industry assists the government to regulate the types of fish species that are allowed to be farmed within the area of Limpopo Province and beyond. The limitation on the movement of fish species within and outside the province is very much essential to minimise the spread of non-native species, spread of fish disease and hybrid species. (National Environmental Management: Biodiversity Act (Act No.10 of 2004).

#### 2.4.4 National Water Act (Act No. 36 of 1998)

According to Department of Water Affairs and Forestry (2006:17), the sustainable use of water for aquaculture or fish farming should be through authorisations, registrations, regulations and other appropriate measures which could include the declaration of aquaculture as a controlled activity in terms of Section 38 of the National Water Act, 1998 (Act No. 36 of 1998). DWAF (2006:14) stresses that aquaculture should be correctly positioned and practiced according to the suitability of the water resource, any zoning implications, and the integration of the aquaculture activities with other uses of the same water resource. The sustainable use of water for aquaculture should be compatible both in space and time with other water uses and users; and must comply with public health and safety norms, standards and regulations.

It is a prerequisite for every water user including fish farmers in Limpopo Province to apply for the water rights from the Department of Water and Sanitation for aquaculture farming prior to execution of aquaculture or fish farming activities.

#### 2.4.5 Limpopo Environmental Management Act (Act No. 7 of 2003)

The Limpopo Environmental Management Act (Act No. 7 of 2003) stipulates that no person may without a permit, establish or operate aquaculture, place or release live aquatic biota in any aquatic system except aquatic biota released alive by the person who had caught it in the same waters where it had been inhabitant. The Act further indicate that no person shall import into, convey in the province, buy, sell, donate and receive as gifts, live fish. This legislation controls the operations of fish farming or aquaculture in Limpopo Province. (Limpopo Environmental Management Act (Act No. 7 of 2003).

#### 2.5 Global fish farming

According to Rabo, Zarmai, Jwanya and Dikwahal (2014:21), more than 120 million people throughout the world are estimated to depend on fish for all or part of their

income. FAO (2014:45) concurs with the statement by Rabo et al (2014) that millions of people around the world find a source of income and livelihood in the fisheries and aquaculture sector. Sowman (2006:60) affirms the statement by Rabo et al (2014) which shows that small-scale fish farming is the main income generator to improve the livelihoods of millions of people in Asia, Africa and Latin America. In support of this statement, Bondad-Reantaso and Prein (2009:3) point out that small-scale fish farming improves rural livelihoods and provides income opportunities to enhance the quality of life of rural poor communities. The statements above by different scholars confirm the contributions made by small scale fish farming income generation to improve livelihoods particularly in rural areas. This indicates that in most of the developing countries, small scale fish farming is considered as a direct contributor to the development of the local economy to provide people with income and employment opportunities.

According to Asif et al. (2015:290), aquaculture is a significant socio-economic activity, especially for rural communities, contributing to livelihoods, food security and poverty reduction through such mechanisms as income generation, employment and diversified farming practices. Bostock J, McAndrew B, Richards R, Jauncey K, Telfer T, Lorenzen K, Little D, Ross L, Handisyde N, Gatward I and Corner R. I. (2010:2897) emphasise that global fish farming has grown dramatically over the past 50 years to around 52.5 million tonnes in 2008 worth US\$98.5 billion and accounting for around 50 per cent of the world's fish food supply. This indicates that small scale fish farming plays a very significant role towards the building up of the world economy to uplift human livelihoods. The development and promotion of fish farming practices contribute positively towards generating income for the poor marginalised rural communities and as well support local and national economies. The Food and Agricultural Organisation of the United Nations (FAO) (2015:9) has implored that the role of small-scale fisheries in local economies and the links of the subsector to the wider economy needs to be recognised. Flores and Filho (2014:331) point out that familiar fish farming stands out for its strong social and economic appeal, because of its potential of income generation and diversification of rural establishments. Furthermore, FAO (2014:69) sees the sector as a significant source of foreign currency earnings, income generation, employment, food security and nutrition in many developing countries.

According to FAO (2014:36), fish farming is another option which has proved to be successful for some farmers in Siaya in Kenya to increase their sources of income and food security, diversifying their near subsistence livelihoods. The argument by Flores and Filho (2014:333) shows that several studies globally have demonstrated the feasibility of fish farming in generating income and nutritional quality of food. The statement by FAO (2014:1) also affirms that poor farmers in parts of Asia farm fish where it is traditional practice which they consume or sell to generate income. This is owed to the fact that selling fish for generating income is a very common practice at the level of small scale farmers to improve livelihoods.

Subasinghe, Soto & Jia (2009:4) noted that the importance of fish farming is to provide farmers with revenue obtained through the sale of their produce, creating employment and enhancing household's disposable income and its ability to purchase food. In relation to the statement by Subasinghe et al. (2009), Bene, Lawton and Allison (2010:934) substantiate the great contribution aquaculture has made to enhancing the income of farming households in Mymensingh. In increasing income, Ahmed & Toufique, (2014:11) indicate the way farmers have improved their income through increased profitability in fish production. According to Arthur et al. (2013:4), few isolated case studies evoke the possibility that income and employment created by aquaculture can benefit low-income households participating in specific, often rural, aquaculture activities in both Asia and Africa.

Many countries of the world have potential challenges in as far as poverty is concerned. In the developing countries, about 90% of the inhabitants reside in rural areas where poverty is prevalent. In addressing the situation above, Mwamfupe (2007:19) confirmed fishing as the primary means of livelihood for the majority of local people both in terms of the supply of food and as a source of income. This evidently shows that fish farming can be a means towards addressing income shortages among people in the impoverished countries.

According to van Helden (2015:41), the development of fish farming or aquaculture can result in job creation, economic development and the earning of foreign exchange to combat poverty, especially in developing countries. This is possible due

to the evidence that fish farming or aquaculture has become a fast growing subsector which generates income that could contribute positively in improving the rural livelihoods.

The increase in fish farming production has a positive contribution in the increase of income that uplifts the livelihoods of the people (Subasinghe et al., 2009:4). Kwasek K, Chea S, Tsatsaros J, Johnstone G and Phillips M (2015:4) critically point out that the small-scale aquaculture is prevalent in many countries in south-east Asia and has been championed by development institutions, governments and non-governmental organisations (NGOs) for its potential to alleviate poverty, enhance food security, diversify livelihoods, and promote economic development. The small scale fish farming sector may be the ideal way for governments to assist in establishing some relevant facilities to increase income. Subasinghe et al. (2009:2-3) concur with the statement by Kwasek et al. (2015) that fish farming with its continued growth which is largely based on small-scale operations, has the potential to contribute to the growth of national economies, while supporting the livelihoods of many communities.

Fish farming development at the global level has been viewed as a measure for improving food security and equally, to supplement income for rural farmers (Ibrahim U.I, Shamaki B.U, Lawal J.R, Grema H.A, Ibrahim A, Majama Y.B, Badau S.J and Kishi C.D , 2016:1). Jentoft and Eide (2011:11) recommended that fishing, fish processing and trading are sometimes the best or in some instances, indeed the only alternative source of income and employment for the disadvantaged people.

According to Phomsouvanh A, Saphakdy B and De Silva S.S (2015:29), culture-based fisheries is an extensive aquaculture practice seen as a low-cost strategy to increase food fish production, improve nutrition of rural households and provide a subsidiary income to these communities. Raghav S.K, Goel P.K, Muzammil K and Gupta H (2015:152) recognise fish farming as a powerful income and employment generator which stimulates growth of a number of subsidiary industries. Gogoi B, Kachari A, Dutta R, Darshan A and Das D.N (2015:327) affirm Raghav et al.'s (2015) view in recognising small scale fish farming as a powerful source of income and employment generator which stimulates growth for a number of subsidiary

industries and is a source of cheap and nutritious food besides being a foreign exchange earner. Vietnam encourages the conversion of poor rice land to fish ponds to improve farmer earnings, previously low-yielding rice fields to more profitable pond-based integrated agriculture-aquaculture systems (Edwards, 2015:8). Helfrich et al. (2009:8) pointed out that small-scale catfish farming in Virginia provides supplemental food and income for small and low income pond owners. This is self-evident that in many countries of the world, small scale fish farming has potential and does exist to provide income to improve the lives of rural poor people.

## 2.6 Fish farming in Africa

According to Mathew (2013:50), small-scale fisheries contribute significantly to foreign exchange revenue in many developing countries. A significant number of them depend on small-scale fisheries as a source of full-time, seasonal, part-time, or occasional income (Be´ne´ et al., 2010:934). It is also seen as a valuable provider of employment, cash income and foreign exchange, with developing countries contributing over 90% of the total global production.

Howard and Omlin (2007:67) further view fish farming as a favoured community activity in western Kenya today with new ponds being constructed and stocked as a way to relieve the pressure on catches from Lake Victoria and as a source of income and protein for people living in rural areas. According to Boto (2013:13), fish produced by aquaculture can be either kept for household consumption or sold for cash income”. Contrary to the statement by Howard and Omlin (2007), Rivera-Ferre (2009:305) supports the idea that poor people in Africa should maintain fish as food but not as goods for foreign exchange”. This idea stated by River-Ferre promotes nations to secure food first for their survival and acquisition of income as secondary want.

According to Islam, Al-Asif, Samad, Rahman, Rahman, Nima and Yeasmin, (2014:153), the fisheries sector play an important role as a source of income, employment, nutrition and foreign exchange earnings. “As fisheries is a relatively profitable income generating activity, women participating in it gain more control of the economic and social returns from it (Meetei, Saha, Pal & Pal, 2015:39)”.

“Many pond fish farmers in rural areas have taken fish farming activities as their secondary occupation and most of the people involved in fish farming have improved their socio-economic conditions through pond fish farming activities (Pravakar, Sarker, Rahman & Hossain, 2013 : 391)”. According to Roy, Mondal, Gupta & Dey, (2016:226) aquaculture can benefit the livelihoods of the poor through an improved food supply and/or through employment and increased income.

Sarwer, Ali, Bhowmik, Asadujjaman and Sharmin (2016:134) state that although the living conditions of the rural fish farmers are poor, their livelihood status has been found to be positive with indication that 94% of the farmers have improved their status through fish farming. Fish farming contributes positively towards improving rural livelihoods in Subarnachar, Noakhali, Bangladesh as revealed in a study conducted by Sarwer et al. (2016). According to Bene, Arthur, Norbury, Allison, Beveridge, Bush, Campling, Leschen, Little, Squires, Thilsted, Troell and Williams (2015:178), 90% of the house-holds living in Lower Medium Income Countries (LMICs) depend on fish-related activities for their income. Sarwer et al (2016:138) remarked that livelihood outcomes of fish farming and related activities are positive and most of the people have increased their income as a result. In Bangladesh, the positive contribution of fish farming manifests itself mostly in the rural area of Subarnachar Noakhali.

According to Musuka and Musonda (2013:299), small-holder aquaculture in Zambia contributes significantly to household food security through provision of cheap fish as food, nutrition (protein), income, diversification of rural livelihood and employment generation, thus stimulating the rural economy. This confirms the contributions made by the subsector which justifies that fish can be one of the major commodities to address the diverse issues within the rural poor communities in the developing countries. Solgaard and Yang (2011:1008) indicate that people belonging to higher income households are usually willing to pay extra money to buy farmed fish. This kind of contribution will really boost the small scale fish farming sector to increase its income. Musuka and Musonda (2013:301) further highlighted the importance of families in adopting small-holder aquaculture to improve rural households' income to

be able to pay school fees for their children with the disposable income from small scale fish farming. Therefore, small scale fish farming improves rural livelihoods by generating income that can provide cash for other household requirements. Jwatya (2010:10) indicated that aquaculture is often considered a source of animal protein for household consumption, with a high potential for cash income generation.

According to Nandi, Gunn, Adebaye and Barnabas (2014:427), small-scale fishing can generate significant profits and make meaningful contributions to poverty alleviation (income) and food security. Nandi, Gunn, Adebaye and Barnabas (2014:427-428) further confirm that small scale fish farming is an important income generating activity among households in the developing countries such as Nigeria where population has already exploded to significant statistical levels. In many poor families, fishing is a way of reducing their vulnerability to risks by supplementing and diversifying their incomes (Mishra, 2012:91).

The development of small scale aquaculture as articulated by Alda & Salia (2008:9) plays an important role in the socio-economic development of any country through provision of cheap and affordable fish that generate income to promote regional development. Muzari (2016:1) noted the opportunities that can be created by small-scale fish farming to the poorest, landless, food-insecure people and households by providing them with a critical and extraordinary source of income.

Fisheries management in Ethiopia has made a great contribution to the economy because it provides employment, food and income, making it possible to evaluate over-exploitation of the fisheries (Janko, 2014:465). Furthermore, Oluwemimo and Damilola (2013:2) signified the fact that fish farming in Nigeria has the potential to help expand the resource base for food production and reduce the pressure on conventional sources of fish which are harvested faster than they can be regenerated. These resources can in future generate significant employment and enhance the socio-economic status of the farmer to generate foreign exchange.

Fish in developing countries is commercialized mainly live or fresh soon after landing or harvesting, or it is processed using traditional preservation methods, such as salting, drying and smoking (FAO, 2014:43). Grema, Geidam and Egevu (2011:229)



appraised the involvement of farmers in small scale aquaculture projects which alleviate poverty and generate income. This confirms the role played by the small scale fish farming sub-sector in improving rural livelihoods.

Jimoh and Mohammed (2015:148) confirm the importance of small scale fish farming to the world at large and the role it plays in improving various countries' economies. Animashaun, Fakayode and Ayinde (2015:72) point out that aquaculture and farm-raised catfish have been identified as a growing source of income for farmers in Nigeria. This shows how the small scale fish farming in Nigeria became very popular and important for the local people so much so that it generated millions in revenue, particularly at the farm level. According to Sanusi and Mohammed (2014:298), the contribution of the sub-sector to GDP at 2010 current factor cost rose from N350 billion to N473 billion in 2014. Asa and Solomon (2015:1) show that catfish production indeed serves as a source of income in Nigeria by reducing the rate of unemployment in the country and increasing the country's Gross Domestic Product. This has further been confirmed by Ugwumba and Chuckwuji (2010:105) that in Nigeria, the small scale fish farming is profitable so much that the sector achieved the mean gross margin of N734, 850.39, mean net farm income of N712, 659.89 and net return on investment of 0.61 percent. Grema, Geidam and Egevu (2011:226) affirm that fish farming alone has the potential to supply the national requirement for fish and produce excesses for export generation to earn foreign exchange.

According to Martin, Lorenzen and Bunnefeld (2013:744), fish provides an instant source of cash for the purchase of food in subsistence or semi-subsistence livelihoods in comparison to the relatively long labour for rice and other arable crops. Martin, Lorenzen and Bunnefeld (2013:737) further indicate that fishing forms a greater proportion of income, employment and food security for the poor and is important in households with poor quality farm land.

Maina, Okaba, Mwangi and Waringa (2014:113) show that fish farming in Kenya was a preferred enterprise to diversify sources of income and improve the nutritional content of local diets. According to Ogundari and Ojo, (2008:43), the Oyo area in Nigeria has 120 fish farms with high potential for generating income and investment in aquaculture farms to ensure sustainable income generation.

According to Nagoli, Chiwaula and Chaweza (2013:14), aquaculture in Malawi contributes at least 10% of aquaculture households' income. Phiri, Dzanja, Kakota and Hara (2013:171) confirm that fish in Malawi acts as a source of income for the people, generating beach price local revenue of about MK2.6 billion (US\$24 million) annually, and contributes about 4% to the GDP. Furthermore, Nagoli, Valeta and Kapute (2013:15) proved that in Malawi fish production in small-scale fish ponds not integrated with agriculture was found to be about 800kg/ha/yr while in integrated aquaculture-agriculture farms, it yielded over 1800kg/ha/yr. In simple terms, this means that Malawi is doing more on small scale integrated aquaculture-agriculture than it is in fish farming alone without integrating with crops. According to Nagoli, Valeta and Kapute (2013:17), small-scale fishers mainly produce for their own consumption and for local markets, as such most of them remain poor and vulnerable to food insecurity.

The importance of small scale fish farming manifests itself in most of the African countries including Nigeria, Kenya, and Malawi for its significant role in sustaining rural livelihoods and alleviating poverty.

## 2.7 Fish farming in South Africa

The Department of Agriculture, Forestry and Fisheries in South Africa (2010) indicate that the most suitable areas for the production of freshwater fish species are in provinces such as Limpopo, Mpumalanga Lowveld and Northern KwaZulu–Natal. This is so because of the suitable climate and resources that prevail in these regions. Jwatya (2010:10) emphasises that even if the small scale fish farming in South Africa is immature, it has immense potential in enhancing the country's economy with a high potential for cash income generation.

Hara and Backeberg (2014:277) noted that in Africa, it is estimated that the fishing sector provides income for over 10 million people and contributes to the food security of over 200 million people. According to Be'ne', Hersoug and Allison (2010:326), many people see fish farming as an entry point for poverty reduction through its role

in generating revenue, creating employment, and its contribution to food security and the Millennium Development Goals.

According to Ellender, Weyl and Winker (2009:681), fish farming does not only provides food security opportunities but also contributes to income generation. For rural poor and food-insecure communities, small scale aquaculture has the potential for contributing towards improved food security, income and livelihoods (Isaacs & Hara, 2015:7). Okwukenye and Ikoyo-Eweto, (2016:2) support the above statement that the importance of fishes produced locally cannot be over emphasized because they generate income for the farmers, thus helping to reduce the poverty levels of the people. The fisheries sector provides food security in a number of developing countries through the nutritional benefits of fish and income generation for those in the fishing sector. Nkomo (2015:20) maintains that food security has been stabilised both through catching fish for direct consumption and selling them for income.

Essentially, fish farming in South Africa has a dual purpose, with one being of providing food to the needy and the other being that of providing income for the families to buy household requirements.

## 2.8 Fish farming in the Limpopo Province

According to Tshitangoni, Okorie and Francis (2010:2375), Limpopo Province is one of the nine provinces of the Republic of South Africa that is the second poorest after the Eastern Cape.

The Limpopo Province is bisected by the Tropic of Capricorn with hot weather during the summer months. The average temperature during the summer months can be about 27°C. The province has a summer rainfall with the northern and eastern areas being subtropical and characterised by hot and humid weather conditions coupled with mist in the mountains. The winter season is usually mild and mostly frost-free.

Despite Limpopo Province being a water-stressed area, the province is endowed with a number of resources including irrigation schemes which can support the

development of small-scale integrated fish-crop farming systems in rural areas to generate income. According to Mapedza, van Koppen, Sithole and Bourblanc (2015:2), the introduction of a new floppy irrigation system in Limpopo Province at the first five existing irrigation schemes such as Phetwane, Elandskraal, Mogalatsane, Kolokotela and Setlaboswane along the Olifants River within Greater Sekhukhune District Municipality has been regarded as an efficient irrigation technology usage that is hoped to provide a solution preserving water. A study by Moyo & Machethe (2016:168) concluded that irrigation enables communities to have reliable access to health, safe and nutritious food and also affords farmers additional income through sale of surplus produce including fish.

According to Basse, Thobejane and Atu (2012:129), gender roles feature prominently both at the stage of involvement and participation in the fisheries sector. Involvement includes employment and socio-economic gains.

The sector started to gain momentum during the early nineties after the new government took over from the old apartheid regime but lacked sufficient support from the new government and private sector due to its unique specialised technicalities. Since then, there has been a remarkable shift by government catching wild fish from large water bodies to feed the public, individuals and supporting group projects to promote small scale fish farming initiatives (aquaculture) in order to improve rural livelihoods through income generation. "Thus, for the aquaculture industry to continue to develop, sustainable substitutes to farmyard manure are a prerequisite (Hlope & Moyo, 2014:1246)."

According to Akinrotimi, Abu and Aranyo (2011:19), aquaculture practice as a business venture is capable of bringing significant development in both rural and urban areas by improving family income. Agbebi (2011:456) indicates that fish farming also generates income for all categories of people involved in it and alleviates poverty in the state by contributing to the national income. The greater proportion of the farmers in Limpopo Province operate at subsistence level to generate income to sustain their family lives. Therefore, fish farming is currently one of the areas that contribute positively towards building the local economy of the Limpopo Province.

Bhattacharyya, Reddy, Hasan, Adeyemi, Marye and Naika (2015:4115) pointed out that in many countries, fisheries are important sources of employment, income and foreign exchange. This confirms the reality that, in most of the developed and developing countries, fish farming is one of the priority areas within governments' plans to develop the economy.

## 2.9 Fish species

Limpopo Province is situated between the tropics within the Highveld regions of South Africa. The province has greater opportunities for warm-water fish species that tolerate water temperatures ranging between 18°Celsius and 28°Celsius. Fish have shown to be an important commodity in the Limpopo Province for income generation, food security and livelihood improvements of the rural population. Common freshwater fish species that are reared on a small scale in Limpopo only include catfish, tilapia and common carp.

Hlophe and Moyo (2014: 795-796) agree with the statement above by indicating that *Clariidae* catfishes [Catfish] are the second most important group of cultured fish in the world and feed on a wide range of artificial and natural food items, have high growth rates and tolerate poor water quality parameters.

DAFF (2014:25) indicates that freshwater aquaculture is experiencing a rapid expansion, owing in part to the government's multi-pronged aquaculture promotion campaign. DAFF (2014) further indicates that the total output of aquaculture is approximately 7 700 tons with an estimated value of about R0.7 billion. African aquaculture production is almost exclusively of finfish, primarily tilapias" (Boto, 2013:7). According to Gomna and Rana (2007:147), Tilapia species in Niger state were consumed with highest frequency (19 %), followed by *Synodontis* (14 %) and *Mormyrops* species (11 %). As compared to other fish species, it is evident that tilapia fish is a highly favoured and preferred fish species by the locals, especially in Nigeria. The statement above is indicative that Tilapia fish has been the most favoured species in the Niger State. The results of a study by Polycarp, Adebayo, Tafida and Amurtiya (2015:189) reveal that 66% of the fresh fish traded in the Yola North and Girei in Nigeria was catfish and 34% was fresh tilapia. While on the other

hand, 62% of fish processed and sold was catfish and 38% of the total processed fish was Tilapia.

In this case, both statements above by Gomna and Rana (2007) and Polycarp et al. (2015) justify the dominance of the two fish species, namely tilapia and catfish over other species. According to Hlophe, Moyo and Ncube (2013:5), it is increasingly important for an aquaculture species to be able to utilise carbohydrates, as more plant resources (high in carbohydrates) are used in aqua feeds. This is essential because utilisation of plant resources and materials as part of the composition in aqua-feeds ingredients promotes an economic gain in reducing input costs.

Grema, Geidam and Egwu (2011:227-228) confirmed that in Nigeria the principal fish species stocked are Catfish (*Clarias gariepinus*); Carp (*Cyprinus carpio*), *Heterobranchus bidorsalis*, *Gymnarchus niloticus* and Tilapia. Carballo et al. (2008) support the statement above that indeed, tilapia, catfish and common carp are the most commonly cultured fish species in the tropics.

As an economic activity, aquaculture is very important to rural communities, fish traders, and processors. "First, many successful fish farming ventures are small, family-run, "backyard-type" operations that produce a limited number of food fish for sale in local markets (Helfrich, Orth and Neves , 2009:1)". Tilapia is the most frequently purchased and favoured fish in countries such as South Africa and Kenya. Obiero, Opiyo, Munguti, Orina, Kyule, Yongo, Githukia and Charo-Karisa (2014:67) confirmed that over 60% of Kenyan consumers purchase fish mainly from open markets in fresh and fried form.

Bostock, McAndrew, Richards, Jaucey, Telfer, Lorenzen, Little, Ross, Handisyde, Gatward and Corner (2010:2898) emphasise the significance of fresh-water fish production which is dominated by the three fish species, namely carp, tilapia and catfish that benefit poor rural inhabitants. Throughout Africa, the above-mentioned three fish species are common within the small scale fish farming sub-sector.

According to Gomna and Rana (2007:147), in Niger state, Tilapia species were consumed with highest frequency (19%), followed by *Synodontis* (14%) and *Mormyrops* species (11%). It is with clear indication that this type of fish species is

preferred widely within the African continent and beyond. Gomna and Rana (2007:145) further confirm that a total of thirty-nine different fish species were consumed in 2007 in Nigeria, with *Tilapia* contributing 24% of the weight of the fish consumed. Figure 2.1 below depicts proportion of various fish species according to people`s preference in Lagos. Tilapia species have become more dominant at the level of 70% followed by *Clarias gariepinus* (catfish) at 21%, Common carp at 8% and Trout at 1% respectively. This is an indication that tilapia species are a highly preferred fish species in Nigeria and other African countries in general.

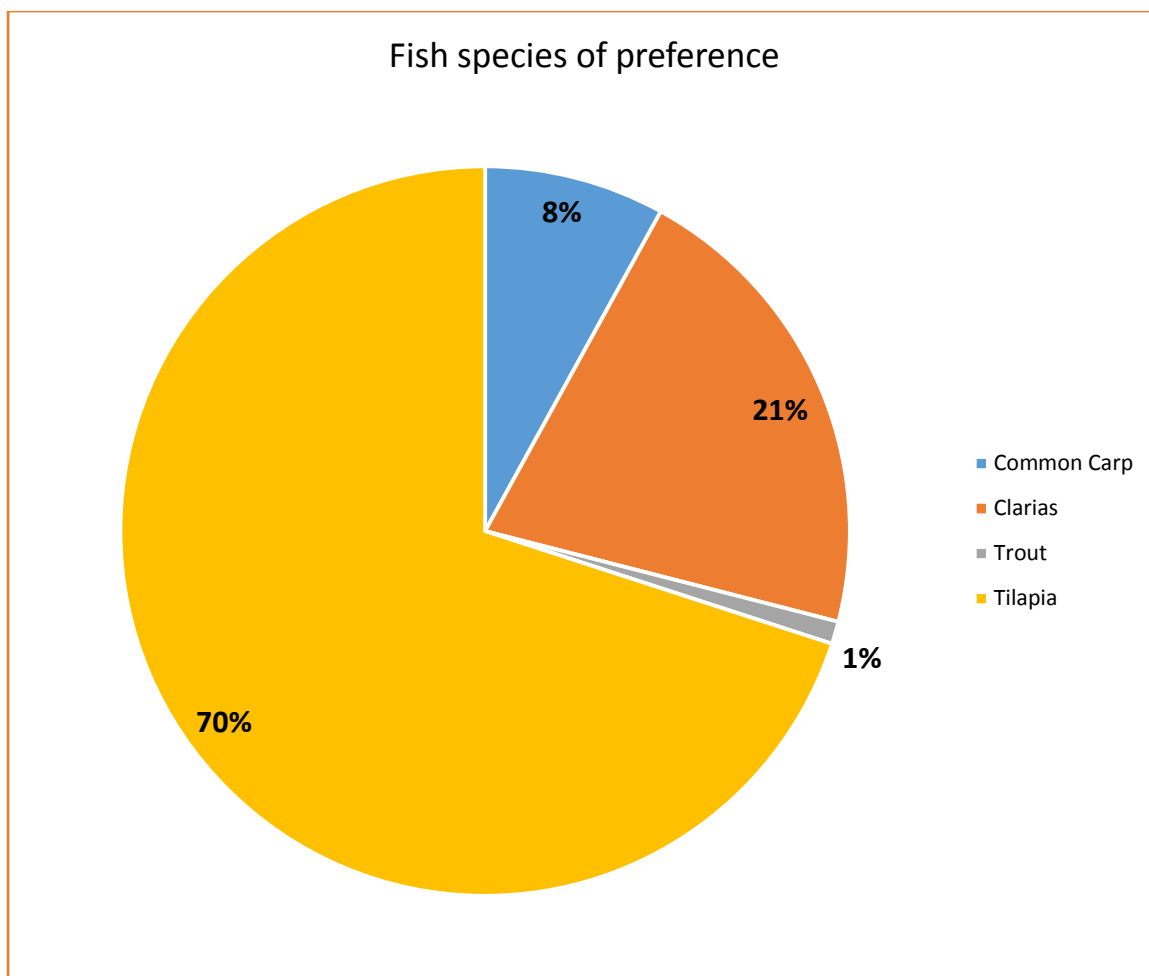


Figure 2.1: Aquaculture production by species of preference. *Source: (Munguti, Kim & Ogello: 2014:4)*

According to Munguti, Kim and Ogello (2014:4), aquaculture in most African countries has been executed in earthen and liner ponds.

“Although a large number of aquatic species were consumed, a few species dominated consumption with Tilapia being the most important (Gomna & Rana, 2007:152)”. Kassam (2014:4) pointed out that small scale fish farming has higher potential to impact poverty through indirect pathways such as economic multiplier effects, than directly through increasing the income and food security of poor fish farming households. According to Gomna and Rana (2007:151), the lower consumption rates of fish in Lagos State could be due to a large number of fishing households selling more of their fish catch to generate income in Lagos markets where prices are higher. The above happens because fish farmers in Nigeria have



become more business oriented than focusing on food security. They sell more fish at the market for generating income rather than ensuring food security especially at the household level. This means that more fish are being sold at the market place whereas less kept is for local consumption. Thus currently, the Nigerian economy is booming because of the participation of the small scale fish farming sector in the local economic development. The high consumption of tilapia in Nigeria has become a good signal to demonstrate that the people have a high preference for this type of fish species over others.

According to Martin et al. (2013:742), there has been great flexibility in the methods of selling fish, including direct sale to other households within a village, salesmen transporting fish to nearby villages, or transporting their catch to the closest market. This is an indication that the method of distributing fish in Nigeria is diverse so much so that more than one method is explored for fish distribution. More people were able to access fish without travelling long distances where they spend the money before giving it in as income to farmers. Table 2.1 by Martin et al. (2013:743) serves as a guide to depict proportions of fish consumed and sold by various categories of people ranging from rich, middle and poor for income generation. It further shows that the two categories namely “middle and rich” consume more fish but sell less due to the fact that they are well off in terms of money than the “poor” category. The third category eats less fish and sells more in order to generate income to obtain other required household needs as compared to other categories. More fish were sold within the poor category of people for generating income to access other basic needs

	Poor	Middle	Rich
Number of households fishing	55	111	44
Proportion of fish consumed (%)	59.51 (±13.26)	57.84 (±9.29)	75.23 (±13.12)
Proportion of fish sold (%)	34.36 (±12.83)	33.47 (±8.88)	17.59 (±11.57)
Mean number of household activities	5.04 (±0.36)	5.65 (±0.20)	6.57 (±0.33)

Table 2.1. Proportions of fish consumed vs cash income generation in Kenya. Source: (Martin et al, 2013:743).

Rai, Thilsted, Shrestha, Wahab and Gharti (2012:5) point out that all farmers in Terai, Nepal sold excess carp and prawn, and earned some income which helped them to be more empowered economically. Alda and Salia (2008:9) indicate that developing fish farming as a way of reducing the dependence on fish needs the government to play an important role through provision of income generation initiatives and promoting regional development. The government of Mozambique encourages people to do fish farming as a way to avoid capture fisheries in the oceans. This should help in the recovery of fish stocks in the ocean while also benefitting the small scale fish farming subsector to generate income from fish farming that boosts the country's economy. "Environmental limitation does not seem to be their major concern, because good yields which means good income is their main driving factor to extend and intensify common carp aquaculture (Carolina, 2015:113)". This implies that when people are eager to perform fish farming, they tend to ignore government legislations that regulate the industry to protect the natural resources for future generations.

## 2.10 Fish production systems

According to DAFF (2013:11), in South Africa the integrated use of ponds and irrigation ditches lined with bentonite clay has proven very popular as a simple way to farm fish. Kassam (2014:9) states that pond aquaculture in Ghana is the dominant production system in the southern and central belts accounting for over 98% of the farms and this is mainly small-scale and semi-intensive farming. Bene et al. (2015:184) confirms that in general, fish farming contributes to poverty reduction directly and indirectly by providing food, income and employment for both producers and other value chain actor households. According to Agbebi (2011:456), integrated fish farming can increase farm sustainability through construction of ponds which also serve as small-scale on-farm reservoirs and rice/fish culture as a component of integrated arrangement".

FAO (2014:82) points out that aquaculture also plays a role in food security through the significant production of some low-value freshwater species, which are mainly destined for domestic production, also through integrated farming. According to Alam

et al (2009:577), integrated farming with poultry, fish and crops can play a significant role in increasing manifold production, income, and nutrition and employment opportunities of rural populations. The integration of fish and crops enhances living standards by increasing and diversifying income. Studies done by Koide J, Fujimoto N, Oka N and Mostafa H (2015:3) have noted that there is greater farm output and income under rice-fish poly-culture when compared to rice monoculture.

Ugwumba C.O.A, Okoh R.N, Ike P.C, Nnabuife E.L.C and Orji E.C. (2010:1) indicate that in Nigeria, the highest net farm income of N1,156, 730.00 or \$7,462.77 was recorded by crop-livestock-fish partial integration which is closest to the full integration of crop-livestock-fish-processing-biogas. In support of the above statement, Nhan D.K, Phong Le.T, Verdegem M.J.C, Duong Le.T, Bosma R.H and Little D.C. (2006:446) state that in recognition of the potential of aquaculture since 1999, the Vietnamese government promoted diversification in agriculture, aiming to reduce the share of rice to the total agricultural output value while increasing the contribution of aquaculture to economic growth and poverty reduction. This confirms the achievements made through the integration of multiple commodities to generate income.

According to Muzari (2016:1741), the extensive, small-holder system is found in sub-Saharan Africa in rural or peri-urban areas with ponds of mostly between 100-200m in area. This simply means that small-holder fish farming system prevails in large proportions in most of the sub-Saharan countries to boost income generation. Munguti, Kim and Ogello (2014:6) explain that integrated fish farming has immense potential to address income instability, nutritional insecurity, unemployment, and poverty of farmers, not only in Kenya, but across East Africa. In terms of fish yield, Mishra et al. (2014:25) indicate that the system used in Eastern India has recorded a fish yield of as high as 1.693kg/ha with the integrated system of rice-fish which generate employment opportunity, increased income for farmers and provide nutritional security.

## 2.11 Challenges in the small scale fish farming sector in South Africa

### 2.11.1 Uncoordinated legislations

DAFF (2013:7) indicates that a large number of laws and policies presently applying to the sector involve different government authorities with uncoordinated legal frameworks and overregulation which is currently hampering the development of the sector. In South Africa, various government departments have a direct or indirect impact on the success of small scale fish farming. Some government departments such as the Departments of Water and Sanitation, Trade and Industry and the Department of Environmental Affairs and Tourism through their mandates provide support to aquaculture or fish farming development. Such support is manifested in the development of policies and legislations to support the fish farming subsector. Each department has its own mandate towards supporting the subsector, hence the existence of numerous policies and legislations. All these policies and legislations from various departments are fragmented without complementing each other for the benefit of the subsector. More effort should be made from various authorities to harmonise these legislations and laws to enhance fish farming.

The Department of Agriculture, Forestry and Fisheries (DAFF) is the custodian of fish farming activities at the national level and is responsible for the formulation of national policies and regulations that are implemented at the provincial levels. DAFF has the responsibility to harmonise all pieces of legislations formulated by various government departments such as Department of Environmental Affairs and Tourism (DEAT), Department of Water and Sanitation (DWS) as well as Department of Trade and Industry (DTI).

If the process of policy formulation is well coordinated, all the pieces of legislations will create an enabling environment at all the spheres of government for the provinces to operate under good conditions for fish farming or aquaculture. Harmonisation of all loose pieces of existing legislations and policies is highly

required towards the building and promotion of a sustainable and sound small-scale fish farming subsector.

### 2.11.2 Lack of support for small scale fish farming

Food and Agricultural Organisation (2015:1) indicate that small-scale fishing communities are commonly located in remote areas and tend to have limited or disadvantaged access to the markets. According to Heck, Be´ne´ & Reyes-Gaskin, (2007:5), over 10 million people engaged in fisheries in Africa are resource poor rural dwellers, usually unskilled and with limited financial or other assets. A high percentage of the population lives within the poverty trap in the rural countryside where the small scale fish farming sector is always regarded as fast growing sector that can contribute to income generation. FAO (2007) highlights that there are factors such as the novelty of fish farming, the general poor economic conditions in many countries and the relative paucity of entrepreneurial skills, and limited credit facilities that hamper the development of the sub-sector. The above concerns are some of the requirements that the small scale fish farmers lack in order to generate income to improve rural livelihoods.

Despite technical advances and innovations, many countries, especially those with less-developed economies, still lack adequate infrastructure and services, which can affect the quality of fishery products, contributing to their loss or difficulty in marketing” (Food and Agricultural Organisation, 2014:71). In support of the above statement, Janko (2007:6) indicates that the major challenges confronting all fish farmers is lack of access to credit and high costs of inputs such as feed and fingerlings. Small scale fish farming initiatives in South Africa and Limpopo Province in particular, lack major relevant support including credit, infrastructure for the production and marketing of the products. The fish farming sub-sector requires massive monetary and technical support injection from both the public and private sectors to contribute to rural income generation. This will have a positive impact on the livelihoods of South Africa’s rural communities. In this regard, the role of the government is key in supporting the development of small-scale fish farming or aquaculture for the benefit of the rural communities in the country.

## 2.12 Conclusion

The literature review presented in this chapter highlighted the fish farming dynamics at the global, continental, national, and local levels. It shows the manner in which fish farming or aquaculture operates by depicting that fish farming plays a major role in contributing towards the improvement of livelihoods especially in the rural areas.

In terms of legislations and the requisite support to the subsector, there are some gaps that exist within the sector that need to be addressed in order to enhance the momentum with which aquaculture, particularly fish farming is growing. Furthermore, there is a need to address challenges that cause uncertainties and create delays in growing the fish farming subsector to contribute to income generation among fishing communities.

## CHAPTER THREE

### 3. RESEARCH DESIGN AND METHODOLOGIES

#### 3.1 Introduction

The purpose of this chapter is to present the research design and methodology that was used to collect and analyse data for the study in investigating the contribution of small-scale fish farming in rural income generation. This chapter deals with the research methods and techniques that the study used to collect information or data from the research respondents. This chapter further describes the research design, methods of data collection, population, the processes of sampling the target population, methods of data analysis and ethical considerations.

#### 3.2 Research design

Edmonds and Kennedy (2013:3) define research design as the actual structure or framework of investigations, conceived so as to obtain the answer to research questions or hypothesis. Maxwell (2013) on the other hand defines research design as a plan or protocol for carrying out or accomplishing a scientific experiment. Both definitions complement each other in laying down the foundation of the research design for this study. The research design for this study was exploratory.

##### 3.2.1 What is exploratory research design?

Hair, Celsi, Money, Samonel and Page (2011:147) define exploratory research design as a design that is meant to discover new relationships, patterns and themes to address research questions. A definition by Mooi and Sarstedf (2011:13) views exploratory research design as a research method that is used to explore or

investigate a problem or a situation. This statement complements the definition by Hair et al. (2011).

Exploratory research design was chosen for this research study because it allows the researcher to obtain first-hand information directly from the research respondents through the semi-structured interview. This research design was appropriate for this study because the researcher had access to a direct conversation with respondents to get verbal follow-ups on research questions around issues that needed more clarity.

### 3.2.2 Advantages of exploratory research design

According to Hair, Celsi, Money, Samonel and Page (2011:147):

- (i) Exploratory research design is used to gather more data when the researcher has little information for the study.
- (ii) The exploratory research design is meant to discover new relationships, patterns, themes and ideas but is not intended to test specific research hypothesis.
- (iii) The exploratory research method enables the researcher to use instruments such as tape recorder to capture information directly from the respondents which assists during the analysis and interpretation of the data and report writing.
- (vi) The exploratory method provides the researcher with the extensive information on the plan to be executed for data collection and analysis in the study. Hair et al. (2011:275) further explain that qualitative research is discovery-oriented where analysts use primary data to generate ideas and also apply theories based on inductive reasoning.

### 3.2.3 Disadvantages of exploratory research design

According to Hair et al. (2011:275), the following aspects of exploratory research are its main demerits:

- (i) Exploratory research design does not often provide answers to the research questions.



(ii) Exploratory research design does not become conclusive, which may lead to improper decisions.

### 3.3 Research approach

Henink, Hutter and Bailey (2011:08) define qualitative research approach as the approach that allows the researcher to examine people's experiences in detail by using a specific set of research methods such as in-depth interviews, focus group discussions, observation, contents analysis, visual methods and life histories or biographies. According to Baarda (2014:22), the qualitative research approach refers to an approach which is primarily about gaining new insights and less about numerically proven facts.

In this study, the qualitative research approach was applied using the semi-structured interview as an instrument to collect data from the respondents. There are identified advantages and disadvantages of using the qualitative research approach. Some of the advantages include the following:

#### 3.3.1 Advantages of qualitative research approach

According to Mack, Woodsong, MaCQueen, Guest and Namey (2005):

- (i) Qualitative research approach allows the researcher the flexibility to probe initial participants' responses, that is; to ask why or how aspects of the responses, enabling coverage of issues in great depth and detail.
- (ii) Qualitative research approach uses open-ended questions with probing that gives participants the opportunity to respond in their own words.
- (iii) Qualitative research approach is typically more flexible by allowing greater spontaneity and adaptation of the interaction between the researcher and the study participant, thereby giving participants the opportunity to respond more elaborately and in greater detail. Therefore, this research approach covers issues in great depth and detail.

#### 3.3.2 Disadvantages of qualitative research approach

Mack et al. (2005) indicate that:

- (i) The replicability of using qualitative approach is very much difficult to do.
- (ii) Researcher bias is built in and unavoidable when using the qualitative approach
- (iii) The in-depth comprehensive approach to data gathering is limit in scope.
- (vi) Qualitative approach is labour intensive and expensive whereas its flexibility also leads to procedural problems.

### 3.4 Research population

Ritchie and Lewis (2003:87) define research population as people who by virtue of their proximity to the research question, are able to provide the richest and most relevant information. By contrast Denscombe (2014:21), refers research population to all items in the category of things that are being researched. Crossman (2016), in support of the statement by Denscombe (2014) views research population as the set of objects to be studied. According to Lim and Ting (2012:2), research population refers to a complete group that shares a common set of characteristics such as those of homosexuals and metrosexuals. All statements shown above complement each other with regard to the definition of the research population.

The total research population for the study was thirty individual small scale fish farmers who operate within the Thulamela Municipality in Vhembe District. A sample population of fifteen small-scale fish farmers was purposively selected and interviewed to collect primary data from the respondents.

### 3.5 Sample size

Daniel (2012:1) defines sampling as the selection of a subset of a target population for inclusion in a study. He further explains that if the sample could be done properly, it can save money, time and effort while providing valid, reliable and useful results. According to Lim and Ting (2012:2), sampling refers to a means of gathering useful information about a population.

The study took a sample size of fifteen individual small-scale fish farmers from the total research population of thirty farmers. Daniel (2012:56) shows that the larger the

population, the more favourable it is to choose a sample and the smaller the population, the more favourable it is to take a census. Due to the fact that the total population of small scale fish farmers was small, the study selected a sample of fifteen small-scale fish farmers and interviewed them to collect primary data.

### 3.5.1 Sampling technique

Purposive sampling method was used to collect homogeneous data from individual small scale fish farmers with same characteristics in various villages within the study area in the Thulamela Municipality. Dudovskiy (2016) views purposive sampling as a judgemental, selective or subjective sampling technique in which the researcher relies on his or her own judgement when choosing members of the target population to participate in the study. Crossman (2016) defines purposive sampling as non-probability procedure that is selected based on characteristics of a particular population in relation to the objective of the study.

### 3.5.2 Advantages of purposive sampling

According to Dudovskiy (2016):

- (i) Purposive sampling enables the researchers to identify and locate the population of interest with the same characteristics.
1. (ii) Purposive sampling method also enables the researcher to solicit persons with specific characteristics to participate in a study.
2. (iii) Purposive sampling methods are most cost effective and time-effective.
3. (vi) Purposive sampling methods are the only appropriate methods available if there are only a limited number of primary data sources that can contribute to the study and are also effective in exploring anthropological situations.

### 3.5.3 Disadvantages of purposive sampling

Johnson and Christensen (2012:231) show that purposive sampling methods have the limited ability to generalise findings from a sample to the entire population on the basis of a single study.

According to Dudovskiy (2016):

- (i) The purposive sampling method is vulnerable to errors in judgement by the researcher.
- (ii) The method has a low level of reliability.
- (iii)The method has a high level of bias and
- (vi)The researcher may not be able to generalise research findings.

Based on the strengths of the purposive sampling procedure, this sampling method was used effectively to identify respondents with homogeneous characteristics.

### 3.6 Data collection

Altinay, Paraskevas and Jang (2016:168) refer to data collection as a systematic way of collecting data through asking questions and carefully listening and recording data. The study used the semi-structured interview as the instrument with which to collect primary research data. The semi-structured interview is a data collection instrument which provides the researcher with the opportunity to explore issues with the respondents in depth. Similarly Boyce and Neale (2006:3) define in-depth interview as a qualitative research technique that involves conducting intensive individual interviews with a small number of respondents to search for and discover information on a particular idea or situation. According to Boyce and Neale (2006) the face to face semi-structured interview provides much more detailed information in a more relaxed atmosphere for respondents as opposed to other data collection methods such as the survey method. The study was conducted using semi-structured interviews where individual respondents were visited to capture data using videos and tape recorders.

### 3.7 Data analysis

Vaismoradi, Turunen and Bondas (2013:400) describe content analysis as a systematic coding and categorizing approach used for exploring large amounts of textual information unobtrusively to determine trends and patterns of words used, their frequency, relationships, structures and discourses of communication. In this study, data analysis followed a qualitative research analysis approach for data

obtained through the semi-structured interview. Data were analysed using the content analysis method of coding for categories such as events, description and behaviour of the respondents. According to Flick (2014:11), the major step in data analysing is to code the data in order to allow the grouping of several elements under one concept to limit the number of codes or categories. Data analysis in this study was done by comparing codes involving the search for consistency, differences and patterns. NVIVO Software Package was used to analyse data.

### 3.8 Validity

Johnson and Christensen (2012:146) define validity as the accuracy of the inferences, interpretations or actions made on the basis of test scores. According to Altinay L, Paraskevas A and Jang S., (2016), validity refers to the extent to which the data collection method accurately measures what it is intended to measure and the extent to which research findings are really about what they profess to be. Aparasu (2012:6) expressed validity as the way of ensuring that the instrument developed for measurement purposes truly represents the underlying construct. A pilot study was conducted to check the validity of the instrument.

### 3.9 Reliability

According to Pickard (2013:22), reliability is concerned with stability of the research findings over time and across locations. Olsen (2012) concurs with the above statement that reliability means that a study's findings would be the same even if it had been conducted by a different researcher more than once. To ensure the reliability of the research results, the research instrument has to be tested more than once where the results have to be found significantly similar.

### 3.10 Ethical considerations

Hammersley and Traianoy (2012:16) define ethics as a set of principles that embody or exemplify what is good or right, or allow us to identify what is bad or wrong. According to Shamoo and Resnik (2009:14), ethics refer to standards of conduct that distinguish between right and wrong, good and bad. The two statements above complement each other on the meaning of ethics towards research studies.

### 3.11 Informed consent

Gijjar (2013:12) defines informed consent as the process which ensures that individuals voluntarily participate in the research with full knowledge of relevant risks and benefits. Prior to the commencement of the study, all respondents were consulted and made aware of the circumstances with regard to the informed-consent rule. This procedure was followed in order to ensure the respondent's agreement to the rules.

### 3.12 Anonymity and confidentiality

#### 3.12.1 Anonymity

The consideration of mechanisms to protect the identity of research respondents is central to the design and practice of ethical research (Grinyer 2009:49). Anonymity within the study is very much significant in order to hide the informant's identity. The researcher provided a unique identity number to every research participant in order to protect their real names and identities. This ensured that the source of information was kept anonymous in order to protect the respondent's identity.

#### 3.12.2 Confidentiality

Johnson and Christensen (2012:116) define confidentiality as the means to hide the respondent's identity not to be revealed to anyone other than the researcher and his or her staff. During data collection, confidentiality was observed at all times and maintained in a way that ensured that the identities of the research respondents were withheld from being known by other people.

### 3.13 Limitations of the study

There were limitations that were identified in the study so that it could be completed within the context of available resources, time and funds. The following were identified as limitations of the study:

- (i) The collection of data was confined within 10 villages within the Thulamela Municipality which represented the whole research population.

(ii) Only fully operational rural fish farmers comprising both men and women. This yielded 15 respondents who were considered from a study population of 30 fish farmers.

(iii) The collection of data for the study concentrated mainly on the rural fish farmers with homogeneous characteristics in fish farming regardless of their gender.

### 3.14 Conclusion

This chapter presented research methods and techniques that were used to collect data to determine the contribution of the small-scale fish farming subsector in income generation in the Thulamela Municipality. Data collected for this study were used to address the research questions formulated for the research study. Data collection methods, techniques and instruments included the semi-structured interview within the qualitative research approach. During data collection process, information was captured using videos and tape recorders.

## CHAPTER FOUR

### 4. PRESENTATION OF THE FINDINGS

#### 4.1 Introduction

The purpose of this research is to provide answers to research questions in relation to the research conducted. The target population of this research study composed of 15 respondents of which 4 were female farmers and 11 were male farmers from the Thulamela Municipality in the Vhembe District of Limpopo Province. The target population was successfully selected purposively in order to obtain in-depth information.

Data were collected through the semi-structured interview and was captured with the aid of a tape recorder. Data collection process was done through the local Agricultural Extension officer who organised the chosen farmers to be available for data collection. The respondents were asked some questions regarding the three core objectives of the study. The first objective was to investigate the contribution of small scale fish farming in order to generate income. The second objective was to find out which fish species contributed to income generation. The third objective was to make recommendations on how small scale fish farming can contribute to income generation. A number of questions were developed to allow the respondents to answer accordingly.

#### 4.2 Presentation of results

The questions were presented during the interviews to 15 small scale fish farmers comprising 11 males and 4 females.

#### 4.3. Results and discussions



Data obtained from the interview with the respondents was analysed and interpreted qualitatively. The results are hereby demonstrated using charts and tables.

#### 4.4. Demographic data

The demographic information of the respondents in the study is very important. In this study, the demographic information indicates the variety of respondents and the way the responses were influenced by the demographic dynamics. During the data collection process, the researcher asked demographic information such as age group and gender. The following are the responses in connection with the demographic information.

#### 4.5 Age group

Table 4.1 below shows the results of the investigation concerning the age group of the 15 research respondents. Of the 15 respondents, zero (0%) or no respondent was within the age range of 18 to 30 years. Only three (20%) respondents were within the age range of 30 to 40 years. There were seven (47%) respondents within the age range of 41 to 50 years whereas five (33%) were within the age range of 50+ years and above.

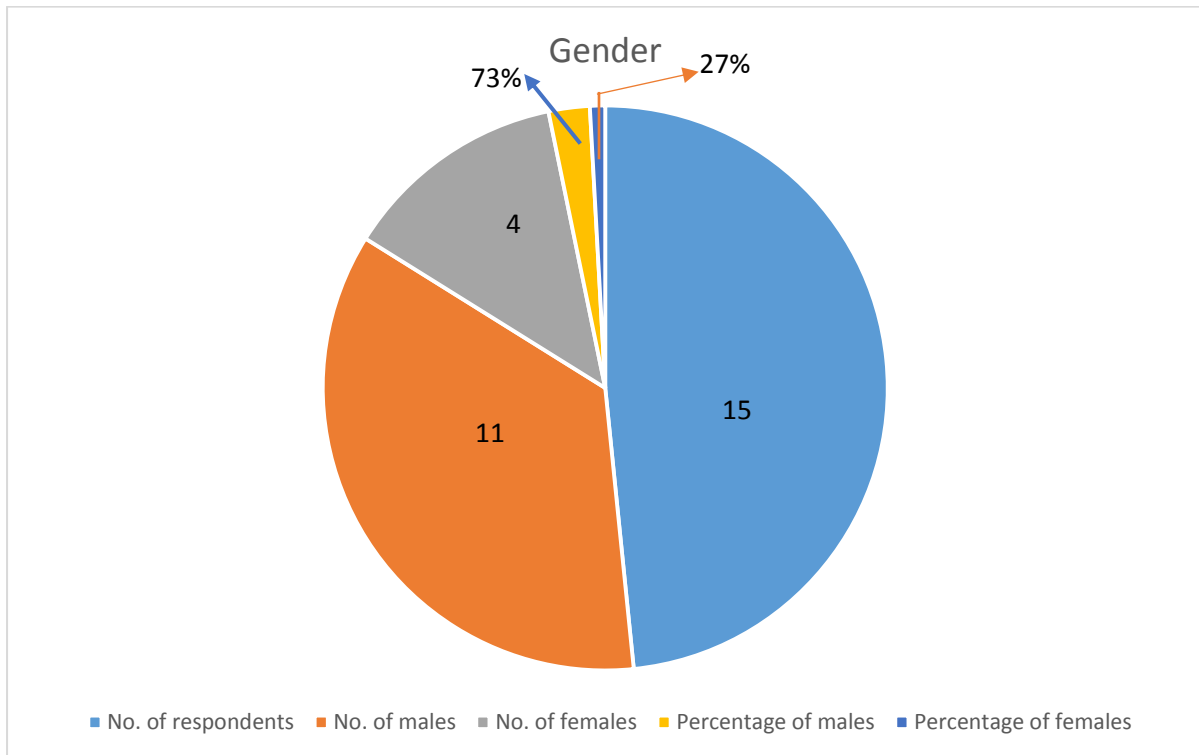
**Table 4.1: Age group of respondents**

<b>AGE RANGE OF PARTICIPANTS</b>	<b>NUMBER OF RESPONDENTS</b>	<b>PERCENTAGES</b>
18-30 years	0	0%
30-40 years	3	20%
41-50 years	7	47%
50+ years	5	33%
<b>TOTAL</b>	<b>15</b>	<b>100%</b>

#### 4.6. Gender

The results of the investigation with regard to the gender of the 15 research respondents are illustrated in Figure 4.1 below. Of the 15 research respondents,

eleven 11 were males and four were females. In terms of percentage, males were 73% whereas females were 27% from the total number of fifteen respondents. This is a clear indication that more men participated in fish farming than women.



**Figure 4.1: Representation of participants by gender**

The results of objective 1 of the interview, which was to determine the contribution of small scale fish farming for income generation in the Thulamela Municipality in the Limpopo Province are presented in tabular forms in the section that follows:

**Question 1: What is the name of your business?**

**Table 4.2: Names of the business of respondents**

Respondent No.	Response from the respondents for question 1.
1.	<ul style="list-style-type: none"> <li>(A) fishery</li> </ul>
2.	<ul style="list-style-type: none"> <li>(B) fish farming</li> </ul>
3.	<ul style="list-style-type: none"> <li>(C) fish farming</li> </ul>
4.	<ul style="list-style-type: none"> <li>(D) fishery</li> </ul>
5.	<ul style="list-style-type: none"> <li>(E) fishery project</li> </ul>

6.	<ul style="list-style-type: none"> <li>• (F) fish farming</li> </ul>
7.	<ul style="list-style-type: none"> <li>• (G) agricultural Cooperative</li> </ul>
8.	<ul style="list-style-type: none"> <li>• (H) fishery</li> </ul>
9.	<ul style="list-style-type: none"> <li>• (I) aquaculture-Agriculture cooperative</li> </ul>
10.	<ul style="list-style-type: none"> <li>• (J) fishery</li> </ul>
11.	<ul style="list-style-type: none"> <li>• (K) aquaculture farming</li> </ul>
12.	<ul style="list-style-type: none"> <li>• (L) fishery</li> </ul>
13.	<ul style="list-style-type: none"> <li>• (M) fishery</li> </ul>
14.	<ul style="list-style-type: none"> <li>• (N ) business Enterprise</li> </ul>
15.	<ul style="list-style-type: none"> <li>• (O) fish farming</li> </ul>

Fifteen (100%) respondents indicated the names of their businesses mainly in fish farming. Each name of a business was given a Code to identify it. Table 4.2 indicates the codes of the respondents.

#### Question 2: How was it established?

**Table 4.3: How the fish farming businesses was established.**

Respondent No.	Response from the respondents for question 2.
1.	<ul style="list-style-type: none"> <li>• I started with one pond and some fingerlings I bought from a certain fish farmer</li> </ul>
2.	<ul style="list-style-type: none"> <li>• I got inspired by respondent number 1 and started fish farming together with cash crops</li> </ul>
3.	<ul style="list-style-type: none"> <li>• I inherited from my father</li> </ul>
4.	<ul style="list-style-type: none"> <li>• I was inspired by fish farmers using aqua-dams and built 5 fish ponds</li> </ul>
5.	<ul style="list-style-type: none"> <li>• I have built one big pond for irrigation and later turned it for fish farming</li> </ul>
6.	<ul style="list-style-type: none"> <li>• I caught fingerlings from the river and put them in a pond and they multiplied</li> </ul>
7.	<ul style="list-style-type: none"> <li>• I started fish farming with 11 men and 11 women as a co-operative</li> </ul>
8.	<ul style="list-style-type: none"> <li>• I have built the fish pond and stocked some fingerlings</li> </ul>

9.	<ul style="list-style-type: none"> <li>• <i>I built one pond, bought 100 fingerlings and stocked them in a pond and they multiplied</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>I have built one pond and stocked the fish</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>I have built some ponds and bought fingerlings from existing fish farmers</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>I have built small ponds and stocked fingerlings</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>I started with one pond</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>I have built two fish ponds and stocked them with fingerlings</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>I started with one fish pond</i></li> </ul>

The manner in which the businesses were established is very much significant. Eleven (73%) respondents indicated that they started with the digging of fish ponds on their own and stocked some fingerlings. Table 4.3 indicates the responses from the respondents on how their businesses were established. Two (13%) respondents indicated that they were inspired by visiting some existing fish farmers operating within their areas whereas one (7%) respondent inherited the fish farming activities from his/her father. Another (7%) respondent showed that the business started as a cooperative with men and women working together.

**Question 3: May you please describe your current business in detail?**

**Table 4.4: Descriptions of current business**

Respondent No.	Response from the respondents for question 3.
1.	<ul style="list-style-type: none"> <li>• <i>I harvest fish using parachute net and sell to communities.</i></li> <li>• <i>I am busy digging two (2) new ponds to create space for more fish</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>I am doing fish farming and other commodities including sugar cane, vegetables, bananas and litchis</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>I am doing fish farming including other commodities such as macadamia, goats, cattle and fruits orchard</i></li> </ul>

4.	<ul style="list-style-type: none"> <li>• <i>I am doing fish farming</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>I open for people to come and catch fish using lines (hooks) and let them pay for what they catch</i></li> <li>• <i>I also allow people to catch big fish and return the small ones back into the water</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>I am doing fish farming using the fountain as a water source.</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>Currently I`m doing fish farming and fish are available doing well but am unable to determine prices when selling</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>Fish farming</i></li> <li>• <i>Currently fish are available</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>I am doing fish farming and supply the local retailers or supermarkets with fish.</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>Fish farming</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>Fish farming and vegetables</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>I am doing fish farming and sell fish to the communities</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>Fish farming</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>Fish farming</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>Fish farming</i></li> </ul>

Twelve (80%) respondents indicated that they were currently doing fish farming only and selling them to communities and retailers whereas three (20%) respondents indicated that they were farming fish and other commodities.

**Question 4: What impact does your business have on the communities?**

**Table 4.5: Impact of business on the communities**

Respondent No.	Response from the respondents for question 4.
1.	<ul style="list-style-type: none"><li>• <i>The business is creating jobs for community members</i></li></ul>
2.	<ul style="list-style-type: none"><li>• <i>I hired temporary workers who gain income</i></li></ul>
3.	<ul style="list-style-type: none"><li>• <i>Community members get jobs</i></li></ul>
4.	<ul style="list-style-type: none"><li>• <i>Communities will get fresh fish from my business</i></li></ul>
5.	<ul style="list-style-type: none"><li>• <i>Community members get fresh fish from my business especially young men</i></li></ul>
6.	<ul style="list-style-type: none"><li>• <i>Community members come and learn about fish farming</i></li></ul>
7.	<ul style="list-style-type: none"><li>• <i>The business hires some temporary workers to assist with work</i></li></ul>
8.	<ul style="list-style-type: none"><li>• <i>The community gets fresh fish from my business</i></li></ul>
9.	<ul style="list-style-type: none"><li>• <i>My business is providing the local community with white meat</i></li></ul>
10.	<ul style="list-style-type: none"><li>• <i>Community members get food</i></li></ul>
11.	<ul style="list-style-type: none"><li>• <i>It has improved the lives of people because they come here when they need fish</i></li></ul>
12.	<ul style="list-style-type: none"><li>• <i>People get fresh fish</i></li></ul>
13.	<ul style="list-style-type: none"><li>• <i>Communities come and observe fish while others buy the fish</i></li></ul>
14.	<ul style="list-style-type: none"><li>• <i>People dig ponds and get paid</i></li></ul>
15.	<ul style="list-style-type: none"><li>• <i>It supplies communities with fish</i></li></ul>

Nine (60%) of the respondents indicated that community members get fresh fish as food from fish farming. Five (33%) respondents showed that community members got employment opportunities from the business of fish farming. One (7%) respondent indicated that community members gained knowledge about fish farming. Table 4.5 above shows the responses from the respondents on the impact of fish farming on the local communities.

**Question 5: What opportunities do you think fish farming will create?**

**Table 4.6: Opportunities created through fish farming**

Respondent No.	Response from the respondents for question 5.
1.	<ul style="list-style-type: none"> <li>• <i>It will become a learning area/centre for school children</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>Fish farming will create employment opportunities</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>It will create job opportunities</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>It creates opportunities by providing communities with fresh fish</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>It will create job opportunities for jobless people if we practise it in a large scale</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>It will create income opportunities</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>Fish farming creates job opportunities for the people to have work</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>It can generate income</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>It can create jobs</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>It will provide fresh fish to the local people</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>People come and get fish very easily</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>It will provide fresh fish</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>To sell fish to the people</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>To hire more people for jobs</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>It will create job opportunities and business that supplies retailers with fish</i></li> </ul>

Four (27%) respondents indicated that fish farming could create job opportunities whereas four (27%) respondents showed that fish farming could create businesses. Three (20%) respondents indicated that fish farming could generate income. Another three (20%) respondents indicated that it could create opportunities such as a food supplier whereas one (6%) respondent indicated that fish farming could serve as a centre for school children to learn science.

**Question 6: What difference will these opportunities make to fish farming?**

**Table 4.7: Opportunities associated with fish farming**

Respondent No.	Response from the respondents for question 6.
1.	<ul style="list-style-type: none"> <li>• <i>It will add value to the people`s lives</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>It will promote fish farming</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>They bring income to operate fish farming as business</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>It will promote fish farming</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>The more fish farmers have more ponds, more people will have more jobs</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>Generation of income will make fish farming to reduce poverty</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>It will make fish farming to increase the world economy</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>Fish farming will reduce malnutrition</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>Fish farming will reduce malnutrition</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>It will promote fish farming</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>To promote fish farming</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>They will make fish farming to generate income</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>Fish farming to develop further</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>To increase fish farming</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>To make fish farming to increase the economy</i></li> </ul>

Four (27%) respondents indicated that the above opportunities would promote fish farming. Three (20%) respondents indicated that they would make fish farming to generate income whereas two (13%) respondents also indicated that they would make fish farming to contribute to improve the local economy. Two (13%) respondents indicated that these opportunities would enable fish farming to address malnutrition. Two (13%) respondents indicated that these opportunities would help



fish farming to add value to the lives of the ordinary people whereas two (13%) respondents also indicated that the opportunities would increase fish farming activities.

**Question 7: What impact do you perceive the opportunity will have on fish farming?**

**Table 4.8: Impact of opportunities on fish farming**

Respondent No.	Response from the respondents for question 7.
1.	<ul style="list-style-type: none"> <li>• <i>It develops inspiration to people who would like to start fish farming</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>People will be assisted more in fish farming</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>Expand fish farming and production of quality fish</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>I will sell fish to the local community and earn income</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>It can improve our lives if the government can assist us</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>It will enable the industry to expand</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>Fish farmers will be empowered with appropriate equipment to enable them to supply other countries with quality fish</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>Fish farming will become the learning centre for children about fish farming</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>Fish farming will keep the environment in a good condition</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>It will improve people`s health</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>It will create employment opportunities</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>Fish farming will provide food</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>It will provide food to my family</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>It will make local people to have access to fresh food</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>Fish farming will have great opportunities</i></li> </ul>

**Question 8: What impact do you perceive the opportunities will have on the community?**

**Table 4.9: Impact of opportunities on the community**

<b>Respondent No.</b>	<b>Response from the respondents for question 8.</b>
1.	<ul style="list-style-type: none"> <li>• <i>Community members developed interest in fish farming after they visited my business</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>People will have food and jobs</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>Communities will get income and expand their businesses of fish farming</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>Communities will have food</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>People will get fish for food at the local level than travelling long distances</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>Families will get income and become self-supporting</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>Communities will get food and jobs,</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>People will produce fish as food</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>It will create space for jobs</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>Learning places for children about fish farming</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>Create jobs to improve community livelihoods</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>Community will get food</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>Community will get food locally to avoid long distances while travelling to get fish</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>People will get food close by and avoid long distances for travelling to get fish</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>Community members will get employment to earn income</i></li> </ul>

Eight (53%) respondents indicated that the community members would have access to fish as food for them and their families. Three (20%) respondents indicated that income would be generated to enable the communities to purchase their items of need and become self-reliant. Another four (27%) respondents indicated that jobs would be created for the communities.

**Question 9: What are the good aspects related to fish farming and the perceived change associated with it?**

**Table 4.10: Good aspects related to fish farming**

Respondent No.	Response from the respondents for question 9.
1.	<ul style="list-style-type: none"> <li>• <i>Fish farming generates income, creates jobs for local people, serve as a food base and as a business</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>Whenever I sell some fish I will have income</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>Fish farming serves as a business to generate income and it motivates people to live a healthy life by eating fish</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>Watching fish relieves community members from stress as they become happy</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>It provides food</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>Fish farming promotes water conservation and prevents fish extinction</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>People will be financially stable which will improve their health and livelihoods</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>Fish is good for people`s health</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>Good health and good development of people`s brains</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>Fish farming always keeps the ponds clean</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>My friends come and see fish and they go back home happy</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>Fish farming improved our lives because when we sell fish we get income</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>I developed very well in fish farming since I worked with the extension officer</i></li> </ul>

14.	<ul style="list-style-type: none"> <li>• <i>To save water through fish farming</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>The change is that I'm able to provide people with food</i></li> </ul>

Five (33%) respondents indicated that the good aspects related to fish farming were that it generates income which improves the people's livelihoods. Three (20%) respondents showed that when community members watch the fish in the ponds, they get relieved of stress and become happy. Three (20%) respondents indicated that fish farming promotes water conservation since people usually conserve water to perform fish farming activities. Two (13%) respondents indicated that eating fish promotes good health to the community members and brings change towards healthy lives. Two (13%) respondents indicated that fish farming generates food for the communities.

**4.4 Objective 2:** To determine the fish species that contribute to income generation.

**Question 10: What type of fish species do you farm?**

**Table 4.11: Types of fish species**

Respondent No.	Response from the respondents for question 10.
1.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia and Catfish</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia and Catfish</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia and Catfish</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia and Catfish</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia and Catfish</i></li> </ul>

13.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia and Catfish</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>I rear Tilapia</i></li> </ul>

Nine (60%) respondents indicated that they kept only Tilapia fish species whereas six (40%) respondents said that they reared both Tilapia and Catfish fish species. This is an indication that a large number of fish farmers reared tilapia species as compared to those who reared catfish.

### **Question 11: Why do you keep this type of fish?**

**Table 4.12: Reasons for farming specific fish species**

<b>Respondent No.</b>	<b>Response from the respondents for question 11.</b>
1.	<ul style="list-style-type: none"> <li>• <i>Tilapia is good for this province and can tolerate harsh conditions</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>The fish can tolerate the harsh conditions in our area</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>Tilapia can tolerate harsh conditions</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>I rear tilapia because they resist some diseases</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>It is available locally in rivers and dams</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>They can live in harsh conditions</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>It can live in local conditions and tolerate harsh conditions</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>They are locally available</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>Tilapia species make good production and resist cold and other aspects that can destroy fish farming</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>Tilapia species perform well in the local environment</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>They are suitable for the local environment</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>People prefer this type of fish</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>Most people prefer tilapia</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>Because these are the species I had access to</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>I realised that most people prefer tilapia</i></li> </ul>

Five (33%) respondents indicated that they reared tilapia and catfish because these fish species have a good taste and can tolerate harsh conditions. Three (20%) respondents indicated that most of the people in the community preferred tilapia whereas two (13%) respondents indicated that the species performed well in the local environment. Two (13%) respondents indicated that they kept tilapia because it can be resistant to diseases, cold and other aspects that can destroy fish farming. Two (13%) respondents indicated that they kept tilapia because the species were locally available for fish farming. One (7%) respondent indicated that the fish species was the only one he had access to.

**Question 12: How do you market or sell your fish to the clients?**

**Table 4.13: Methods of selling fish to the clients**

Respondent No.	Response from the respondents for question 12.
1.	<ul style="list-style-type: none"> <li>• <i>I sell fish at the farm gate</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>I net the fish and sell to those who want them most</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>I net the fish and sell to the people around the community</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>I sell the fish un-gutted and fresh at the farm gate</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>I let people come and catch fish using fishing lines and charge them</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>I sell fish locally at the farm gate and by the road side</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>I sell fresh fish to the local people</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>I gut the fish and sell them while fresh to the people</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>I sell fish un-gutted while fresh at farm gate to community members.</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>People come to buy at the farm gate as individuals</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>I net the fish and weigh them to determine the price</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>I net the fish, take them home, sort and sell the fish</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>I net the fish and weigh them to determine the price</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>Not yet selling</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>I determine the price through the fish size</i></li> </ul>

Five (33%) respondents indicated that they sold their fish at the farm gate. Three (20%) respondents also indicated that they caught their fish and sold to the people in the community. Two (13%) respondents indicated that they sold the fish in their fresh state to the people whereas another two (13%) respondents said that they weighed the fish before they sold them to determine the price to the clients. One (7%) respondent indicated that he allowed his clients to catch fish using fishing lines and charged them according to their catch. One (7%) respondent indicated that he determined the price by the physical size of the fish when selling them to the clients. Of all the 15 respondents, there was one (7%) farmer who indicated that he had not yet started selling his fish.

**Question 13: What are the marketing tools that you use to promote fish farming?**

**Table 4.14: Marketing tools used to promote fish farming.**

Respondent No.	Response from the respondents for question 13.
1.	<ul style="list-style-type: none"> <li>• <i>I contact people through cell phones to inform them about fish availability</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>I notify the community about fish availability through headman`s imbizos</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>I market my fish through local radio stations</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>I announce during the headman`s imbizos</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>I advertise in the local radio stations</i></li> <li>• <i>Television</i></li> <li>• <i>Local newspapers</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>Verbally</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>Posters</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>I communicate verbal with communities to advertise my fish</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>Local radio stations</i></li> <li>• <i>Local newspapers</i></li> <li>• <i>Farmers' weekly magazines</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>I notify people verbally at the taverns and around the</i></li> </ul>

	<i>village to spread the message</i>
11.	<ul style="list-style-type: none"> <li>• <i>Local radio stations</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>I put up some posters</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>I announce at the community imbizos</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>Not yet started marketing</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>When people come to my business i inform them verbally about fish availability</i></li> </ul>

Five (33%) respondents indicated that they used verbal communication to inform communities in order to promote their fish farming whereas four (27%) respondents indicated that they used local radio stations to promote their fish farming. Three (20%) respondents indicated that they announced at the headman's community *imbizos* to promote their fish farming. Two (13%) respondents showed that they used posters to promote their fish farming whereas one (7%) respondent indicated that he had not yet started marketing.

**4.5. Objective 3:** To make recommendations on how small scale fish farming can contribute to income generation in the Thulamela Municipality of Limpopo Province.

**Question 14: What are the current challenges in fish farming?**

**Table 4.15: Current challenges in fish farming.**

<b>Respondent No.</b>	<b>Response from the respondents for question 14</b>
1.	<ul style="list-style-type: none"> <li>• <i>Theft</i></li> <li>• <i>Insufficient water during drought</i></li> <li>• <i>Fish-eating birds</i></li> <li>• <i>No proper infrastructure</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>Fish-eating birds and predators</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>No proper infrastructure (fish ponds)</i></li> <li>• <i>Fish-eating birds</i></li> <li>• <i>Lack of equipment</i></li> <li>• <i>No access to funding</i></li> <li>• <i>No proper market</i></li> </ul>



4.	<ul style="list-style-type: none"> <li>• <i>Unavailability of fish feed</i></li> <li>• <i>High prices of fish feed</i></li> <li>• <i>Insufficient water during drought period</i></li> <li>• <i>Improper infrastructure</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>Fish-eating birds</i></li> <li>• <i>Insufficient water during drought</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>Insufficient water during drought</i></li> <li>• <i>Insufficient space or land</i></li> <li>• <i>Insufficient government support</i></li> <li>• <i>No fingerlings supply</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>Insufficient water during drought</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>Fish-eating birds</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>Unavailability of fish feed</i></li> <li>• <i>Unavailability of operational equipment</i></li> <li>• <i>Shortage of land or space</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>Fish-eating birds</i></li> <li>• <i>Insufficient water during drought</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>Fish-eating birds</i></li> <li>• <i>Leaking dams</i></li> <li>• <i>Unavailability of fish feed</i></li> <li>• <i>Limited amount of fish feed</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>Fish-eating birds</i></li> <li>• <i>Shortage of water during drought</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>Shortage of feed</i></li> <li>• <i>Water scarcity</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>Theft</i></li> <li>• <i>Drought</i></li> <li>• <i>Expensive fish feed</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>Fish-eating birds</i></li> <li>• <i>No fencing materials</i></li> </ul>

Nine (60%) respondents indicated that fish-eating birds were their current challenge in fish farming that destroyed a greater portion of their production. Three (20%) respondents indicated drought as another challenge in fish farming. Two (13%) of the respondents highlighted theft as a challenge whereas one (7%) indicated the unavailability of fish feed as a challenge.

**Question 15: What are the perceived constraints that may hinder the development of fish farming?**

**Table 4.16: Constraints that may hinder the development of fish farming.**

Respondent No.	Response from the respondents for question 15
1.	<ul style="list-style-type: none"> <li>• <i>Lack of proper infrastructure</i></li> <li>• <i>Lack of operating tools</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>Lack of proper infrastructure</i></li> <li>• <i>Unavailability of feed</i></li> <li>• <i>High cost of feed</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>Lack of proper infrastructure</i></li> <li>• <i>Fish predators</i></li> <li>• <i>Shortage of water during drought season</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>Lack of proper infrastructure</i></li> <li>• <i>Fish predators</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>Water scarcity</i></li> <li>• <i>Theft</i></li> <li>• <i>Fish predators</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>Water scarcity</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>Non- availability of fingerlings supply</i></li> <li>• <i>Unavailability of feed</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>Water scarcity</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>Delay in issuing of water use licences</i></li> <li>• <i>Unavailability of land</i></li> </ul>

10.	<ul style="list-style-type: none"> <li>• <i>Water scarcity</i></li> <li>• <i>Shortage of fish market</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>Water scarcity</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>Theft and water scarcity</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>Shortage of feed</i></li> <li>• <i>Water scarcity</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>Water scarcity</i></li> <li>• <i>Theft</i></li> <li>• <i>Unavailability of feed</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>No constraints</i></li> </ul>

Six (40%) of the respondents indicated water scarcity as a constraint that hindered the development of fish farming. Four (25%) of the respondents indicated lack of proper infrastructure especially fish ponds as a constraint that also hindered the development of fish farming whereas one (7%) respondent mentioned the delay in the issuing of water use licences as a hindrance. One (7%) respondent indicated theft as a problem that could hinder the development of fish farming. Another (7%) respondent indicated non-availability of fingerlings as a constraint whereas another (7%) indicated that shortage of fish feed hindered the development of fish farming. Notably, respondent number 15 expressed that he/she did not encounter any constraints in fish farming. This could be attributable to the respondent's own ability and good management practices coupled with experience in running his other current businesses including car wash operation. It could also be that the respondent has access to a wide variety of resources that enable him to thrive

**Question 16: What interventions can you propose to address the constraints stated above?**

**Table 4.17: Interventions to address fish farming constraints.**

<b>Respondent No.</b>	<b>Response from the respondents for question 16.</b>
1.	<ul style="list-style-type: none"> <li>• <i>Construction of strong fences to prevent theft</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>Government and farmers to promote fish farming</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>Drill boreholes to address water shortage</i></li> </ul>

	<ul style="list-style-type: none"> <li>• <i>Construct proper infrastructure</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>Drill boreholes</i></li> <li>• <i>Install proper fences</i></li> <li>• <i>Build proper infrastructure</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>Drill boreholes</i></li> <li>• <i>Construct strong fences</i></li> <li>• <i>Make feed available</i></li> <li>• <i>Create a product market</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>Drill boreholes to address water shortage</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>Drill boreholes to address water shortage</i></li> <li>• <i>Build fish breeding stations</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>Drill boreholes to address water shortage</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>Water laws on issuing of operating licences should be relaxed</i></li> <li>• <i>Make more land available for fish farming</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>Drill boreholes to address water shortage</i></li> <li>• <i>Create market</i></li> </ul>
11.	<ul style="list-style-type: none"> <li>• <i>Drill boreholes for more water</i></li> <li>• <i>Construct fences</i></li> <li>• <i>Cover ponds with bird nets</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>Construction of fencing to prevent theft</i></li> <li>• <i>Hire security</i></li> <li>• <i>Drill boreholes</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>Drill boreholes for more water</i></li> <li>• <i>Provide quality feed</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>Drill boreholes</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>Erect fences</i></li> <li>• <i>Cover the ponds with nets</i></li> </ul>

Ten (66%) respondents indicated that drilling of boreholes to add more water for fish farming can be an intervention to address the constraint in fish farming. Two (13%) respondents indicated that the construction of strong fences may address the issue

of theft whereas one (7%) respondent mentioned that government and farmers should promote small scale fish farming. One (7%) respondent indicated that water use laws needed to be revised so that delays in the issuing of operating licences be addressed in favour of fish farming. Another (7%) respondent indicated that there was no constraint in the development of fish farming, because he has sufficient resources such as water and infrastructure to operate on.

**Question 17: How will the proposed intervention provide solutions to the current challenges in fish farming?**

**Table 4.18: Solutions to the current challenges**

Respondent No	Response from the respondents for question 17.
1.	<ul style="list-style-type: none"> <li>• <i>Construction of strong fences will prevent theft</i></li> </ul>
2.	<ul style="list-style-type: none"> <li>• <i>Providing water through boreholes will assist farmers</i></li> </ul>
3.	<ul style="list-style-type: none"> <li>• <i>If farmers can have access to funding to drill boreholes to address water shortage</i></li> </ul>
4.	<ul style="list-style-type: none"> <li>• <i>Strong fences will prevent theft</i></li> </ul>
5.	<ul style="list-style-type: none"> <li>• <i>Sufficient water will improve fish farming and maximise production</i></li> </ul>
6.	<ul style="list-style-type: none"> <li>• <i>Boreholes will supply more water for fish farming</i></li> </ul>
7.	<ul style="list-style-type: none"> <li>• <i>Sufficient water through boreholes will enhance fish farming</i></li> </ul>
8.	<ul style="list-style-type: none"> <li>• <i>Sufficient water will enhance fish farming</i></li> </ul>
9.	<ul style="list-style-type: none"> <li>• <i>Issuing of water licences in time will promote fish farming</i></li> <li>• <i>Availability of state land to farmers</i></li> </ul>
10.	<ul style="list-style-type: none"> <li>• <i>If boreholes can be drilled during drought then my fish ponds will always be full of water</i></li> <li>• <i>Farmers should cover ponds with bird nets</i></li> <li>• <i>Hire machines to construct proper fish ponds</i></li> </ul>

11.	<ul style="list-style-type: none"> <li>• <i>Boreholes will provide sufficient water</i></li> <li>• <i>Construct fences</i></li> </ul>
12.	<ul style="list-style-type: none"> <li>• <i>Boreholes will provide sufficient water</i></li> <li>• <i>Construct fences</i></li> </ul>
13.	<ul style="list-style-type: none"> <li>• <i>Availability of quality feed will promote my fish to grow for the market</i></li> <li>• <i>Government officials to provide guidance</i></li> </ul>
14.	<ul style="list-style-type: none"> <li>• <i>Construct fence</i></li> <li>• <i>Harvested water can be stored and used to fill the ponds during drought</i></li> <li>• <i>Minimise usage of feed</i></li> </ul>
15.	<ul style="list-style-type: none"> <li>• <i>Protect ponds with nets</i></li> </ul>

Twelve (80%) respondents indicated that the provision of sufficient water through drilling of boreholes would provide solutions to their current challenges. Two (13%) respondents indicated that construction of strong fences around fish ponds would prevent theft whereas one (7%) of respondents said that the availability of fish feed would promote fish farming for the market.

**Question 18: Do you have forums where issues of fish farming and other information can be shared?**

**Table 4.19: Fish farming Forums`**

Respondent No	Response from the respondents for question 18.
1.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
2.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
3.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
4.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
5.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
6.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
7.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
8.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
9.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>

10.	• Yes
11.	• Yes
12.	• Yes
13.	• Yes
14.	• Yes
15.	• Yes

All (100%) the respondents indicated that they had fish farming forums from where they could share information on fish farming. Thus, despite the farmers' different levels of experience in the sector and the nature of challenges they encountered in the fish farming enterprise, the existence of such forums could be used as a knowledge or skills development hub to nurture other fish farming initiatives in the province.

**Question 19: Have you consulted with government officials about fish farming?**

**Table 4.20: Farmers' consultation with government officials**

Respondent No.	Response from the respondents for question 19.
1.	• Yes
2.	• Yes
3.	• Yes
4.	• Yes
5.	• Yes
6.	• Yes
7.	• Yes
8.	• Yes
9.	• Yes
10.	• Yes
11.	• Yes
12.	• Yes
13.	• Yes
14.	• Yes

15.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
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All the fifteen (100%) respondents indicated that they had been consulting with government officials seeking advice on ponds management, feeding, netting and harvesting.

**Question 20: Have you been consulted by any government official about fish farming?**

**Table 4.21: Government officials' consultation with farmers**

Respondent No	Response from the respondents for question 20.
1.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
2.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
3.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
4.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
5.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
6.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
7.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
8.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
9.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
10.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
11.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
12.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
13.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
14.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>
15.	<ul style="list-style-type: none"> <li>• Yes</li> </ul>

All fifteen (100%) respondents indicated that government officials had been consulting with them to provide technical advice including feeding methods, water quality management principles and general extension work on fish farming.

4.7 Summary of the results



The results of interviews with the fish farmers have been presented in a tabular and graphical format which provided clear pictures of the contributions from the small scale fish farming subsector in relation to income generation. The results from the respondents indicate that men were more involved in the fish farming sector than women. About 73 percent of men within the age range of 41-50 years and 50 years and above participated more in fish farming than other age groups. Only about 27 percent of women participated in fish farming which is a relatively small number as compared to men.

#### 4.8 Conclusion

The results of the interviews revealed that farmers encountered numerous challenges including fish theft; fish-eating birds; no access to funding; expensive fish feed; unavailability of fish feed; shortage of land; no proper infrastructure; insufficient water during the dry period and lack of a proper product market for the fish harvest. Furthermore, the results also reveal that constraints such as lack of proper infrastructure, water scarcity and other impediments that hinder fish farming initiatives needed to be addressed in order to assist fish farmers to increase fish production.

From the results of the interview indicated above, it is evident that the fish farming subsector in Thulamela Municipality needs intervention to address both challenges and constraints in order to escalate this subsector to the next level of operation.

## CHAPTER FIVE

### 5. SUMMARY OF RESULTS, CONCLUSION AND RECOMMENDATIONS

#### 5.1 Introduction

This chapter outlines a summary of the results that were collected from the respondents within Thulamela Municipality with respect to fish farming projects in Limpopo Province. This chapter further presents the conclusion and recommendations made based on data analysed in Chapter 4 of the study.

5.2 Objective 1: To determine the contribution of small scale fish farming for income generation in Thulamela Municipality of Limpopo Province.

According to Ahmed (2009:11), people require a range of assets to achieve positive livelihood outcomes. Under this objective, factors such as experience in fish ponds

construction, fingerlings sources, fish availability, striving to determine fish price, inspiration, passion, fish availability, fish-farming skills and business skills were found to have contributed positively towards income generation.

All fifteen (100%) respondents in the study indicated that they had built fish ponds on their own to do fish farming.

The findings on this objective clearly indicate that having passion as inspired by other farmers, having business skills, the ability to build fish ponds on their own, and improving fish farming skills could make the farmers contribute to income generation.

### 5.3 Objective 2: To determine the fish species that contribute to income generation.

The results on this objective showed that Tilapia and Catfish were fish species that contributed to income generation among fish farmers.

Five (33%) respondents indicated that they reared tilapia and catfish because these fish species have a good taste and can tolerate harsh conditions. Three (20%) respondents indicated that most of the people in the community preferred tilapia whereas two (13%) respondents indicated that fish species performed well in the local environment. Two (13%) respondents indicated that they farmed tilapia because it has good resistance to diseases, cold and other aspects that can destroy fish farming. Two (13%) respondents said that they kept tilapia because the species was locally available for fish farming. One (7%) respondent indicated that fish species was the only one he had access to.

The findings on this objective indicates that farmers believed that tilapia and catfish species have high tolerance to live in harsh conditions, have good taste, are indigenous, can resist diseases, and therefore could contribute to income generation.

### 5.4 Objective 3: To make recommendations on how small scale fish farming can contribute to income generation in the Thulamela Municipality of Limpopo Province.

The respondents suggested various interventions to address the current challenges on fish farming. Interventions suggested include provision of proper infrastructure (particularly ponds) to enable fish farmers to operate within the appropriate standards, construction of strong fences around fish farming projects to prevent theft, proper netting to cover ponds to deter fish-eating birds and predators, drilling of boreholes to provide water during the dry period, creation of a market and availing affordable fish feed to farmers.

All (100%) of the respondents indicated that assistance in the drilling of boreholes to provide sufficient water during drought, provision of proper infrastructure, construction of strong fences around fish farming projects to prevent theft, proper netting over fish ponds to prevent predators, availability of more land for fish farming, creation of a product market, electrified fencing and the relaxing of water use laws in issuing water use licences were necessary. This concurs with scholarly assertions which highlight that “efforts to improve the sustainability of aquaculture production will require efforts that must include an optimisation on how to efficiently allocate resources among competing users, maximising returns or outputs and minimising impacts or inputs (Fitwi, Wuertz, Schroeder & Schulz, 2012:9)”.

## 5.5 Conclusion

The results of the study show that small scale fish farming has a significant impact on the lives of the surrounding communities in Thulamela Municipality. The study results further reveal that small scale fish farming subsector can contribute to the generation of income through creation of jobs and development of fish farming as a business in addition to ensuring food security for the local communities. In view of the contributions of the fifteen (15) participants interviewed in this study, the availability of infrastructure and financial resources are the main determinants that can guarantee the success of the subsector.

The results further indicate some challenges and constraints that usually become deterrents to the sector’s development if left unchecked. These challenges include fish theft by community members, improper infrastructure, fish predators, no access to finance, and high feed prices. Furthermore, the results indicate that there is a need to construct proper infrastructure, cover ponds with nets to prevent predators,

have increased access to funding and to manufacture feed locally. All these interventions will enable small scale fish farming subsector to contribute to generation of income for fish farmers in the province.

## 5.6 Recommendations

According to the research findings, there is a clear indication that small-scale fish farming prospects exist in the Thulamela Municipality with the potential to yield benefits for the local farmers if properly implemented. Mufudza (2015:60) points out that the government is supposed to take the income generating projects as a strategy to fight unemployment both in urban and rural areas. However, all the respondents indicated a number of challenges and constraints which may contribute towards reducing farmers` benefits if these remain unattended. Jacobi (2013:90) indicates that the main support needed in all groups is usually financial support in order to improve and sustain fish farming projects.

The following recommendations based on the outcomes of this study, should be noted and executed to support the small scale fish farming subsector for contribution to income generation:

(i) Fish farmers should be assisted to construct proper infrastructure facilities including fish ponds. This will enable farmers to maximise fish production and make it more sustainable and cost-effective.

(ii) Private and public sectors should provide assistance in constructing strong fences around the fish production facilities in order to minimise theft of fish.

(iii) Alternative reliable water sources should be established and secured so that sufficient water is available for fish farming especially during drought.

(vi)The government should allocate available state land to successful small scale fish farmers to expand their fish farming activities.

(v) Fish farmers should be empowered to produce their own high-quality fish feed locally using easily available ingredients.

(vi) The government together with farmers should promote local feed mills and hatcheries to produce feed and fingerlings in order to reduce transport costs for important fish farm inputs.

(vii) Fish farmers should be encouraged to become members of fish farming forums and cooperatives to improve communication among fish farmers which may prove to be helpful in solving some of the problems faced by fish farmers.

(viii) The Department of Agriculture through its farmer support branch should assist farmers in adapting to a farmer to farmer support system to enabling them to train one another in terms of predator control.

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(ix) Fish farmers forums should consistently facilitate publishing of the results of good performing fish farming projects in the local media in order to attract funding from both local and external funding agencies.

(x) Since the results showed that there was a small number or percentage of women and youth involved in the fish farming sector, such categories need to be encouraged to participate more actively in fish farming activities in order to boost the local economy.

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## APPENDIX B

**(Contribution of small scale fish farming sub-sector to rural income generation in Thulamela municipality in Limpopo Province, South Africa)**

### **SEMI-STRUCTURED INTERVIEW GUIDE**

#### **1. Introduction**

My name is Moatladi Jacob Phosa. I am currently registered for Master`s Degree in Development (MDEV) with the University of Limpopo for the year 2017. My research topic is **Contribution of small scale fish farming sub-sector to rural income generation in Thulamela municipality in Limpopo Province, South Africa**. The main objectives of my study involve the following:

- To determine the contribution of small scale fish farming for income generation.
- To determine the fish species that contribute to income generation.
- To make recommendations on how small scale fish farming can contribute in income generation in the Thulamela Municipality in the Limpopo Province.

## 1. Demographic

### 1.1

Male		Female	
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### 1.2 Is your age range:

18-30		30-40		41-50		50+	
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**Objective 1:** To determine the contribution of small scale fish farming for income generation in the Thulamela Municipality in the Limpopo Province.

1. What is the name of your business?

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2. How was it established?

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3. May you please describe your current business in details?

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4. What impact does your business have on the communities?

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5. What opportunities do you perceive fish farming will create?

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6. What difference will these opportunities be to fish farming?

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7. What impact do you perceive the opportunity will have on fish farming?

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8. What impact do you perceive the opportunities will have on the community?

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9. What are the good aspects related to fish farming and the perceived change that be caused by it?

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**Objective 2:** To determine the fish species that contribute to income generation.

10. What type of fish species do you farm with?

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11. Why do you farm with this type of fish?

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12. How do you market or sell your fish to the clients?

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13. What are the marketing tools that you use to promote fish farming?

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**Objective 3:** To make recommendations on how small-scale fish farming can contribute in income generation in the Thulamela Municipality in the Limpopo Province.

14. What are the current challenges of fish farming?

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15. What are the perceived constraints that may hinder the development of fish farming?

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16. What intervention can you propose to be used to address the constraints?

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17. How will the proposed intervention provide solutions to current challenges in fish farming?

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18. Do you have fish farming forums where issues of fish farming and information is shared?

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19. Have you consulted with government officials about fish farming?

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20. Have you been consulted by any government official about fish farming?

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**THANK YOU FOR YOUR PARTICIPATION IN THIS. IT IS MUCH APPRECIATED**