ANALYSING SUSTAINABILITY OF THE LIVELIHOOD STRATEGIES EMPLOYED FOR ADAPTATION BY HOUSEHOLDS INVOLVED IN FISHING ACTIVITIES AROUND LAKE CHILWA IN THE FACE OF CLIMATE CHANGE

MASTER OF ARTS (DEVELOPMENT STUDIES) THESIS

CLAUDIA FISKANI NGOMA

UNIVERSITY OF MALAWI

NOVEMBER 2023

ANALYSING SUSTAINABILITY OF THE LIVELIHOOD STRATEGIES EMPLOYED FOR ADAPTATION BY HOUSEHOLDS INVOLVED IN FISHING ACTIVITIES AROUND LAKE CHILWA IN THE FACE OF CLIMATE CHANGE

MASTER OF ARTS (DEVELOPMENT STUDIES) THESIS

By

CLAUDIA FISKANI NGOMA
BA (Social Sciences) - University of Malawi

Submitted to the School of Law, Economics and Governance in partial fulfillment of the requirements for the degree of Master of Arts (Development Studies)

UNIVERSITY OF MALAWI

NOVEMBER, 2019

DECLARATION

I, the undersigned, hereby declare that this thesis is my own original work which has not been submitted to any other institution for similar purposes. Where other people's work has been used acknowledgements have been made.

CLAUDIA FISKANI NGOMA

_____

Full Legal Name

_____

Signature

_____

Date

CERTIFICATE OF APPROVAL

The undersigned certify that this thesis represents the student's own work and effort and has been submitted with our approval.

Signature: _____ Date: _____

Paul Kishindo, PhD (Professor)

MAIN SUPERVISOR

Signature: _____ Date:_____

Peter Mvula, PhD (Senior Lecturer)

SECOND SUPERVISOR

DEDICATION

To my son Andile Lwethu Nthani; you who in your early infanthood had to endure the suns of Chirunga campus so mum could get her MA. To my daughter Lungile for being a perfect motivation. Whenever I felt like giving up, I looked at you my children and asked myself, what reason am I going to give to these babies of mine for failing to complete My Masters studies?

ACKNOWLEDGEMENTS

All thanks and praises to the Lord God who gave me the strength to carry on and excel remarkably. Christ the King! You made everything possible. Yahweh ndinu mfumu!

Many thanks to my Supervisors, late Prof. Paul Kishindo (may his soul rest in peace) and Dr. Peter Mvula for the expert insights and valuable comments they guided me with throughout the thesis development. It has been such an honor learning from you and you surely made the best team of supervisors.

My deepest gratitude to my dearest husband Henry Hal Nthani for your tireless moral and financial support throughout the journey. You encouraged me, always checked on my progress and pushed me. Kutsala pang'ono kundikwapula kuti ndimalize thesis. Well here we are on the finish line, relax daddy, it's done. My parents Elias and Nancy Ngoma for always believing in me, for all the selfless sacrifices you made so you could productively invest in me. Here I am, *Nafiska sono amama na adada, mukanozga kubako*, may God bless you more mum and dad! My siblings for being an ever flowing source of inspiration in my life, I could not have come this far without your everyday support and motivation to achieve more. May I also acknowledge MDS Class of 2016, the most awesome class I have had in my entire academic life, am glad we made it here! I also say many thanks to my God sent neighbor Mama Chrissie James Kalidozo for always being there for me and my family in so many ways, may God continue to bless you more mama. To Annie, Atisunga and Dorea our faculty administrators for your dedicated support, munatiphwekesela moyo madona, keep on wearing those beautiful smiles and checking on your students like you owe them.

Leah Mziya and Mphatso Nana Mwandali; God knew I had to meet you two in my life. My deepest thank you for taking time out of your busy schedule to help me with my data collection even without any monetary incentive. Such rare friends, tizalipila.

I won’t forget to say thank you to Tiwonge Munthali and Massy Chiotcha for helping me with my quantitative data analysis. Keep on being good and of service to others.
And lastly, the people of Kachulu Beach, musatope nkulandila alendo ozachita kafukufuku. Zikomo kwambiri potenga nawo mbali, mulungu adalitse inu ndi Nyanja yanu yokondeka.

How can I forget Esnart, (Anambewe) for taking care of my then new born baby ‘Andile’ while I attended classes, prepared for and sat for exams! Mulungu akudalitseni mama. And lastly amake Jusi, aNankhoma for being Andile’ and Lungile’s awesome auntie, caretaker and friend while I worked on my thesis. Pitilizani kukhala munthu wabwino koposa mama. God bless you.

ABSTRACT

It has been globally accepted that climate change poses serious long term effects on livelihoods. The effects of climate change in Malawi largely manifest in the drying up experiences of the Lake Chilwa, the second largest lake in the country. Fishing has for a long time been the main occupation contributing significantly to the livelihoods of the lake's catchment area with households sorely relying on fishing activities. However, climate change has caused so much uncertainty on the lake and these uncertainties have had implications on fishing livelihoods. Located in a climatically unstable environment, Lake Chilwa is prone to drying and when it dries it takes 1 to 2 years for it to refill and about 3 to 4 years for the fishery to recover. During these recessions, fish mortalities and reduced catches are recorded. While households have previously had to cope with periodic recessions, the situation has become perpetual as water levels continue to drop while the fish stocks fatally decline. The study thus sought to; determine the perceptions of households involved in fishing activities regarding the changes, identify the livelihood strategies employed for adaptation and finally to analyse the sustainability of the livelihood strategies employed for adaptation. The study employed a mixed methods approach and focused on households surrounding Kachulu beach. Household and in-depth interviews were conducted and quantitative data was analysed using descriptive statistics in the form of frequencies while qualitative data was analysed using content analysis by coding emerging dominant themes. The study results show that the households are aware of the changes and they attribute these changes to climate change. Further results show that households have adapted by engaging in farming activities, farm and off-farm '*ganyu'* and small scale businesses. While some have lost hope and completely quit fishing, others have only learnt and diversified their livelihoods. Furthermore, the study concluded that although the livelihoods strategies for adaptation have been employed for some time even over five years, they have not been able to maintain the positive livelihood outcomes that the households enjoyed from fishing activities. Hence; concluded to be unsustainable.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

DFID Department for International Development

FGD Focus Group Discussions

GOM Government of Malawi

HA Hectares

IDIs In-depth Interviews

IPCC Intergovernmental Panel on Climate Change

NASA National Aeronautics and Space Administration

NEP National Environment Policy

SLF Sustainable Livelihood Framework

SSA Sub Saharan Africa

TA Traditional Authority

VSL Village Savings and Loans

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Globally, climate change has been recognized as one of the biggest challenges facing humanity. It is a grave threat to livelihoods and any development gains that the earth has made (Wollersheim, 2017). By definition climate is the average weather over a duration of time of a particular region. It can be a few months, seasons, or a few years (Houghton, 2000). When we talk of climate change we thus talk of the variation in long term trends in climate on average and it includes the change to the average temperatures and precipitation. Even thou nature can effect these changes, scientifically it has been accepted that human induced climate change plays a major role in worsening its impacts (GoM, 2012). Human activities mainly clearing forests and the burning of fossil fuels respectively reduces CO2 capture and increases the emission and concentration of CO2 and other heat trapping greenhouse gases within the upper layers of our atmosphere thus; causing the slow rising of the earth's average temperature a process commonly referred to as 'global warming' (Boko et al., 2007). The term global warming is however in many scenarios referred to as climate change and the two are interchangeably used.

Successive reports by the Intergovernmental Panel on Climate Change (IPCC) attribute these changes to the activities of man arguing that with the growing pursuit of economic gains since the industrial revolution, human beings through various industrial and manufacturing activities produce gases that emit into the atmosphere (IPCC, 2007). Wollersheim, (2017), further observes that since the beginning of the industrial revolution there has been a 40% increase in the atmospheric concentration of carbon dioxide from 280 ppm to 406 ppm in early 2017. Even thou countries of the Global South such as Malawi are typically low-income countries and least responsible for contributing to greenhouse gas emissions, they are the most severely

affected by climate change impacts (Boko et al., 2007). Given their predominantly rain-fed agriculture, a large percentage of their population being economically dependent on agriculture, and their low financial and institutional capacity to cope with and to withstand natural hazards, these countries are generally prone to be hit the most.

Malawi specifically is a country with unique and fragile natural resources that are prone to extreme weather events such as floods, droughts, strong winds and prolonged dry spells. According to the 2010 Malawi State of Environment and Outlook Report, since the late 1970s the country has experienced an increase in such extreme weather events in magnitude and frequency (Chiotha and Mphepo, 2011). Chiotha et al., (2017) further explain that the impact of these extreme weather events has contributed to weather related disasters in Malawi such as the 1992, 1994 and 2001 devastating droughts. For floods, the country experienced flash floods 1991 and recently, as a result of the El Nino effect, the most devastating floods were experienced in 2015 which were later followed by droughts in 2016.

The devastating effects of climate change in Malawi highly manifest in the experiences of the lake Chilwa, the second largest lake in the country. Located in the southern part of Malawi, at 624m above sea level between 35°45'E and 15°15'S in the centre of the low lying Phalombe plain, Lake Chilwa is a highly valuable ecosystem (Nagoli, 2017). It offers a wide range of natural resources for exploitation, such as fish, water, birds, small animals, pasture, land, timber, fuel wood, grass for grazing, mushroom and wild forests (Chiotha and Mphepo, 2011). The lake thus contributes significantly to the livelihoods of the catchment area population estimated at 1.6 million with a density of 321 persons per km^2, one of the highest in Malawi (NSO, 2008). This high density puts tremendous pressure on the areas resources leading to among others, rapid deforestation, wild spread soil erosion and reduced fishery due to over fishing and offseason fishing (Njaya et al, 2011). Consequently, in the long run, the Lake faces environmental challenges such as floods and droughts which affect the livelihoods of its catchment population, 85% of which rely on rain-fed subsistence farming for their food consumption (ibid).

It must be noted, however, that Lake Chilwa Basin is located in a climatically unstable environment and fluctuations in rainfall and temperature have been recorded since the 1960s (Chiotha et al., 2011). Furthermore, according to McNeil, (2003), Lake Chilwa is a closed drainage lake, meaning that no water flows out of the lake. Thus, the water level is a direct result of the amount of rainfall that falls during the annual rain season and the amount of water that evaporates. Aggravated by its shallowness, Lake Chilwa is prone to drying, and when it dries it takes 1 to 2 years for the lake to refill and about 3 to 4 years for the fishery to recover (Njaya, 2011). Correspondingly, Njaya et al, (1996) argued that the basin population lives under constant threat of extreme and highly variable weather while eking out a living from a declining natural resource base.

The drying of the lake Chilwa is thus considered the biggest threat posed by climate change in Malawi and one of the concerns is that higher temperatures and a possible reduction in precipitation will cause the lake to dry up more frequently (FAO 1966). In the past century the lake has dried nine times: 1903, 1913–1916, 1922, 1934, 1943–1949, 1967, 1973, and 1975 and later in 1995– 1996 (Chapotera, 2012). In the millennium era, due to decreasing water levels and rainfall recorded, it was feared the lake could dry up completely between 2012 and 2013 but it only dried partially and just recently, between 2017 and 2018, the lake dried completely. During these minor and moderately severe recessions, fish mortalities and reduced catches are recorded (Njaya, 2001). Fish production from the lake has generally been trending downwards from 9,207.38 metric tonnes in 2010/11 financial year to 661.26 metric tonnes in 2016/17 due to partial drying of the lake and slow recovery of fisheries after the lake refilled (GoM, 2018). The drop of 8546.12metric tons (93.0%) represents an economic loss of over MK15, 636,734,732 (USD21, 717,687) over a Nine-year period translating to annual loss of MK1, 737,414,970 (USD2, 393,133.57) (ibid). Drying up of the lake thus affects the entire biodiversity of the basin and the community at large whose livelihoods depend on the lake. The graph below shows records of fish catches from Lake Chilwa between 2008 and 2017.

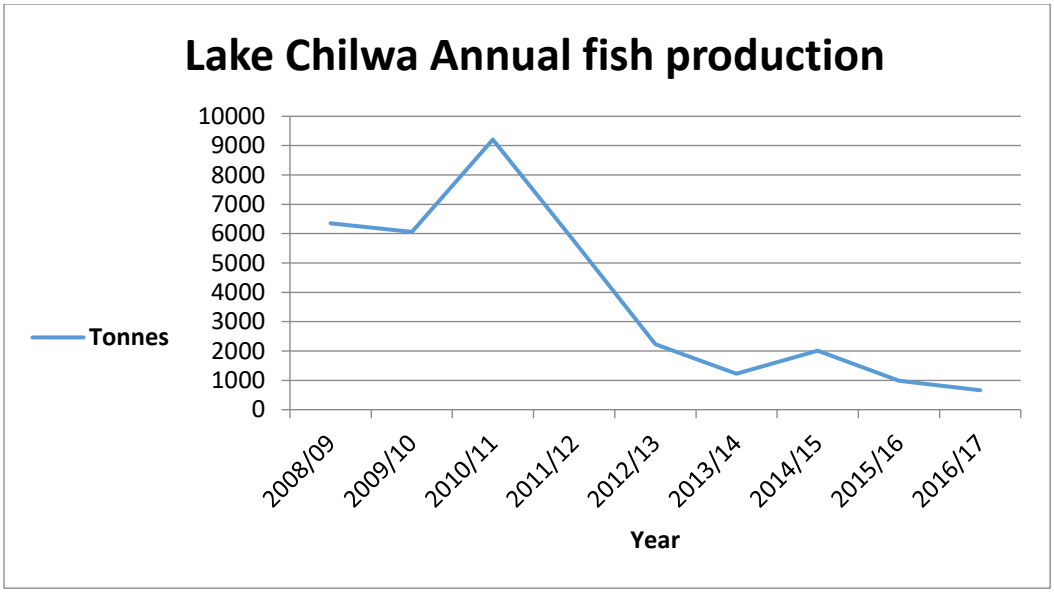

Figure 1: Evidence of declining fish stocks; Lake Chilwa annual Fish production

Source: Zomba District Fisheries Office, 2019

According to Nagoli, (2016), household income data from a co-management survey shows that fishing is an important livelihood strategy for Lake Chilwa basin households. Over 60% of income for these households is from fishing and other fishing-related businesses such as fish processing and trading. Furthermore, data from a study that aimed to understand the influence of various agents of change on coping with environmental shocks shows that nearly 75% of the respondents were involved in fish related businesses including fishing, processing and trading (ibid). Fishing is, therefore, the main occupation for communities around Lake Chilwa basin. However, Nagoli further points out that despite the high economic potential of Lake Chilwa to surrounding communities, the majority of the households are highly vulnerable to food insecurity and poverty due to the deteriorating state of the Lake. This thus signals the need for sustainable adaptation livelihood strategies that according to Chambers and Conway (1988), minimize current vulnerabilities and cope with and recover from the stresses and shocks and maintain or enhance its capabilities and assets both now and in the future without further undermining the natural resource base.

Government of Malawi thus recognizes that Global Climate Change has serious implications for the country. As such, in 1996 Malawi developed the National

Environmental Policy (NEP) framework which aims at narrowing the gap between degradation of natural resources and the environment and promoting sustainable production and economic growth (GoM 2000). According to GoM (2012), as stated in the 2012 Malawi Climate Change Policy, The Malawi Government will achieve this through better adaptation to, and mitigation against, climate change, with a focus on sustainable livelihoods for resilience building for Malawi's citizens. It is thus against this background that this study seeks to establish how better and sustainable the adaptation strategies employed by the households involved in fishing and related activities around lake Chilwa are.

By definition, adaptation involves lowering the risk posed by climate change by taking actions to counteract new or changing environmental challenges (Adger et.al 2003). It makes changes to prepare for and negate the effects of climate change, thereby reducing the vulnerability of communities and ecosystems (ACT, 2018). Adaptation can take place in anticipation of an event or as a response to it; it includes adjustments through climate planning as well as autonomous reactions by individuals and public bodies. There are several other definitions of climate change adaptation; although not very far from the former, the UNFCCC defines adaptation to climate change as "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC, 2014). Similarly, Adger et al. (2003) state that "adaptation to climate change is the adjustment of a natural or human system to moderate the impacts of climate change, to take advantage of new opportunities or to cope with the consequences.

In the Case of this study adaptation has been defined as a long term response to a persistent threat hence goes beyond achieving survival to as far as achieving a satisfactory living. While coping is about survival in the short period of posed episodic threats or shocks, adaptation goes beyond achieving mere survival, it makes adjustments to achieve acceptable standards of living.

1.2 Problem Statement

Climate change and extreme weather events have caused so much uncertainty on Lake Chilwa, and these uncertainties have implications on fishing livelihoods. From

various literature sources, it is very evident that fishing has for a long time been the main occupation in the area (Allison and Mvula, 2002, Njaya, 2011, Kutengule, 2014 and Nagoli, 2016). However, in the face of climate change, the future of fishing is highly variable and previously households have had to cope with periodic water recessions and reduced fish stocks. Nevertheless, coping is only for the short term and currently, the situation has become very persistent and perpetual such that frequent and prolonged declining fish stocks have brought severe stress on the Lake Chilwa population hence need for long term livelihood response through adaption. For example, according to published literature by environmental scientist professor Sosten Chiotha, who has studied the lake for 27 years, the lake recessions were previously a cycle of 20 to 25 years but currently from the 1990s, the frequency of the drying has increased to 8years or less (Deepa, 2017). Furthermore, water levels continue to decline and current estimates indicate that the lake is now 60 percent dry (Ibid). As such response to the situation can no longer be coping for the short-term but rather adapting sustainably in the long term.

Literature reviewed however shows that most studies on livelihoods in the area have focused on the alternative temporary coping strategies employed during the periodic lake recessions. How households involved in fishing activities have so far adapted for the long-term in the face of the frequent and persistent declines has not been adequately looked at and the sustainability of the employed adaptation livelihood strategies has been increasingly ignored.

Therefore, while it has been established how households coped with the situation in between the short-term recessions, it is unclear how households involved in fishing and related activities around Lake Chilwa have adapted to the current persistent situation.

The study therefore sought to contribute to the existing body of knowledge on climate change by establishing how households involved in fishing activities around Lake Chilwa as influenced by the perceptions they hold regarding the climate changes taking place have taken advantage of other opportunities away from the lake and adapted. The study further fills in on the knowledge gap by analysing the sustainability of the livelihood strategies employed for adaptation.

1.3 Objectives

1.3.1 Main Objective

- The study sought to analyse the sustainability of the livelihood strategies employed for adaptation by households involved in fishing activities around Lake Chilwa in the face of climate change.

1.3.2 Specific Objective

- To determine how households involved in fishing and related activities around Lake Chilwa perceive the changes (declining water levels and fish stocks) that have occurred to the lake.
- To identify the livelihood strategies these households have employed for adaptation.
- To analyse the sustainability of the adaptation strategies employed.

1.4 Significance of Study

This study is very important since it will not only identify the livelihood strategies employed by households involved in fishing activities around lake Chilwa but it will further significantly determine and analyse the sustainability of the livelihood strategies that these households have so far employed for adaptation.

Most research on climate change and the lake Chilwa has focused on how people cope with periodic declined fish stocks but this study sought to fill the knowledge gap by establishing how households involved in fishing activities have in the long run adapted to the recurrent and long lasting declines and rebuilt livelihoods away from the lake.

CHAPTER 2

REVIEW OF RELATED LITERATURE AND THEORETICAL FRAMEWORK

2.1 Introduction

Building on chapter one, this chapter provides a general understanding of climate change and how it affects livelihoods. It also goes further to highlight on climate change and the lake Chilwa livelihoods as found by different scholars. Additionally, the chapter presents the Sustainable Livelihoods Framework as the theoretical framework that guided this study.

2.2 Global Climate Change

Increasing evidence states that there is indeed global climate change as a result of human induced activities which emit greenhouse gases into the atmosphere. For example, Wollersheim, (2017), observes that since the beginning of the industrial revolution around 1950 there has been a 40% increase in the atmospheric concentration of carbon dioxide from 280 ppm in 1970 to 406 ppm in early 2017. Furthermore, a comparison of atmospheric carbon dioxide samples contained in ice cores before the industrial revolution and direct measurements after the revolution provided evidence that atmospheric Carbon dioxide concentration had increased from 310 to 390 (ppm) (McNeil, 2003). Such increased atmospheric carbon dioxide concentrations according to researchers from the Massachusetts Institute for Technology increase warm temperatures thereby causing sea-level rise, and reduction in the strength of ice thereby making ice caps more vulnerable to cracking and shrinking.

McNeil, (2003) also states that rising atmospheric green gas concentrations have increased global average temperatures by approximately 0.2°C per decade since 1980 and most of the added heat energy is absorbed by the world's oceans there by increasing the oceans heat content and melting up the ice. In agreement with these

findings, data form national aeronautics and Space Administration (NASA) illustrate a decrease in the Antarctica ice sheets by about 152 cubic kilometres per year between 2002 and 2005. And on overall, the earth has consistently reported increased temperatures and an increase in the number and magnitude of storms and floods worldwide.

However, even though there is such increasing consensus that there is global climate change with temperatures on earth increasing by approximately 1.8°F since the early 20th century and that over this time period, atmospheric levels of greenhouse gases such as carbon dioxide (CO2) have also notably increased. There is disagreement on the actual causes of climate change (Houton, 2000). According to Houton (2000), while one side of the debate argues that rising levels of atmospheric greenhouse gases are a direct result of human activities such as burning fossil fuels, and that these increases have and continue to significantly increase severe climate changes such as global warming, stronger storms, and more droughts. The other side of the debate argues that human-generated greenhouse gas emissions are too small to substantially change the earth's climate and that the planet is capable of absorbing those increases. According to this side of the debate, warming over the 20th century resulted primarily from natural processes such as fluctuations in the sun's heat and ocean currents. They further contend that the theory of human-caused global climate change is based on questionable measurements, faulty climate models, and misleading science (ibid).

Much as authors from both sides of the debate make compelling arguments, these arguments are lacking as they are purely experimental based only on technical findings. They did not go further to match their scientific findings with people's observations and actual experiences of the climatic changes. People's perceptions of the changes are totally ignored hence making their arguments somewhat lacking

2.3 Climate Change in the Global South

Global projections of climate change suggest that countries in the south will be affected the most because of their geographical and climatic conditions, high dependence on agriculture, and worse still because of their limited capacity to adapt (Boko et al., 2007). In agreement with these projections, climate change and variability has been found to be a key challenge especially in semi-arid areas of sub-

Saharan Africa where peoples' livelihoods are predominantly dependent on subsistence rain-fed agricultural production (Adger et al. 2003). However, other quarters have stated that despite the disadvantaging geographical and climatic conditions of the SSA, a host of non-climate related factors such as an equal land distribution, insecure land tenure, poorly developed markets, trade barriers and inadequate infrastructure also contribute to its vulnerability to climate change (Fisher, 2008). Furthermore, there are opposing assertions on the common assertion that countries in the global south such as Malawi are typically low-income countries and least responsible for contributing to greenhouse gas emissions. Such opposing assertions state that, because of high population growth in most countries of the global south, deforestation is so rampant and when it comes to climate change deforestation is a is a very big and worrisome issue as it is a very significant contributor of GHG emissions. For example, the population of SSA is projected to reach 2 billion or 22% of the world's total population by 2050 yet its food production is not growing as fast as its population there by pressure ends up being diverted onto its natural resources (ibid). Consequently, the SSA lacks capacity to mitigate and adapt to the effects of climate change effectively hence seen to be hit the most.

The literature above gives a very good insight on the status of climate change in the global south. However, the authors dwell much on the projections of climatic impacts for SSA in the face of its growing population but fail to give an account of how the SSA has adapted so far. SSA's dependence on rain fed agriculture is indeed a big challenge but the authors ignored how such countries have adapted by introducing irrigation agriculture and drought resistant crops and farming practices, the focus is thus on the vulnerability of the SSA rather than its capacity to adapt accordingly. As such the authors fail to give an account of how vulnerable populations such as the Lake Chilwa population have dynamically responded to the climatic challenges facing them and how they have fared so far.

2.4 Climate Change in Malawi

According to Malawi Meteorological Services, the country 's climate is sub- tropical, meaning that it is strongly seasonal with three seasons alternating. The warm- wet season usually lasts from November to April and this is when 95% of the annual

precipitation in Malawi takes place, from May to August the country experiences the cool-dry winter season with moderate average temperatures. The hot-dry season then lasts from September to October (EAD 2002). However, according to Mpasuka, (2013) Malawi lacks substantial data on climate change and many of those who believe there is a change in climate do not base their opinions on scientific findings. Mpasuka observes that there are no studies that provide empirical evidence of the existence of climate change in Malawi and the case for climate change is only validated by referring to weather-related shocks. Thus; if climate change is understood as changes in duration, onset of seasons and frequent occurrences of extreme weather such as floods, droughts and hailstorms, then climate change is a widely held phenomenon by the majority in Malawi.

Contrary to Mpasuka's sentiments however, Joshua et. al, (2016) conducted a study on climate change in semi-arid Malawi in which people's observations on climate change were compared with empirical evidence using temperature and rainfall data for nearby climate stations at Chikwawa, Ngabu, Makhanga and Nchalo. As part of data collection, daily maximum and minimum temperature and rainfall data at the mentioned stations for the period 1960–2010 were obtained from the Malawi Department of Climate Change and Meteorological Services. Daily rainfall (1978–2008) and temperature data (1971–2008) for three stations in the area, namely Nchalo, Makhanga and Ngabu, were analysed using standard techniques and the findings the authors suggest indicate similarities in the empirical evidence and people's narrations of their observations of climate variability (ibid).

The study report shows that daily minimum temperatures have increased in the area of which Nchalo and Makhanga stations had an increase at 95% level of significance Daily maximum temperatures also increased significantly at Nchalo and Makhanga Stations, whereas a local decrease in the daily maximum is suggested for Ngabu Station (Joshua et al., 2006). The daily temperature experienced a decrease, which according to the authors is a key indication that suggests that the minimum temperatures increased more than the maximum temperatures. Significant increases in the diurnal temperature range were also observed at Ngabu and Nchalo stations. At monthly level, minimum mean temperatures increased with Nchalo reporting the only significant trends. In the same study, Monthly maximum mean temperatures

increased significantly at Nchalo and Makhanga with the former reporting significant increases, whereas a statistically insignificant decrease is suggested for Ngabu. Just like the daily time scale, the temperature ranges also decreased at monthly scales at all sites, albeit insignificantly. Furthermore, as Joshua et al., (2006), observes, the area mostly experienced a decrease in daily rainfall, with Chikwawa Boma Station experiencing a significant decrease at 95% levels. However, the authors make it clear that although the monthly rainfalls also suggest decreased trends, none of the stations experienced a significant trend at 95% level. The study findings therefore conclude that people's perceptions of changes in rainfall and temperature generally agree with the empirical evidence. Additionally, the authors point out that it is worth noting that 9 of the top 10 natural disasters from 1900 to 2012 have occurred between 1990 and 2007, indicating high frequency in less than 20 years hence; evidencing climate change (ibid)

Relating to this, Mkwambisi and Gomani (2008), state that over the last few decades, Malawi has experienced extreme weather events, ranging from droughts (1991/92) to floods (1996/97) and flash floods (2000/01). During the 1996/97 crop season, when there were floods in the southern region, some parts of the northern region along the Karonga lakeshore plain experienced drought conditions. These extreme weather events according to Mkwambisi clearly show the large temporal and spatial variations in the occurrence of climate-related disasters and calamities. Such assertions about climate change in Malawi are further evidenced by the shocking events of 2015 where by in January, Malawi experienced the heaviest rainfall in recorded history (Mkwambisi, 2015). The southern regions of the country were hit especially hard, with 400% higher precipitation than normal. The heavy rain led to serious flash floods in 15 of the 28 districts in Malawi that a state of emergency was declared in these districts. This was the worst ever climate shock in the country leaving 145.000 people displaced and 106 dead (ibid)

Joshua et., al present a very strong case of climate change with well detailed empirical evidence which also includes people's actual observations of the changes experienced. The trends in climate change and weather variability are very well and carefully analysed. Additionally, adding to their strong case, both Joshua and Mkwambisi separately recognise that climate change and variability are a threat to

sustainable development in Malawi and that this calls for identification of sustainable adaptation strategies. Nonetheless, in their studies they both detail how households and communities have adapted so far but did not go ahead to analyse the sustainability of the livelihoods for adaptation. Additionally, a household was not a unit of analysis but rather communities at large.

2.5 Adaptation to Climate Change

Worldwide, it has been widely accepted that climate change poses a great threat to rural livelihoods and there is need for human systems to adjust accordingly. The discussion on climate change has thus moved towards two main climate change policy responses; how to mitigate climate change, and to a growing extent, how to adapt to the changes (Adger 2003). While mitigation addresses the root causes, by reducing greenhouse gas emissions, adaptation seeks to lower the risks posed by the consequences of climatic changes and has been recognised as a crucial strategy to deal with the current and future climate changes. Consequently, nations including Malawi have developed policies and strategies to address climate change related risks examples of which include the National Adaptation Programs of Actions (NAPAs) that provide a framework of adaptation programs to ensure rural livelihoods security (GoM, 2006). Adaptation measures may be planned in advance or put in place spontaneously in response to a local pressure and humans have been adapting to their environments throughout history by developing practices, cultures and livelihoods suited to locally emerging conditions (Joshual et., al. 2016)

According to study findings by Smithers and Smith (2009), adaptation can be influenced by a number of things amongst which key are the environmental perceptions held by individual, households or a community at large. Resource endowments such as physical household assets, income, time and household manpower are also found to influence a household's choice of an adaptation strategy (ibid). Furthermore, other studies on gender and adaptation reveal that gender particularly differences in gender roles for men and women at household level produce inequalities that influence choice of an adaptation strategy and levels of the same (Kumar, 1994). The findings of the study further state that women are mostly labor and economically constrained such that they are significantly disadvantaged in

terms of inputs and necessary equipment's required to pursue a certain livelihood strategy hence they generally have limited choices of adaptation strategies. Accordingly, female headed households were also found to be faced with limited choices of adaptation strategies in as far as resources such as income and manpower are involved (ibid). Coupled with their care taker roles, women generally have limited time resources to effectively pursue livelihood strategies and all this together cripples their adaptive capacity.

However, other studies have found women to be successful implementers of livelihood strategies. Through their active participation in women's Village Savings and Loans groups (VSLs), women are able to save up and even borrow income for investments in farming activities and livestock rearing thereby they are able to overcome the limitations of income and manpower deficits by hiring in labor (Bryan *et al.,* 2011). Furthermore, although women indeed have such limitations mentioned above, they to a great extent enjoy a great deal of human capital in the form of knowledge of productive modern practices such as crop diversification and management, livelihood diversification as well as small scale business tips gained through their active participation in community knowledge transfer and empowerment meetings. Such knowledge can easily be translated to successful adaptation strategies (ibid).

The authors give a very good presentation on how responses to climate change have evolved so far. Adaptation and what influences the choice of a livelihood strategy for adaptation is also very well explained. However, despite the fact that the authors also did not anyhow particularly dwell on fishing households, they also did not go further to study the livelihood outcomes after adaptation. Whether the choice of a livelihood strategy for adaptation is influenced by environmental perceptions, assets or gender as the authors state, the studies could have highlighted on what the livelihood outcomes after adaption have been so far. Consequently, sustainability of the livelihood strategies employed for adaptation were ignored.

2.6 Climate Change and Food Security

Climate change and variability is considered as one of the most serious threats to sustainable development with adverse impacts on food security (Fisher, 2012). Agricultural yields and reliance on natural resources tend to be the support system for most livelihoods especially in Africa. However, the effects of climate change and variability present a horrible fate for crops, livestock and people's survival as such, the majority of farming households in Africa have struggled to sustain their livelihoods. Recurrent droughts, hostile climates, poor and excessive precipitation has reduced food crop production by 30% and increased food insecure households from 160 million in 1996 to over a 200 million in the 2000s thereby letting down efforts to meet the United Nations Millennium Development Goals (MDGs) of reducing hunger by half by 2015 (Njaya 2003). Furthermore, in many developing nations, climate change has decreased cereal production in almost 65 nations and a loss of 16 percent of Gross Domestic Product in other cases. According to the world bank in Mpasuka, (2013), the food security situation is further expected to worsen as Africa's arable land which is 26 to 60 million hectares is expected to be affected by climate change especially from severe climate or soil constraints by 2080.

Malawi like many countries of Southern Africa has experienced deteriorating food production due to climate and weather variability, FAO in Njaya et al., (2011). Approximately 85% of household food and nutritional security is derived from agricultural sector 70% of which is dominated by subsistence farming there by constituting the primary source of livelihood for the overwhelming majority of the population (ibid). According to the World Bank in (Fisher, 2012), the sector forms the foundation of the national economy employing 85% of the labour force and contributing about 35% to gross domestic product and 73% to total export revenues. However, despite concerted efforts to improve dissemination of seasonal weather forecasts at the beginning of the rainy season, erratic rains across the country have disrupted farming systems resulting in acute crop failure and damage Action Aid, Mkwambisi, (2008). The failure of crops has thus resulted in shortfalls in food production thereby leading to food insecurity hunger and malnutrition, especially among vulnerable rural communities (ibid). Food security is a situation where all

household members have adequate food throughout the year and in Malawi, households are considered food secure if each household member has at least 270 kg food per year, GoM, 2008, Action Aid, 2006 in (Mkwambisi, 2008).

Even thou presently food production does not meet the food demand due to, in part, high population growth, deteriorating soil productivity and unsustainable technologies among others, it is evident that the situation has been exasperated by climatic and weather variability Action Aid in Gomani, (2008). Precipitation and other related factors have been major causes of fluctuating crop production as FAO in Njaya et al., (2011) states that erratic precipitation and temperature drastically reduced household food production in 1991/92, 1994/1995 and 2001/2002. Similar to this, according to the 2008 Annual Economic Report by Ministry of Development Planning and Cooperation, Malawi experienced a reduction in production by 3.1% in 1997/1998 and followed with 3.5% drop in 2000 and 2001 and another 10% decline in the middle of 2004 (GoM, 2008). In 2002, between 500 and 1000 people died of hunger or hunger-related diseases and about 4.7 million people out of the 12 million population experienced food shortages in 2005 (Mpasuka, 2013). Furthermore, in 2008, about 1.1 million people, on average 242,000 households, were food insecure due to extreme events such as droughts and floods but those that had severe impacts on crops are the ones that took place in the following crop seasons; 1991/92, 1993/94, 2003/04, and 2004/05 (ibid).

Mkwambisi and Gomani (2008), also observe that in the affected areas, these events have had irreversible and damaging effects on crop and livestock production, especially the droughts that occurred during the 1978/79, 1981/82, 1991/92 and 1993/94 crop growing seasons. For instance, in the 2009/10 agricultural season, the Lower Shire valley experienced a long dry spell between the months of December and February and this resulted in crop failure ending up with about 1.5 Million food insecure people in the period between June 2010 and March 2011 GoM in (Fisher, 2012). Additionally, following the most devastating floods ever of 2015, the 16th situation report by the Department of Disaster Management Affairs stated that some 63,000 hectares of land had been submerged, more than half of which was cropland. This according to the report left an estimation of 116,000 farmers being severely impacted as compromised crops could lead to no food or income in the near future if

no action was taken. In addition to crops being compromised, much livestock was lost and this affected the country as a whole as the GoM estimated a loss of over $8 million in food production (GoM, 2015).

The authors give a very good and detailed account of how climate change has affected food security in Africa particularly Malawi. Mkwambisi and Gomani further strengthen their argument by giving a historical account of the food security trends in Malawi as affected by climate change. However, strong as their arguments are, the authors do not mention the direct impact climate change has had on particularly fisheries. Their arguments are general to food security as affected through crop and livestock production but give no detailed account particular to fishery trends as affected by climate change. Furthermore, how Africa in general and Malawi in particular have responded to counter the effects climate change has had on food security is also not mentioned.

Much as there are such strong arguments on how climate change has affected food security, on the other hand, Maxwell (1992) contests the sentiments of climate change being the cause of food insecurity and states that the underlying causes for food insecurity in Africa are limited growth of the agricultural sector, increasing income disparity, rapid population growth, and urbanization. These factors according to Maxwell (1992) are often the consequence of bad governmental or donor policies and food insecurity in these countries only reveal inherent weaknesses of a country's food system. (Fisher, 2012) further agrees and mentions that food insecurity is largely a result of domestic policies, both sector-specific and economy wide that have imposed fairly large disincentives on agriculture and food production and largely penalized it into dismal performance. Furthermore, vast areas of un utilized farm land, high taxes, declining exchange rates, high interest rates and the enormous debt burden in most African countries like Malawi are some of the important underlying causes of the weak agricultural performance of the continent (ibid). However, he too in his arguments did not give special attention to fisheries. His arguments are general on the causes of food security in Africa.

2.7 Fishing Livelihoods in Malawi

The fisheries sector in Malawi provides a very significant source of livelihoods for the rural poor thereby potentially contributing to local and national economic growth and poverty reduction (Mvula et al, 2014). Livelihoods studies based in five villages on the shores of Lakes Malawi and Chilwa also reveal fisheries to be an important contributor to poverty alleviation and rural economic growth in lakeshore areas (Allison and Mvula, 2002). On the same, it is believed that 1.6 million people in the lake shore communities derive significant proportions of their in-kind and cash incomes from the fishing industry (Mvula et, al 2014). Thus according to USAID in Njaya, (2013) fisheries sustain the livelihoods of about 10% of the population and represent about 4% of the Gross Domestic Product (GDP).

About 90% of Malawi's annual fish production is from small-scale fishing and play a significant role in the livelihoods of rural populations because they are sources of income, sustenance, and employment (ibid). Furthermore, USAID, in Njaya (2013) states that fisheries in Malawi employ about 60,000 fishers and indirectly employ over half a million Malawians through processing, fish marketing, boat building and repair. Many of these employees are rural women involved in fish processing and marketing. Similarly, women are also said to be significantly involved in income-generating and food-providing activities in fishing villages (Allison and Mvula, 2002). Cash and investment in rural Malawi is extremely limited and an effective market economy based on agriculture has failed to develop in most areas as such; fishing, processing and fish trading constitute a principal occupation for the majority of households in lakeshore areas and a significant other from nearby communities thus generating cash income in both rural and urban areas (Allison and Mvula, 2002, USAID, 2013). To concur this assertion, Allison and Mvula, (2002) further observe that the incomes and asset status of households involved in fishing, particularly those of boat and gear owners, are significantly higher than those of non-fishing or farming households in the same villages. This income is thus in turn invested in agriculture, trading and service enterprises in the rural areas as Allison and Mvula also establish that fishing in the shores of lake Chilwa had stimulated a number of economic ventures and that there are links between fishing and other significant rural services.

Additionally, fisheries play an important role in combating food insecurity in Malawi, as they are a significant source of protein, vitamins, minerals, and micronutrients (MoG, 2006). Fish provide 28% of the country's animal protein supply and are critical for the health and nutrition of Malawians, especially for rural communities and those living around lakes (USAID, 2013, FAO, 1993). A comprehensive food security and vulnerability analysis found fish to be the most consumed animal protein, with 65% of households stating they consumed fish at least once per week, with an average consumption of 1.8 days per week (ibid). Similarly, Njaya, (1996) also mentions that fish significantly accounts for between 6 and 7% of the cash expenditure on food by the poor in rural Malawi.

However, even thou fish remain a key item in the diet of Malawi's people, maintaining the supply of fish to consumers from domestic production has proved impossible in the face of population growth. The Malawian fisheries have experienced a considerable decline especially from early 1990s; annual catches declined from an average of 68,000 metric tonnes (1976-1990) to an average of 55,000 metric tonnes (1993-2003) (Njaya, 2002). National per capita supply of fish has dropped from 12-18 kg/yr in the 1970s to around 6-7 kg/yr in the late 1990s while individual fish consumption is estimated at 5.6 kg/year, which is a large drop from 14 kg/year in the 1970s (USAID, 2013). With domestic fish production declining, fish imports in Malawi have taken a generally upward trend from about 760 metric tonnes in 1997 to 2808 metric tonnes in 1999 (Njaya, 2002). Convenient with this increase in fish imports was a decrease in fish exports indicating low contribution to foreign exchange by the fisheries sector. Additional to population pressure, a combination of complex factors contributed to the decline including localised overfishing in some inshore stocks of Lake Malawi and climatic influence that results in drying up of Lake Chilwa (ibid). Below is a graph giving us a graphic detail of the declines since 2008.

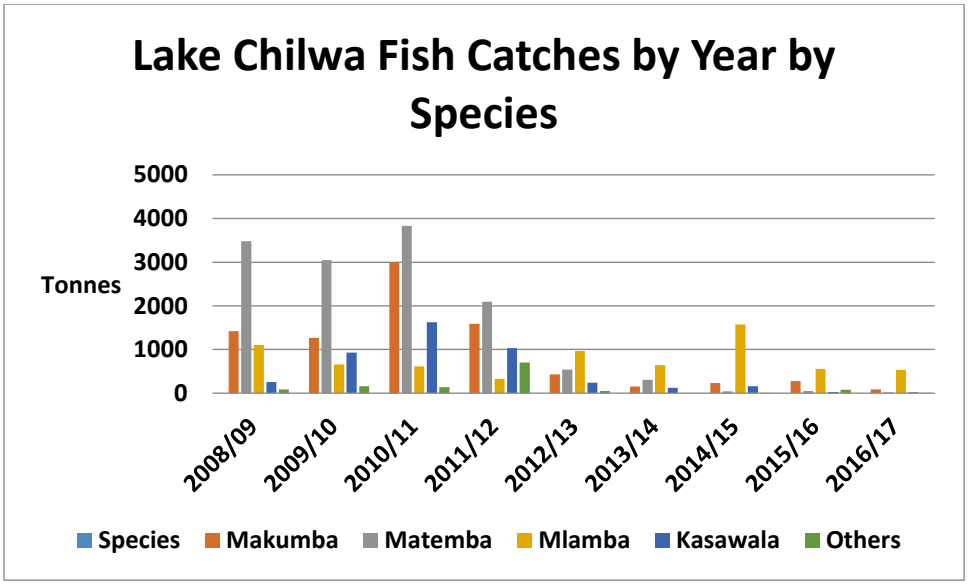

Figure 2: Evidence of declining fish catches; some species like Matemba have become extinct

Source: Zomba District Fisheries Office, 2019

Nevertheless, even with such notable declines on record, the authors focused on the economic impact that the fishing industry has on the fishing households and Malawi's economy at large. The studies cited above did not go further to look into detail how the declining fish catches have impacted on the households that depend on fisheries. All the authors recognise that income earned from fisheries is in turn invested in agriculture, trading and service enterprises in the rural areas and that there are links between fishing and other significant rural services within the fishing communities. However, how households that benefited from such significant rural services have adapted in response to the declines was not of key concern and is barely mentioned throughout the literature.

2.8 Livelihoods of the Lake Chilwa

The benefits which the local population derive from the wetland make it an immensely valuable livelihood asset. From a number of studies, it is evident that fishing is a central element of the livelihood systems of Lake Chilwa (Mvula et al, 2014). It is part of a flexible set of economic activities that constitute diversified livelihood strategies on which families depend (ibid). With the value of fishery estimated between US$11 million and US$17 million annually, it has been argued that the fish sector is the engine of the basin's economy with (GoM 2009). On a good

year it is said that fishery can support 9000 fishermen, not counting the fish processors, traders and gear owners (Njaya 2011).

Similar to the findings by Allison and Mvula, (2002) in a LADDER study that observed five villages along the lake shores of Malawi, Njaya, (2011) observe that in the lake Chilwa plain, households that are involved in the fish sector are generally better off than those who are not. Incomes of fishing households are significantly higher than those of farming households in the same district in five of six countries studied by FAO and the amount saved and saving rates are higher for fisher folk than for agriculturalists (Allison and Mvula, 2002). It was also observed that in some cases, fishing contributes more to household income than do cattle and crop sales. However, the capital that the fish sector brings to the basin also keeps other businesses going such that most households are nevertheless dependent on the lake and the fish sector in one way or the other as the money from the fish sector is often invested in farming or other small businesses such as restaurants, shops or room rentals. (Njaya et al, 2011).

Additionally, the lake Chilwa plain is also a highly productive agro ecological zone as it has rich sedimentary alluvial soils (Mvula et al, 2014). Agriculture production in the area is dominated by smallholder farmers with land holding sizes averaging mostly less than one hector per household and the major crops grown in the plain include rice, maize sweet potatoes, cassava, pigeon peas and beans (ibid). Recently, Barley tobacco has been introduced in the area as a cash crop and there are some tobacco estates that together with the rice schemes provide employment during much of the year through piece work thus addressing food security problems during the hungry season (ibid). Additional to the crops are livestock such as chickens and goats that also, however, due to lack of veterinary services most livestock has suffered high mortality.

Nonetheless, fishing livelihoods in the plain are vulnerable to the vagaries of weather as much as farming systems are. Climate change processes contribute to fluctuations in the levels of lake Chilwa which affect the whole productivity of the lake's fisheries as well as the livelihoods of the people of the plain (Mvula, et al, 2014). Yields from the lake are declining significantly; for example, Lake Chilwa's total catch has

dropped by more than a third since the 1990's (Njaya, 2011). Statistics from the Meteorological Department show that the mean maximum temperatures in the basin have risen by approximately 1°C while decrease in precipitation since the mid-1980s has also been documented in the basin such that the combined effects of higher temperatures and less rain is arguably the reason for the gradual decrease in Lake Chilwa's water level discussed above (EAD 2000).

Thus, when the lake dries up, so does the basin's economy; rural fishing communities are facing thus difficulties in the wake of declining catches. Furthermore, drought or poor rainy seasons that cause the lake to dry up also have a devastating effect on people´s crops, resulting in food insecurity throughout the region (Njaya 2011). Diversified, adaptable and mobile rural livelihoods are thus characteristic of this unstable Lake Chilwa production environment. In order to get by people, travel long distances to buy food or migrate to other districts to find temporary jobs in other sectors. Fisherfolk are not nearly so occupationally immobile and have responded dynamically to reduced opportunities in fishing and increased opportunities elsewhere (Allison and Mvula, 2011). For example; Chisi Island had 11 villages with 2015 people, men outnumbered women by 15 to 1 and most of them were migrant fishermen. By 1968, when the lake had dried out, the population of Chisi Island had fallen to 779 persons. All the temporary migrants had left, and 228 resident men had also left to find alternative employment. At Kachulu fish landing population fell from 800 in 1966 to 186 in 1968 (Njaya, 2011). Fears are that persistent higher temperatures and a possible reduction in precipitation will cause the lake to dry up more frequently rendering the livelihoods of the plain even more vulnerable.

Although the scholars make mention that lake Chilwa has for a long time been the engine of the basins economy and that the basins population are facing difficulties in the wake of declining fish catches. They did not go further to detail how the basins population particularly those involved in fishing and related activities have responded to the situation. The authors only briefly mention that fisher folk have responded by seeking opportunities elsewhere but did not go further to establish how these households have utilised their assets to explore other opportunities within the area. Additionally, the authors also fail to give account of how such households are faring in the new opportunities engaged.

2.9 Conceptual Framework

2.9.1 The Sustainable Livelihoods Framework (SLF).

The study associated with the assertion that climate change causes devastating effects on people's livelihoods and that people adapt and respond dynamically through employment of different livelihood strategies that also bring about different livelihood outcomes. This study thus worked on the assertion that 'effects of climate change particularly the persistent declining water levels and fish stocks of the Lake Chilwa have caused households involved in fishing and related activities to adapt, shift livelihoods and employ other livelihood strategies away from the lake and this has brought about different livelihood outcomes for these households in terms of sustainability.

The SLF is a holistic and integrated view of the processes by which people achieve or fail to achieve sustainable livelihoods (Scoones 1998). It can be used to analyse sustainability of the adaptive livelihood strategies pursued by individuals, households and communities as a response to external shocks and stresses (DFID, 2000). The DFID developed the SLF with the aim to eliminate poverty of the poorer countries. It therefore provides a useful conceptual base for understanding vulnerability and the situation of people living in vulnerable contexts like that of the Lake Chilwa. The study was thus guided by the SLF as it was found to be a more analytically rigorous tool to assess the ability and capabilities of the vulnerable households to adapt sustainably (Adger etal 2003). As a concept, sustainable livelihoods approach is held to provide a more rounded picture of the complexities of living and surviving in poor/vulnerable communities (IISD, 2013). As such the SLF was chosen for the fact that it provided techniques to enhance understanding of the livelihoods of vulnerable households in the Lake Chilwa.

Unlike other frameworks, the SLF has connected multi-dimensional aspects which include vulnerability context, livelihood asset, livelihood strategy and livelihood outcome and these are the main significant variables for this particular study whereby declining water levels and fish stocks of the lake Chilwa, various assets owned by households involved in fishing and related activities, livelihoods employed for

adaptation and the sustainability of these livelihoods respectively represent vulnerability context, livelihood asset, livelihood strategy and livelihood outcome of the SLF. Therefore, these features of the SLF tally well with the assumption of this study which as mentioned above is that 'the vulnerability context of persistent declining water levels and fish stocks has caused households involved in fishing and related activities to shift livelihoods and employ other livelihood strategies away from the lake and this has brought about different livelihood outcomes.

The fundamental feature of the SLF is the analysis of five different types of assets own by individual households to build their livelihoods which consists of natural, social, human, physical and financial capital (Carney, 1998). More significant to this study, the SLF particularly links inputs (designated with the term 'capitals' or 'assets') and outputs (livelihood strategies), connecting in turn to outcomes, which include levels of well-being and sustainability (Scoones, 1996). Also of more significance to this particular study is that the input-output-outcome elements of the livelihoods framework allows for the analysis of a range of formal and informal organizational and institutional factors that influence the utilization of different assets that in turn influence livelihood strategies employed to achieve sustainable livelihood outcomes (Carney 1998). Unlike the SLF, some livelihoods analysis has unfortunately never moved much beyond this, missing out on wider social and institutional dimensions

In the livelihoods discourse and in the particular case of this study, the term 'sustainable livelihood' thus implies that livelihoods are stable, durable, resilient and robust enough to maintain and enhance positive livelihood outcomes in the face of both external shocks and internal stresses (Scoones 2009). By using the SLF, assessing the sustainable livelihood outcomes therefore requires a careful selection of parameters, which are representative indicators of all the sectors of human-life (ibid). Outcomes of course vary, and how different strategies affect livelihood pathways or trajectories is an important concern for sustainable livelihoods analysis (Scoones, 2009). These features of the SLF thus also largely correspond with the main objective of this study which assessed comprehensively the sustainable livelihood outcomes of the vulnerable households in Lake Chilwa (Vulnerable as their livelihoods are dependent on a deteriorating and unstable resource.) and allowed for a careful

analysis of sustainable livelihood outcomes by use of relevant sustainable livelihood outcome indictors selected for this particular study.

Furthermore, perceptions and determinants of climate change adaptation are highly contextual thus a thorough understanding of such requires a careful understanding of institutions that shape them. The SLF provided the study with such an opportunity further to which the framework thus helped the study to determine the assets, opportunities, well-being and other sustainable livelihood outcomes as mediated by social-institutional processes that shaped perceptions and determined choices of adaptation. On overall, the use of the SLF in this study helped the study understand how vulnerable households involved in fishing and related activities in the lake Chilwa are making use of their assets and other opportunities present to make a sustainable living in the face of the drying up of the lake Chilwa and declining fish stocks challenges.

The figure below presents the SLF and its interconnected variables.

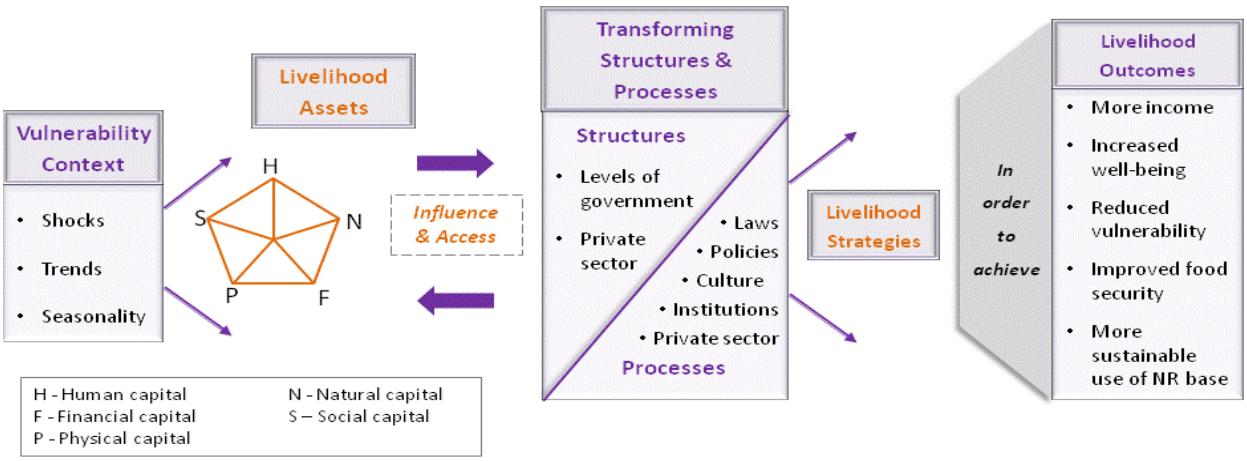

Figure 3: The Sustainable Livelihood Framework: Adapted from DFID (1999)

Summary

Literature reviewed shows that different scholars have done a lot of research on climate change, livelihoods and adaptation. Particularly there is a lot of literature on Lake Chilwa its fisheries and other livelihoods. However, it is clear from the literature reviewed that the scholars focus on how the affected households involved in fishing and related activities have adapted to the persistent Lake Chilwa situation is very limited or non-existent altogether. Those that have gotten any close to establishing how the affected households have responded have so far only focused on the coping mechanisms that these households employ during the lake recessions. No research has been done to establish whether the affected households involved in fishing and related activities have adapted and what kind of livelihood strategies they have employed for adaptation so far. In addition, although the term sustainability has become so popular in all development arenas, there is very little or no mention at all of how households involved in fishing and related activities are faring in terms of sustainability of their livelihood strategies. It is thus in view of such existing gaps in literature that this study was conducted and employed the SLF so as to determine the linkages between vulnerability, assets ownership and how these interact to influence the choice of a livelihood strategy to achieve a sustainable livelihood.

CHAPTER THREE

METHODOLOGY

3.1 Chapter Overview

This chapter discusses the research methodology that was used in the study. Specifically, the chapter describes the research design and methods used for data collection, the sampling techniques and analysis methods employed. It also goes further to discuss the site and participants of the study.

3.2 Research Design

The study adopted a mix methods approach with a bias towards qualitative approach. Both qualitative and quantitative approaches were combined, however, with reference

to the sustainable livelihoods framework, the quantitative approach was important for the study as it was basically used to quantify and measure the asset levels of the households and also to summarize by frequencies the different livelihood strategies employed. On the other hand, the qualitative approach was important for the study as it was used to get a more detailed and comprehensive overview of how the households involved in fishing and related activities are making a living with the adaptation strategies employed within evolving climatic contexts and a declining livelihood source. It also helped the study deeply understand how the assets provided new opportunities for households to achieve multiple and diverse livelihood outcomes in the face of a variable livelihood source.

3.3 Study Site

The study was conducted in Lake Chilwa; Kachulu beach surroundings. The site was chosen because it is one of the 3 main fish harbors of the Lake Chilwa, and central and busiest amongst the three. Furthermore, the Kachulu side is said to be much shallower than the rest hence dries up faster than the rest.

3.4 Study Participants

The study employed households involved in fishing and related activities around Kachulu beach. Since fishing livelihoods are not only derived from the actual fishing itself but also from activities related to it (Allison and Mvula, 2002); for the purposes of this study, the fishing households were categorized into four; the actual fishermen, the fish processors, the boat owners and the fish traders. This was done to incorporate and specifically target all the main fishing activities of the area.

3.5 Methods of data collection

The study employed primary data through household questionnaires and in-depth interviews. On quantitative data was collected through household interviews with household heads from all the four fisher categories. The household questionnaire helped the study to determine household's assets base and rank the different livelihood strategies employed by the households involved in fishing and related activities.

For qualitative data, they study employed In-depth interviews with household heads. In-depth interviews helped the study to get a comprehensive overview of the people's perceptions regarding the climate induced changes that are taking place and how households are making a living in the face of the changing environment and declining fish stocks. In-depth interviews were preferred because they provided a more detailed insight into individual experiences of the fisher households' e.g. livelihood experiences at household level than an FGD would (Cohen, 2006). Furthermore, Cohen (2006) argues that in-depth interviews allow the respondents the freedom to express their views in their own terms hence; they provide reliable and comparable data.

3.6 Sampling techniques

For quantitative data, the study meant to purposively sample out 48 households from the general population of villages surrounding Kachulu however, only 45 households were successfully interviewed as the boat owner fisher category could not reach target. In purposive sampling the researcher identifies the people, places and situations which has the largest potential for advancing his/ her understanding of the concerned issues (Palys 2008). Therefore, since this study sought to categorise the fisher households into the four main fishing activity categories of the lake Chilwa, 12 households from each category were supposed to be purposively sampled for the household interviews. This was done so as to have an equally and representatively distributed sample across all the four fisher household categories. Additionally, the 12 households per category were deemed reasonably adequate to capture diverse experiences within each category. However, only 9 households from the boat owner category were successfully interviewed as they were scarce.

For in-depth interviews, the study purposively sampled and targeted 16 households involved in fishing activities. That is from the 12 interviewed for the household survey in each category, 4 households were sampled for the in-depth interviews. This sampling purposively targeted households that were found to have pursued and depended on fishing and related activities the longest and also those that had reported through the household interview that they had been adapting to the situation for at least 5 consecutive years. These households were targeted as their minimum 5 years of adaptation provided the study with an ample period for sustainability analysis of

the livelihood strategies employed. In-depth interviews with these households were also deemed necessary as these households were better positioned to give a detailed overtime insight on trends in their own personal experiences and how other fisher households had adapted and made a living in the face of climate change and declining fish stocks. Additionally, they were believed to be well informed on the trends in livelihood strategies amongst fisher households in the area.

3.7 Data analysis

Data analysis on the quantitative part used descriptive statistics to summerise frequencies using the Statistical Package for Social Scientists (SPSS). Frequency analysis is a descriptive statistical method that shows the number of occurrences of each response chosen by the respondents (Cohen, 2006). As such SPSS was chosen because of its accuracy in summerising occurrences and was used to analyze livelihoods in the context of capital assets and livelihood strategies employed.

While for the qualitative part, the study employed content analysis. Content analysis is a research method which allows social scientists to examine replicable patterns in qualitative data and systematically and reliably make generalizations in relation to the categories of interest to the researcher (Terry, 2015). Content analysis thus helped the study to draw dominant themes from the consistencies in data outcomes in relation to objective one and partly objective three.

According to Chambers and Conway (1991) a livelihood "comprises the capabilities, assets and activities required for a means of living and it is sustainable when it can cope with and recover from stresses and shocks while maintaining or enhancing its capabilities and assets. In the livelihoods discourse and in the particular case of this study, the term 'sustainable livelihood' thus implies that livelihoods are stable, durable, resilient and robust enough to maintain and enhance positive livelihood outcomes in the face of both external shocks and internal stresses (Scoones 2009). Sustainable livelihoods thus can be measured by looking at household livelihood outcomes which may also be referred to as sustainable livelihood indicators (Scoones, 1998). Determining sustainability thus requires developing outcome indicators, as such, for the purposes of this study; household assets base, food security and general

household subjective social wellbeing were adopted from the (SLF) and employed as outcome indicators of sustainable livelihoods. Furthermore, the study was somehow retrospective in nature as participants recalled their livelihoods from as far as 5 years back and compared with their current livelihoods. As such all data collection tools were designed in such a way that they allowed for comparison of outcome indicators as variedly experienced overtime from the year the household started adapting to the time of the interviews.

3.8 Ethical Considerations

- A consent statement was issued to the respondents with assurance of anonymity, and confidentiality.
- Freedom to participate as well as withdraw from the study at any time they wish was emphasized.

3.9 Limitations of the Study

Study findings may not be generalised to other fishing communities elsewhere as this study was based on the case of Lake Chilwa hence some conditions may not be exactly the same elsewhere. Furthermore, the study might have missed out on some relevant perceptions since at the time of the study, a lot locals had gone in search for greener pasture elsewhere.

CHAPTER 4

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Chapter Overview

This chapter presents the findings of the study which looked at the sustainability of the livelihood strategies employed for adaption by households involved in fishing and related activities around Lake Chilwa. Particularly, the study focused on households involved in fishing and related activities around Kachulu beach. The study involved both male and female participants who were the actual fishermen, the fish processors, the boat owners and the fish traders. Household interviews and in-depth interviews were conducted from 10th to the 15th of December 2018. The study had three objectives and in response to these objectives, this chapter has been presented in three sections with each section presenting findings under a particular objective followed by results discussion. The first objective was to determine how households involved in fishing and related activities around Lake Chilwa perceive the climatic induced changes that have taken place. The second objective was to identify the livelihood strategies these households have employed for adaptation. The third and last one was to analyse the sustainability of the livelihood strategies employed for adaptation

4.2 Household Perceptions regarding the changes that have taken Place

Available studies have shown that understanding adaptation and mitigation of the adverse effects of climate change requires important understandings with regard to the awareness and perceptions of the target population (IPCC, 2014). How people perceive climate change largely determines how they respond to its effects whether through coping or adapting in the long run (Ibid). This study thus first sought to understand how households involved in fishing and related activities perceive the changes that have taken place in the area. This was achieved by first establishing if at all these households are aware of the changes that have taken and continue to take

place and it went further to determine what they thought was the cause of the changes being experienced. Below are the findings from the study.

4.2.1 Awareness of the changes that have taken place

All participants from the in-depth interviews reported to have heard and have themselves observed and experienced changes in the water levels and declining fish stocks of the Lake Chilwa in one way or another. Major changes manifested in their experiences of disrupted livelihoods. Also while growing up, they themselves experienced the drying of the lake or heard stories about the recessions from their elders. All 16 participants observed that the fish catches had declined and over half of them note that the water levels had hugely dropped and the fish declines had become even more severe. Referring to the 2017-2018 complete dry out almost all participants reported that the experience is something they had never seen in their life time as in most previous recessions the lake would only dry partially but during this period it was a complete dry out.

> *"Ine ndinabwela kuno 2010, nthawi imeneyoyo kuno Nsomba zinali zambiri moti ineyo ndinabwela kuno chifukwa cha nsomba. Nthawi ngati yino timakhala kuti tili kudoko uko, kugula nsomba, kugula kwenikweni mmene ungagulire munthu. Muthandala monse umu mmadzadza nsomba. nsomba zimachita kuola mmabench anfumu nkuyimba belu kuti nsomba izi mukwilire zonse tayani. Anthu ndikukwilira koma pano zinangosintha palibenso kuti olo themba lenileni uliona. Olo kudutsa munsikamu simukapezanso themba la munyanja iyi, ndiusipa kapena a bonya a lake Malawi."* (I settled in this area in 2010 and around that time there was so much fish here, it was the fish that attracted me to this place. Around this time of the year we would be at the beach buying fish and there used to be so much fish that we would buy without limit. The benches you see here would all be filled with fish to the extent that they got rotten and the village head would command us to throw it all away by burying it in the ground. But now everything has just changed, you can't even find a simple 'matemba' fish in our market, the market is full of Usipa and bonya from Lake Malawi.

(**Female fish processor)**

Monganso nyanja yathuyi mmene ikaphwelera simmene yaphwelera panomu. Kale imatha kuphwela mbali yina mbali yina ndikukhala madzi koma osati mpaka anthu kumaoloka kupita tsidya linalo wapansi kapena galimoto kumadutsa panyanjapa ngati ndaziona ine chaka chino, iyayi. (What I have seen happening with the lake this year is something I have never seen before. Yes, the lake would dry up previously but not to the extent of people crossing over on foot to the other side of the lake or cars driving through. It is very alarming.)

(**Female fish trader)**

"Nyanja inali ndi nsomba zamitundu mitundi iyi, kuweza munthu ndikumachita kusankha kuti lero ndidyeko ntundu uwu koma pano tikuona ife ndimilambatu basi. Milamba yakenso kwachela iwiri yeniyeni pomwe kalero timapita kunyanja kugwila nsomba nkumabwelera matumba athalauza atazaza ndalama." (I tell you this lake had a lot of fish species that we would choose which kind to eat for the day, but nowadays all we see are just a few Milamba yet in the past when we went fishing we would come home with pockets full of money from sales.)

(Fisherman)

These study findings confirm recent literature on Lake Chilwa that indicate that the lake recessions have increased in frequency and that the lake is almost 60% dry leading to the increased fatality in fish stocks hence disrupting the fishery livelihoods (Deepa, 2017). Furthermore, such perceptions also agree with recent literature that indicates that some fish species of the Lake Chilwa have become extinct. "The lake used to have 14 species of fish but some are now extinct; only three continue to exist thus: Matemba (*Barbus paludinosus*), Mlamba *(Clarias gariepinus)* and Makumba *(Oreochromis shiranus chilwae)* and recently, Matemba has also vanished (GoM, 2019).

4.2.2 Perceived Causes of the Changes Experienced

Participants were asked what they thought caused the changes being experienced and below are the findings in detail.

4.2.2.1 Climate Change

All 16 participants of the in-depth interviews recognized that the devastating changes that they had experienced were a direct result of climate change. Participants from the in-depth interview consistently reported increases in temperature coupled with a consistent decrease in the amount of rainfall received. Further to this participant also reported to have experienced a change in the onset of rains accompanied by erratic rainfall patterns. Not only has the rainfall season changed its onset but has also become unstable and the rains fall inconsistently. One is not sure when the rains will start and if at all it will continue to fall uniformly as sometimes it just cuts off and resume later after so many days sometimes even after a week. Such experiences they said have resulted into the lake not retaining enough water thus drying up.

> *Kutenthako ndiye kukuyenjeza madzi munyanja akungouma nsanga Chikhala mvula imabwela yokwanila bwenzi madziwo akulimbamo munyanjamo.* (There are very high temperatures in this area, If only we received enough rains the water in the Lake would last longer.)
>
> **(Male Fisher Man)**

> "*Magwedwe akenso mvulayi yamasiku ano osasangalatsa, imabwela mochedwa, ndiye imati ikagwa lero mawa muona ziiii, kumati iiih mwina igwa tsiku linalo, muonanso ziiii nkukhalanso kumangodikila. Ndiye ikagwa lero pena igwe phwii, pena mawa muona pang'onongono, zogwetsa ulesi"* (The rainfall pattern nowadays is not even satisfying. The rainy season begins very late and then you have rains today expecting to have them again tomorrow but they don't show up and we just wait. When it falls it's not even uniform, today we have a heavy rainfall and the next day just a little and we end up being demoralized.)
>
> **(Female fish Processor)**

Such perceptions of people involved in fishing activities on climate change are also very much consistent with statistics from the Zomba Meteorological station that show

that the mean maximum temperatures in the basin have risen by approximately 1°C while decrease in precipitation since the mid-1980s has also been documented in the basin such that the combined effects of higher temperatures and less rain is arguably the reason for the gradual decrease in Lake Chilwa's water levels (EAD 2000). additionally, findings by Joshua et al., (2016) in a study on climate change in Chikwawa district, semi-arid southern Malawi, in which people's observations on climate change were compared with empirical evidence using temperature and rainfall data for nearby climate stations, the authors state that the findings indicate similarities in the empirical evidence and people's narrations of their observations of climate variability. Similar to the narrations of the people of Kachulu in this study, the climate data from the study by Joshua et al., shows fluctuations in onset date, cessation date of rainfall and change in climate. Furthermore, the same study report by Joshua et Al., similarly shows that daily minimum temperatures have increased with some stations having significant increases at 95% levels.

4.2.2.2 Deforestation

Further results from this study also indicate that due to increased population, deforestation is rampant in the area and has caused the lake to dry and reduce its fish stocks in two ways. First; by directly leading to climate change as lack of trees block rain clouds from forming thereby leading to erratic low rainfall. Second; by allowing large deposits of sand into the lake there by reducing the depth of the lake and consequently leading to low water levels and declined fish stocks. Participants report that there is a high population in the area and trees are rapidly cut down to make boats, some use the trees for firewood and others for charcoal burning to sell, a practice that participants reported is on the increase as an alternative to fishing due to the drying up of the lake. Findings further indicate that participants attribute the existence of large deposits of sand into the lake to cultivating along river banks due to land pressure.

> *Komanso kulima mmbali mmwa ntsinje ndikudula mitengo mosasamala imene imatchingila dothi ndiye dothi lija limangokokoloka nkukadzadzanso munyanja mwathumu Nyanja nkumaphwela.* (Cultivating along river banks and careless cutting down of trees that hold and protect our soils has led to siltation consequently filling up the lake with sand, thereby decreasing its depth and drying it up.)

(Female Fish Processor)

"*Kusintha kumeneku kukuchitika chifukwa chokuti anthu kusamvela zomwe amabungwe akumatilangiza kuti zinthu zachilengedwe muziziteteza. Anthu achulukana angodula mitengo Chisawawa. Ndiye kwathu kuno kulibe chitetezo chachilengedwe chokwanila ndiye mvula sibwela. Komwe kuli mitengo mvula simachedwa kugwa koma komwe kulibe mitengo mvula imavuta, nkona amati tizizala mitengo pafupi pafupi cholinga mitengo ija izithandizila kupanga mitambo yoyitana mvula. Ndiye kwathu kuno ndikuchepa mitengo, mitambo yamvula sipangika zotsatila zake mvula sibwela bwino.* (These changes are a result of disregarding advice from experts that we should protect the environment. This area is densely populated such that trees are just cut down carelessly as a result the area is left vulnerable. Where there are trees rain falls timely but where there are no trees rainfall is erratic and that is why experts advise us to plant trees often in order to induce rainfall since trees help with the formation of rain clouds. But with the inadequate trees in this area, rain clouds do not form and we end up having erratic rainfall).

(**Female Fish Trader)**

"Zimenezitu zikuchitika chifukwa kunjaku kwayela kwambiri. Amabungwe azanyengo kuphatikizapo a boma amatha kumatiuza osadula mitengo chisawawa koma anthu mitengo amangosakaza mwachangu. Kudela kuno ngati tili ndimitengo ndee ndi cha uko ku Chisi uko komanso nako kwayela mukuonelamu. Ndiye mvula siigwa chifukwa mitengo yoyitana mvulayo kulibe, komanso mvulayo ikagwa imangokokolola dothi nkumangolidzadza munyanjamu" (These changes are being experienced because the environment is too bare. Climate change experts from NGOs and the government would advise us not to cut down trees carelessly but people have just done the opposite, quickly clearing up the land of trees. If we claim to have trees in this area, we talk of those in Chisi Island but as you can see from here even Chisi is being cleared up. As a result, rain fails to fall

because there are no trees to form rain clouds and when it rains the bare soil is just washed away into the lake hence filling it up.)

(Boat Owner)

These findings also highly correlate with earlier studies which found that in the Lake Chilwa Basin, the high population growth rate aggravates the pressure on natural resources and has resulted in an immense loss of forest cover decreasing the forest area from 5084 hectares to less than 1,000 hectares between 2001 and 2011 (Chanyenga et al. 2011).

4.2.2.3 Unsustainable Fishing

According to the study results, population increase has not only caused rapid deforestation but also unsustainable fishing practices such as over fishing by use of small holed fish gears such as mosquito nets that catch even the smallest fishes from the lake. Additionally, cutting off of *Milulu* a very important aquatic grass that is habitat to fish and more significantly provides a breeding ground for fish has caused both the declining water levels and declining fish stocks. Participants report that because they are habitat for fish, the *Milulu* are a target so as to increase fish catches and this prevents further breeding of the fish as the fish eggs are destroyed and when cut these grasses are just thrown right into the lake there by forming loads under the lake hence; decreasing the water capacity of the lake.

Nyengo yasintha chifukwa mitengo ndiyochepa. Zachilengedwe ndizochepa. Mitengo ikungodulidwa mosasamala. Komanso mawezedwe anabwela ndi anzathu aku Mangochi nawo owononga ndiye asodzi akuno tangotengela kumadula Milulu zomwe zili nyumba zansomba munyanjamu pofuna ati kupha nsomba zambiri. Chilengedwe sichingasamalilike, olo nsomba sizingachulukane. (Climate has changed because there are not enough trees as they are being cut carelessly. Additionally, fellow fishermen from Mangochi introduced to us destructive fishing practices of cutting off Milulu an aquatic grass that breeds fish and the fishermen here just copied the practice all in the name of catching more fish. The environment is not protected and fish cannot

multiply.)

(Fisherman)

Komansotu kuweza kwache masiku ano tiwezela masikito net. Amene aja ndimibowo yache ing'onoing'gono amapha nsomba zambiri ndizazing'ono zomwe ndiye ife asodzi timawathamangila kuti tiphe nsomba zambiri. (And nowadays fishermen are fond of using mosquito nets for fishing. With their small holes, mosquito nets catch even the smallest fish as such we fishermen prefer to use them as they increase catches.)

(Fisherman)

These perceptions are consistent with an analysis by Njaya on the effects of overpopulation on natural resources in the area. According NSO (2008), the area's population estimated at 1.6 million with a density of 321 persons per km^2, is one of the highest in Malawi. Thus based on this finding, Njaya et al., (2011) further established that this high density puts tremendous pressure on the areas resources leading to among others, rapid deforestation and widespread soil erosion and overfishing. However unlike the popular assertions and findings by numerous previous studies that fishermen are not well informed of climate change and its causes, this study revealed that people involved in fishing activities around Kachulu beach including the fishermen themselves are well informed of climate change, its causes and its effects as there are lots of efforts by NGO's such as LEAD and the government at large through its extension workers to raise awareness about climate change issues in the area.

All in all, building on the fact that beliefs about climate change matter and that enhanced knowledge of climate change leads to greater concern and better and sustainable adaptation (Misir, 2014). By determining how the target community perceive the climate induced changes that have taken place in the lake Chilwa, this study therefore sought to first understand the climate change awareness and perceptions of the households involved in fishing and related activities and it was established through this study that people involved in fishing activities around Kachulu beach have experienced and are well aware of climate change and its

impacts upon them such that they ably attributed the water level and fish stock changes to climate change.

Findings of this study established that households involved in fishing and related activities around Lake Chilwa strongly perceive climate change as the main cause of the declining water levels and fish stocks they have experienced. The general consensus was that the low water levels and declining fish stocks were a direct result of climate change and that to a greater extent, human activities contributed directly to the declines. Specifically, households attributed the changes to human action through mainly deforestation, cultivating along river banks and unsustainable fishing practices such as overfishing and cutting off of *Milulu* an aquatic glass that provides breeding ground and housing for fish. Such practices have respectively resulted in erratic rainfall, unsustainable fishing and increased siltation leading to large deposits of sand into the Lake hence making it shallower. Such knowledge and perceptions have thus consequently led to households adapting to the situation and employing other livelihoods away from the lake.

4.3 Livelihood Strategies Employed for Adaptation by households involved in fishing and related activities

Climate shocks and a deteriorating natural resource base like the Lake Chilwa expose people to a vulnerability context which influences people's assets and livelihood opportunities. Evidence shows that climatic shocks lead to disrupted livelihoods and reduced income earning opportunities (Adger et. all, 2003). This may come about due to the loss of an economic resource base or weakened capacity altogether. However, there have been a lot of studies on climate change most of which state that many vulnerable communities have made adjustments and developed various adaptation strategies to face the increased climatic variability and occurrence of extreme events (IPCC 2001, Adger et al., 2003). From various existing literature and from this study as earlier presented, it is highly evident that the households involved in fishing and related activities in the lake Chilwa have had their livelihoods and income earning opportunities persistently disrupted thus; the study sought to further find out how these households have responded to these persistent disruptions. The section below

explains in detail how these households have responded to the changes and the various livelihoods strategies employed.

Asked what was their previous main occupation, all household heads interviewed indicated that they were not merely involved in fishing and related activities but actually; the respective fish related activities they undertook signified their main occupation. According to the four main fishing categories targeted in this study therefore, the main occupation for household heads represented 26.6% for each fishing category of target except for boat owners who were only 20% of the 45 households that were successfully interviewed in this study. Thus, of the 45 households that were interviewed in this study, 97.3% of the households indicated that fishing and related activities was the main source of livelihood for their households and amongst these, most of them indicated that it was actually the sole source of livelihood for their households as different members of the household undertook different fish related activities. While 2.7% of the households indicated farming particulary rice farming was the main source of livelihood for their household complemented by fish trading.

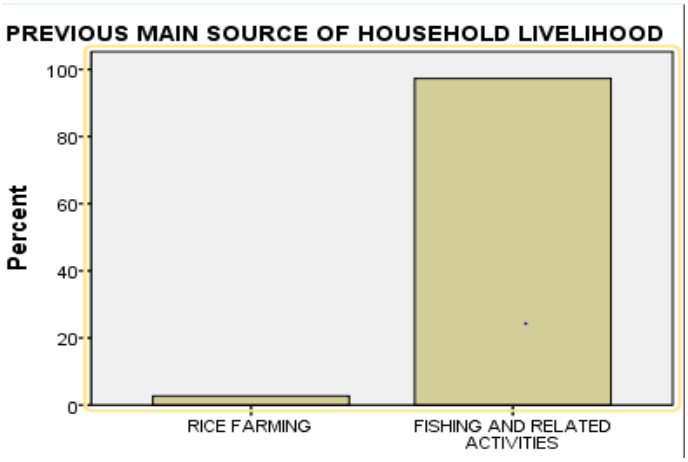

Figure 4: Previous Main Livelihood Source for Households

Source: Household interview

The findings above highly correlate with previous literature which indicates that because cash and investment in rural Malawi is extremely limited and an effective market economy based on agriculture has failed to develop in most areas; fishing, fish

processing and fish trading constitute a principal occupation for the majority of households in lakeshore areas and a significant other from nearby communities thus generating cash income in both rural and urban areas (Allison and Mvula, 2002, USAID, 2013). Indeed, results from this study show that these households and many others from the area generated income through mainly fishing related activities and that these activities were the sole livelihood source for most before the state of the lake deteriorated.

Nonetheless, when asked how they had responded to the persistent changes, all households interviewed reported to have adapted to the climatic changes as experienced through the drying of Lake Chilwa and declining fish stocks. Results show that households started adapting to the changes as early as 2008 with the highest percentage of 32.3% reporting to have adapted since 2015 followed by 18.9% who reported to have adapted from 2016.

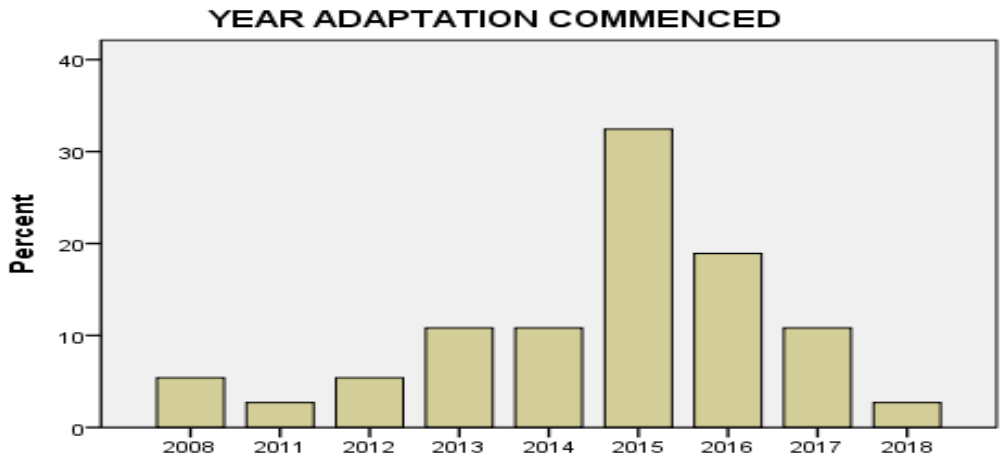

Figure 5: Year Household Started Adapting

Source: Household Interview

Under livelihood strategies employed for adaptation study results reveal that farming has become the most commonly adopted livelihood strategy as seconded by *ganyu* then followed by small scale business and lastly migration to other areas. Below is a qualitative analysis of the livelihoods employed

4.3.1 Farming

Participants from the household interviews reported that rice and maize farming have become the core livelihood activities amongst households involved in fishing activities with rice farming being the most popular livelihood. Results from the study show that previously most of the people involved in fishing activities sorely relied on the fishing activities for livelihood and it was enough to cater for all needs throughout the year. But recently due to the situation at hand most of the households have opted for rice farming for a livelihood. Maize farming is also an alternative but due to high costs of inputs required for its production, plus the low harvests that are usually incurred, it is not as popular as rice farming. Continuous failure of the maize crop due to prolonged dry spells and lack of fertilizer has also made people shy away from the activity.

> *"Poyambapo chikaziwa ife nyanjayi ikavutapo ndiye kuti tizingogwila maganyu kwachela. Ena m'mbanjamo ndiye kuti tikasamukila kumadela ena tizikapata khobidi kumeneko, tikamvesedwa kuti nyanja yabweleramo ndiye tibweleko nkuzayambilanso zintchito zathu zokhuzana ndi nsomba. Koma muzaka zimenezi anthu tachangamuka, titolima, ena akupanga ma bizinesi chifukwa ndichachiziwikile kuti nyanjayi sibwleranso mwakale."* (Previously we would cope with the drying of the lake by engaging in *ganyu* throughout, others within the household would temporarily migrate to other areas to earn a living and when the lake bounced back, we would come back and resume our various fishing activities, but nowadays it is has become so obvious that the lake will never bounce back to its normal capacity so we have adapted and employed farming while others have employed other businesses.)
>
> **(Fisher man)**

> "*Pano ndiye ambiri timadalira ulimi wa mpunga ndichimanga koma kwambiri timagomela mpunga, chimanga sikwenikweni."* (These days most of us rely on rice and maize farming. But mostly we prefer rice farming, maize farming is not as popular)
>
> ***(*Female Fish Trader)**

"Ine ndikulima mpunga, ambirinso tikadalira nyanja tathawila kumpungaku. Monga mudziwa kwathu kuno timadalira mpunga, chimangachi patalipatali chifukwa chimadalira kwambiri ferlitiser ndiye fertiliser naye kuti umpeze nyengo zake zimenezi kumakhala kovuta. Malo amene umalima mpunga ndimalo omwe umalima chimanga tiyelekeze onse ndi one acre, mmene tingakololere chimaga ndi mpunga kusiyanilatu, mpunga umatuluka wambiri koma kafertiliser kolowa kochepa." (I have gone into rice farming, so have many of those who relied on fishing activities. As you know, in this area maize farming is not as popular as rice farming because maize farming requires a lot of fertiliser and it is difficult for us to afford. For the same size of land, rice will produce more yields than maize would yet with just a little fertiliser applied.)

(Fisher Man)

4.3.2 Ganyu (Piece work)

Other than farming and business the study findings reveal that involvement in *ganyu* has become so popular amongst households previously involved in fishing activities in the area. Over half of the households mentioned that they employed *ganyu* either as a main livelihood or as a means of diversifying their livelihoods. While they await the harvest period, they have to find something to feed their families on a daily basis as such they resort to *ganyu* for consumption smoothing. Currently most ganyu in the area is agri-based particularly in the large rice plots. There are people who own especially large rice plots in the area and these are the people that provide piece work to others. In some cases, all household members have to engage in ganyu to make ends meet.

"Kwambirinso ndiye tikudalira maganyu. chifukwa ulimi kuti uchee eeh! pali ulendo. Kuti tipeze kachakudya katsikulo timakapempha kwa anthu amene ali ndi minda yambiri ndikukakagwilako ndi banja lako." (For a good part of the year we are surviving on ganyu, because for one to wait until harvest it's a very long time so for us to at least find food for the

day, we go around asking for piece work from those who have big fields and we do the work with our families.)

(Female Fish Trader)

Maganyutu pano ndiwo akutilera. Ngakhale otochita kukanganilana komabe timapezako kenakake kusiyana ndikuyala bonya pansika azitosowa okugula. (Piece work is what is keeping us going. Even though it is scarce and we have to struggle to secure one but at least we do earn something unlike when you are selling bonya in the market place. There is no one to buy.)

(Fish trader)

This finding is also in agreement with other study findings that state that involvement in *ganyu* is a mechanism for coping with climate change and food insecurity. People get involved in *ganyu* as a way of responding to the effects of climate change and flood times (Stringer et al., 2009; Jere, 2011). However according to this study findings, because of very minimal viable opportunities for the households around Lake Chilwa, they have engaged in *ganyu* not only to cope but to adapt accordingly. It has become a main livelihood source for some households as they complement it with other livelihood sources

4.3.3 Business

Participants from the household interview also consistently reported that as a way of further diversifying their livelihoods households involved in fishing activities have also started employed small businesses as a livelihood option. The most commonly reported business in the area is fish trading. Most people reported to have ventured into fish selling, whereby sellers travel and buy fish from other areas and bring it to Kachulu. The most common fish sold is the popular 'bonya' which is bought from Songani market and sold in the Kachulu market place. Some even reported that they go as far as Mangochi to buy fish and sell in the area. Other businesses include buying and selling of rice. Rice is bought from the area and sold in areas outside of Kachulu. Tomato, vegetables and charcoal selling are also some of the businesses the people involved in fishing activities have ventured into.

Pano taphunziranso ma business ang'ono ang'ono ngati kugula ndi kugulisa chimanga, chimanga chimakagulidwa kuchokela madela ena. Komanso kugula ndikugulitsa nsomba kuchokela ku Songani. Nanga nsomba ndee tinazolowela kugulisa. Imeneyo bola ndi imene ikuchitako bwino kwathu kono, anthu anazolewela abonya. (We have learnt to run small scale businesses such as buying and selling of maize which is bought from other areas and sold here. We are also buying and selling fish from Songani Market. We are just so used to fish trading and it seems to be the one business at least doing well here since people are already used to eating Bonya fish).

(Fish Trader)

Tikuchulukitsa kuchita ulimi wa mpunga ndikumapanganso ma business ang'ono ang'ono. Koma ngakhale anthu tayamba ma business sikuti tatayilatu mtima, nyanja itati yabwelera tizawezanso. Komabe ambiri panopa tatengelapo phunziro sitikudalila nyanja yokha iyayi, tikukhala ndimagawo awiri atatu odalira kuti zitithandize paumoyo wathu chifukwa poyambapo anthu amangodalira Nyanja yokha basi chaka chonse ndiye mmene mukuonelamu, sizinatithele bwino iyayi. (People previously involved in fishing activities have mostly employed rice farming and small scale businesses. But even though we have started venturing into other businesses we haven't really lost all the hope, if the lake refills back to normal we will go back to our various fishing activities but this time around we have learnt our lessons not to sorely rely on the lake all year through. We have learnt to diversify because previously we would just rely on the lake all year round and as you can see, it did not end well for us.)

(Female Boat Owner)

However, participants in both the in-depth and household interviews reported that income generating activities in the area are not as fast and profitable as there are limited markets. Most business men who provided a ready market for most businesses have moved away from the area and the people left behind simply do not have the money hence once on the market goods take too long to finish and by the time they

are finished one has already fed on the capital. Indeed, as seen in the picture below, at the time of the study, grocery shops and tea rooms around Kachulu beach lied lifeless with no operations at all. Below is a picture of shops at Kachulu beach and it tells the whole story.

This therefore indicates how the fish industry runs the businesses of the area and such study findings presented above are consistent with Njaya et al, (2011) who in an analysis of the Lake Chilwa basin economy, indicated that the capital that the fish sector brings to the basin also keeps other businesses going such that most households are nevertheless dependent on the lake and the fish sector in one way or the other as the money from the fish sector is often invested in farming or other small businesses such as restaurants, shops or room rentals.

Additionally, here is a quantitative analysis of the findings above which also provide evidence that farming followed by *ganyu* have become the main contributing sources of livelihood for households involved in fishing. In this study households were asked to rank their current livelihood sources and for the main contributing source of livelihood for households involved in fishing, 23 out of 45 households stated that farming was their main livelihood contributing source representing 51.1%. 11 households mentioned agriculture piece work representing 24.4%, 2 households mentioned non agriculture piece work representing 4.4% while 8 households (17.8%) mentioned petty business as the main source of livelihood. Lastly 1 household mentioned remittances as their main source and this fell under other (Specify) representing 2.2% for remittances.

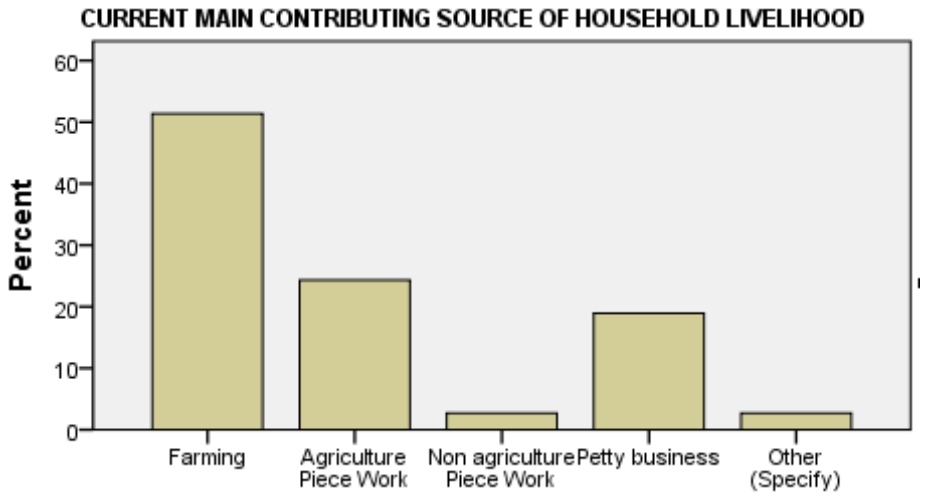

Figure 6: Currently Main Employed Livelihood Strategies by Household

Source: Household Interview

4.3.4 Migration

From the household interview, participants also reported an increase in migration amongst men from the area stating that men from the households previously involved in fishing and related activities have since migrated to other fishing areas and countries like South Africa and Mozambique as a means of adapting and diversifying livelihoods for their households. Participants from both the household and in-depth interviews further reported that women from such households do not usually migrate as they are left with the responsibility of taking care of the family left behind. This finding agrees with findings by Adger et al., (2003) and Tacoli, (2011), who both separately identified migration as a traditional coping and adaptation method particularly in west and eastern Africa and stated that it is set to increase in the face of climate change. Tacoli (2003), further argued that successful migration through remittances helps origin households or communities sustain consumption of basic needs.

However findings from this study indicate that the migration by Kachulu men is not quite successful as study participants consistently mentioned that that some men who migrated to other fishing harbors have returned home unsuccessfully while others have not returned home since and rarely send remittances back home. Also similar to

other studies that indicate that because of women's care taker gendered roles, migration as an adaptation strategy is gendered with mostly the men being the migrants (Tacoli, 2011). This study finding indicate consistent reports that state that it is the men that mostly migrate and the women are left home to look after the children. However, sometimes, some women are lucky to find house maid jobs elsewhere outside the area.

> *"Azibambo maka achinyamatawa kuno ndiye kulibeko, ambiri apita kuMangochi ena kuSalima, ena anatuluka kupita ku joni. Ena chipitileni sanayambe abwelapo olo kutumiza kanthu. Ena akamabwela akubwelako wapansi kusowa transipoti kufikanso kuno kumasowa pogwila. Akamachoka amawauza azimayiwa asale azisamala ana, koma chithandizocho sichibwela ataa*." (Most of the youthful men involved in fishing activities have left this place to Mangochi or Salima while some have gone to other countries like South Africa. some of them have never come home to visit or at least send something home. Some even return home on foot and struggle to establish a livelihood back here. When leaving they tell their wives to remain home and take care of the children but they literally send no kind of assistance back here.)
>
> **(Fisher Man)**

> *"Naaa mmene zilili kuno, kunena zoona zinthu sizili bwio. Ndiye m'mabanjamu anthu ena akumaona kuti bola wina achoke akasake ganyu oonjezela kwina. Ndiye ena amapita kumadela komwe kulinso nsomba ngati kuMangochi, ena mmatown azikasaka maganyu kumeneko. Bolako amapita mmatown'wo kangachepe kokha amatumiza koma apita mmadokowa ndee mmh ambiri akubwelako chabe."* (To say the truth, things are really bad in this area and as a means of diversifying, households opt to have at least one member migrate to other areas where they seek employment. Others go to other fishing areas like Mangochi while others go to townships and seek piece work there. At least for those who go to townships are able to send some remittances back home but those that go to other fishing areas very rarely do send anything at all and they end up just coming back.)

(Boat owner)

However, even though migration in this study has been found to be unsuccessful as emigrants fail to carter for households back home, these results also further agree with study results by other scholars who found that fisher folk are not nearly so occupationally immobile and have responded dynamically to reduced opportunities in fishing and increased opportunities elsewhere (Allison and Mvula, 2011). Additionally, other scholars found that during the lake recessions, in order to get by people, travel long distances to buy food or migrate to other districts to find temporary jobs in other sectors. For example, results from other studies show that during the 1967/1968 lake recession, at Kachulu fish landing population fell from 800 in 1966 to 186 in 1968 (Njaya, 2011). The unsuccessful migration by particularly those who migrate to other fishing areas however may be because of the current climate change challenges that other lakes in Malawi are equally facing and second because of the hostility migrant fishers are faced with elsewhere as such they may not be able to successfully put their fishing skills to use.

All in all, indeed from various literature sources, it is evident that fishing has for a long time been the main occupation in the Lake Chilwa area (Allison and Mvula, 2002, Njaya, 2011, Kutengule, 2014 and Nagoli, 2016). However, through this study it was also established that due to persistent declining fish stocks households involved in fishing activities have had to adapt by employing other livelihood strategies. Previously household sorely relied on fishing activities and findings from the study show that some have had to completely turn away from the fishing activities and adopt other livelihoods separate from the lake such as rice farming, maize farming and various small scale businesses which include buying and selling of fish from Songani, battery charging, buying and selling of rice and selling of homemade bakery products. While others report to have for some time now been employing other livelihoods as a means of diversifying or spreading the risk.

Additionally, it was also established that households involved in fishing and related activities now live on *ganyu* and that many men from these households have adapted by migrating to other fishing sites such as Mangochi and Salima while others go as far as South Africa and Mozambique.

4.4 Sustainability of the Livelihood Strategies Employed

With reference to the SLF, sustainability of livelihoods can be measured by looking at household livelihood outcomes overtime which may also be referred to as sustainable livelihood indicators (Scoones, 1998). According to Chambers and Conway (1991) a livelihood "comprises the capabilities, assets and activities required for a means of living. In the livelihoods discourse and in the particular case of this study, the term 'sustainable livelihood' thus implies that livelihoods are stable, durable, resilient and robust enough to maintain and enhance competencies and positive livelihood outcomes in the face of both external shocks and internal stresses (Scoones 2009). At household level therefore, the main goals for employing a livelihood strategy are largely food security and general household wellbeing and these are achievable with a viable varied asset base (Scoones, 1998). In this particular case therefore, the study adopted household asset base, household food security and general household wellbeing as the three indicators whose outcomes were assessed to analyze sustainability of the employed livelihood strategies for adaptation. Households were thus asked to compare these indicators as experienced when they were involved in fishing and related activities to the period from the year they started adapting to the time of the study. A minimum for this comparison was a 5year period. The section below presents the outcomes under each of the three indicators in detail.

4.4.1 Household Asset Possession

Overall study results show that the interviewed households involved in fishing activities currently have a weak asset base. Participants from both the household and in-depth interviews constantly stated that the number of assets the households owned have declined over the years. Reports indicate that due to disrupted livelihood sources the assets had to be sold to meet the expense of emerging needs. Assets reported to have been sold include bicycles, tables and chairs, cellphones, television sets and radios. Currently, most commonly owned assets amongst the households include a hand hoe at 100%, a sickle at 86.5% and a torch at 78.4%. Productive assets like land are only owned by 59.5% of the population, bicycles are owned at 48.6% while a house with iron roofing is only owned by 40.5% and only 32.4% of the population own a radio. Most of the assets owned were reported to mostly have been acquired

before 2012 when the lake was much more productive. While between 2013 and 2016 a good number of assets were also acquired while between 2016 and 2018, households reported to have lost a lot of their assets.

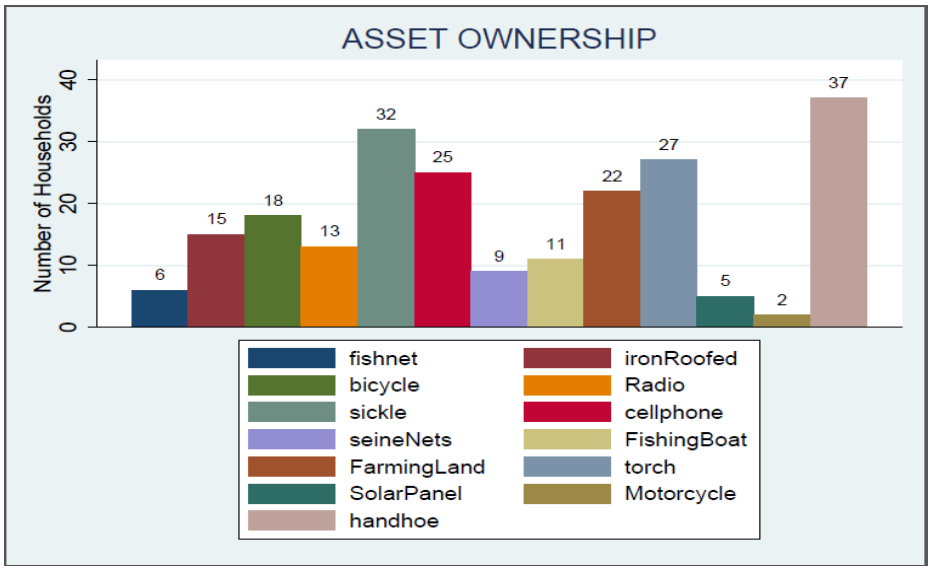

Figure 7: Asset Ownership amongst the Households

Source: Household Interview

Asked what had been the effect on their asset base since fishing and related activities ceased to be their core livelihood source 2.7% reported to have experienced an increase, 16.2% reported the number of household assets had remained the same while 81.1 % reported to have experienced a decrease in the number of household assets owned.

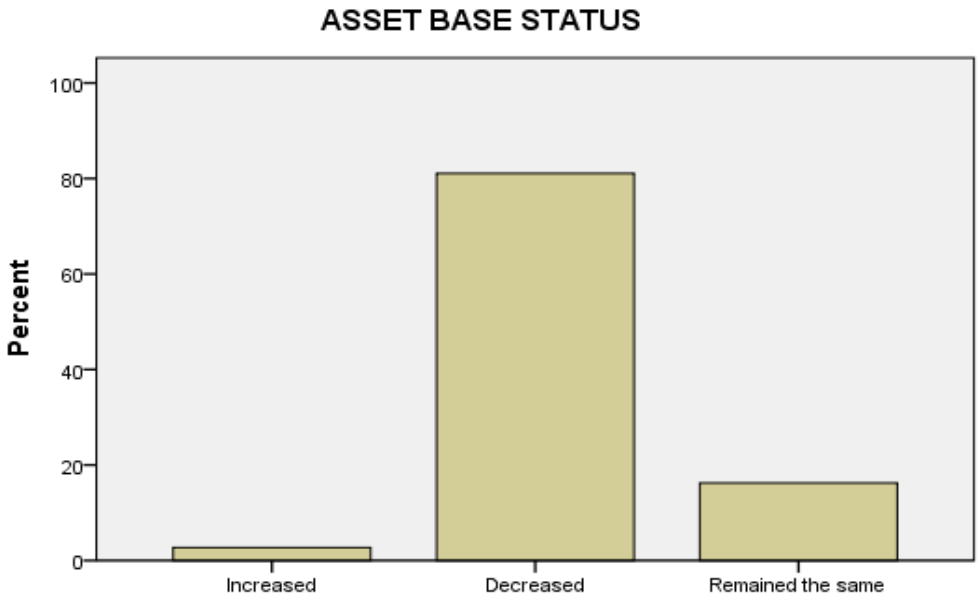

Figure 8: Asset Outcome since the Main Livelihood Shift

Source: Household Interview

Livestock is also so scarce among these households with only 51% reporting to currently own some livestock. Amongst the 51% households who reported to currently own livestock only 1 reported to have cattle, 7 reported to own goats, 4 households reported to own ducks while 15 households reported to own chickens representing 2.7%, 18.9%, 5.2% and 45% respectively. Furthermore, amongst the 45% that own chickens, up to 60% own less than 5 chickens.

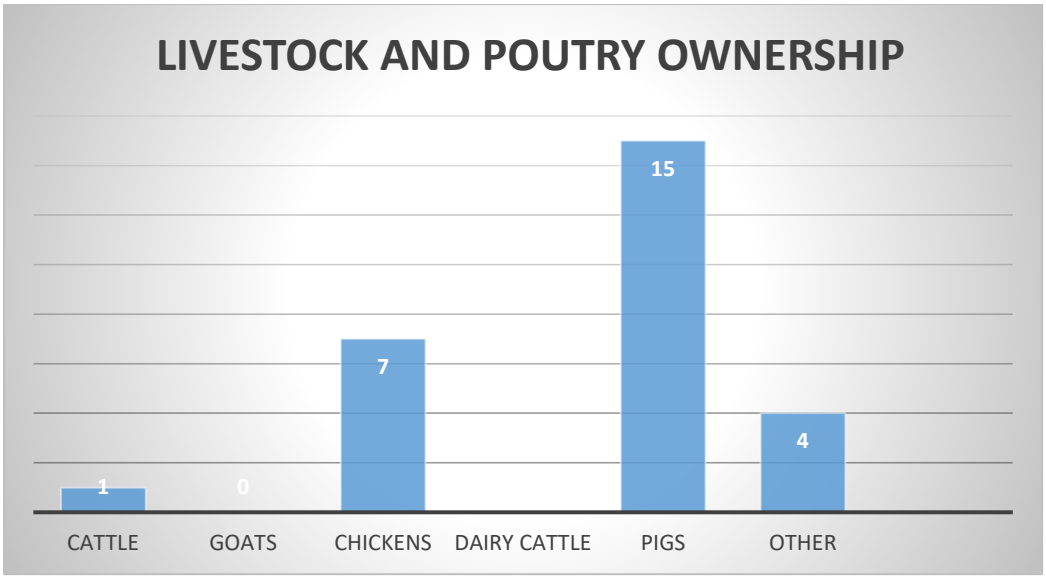

Figure 9: Livestock and poultry Ownership amongst the Households

Source: Household Interview

Additionally, 83.8% of households who currently still own livestock reported that the number of livestock previously owned had declined over the years since fishing ceased to be their core livelihood; 16.2% reported that the number of livestock stayed the same while none reported to have the number of livestock increased hence representing 0%.

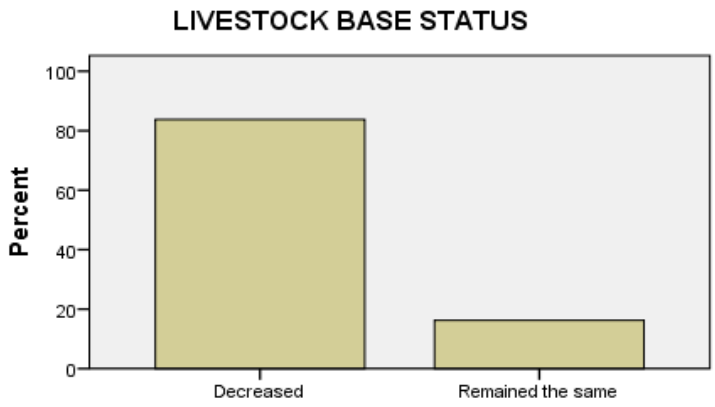

Figure 10: Livestock Outcome since the Main Livelihood Shift

Source: Household Interview

Study findings further indicate that, livestock has in the long run been cushioning these households from being hit hard by the effects of declining fish stock. Almost all participants indicate that livestock represented a quick solution to most problems in the household such that for those who reported a decrease in the number of livestock; 59.5% reported to have sold some after a crisis such as low or no harvests, 13.5% reported that some died of diseases, 8.1% reported to have consumed some while 5.4% reported to have sold some and consumed some as well.

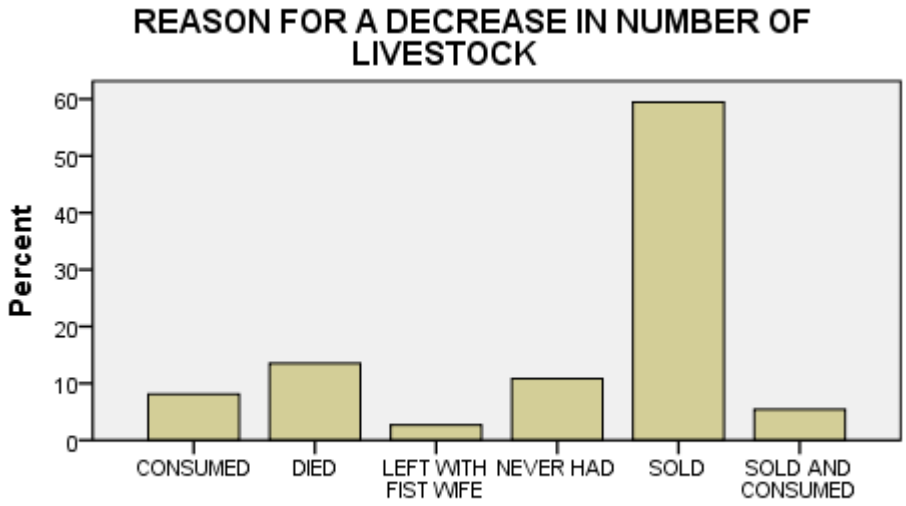

Figure 11: Reasons for the Livestock Decrease

Source: Household Interview

When asked if they previously owned any livestock 86.5% of those who currently don't own any livestock reported that they previously owned livestock but; 58.63% reported to have sold them all after a crisis, 11.1 % reported to have consumed them all, 11.1% reported to have lost them to diseases, 5.6% reported to have had them seized by debtors while 13.9% reported other various reasons.

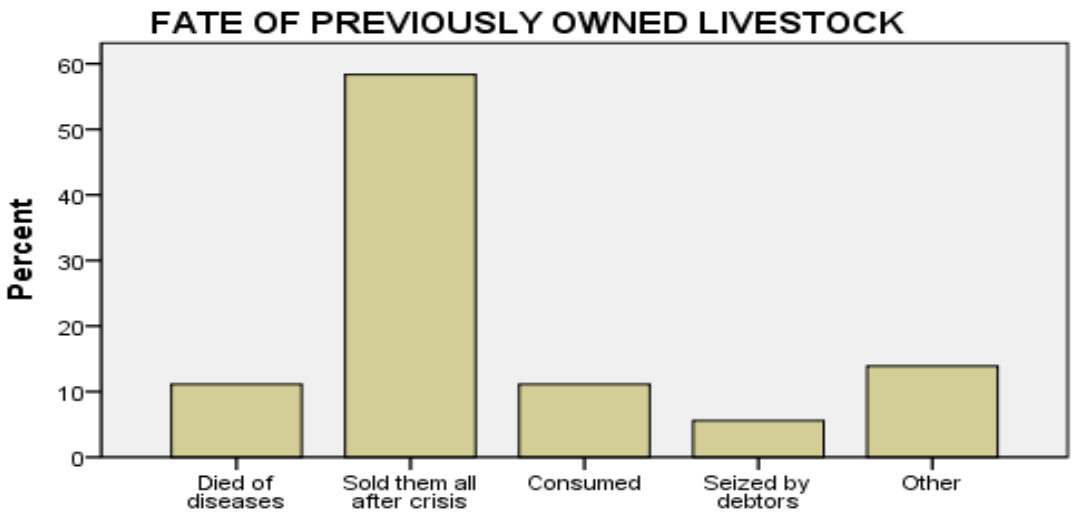

Figure 12: Fate of Previously Owned Livestock

Source: Household Interview

Making matters even worse for the people involved in fishing and related activities around Kachulu is the lack of financial capital. According to this study, 12 of the 16 in-depth interview participants complained of lack of financial capital to undertaking meaningful business. Indeed, as the SLF states: successfully employing a livelihood in a vulnerable situation requires a combination of connected viable assets and resources of various kinds. Even though these assets differ, they are all important for people to achieve their livelihood outcome as no single category of asset on its own is sufficient to yield many and varied livelihood outcomes that people may seek (DFID 1999). Amongst the assets stated in the SLF include financial capital which may also be in form of credit. Previous studies on adaptation elsewhere indicate that credit has increasingly become an important adaptation tool for most men and women hit by the effects of climate change (Slater et al., 2007). However, results from this study reveal that households involved in fishing and related activities in the area have no access to credit. Findings from the study show that microfinance institutions in the area only existed when the lake was highly productive but once it started perpetually reducing its productivity, creditors left the area thus; leaving the people stranded without a source of financial capital. The quote below says it all.

> *"Ife ngongole pano ndiye ndimaloto chabe, nyanja ikangoti yaumaje chaka chimenecho, amabungwe angongole kuno saonekako, Nyanja izangoyamba iwo zomangophwa iphwa ndiye iiih anasowelatu*

sabwelanso. Nanga amaopa akatibweleka tibweza ndichani?" (Access to credit is only a dream for us. Previously once the lake dried up microfinance creditors would also leave the area. Since the lake started to persistently dry up, they have completely fled as they fear a high turnover of loan defaulters since we do not have tangible livelihoods.)

(Female Fish Processor)

Ngongole kalepo amabungwe amapeleka, koma pano zonsezo palibe. Tokhatokhanso kuti tibwelekane kuzela mmagulu ataa, zitotilephela, obweleka atotenga nthawi kuti abweze ndekuti ena kumangodikila kenako kumangosutsanapo basi gulu ndi kutha. (In the past we could access credit through microfinance institutions which doesn't happen nowadays. We can't even borrow each other amongst ourselves through village grouping because people were taking time to pay back and others had to wait for a long time for their turn and we ended up just fighting and dissolving the group.)

(Boat Owner)

According to Scoones, (1998), given a particular vulnerability context, households utilise their assets to undertake a combination of livelihood strategies to adjust to their environment in order to achieve their livelihood goals. The more varied the asset base, the better equipped the strategies are and the more sustainable and secure the livelihoods will be to sustainably respond to impacts of climate change (ibid). However, diminished ecosystem capacities and dwindling natural resource bases can translate into greater exposure to climate-related hazards and fewer resources from which to draw upon during times of scarcity and crisis (DFID, 1999). Limited capacities and resources for responding to stresses thus constrain household's ability to meet basic needs and move out of poverty. Climate change therefore combined with a weak resource base threatens to exacerbate existing vulnerabilities and create new ones for households' hence threatening livelihood sustainability (ibid). These new vulnerabilities may include loss of livelihoods through deepening poverty cycle associated with disposal of livelihood assets towards recovery and coping, to name a few.

Indeed, similar to the assertions above this study established that households involved in fishing activities around Kachulu beach have experienced a devastating change with regard to their livelihood generating activities hence negatively impacting on their households' asset base, when they had fishing activities as their core livelihood, most of these households had varied assets. However, the study found out that with the current state of Lake Chilwa, households have had to sell off assets just to afford a decent meal or afford other equally pressing needs. The deepening poverty cycle due to disrupted livelihood sources has led to further loss of livelihoods through livestock disposal. Making matters even worse, the people have no access to credit with which they can invest and improve their current status.

4.4.2 Household food security Status

All 45 households through the household interviews claimed that while previously involved in fishing and related activities as their core livelihood source, they had food throughout the year but in recent years since employment of the current livelihood strategies the food security status of the households has deteriorated. As reported by the participants, usually the proceeds from fishing activities would be used to buy food. While 9 participants in the in-depth interviews stated that they were able buy a number of bags of maize and rice to cater for a certain period and before that lot finished they were able to buy another lot for the next period and that would go on until the year ended, 7 participants stated that they were able to buy enough bags of maize and rice at once during the harvest season to last them through the year to the next harvest season. The rice was usually consumed as breakfast porridge and children would also take to school. Relish was not even a problem as they mainly consumed different kinds of fish and were even able to sometimes buy meat and eggs for a change. Since the lake dried up and farming is less productive due to unreliable rains, all this is now history as most of these households now live from hand to mouth. Sometimes they have to skip a meals and even worse still go hungry for the whole day.

> *"Chakudya ndimakhala nacho chaka chonse china kugonela, chinanso pena kuola. Tikati tikamwa tiyi 7koloko timwenso 10 kenako kudya nsima 12, ndekuti pena masananso tiyi wina mma4, ndipo akakhala wankaka, sitikalola kungomwa choncho tikati mikozo ya mbuzi, lero zimenezo kulibe, ndikachakudya kapatsiku komwe kuchita kusaukila."*

(We used to have food throughout the year and into the next year, sometimes food would even go bad. When we had our tea at 7am, we would have another tea at 10am, then have Nsima at 12noon. Sometimes we would have another tea served at 4pm and this would always be with milk, having tea without milk we would call it 'goat urine'. But all that is now history, we even struggle to find a day's meal.)

(Female fish Processor)

Sindimakhala opanda chakudya ine pakhomo panga, chikamatha chakudya chimakhala china tikugula, kumangokumana. Koma pano kaufa kakapezeka pena kopandanso ndiwo tingoti aphikileni ana phalala. (I never went without food in my home. When our ration would be going to an end we would buy another one. But nowadays when we find maize flour it is sometimes without relish and we just prepare porridge for the kids).

(Female Fish Trader)

"Njala pano ndiye tangofika popanga nayo ubale. Kulima munthu ndikumalima kuti ukololepo kenakake koma ata, ndimagwedwe ake amvulawa komanso kusowa kwafeteleza, munda onse olo matumba atatu osakwana, ndiye ndikusowa kwandalamaku pakali pano olo yogulira chimanga osaoneka kumadalira maganyu kuti uwonjezele chakudya pakhomo." (Hunger has just become part of our daily lives, we try to farm so that we can harvest something but with the current rainfall trends coupled with lack of fertilizer, we can't even harvest just 3 bags from a whole field. Nowadays we don't even have money to buy food as such we just rely on piece work to complement on household food.)

(Fisherman)

These study findings agree with many study findings that indicate that climate change may affect the most fundamental needs for rural poor in the Lake Chilwa Basin, their food security and their livelihood due to their overdependence of natural resources (Njaya et al 2011). The drought or poor rainy seasons that cause the lake to dry up

also have a devastating effect on people´s crops, resulting in food insecurity throughout the region (ibid).

However, findings from this study also show that the food security of households previously involved in fishing activities in Kachulu area has also worsened due to the fact that farming land is scarce in the area. As other study findings state: fisheries form part of the diversified livelihood strategies and is regarded as an important engine for economic growth and food security in most rural areas (Adger et, al., 2003). It also acts as a safety net to the landless or where other livelihood strategies have failed (FAO 2005; Daw et al., 2009). Indeed, findings through this study agree with previous studies as they indicate that a good number of the households (41%) involved in fishing activities around Kachulu do not own land, as such fisheries posed as a safety net for such households as most of them (70.2%) are immigrants who since their arrival at the area made a living sorely from the lake proceeds. Land is one of the most important assets yet the study reveals that most of these households are landless as they migrated from other districts around Zomba only to seek livelihoods from the Lake Chilwa fisheries. Venturing into farming thus requires such households to borrow land at an annual fee of MK10, 000 for 0.16 hectares of land and this makes the farming venture even more daunting and expensive.

According to this study, from the 45 households that were interviewed, 32 (71.1%) are immigrant households who came to the area sorely to seek livelihoods from the lake. Only 1 (3.1%) household amongst the 32 reported to have come to the area for government work but upon retirement opted to stay in the area to benefit from the lake earnings. Among the 32 immigrant households, only 18 households (56.25%) at least own some farming land and the remaining 43.75% are landless.

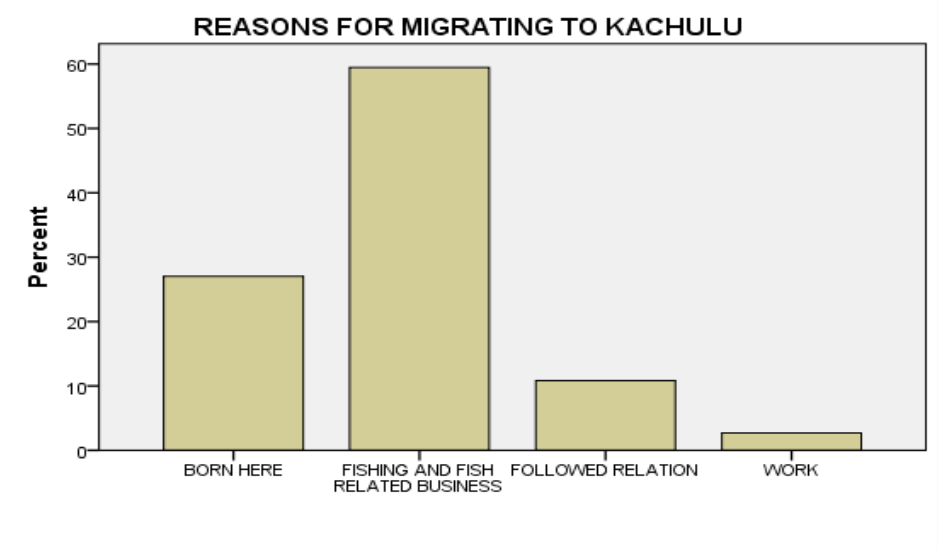

Figure 13: Reasons for Migrating to Kachulu

Source: Household Interview

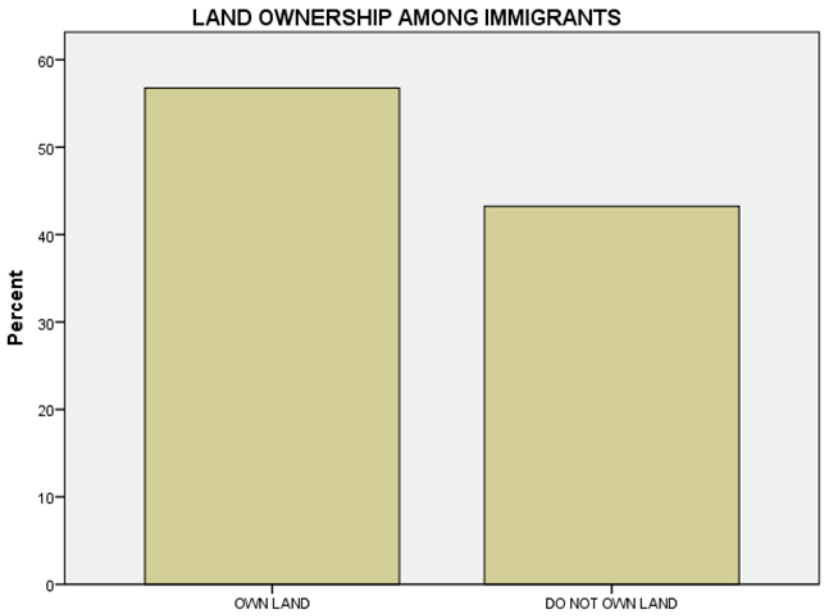

Figure 14: Land Ownership amongst Immigrants

Source: Household Interview

4.4.3 Household Wellbeing

Last on the adopted sustainability indicators for this study is household wellbeing and the focus was on general household wellbeing in terms of subjective social wellbeing,

comfort, general happiness and satisfaction with life. Participants both in the household interviews and in-depth interviews were asked to compare their household wellbeing between the time they were involved in fishing and related activities as a core livelihood source and the time they started adapting to date. Below are the study findings according to what people had to say on their wellbeing as experienced in between the livelihood shifts.

Participants from both the household interviews and In-depth interviews narrated that their households previously lived in comfort and little distress. The household heads were able to provide for the household needs as the daily income earnings from the fishing activities were good and regular. Asked what was the average daily earning from their fishing activities, participants mainly from the household interview reported that they would earn a daily cash of between MK3, 000 to MK4, 500. These amount ranges were consistent across the actual fishermen, fish traders and fish processor respondents while for boat owners the average daily earnings were high between MK9, 000 to MK12, 000. According to the participants, such earnings were regular and households could also afford a little luxury like buying clothes and shoes from the shops. They needed not to worry what they were going to eat because food was readily available. Children went to school on full stomachs and dressed in good uniforms and comfortable crocs *(zimbaula/gwaladi)* shoes. Sickness and every other arising emergency were well taken care of since the households made a significant daily income. As earlier mentioned, a good number of the households are immigrants and they reported to have previously been able to send remittances back home stating that even emergencies back home were well taken care of but now life is not the same.

Table 1: Estimated average daily and annual earnings from fishing activities.

Main Fishing Occupation	Estimated Average Daily Income (MK)	Estimated Average Annual Income (MK)
Fisher Men	3700	1,332,000
Fish Traders	3750	1,350,000
Fish Processors	3750	1,350,000
Boat	10,500	3,780, 000

Note: (the amounts below were calculated by finding the average of the ranges given by respondents as their daily earning)

However, participants from both household and in-depth interviews consistently reported that now that their main livelihood source is either farming, small scale businesses or *ganyu*, life is not the same. Earnings from such livelihood activities are so inconsistent and way below the average earnings they enjoyed from fishing activities. Asked how much they earn from such livelihood activities, household heads through the household interviews especially those currently involved in ganyu said that earnings per day were MK1, 500 or even less. *Ganyu* work is vesry scarce as there is high demand for it such that sometimes they go home with a mere MK500 with no hope of finding another *ganyu* work the next day. Business is equally so slow and less productive in the area. Participants involved in business reported that on a rare lucky day, they go home with a MK1, 000 profit but normally, sales are too slow with an average daily earning of between MK200 to MK500 and sometimes they earn literally nothing. With such little earnings they have to worry about how they are going to carter for meals, manage children's welfare at school and they also have to worry about their extended families back home.

Table 2: Estimated average daily earnings from adaptation livelihoods.

Adaptation Livelihood	Average Daily Income (MK)	Average Annual Income (MK)
Ganyu (Piece work)	1000	360, 000
Small Scale Businesses	600	216, 000

Note: (the amounts above were calculated by finding the average of the ranges given by respondents as their daily earning)

Amongst the adaptation livelihoods mentioned earlier were also rice and maize farming and participants from the in-depth interviews constantly reported that relying on farming also brings a lot of distress to their households. Study participants who reported to rely on farming activities said that they find farming to be so challenging. As earlier found, since most of these households do not own land they not only have to worry about fertilizer and other inputs but also farm rentals. It doesn't end there as

farming is so uncertain so they also have to spend a whole season worrying about whether they are going to harvest something or not and at the end of the season the harvests are usually too little. Further reports made by the participants also indicate that some children who previously never involved in piece work now also have to involve in piece work to supplement household incomes. Such distress they say, was almost non-existent in fishing. Additionally, at least 3 households mentioned to also have experienced weight loss among family members due to poor nutrition and wellbeing. Children in some households were also reported to be registering weight loss at antenatal clinics.

Below are some of the qualitative findings on wellbeing as directly quoted from the in-depth interviews.

> *"Kodi umoyowo ungakhale bwanji wabwino ndimmene ziliri zinthumu? Zodandaula kungoti Phwiii! Mamawa uzuke ulawile kosaka ganyu ana mmbuyomu nauwasiya akupita kusukulu opanda chakudya. Kuganyuko ukapatako kandalama komweko kalowele kumunda ndiye uwonenso chakudya pakhoma? Usozi sindikaziona ine zimenezi inali daily cash."* (How can we enjoy household wellbeing when there is just too much to worry about? You wake up in the morning to search for piecework while behind you leave your children going to school on empty stomachs. When you are lucky to earn something from piecework that day you then worry about how to distribute that little income amongst your needs? I never experienced this as a fisherman, it was daily cash.)
>
> **(Fisher man)**

> *"Kuno ndalama siyikasowatu, business iliyonse olo ing'onong'ono imatulutsa ndalama. Tinali ndi mtendere olo matenda atigwele kaya chani, timathana nacho. Pano olo ndalama kumudzi kaya ndinatumiza liti kaya? Olo kuti ayimbe apa nane ndingoti kakasi. Business siziyenda, pano anthu angodula mitengo kumaotcha makala kuti bola chakudya chapatsiku chipezeke. Sizilibwino."* (This place had a lot of money, every little business would yield something, we had piece of mind that even in cases of illnesses or

other emergencies we would take care of them accordingly. I don't even remember the last time I sent money back home and even if they call me now, I won't know how to source a quick income. Business is not as fast and profitable; people are just cutting off trees to burn charcoal just so they find food for the day. Things are really not well.)

(Male Boat Owner)

"Ana nawo sakukondwa ngati kale, akadzuka nawo kusaka ganyu pamene mbuyomu akapita kusukulu atatchena ma uniform awo, magwaladi awo kuphazi atakhuta phala lampunga. Ma weight akutsika chifukwa sitidya ngati kale Ineyo ndi bambo tikudwlaladwala pafupi pafupi chifukwa chosowa zakudya mthupi ndimankhwala amasikumanowa ndee aaah." (Even our children are not as happy. They also have to work early in the morning and look for piece work yet in the past they would be going to school in their beautiful uniforms and crocs shoes with their bellies filled with rice porridge. We are even losing weight because we are not eating well as we used to in the past. My husband and I are frequently ill because we lack enough food in our bodies and being HIV positive makes it worse.)

Female Food Processor)

Previous literature on fisheries agreeably state that fish production from small-scale fishing play a significant role in the livelihoods of rural households because they are sources of income, sustenance, employment and prosperity (USAID, 2014). Thus, when the Lake Chilwa dries up, so does the basin's economy; rural fishing communities thus face welfare difficulties in the wake of declining catches and periodic recessions (Nagoli, 2014). These sentiments are in total agreement with this study's findings as indeed the basins economy seems to have dried up with the lake and as reported by the respondents above, the wellbeing of these rural households is facing constant difficulties as households struggle to sustain themselves and prosper.

Similarly, other previous studies also found fisher folk to be wealthier than other occupational groups living in the same communities. According to Mvula (2002) in Allison and Mvula (2004), household income, asset profile and expenditure surveys conducted in three villages on the shores of Lake Malawi in 1999 found fishing activities to earn significantly more income for households involved in fishing and related activities. Similar to this study findings, Mvula's study found that boat owners were found to be the highest income earners with the highest annual household income registered being MK172, 130 at US $44 to 1MK. At the current exchange rate of 750$ this amount translates to MK2, 934, 034. A similar study conducted in the shores of Lake Chilwa in 2002 also found similar results stating that both mean income and asset profiles of the fishing households indicate that the fisher folk are better off than other occupation profiles like farmers (Allison and Mvula, 2004). These two lake shore surveys further found that overall household income was almost three times higher in the fishing villages of both Lake Chilwa and Lake Malawi than in the farming villages.

Results from this study thus correspond with such previous literature as it found that households previously involved in fishing activities were much better off and enjoyed a significant good level of wellbeing as fisher folks than as business persons, *ganyu* workers or farmers. Fishing activities earned these households a significantly higher income than farming and *ganyu* does hence impacting on the welfare of the households. Household welfare further translates to the experience of health, happiness and general comfort which have together been coined "wellbeing" (Misir, 2014). It includes having good mental health, high life satisfaction and a sense of meaning or purpose. Basically, wellbeing is the state of general contentment with life and the way things are. However, findings from this study consistently show that the current state of affairs among households previously involved in fishing activities as a main livelihood source is characterized by dissatisfaction with daily life hence, a deteriorating state of household wellbeing.

As mentioned earlier, while coping is about survival in the short period of posed episodic threats or shocks, adaptation goes beyond achieving mere survival. It is a long term response to a persistent threat hence goes beyond achieving survival to as far as achieving a satisfactory living. After achieving survival through coping, well-

being in the case of adapting is therefore simply the satisfaction of surviving. It encompasses both the psychological wellbeing and subjective social well-being for positive self-acceptance (Keyes et al. 2002). In the case of this study therefore, the focus was on general household wellbeing in terms of subjective social wellbeing, comfort and general happiness and satisfaction with life and it was found out in this study that households involved in fishing and related activities describe their daily lives as currently defined by dissatisfaction with daily life, and are consistently stressed about making a living and generally live in daily worry.

4.5 Conclusion

Because of climate change, the declining water levels of the Lake Chilwa coupled with persistent declining fish stocks have hit hard on the households involved in fishing and related activities in so many ways. However, the study focused on the sustainability of the livelihood strategies employed for adaptation by households from villages surrounding Kachulu beach as influenced by their perceptions regarding the changes taking place. It has been found that these households are well aware that climate change is the main cause of the disruptions in their fishing livelihoods and that they live in anticipation of the recessions and have for some years now come to terms with the persistent declining fish stocks and employed other livelihoods.

As a means of adapting, these households have so far employed rice and maize farming, farm and off farm *ganyu* and small scale businesses. However, these households consistently reported that these livelihoods employed are generally stressing and less rewarding as compared to fishing and related activities. As a result, these livelihoods have failed to maintain the status quo that these households previously enjoyed while involved in fishing and related activities. Food insecurity has become so rampant and asset disposal has become so popular amongst these households leaving them worse off than they were before hence; the livelihoods have been concluded to be unsustainable.

CHAPTER 5

SUMMARY AND CONCLUSION

5.1 Introduction

This chapter provides a summary and conclusion of the study findings.

5.2 Summary and Conclusion of the Study Findings

Mainly, the study sought to assess sustainability of the livelihood strategies employed for adaptation by households involved in fishing and related activities in villages surrounding Kachulu beach of the Lake Chilwa. Specifically, the study was meant to first understand how these households perceived the changes taking place in the Lake Chilwa water levels and declining fish stocks. Secondly, it sought to identify the livelihood strategies these households have so far employed for adaptation and finally, it meant to assess the sustainability of the livelihood strategies employed for adaptation. The study was guided by the Sustainable Livelihoods Framework (SLF), developed by DFID.

The study found that households involved in fishing and related activities around Lake Chilwa are well aware and have themselves directly experienced the changes. These households strongly perceive climate change as the main cause of the declining water levels and fish stocks they have experienced. The general consensus was that the low water levels and declining fish stocks were a direct result of climate change and that to a greater extent, human activities contributed directly to the declines. The study further found that the drying up of the lake and the persistently declining fish stocks negatively affected the fishing livelihoods of the area. Before the persistent declines, fishing and related activities were the main and sole livelihood source for most households of the area with very high income returns. However, the current situation presents a vulnerability context that has left most households crippled in as far as livelihoods are concerned. As such households have had to adapt by employing other livelihood strategies mainly; farming, *ganyu* and small scale businesses.

Nevertheless, these households struggle to make a decent living with the current livelihood strategies employed. Coupled with a number of other factors such as lack of physical and financial capital as illustrated in the SLF, most of these households are further greatly disadvantaged.

With reference to the SLF, it can be argued that these households have been hit so hard first because of lack of livelihood diversification that would have spread the risks and cushion the households in the events of a shock or seasonality of any kind. The study found that these households previously sorely relied on the lake proceeds for their livelihoods. Different members of the same household undertook different fishing related activities on the lake and when the shock of declining fish stocks and drying up of the lake struck, all sources of livelihood for the households were cut at once. Secondly, it can also be argued that these households have also been hit so hard because of lack of physical assets such as farm land for rice or maize production. The study found farming to be the most adopted livelihood for adaptation in the area yet it was also revealed through the study that a good number of the households are immigrant households and do not own land in the area, for those immigrants and natives that do own land, the land holdings are reported to be very small due to the population pressure in the area thereby affecting household's agricultural productivity leading to persistent food insecurity amongst these households.

Furthermore, lack of financial capital has further fueled the situation at hand. Households involved in fishing and related activities have made efforts to establish small scale businesses in the area but the lack of financial capital in the form of credit has made such efforts fruitless. The study found that since the declines started to be recorded there are no microfinance institutions in the area as they have left fearing high loan defaults. Business men who provided a ready market for IGAs such as restaurants and tea rooms have also left the area leaving almost no buyers behind.

The study has thus concluded that indeed households involved in fishing and related activities around Kachulu beach are aware that the changes they are experiencing are a result of climate change. The study also concluded that these households have adapted by employing other livelihoods in the area other than fish related. While some have completely quit fishing and related activities, some have only employed

these other livelihoods as a means of diversifying their livelihoods unlike previously when they sorely relied on the lake. According to this study, a livelihood is sustainable when it is stable, durable, resilient and robust enough to cope with and recover from stresses and shocks while maintaining or enhancing its competences, assets and other positive livelihood outcomes overtime. The study thus employed household asset base, food security status and general household wellbeing as indicators of sustainability for this study. However, the study found that although the livelihoods for adaptation have been employed for at least five consecutive years, they have not been able to maintain the competences and positive livelihood outcomes that these households used to enjoy when the lake had its full life and they sorely relied on fish and related activities. The employed livelihood strategies have thus been concluded to be unsustainable as they have failed to maintain the standards of living that the Lake Chilwa fishing livelihoods previously provided in terms of household asset base, food security and general household wellbeing. Households have lost a lot of their assets in between the livelihood shift, they now experience severe food insecurity a situation they never experienced while involved in fishing and the welfare of the households is in a sorry state as it is constantly characterized by daily worry and stress over how to make a living. Hence; concluded to be unsustainable.

5.3 Areas of Further Study

This study only focused on the livelihood strategies employed for adaptation and their sustainability. Further research can be conducted on the differences in livelihood outcomes for immigrant households and the native households of the area. Research can also be conducted on the feminization of a number of fishing related activities in the area.

REFERENCES

Adger, W.N., Saleemul Huq, S., Brown, K., Conway, D. & Hulme, M., (2003). Adaptation to climate change in the developing world. *Progress in Development Studies,* 3(1), 179–195.

Boko et. al, (2007) Impacts, *Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental panel on Climate Change.* University of Dar-es-salaam, Dar-es-salaam, Tanzania.

Carney, D., (1998*).* Implementing the sustainable rural livelihoods approach. In D. Carney, (Ed.*), Sustainable rural livelihoods: What contribution can we* (pp. 123-34). DFID.

Chambers, R. & Conway, R. (1991). Sustainable Rural Livelihoods: Practical Concepts for the 21st Century. *Institute of Development Studies Discussion Paper 296*.

Chiotha, S.S., Likongwe, P.J., Sagona, W., Mphepo, G.Y., Likoswe, M. Tsirizeni, M.D., Chijere, A. & Mwanza, P. (2017). *Lake Chilwa Basin Climate Change Adaptation Programme: Impact 2010 – 2017*. LEAD SEA Publications.

Chiotha, S.S., Nhlema, T.D., Kachiwanda, Y., Kamanga, T.N., Kossam, F. and Mtonya, A. (2016, August 10-11). Strengthening Early Warning in Malawi. Proceedings of the First Stakeholder Workshop on *Enhancing Early Warning Systems in Malawi,* at Golden Peacock Hotel, Lilongwe.

Cohen, D. & Crabtree, B. (2006). *Qualitative Research Guidelines Project.* http://www.qualres.org/HomeEval-3664.htm

DFID, (1999). *Sustainable Livelihoods Guidance Sheet*. Author.

Food and Agriculture Organisation (FAO). (1966). *Report to the Government of Malawi: a Programme for Fisheries Development.* Author

Government of Malawi, (2012). *National Climate Change Policy.* Ministry of Environment and Climate Change Management.

GOM (2006). *Malawi's National Adaptation Programme of Action.* https://unfccc.int/resource/docs/napa/mwi01.pdf.

Government of Malawi, (2000). *Lake Chiwla Wetland: State of the Environment.* Ministry of Environment and Climate Change Management.

IISD (2013). *A Review of Phase One Activities for the Project on, "Climate Change, Vulnerable Communities and Adaptation.* Author

IPCC, (2014). Climate change 2014: Synthesis report. In R.K. Pachauri & L.A. Meyer (Eds.), *Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp.1–151). IPCC.

IPCC, (2007). Climate change 2007: Synthesis report. In R.K. Pachauri & A. Reisinger (Eds.), *Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (* pp. 1–104). IPCC.

IPCC (2007). *Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

IPCC, (2001). Climate change 2001: Synthesis report. In R.T. Watson (Ed.), *Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change (*pp. 1–398). Cambridge University Press.

IPCC, (1998). The regional impacts of climate change: An assessment of vulnerability. In R.T. Watson, M.C. Zinyowera & R.H. Moss (Eds.), *Special report of IPCC Working Group II* (pp. 1–517). Cambridge University Press.

Joshua, M.K., Ngongondo, C., Chipungu, F., Monjerezi, M., Liwenga, E., Majule, A.E., Stathers, T. & Lamboll, R. (2016). Climate change in semi-arid Malawi: Perceptions, adaptation strategies and water governance. *Jàmbá:*

Journal of Disaster Risk Studies, 8(3). http://dx.doi.org/10.4102/jamba.v8i3.255

McNeil, J.R. (2003). Observations on the nature and culture of environmental history. *History and Theory*, 42(1), 5–43. http://doi.org/10.1046/j.1468-2303.2003.00255.x.

Nagoli, J., Green, E., Mulwafu, W., & Karltun L.C. (2017). Coping with the Double Crisis: Lake Chilwa Recession and the Great Depression on Chisi Island in Colonial Malawi, 1930–193. *Hum Ecol Interdiscip J*., 45(1), 111–117. http://doi.org/10.1007/s10745-016-9882-1

Nagoli, J. (2016). *A Lake without Water: Livelihood coping strategies during the Lake Chilwa water recessions in Malawi (*Doctoral Thesis). Swedish University of Agricultural Sciences, Uppsala.

Oxfam International (2015). *A Dangerous Divide: The State of Inequality in Malawi*. Author

Njaya F., Snyder K. A., Jamu D., Wilson J., Howard-Williams C., Allison E. H. & Andrew N. L. (2011). The natural history and fisheries ecology of Lake Chilwa, Southern Malawi. *Journal of Great Lakes Research,* 37(1), 15–25

Njaya, F. J. (2001). *Review of Management Measures for Lake Chilwa Malawi: Final Project report.* United Nations University, Reykjavik, Iceland.

Njaya, F. J., Chiotha, S., & Kabwazi, H. (Eds.) (1996, June 14-15). Lake Chilwa Management Plan. Proceedings of a workshop on *the development of Lake Chilwa Management Plan*, University of Malawi, Zomba.

NSO (National Statistical Office) (2008). *Malawi population and housing census.* Author

Scoones I. (1998). Sustainable Rural Livelihoods: A Framework for Analysis. *IDS Working Paper Number 72*. Institute of Development Studies.

Scoones, I. (2009). Livelihoods perspectives and rural development. *Journal of Peasant Studies*, 36(1), 171-96. https://doi.org/10.1080/03066150902820503

Wollersheim, L. (2017) *Climagedddon: The Global warming emergency how to survive it.* Job One for Humanity

APPENDICES

APPENDIX A: Household questionnaire and interview guide

HOUSEHOLD QUESTIONNAIRE

Household head: ……	Fisher category: *(1) Fisher man (2) Fish Trader (3) Fish processor (4) Boat Owner*
District: ……..	Village: ……..... T/A: ……
Date: ……	Enumerator: ……

A) HOUSEHOLD CHARACTERISTICS

1. Household information:

Name of Regular HH Member (Start with the name of HH head)	Relation to HH head	Sex[2]	Marital Status[3]	Age	Education[4]	Can read /write[5]	Occupation	
							Primary	Second
1.								
2.								
3.								

4.								
5.								
6.								
7.								
8.								
9.								
10.								

1 Relation to HH Head: 01= H.H. Self, 02=Spouse, 03=Son/Daughter, 04= Father/Mother 05= Brother/Sister 06= Nephew/Niece 07= Grandchild, 08=Grandparent, 09= Daughter in law/son in law 10= Others relations

2 Sex: 1=Male, 2=Female

3 Marital Status: 1=Married, 2=Unmarried, 3=Widow, 4=Divorced, 5=Separated

4 Education: 1=Junior primary (std 1-5), 2=Senior primary (std 6-8), 3=Form 1-2 4=Form 3-4, 5=University and any professional training, 6=Non formal education, 7=No education

5 Can read & write: 1=Yes, 2=No,

6 Occupation: 01=Unemployed, 02=Agriculture, 03=fishing, 04=fishing and Agriculture, 05= House helper/maid, 06=Business (Specify.), 08=Housewife, 09= IGA at home, 10=NGO worker, 11= Private/govt. service, 12= Student, 13= Others (specify).

For all not applicable indicate - 99

B) HOUSEHOLD LIVELIHOOD HISTORY

1. When did you start your own household? **Munayamba liti kukhala mutu wa banja lanu lanu?**
   Year [.....]

2. How long have you lived in this area? **Kudela lino mwakhalako nthawi yayitali bwanji?**

Number of Years [……] ***(indicate age if lived here since birth and skip to 4)***

3. Why did you move to this place? **Mchifukwa chani munasamukila kudela lino?** (***for those who according to 2 above were not born in the area***)
4. What was your main livelihood activity since you moved to this place/started your own household? **Chisamukilireni kudela lino, ndichani chenicheni chomwe mumapanga kuti mupeze ndalama/chakudya chatsiku nditsiku?**
   (1= farming, 2=fishing, 3=employment, 4=selling labour/ganyu, 5=others (specify…….....)
5. Has there been any shift in the main livelihood activities for your household over the last 10 years? **Muzaka 10 zapitazo mwasinthapo ntchito yomwe mumadalira kuti mupeze ndalama ndi chakudya chatsiku nditsiku? ……..**Yes/no
6. ***(If 'Yes'***) Since when? **Ngati ndi choncho, munasintha kuyambira chaka chiti?** (*Indicate year)***…….**
7. Why has there been a shift? **Ndichifukwa chani munasiya ntchito yomwe mumadalira ndikuyamba ina?**
   …….....
   …….....
   .....
8. What are your Livelihood Sources now? **Pakali pano mumadalira chiyani kuti mupeze ndalama/chakudya chatsiku nditsiku**

Once you have identified the income sources, ask the HH to rank 3 top contributing sources and write them in the extreme right column.

(tick)				
1	Farming		1st	
2	Livestock rearing		2nd	
3	Poultry rearing		3rd	
4	Fishing/fish processing/fish trading/boat lending		4th	
5	Fish farming			
6	Bird hunting			
7	Agriculture wage labor			
8	Non agri. wage labor			
9	Petty business			
10	Business			
11	Urban remittance			
12	House helper/maid			
13	Handicraft			

14	Others (specify)	
15		

C) ASSETS

1. Does the household possess the following items, how many and when were they acquired? **Kodi pabanja panu muli ndi katundu nditchuleyu?**

Asset	#	Year Acquired	Asset	#	Year Acquired	Agricultural tools and equipments	#	Year Acquired
Fishing net			Seine nets			Hand Hoe		
Boat/Canoe			Fishing boats			Panga Knife		
House–iron roofing			Farming Land			Axe		
Bicycle			Torch/Lamp			Slash		
Radio			Solar Panel			Sickle		
Sewing machine			Plough/Ridge			Watering Cane		
Cell phone			Motorcycle			Treadle pump		
TV set			Car			Ox cart		
Table			Others:			Granary		
Chairs						Livestock Kraal		
Modern furniture								

2. Has the number of assets for your household increased, decreased or stayed the same since the shift of the main Livelihood source? **Kodi chisinthileni njira yomwe mumadalira kuti mupeze ndalama munganene kuti nambala yakatundu yemwe munali naye yachuluka, yachepa kapena ikadali chimodzi modzi?** lIncreased [.....] Decreased [.....] the same [.....]

3. How do you explain the decrease/increase in the number assets you own? **Mukuona ngati ndichifuka chiyani nambala yakatundu wanu yachuluka/yatsika/ili chimodzimodzi?**

.....……...……

……..……..

4. Do you own any Livestock? **Muli ndi Ziweto?** .....Yes / No (if No, ***skip to 7***)

LIVESTOCK	QUANTITY
Cattle	
Dairy cattle	
Goats	
Pigs	
Chickens	
Other (Specify)	

5. *(If 'YES' to 4 above)* Has the number of Livestock for your household increased, decreased or stayed the same since the change of the main Livelihood source? **Kodi chisinthileni njira yomwe mumadalira kuti mupeze ndalama munganene kuti nambala yaziweto zomwe munali nazo yachuluka, yachepa kapena ikadali chimodzimodzi?** Increased [.....] Decreased [.....] the same [.....]

6. How do you explain the decrease/increase in the number of livestock you own? **Mukuona ngati ndichifuka chiyani nambala yaziweto zomwe munalinazo yachuluka/yatsika/ili chimodzimodzi chisinthileni ntchito yomwe mumagwila? .....……**

……..……

……..

7. *(If 'NO' to 3 above),* did you own any livestock in the past? **Munakhalapo ndi ziweto mmbuyomu? .....**Yes / No
8. *(If 'yes' to 3 above)* What happened to the livestock you owned in the past? **Ziweto zomwe munali nazo mmbuyomu zinatani kuti pano musakhale ndiziweto? [.....]**

1=diseases, 2=theft, 3=sold them all after crisis, 4= consumed 5=seized by debtors, 6=others (specify)

……...

THANK YOU!

APPENDIX B: Indepth Interview Guide

Questions under each objective

NOTE: (Fishing/Fisher in this guide represents all fisher categories)

• **To understand how fishers around Lake Chilwa perceive climate change**

1. What are the main sources of livelihoods in this area? **Mudela lino, ndi ntchito zanji zomwe anthu amadalira kuti apeze ndalama/chakudya chatsiku ndi tsiku**

2. Have you heard about climate change? What have you heard or what do you know? **Munayamba mwamvapo zakusintha kwanyengo? Munamvapo chani/Mukudziwapo chani?**

3. Over the past 10 years, have you observed/experienced any change in climate? **Muzaka 10 zapitazi mwaonapo kusintha kwanyengo kwinakulikonse?**

4. What are these changes? **Ndikusintha kwanji komwe munaonaku?**

5. What do you attribute these changes to? **Mukuona ngati kusintha kumeneku kukuchitika chifukwa chani?**

6. Have the changes had any impact on your sources of livelihoods? **Kodi kusintha kumeneku kwakhudza njira zomwe mumapezela ndalama/chakudya chatsiku nditsiku mwanjira ina iliyonse?**

7. What has been the impact of these changes on your livelihoods? **Njira zome mumapezela ndalama/chakudyazi zakhudzidwa bwanji ndikusintha kwanyengoku?**

8. In what specific ways have these changes affected the livelihoods of households that are involved in fishing activities in general? **Nanga makamaka mabanja omwe amapeza ndalama ndichakudya kudzela muzintchito zokhuzana ndi nsomba, Kusintha kumeneku kwawakhudza bwanji?**

• To identify the livelihood options available to the fisher households for adaptation

1. How are fishers in the area responding to the adverse effects of climate change? **Kodi asodzi ndi ena onse azintchito zokhuzana ndi Nsomba mudela lino akuchitapo chani kuti ndizotsatila ndikusintha kwanyengo?**

2. Have the fishers had to completely shift their primary livelihood strategies as a result of climate change impacts and shocks? (adaptation) **Chifukwa chakusintha kwanyengo, zachitikapo kuti anthu omwe amadalira kwambiri ntchito zokhuzana ndi Nsomba asiyiretu kudalira Nsomba nkuyamba kudalira ntchito zina?**

3. What are the specific issues that have influenced these shifts? **Ndi chani chenicheni chomwe chapangitsa kuti anthu asinthiletu kusiya kudalira ntchito zokhuzana ndi Nsomba kuyamba kudalira ntchito zina?**

4. Apart from fishing related activities, what other sources of livelihoods are obtained in this area? **Kupatulapo ntchito zokhuzana ndi Nsomba, ndintchito zina zanji zomwe anthu amapanga/amadalira mudela lino?**

5. What are the most commonly adopted livelihood options by fisher households so far? **Pantchito zimenezi, ndi ntchito ziti zomwe anthu amene ankadalira ntchito zokhuzana ndi nsomba akugwila kwambiri?**

• To determine how the employed livelihood strategies are sustainable

1. In general, how would you compare your life now to when you had fishing as your main livelihood source? **Mungafanizile bwanji moyo wanu mmene uliri pano ndi mmene unaliri nthawi imene mumadalira zintchito zokuzana ndi Nsomba**

2. Would you say your life has been the same, better off or worse off? **Munganene kuti moyo wanu uli chimodzimodzi, wachita bwino kapena zinthu zavutirapo?**

3. Why do you say so? (probe for specific examples where possible) **Ndichifukwa chani mukunena choncho?**

4. What assets were you able to acquire while involved in fishing activities? **Ndi katundu wanji amene munakwanitsa kugula nthawi imene mumadalira ntchito zokhuzana ndi Nsomba?**

5. And now what have you been able to acquire since the shift? (Would you say your household asset base increased, decreased or stayed the same**?) Chisiyireni kudalira Nsomba, ndikatundu wanji yemwe mwakwanitsa kugula? Munganene kuti katunduwanu wachuluka, wachepa kapena ali chimodzi modzi?**

6. Why do you say so? **Ndichifukwa chani mukutelo?**

7. What was the food security status of your household as a fisher man? (E.g. Before the shift, did you have enough food to last throughout the year?) **Nthawi yomwe mumadalira Nsomba, zimakhala bwanji kumbali yakapezekedwe chakudya chapakhomo panu? E.g. mumakwanitsa kukhala ndi chakudya pakhomo panu kwa chaka chonse?**

8. Has the situation changed now? How? **Pakali pano zinthu zili bwanji kumbali yakapezekedwe kachakudya pakhomo panu?**

9. How do you explain the change in the food security status of your household? **Munganene ngati kapezekedwe kachakudya pakhomo panu kasintha chifukwa chani?**

10. How was the wellbeing of your household as a fisher? (wellbeing = the health, conformability and happiness of the household) **Nanga umoyo wabanja lanu unali otani nthawi yomwe mumadalira ntchito zokhuzana ndi Nsomba?**

11. How has your wellbeing been since the shift? **Nanga umoyo wanu wasintha bwanji chisinthireni ntchito yomwe mumadalira**

(For each indicator probe for specific examples where possible