

**KNOWLEDGE, ATTITUDES AND PRACTICES (KAP)
REGARDING SHALLOW WATER FISHING IN RELATION TO
SCHISTOSOMIASIS CONTROL AT CHEMBE VILLAGE,
MANGOCHI DISTRICT, MALAWI**

MSc. (Environmental Science Thesis)

BY

MICHAEL JEFFREY RICHARD MAKONOMBERA

BSc. (Mlw)

**Submitted to the Faculty of Science, Chancellor College, University
of Malawi in Partial Fulfilment of a Master of Science (MSc.) in
Environmental Science Degree.**

**University of Malawi
Chancellor College**

July 2008

DECLARATION OF ORIGINALITY

The work contained in this thesis is my original work and has not previously in its entirety or partial in the past been submitted at any University for a degree or a diploma. Where information from other sources is used in the text, it has been fully acknowledged.

Signature:

Date:

Michael J. R. Makonombera

Previous degree: Bachelor of Science (1995), Chancellor College, University of Malawi, Zomba.

CERTIFICATE OF APPROVAL

The undersigned hereby certify that they have read and recommend to the University of Malawi for a thesis entitled “Knowledge, Attitudes and Practices (KAP) Regarding Shallow Water Fishing in Relation to Schistosomiasis Control in Chembe Village, Mangochi District, Malawi” by Michael J. R. Makonombera as a fulfilment of the requirements for the Master of Science (MSc.) in Environmental Sciences Degree.

Signature:

Date:

Dr. Peter Mvula

Supervisor

Signature:

Date:

Prof. Sosten S. Chiotha

Supervisor and Program Coordinator

Signature:

Date:

Dr. Paul Bloch

Supervisor

DEDICATION

To my wife Annie and my four children Emily, Thokozani, Faith and Michael Jr. Your two years perseverance of an abrupt shift of our life style was the lamb sacrifice for the success of this study. To my children, I am setting tough, but achievable standards for you.

TABLE OF CONTENTS

DECLARATION OF ORIGINALITY	I
CERTIFICATE OF APPROVAL	II
DEDICATION	III
LIST OF ACRONYMS	VIII
LIST OF TABLES	IX
LIST OF MAPS	X
LIST OF FIGURES	XI
ACKNOWLEDGEMENT	XV
1.0 INTRODUCTION.....	1
1.1 BACKGROUND TO THE STUDY	1
1.2 LAKE MALAWI NATIONAL PARK.....	1
1.2.1 THE ISLANDS ZONES	2
1.2.2 THE AQUATIC ZONE	2
1.2.3 THE MAINLAND ZONE	2
1.3 THE FISHERIES SECTOR: CONTRIBUTION TO MALAWI’S ECONOMY ..	3
1.4 PROBLEM STATEMENT	4
1.5 OBJECTIVES.....	7
1.5.1 MAIN OBJECTIVE	7
1.5.2 SPECIFIC OBJECTIVES	7
1.6 RESEARCH QUESTIONS	7
1.7 ORGANIZATION OF THE THESIS.....	8
2.0 LITERATURE REVIEW	9
2.1 FISHERIES IN MALAWI	9
2.1.1 FISHING POLICY IN MALAWI	9
2.1.2 ECONOMIC ASPECTS OF FISHERIES IN MALAWI	10
2.1.3 FISHING AND FISHING PRACTICES IN LAKE MALAWI	10
2.1.4 CHALLENGES OF THE FISHERIES SECTOR IN MALAWI.....	16
2.1.5 FISHERIES REGULATIONS	17
2.2 SCHISTOSOMIASIS INFECTION	21
2.2.1 INTRODUCTION	21

2.2.2	LIFE CYCLE OF SCHISTOSOMIASIS.....	22
2.2.3	SIGNS, SYMPTOMS AND PATHOLOGY OF SCHISTOSOMIASIS	25
2.2.4	CONTROL MEASURES.....	25
2.2.5	SCHISTOSOMIASIS IN MALAWI	28
3.0	METHODOLOGY	29
3.1	THE STUDY AREA.....	29
3.1.1	GENERAL INTRODUCTION	29
3.1.2	THREE DISTINCT SECTIONS OF THE VILLAGE.....	32
3.1.3	POPULATION AND PEOPLE OF CHEMBE VILLAGE	34
3.1.4	TOPOGRAPHY AND CLIMATE.....	34
3.1.5	AGRICULTURAL ACTIVITIES	35
3.1.6	FISHING ACTIVITIES.....	35
3.1.7	TOURISM ACTIVITIES	36
3.1.8	PROBLEM OF SCHISTOSOMIASIS IN CHEMBE VILLAGE	37
3.1.9	SCHISTOSOMIASIS CONTROL EFFORTS AT CHEMBE VILLAGE	38
3.1.10	ROAD INFRASTRUCTURE	39
3.1.11	OTHER FACILITIES.....	40
3.2	JUSTIFICATION FOR SELECTING THE AREA OF STUDY.....	40
3.3	DATA COLLECTION PROCEDURES AND TOOLS	40
3.3.1	TOOLS USED	40
3.3.2	IN-DEPTH HOUSEHOLD INTERVIEWS.....	41
3.3.3	KEY INFORMANT INTERVIEWS	42
3.3.4	FOCUS GROUP DISCUSSION (FGD)	43
3.3.5	PARTICIPANT OBSERVATION.....	44
3.4	FIELD WORK PRE-TEST.....	45
3.5	DATA PROCESSING AND ANALYSIS PROCEDURES.....	46
3.6	STUDY ETHICAL CONSIDERATION AND SCIENTIFIC APPROVAL PROCESS.....	46
4.0	RESULTS AND DISCUSSION	48
4.1	AWARENESS LEVELS, OPINIONS AND COMPLIANCE OF CHEMBE VILLAGE ABOUT FISHING RULES AND REGULATIONS	48
4.1.1	DECENTRALIZED FISHERIES MANAGEMENT REGIMES AT CHEMBE VILLAGE	48

4.1.2	BVC KNOWLEDGE AND OPERATIONS	49
4.1.3	DAILY MONITORING OF FISHING ACTIVITIES.....	50
4.1.4	AWARENESS OF FISHERIES MANAGEMENT REGIMES AT CHEMBE VILLAGE	51
4.1.5	LEGITIMACY OF FISHING REGULATIONS	53
4.1.6	ATTITUDES TOWARDS FAIRNESS AND EFFECTIVENESS OF FISHING RULES AND REGULATIONS	55
4.1.7	COMPLIANCE TO FISHING REGULATIONS AT CHEMBE VILLAGE	57
4.2	DEVELOPMENT OF FISHERIES ACTIVITIES AT CHEMBE VILLAGE	60
4.2.1	THE REPORTED AGAINST THE ACTUAL FISHING PRACTICES AT CHEMBE VILLAGE	60
4.2.2	PERCEPTIONS ON DEVELOPMENT OF FISHERIES	61
4.2.3	CHEMBE VILLAGE PERCEPTION FOR THE DECLINE IN FISH RESOURCES.....	63
4.2.4	FUTURE OF THE FISHERMEN	65
4.2.5	ALTERNATIVE SOURCES OF INCOME	66
4.2.6	PROBLEMS FACED BY THE FISHERMEN IN THE FISHING INDUSTRY AT CHEMBE VILLAGE.....	68
4.3	THE FISHING PRACTICES OF CHEMBE VILLAGE REGARDING SHALLOW WATER..	68
4.3.1	LEGITIMACY OF SHALLOW WATER FISHING RESTRICTION	68
4.3.2	OPPORTUNITIES FOR LEGALISING SHALLOW WATER FISHING RESTRICTION	72
4.3.3	ACCEPTABLE MEASURES FOR IMPLEMENTATION OF SHALLOW WATER FISHING BAN.....	72
4.3.4	AWARENESS LEVEL OF SHALLOW WATER FISHING RESTRICTION AT CHEMBE VILLAGE.....	74
4.3.5	SHALLOW WATER BAN COMPLIANCE AND PUNISHMENTS FOR NON- COMPLIANCE	76
4.3.6	USEFULNESS OF SHALLOW WATER FISHING RESTRICTION	77
4.4	SCHISTOSOMIASIS INFECTION.....	79
4.4.1	AWARENESS OF SCHISTOSOMIASIS INFECTION	79
4.4.2	KNOWLEDGE ON THE SPREAD OF SCHISTOSOMIASIS AT CHEMBE VILLAGE	79
4.4.3	SOURCE OF MESSAGES FOR SCHISTOSOMIASIS	81

4.4.4	EFFECTS OF SCHISTOSOMIASIS.....	82
4.4.5	KNOWLEDGE ON CONTROL MEASURES OF SCHISTOSOMIASIS AT CHEMBE VILLAGE	82
4.4.6	HOW SHALLOW WATER FISHING RESTRICTION LINKS WITH SCHISTOSOMIASIS	84
3.4.7	TREND OF SCHISTOSOMIASIS	85
3.4.8	PRESENTED REASONS FOR OBSERVED SCHISTOSOMIASIS TREND AT CHEMBE VILLAGE	86
5.0	CONCLUSION, RECCOMENDATIONS AND AREAS FOR FURTHER RESEARCH	88
5.1	CONCLUSION	88
5.2	RECOMMENDATION.....	90
5.3	PROPOSED AREAS FOR FURTHER RESEARCH.....	92
6.0	REFERENCES.....	93
7.0	LIST OF APPENDICES	98

LIST OF ACRONYMS

BVC	Beach Village Committee
BCP	Bilharzia Control Project
CDSS	Community Day Secondary School
DDP	District Development Plan
DNPW	Department of National Parks and Wildlife
DSOER	District State of the Environment Report
EE	Environmental Education
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GNP	Gross National Product
HSA	Health Surveillance Assistant
IMF	International Monetary Fund
KAP	Knowledge, Attitudes and Practices
LMNP	Lake Malawi National Park
LMSRP	Lake Malawi Schistosomiasis Research Programme
MDHS	Malawi Demographic and Housing Survey
MEET	Malawi Environmental Endowment Trust
MSCE	Malawi School Certificate of Examination
NIH	National Institute for Health
NSF	National Science Foundation
NSO	National Statistical Office
NSOER	National State of the Environment Report
SCF	Save the Children Federation
SEP	Social Economic Profile
SPSS	Statistical Package for Social Scientist
WHO	World Health Organisation
WSSD	World Summit on Sustainable Development
WWF	World Wildlife Fund

LIST OF TABLES

Table 1: Population of Chembe Village.....	32
Table 2: Reasons for observed schistosomiasis trend at Chembe	81

LIST OF MAPS

Map 1: Malawi showing Chembe Village.....	28
Map 2: Namkumba Peninsula showing Chembe Village.....	31
Map 3: Lake Malawi National Park showing the Aquatic Zone.....	65

LIST OF FIGURES

Fig. 1: Chilimila net shape (A) and operation (B – E).....	
Fig. 2: Chambo beach seine net: Shape (A) and operation (B – C).....	
Fig. 3: A schistosomiasis trematode (worm) in vesicle plexus of human Body.....	22
Fig. 4: Life cycle of urinary schistosomiasis.....	
Fig. 5: Reported institutions that are involved in daily monitoring of Fishing activities at Chembe Village.....	51
Fig. 6: Sampled juvenile fish caught in the shallow water zone at Chembe Village.....	57
Fig. 7: Reported reasons for non compliance to fishing regulation at Chembe Village.....	58
Fig. 8: Perception on Development of Fisheries at Chembe Village.....	62
Fig. 9: Reported reasons for the decline in fish resources at Chembe	64
Fig. 10: Captured future economic plans for Chembe Village	67
Fig. 11: Perceived appropriate and acceptable implementation measures for ban at Chembe Village	74
Fig. 12: Perceived institutions that instituted shallow water fishing Restriction at Chembe Village	76
Fig. 13: Perceived modes of schistosomiasis contraction at Chembe	80
Fig. 14: Sources of information for schistosomiasis infection at Chembe Village.....	82
Fig. 15: Perceived control measures of schistosomiasis at Chembe	84
Fig. 16: Bilharzia cases and prevalence (%) at Chembe Village (Oct. 2005 – Jan 2006).....	86

ABSTRACT

This study was carried out in Chembe Village in Mangochi District, Southern Malawi and was done over a period of one year. The study was mainly qualitative and aimed at assessing the knowledge, attitudes and practices (KAP) of Chembe Village regarding fishing in the shallow water zone in relation to the prevalence of schistosomiasis in the area. The significance of the study was to come up with acceptable and realistic measures to reduce shallow water fishing to control and consequently reduce the prevalence of schistosomiasis infection in this village. This study was part of Lake Malawi Schistosomiasis Research Project (LMSRP). Lake Malawi Schistosomiasis Research Project is also carrying out research aimed at establishing the cause-effect relationships between fish, snails and schistosomiasis transmission to human beings at Chembe Village.

Five tools of in-depth household interviews, key informants interviews, focus group discussions and participant observation were used. Data was handled and analysed differently depending on approach. Quantitative data from the household survey was coded, entered and analysed using a Statistical Package for Social Scientists software. Descriptive statistics was used to describe the basic features of the findings by summarising frequencies, percentages and basic statistics such as the mean, mode, standard deviation and variance. Qualitative data obtained from key informants, focus group discussions and participant observation tools was compiled and transcribed using line by line coding. The coding involved categorizing all emerging issues into different themes.

The study noted that shallow water fishing restriction is contained in the Parks and Wildlife Act (2004) but that it applies only to the aquatic zone of Lake Malawi National Park (LMNP). However, the study observed that the enforcement of this restriction was extended to as far as the area along all the shores of Chembe Village. This study therefore noted that the enforcement of the restriction to Chembe Village was illegal because the area is outside the jurisdiction of the

restriction as stipulated in the Act. At the same time, the study observed that this restriction is necessary if the main experiment under investigation by LMSRP is to be successfully done. It is also important for the management of fish resources in that apart from assisting LMSRP to successfully complete its research, this restriction will also help to check the current declining trend of fish resources. The study found that for this restriction to become enforceable at Chembe Village and the other three enclave villages, LMNP boundary should be refined and re-demarcated so that the villages become integrals of the Park. The study further found that while it is important to let fishermen make and enforce their own decisions, effective management entails that the government should work with the local people in the management of the fisheries since effective solutions will require a multifaceted approach. It was observed that it is unlikely that the community and fishermen will effectively manage the resource without the Fisheries Department actively taking a role in the implementation of the fishing regulations.

This study further noted that once the shallow water restriction is effected, there would be need to take into account the villagers' expectations of acceptable and realistic measures for implementing it at Chembe Village. Most respondents (31.8%) suggested the involvement of the community in the implementation of the restriction through establishment and/or strengthening of its Beach Village Committees (BVCs). Others suggested the sensitisations of the entire community, strengthening of enforcement mechanisms or introduction of alternative sources of income generation in the village. Hence the study observed a need to enhance capacity of the BVCs to enable these committees to institute and enforce the local fishing restrictions.

Regarding the need to come up with alternative sources of income for the fishermen, the study recommends implementation of projects aimed at improving the ecological habitats and bringing behavioural change. The study also found a need to enhance the capacity of Chembe Village Trust (already established in the

village) so that natural resources from the Park can be harnessed to benefit the whole village.

Finally, the study found a need to intensify tourism activities in the Park and improve the relations between Chembe Village Trust and LMNP, which is currently strained, so that the village benefits from the tourism proceeds from the Park.

ACKNOWLEDGEMENT

So many organisations and individuals have helped throughout my study that not each one of them can be mentioned. But the following deserve special mention:

Malawi Environmental Endowment Trust (MEET) and the Lake Malawi Schistosomiasis Research Project (LMSRP) for the joint financial support of the study. I also wish to thank the Ministry of Mines, Natural Resources and Environmental Affairs, for granting me a two-year study leave.

My supervisors: Dr. Peter Mvula, Prof. Sosten Chiotha and Dr. Paul Bloch for the tireless and valuable comments, criticisms, suggestions and guidance which helped in the completion of this study. The supervisors took personal interest in the study and were always there when their support was needed the most.

Peter Makaula, for connecting me to LMSRP and whose earlier briefing on LMSRP activities stimulated my interest in the topic and helped me to figure out direction of the study. Peter has been consistently supportive and always available for consultations throughout the study period.

My Research Assistants: Mercy Chilambula, Adamson Anubi, Gabriel Chalamanda, Esau Chakoma and Vanessa Adyera did a commendable job.

Mphatso Mponda provided unique support and services which will never be forgotten. Pastor Shadreck Mangwiro of Chancellor College was always by my side. In Chembe Village, Elias, the first person I met and became a close friend, did a lot in familiarising me to the village and always made good company.

My parents: Kenneth and Emily; the only brother Bernard; sisters Elina, Harriet, Grace and Lita, I am glad you did not leave me alone. Your moral support contributed towards the success of this study.

My fellow students: Yunes Agabu, Stephen Kuyeli, Samuel Nyanyale, William Mgoola, Chikumbusko Kaonga, Gift Ndengu and Samson Phiri, it has been a great pleasure to be in your company throughout the two year period.

Finally, any errors and shortcomings in this study are entirely mine and I am fully responsible hence welcome any suggestions.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Widespread news of urinary schistosomiasis infection in Chembe Village dissuaded tourists from its beaches to other beaches of Lake Malawi. Other would-be tourists (into the country), changed their plans altogether at hearing the news (Ambali, 2002) and by changing their destination to elsewhere, Malawi stood to lose a chunk of foreign earning. The fishing community and local residents were equally affected by the infection and the fallout in the tourism industry which were also compounded by other problems such as the failure by government and the private sector to adapt and respond to the modern requirements in the tourism industry like improved road networks and other communication facilities, enhanced security, and improved lodging facilities. The parasites that cause schistosomiasis are mostly found in the shallow water regions of water bodies and certain varieties of fish are hypothesised to biologically control their vectors. At Chembe, it is hypothesised that these fish varieties are over fished by the communities. The study was hence instituted to provide for acceptable and realistic measures of reducing shallow water fishing by these communities.

1.2 LAKE MALAWI NATIONAL PARK

Lake Malawi National Park (LMNP) is located on the northern shore of the wider Namkumba peninsula on the southwest arm of Lake Malawi. LMNP was created in 1980 in the southern end of Lake Malawi with the primary aim of “protecting examples of Lake Malawi’s aquatic communities and their habitats with special reference to the rocky littoral zone of the lakes here and its specialist cichlid community”. The study area (Chembe Village) alongside four other villages of Zambo, Msaka, Chizale and Mbvunguti are enclaved in this Park. In total, the Park

covers an area of 93 sq km. To facilitate achievement of its objectives, the Park was subdivided into three broad management zones as follows:

1.2.1 The Islands Zones

The Park includes thirteen islands, rocks and reefs that vary in size and location but most of which are within the area of Traditional Authority (TA) Namkumba, in Mangochi District. The Chembe Village group of mountains is located close to Chembe Village and includes Otter, Domwe, Mumbo, Thumbi West islands and Zimbabwe Rock.

Also in the Park are the Chinyankhwazi and Chinyamwezi reefs in TA Makanjira in Mangochi District and Boadzulu Island in TA Mponda also in Mangochi District. However, the three islands of Nankoma, Maleri and Nakantenga are within the jurisdiction of TA Maganga of Salima District.

1.2.2 The Aquatic Zone

LMNP aquatic zone is the 100 metre strip of Lake Malawi that includes the water surface, the water column and the lake bed contiguous with all lakeshore land components of LMNP. In total the aquatic zone covers about 7 sq km and it is off-limits to any fishing activities.

1.2.3 The Mainland Zone

The mainland zone includes enclave fishing villages and the remnant forest resources. While the four villages (as mentioned above) are not integrals of the Park, Chizale is an integral, because by the time of establishment of the Park this village was not inhabited. The Park boundary with the four villages therefore follows a cleared trace around the perimeter of each village at the foot of the surrounding hills. Upon establishment of the Park, the understanding was that the inhabitants of the enclave villages would not be relocated from the area and that they would have to subsist and survive on the Parks resources. Therefore the four

villages did not relocate and are not within LMNP boundaries; hence the conservation rules for the Park are not applicable to these villages.

1.3 THE FISHERIES SECTOR: CONTRIBUTION TO MALAWI'S ECONOMY

The Fisheries sector is of great importance to the national economy as a source of rural employment, household food security, rural income, export, import substitution and biodiversity (Malawi Government, 2006). Malawi Poverty Reduction Strategy Paper (MPRSP) places fisheries sector as the second largest employer from crop sector, within the agricultural and natural resources sector. According to the Annual Economic Report (2006), the fishing industry contributes 4.0% to the country's gross national product (GNP), directly employs about 57,854 people and indirectly employs nearly 300,000 people who are involved in fish processing, fish marketing, boat building and engine repair. Furthermore, the fish industry supports nearly 1.6 million people in lakeshore communities (about 10% of Malawi population) and makes substantial contributions to their livelihoods (Malawi Government, 2006). There are about 48,000 traditional fishermen in Malawi (Malawi Government, 1997).

The fisheries sector provides vital and unique nutritional benefits such as protein, vitamins, minerals and micro-nutrients. Annual Economic Report (2006), estimates that fish provides over 60% of the dietary animal protein intake of Malawians and 40% of the total protein supply. Much of the fish consumed in rural areas contribute significantly to daily nutritional requirements to people living with HIV/AIDS and to some vulnerable groups such as orphans and the poor.

In addition, literature reveals that fishing communities are better off in terms of meal frequency, meal composition, meal diversity, availability of household assets and the level of income with which they buy food to ensure household food and nutrition security.

The country also benefits from ornamental fishery which is a good source of foreign exchange. Ornamental fishery exports live fish for the aquarium fish market. The most commonly exported fish species from Lake Malawi is the small colourful rock dwelling mbuna (*Pseudotropheus spp.*) and this helps to bring the much needed foreign exchange.

1.4 PROBLEM STATEMENT

Malawi is a landlocked country located to the south of the equator in the Sub-Saharan Africa and it is bordered to the north and northeast by the United Republic of Tanzania, to the east and southwest by the Peoples Republic of Mozambique, and to the west and northwest by the Republic of Zambia (MDHS, 2004). Landlocked Malawi is one of the poorest countries in the world with a *per capita* Gross Domestic Product (GDP) of US\$160 and the country's economy depends on substantial inflows of economic assistance from the International Monetary Fund (IMF), the World Bank and individual donor nations (WRI, 1996). The majority of the population (70%) live below the poverty line (i.e. survives on daily expenditure of less than US\$1), the poorest population being smallholder subsistence farmers and their families (WRI, 1996). The population is mainly rural with 80% of the country's population living in rural areas where access to basic social services is severely limited (WRI, 1996).

Malawi's economy is predominantly agricultural (MDHS, 2004) with maize, cotton, millet, rice, peanuts, cassava and potatoes being the principal crops grown and tobacco, tea, sugarcane, and tung oil being grown in large estates as main exports (Malawi Government, 2006). Tobacco is also the principal export of the country, but the commodity is losing its export value due to the global antismoking campaign. The other major sectors that contribute considerably to the national economy are tourism, manufacturing, utilities, construction, transport, distribution and communications as well as government services (Malawi Government, 2006). With the fallout of tobacco crop on the global market, the country's policies apart from emphasising other sectors, stress the need to enhance fisheries and tourism

industries. Malawi's development policy expresses the need for reduction of poverty, ignorance and disease by the achievement of rapid and sustained economic growth, an improvement in income distribution and a reduction in the instability of welfare for both the individual and the nation (Malawi Government, 1997). Fisheries policy therefore recognises that fisheries industry has a key role in poverty reduction through the provision of rural employment and more importantly, through its contribution to household food security (Malawi Government, 1997).

History of tourism in Chembe Village dates back to the 1940's. However, literature shows that tourism had been booming in this village for a number of years until 1999 that signs of slump started to creep in due to the news of schistosomiasis infection and failure by government and the private sector to adapt and respond to the current requirements in the tourism industry, among other factors. The survey conducted by Lake Malawi Schistosomiasis Research Program (LMSRP) in 1998 indicated that Chembe Village, suffers from high rates of *Schistosoma haematobium* infection. The study also found the transmission of urinary schistosomiasis to be still high in this area despite the previous systematic annual mass treatment campaigns by the Bilharzia Control Project (BCP). The study further observed that the transmission rates were sufficiently high to pose significant risk to a large number of people. This created a worrisome situation for the health of the local people as well as for those of the tourists.

Several options are available for controlling the infection, but the international consensus is that holistic participatory community-based efforts are the most sustainable and effective means to control schistosomiasis (WHO, 1980). However, Chiotha (1990) observed that due largely to financial constraints; most control approaches for the infection are not implemented or feasible in underdeveloped countries such as Malawi.

The biological control of schistosomiasis vector snail hosts by the facultative molluscivores and popular food fish, *Trematocranus placodon* is still a research

issue. Both the snail hosts and *Trematocranus placodon* are found in the shallow water zones of water bodies in Lake Malawi. The Bilharzia Control Project and the Lake Malawi Schistosomiasis Research Program recommended conservation of this zone to increase population of these fish molluscivores in the battle to defeat schistosomiasis. Lake Malawi Schistosomiasis Research Programme which is currently carrying out a research to determine the relationship among abundance of fish molluscivores, the abundance of snail vectors and the prevalence of the infection, reinforced a fishing ban in these shallow waters at Chembe Village in the year 1998.

Fishing is the basis of economy for Chembe Village. As such, fishermen would do everything possible to bypass the ban and optimise the catch. Thus, any conservation strategy for the fish is likely to face resistance of some sort. Evidently, poor fishing practices and violation of fishing regulations are among the practices that are degrading the fisheries sector. It was therefore deemed necessary to investigate the behaviour of Chembe Village regarding awareness levels, opinions and compliance with the fishing rules and regulations that include fishing in the shallow water zone. This investigation was done to determine the available useful and realistic opportunities for change in their fishing behaviour.

Failure to comply with fishing regulations at Chembe Village can be attributed to, among other factors, the decline in the fish resources. The Fisheries Department notes that the total catch landings of small-scale and artisanal fisheries had declined from 70,858 metric tonnes a year in 1990 to just 43,019 metric tonnes per year a decade later (Malawi Government, 2002 a) and it is assumed to have declined further now. This study therefore wanted to investigate the development of fisheries activities in Chembe Village.

At Chembe Village, the people's knowledge, attitude and practices regarding management of fish resources especially in the shallow water zone is not known. There is therefore a need to know this if the positive behavioural change regarding

fishing habits is to be promoted. This study is therefore aimed at analysing the knowledge, attitudes and practices of this village regarding fishing in the shallow water zone.

1.5 OBJECTIVES

1.5.1 Main Objective

The main objective of the study was to analyse the knowledge, attitudes and practices of Chembe Village regarding shallow water fishing.

1.5.2 Specific Objectives

1. To investigate the awareness levels, opinions and compliance of the Chembe Village about fishing rules and regulations.
2. To investigate the development of fisheries activities in Chembe Village.
3. To investigate the fishing practices of Chembe Village regarding shallow water fishing and determine useful and realistic opportunities for change.
4. To analyse the knowledge and attitude of people living in Chembe Village with regards to schistosomiasis infection and control.

1.6 RESEARCH QUESTIONS

The following research questions guided the research:

1. What are the awareness levels, opinions and compliance levels of Chembe Village regarding the fishing rules and regulations?
2. What developments are there in Chembe Village as regards to fisheries activities?
3. What are the available fishing practices of Chembe Village regarding shallow water fishing and what are the useful and realistic opportunities for change?
4. What is the community's knowledge and attitudes towards Schistosomiasis infection and control?

1.7 ORGANIZATION OF THE THESIS

This thesis is divided into five chapters as follows:

- i. Chapter 1 presents introduction. It sets a general background to the study and outlines the socio-economic situation in Malawi with a slight reference to the fisheries sector. Statement of the problem, objectives of the study, research questions and organisation of the thesis are also presented in this chapter.
- ii. Chapter 2 reviews literature for the study. It reviews literature on how the fisheries sector has contributed to the economy of Malawi, the fisheries management and the current problems affecting the sector. It then attempts to link problems in the fisheries sector with schistosomiasis infection which is a problem of public health concern at Chembe Village. Finally, it reviews strategies in fishing activities that can assist in controlling Schistosomiasis infection.
- iii. Chapter 3 describes the methodology used in the research. It starts by describing the study area and justifies selection of the site for this study. It then describes data collection tools, gives a brief description of the sampling technique and finalises with the data analysis techniques.
- iv. Chapter 4 summarises the results and presents the discussion on the research findings. The reported and actual fishing activities at Chembe Village and the suggestions on practical and sustainable restrictive measures which are appropriate and acceptable to people living in Chembe Village are discussed in details in this chapter.
- v. Chapter 5 offers a conclusion and recommendations on how to change people's attitude on fishing in the shallow water.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 FISHERIES IN MALAWI

2.1.1 Fishing policy in Malawi

Malawi's development policy expresses the need for reduction of poverty, ignorance and disease by the achievement of rapid and sustained economic growth, an improvement in income distribution and a reduction in the instability of welfare for both the individual and the nation (Malawi Government, 1997). Fisheries is one of the key sectors in the country's poverty reduction. Malawi is blessed in this sector because over 20% of its total area is covered with fresh water bodies, the most significant being Lakes Malawi. Other water bodies are Lake Chilwa, Lake Chiuta, Lake Kazuni, Lake Malombe and the Shire River. All these water bodies are of great local importance and the country realises tremendous benefits through fisheries activities from these water bodies. In these water bodies diverse methods are used for fishing a diverse of fish species.

Lake Malawi is the largest in terms of size and capacity and most significant in terms of fish production of all the water bodies in the country. The lake is the southernmost basin in the African Great Rift Valley system and it contains the most diverse community of fresh water fishes in the world (Smith, 1993a). The lake is bordered by three countries of Malawi to the west, Tanzania to the north and Mozambique to the east with the greatest part being in Malawi. In Malawi, the lake extends almost the entire eastern length of the country from Chitipa to Mangochi Districts and covers a total of 22, 490 sq km. According to the Malawi-German Fisheries and Aquaculture Development Project (MGFAD), Lake Malawi alone covers 20% of the country's surface and has the potential for the development of a remarkable fishing industry. In terms of fish production, the total national estimated

catches are currently over 50, 000 metric tons/year of which 81.3% originate from Lake Malawi. In 2003, Lake Chilwa contributed about 14% of the total catch, Lake Malombe about 1.2%, Lake Chiuta about 2.4%, Upper Shire River less than 1%, and the Lower Shire River about 4.2% (Malawi Government, 2006).

2.1.2 Economic aspects of Fisheries in Malawi

The fisheries sector contributes to the economy of Malawi in a number of ways. The sector provides rural employment and also contributes towards household food security in the country. The 2002 Malawi National State of the Environment Report (NSOER) provides that the fishing industry contributes about 4.0% to the country's Gross National Product (GNP) and directly employs nearly 300, 000 people. The report, further states that fish is also a major source of animal protein. It is estimated that 70% of animal protein and 40% of the total protein intake for the majority of the rural poor come from fish. In addition, the sector indirectly supports about 14% of the Malawi population which resides along the lakeshores of Lake Malawi through fishing, processing, marketing, fishing gear construction, boat building and other ancillary activities (Malawi Government, 1997).

2.1.3 Fishing and fishing practices in Lake Malawi

The vast majority of fish species found in Lake Malawi belong to the large cichlid family. This is a very diverse group of fishes that exhibits complex reproduction and feeding habits and seems to have the ability to adapt to new environment relatively quickly; hence they are capable of exploiting various habitats (Smith, 1993 a). Lake Malawi cichlids are further divided into two groups i.e. the tilapiines and haplochromines. The tilapiines is a group of at least five relatively large species which feed on plankton or detritus and prefers sandy or silty habitats (Trewavas, 1983), while the haplochromines is a very diverse group of several hundred species found in virtually every ecological niche and habitat in the lake (Eccles and Trewavas, 1989). Almost all the fish species found in Lake Malawi are endemic to the lake i.e. they occur in this lake only and nowhere else.

The fisheries that exploit Lake Malawi fishes is divided into three categories: commercial, artisanal and ornamental (Smith, 1993 a). While commercial and artisanal fisheries catch fish for food, ornamental fishery catch fish only for exports of live fish (Smith, 1993 a). The most commonly exported aquarium fishes from Lake Malawi are the small colourful rock dwelling mbuna especially of the genera *Pseudotropheus*. Commercial fishery in Malawi is done with trawlers and ring nets using medium sized to large boats which are equipped with inboard engines. This type of fishery in the country is mainly practised by the Department of Fisheries, a privately owned company Malawi Development Corporation (MALDECO) fisheries and some few individuals. The artisanal fishery (otherwise known as traditional or village based fishery) on the other hand is practised by the indigenous villagers. They use a variety of ways to catch the fish. The following are the gear types at Chembe village:

2.1.3.1 Chilimira net

The Chilimira net is an open-water seine net (a net which is pulled through the water by ropes attached to its two ends). Chilimira has been recorded only in Lake Malawi and it is the most economically important artisanal fishery gear in terms of numbers and biomass of fish caught. Chilimira is the most commonly used net in the village and it employs more crew members. This net is constructed in a “D” shape with floaters on the curved side and weights on the straight side. This shape gives Chilimira net a conical appearance. The bunt mesh size ranges from mosquito netting to 25 mm and headline length from 20 to 40 m while its depth ranges from 5 to 15 m. The headrope is almost always twice as long as the footrope. The net is operated from two dugout canoes and one planked boat with a total crew of nine. The planked boat and the larger dugout canoe are actually involved in the casting and hauling operations. At night the team leader, located in the smaller dugout canoe equipped with a brightly shining kerosene pressure lamp, directs the actions of the crew in the other craft. When he locates a fish school (usually usipa), he tells the other fishermen when to shoot the net. The net is towed in the opposite direction to the movement of the fish. When the fish are caught, the team leader joins in

hauling the net into the boat and the larger dugout canoe. During the day the net is used for utaka fishing, as it can quickly be prepared for this by removing the mosquito-net lining, which is needed for catching usipa. Chilimira net was further categorised into four groups of 9 ply, 6 ply, 3 ply and 2 ply based on the mesh sizes. Figure 1 below shows Chilimira net shape at various stages of its operations:

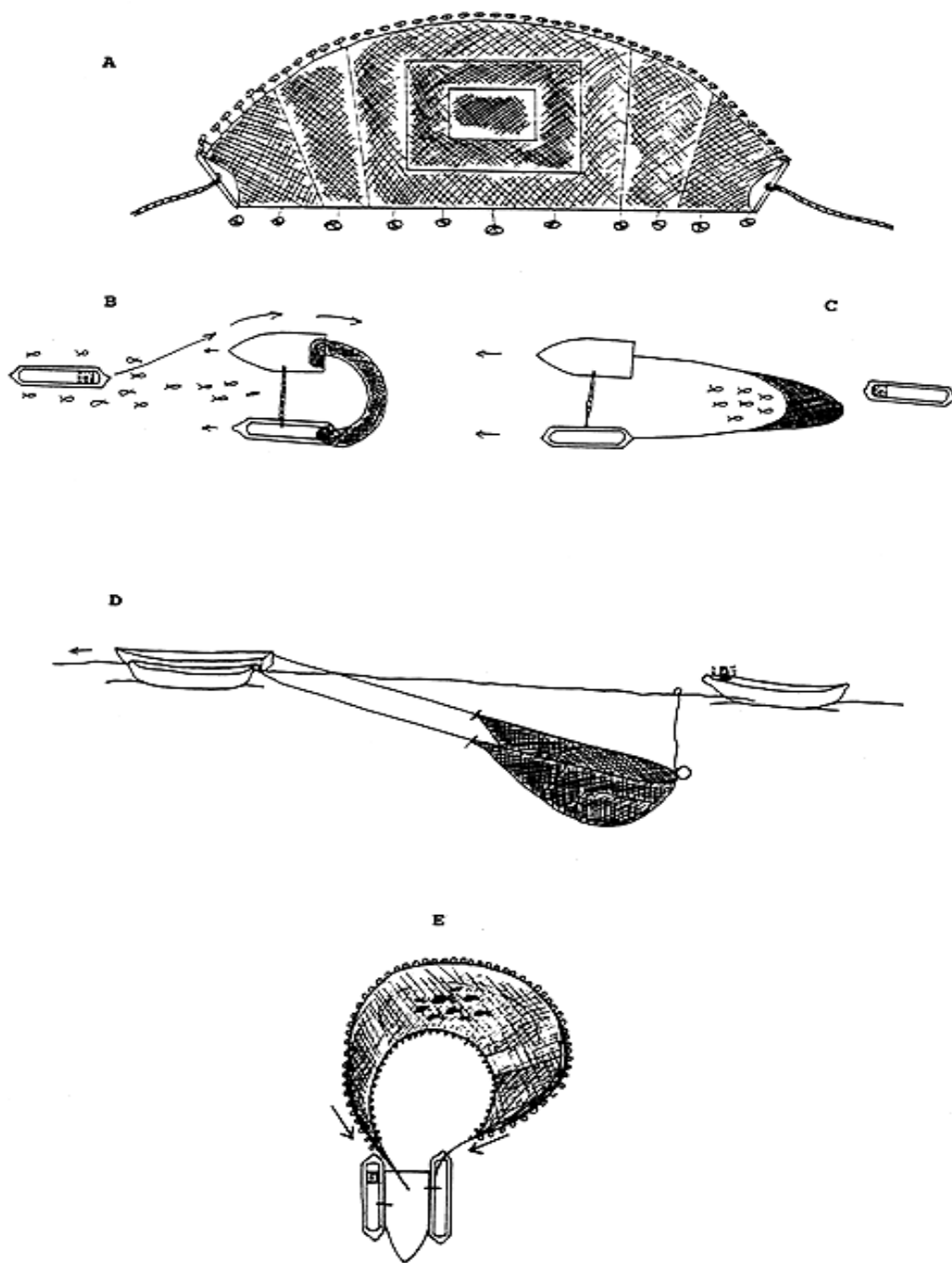


Fig. 1: Chilimira net shape (A) and operation (B-E) – below.

2.1.3.2 Beach Seine Nets

These are long and narrow enclosing nets that are pulled through shallow unobstructed water into a sandy beach. The nets are cast using a single, planked boat and they are usually operated by two sets of people wading out from the shore. The seine may be set from a boat but hauled in from the land. The net has lead weights to keep the bottom on the lake floor and floats to keep the top of the net at or near the surface (Smith L. 1993 a). The beach seine net is also called a shore seine, a drag seine, a draw net, a haul seine, a yard seine or a sweep net. Once the net has been placed, two sets of fishermen on the beach simultaneously haul in the wings of the net. As the net approaches the beach, fish are driven into the bag-like centre locally known as *ndumba* and are hauled up on shore. This type of fishing gear is very important to the communities because it creates employment and provides animal protein. However, the gear does not guarantee sustainability in the exploitation of fisheries resources because it is not selective, meaning that it catches juveniles along with the adult fish. Fishermen operating beach seine nets are also most likely to spread or be infected with schistosomiasis because they spend most of their time in the shallow water zone. Beach seine nets are a type of fishing gear that has serious effects on the sustainability of fisheries resources; hence their use must be regulated to protect the juveniles from being caught. Two types of beach seine nets are used at Chembe Village as follows:

a. Kambuzi Seine Net

Kambuzi seine net is locally known as *chalira*. This is a beach seine which has a mesh size below 25 millimetres at the bunt and a headline length range from 50 metres to 700 metres. The depth of the nets varies from 2 metres to 12 metres. The kambuzi seine normally requires 6 to 20 assistants depending on the headline length. The longer the length, the more the people that it requires. Sometimes, it is operated behind the Chambo seine or another Kambuzi seine net of longer headline and possibly bigger mesh size to catch the fish that escape the first net.

b. Chambo seine net

This is a beach seine whose bunt mesh size varies from 76 millimetres to 90 millimetres and the headline length from 100 metres to 1, 800 metres. The depth varies from 5metres to 20 m. The chambo seine is operated in the same way as kambuzi seine but requires the use of 10 to 30 helpers for its operation. Comparatively, there are few Chambo seine gears now in use at Chembe Village and other parts of Lake Malawi due to the collapse of the chambo stocks. Fig. 2 below shows Chambo beach seine net

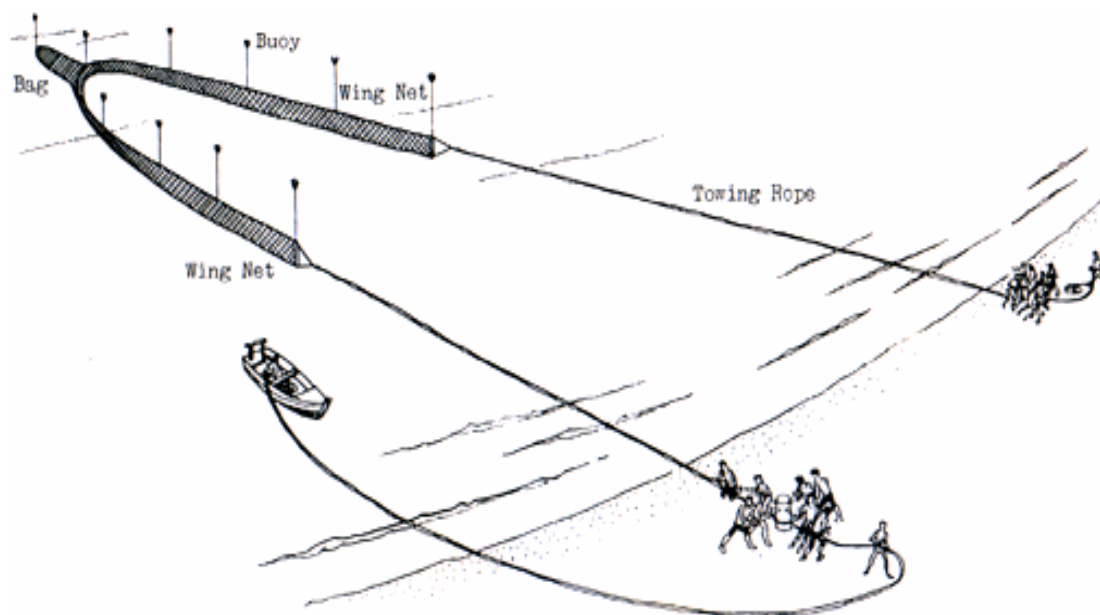


Fig. 2: Chambo beach seine net

2.1.3.3 Gillnets

These are nets which are suspended in the water and left for hours, in most cases from evening to morning hours, to trap fish by their gills. The gillnet is a rectangular gear usually made from 4 or 6 ply twine. In general there is only one mesh size used in a gillnet fleet. The commonest mesh size in Lake Malawi is 90 mm, with a range from 64 to 102 mm. The headline length varies from 100 to 3, 200 m and the depth from 5 to 25 m. At Chembe Village and other parts of Lake Malawi, a gillnet is normally used with a single planked boat (with or without a motorized engine) and a crew of four and it is bottom-set overnight and hauled up in the morning.

2.1.3.4 Hooks

Hooks are categorized into longlines and handlines as follows:

a. Longline

Long-line fishing is a commercial fishing technique that uses hundreds or even thousands of baited hooks hanging from a single line. This is a technique that comprises a main fishing line up to 100 km in length, with secondary lines branching off it. Each set has hundreds or thousands of barbed, baited hooks. Longlines can be set to hang near the surface or on the lake bottom. The technique is used to catch fish in open waters, including those that live near the lake floor. At Chembe Village, this technique targets fish species such as kampango (*Bagrus meridionalis*), bombe (*Bathyclarias spp.*) and ncheni (*Ramphochromis spp.*). Longline devices and techniques do not avoid bycatch and hence they also result in the incidental capture and death of aquatic animals that include water birds and turtles.

b. Handline

A handline also called a short line is used with a hook or hooks at one end. The number of hooks varies from one to twenty. Handlines are cast either in the shallow water or in the open water using a dugout canoe. At Chembe Village it is common to find boys fishing using the handlines while seated or standing at the beach. This technique is usually done on a subsistence scale.

2.1.4 Challenges of the Fisheries sector in Malawi

Despite the enormous benefits the country realises from fisheries, the sector is currently facing several challenges resulting in fish depletion. Between 1988 and 1992, the commercial fish catch in the country fell by over 20% (Malawi Government, 2002 b). The fisheries Department observes that the total catch landings of small-scale and artisanal fisheries had declined from 70, 858 metric tonnes a year in 1990 to just 43, 019 metric tonnes per year a decade later (Malawi Government, 2002 d) and it is assumed to have declined further now. Malawi's

report to the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002 highlighted the decline in the chambo trade and committed the government to restoring fish stocks to the maximum sustainable yield by 2015. There is strong evidence that water bodies are over fished rendering many fish stocks to decline to the extent of being in danger of extinction (Malawi Government, 2006). Malawi Government (1993) reports that over fishing and increased economic activities are depleting the fish stock in Lake Malawi, the Africa's third largest lake. The State of Environment Report (2002 d) indicated that too many fishermen and a great demand for fish are some of the major contributing factors to over-fishing. Other factors leading to over-fishing and loss of species in Lake Malawi are high population growth, rampant poverty and other economic factors. These problems have major economic and environmental consequences for the future of Malawi since the changing conditions of fishery will affect the social and economic welfare of many people living in the lake shore areas and the major cities of Malawi.

2.1.5 Fisheries Regulations

The fishermen in Chembe Village, which is an enclave fishing village in the Park, observe regulations from two sectoral Acts i.e. Fisheries Management and Conservation Act (2000) and also Parks and Wildlife Act. The Fisheries Conservation and Management Regulations 2000 provide a framework of regulations for protection and management of fish resources which fishermen are expected to know and observe. The following section presents some of the regulations that are listed in the Fisheries Conservation and Management Regulations of 2000 and Parks and Wildlife Act.

2.1.5.1 Closed Fishing Season and Closed area

This regulation was designed to protect major fish species of commercial value like chambo during their peak-breeding season (spawning period). During this season, fishing is prohibited in different lakes or parts of the lake (areas) and at different times. In Lake Malawi, the closed season for all beach seine nets runs from 1st November to 31st December of each year. This intervention helps to protect the

parent chambo fish as well as the juveniles from the fishing nets. In the long term, closed season as a management strategy ensures conservation of different fish species, which would otherwise have been endangered by uncontrolled fishing practices. This regulation revolves around the chambo breeding biology and ecology and how this interacts with the mechanical operations of the beach seines and mesh size. However, the prohibition of beach seine nets only does not make a big sense because other gears as well also catch the commercial chambo during the closed season. Furthermore, other species of fish also need to be protected and conserved (Smith L., 1993 a).

2.1.5.2 Mesh size restrictions

This regulation was formulated to supplement the closed season regulation. The objective is to protect juvenile fish from being caught before they are mature to breed. Minimum mesh sizes for various types of fishing gears are set based on the information of fish size at maturity for the target species. Acceptable standard mesh sizes for all the fishing gears are provided.

2.1.5.3 Minimum takeable size of fish

This regulation was designed to supplement the mesh size restriction. The objective is to protect the fish based on information of its size at maturity. Different fish species have different minimum size at maturity. For example the minimum size at maturity for chambo (*Oreochromis spp.*) is larger than that of usipa (*Engraulicypris sardella*) and other fish species. Furthermore, there is no management options for short sized fish species like usipa because they are short lived and almost semelparous species whose protection would not make much sense.

2.1.5.4 Maximum headline length of fishing net

This regulation was designed to control fishing effort by limiting the length of the fishing net. Each type of the net has its maximum permissible length depending on the water body to which it will be used. For instance, longer size chambo seine net

would be accepted in Lake Malawi while the same size would not be accepted in Lake Malombe.

2.1.5.5 Licensing of fishing gears

This regulation is intended to control the amount of fishing effort by limiting the number of gears licensed to fish. In so doing, it regulates access to the fishery. In the small-scale commercial fisheries, each fishing unit is licensed to fish in the zone it was allocated and these fishing licenses are not transferable. The restriction requires every owner of a local registrable fishing vessel who intends to use the vessel for fishing to apply to the Director of Fisheries Department for registration in the prescribed manner.

2.1.5.6 Regulated Use of trawl net or ring net

This regulation prohibits use of trawl net or ring net within one mile of any of the shoreline of Lake Malawi. It also prohibits its use in waters of depth of less than 18 metres; or in the period between 1700 hours and 0700 hours. Use of bottom trawl net pulled by a vessel powered by an engine(s) of above one hundred horsepower in waters of less than a depth of forty meters in Lake Malawi and use of mid water trawl net is also prohibited.

2.1.5.7 Shallow water fishing restriction

This regulation is applicable to the Lake Malawi National Park 100 metre aquatic strip (zone) only. The zone comprising 100 metres into the water around the Park features is off-limits to any fishing activity. Presently, the Park authorities are the enforcing agents of this ban in tandem with all other restrictions in the Park area. But Chembe Village and the other three of the five enclave villages (except Chizale) are not part of the Park. The 100 metre zone fishing rule is therefore not enforceable within the beaches of this village. The communities from these four villages are hence free to fish as close to the beaches as they can so long as they do not encroach into the Park's aquatic zone.

2.1.5.8 Co-management / Decentralized Fish Management

Government, through the Fisheries Department realised that it was facing numerous problems pertaining to fish resources management mainly due to capacity constraints (Malawi Government, 2002b). As such, the fishermen continuously flouted the above regulations. In response, the Government through the Fisheries Department adopted the co-management policy which envisages progressive transfer of resource tenure from the state to the primary resource users. This is a divorce from the old policy of direct intervention in regulating fishery to a new policy in which the community and Fisheries Department manage fish resources together. With this policy the Government returns control of fish resources to rural communities under the supervision of the Department of Fisheries. The policy of co-management gives people living in the lake shore villages the responsibility to protect the fisheries. In other words, the fishing communities are let to control their own fisheries resources. Both the enforcement of regulations and actual fish resources management are in the hands of local fishermen while the Fisheries Department only provides technical advice without directly enforcing regulations.

To facilitate implementation of this policy, the Malawi Fisheries Conservation Act (1998) provides for establishment of the Beach Village Committees (BVCs), comprising renown fishermen and some influential people in the beach villages under the supervision of the village chiefs. These BVCs are mandated to designate resource use by laws so as to ensure biodiversity conservation. It is this BVC that makes important decisions on behalf of the fishermen by making and enforcing their own by-laws. The perpetrator can be brought before a court presided over by the village chief and if convicted the fishermen can be fined and have their nets confiscated. The advantage of this policy is that different stakeholders combine efforts to manage the natural resources, contributing strengths to compensate for the weaknesses of the other stakeholders.

Various options for co-management in which rights and responsibilities are shared by the state and the user are provided. The underlying premise is that state control

of natural resources encourages *de facto*, an open access to the resource, whereas localized tenure systems imply restriction of access and therefore afford a realistic opportunity for responsible management. But the devolution of tenure does not mean the abdication of state responsibilities in wildlife conservation and management (Malawi Government, 2002 c). Thus, through decentralisation, decision-making on issues related to fish management is devolved to the districts and subsequent local level committees. This is done to promote legitimacy of policies, legislations and decisions made at that level.

2.2 SCHISTOSOMIASIS INFECTION

2.2.1 Introduction

Schistosomiasis, also known as bilharzia (bilharziasis) named after Theodor Bilharz who discovered the parasite in 1851, is a debilitating disease. The infection is caused by blood dwelling trematodes of the genus *Schistosoma* and super family *Schistosomatoidea*. Since the 1960s, this infection has been one of the most serious public health problems in the tropics and subtropics (WHO, 1965). This genus probably originated around the great lakes of Central Africa and eventually spread to other parts of Africa, the West Indies and South America (Jordan and Webbe, 1969). The important species of medical concern within this genus are *Schistosoma japonicum* (Katsurada), *S. mansoni* also known as Sambon and *S. haematobium*.

Schistosomiasis is one of the most prevalent parasitic diseases in the world. Literature shows that the disease is endemic in 74 developing tropical and subtropical countries and that it ranks second only to malaria among parasitic diseases in terms of socioeconomic and public health importance. The current estimates of the global prevalence put the number of people infected at 200 million while another 600 million are at a constant risk of infection as the disease continues to spread to new areas (Jordan, 1980).

2.2.2 Life Cycle of Schistosomiasis

The different species of schistosomes that infect humans have rather similar life cycles (Barbour, 1982) with a sexual generation in vascular system of the definitive host and an asexual generation in the intermediate hosts (snails). They all have a typical trematode vertebrate-invertebrate lifecycle, with humans being the definitive host. Stauffer, (1997) illustrated that schistosomes need both humans and snail species to complete their life cycle. If either of the hosts is absent, the schistosomes cannot survive and the life cycle can be interrupted. Schimdt et, (1985) reported that the vector snails for schistosomiasis infection belong to three genera of: *Bulinus*, *Biomphalaria* and *Oncomelania*. In Lake Malawi, the main vector is the thin-shelled *Bulinus globosus* (morelet) which are more common along certain parts of the lake and the main intermediate host of *S. haematobium* at Chembe Village is *Bulinus nyassanus* while that of *S. mansoni* are snails of the genus *Biomphalaria* (Planorbidae family). This species prefers coarse sand or gravel as substrate rather than vegetation and silt/mud (Madsen et al. 2004). *Bulinus* is a turreted snail with a left-handed opening when looked at with the spire upwards.



Fig. 3: Adult Schistosoma trematode (worm) in vesicle plexus of human body

The cycle begins from the female adult worm in the human body. Each female adult of urinary schistosomiasis lays 20 to 300 embryonated eggs per day. But other

trematodes produce between 100 to 3,500 eggs per day, with *S. mansoni* producing the fewest. A large number of these eggs leave the host (human being) through the urine and excreta. When the eggs are deposited into a suitable environment, they hatch into swimming larvae known as miracidia that penetrate into the snail intermediate hosts. The miracidia die in 16 to 32 hours if they do not succeed in reaching a suitable snail intermediate host (Muller, 1975). Schimdt and Jordan (1969) observed that the miracidia portray positive phototropic and negative geotropic responses which bring them to the surface where a large proportion of snail intermediate hosts are found. Nevertheless, miracidia can also infect snails that lie at the bottom (Brown, 1980). In the snail, the parasites undergo two asexual multiplication stages (first and second generation sporocysts) giving rise to cercariae, which are shed into the water (Chiotha, 1990). Once the cercariae leave the snail, it is capable to survive for about 48 hours in water. They are now able to re-enter the human skin infecting new victims and continuing the cycle. Human infection takes place upon contact with the contaminated water and cercariae subsequently penetrate the skin. Within several weeks after penetration, cercariae move into the lungs where they shed the tail and grow into larval stage called schistosomula. This schistosomula moves from the lungs to the portal vessels and there grow into adult schistosomes which mate and remain in pair. The adult worm pairs migrate to the mesenteric veins (*S.mansoni*, *S.japonicum*, *S.mekongi*, *S.intercalatum*) or the veins of the vesical and pelvic plexuses (*S.haematobium*) and start laying eggs.

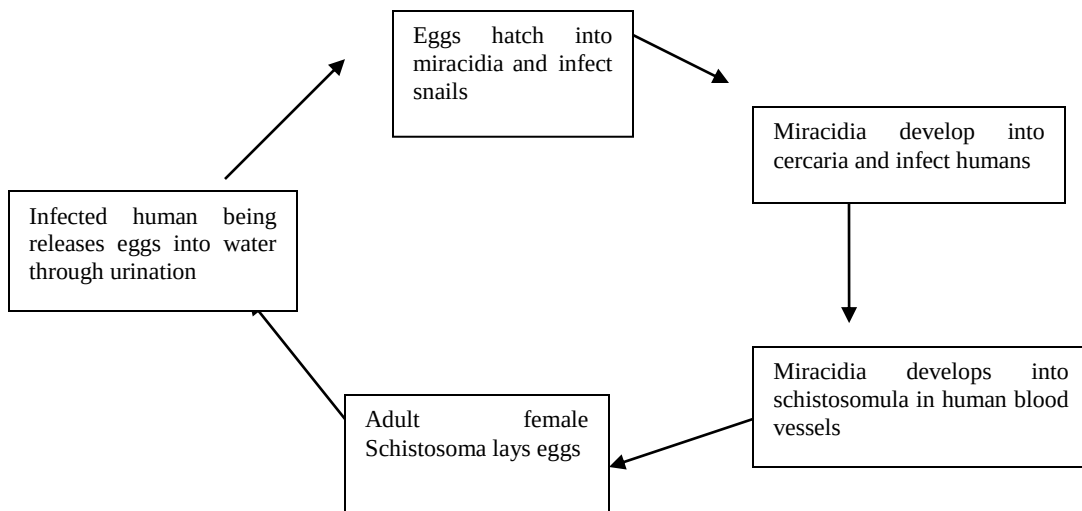


Fig. 4: Life Cycle of Urinary Schistosomiasis

The parasite that causes schistosomiasis lives for years in veins near the bladder, where it lays thousands of spiny eggs that tear and scar tissues of the intestines, liver, bladder, and lungs. Goddard and Jordan (1980) reported that individual worms can survive up to 20 years, although the average life span is between 3 and 5 years. It is the eggs produced by the schistosome worms and not the worms themselves that produce an adverse reaction in humans (Muller, 1975). The damage to the urinary tract and intestines punctures blood vessels, creating internal bleeding. Blood resulting from this internal bleeding carries with it the parasite eggs, which then enter the urine and stool.

Once the infected people, often children, urinate or pass faeces in the water, the eggs are immediately released into the community water source and the cycle starts again. Infection takes place between 10 o'clock in the morning and 2 o'clock in the afternoon because that is when cercariae shedding by the snails peaks because cercariae respond to sunshine. This is an evolutionary adaptation by the parasite because that is the time more people likely go to swim (Muller 1975). When it is cold the shedding is lower and hence transmission also lowers. By occupation, adults whose occupation requires them to remain in water for a considerable time like the fishermen, agriculturalists, divers and housewives are at greatest risk of the

infection. By age group, children aged between 10 and 19 years are at greatest risk of becoming infected with this destructive disease because schistosomiasis is easily contracted while bathing or swimming in contaminated water, an activity which is most liked by this age group (Muller 1975).

2.2.3 Signs, Symptoms and Pathology of Schistosomiasis

Chitsulo (1984) reported that the parasitic effects of schistosomiasis infection vary such that those infected might not show symptoms. Nevertheless, Foster (1967) reported that schistosomiasis can cause considerable pathological changes in a comparatively large section of the population, though only a fraction of infected individuals die as a result of the disease.

The eggs of schistosomiasis accumulate progressively in the human bladder and uterus. The reaction to these eggs leads to cystitis, hydronephrosis, ureteric obstruction and occasionally cancer of the bladder. Eggs in the bladder or bowels cause blood in the urine or faeces thereby depleting the blood of haemoglobin hence impairing physical activity. Schistosomiasis causes gynaecological lesions and a consequent reduction in productivity. After many years of repeated infection, the parasite can damage the liver, intestines, lungs, or urinary bladder. Victims of schistosomiasis may suffer from stunted growth and poor school performance, as well as bladder dysfunction, kidney disease, and premature death (WHO, 2006). Occasionally, central nervous system lesions occur. *Schistosomiasis haematobium* infections may result in a transverse myelitis with flaccid paraplegia. Novel central nervous system manifestations have also been reported from Malawi (Chiotha, 1990). For communities already burdened by poverty and ravaged by scourges such as malaria and HIV/AIDS, schistosomiasis is especially devastating (WHO, 2006).

2.2.4 Control Measures

Control of schistosomiasis is difficult, environmental sanitation, safety of water supply and education are essential. The World Health Organization (WHO, 1980) described Schistosomiasis control as a "long term commitment" calling for a

continued commitment by the countries. It is this commitment that has helped to completely eradicate the disease from Japan, Lebanon, and Tunisia. In China, continuous efforts over the last four decades have led to a 90% reduction in the number of infected people compared to the 1950s (WHO, 1980). This gives hope that it is possible to control this disease. Muller (1975) reported that there are four principle methods of control: destruction of snails, mass chemotherapy, environmental sanitation and behavioural change to reduce water contact. The international consensus is that holistic participatory community-based efforts are the only sustainable and most effective means to control schistosomiasis. But it is usually essential to provide alternatives or use two or more methods simultaneously. Muller (1975) suggested a combination of mass chemotherapy and snail control and said that the combination is likely to provide the most rapid and effective results. According to the life cycle, strategies for reducing transmission of Schistosomiasis should target any of the three points on its cycle as follows:

2.2.4.1 Egg producing adult worm

The first point in controlling schistosomiasis is targeting the egg producing female adult worm in the body of infected human beings. This control can be achieved by chemotherapy of the infected individuals. Apparently, praziquantel is the most effective chemotherapy (drug) for all forms of schistosomiasis (WHO, 2005). Nevertheless, while Praziquantel is safe and highly effective in curing an infected patient, it does not prevent the re-infection by cercariae and is thus not an optimum treatment for people living in endemic areas (WHO, 2005). Furthermore, though the cost of this drug has dramatically dropped from \$1 to around six cents a tablet since 1991 (WHO, 2005), there is no company that donates it, unlike Mectizan®, albendazole, and Zithromax® which are used for mass treatment of other parasitic infections of man. Worse still, a vaccine for the infection does not exist (WHO, 2005). Different research groups are now working on developing vaccines for schistosomiasis (WHO, 2005). But one vaccine for *S. haematobium* has entered its second phase of clinical trials (WHO, 2005). Once successful, this vaccine may eventually empower the world to win the war against schistosomiasis.

2.2.4.2 Depositing of eggs by infected humans

The second control targets where infected humans deposit eggs in water through urinating. Strategies for targeting this stage involve change of cultural practices through public health education.

2.2.4.3 Denying the eggs an entry into the snail vector hosts

The third and final strategy involves denying the eggs an entry into the snail vector hosts which are the natural reservoirs. This can be done by provision and use of safe water through the sanitation improvement projects, habitat modification (e.g. drainage of stagnant water bodies) and the chemical, physical or biological removal of the snails.

Accesses to clean water, habitat modification and adequate systems for the disposal of human wastes are of paramount importance in the prevention of water borne parasitic diseases because they disturb the parasite life cycle. However, Chiotha (1990) observed that the provision of improved sanitation facilities and public health education aiming at improving hygiene practices are costly for the poor less developed countries. Consequently, development in this area has been poor. WHO (1990) reported that only 10%, 13% and 16% of rural populations in eastern Mediterranean countries, South-eastern Asian countries and Africa respectively had access to suitable sewage disposal systems in 1990. Additionally, draining ponds that harbour parasites and their vectors/hosts may work against development needs (e.g. aquaculture) in many countries (Chiotha et al 1991).

Chiotha (1990) further observed that disease control by snail destruction with molluscicides has fish toxinogenic effects and they are costly. On the other hand, physical removal of snails is laborious, costly, time consuming and can promote the spread of the infection.

Biological control of the vector snail hosts by the facultative molluscivores and popular food fish, *Trematocranus placodon* is another strategy for controlling

schistosomiasis. But this strategy is still under study. These studies hypothesise that both vector snail hosts and *T. placodon* are found in the shallow water zone of water bodies, hence conservation of this zone can increase populations of *T. placodon* and consequently, decrease schistosomiasis parasites. But the success of conservation efforts of this zone depends on the availability of regulations that protect the zone as well as the user community compliance or willingness to comply with these regulations. At Chembe Village, this zone ecosystem has been degraded.

2.2.5 Schistosomiasis in Malawi

The seriousness of Schistosomiasis in Malawi was recognised over hundred and twenty years ago. Ransford (1948) in Chiotha (1990) reported that the widespread occurrence of urinary schistosomiasis in Malawi had been recognized for over seventy years and Dye (1924) indicated that the incidence of Schistosomiasis was increasing in the country. Ransford (1948) found Malawi to be endemic for both *S. mansoni* and *S. haematobium* and reported the former to be the most dominant in the country. Chiotha (1990) observed that in the recent years the lakeshore communities in the southern part of Lake Malawi had experienced a significant increase in the rate of infection with urinary bilharzia. Chiotha (1990) further reported that all the past and present studies of this disease have reported high infection rates among the inhabitants of Lake Malawi's shoreline.

CHAPTER THREE

3.0 METHODOLOGY

3.1 THE STUDY AREA

3.1.1 General Introduction

This study was undertaken at Chembe Village in Mongochi District (Map 1). Chembe Village is the largest of the five enclave fishing villages of Lake Malawi National Park both in terms of spatial and population size. The other four enclave fishing villages in LMNP are; Msaka, Mvunguti, Zambo and Chizale. The population of Chembe Village alone equals to the population of the other four enclave fishing villages combined (Mwale, 2002). The present population of the village is at 5,825 with a total of 1,302 households (LMSRP, 2005). The total land area of the village is 8.5 sq km with a beach that extends 3.5 km long.

Geographically, Chembe Village is located on the northern shore of the wider Namkumba peninsula on the southwest arm of Lake Malawi in Mangochi District. The village lies near the tip of the peninsula between 14° 01' 52" S latitude, 34° 50' 84" E longitudes and at an elevation of 1,140 metres above the sea level. The main subsistence activities for the communities in Chembe Village include fishing, agriculture and small service industries such as lodges, rest houses and restaurants. Most households, however, have a highly mixed economy with several of them involved in a combination of farming, fishing, tourism and other small scale enterprises.

The golden sand of Chembe Village beach and the LMNP which is also a world heritage site provide a spectacular scenic value and fascinating underwater wildlife for tourist interest. As such, the village became one of the country's major tourist attraction centres in this part of the continent. Smith L, (1993 b) observed that the history of tourism in the village dates back to the 1940's. In addition to the land components, LMNP also includes an aquatic zone (strip) of the lake itself including the water surface, the water column and the lake bed of 100 metres in width, contiguous with all lakeshore land components of the National Park. The Park aquatic zone is off-limits to any fishing activity. But the aquatic zone does not extend along the enclave beaches. Enclave areas were designed to allow all the four villages (except Chizale) existing before the establishment of the Park to continue their traditional way of life undisturbed. Unlike the other four villages, Chembe Village is a tourists attraction and at the same time there are lots of fishing activities. The people depend for their livelihood on income from fishing as well as tourism related businesses. However, literature shows that in 1999 signs of slump in tourism started creeping in due to the news of schistosomiasis infection and due to a slack in the development of tourists attraction facilities. Consequently, tourists preferred to other places.

In response, the Bilharzia Control Project and Lake Malawi Schistosomiasis Research Program have been and are still implementing several interventions and

have carried out surveys with the aim of controlling the infection. This study complements the study being carried out by the LMSRP. The village is divided into three distinct sections.

3.1.2 Three distinct sections of the Village

3.1.2.1 Dwale Section

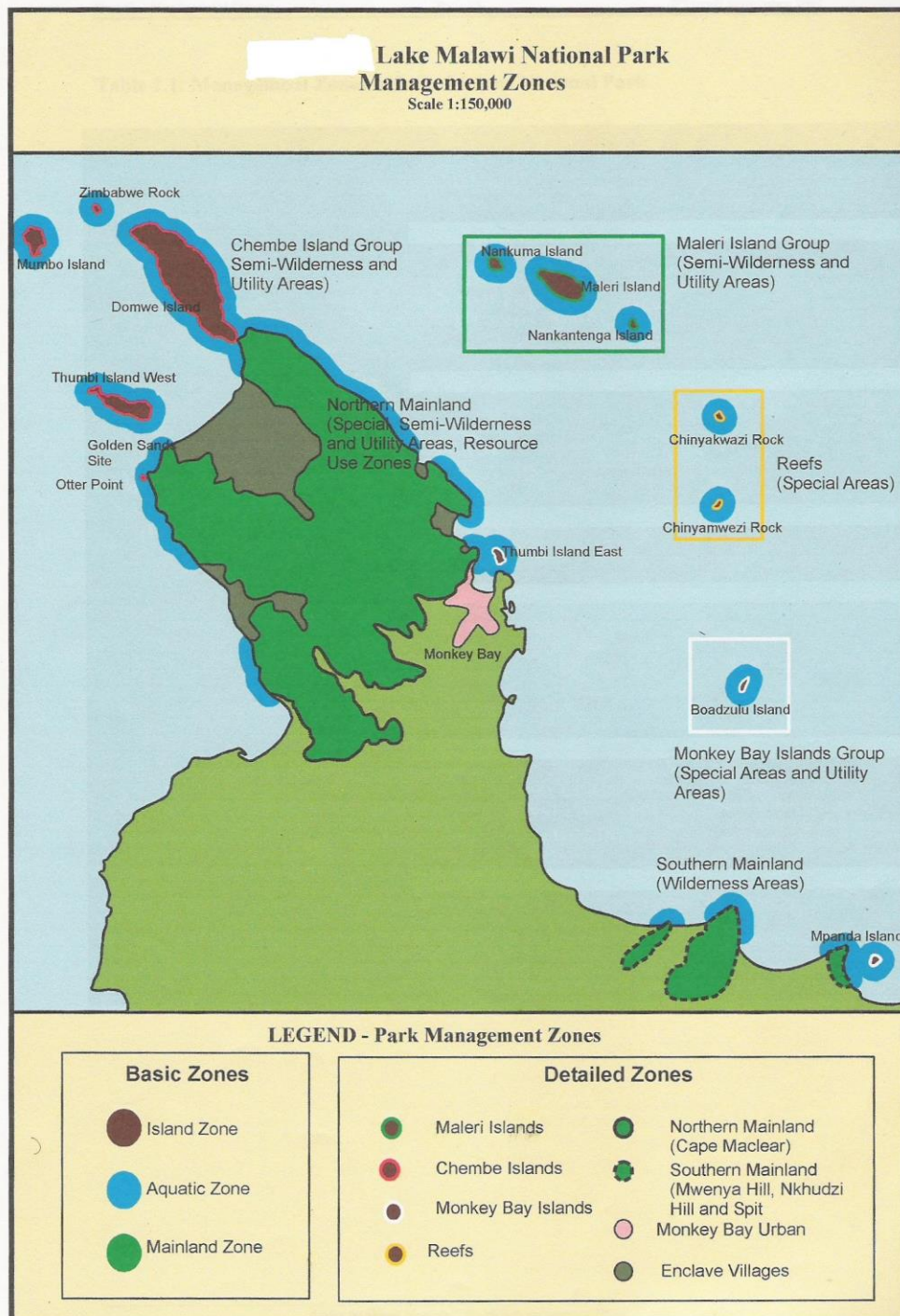
The most northern section of the village is mostly comprised of the dwale rock. This area is mainly inhabited by transient Tonga and Tumbuka fishermen from the Northern Region of Malawi. A small stream known as Mphani separates Dwale from its bordering section Mchenga.

3.1.2.2 Mchenga Section

This section is to the south of Dwale and it extends south-westerly for approximately 1.5 km to a creek bed extending from the mountains to the lake. This section of the village has retained more of Chembe Village tradition and settlers are mostly long term residents. The western part of this section is known as Kumalo and it is a place where the ancestors of the village are believed to have first settled. The chief's headquarters is in this section.

3.1.2.3 Nsonga Section

This is the third portion of the village. It begins at the creek bed and extends for approximately 1.5 km south-westerly along the shore. This is where most recreational activities take place. The former Golden Sand Holiday Camp, the LMNP Environmental Education (EE) centre, most privately owned and more modern lodges, resorts and cottages like Cape Mac Lodge, Gecko Lodge, Fat Monkey Lodge and Gia Lodge are in this section.



Map 2: Namkumba Peninsula showing Chembe Village

Source: Croft, T.A. 1981

3.1.3 Population and People of Chembe Village

Historically, no people lived in Chembe Village on permanent basis until the establishment of the Livingstonia Mission in 1875 (Mwale, 2002). By 1880, about 600 people lived in the area. The population has been increasing rapidly over the years to the present population size of 5,825 (Table 1). Nowadays the village is almost entirely of indigenous Chewa tribe with an exception of Dwale section which has been settled by the transient Tonga and Tumbuka tribes from the Northern Region of the country. Hence the population of Chembe Village is of a mixed ethnic descent that comprises the Chewa, Tonga and the Tumbuka. The Chewa speaking people were the earliest inhabitants in the area known to have been first settled by mid 19th century and the village chief traces origin of their ancestral inhabitants from Salima District of central Malawi.

Table 1: Population and Annual Intercensal Growth Rate of Chembe Village

Year	Population	Average Annual Intercensal Growth Rate (%)
1880	590	-
1910	555	-0.2
1920	695	2.5
1940	1135	3.2
1967	1865	3.8
1977	2055	1.0
1987	3125	5.2
1992	4670	9.9
2005	5, 825	1.9

Source: Adapted from Mwale 2002

3.1.4 Topography and Climate

Chembe Village is at the tip of Namkumba peninsula (an area of land almost surrounded by water). At either end of the beach are hills. This topography makes the village well protected from the strong winds, which blow in the southern and

eastern sections of Lake Malawi. Together with its large space of fishing beach, this topography makes fishing activities favourable at Chembe Village. The mean annual rainfall is 766 mm though it is very variable (Mwale, 2002). The topography and seasonal changes generally influence the local temperature, but the mean annual temperature is 22.7^o C (Mwale, 2002). This temperature is good for agricultural activities as well as for traditional means of fish processing. The topography constitutes pulling factors for the fishermen who quickly moved into this area, making it the largest of all the enclave villages in the Park.

3.1.5 Agricultural Activities

Of all the five enclave fishing villages in the Park, Chembe Village has a large agricultural land totalling 1, 892 acres of cultivatable land (Mwale, 2002). Nevertheless, with the population of Chembe, this arable land is relatively small though the land makes considerable agricultural activities especially during the rainy season possible. The village agricultural sector is dominated by the small scale subsistence farming which is characterised by a low level of technology. Hand hoes are the main tillage implements used for cultivation. Crop production is mainly for the country's main staple food crop, maize. Other crops like rice, sorghum and millet are also grown. This sector faces a lot of challenges in terms of conflicts with wild animals especially monkeys.

3.1.6 Fishing Activities

Fishing is the major industry that contributes to the economy of Chembe Village. This industry constitutes the main source of income in the village and the majority of households rely on fish as their primary source of food and income. The bulk of the catches in Chembe Village are *Engraulicypris sardella* (usipa) and *Copadichromis virginalis* (utaka) (Smith, 1993 b). Catches for these species peak during the months of August to October. Most fishing activities are done in the immediate vicinity of the village. While men do the actual fishing, women often process the fish and transport it to the markets for sale. The fish traders who come

from inland districts take the products to inland markets of Lilongwe, Ntcheu and Blantyre.

Chembe Village fishery is mainly artisanal comprising five gears that include Chilimira, gillnet, longlines, beach seines and handline, Chilimira being the most important. Gill nets come second in terms of importance at Chembe Village followed by the longlines, handlines and beach seine.

Literature shows that until the time of Livingstone's settlement at Old Livingstonia (Chembe Village), fishing in this area was not commercialised and that Chambo was the most important fish group in the Chembe Village fishery (Betram, 1942 as reported by Smith, 1993 a). At that time only mature large fish were caught using the chambo beach seines while usipa was only caught for hand lines and long lines bait. The older fishermen of the village relate that beach seines and hand lines were virtually the only gears in use when they began fishing as small boys (Smith, 1993 a). The Chilimira net was introduced in Chembe Village in the late 1950s by migrating fishermen from the northern part of the lake. Smith (1993 a) reports that by mid 1960s Chilimira seine outnumbered beach seines in the area.

Ambali, (2002) observed that the seven most commonly caught fish taxa in order of importance in terms of biomass caught at Chembe Village are as follows: usipa (*Engraulicypris sardella*), utaka (*Copadichromis spp*), kampango (*Bagrus meridionalis*), bombe (*Bathyclarias spp*), chambo (*Oreochromis spp*), ncheni (*Ramphochromis spp*) and ningwe (*Labeo cylindricus*). However, evidence of these economically important groups of fish indicates that this fishery is in a state of serious decline both in terms of catch and catch per unit effort (Malawi Government, 1997).

3.1.7 Tourism Activities

Lake Malawi's lakeshore areas are in general the country's major tourist attraction centres. These areas are of tourist interest because of their spectacular scenic value

and fascinating underwater wildlife. The lake has the reputation of being one of the few unpolluted fresh water lakes in the world. At Chembe Village, the beach comprises golden sands. As such, Chembe Village boosts a lot of tourism activities in the country. The village has a long history of tourism that dates back to the 1940's (Smith, 1993 b). Apart from the beach, tourists to Chembe Village are also attracted by the LMNP which is also a world heritage site. Tourists come from far and wide with the majority coming from Europe, USA, Australia and South Africa. In this case, Nsonga is the most patronised section of the village by the visitors. This is due to its proximity to the Park's EE centre, the former Golden Sands Holiday Camp Site and more modern lodges and resorts. Construction of a number of rest houses, restaurants and lodges in this section of the village is actually a response to the many tourists that patronise it. Amongst the local communities, the pioneer to join the tourism industry is a Mr. Stevens who first opened his lodge to guests in 1982. Literature shows that tourists had been flocking to Chembe Village for a number of years until 1999 when signs of slump started to creep in and the investors moved to Salima and other districts (Ambali, A. et al. 2002). The schistosomiasis threat is among the factors that have negatively affected tourism in this village.

3.1.8 Problem of Schistosomiasis in Chembe Village

A survey carried out by Lake Malawi Schistosomiasis Research Programme at Namkumba Peninsula in 1999 confirmed prevalence of schistosomiasis at Chembe Village and the survey revealed that 22.4% of adult population and 80.6% of school pupils were infected. At Chembe Village, adults who by trade are required to remain in water for a considerable time like the fishermen, agriculturalists, divers, and housewives and children aged between 10 and 19 years are at greatest risk of the infection. The fishing communities, communities working along the lakeshore, as well as the tourists have all been infected or affected. This development has negatively affected the working capacity and economic production of the fishing communities, the cognitive capabilities and performance of school children as well as trade and tourism of the region (GM/DANIDA, 2002).

3.1.9 Schistosomiasis control efforts at Chembe Village

In response to this prevalence, the government through Ministry of Health and Population and other organisations are embarking on several initiatives aiming at reducing the prevalence of Schistosomiasis. Initiatives include:

3.1.9.1 Treatment of infected individuals

From 1998 to 2002, Bilharzia Control Programme (BCP) has been implementing various control programme like mass chemotherapy programme at Chembe Village Primary School while Chembe Village and Monkey Bay clinics treat the infected individuals. Lake Malawi Schistosomiasis Research Programme, Save the Children Fund (SCF) and other organisations have also been implementing mass chemotherapy at Chembe Village.

3.1.9.2 Sanitation improvement programmes.

Various sanitation improvement programme are being implemented

3.1.9.3 Provision of safe water

Plans are underway to install a water purification plant under the Chembe Village Water Development Project. Ministry of Health and Population through Health Surveillance Assistant (HSA) also distributes free chlorine to the community for water treatment.

3.1.9.4 Environmental Education campaigns

Ministry of Health and Population, LMSRP, SCF, Chembe Village Primary School and BCP conduct sensitisation programme

3.1.9.5 Research programs

Since 2002, LMSRP has been conducting a research in Lake Malawi which is expected to complete in the year 2007. The purpose of the study is to address cause-effect relationships between fish, snails and schistosomiasis transmission to human beings and it is being carried out in selected lakeshore communities along Lake Malawi including Chembe Village. This is a collaborative research project between the University of Malawi (Bunda College and Chancellor College), Pennsylvania State University in the USA and Danish Bilharziasis Laboratory – Institute for Health Research and Development in Denmark. The project is funded by the National Science Foundation (NSF) and the National Institutes of Health (NIH), both in USA. This study is part of LMSRP.

More recently, facultative molluscivore and popular food fish, *Trematocranus placodon* have been hypothesised to be responsible for preventing the thin-shelled schistosomiasis vector snails, *Bulinus globosus* (morelet) from invading the open regions of Lake Malawi (McKaye., 1986). Stauffer, (1997) suggested that a lake-wide strategy for controlling schistosome hosts using fishes should be initiated to reduce the prevalence of this disease. If tested and confirmed, this strategy can be one of the most sustainable of such programme. Lake Malawi Schistosomiasis Research Programme is therefore testing this hypothesis. As such, it recommends conservation of shallow water zone in order to conserve these fish molluscivores in the battle to defeat bilharzia. Lake Malawi Schistosomiasis Research Programme took an initiative to reinforce the ban in shallow water fishing at Chembe Village from January 2005 and also conducted sensitisations and trainings for BVCs on the same between November and December the same year in its quest to control schistosomiasis.

3.1.10 Road infrastructure

The village is accessible by a poor feeder road that joins the main Mangochi to Monkey Road at Cape Maclear Turn Off. The access road is 19 km long but it is in bad shape as it becomes impassable in the rainy season. Of late, the government has

been grading this road so often. However, due to the terrain of the area, the road gets eroded every rainy season. When it has been washed away, the road cuts off Chembe Village from the main markets for their products, particularly fish.

3.1.11 Other facilities

Chembe Village has also a primary school, a Community Day Secondary School (CDSS), popularly known as “ku a tongongole” due to many little black stingless-bees (also known as sweat-flies or eye-flies) of the family *Meliponidae*, which are so abundant at this site and continually disturb teachers and pupils ears and eyes in class, a clinic run by the Billy Riodan Memorial Trust from Ireland, seven functional boreholes, a produce market, a police post, three maize mills and several restaurants and mini shops.

3.2 JUSTIFICATION FOR SELECTING THE AREA OF STUDY

Lake Malawi Schistosomiasis Research Programme is conducting its studies at Chembe Village. This study was therefore developed within the framework of the research by LMSRP in order to inform this project about the knowledge; attitude and practices (KAP) related matters. In the long run, it is desirable to find acceptable measures for minimizing shallow water fishing with community involvement. The study focuses on urinary bilharzia (*S. haematobium*) because this is what is more prevalent in the study area, Chembe Village.

3.3 DATA COLLECTION PROCEDURES AND TOOLS

3.3.1 Tools Used

The study utilised a number of tools most of which were qualitative in nature. Among the tools utilised were household survey, key informants interview, focus group discussions and participant observation. The tools were administered from October 2005 to August 2006 by the Researcher, an Assistant and four enumerators. In total, 265 households and 8 key informants were interviewed and three focus group discussions were conducted. The combination of five tools contributed to

thorough data collection and triangulation of the information collected which could not be possible if only one tool was used.

3.3.2 In-Depth Household Interviews

An in-depth household survey was conducted for the first and fourth objectives. Structured household questionnaires comprising both closed and open-ended questions (appendix 1) were used through direct oral interviews. Structured questions were deliberately used to get as much insight from the respondents without limiting them. The household survey investigated household knowledge and perceptions towards fish resources management and schistosomiasis infection. The household survey targeted 265 households as primary sampling units and household heads as respondents. Where the head was not available, other members of the household, preferably the spouse or somebody most knowledgeable about the issues, were interviewed instead. This approach ensured that the active fishermen as well as women were taken on board.

The sampling frame of 1,301 households was obtained from the census result conducted by Lake Malawi Schistosomiasis Research Project (LMSRP) in December 2005. During this census, three enumerators were engaged and these were designated with letters A, B and C. Enumerator A recorded 339 households, B recorded 477 households while C recorded 485 households. The sample space for the present study was therefore systematically selected from the whole enumerated population according to the following approach:

The following formula was used to calculate the number of samples to be pooled from each of the three groups of households:

$k = nc/N$ where

- k is the number of samples pooled from each group.
- n is the size of the group
- c is the sample space for this study
- N is the sampling frame

From group A	$k = 339 \times 300 / 1301 = 78$
From group B	$k = 477 \times 300 / 1301 = 110$
From group C	$k = 485 \times 300 / 1301 = 112$

Systematic sampling was then done to get 78, 110 and 112 households from groups A, B and C respectively using the formula:

$k = N/n$ where k is the interval constant
 N is the total number of households in each group
 n is the sample size

For group A $n = 78$, $N = 339$, hence the sampling interval (k) = $339/78 = 4$
For group B $n = 110$, $N = 477$, hence the sampling interval (k) = $477/110 = 4$
For group C $n = 112$, $N = 485$, hence the sampling interval (k) = $485/112 = 4$

Since k is 4 from each group, then every fourth household from each list was selected. The first household was randomly selected from the first 4 households on the lists.

3.3.3 Key Informant Interviews

Key informant interviews were conducted for the second and third objectives. The tool was administered through direct oral interviews. Key informants are persons whose positions or previous experience give them particularly valuable information on a given topic. The key informants were interviewed to supplement and provide explanation on the information obtained from the individual interviews and the FGDs. Information on the level of awareness and attitude regarding the fishing regulations and schistosomiasis infection was also obtained from interviews with the key informants.

The key informants interviewed and the check lists used to interview them are listed in appendices 2a, 2b and 2c.

3.3.4 Focus Group Discussion (FGD)

A Focus Group Discussion (FGD) is a discussion of persons with common characteristics and guided by a facilitator, during which group members talk freely and spontaneously about a certain topic. The tool generates qualitative data on thematic issues to complement household level and field level data. For this study, a total of three focus group discussions were conducted in the village for the second, third and fourth objectives. Participants gathered at the chief's headquarters and all the three FGDs were conducted on the same day but at different times. The focus groups included a women group, a fishermen group and a Beach Village Committee (BVC). There are three BVCs in the village. Five members from each of them were therefore invited to assemble a group of fifteen members for the discussions.

In Malawi, rural women speak out their views less than men when they are combined with men in a meeting. A group of women was therefore, deliberately targeted to generate sex-disaggregated data. A checklist for FGDs (appendix 3a) was developed and used to guide the discussions. However, participants were also encouraged to illustrate their views and ideas in a way they felt more comfortable. The FGD tool was strategically chosen because it enhances interaction between the interviewer and respondents and amongst the respondents themselves thereby giving them the freedom to express their views representing sections of the wider community.

The FGDs were conducted before administration of the in-depth household questionnaires so that issues emerging from the FGDs could feedback into the household questionnaire leading to its adjustment. The village chief took a major role in identifying the participants so that they came from a wider section of the village. Care was taken to make sure that no one person dominated the discussions. FGDs were facilitated by the Researcher while the Assistant and the enumerators

were taking notes. Finally, a narrative FGD field report was compiled in preparation for analysis.

3.3.5 Participant Observation

A local research assistant was engaged to assist in the process of data collection especially in the administration of this tool. The researcher and the Assistant personally engaged in direct observation by regularly walking up and down the beach several times a day and five days a week (not always on the same days) to count and record actual fishing practices in the shallow waters. The two spent the scheduled day observing all the fishing activities taking place in the shallow waters. Information gathered on each day included the date, time of day, the observed number of fishermen fishing in the shallow waters, type of gear used and where possible, where the fishermen were resident and species of fish caught. Information regarding where the fishermen were resident and the species of fish caught was only recorded when the fishermen landed on the shore, otherwise it was not possible to get this information when the fishermen were offshore. When the fishermen landed at the shore, the local research assistant was able to identify them (being one of the villagers) since all the residents of Chembe Village know each other. At the end of each day and at the end of each month, notes were compiled as to what had been observed in that month.

The participant observation tool was mainly engaged to capture information about the community's actual shallow water fishing practices. It provided a deep understanding of actual fishing practices in the shallow waters at Chembe Village. The method is flexible hence could be combined with other data capturing tools. Generally, this technique proved to be a good method for evaluating strengths of enforcement and compliance for fishing regulations. For participant observation tool to be successfully done, the researcher and the assistant took up residence within the Chembe Village from September 2005 to end June 2006 (a period of ten months) and worked on mutual trust. There was no need to learn the local language, daily life and culture since the researcher comes from an area that shares some

similarities to that of the study site. The research Assistant who assisted in the process of data collection was also locally engaged. Since compliance with fishing regulations is a sensitive issue to the fishermen in the village and any fishing area, as it is envisaged to be a threat to their livelihood, caution was taken by the researcher and the Assistant to avoid being associated with the law enforcers like the Departments of Fisheries and Parks and Wildlife, police and any other institution perceived by the community as connected to the institution or enforcement of the regulations. To achieve this objective, the research Assistant was carefully and thoroughly trained to ensure neutrality in the process of data collection.

3.4 FIELD WORK PRE-TEST

Fieldwork was preceded by questionnaire and checklist pre-testing. This exercise was undertaken at Mbwadzulu village and it was done two months prior to the actual fieldwork. Mbwadzulu Village is about 10 km from Monkey Bay along the main road to Mangochi town. This village was selected because its setting is more like that of Chembe Village (the research site) where villagers earn a living mostly through fishing activities. Just like Chembe Village, this village is also surrounded by holiday resorts and cottages. Commercial fishing and the tourist cottages in this area attract people from different parts of Malawi just like in Chembe Village. The two villages differ in the sense that while Mbwadzulu is along the main road, Chembe Village is approximately 19 km off the main road and that Chembe Village boosts a lot more tourists than Mbwadzulu.

The pre-test was conducted to establish and limit the main survey to issues regarding fishing practices and schistosomiasis infection prioritised by the local people. During the pre-testing, household questionnaires were administered to 32 households, three Focus Group Discussions (FGDs) (one for fishermen, one for women and one for BVC) were conducted and three interviews were held with key informants. Corrections and clarifications were made on the main questionnaire and checklists for FGDs and Key Informants based on the responses obtained from the

pre-survey. The questionnaires were administered by the interviewers in the local language, Chichewa. For quality control, the questionnaires were translated into Chichewa for three times by the researcher then back into English by three separate research assistants. This process aimed at improving quality of the questions while conserving the messages addressed.

3.5 DATA PROCESSING AND ANALYSIS PROCEDURES

Quantitative data from the household survey was coded, entered and analysed using a Statistical Package for Social Scientists (SPSS) software. Descriptive statistics was used to describe the basic features of the quantitative data by summarising frequencies, percentages and basic statistics such as the mean, mode, standard deviation and variance. This was also used to create frequency tables, percentages and cross tabulations showing the proportion of respondents agreeing or disagreeing on an issue. Tabular and graphic analysis was used to aid in quantitative analysis of the data. Descriptive Statistics was used because quantitative descriptions are presented in a manageable form by simplifying large amounts of data into a relatively simple summary.

Qualitative data obtained from key informants interviews, FGDs and Participant Observation tools was compiled and transcribed. The coding involved categorizing all emerging issues into different themes. This analysis was applied to list the observed fishing practices at Chembe Village, levels of compliance and features that either frustrate or promote fishing management in the area.

3.6 STUDY ETHICAL CONSIDERATION AND SCIENTIFIC APPROVAL PROCESS

The study observed some ethical considerations in that as a very first step, the researcher made a courtesy call to the village head to inform him about the study, its objectives, the methodology, the purpose of the study and to solicit his assistance. This was done for the researcher to get permission and support to administer the research tools in the village. Prior to the interview, the researcher and

the enumerators also explained to all the identified potential respondents of the study, its objectives, the methodology and the purpose of the study.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 AWARENESS LEVELS, OPINIONS AND COMPLIANCE OF CHEMBE VILLAGE ABOUT FISHING RULES AND REGULATIONS

4.1.1 Decentralized Fisheries management regimes at Chembe Village

FGDs results showed that the decentralization had taught local communities to be more responsible in managing fish resources as they assumed the role of protecting and conserving the fish resources. It had also made them assume the responsibility to keep the beaches hygienically safe all the year round. Just like the village, the beach was also divided into three portions of Dwale, Mchenga and Nsonga. In each of these portions was established a BVC. Nevertheless, members of these BVCs bemoaned that they had never received any training. Further, follow ups to these committees by the responsible line ministries was either minimal or absent. This showed that Government transferred the whole responsibility for managing fish resources to the communities. But the devolution of tenure does not mean the abdication of state responsibilities in wildlife conservation and management (Malawi Government, 2002 c). This showed that implementation by the Malawi government of the decentralisation policy was contrary to what its clauses stipulate. Key informant interviews with fisheries officers confirmed that the trainings and follow ups were not done due to resources constraints. Consequently, the BVCs did not know their terms of references (TORs) and that they hardly met. Apparently, the most famous role of these BVCs which was known by the many was that of assisting the fishermen who fell into different problems like illnesses and deaths. As such, the BVCs were so weak that fewer members were still active while the rest of the members unceremoniously deregistered themselves.

The principle of decentralised fisheries management requires that decisions related to fish resources management be taken as closely as possible to the citizen because it is based on the understanding that users of the resources within the ecosystem could best undertake fish resources planning and management. That way, decentralisation is expected to enhance transparency, accountability, ownership and efficiency in resource use and management. It is against this background that decentralisation is considered one of the tenets of fish resource management. But for this strategy to be successfully implemented, adequate resources in terms of facilities, human and financial resources are required.

However, inadequate capacity by the implementers at central government, district and community levels has set some undesirable precedent at Chembe Village thereby presenting a major challenge to fish resource co-management. At Chembe Village, trainings for BVCs were not conducted and facilities for supervision were not available. The inadequacy in community capacity building strategies were frustrating decentralised fish resources management. Furthermore, it was reported during the key informant interviews that decentralisation had only emphasized devolution of functions to the local levels while withholding operational resources at central level. At the time of the study, operational funds for the sectors responsible for implementation of this principle including the District Fisheries Office, Environmental District Office, District Assembly and others were heavily controlled by the central government, with barely little or nothing trickling down to the districts over long periods of time. When made available, resources were not adequate to make for intended activities. At Chembe Village it was also noted that there was a total abdication of state responsibilities in fish resource conservation and management. This is the reason Chembe Village BVC training had not taken place.

4.1.2 BVC Knowledge and Operations

The study, through household interviews, found that 63.9% of the fishermen respondents knew or had ever heard about the existence of BVCs in the village and

60.7% of those that had heard about the BVCs thought that these committees were effective and efficient. Household interviews results also showed that 59.7% of fishermen respondents admitted that they got advice on fish management through these BVCs and the Department of Fisheries. However, the FGDs observed that in most cases it was only one or two members of each of the three BVCs who always showed interest and were active. Perhaps lack of training discouraged BVC members as they did not exactly know what was expected of them. At least there was a high level of awareness of these committees in the village. This was an indication of acceptance, ownership and approval of the principle of co-management. If capacity for these committees was built, they could be encouraged and hence could be effective and efficient in their operations. Consequently, management and conservation of fish resources at Chembe Village could be improved.

4.1.3 Daily Monitoring of Fishing Activities

The study, through household interviews found that respondents had several perceptions regarding an institution that monitored fishing activities in the village. Fig. 5 below shows that 35.9% of the respondents thought that the daily monitoring of fishing activities in the village was done by the BVCs, 24.0% of respondents thought that the monitoring was done by Messrs Jali, Ng'ona, Lukiyo and Wanda. It was then revealed that these mentioned individuals were leaders and the only active members of the BVCs and also most famous and successful fishermen at Chembe Village. These mentioned individuals were influential in as far as fishing activities at Chembe Village were concerned. The study also found that 1.0% of the respondents thought that the monitoring was done by World Wildlife Fund (WWF). World Wildlife Fund is an international organisation involved in the conservation of the environment and wildlife (especially those threatened by extinction). WWF was associated with daily monitoring of fishing activities because of its connection with the implementation of shallow water fishing restriction.

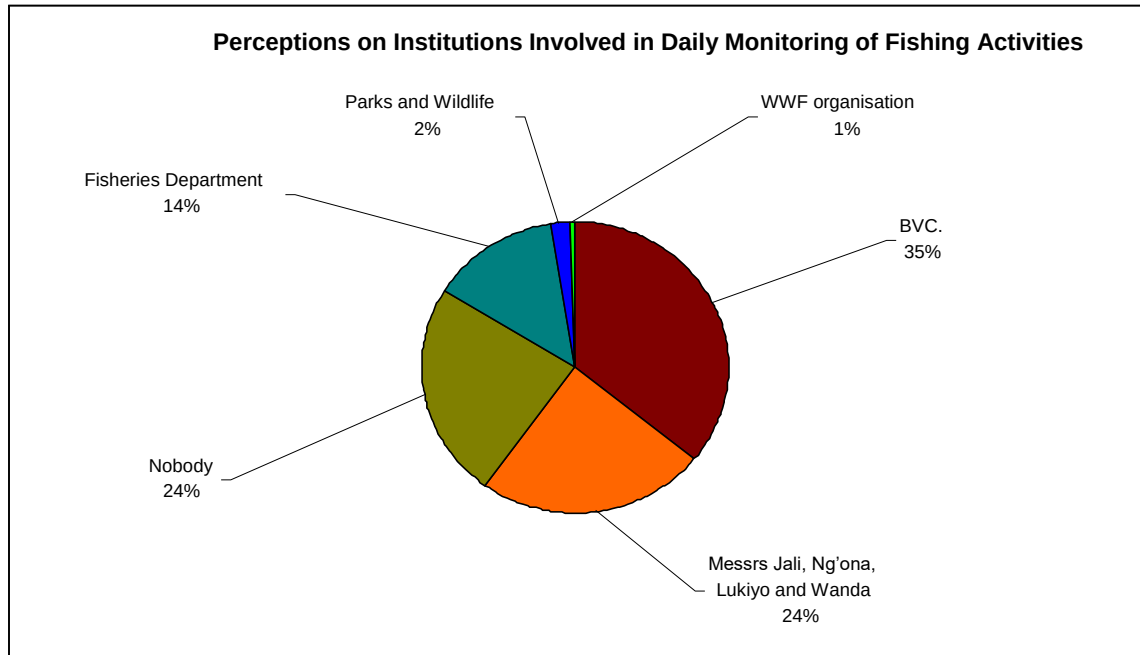


Fig. 5: Reported Institutions Involved in Daily Monitoring of Fishing Activities at Chembe Village

Community's knowledge of the institution that monitored fishing activities was a measure of the effectiveness of the institutions mandated with this role. At Chembe Village few people thought that BVCs monitored the activities and they also thought that the few individuals that monitored the activity did this in their personal capacity. This confirms that BVCs are weak in the village. It was interesting to note that WWF was associated with monitoring of fish activities. The recognition of this NGO by members of community showed that WWF was making an impact in the village provided the role was within its context.

4.1.4 Awareness of Fisheries Management Regimes at Chembe Village

Household interviews results indicated that 77.7% of the interviewed fishermen were aware of at least one or more regulations related to protection and management of fish resources while 22.3% reported to have never heard about any regulation at all. This indicates that issues of awareness of fishing regulations in the village were well known. At least all the basic rules for artisanal fisheries were known though none knew all of them at a given time.

It was interesting that during the FGDs, a women focus group was more active in brainstorming and came up with a longer list of the fishing regulations as opposed to the other two groups of BVC and fishermen. Better reporting of fishing rules by women, than men (who were very much involved in the fishing activities) was of special interest. It indicates that women are custodians of important information which they can provide if they are accorded a chance. But it can also indicate that men choose to deliberately pretend not to know the regulations so that they should keep on violating them.

The study also established that above the formal regulations (regulations which are documented and were enacted by parliament), the village had other non formal regulations (those set by the community and in most cases they are not documented anywhere but written in the hearts and are only applicable in this village). Generally, the main formal regulations that restrict fishermen on the gear types, mesh sizes, catch size and closed season were presented. What was more important was the fact that both the formal and non formal regulations served to conserve and manage fish resources at Chembe Village. Below is a list of the reported non-formal regulations at Chembe Village.

- a) Shallow water fishing restriction. The respondents reported that any fishing activity close to the beach (in the shallow waters) is prohibited. Household interviews and FGDs respondents reported to have heard about the regulation from a certain researcher, the BVC and from LMSRP.
- b) Respondents reported that no fishing activity is allowed when there is a funeral in the village and that this regulation was an order by the village chief.
- c) No fishing activities on Sundays. Chembe Village, being mostly a Christian village, more people rest and go to their respective churches on Sundays. Over the years, this day became culturally accepted as a resting and no fishing day.

- d) Banning of fishing gears with illegal mesh sizes like Nkacha and trawler gears. According to the respondents this regulation was instituted by the community through their BVCs after noting that this kind of gear was devastative in nature.

Among the formal fishing regulations, this study found that the closed season rule was illegally enforced on all fishing gears in the country. The Fish Conservation and Management Regulations 2000 specifies that the rule is for various beach seines only. But various law enforcers enforce a total closed season for all the fishing gears. It was interesting to note that while members of the community had a better understanding and interpretation of the closed season rule, the key informant from Fisheries Department learnt during the interviews that the rule only applies to various beach seines. For instance, participant observation showed that Chilimira gear was still in use at Chembe Village during the closed season. But the key informant from Fisheries Department bemoaned resources limitations to enforce the regulation at Chembe Village. It was only after going through the Fisheries Conservation and Management Regulations 2000 together that the key informant accepted the problem with the regulation. However, the fishermen themselves, during the FGD rightly reported that the closed season was only applicable to beach seines and not on all gears.

4.1.5 Legitimacy of fishing regulations

The study found that people in Chembe Village had different perceptions as to who institutes the fishing regulations. Several, institutions were mentioned during the household interviews as being responsible for instituting these regulations. The list included the BVCs, the village chief, Department of Parks and Wildlife, Department of Fisheries and yet others thought the regulations were instituted by a certain researcher who resides and operates within the village. The results showed that 87.4% of the respondents thought the fishing regulations were instituted by the government through the Department of Fisheries and Parks and Wildlife.

The study also found that 50.6% of the respondents thought that institutionally, Fisheries Department was better placed to institute the fishing regulations while 40.7% were for village based fishing regulations. Household interviews results also showed that the respondents believed the two institutions of Department of Fisheries (46.7%) and the BVCs (35.7%) were better placed to enforce the fishing regulations.

At the centre of any legislation must be the social acceptance or legitimacy of the rules of the game, which must concur with best possible scientific knowledge (Falkenmark et al., 2004). In democratic societies, rules that come from legitimate institutions only are accepted. In Malawi, the legitimate institutions which are mandated by the Fisheries Conservation and Management Act (1997) to develop and implement the fishing regulations are the Department of Fisheries and the BVCs. Rules developed by these institutions are legitimate and are expected to be accepted and followed by all fishermen. A fishing rule developed by any other institution other than these two, is illegal and would be unlikely to be accepted and complied with.

The results obtained from this study showed that the two legal institutions of BVCs and Fisheries Department were recognised by Chembe Village to be the ones responsible for instituting and enforcing the regulations. This recognition meant that the co-management strategy could work very well. The recognition means an acceptance.

As for the non-formal rules regarding fishing on Sundays and when there are funerals, they contribute a lot in the conservation of fish resources though right steps were not followed in their formulation. The right step would be to let the BVCs formulate the rules. Since these rules were formed very long ago, they now became instinct.

It is not a common practice for the Department of Parks and Wildlife to be involved in the formulation and implementation of fishing regulations. Involvement of this Department at Chembe Village is due to the fact that the village and other few surrounding villages are enclaved in Lake Malawi National Park. It is important to mention that this Department formulates and implements the rules to be implemented specifically within its area of jurisdiction only and not the entire beach.

The study found that 57.1% of respondents thought that it was not possible for local fishermen to manage fishing regulations themselves while 42.9% thought that it was possible. The fishermen themselves also shared this belief. This shows that the decentralised fishing management was not fully implemented at Chembe Village. It was interesting that Chembe Village still thought government had to take a major role in the conservation and management of fish resources despite the present policy on co-management that leaves this role in their hands while the Fisheries Department is mandated with the role of providing technical advice only without directly enforcing regulations. This village lacks self confidence to manage the resource on its own, perhaps due to capacity constraint.

4.1.6 Attitudes towards fairness and effectiveness of fishing rules and regulations

This study found that 62.6% of the respondents thought that the fishing regulations were fair and effective, 16.6% thought that the regulations were neither fair nor effective while the remaining respondents held other varying minor views. The women focus group thought the regulations were ineffective because enforcers apply double standards by subjecting the regulations to the village artisanal small scale fishermen only while big companies involved in commercial fisheries like MALDECO fisheries and the Fisheries Department who used trawlers were exempted. The BVC and fishermen focus groups accepted that the regulations were effective as they afforded juvenile fish an opportunity to grow into maturity. The study found that the most favoured fishing regulation in the village was the one that

prohibits fishing of juvenile fish. It was found that 75.1% of all respondents were in favour of this regulation. The study also found that 73.2% of all respondents were in favour of the restriction to be imposed on use of mosquito nets. The closed season was the least favoured and 59.6% of the respondents were in favour of this regulation. Based on the above findings, this study finds it reasonable to assume that fishing practices can be changed in Chembe Village through reinforcement of rules.

The study found that 70.0% of respondents thought the rules are fair and effective and that they appreciated the importance of these rules regarding conservation of fish resources. It was therefore, noted that the fishermen deliberately violated the rules. Perhaps they took advantage of the porous enforcement or they violated rules out of poverty since they had no other sources of income generation other than the fishing industry. However, the issue of lacking other sources of income generation cannot be a substitution to depletion of the valuable resources. The regulations need to be reviewed and enforcement strengthened regardless of the people's socio-economic status and dependence on the lake resources. After all, the regulations are meant to conserve and sustainably manage the same resource so that it supports this generation and that of the future.

The issue of bias in which bigger commercial fishing companies were perceived to be favoured as opposed to artisanal fishermen needs to be addressed. Key informant interviews indicated that these big companies comply with fishing regulations only that they harvest large quantities of fish. As such, they are perceived as devastating in nature by the villagers. Furthermore, the study found that there was none of these companies operating within Chembe Village beach though they have a general effect since they operate in the open waters where Chembe Village artisanal fishermen also operate.

Participant observation showed that beach seines supplied the highest quantities of fish for food in the village of all gears. The other gears mostly supplied fish to be

traded to markets in other towns and major trading centres. As such, beach seines were more favoured and supported by villagers. This was the reason the closed season rule was least favoured since it mainly targets the beach seines.

4.1.7 Compliance to fishing regulations at Chembe Village

During the household interviews, only 42.5% of the respondents thought that the fishing regulations were complied with in Chembe Village despite the awareness level of these regulations which was at 77.7%. Interestingly, 0.4% of the respondents openly said that they did not require any fishing regulation at all in the village. Different reasons were presented for failure to comply, but 21.7% of respondents thought lack of alternative sources of income was the major one. Participant observation, confirmed that compliance to the regulations was a problem at Chembe Village. Walking along the beach, one would observe; Chilimira netting with mosquito nets at their centres, women fishing juveniles in the shallows using mosquito nets (refer Fig. 8), gears being used in the LMNP aquatic zone and beach seines being used during the closed season period.



Fig. 6: Sampled Juvenile fish caught using mosquito net at Chembe Village

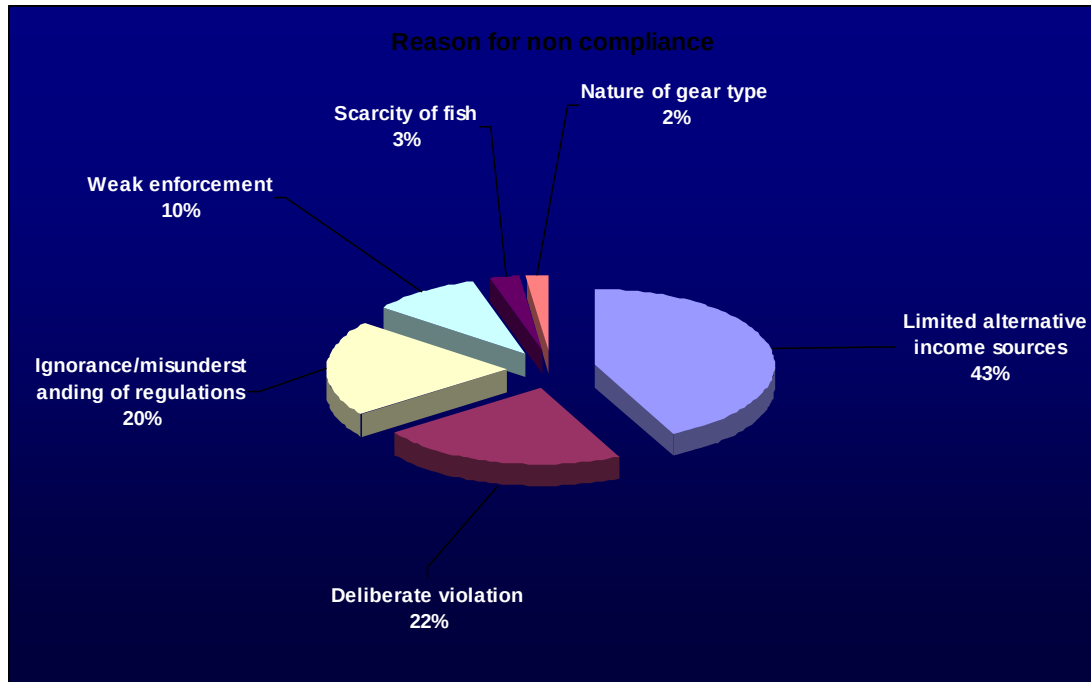


Fig. 7: Reported Reasons for regulations non compliance at Chembe Village

Use of illegal fishing gears in Lake Malawi is not a new phenomenon. A Situation Analysis of Poverty conducted by the Fisheries Department and United Nations in 1993, found that all the beach seine nets used in Lake Malawi and 96.0% of the gill nets had illegal mesh (undersized mesh) sizes. The present study found that issues of compliance to fishing regulations in Chembe Village are sensitive and the reasons are twofold as follows:

Firstly, there is an issue of deliberate violation of the regulations perhaps due to ignorance, misunderstanding of the objectives for setting the regulations, weak enforcement and scarcity of fish resources in the lake as presented in fig. 7 above. This problem required intensive sensitisations. Perhaps, there was also a need to introduce a rewarding system to communities along the beach for any effort that they carry out aiming at conserving and managing fish resources. If those living in the lake-shore areas received capacity building trainings and concrete benefits from conservation efforts, there was likelihood that they would change their attitude and practices. Capacity of the BVCs and the Fisheries Department needed to be

strengthened since violation of regulations is very much attributed to poor enforcement by these institutions.

Secondly, the regulations were not complied to perhaps due to poverty levels in the village and that people do not have alternative sources on income. As a result people had no choice but to exploit every procedure at their disposal that would optimise their day's catch. With this scenario, it would be difficult for the community to follow the rules. This indicates that there was need to incorporate economic development in all the efforts that were aimed at conserving and managing fish resources at Chembe Village. Chitsulo, (1984), reported that it was not enough to discourage small fishers from catching fish when they are forced to do so in order to survive. Chitsulo (1984), therefore, suggested that the government must find alternative ways for these people to earn an income other than by fishing.

The study also found that violations of fishing regulations in Chembe Village were usually dealt with by the BVCs and the village chief. If the violation was severe, the village chief summoned the offender for judgement which in most cases was in form of punishment, fine and/or counselling. The punishment would be in the form of a fine, confiscation of the gear and the fish harvests or expulsion of the offender from the village fishery. The fine would be in form of cash or kind depending on the severity of the crime committed and this would be at the discretion of the village chief. WRI et al., (1996) observed that this type of sanctioning authority requires strong leadership that serves as the focal point for discussion and decision-making. At Chembe Village, the current leadership is strong but perhaps what it requires is the necessary support by the legitimate law enforcers.

4.2 DEVELOPMENT OF FISHERIES ACTIVITIES AT CHEMBE VILLAGE

4.2.1 The reported against the actual fishing practices at Chembe Village

The study found a variation between the reported and the actual (observed) fishing practices at Chembe Village. During the FGDs, respondents confirmed the village fishery being mainly artisanal. But the respondents reported that the village fishery only comprises three main gears of Chilimira, gillnet and hooks (long and hand lines). However, participant observation captured other fishing gears like beach seine, mosquito nets, zitenje (pieces of cloth), bottles and fish traps above the reported gears (refer to appendix 4 for results). During FGDs, a group of fishermen was at pains to mention use of these gears in the village to an extent that a certain fisherman who mentioned use of this gear was at loggerheads with rest of the group members.

It was also noted during the FGDs that a group of women was freer and more open throughout the discussions and hence confirmed use of beach seine and other practices which were not presented by the other two focus groups. During the household interviews a similar trend was also observed in which more female respondents reported use of beach seine, mosquito nets, bottles, chitenje and fish traps while their male counterparts, especially those involved in fishing activities did not want to mention use of these gears.

The above findings show that the villagers were comfortable to report use of gears used at offshore only and not the fishing gears used in the shallow waters. This indicates that there is fear amongst the village fishermen regarding which gears should be used in the village.

A further probe revealed that the fear was instilled by a certain co-researcher attached to LMSRP who was assigned with the responsibility of enforcing the

shallow water fishing restriction. The probe revealed that in the course of enforcing the restriction, the researcher was confiscating fishing gears that were used in the shallow waters in the village. This action created a tension in the village and made the villagers interpret that the government was either contemplating introducing a total fishing ban in the village or relocating the indigenous villagers to a different place so that the village becomes an entire tourism area. Further probe showed that LMSRP regretted the enforcement strategy by this co-researcher and hence he was consequently relieved of the responsibility.

The fears also came about because strategies for enforcement of shallow water fishing restriction in the Park area by LMNP officials were misunderstood. As such, the sensitisations and trainings conducted by the LMSRP only achieved to confirm fears by the villagers. It was for this reason that the villagers were sceptical to report all the gears that are used in the shallow waters in the village. They thought that reporting use of these gears would facilitate implementation of government's plan of closing the beach or relocating the village.

4.2.2 Perceptions on Development of Fisheries

Fig. 8 below shows respondents' perception on development of fisheries for the past decade in the study area as captured by the household interviews. Four opinions were presented, but 90.0% of the respondents believed that fishermen catch less fish these days than a decade ago because fish stocks in Chembe Village have either drastically gone down or are extinct. This perception was also confirmed by the key informants, who were also prominent gear owners. These could rekindle their golden past when fish could be caught in abundance. The informants recollected that fish in the past could be caught in the shallows and that just by going to the beach, one was sure to get free fish for relish. A 64-year old village woman, Stelia Injini, recalled and said that, "In the early 1970s, fish was plentiful and cheap. Fishermen could give us free fish. We only used to eat big sized, mature and tasty fish and that the by catch of usipa and utaka was left along the beach to be eaten by the birds because we could not eat usipa and utaka for relish." Walking along the

beaches during the participant observation the claim was confirmed because fishermen were landing with fewer quantities of fish catches. The respondents that believed that fish resources had declined also predicted a doom in the fishery industry as they expected the resource to decline further in future.

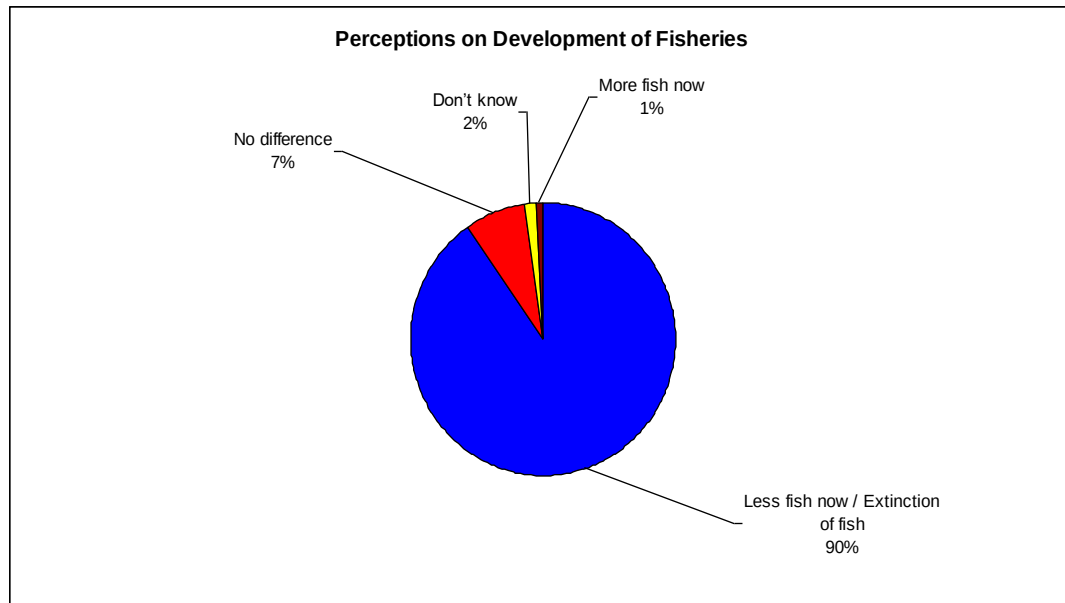


Fig. 8: Perceptions on Development of Fisheries at Chembe Village

Chitsulo (1984) wrote that chambo was the most important fish group in the Chembe Village fishery and that only mature large sized fish species were caught using large sized mesh beach seines while Chilimira net was not yet introduced in the area. Chitsulo (1984) further narrated that when Chilimira net was being introduced in the village, the gear owners faced resistance to an extent that they were expelled because it was felt that there was over fishing since large quantities of small sized fish species was caught. The 2006 Annual Economic Report – Budget document No. 2 confirms that the total catches from traditional sector of Lake Malawi for the years 1989 to 1999 have fluctuated from year to year with a declining trend. The report also observed that fish supply per capita has steadily fallen due to high population growth against declining fish production and that this was a real threat to food security and human nutrition in Malawi. The report further observed that in 1976, per capita annual fish supply was 12.9 kg but that it had

fallen to 7.4 kg in the 1990s and decreased further to 6.1 kg in 2000. This was by far less than 13 – 15 kg per capita supply recommended by World Health Organisation (WHO). This is the evidence that there were large quantities of fish species at this particular time. Today the mature large sized fish species have greatly dwindled to an extent that usipa and utaka are the main economic fish of Chembe Village. The fact that the main fish caught in today's fishery at this area are utaka and usipa confirms that the large sized fish resources have now declined at Chembe Village. Interestingly, 7.0% of the respondents reported that there was no difference between the present and the past while 1.0% reported that fish stocks were increasing as compared to the past. This group also predicted an improved catch in future citing good fish management as the major contributing factor. There is a possibility that this group of respondents might have chosen to misrepresent the facts. Perhaps, this misrepresentation of facts can be attributed to the fears instilled in the village. By reporting that all was well, this group might have thought that government would rescind its plans of closing the whole beach or relocating the village.

4.2.3 Chembe Village Perception for the Decline in Fish Resources

Figure 9 below summarizes perception of Chembe Village regarding the decline of fish resources as perceived by the respondents during the household interviews. Six reasons were presented but the 44.4% of respondents thought that fish resources had declined due to an increase in number of fishing gears and fishermen while 35.5% of the respondents thought natural factors were at work. Those who attributed the decline to natural factors said that nobody can reverse the trend except God. Other respondents (11.0%) thought that fish resources had declined in response to the rapid increase of human population that exerts pressure on the resource. Figure 9 also shows that quite a remarkable number of respondents (8.0%) blamed the decline in fish stocks to the fishermen themselves as they did not comply with fishing regulations that were aimed at conserving the resource. A few respondents (1.0%) blamed the use of trawler netting while others blamed overdependence on the fishing industry due to lack of alternative sources of income.

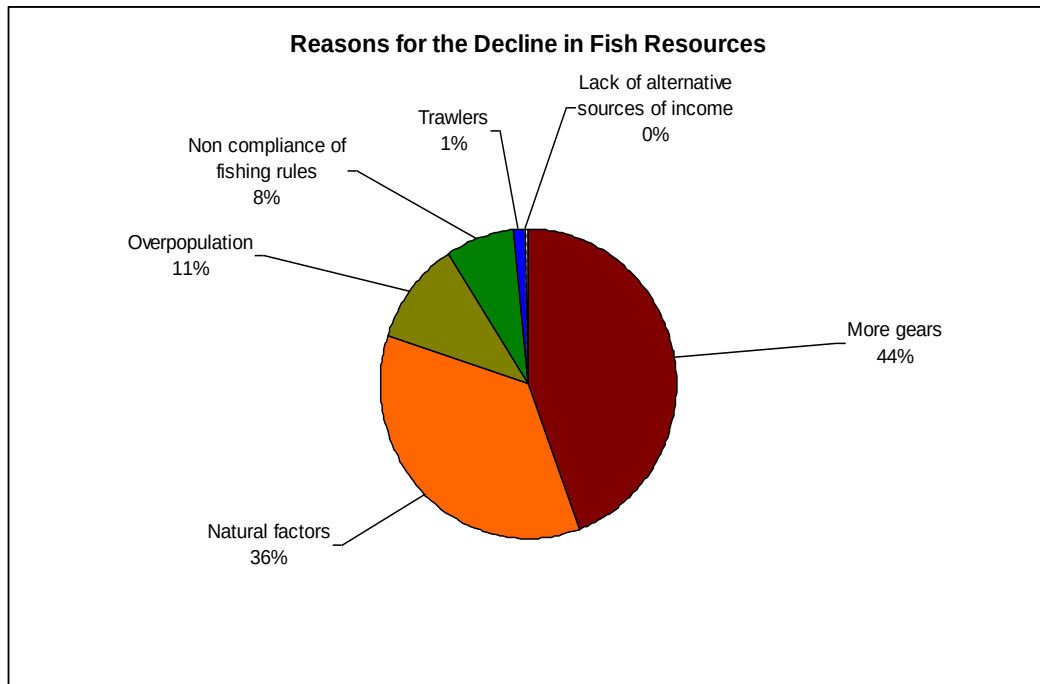


Fig. 9: Reported Reasons for the Decline in Fish Resources at Chembe Village

In the lake ecosystem, several factors led to the reduced fish stocks. The State of the Environment Report (2002 a), attributed this decline to a number of factors that include illegal fishing mainly due to weak enforcement of regulations, habitat destruction, catchments damage and absence of clear property rights. The rapid growth of population in Malawi has resulted in an increased demand of fish for food and has also resulted in more people seeking employment and business opportunities in the fisheries industry. These factors increased the effort and reduce the chances of fish to escape the gears and hence subsequently drastically reduce fish stocks. It is not surprising therefore that other respondents thought non-compliance of rules is contributing to the decline of fish resources. When the effort is too big against a limited resource then people tend to flout the rules because everyone wants to optimize the effort. Unfortunately, failure to comply with the fishing regulations and harvesting of large quantities of fish degrade the fish breeding grounds and alters the ecological balance in the lake. This reduces the numbers and species of fish.

Only 0.4% of respondents attributed the decline in fish resources to lack of alternative sources of income in the village. This small proportion brings a doubt as to whether the village over fishes and degrades the resource because they do not have options for their livelihood.

4.2.4 Future of the fishermen

The study found that 67.7% of the interviewed fishermen and gear owners were not willing to remain in the fishing industry while 67.2% of the interviewed households would not wish their children to become fishermen when they grow up. Different reasons were cited for not willing to remain fishermen or wishing the children to become fishermen in future with 63.1% of the respondents thinking that there was no future in the fisheries industry since fish resources had drastically declined and that there was no indication that fish resource would improve in future. These bemoaned the frequency in which they landed at the beach with small catches after spending many hours of working in the lake. A few other respondents (3.1%) thought that fishing activity was a very tough job so much so that one could not be a fisherman for the rest of one's life if a healthy life was to be maintained. Yet other respondents (1.5%) thought that fishing was a risky job and cited storm winds and continuous conflicts with the aquatic wild animals like hippos and crocodiles as some of the problems that they encounter while in shore.

Willingness by the community as a whole to send their children into the fishing industry or willingness by the fishermen and gear owners to remain in this industry is a good measure of the impact the industry is making in their lives. When more fishermen and gear owners are willing to remain in this industry or when more parents would wish to send their children into the industry, then it indicates that the industry is making a positive impact in their lives. However, this study found that 67.2% of respondents were neither willing to remain nor wishing to send their children into the fishing industry. This means that either the sector was not making an impact in the village or that the benefits that it had been making were

diminishing. Fishermen were able to match the risks and tough job against the benefits that the sector was bringing in the village and concluded that the future of the industry looked bleak.

A small group of respondents indicated willingness to remain in the fishing industry or send their children into the industry. These again cited lack of alternative sources of income as the only reason and thought that they had no choice other than remaining or becoming fishermen in future.

The respondents who were not willing to remain in fisheries industry had different economic plans for their future. These respondents recognised that they were no longer making profits in the industry. Interestingly, these respondents thought trading in fish would be more profitable than being involved in actual fishing activities or being a gear owner. These were not satisfied with their present income and could foresee a future in which income from the lake would continue to decline hence their investments in gear would be less worthwhile. Both the fishermen and gear owners agreed on the fact that they were making unsatisfactory income with their heavy effort and investments. To this effect, respondents suggested several ventures for sustaining their lives if the options were provided.

4.2.5 Alternative Sources of Income

Household interviews found that 53.0% of the interviewed fishermen were not willing to remain fishermen in future. These would rather go into a certain kind of business in future. The proposed businesses included opening of shops, selling of *kaunjika* (second hand clothes) and selling of food items. This trend was also captured during the administration of FGD tool. However, almost all the respondents bemoaned inadequacy or lack of capital and land resources to get started. Boat crew members were the most disadvantaged than their counterparts, the gear owners. Poor crew members could not see themselves having options regarding their future because they were financially handicapped. Those who expressed a wish to try another kind of living, failed to suggest any realistic and

better alternatives mainly due to capital limitations. Consequently, these fishermen considered farming as the only option, not that farming industry is more gainful in this area but that they had no choice. The respondents thought that farming in Chembe Village where household arable land holding size is relatively small is done on subsistence scale hence it would leave them even poorer. Finally, the study found that 0.9% of the respondents had an interest in skilled labour. Sculpture was the main area the respondents would wish to gain a skill because they are assured of a market due to the many tourists that come to the village.

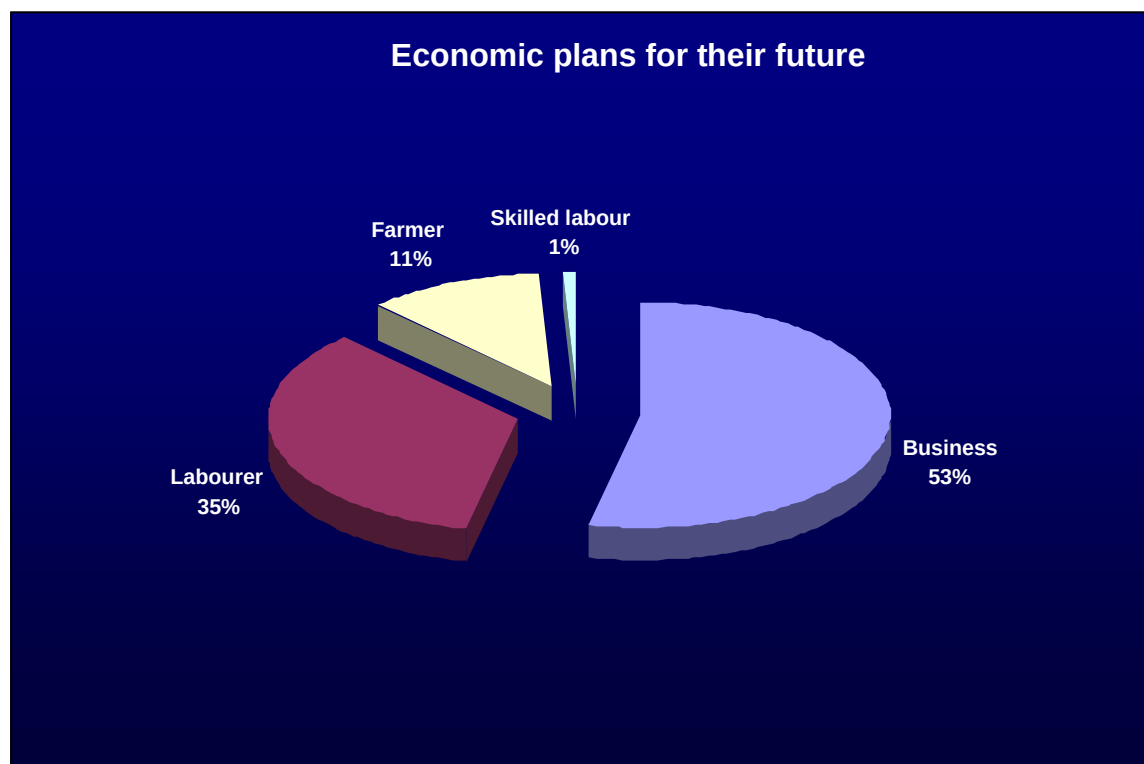


Fig. 10: Captured Future Economic Plans for Chembe Village People

Perhaps, provision of other sources of income for Chembe Village would give a relief to fish in the long run. But even this would require further research because not everybody can become a business man and not every business can be viable and get a market. Perhaps, development of skills would enable people to explore their talents which would in turn be used for their livelihood other than depending on fishing alone.

4.2.6 Problems Faced by the Fishermen in the Fishing Industry at Chembe Village

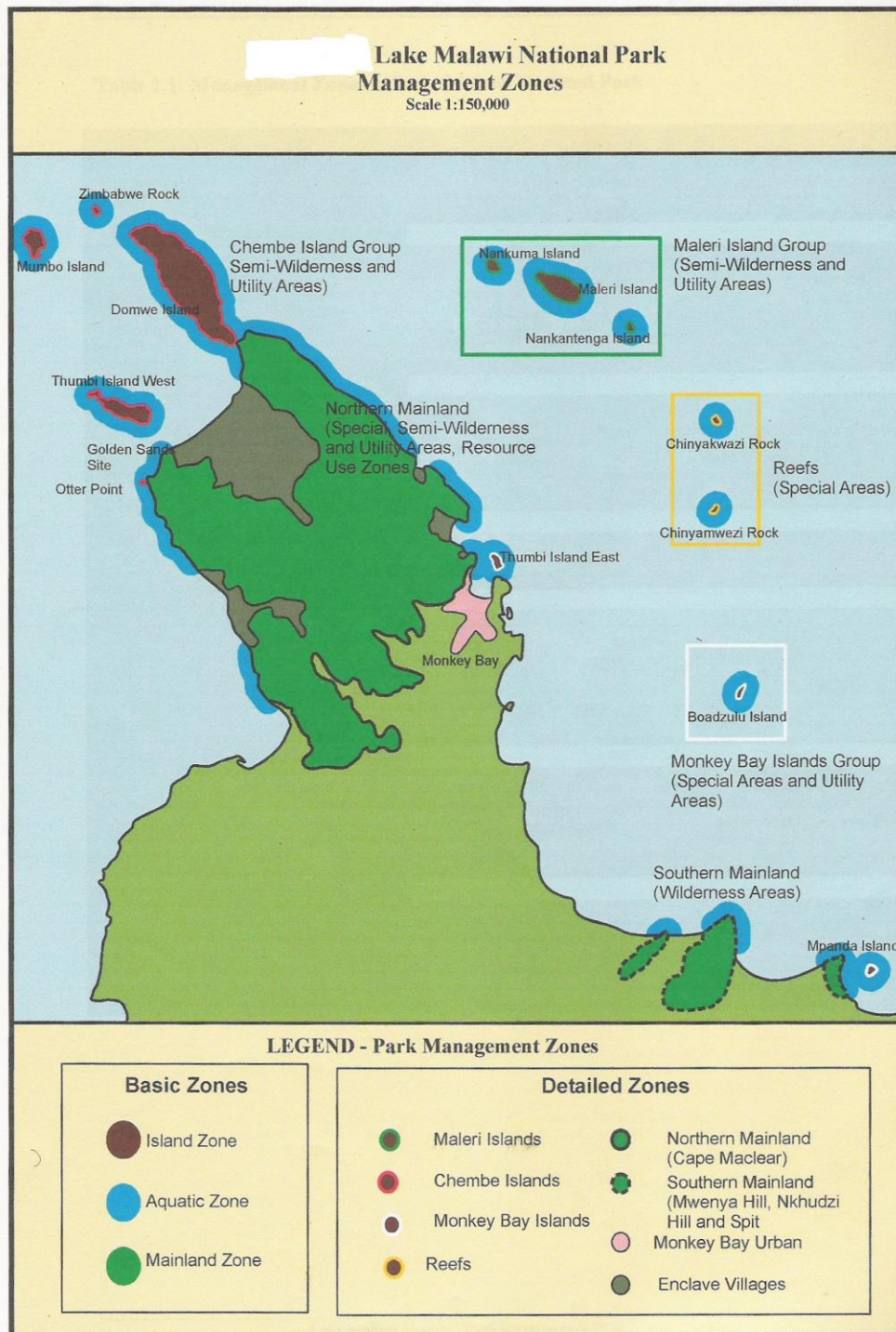
Respondents reported several problems faced by the fishermen in the fishing industry. The list included storm winds, scarcity of fish resources and continuous conflicts with law enforcers as the major problems. Of interest is the last problem which indicates that fishermen continuously violate the regulations, perhaps due to scarcity of fish resources. This shows that there was a problem with fish management at Chembe Village. This is a reason fishermen are in constant conflict with regulations enforcers. Finally, some fishermen especially the gear owners reported that the major problems which they were facing included theft, tangle of nets on rocks, high nets prices or loss of their fishing gears.

4.3 THE FISHING PRACTICES OF CHEMBE VILLAGE REGARDING SHALLOW WATER

4.3.1 Legitimacy of shallow water fishing restriction

The study, through literature review, found that the LMNP boundary in Chembe Village and the other three villages of Zambo, Msaka and Mvunguti follows a cleared trace around the perimeter of each of these villages at the foot of the surrounding hills. It was found out that these four villages were not integrals of the Park, while Chizale was part of the Park because by the time of its establishment this village was not inhabited. The aquatic zone of the Park also excludes these four villages. Therefore, Chembe Village and these three villages are not within the National Park boundaries hence the conservation rules for the Park are not applicable to these villages. Hence, villagers are free to fish as close to the beaches as they like so long as they do not encroach into the Park's aquatic zone and comply with the other formal statutes. In actual sense there is no special regulation that talks about restriction of shallow water fishing in the Parks aquatic zone. Lake Malawi National Park only protects and conserves natural resources within its 100 metre

aquatic zone strip. This study therefore finds enforcement of this regulation at Chembe Village by LMSRP and any other institution illegal. Unfortunately, this regulation has been heavily misinterpreted by enforcers, researchers and other stakeholders who include the whole beach of Chembe Village as integrals of the Park. Map 3 below shows the aquatic zone of LMNP where shallow water fishing restriction is supposed to be enforced.



Map 3: Lake Malawi National Park showing the Aquatic Zone

Source: Croft, T.A. 1981

The misconception of the boundaries of the Park aquatic zone has been a major source of misunderstanding amongst the user communities, law enforcers and other stakeholders. User community had been accused of deliberate non-compliance; the enforcers had been accused of laxity in the enforcement while other stakeholders had been accused of misunderstanding jurisdiction of this regulation. Nevertheless, this study found that LMNP officials as managers of the Park have a correct interpretation of this rule. This is the reason they have been accused of laxity in enforcement since they do not enforce the rule outside the boundaries of the Park. On several occasions, during the participant observation, officers from the Park have been observed conducting routine patrols within the aquatic zone of the Park. Perhaps, players have misinterpreted the regulation because it is confusing to know whether Chembe Village lies within or without the LMNP. Perhaps what is more important is for stakeholders to understand the boundaries of LMNP. Unfortunately, this regulation has been widely misunderstood to an extent that researchers and institutions had been involved in actual physical confiscation of fishing gears within the entire shallow waters of Chembe Village beach while others adopted the strategy of conducting sensitisations and trainings with the aim of promoting compliance. However, the BVCs have a mandate to institute this regulation and any other fishing regulation, according to the Fisheries Conservation and Management Act of 1997.

Nevertheless, Lake Malawi Schistosomiasis Research Programme deemed the shallow water fishing regulation important for a successful testing of its hypothesis that is to say, the relationship that exists among the abundance of snail vector hosts of schistosomiasis, abundance of fish molluscivores and the prevalence of this infection. Lake Malawi Schistosomiasis Research Programme reinforced this regulation based on the assumption that there was a shallow-water fishing regulation in Chembe Village. The study therefore, finds the shallow water fishing restriction within Chembe important, although illegal, for the studies conducted by LMSRP to be successfully completed. The task is therefore to find ways of legitimising the regulation and also find ways in which the restriction can be

respected. Therefore, the next task was to explore opportunities for legitimizing shallow water fishing restriction at Chembe Village.

4.3.2 Opportunities for Legalising Shallow Water Fishing Restriction

Documentary review indicated that three opportunities exist for legitimizing shallow water fishing restriction at Chembe Village.

Firstly, decentralised environmental management provides for establishment of BVCs within the context of co-management strategy. Fisheries Management and Conservation Regulations 2000, mandates BVCs to institute and enforce fishing regulations. Hence, the entry point at Chembe Village can be through the BVCs. With proper facilitation, the BVCs can develop and enforce the shallow water fishing restriction.

Secondly, Chembe Village and the other three villages are already enclaved in LMNP. Perhaps, the Park boundary can be re demarcated to include these villages so that the shallow water fishing rule within the Park legally applies.

Finally, this rule was already introduced in Chembe Village, though illegally. The community was made aware of this rule and also appreciates its benefits. The awareness which is already built is an opportunity for the shallow water fishing restriction to be legalised.

4.3.3 Acceptable measures for implementation of Shallow Water Fishing Ban

The study, through household interviews found that 84.6% of the respondents thought that the ban was sensible. Respondents thought the restriction was sensible because it helped in the protection of the juvenile fish, the breeding fish and their breeding grounds.

Community attitude towards the shallow water fishing restriction is one of the factors that would indicate its acceptability. If the community thinks the restriction is sensible then the restriction could not have problems to be accepted. The above result therefore indicates that suggestions to institute the restriction along the entire beach of Chembe Village is likely to be accepted. It was apparent that the earlier sensitisations, trainings and sporadic enforcement of the ban by institutions and researchers made impacts in people. While some had actually observed it, others had been victimised with it. The fact that people appreciated the importance of this regulation increases an opportunity of its acceptability. Hence, the question of the regulation being accepted does not exist within this village. Perhaps, the task is on how to institute it.

During this study respondents came up with various suggestions on what they thought were appropriate and acceptable measures for implementation of this restriction in Chembe Village. The respondents who suggested for involvement of the community in its implementation through the committee establishment and / or strengthening were 31.0%; 28.0% of respondents suggested for the community sensitisations; 21.0% of respondents suggested for strengthening of the enforcement mechanisms while 8.0% suggested for the introduction of alternative sources of income (refer to fig. 5 below)

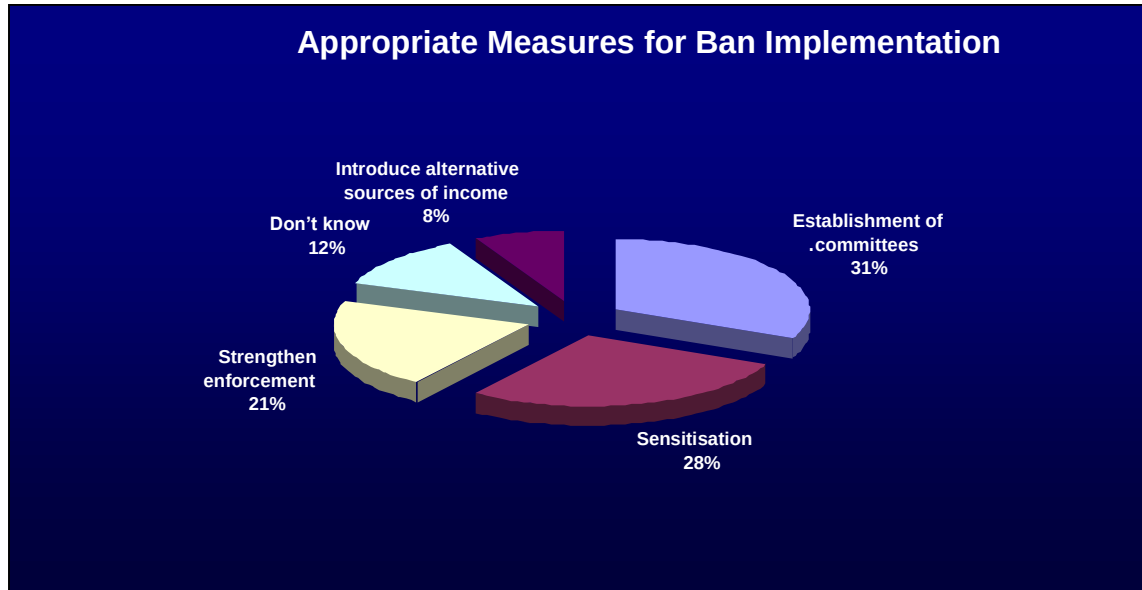


Fig. 11: Perceived Appropriate and Acceptable Implementation Measures for the ban

Figure 11 shows the appropriate measures for implementation of this restriction as perceived by Chembe Village. According to the respondents, the solutions presented in Fig. 11 above, are appropriate and acceptable measures for the implementation of shallow water fishing restriction. These measures can be summarised into two main categories: enhancement of co-management strategy and provision of alternative sources of income. Proper methods for implementation of co-management strategy need to be followed and projects that would provide alternative sources of income while at the same time conserving fish resources need to be provided.

4.3.4 Awareness Level of Shallow Water Fishing Restriction at Chembe Village

The study found that 93.9% of respondents had heard about the shallow water fishing restriction. However, the study further found that the respondents thought that the shallow water fishing restriction was a formal regulation provided in the Fisheries Conservation and Management Act. The study also found that respondents missed the demarcation line for the LMNP aquatic zone and instead generalised the

restriction to include the whole Chembe Village beach. Consequently, the perception was that the restriction covers the entire Chembe Village beach.

However, 45.2% of the respondents correctly mentioned coverage of the ban to be 100 metres from the shore line and also that it applies to the area within the Park. Otherwise 54.8% of respondents thought the coverage of this restriction is in the range of a km or several km from the shoreline.

This awareness level is an opportunity for legitimising the shallow water regulation in Chembe Village. Since the 93.9% of respondents were already aware of the regulation, implementers would not have difficulties to sensitise and impress the people. The study found that people were scared with the restriction because they thought that it covered several km from the shoreline. Hence, the information that the coverage of the restriction is only 100 metres from the beach can bring a relief in the village.

The study also found that respondents had different perceptions regarding institutions that imposed the shallow water fishing restriction. Figure 12 below shows that 84.4% of the respondents thought that shallow water fishing restriction was instituted by the Fisheries Department, while 10.9% of the respondents thought that the restriction was instituted by the BVC. A very small proportion of respondents (3.1%) correctly knew that the restriction was instituted by Parks and Wildlife Department and that it only applies to the area within the Park aquatic zone. However, other members of Chembe Village also thought that the restriction was instituted by the said researcher. By aggregate, more fishermen thought the regulation was instituted by a researcher who they also described as having bad wills towards the Chembe Village fishery. But the rest of the village thought the regulation was either formulated by the BVCs or provided for in the Malawi Fisheries Management and Conservation Regulations.

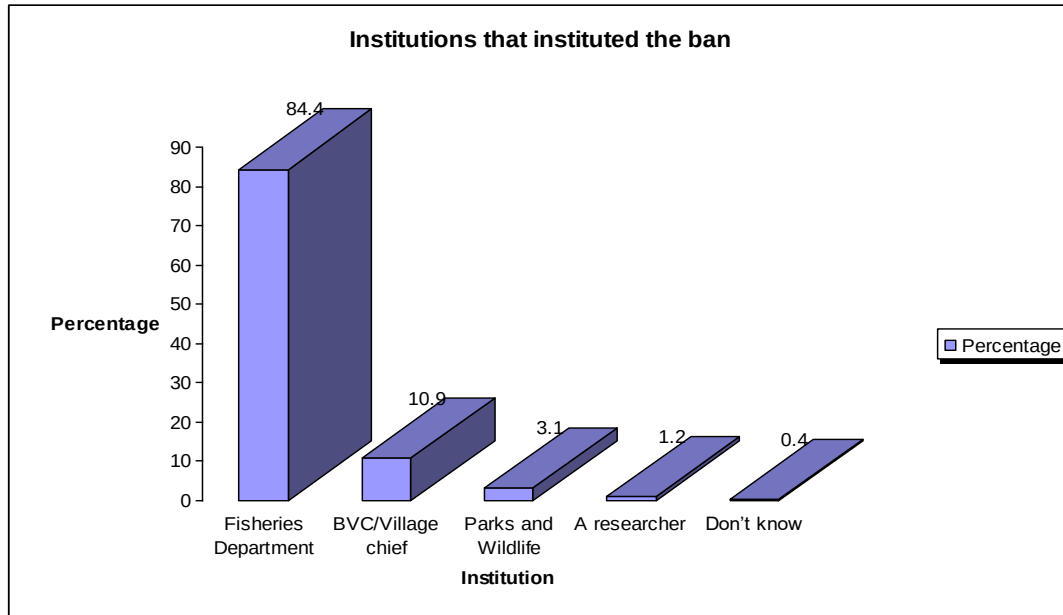


Fig. 12: Perceived Institutions that instituted shallow water fishing restriction

4.3.5 Shallow Water Ban Compliance and Punishments for Non-Compliance

The study found that 49.0% of the respondents thought the ban was complied with while 51.0% thought there was no compliance with the restriction at all. This reported relatively lower level of non compliance was interesting considering the actually observed high levels of non-compliance and also considering the reported high level of awareness. Walking along the beaches, it was evident that this 100 metres zone was routinely illegally utilized by local fishermen especially for gill netting, beach seines, mosquito nets, zitenje and hooks.

This study also observed that in many instances, the ‘right’ of the fishermen to break the fishing laws, including the shallow water fishing law was being upheld by the general public and the political leadership. This was evident by the many community members and political leaders who defended their fishermen for violation of laws and cited limited options for income generation as the reason. During the FGDs, a group of fishermen accepted that the management of LMNP restricts them from fishing within its aquatic zone and only allows them to haul

their nets from their craft if they are within the Park's aquatic zone. But observation showed that fishermen take advantage of this option and they actually fish within the prohibited zone. An interview with the Department of National Parks and Wildlife (DNPW) confirmed that law enforcement patrols are conducted but only within its aquatic zone and that the patrols are not regular due to resource limitations. By the date of interviews, the Department had few requirements like boats and protective clothing but it lacked resources like fuel and lubricants to conduct the patrols.

According to the strategy of co-management, an issue of regulating enforcement of the laws is the responsibility of the BVCs. The study found that the BVCs at Chembe Village were weak. Consequently, there was low level of compliance since the enforcement was also low. It was observed that enforcement of regulations by these BVCs at Chembe was occasional. But the DNPW conducted routine patrols. Unfortunately, the DNPW patrols within its area of jurisdiction only. Once the culprits are caught during the patrols, the DNPW either confiscates the fishing gears or just warns them depending on the degree of crime committed. If the gear is confiscated, cases go to court to be tried. However, the DNPW bemoaned use of too old and outdated laws by the court when trying cases which provide for sentences that are not deterrent.

4.3.6 Usefulness of Shallow water fishing restriction

The study found that 94.7% of the respondents thought that the restriction was beneficial and only 5.0% thought it was not important. Respondents thought the restriction was useful because it protects the breeding grounds for fish, gives chance to juvenile fishes to grow and that it affords mature fish an opportunity to breed in a protected environment. Very few (0.3%) respondents thought that the restriction aimed to control bilharzia infection. A probe on the latter respondents revealed that they work for a researcher who looks on issues related to bilharzia in the village.

It has already been discussed above that levels of compliance to this restriction at Chembe Village was low. It was therefore interesting to observe that so many people (94.7%) felt that the fishing restriction was useful but yet the compliance was low. Perhaps, the compliance was low because fishing was the only major source of livelihood for people in Chembe Village. Furthermore, fishermen knew that there were more fish in the shallow waters than in the open waters. Therefore, people are in dilemma on whether to choose fishing in the shallows and improve their living standards in the short term or on conserving fish resource and deteriorate their living standards in the short term.

Respondents who thought the restriction was not useful cited various reasons to support their belief. These respondents thought that the restriction would drastically affect poor fishermen of the village who relied on the simple traditional dugout canoes which only reached the shallow waters and the young boys and women who fished just for food. These respondents also thought that the restriction would affect people who possessed traditional kinds of fishing gears which were designed to be used in the shallow waters and consequently decline the living standards. Gears that would be affected by the restriction include the chambo and kambuzi beach seines, mosquito nets, zitenje and bottles which were also very much favoured by the villagers.

If the shallow water fishing restriction is legalised and instituted at Chembe Village, it would definitely help to protect the breeding grounds for fish, give chance to juvenile fishes to grow and afford mature fish an opportunity to breed in a protected environment. Some poor fishermen and villagers would really be negatively affected but the effects would be short term. In the long run, fish stocks would improve, and the villagers would benefit the improved catch.

4.4 SCHISTOSOMIASIS INFECTION

4.4.1 Awareness of schistosomiasis infection

The study through household interviews found that 98.1% of the respondents have heard about schistosomiasis infection. Participants of FGDs also displayed high level (99.0%) knowledge of the infection. These correctly mentioned the vector of this infection to be the snails. Asked to rate whether the infection is amongst the “very serious”, “moderate” or “not serious at all”, 96.0% of the respondents rated the infection amongst the very serious infections. These respondents also mentioned the effects of this infection that included pains, when urinating and loss of blood through urine. A small proportion of the respondents thought that the infection leads to barrenness.

4.4.2 Knowledge on the spread of Schistosomiasis at Chembe Village

Further probing as to whether the respondents knew how the infection spreads and how it can be contracted indicated that 66.0% of the respondents thought the infection spreads through urinating in water bodies and 24.0% thought that the infection can be contracted through contact with infested water. Figure 13 below shows mode of spread and contraction for schistosomiasis as perceived by Chembe Village.

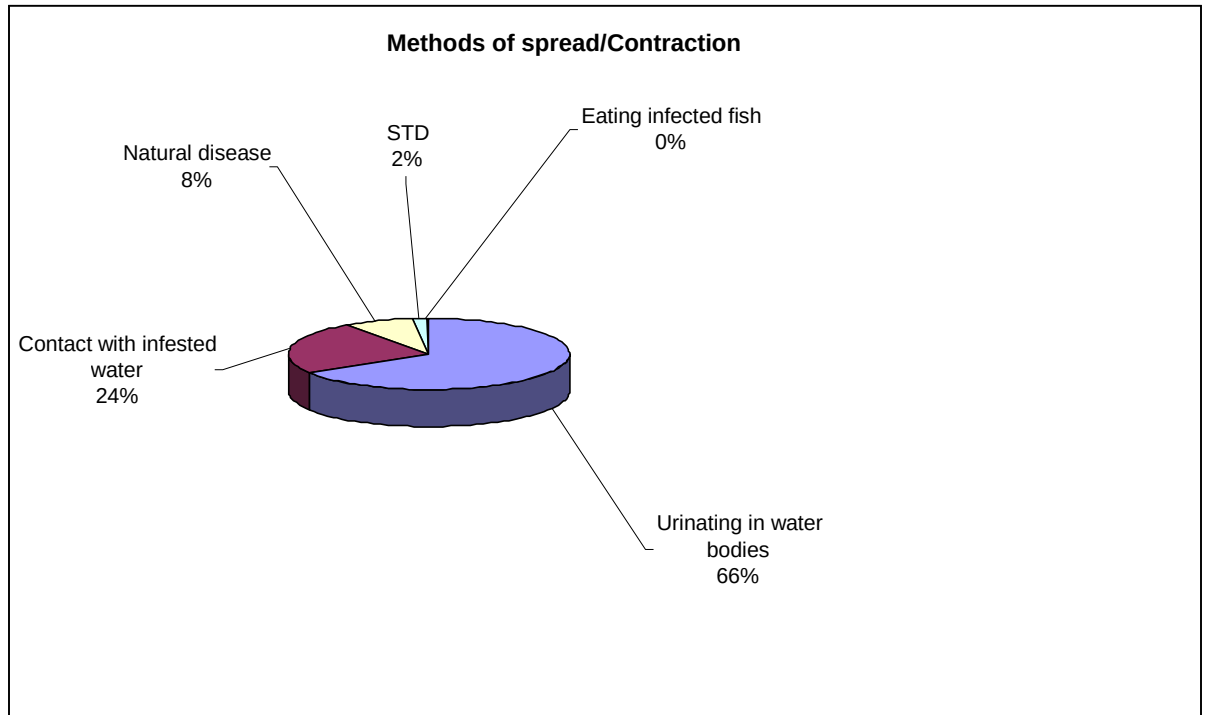


Fig. 13: Perceived Modes of schistosomiasis spread and contraction perceived in Chembe Village

The high level knowledge of the infection and ability by the community to rate the infection amongst the most serious infections means the community is well aware of schistosomiasis. Furthermore, the community knows the vector host of the infection, how the infection can be spread and how it can be contracted. This means that efforts aiming at controlling this infection can easily be understood and accepted by the community provided the efforts are sustainable and culturally acceptable. Non-compliance to the control measures of this infection could therefore be associated with factors other than lack of information on the infection.

A few members of the BVC seemed more knowledgeable on the means of spread of the infection. Further probe showed that these were a target group of the awareness meetings and trainings conducted by LMSRP. Perhaps this was a direct outcome of these awareness meetings and trainings. Although 90.0% of the respondents rightly reported means of spread and contraction for the infection, there was a problem with those respondents who held other varied opinions because they did not know

how the infection spreads. This could cause problems with the control efforts of the infection. For instance, those who thought schistosomiasis spreads through sexual intercourse also thought that the infection can be controlled by being faithful to one partner or use of condoms while other respondents thought that the infection can be controlled by eating a well prepared fish. It therefore would be difficult for these respondents to appreciate and take part in the control measures of schistosomiasis. Therefore, there is still need to raise awareness at Chembe Village.

4.4.3 Source of Messages for Schistosomiasis

Results of household interviews indicated that those who have heard about the infection received the messages from various media as provided in Figure 14 below. However, 59.0% of respondents received the messages from Ministry of Health officials while 12.0% and 11.0% of respondents had heard about the infection from DANIDA and the cottage owners' respectively. Minority of the respondents had heard about the infection from other sources. For instance, 1.6% had heard it from schools, 1.1% from the Environmental Education centre of Parks and Wildlife and 0.5% from Bilharzia Control Program. Key informant interviews and FGDs also agreed on this result. These tools indicated that the Health Surveillance Assistant (HSA) of Ministry of Health who resides within the village conducts regular sensitisation meetings on the infection alongside other infections.

The study through FGDs showed that the community perceives the EE centre as putting more emphasis disseminating environmental education to tourists and not to the masses.

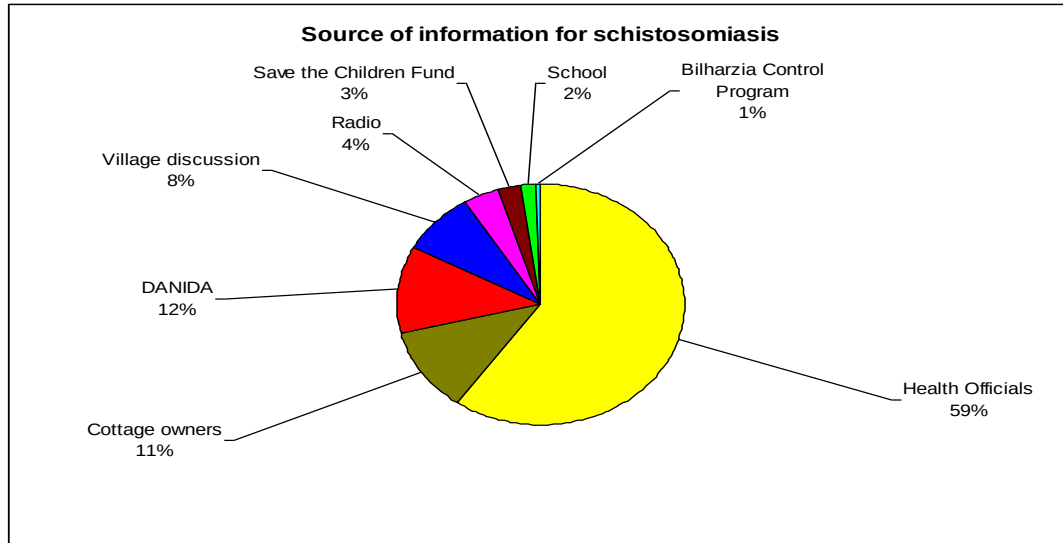


Fig. 14: Sources of Information for schistosomiasis Infection at Chembe Village

4.4.4 Effects of Schistosomiasis

Three main institutions of Ministry of Health, DANIDA and cottage owners are recognised by the community as responsible for disseminating the messages on the infection at Chembe Village. This is an indicator that these institutions are making impacts in as far as dissemination of information on schistosomiasis is concerned. It was interesting to note that cottage owners, who are mostly of European descent, were taking roles in other social and health issues affecting the community besides venturing into the tourism industry. It was also interesting to note that only 1.1% and 0.5% of respondents heard about the infection from EE centre of Parks and Wildlife and Bilharzia Control Program respectively. These institutions are expected to take major roles in sensitising people about schistosomiasis infection. Perhaps these institutions are expected to do more.

4.4.5 Knowledge on Control Measures of Schistosomiasis at Chembe Village

WHO (1965) argued that control of schistosomiasis and any other infection depends on the objective of what one would like to achieve. WHO (1965) further outlined a set of objectives for preventing the spread of schistosomiasis which includes to reduce morbidity or transmission and to permanently interrupt transmission

(eradication). Finally, WHO (1965) concluded by reporting that while eradication is obviously the ultimate goal for schistosomiasis, it was not yet a feasible proposition in most areas. Therefore, public health workers today talk of preventing spread of the disease or reducing its morbidity or transmission rather than a complete eradication.

But the prevention strategies for schistosomiasis would depend on whether the target community is aware of the ways of spread and the control measures. This study assessed the awareness levels of the village as regards prevention and control of the infection.

Several control measures of schistosomiasis infection are known in the study area. It was found that 91.3% of the respondents were aware that schistosomiasis infection can be controlled through following improved hygienic practices like avoiding bathing in the lake, stopping urinating and stopping defecating in water bodies. However, this control measure is difficult to enforce and measure its performance because it is more subjective. One could not know who and when urination and defecating in water bodies are taking place. Perhaps awareness messages would help to slow the practice.

A few respondents (2.7% and 1.2%) thought the infection can be controlled by eradication of snails and community awareness meetings respectively. It was therefore surprising that only 2.7% of the respondents rightly reported snails to be the vector of the infection and that the infection can be controlled through eradication of these vectors. Figure 15 below presents the perceived control measures of schistosomiasis infection at Chembe Village.

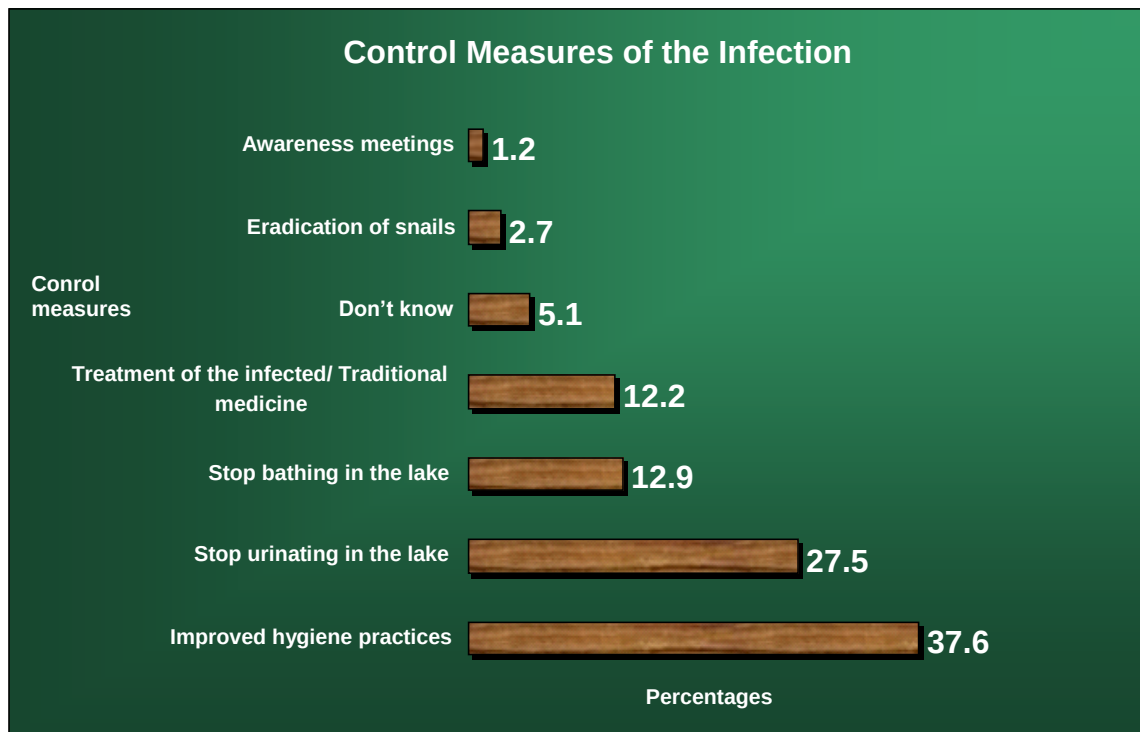


Fig. 15: Perceived Control Measures of schistosomiasis Infection at Chembe Village

4.4.6 How Shallow Water Fishing Restriction Links with Schistosomiasis

It was important to determine the understanding of the relationship that exists between the shallow water fishing restriction and the control of schistosomiasis infection because that would determine whether people appreciated the significance of the restriction. Ability to establish this link by the community was crucial because it would determine its acceptability and failure to establish the link would explain why the ban was getting implementation problems.

Results of FGDs showed that participants were not able to establish the link except for one female member of the BVC. This woman could establish the link very well. Nevertheless, of interest were the diversified views she provided regarding this relationship as listed below:

1. The restriction conserves fish that in turn eat snail vectors of the infection.

2. The restriction spares the fishermen from staying in the shallow waters where they can be urinating or defecating to spread schistosomiasis and also contract the infection.
3. The restriction prevents people from eating fish caught in shallow water which in most cases are infected because they drink water contaminated with the infection.

Household interviews also showed that minority of the respondents (46.2%) were aware of the existence of any link between shallow water fishing restriction and control of schistosomiasis infection while the 53.8% of respondents thought there is no link at all.

This study did not go a step further to help respondents establish this link because it was beyond its mandate.

3.4.7 Trend of Schistosomiasis

Documentary review from the village clinic indicated that schistosomiasis infection cases fluctuated from 16 to 62 while prevalence fluctuated from 1.6 to 6.8 over the past nine months from October 2005 to June 2006 (Figure 16). But 61.0% of the household interviews respondents reported that the infection was on the decline while 35.7% thought the infection was increasing. FGDs results also showed that the village thought that the infection was on the decline.

This finding tallies well with findings of the study by LMSRP in 2002 which revealed that the prevalence of the infection in the village was on the decline. But caution has to be taken in making this conclusion because interviews and clinic records are not the best measures of infection prevalence. Owing to various reasons, other respondents may choose to get treatment from other clinics away from the village clinic, choose not to get treatment at all or choose not to report the infection during interviews.

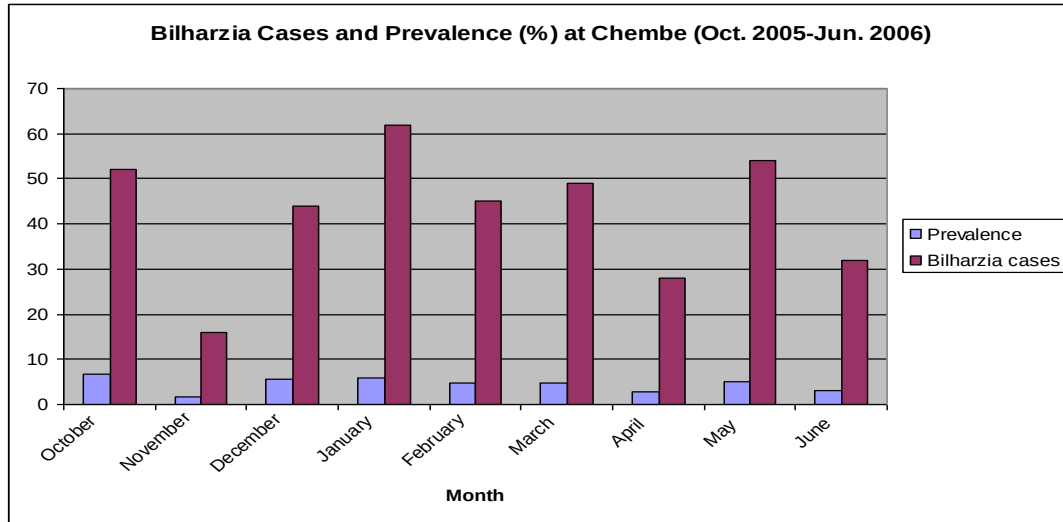


Fig. 16: Bilharzia Cases and Prevalence (%) at Chembe Village (Oct. 2005 to Jun. 2006)

Source: Chembe Village clinic (October 2006)

3.4.8 Presented Reasons for observed Schistosomiasis Trend at Chembe Village

Respondents from both the household interviews and FGDs reported similar reasons as to why they thought that the infection was declining or increasing. Those that reported that the infection was on the decline (61.0%) attributed the declining trend to mass chemotherapy at the village school, while those that reported that the infection was on the increase (26.4%), attributed the increasing trend to improved hygiene practices. Some few respondents (1.4%) attributed the declining trend to the shallow water fishing restriction.

Sixty-three percent of those respondents that reported an increase of the infection cited poor hygiene practices as the main contributing factor. Other factors presented by the respondents were lack of knowledge/ignorance on the control measures of the infection (7.4%), an increase in the population of snails (5.6%), inadequate medicine for treatment of the infection at the clinic (2.8%), failure by people to rate the infection seriously (0.9%) and unfaithfulness between partners (0.9%).

Table 2: Reasons for observed schistosomiasis trend at Chembe Village

Declining trend			Increasing trend		
Reason	Frequency	%	Reason	Frequency	%
Mass chemotherapy of pupils	89	61.8	Poor hygiene practices	68	63.0
Improved hygiene	38	26.4	Natural	21	19.4
Awareness messages	15	10.4	Lack of knowledge	8	7.4
Ban of shallow water fishing	2	1.4	Snails increase	6	5.6
			Inadequate medicine	3	2.8
			People do not rate it seriously	1	0.9
			Unfaithfulness to partners	1	0.9
Total	144	100.0		108	100.0

It is evident from these findings, that the respondents are aware of the factors that play in the reduction or increase of the prevalence of schistosomiasis infection. However, according to the information obtained from the village clinic, schistosomiasis prevalence was neither increasing nor declining but it was just fluctuating. Perhaps, all or most of the mentioned factors were at work.

Of interest are the few respondents who reported that schistosomiasis was declining due to a ban on shallow water fishing. These respondents could be the beneficiaries of the sensitisations conducted by LMSRP in December 2005. This shows that these sensitisations made small impact in the village.

The other interesting finding is the association by the respondents of the infection to unfaithfulness between partners. This shows that there is another good proportion of people in the village who are not aware of the infection.

CHAPTER FIVE

5.0 CONCLUSION, RECCOMENDATIONS AND AREAS FOR FURTHER RESEARCH

5.1 CONCLUSION

Schistosomiasis infection is a threat along the beaches of Lake Malawi including Chembe Village. People are aware of the cause, symptoms, effects and control measures of the infection. Although, people rate the schistosomiasis among the most dangerous infections, they do very little in its prevention and control. Fishing is the main source of living at Chembe. Most prevention and control measures of schistosomiasis which are to do with conservation of the environment are mostly in conflict to optimisation of the fish catches. Therefore, people have to choose whether to conserve the environment thereby reduce the fish catch and control schistosomiasis or degrade the environment thereby optimise the fish catch and increase schistosomiasis prevalence. Fishermen at Chembe prefer optimising the catch. However, individuals and fishermen have become less productive due to the infection. Consequently, the government has made losses in expenditure through treatment of infected individuals and in revenue through the shunning away of tourists. Reduction or complete eradication of the infection along these tourists attraction sites along Lake Malawi beaches is needed. Therefore, any attempt to control the infection needs to be supported and one such attempt is the research carried out by Lake Malawi Schistosomiasis Research Programme.

However, success of the investigation by LMSRP is dependent on conservation measures carried out in the shallow waters of the lake in which the fish molluscivores inhabit. The conservation in the shallow waters can also increase fish population since different species of fish which use the region as the breeding ground will also be spared. This study found that at Chembe Village the shallow water zone is being heavily over-fished and degraded due to non observation of

fishing management regimes. High population growth rate, the economic value of the lake and the Malawian lake-shore culture are some of the factors that contribute to the continued harvesting of large quantities of fish with minimal observance of the fishing management regimes.

The three BVCs established in Chembe Village lack capacity to discharge their duties effectively. People living in this village do not always understand the government fishing conservation policies and strategies. It is therefore prudent for authorities to intervene in the conservation and management in fisheries especially that of shallow waters at Chembe Village.

The shallow water fishing restriction is non existence at Chembe Village. Those that are enforcing it are illegally. Furthermore, there is no appreciation of the link between this restriction on one hand and control of schistosomiasis infection on the other. Consequently, the zone is heavily over-fished. However, opportunities for instituting and implementing it exist. First, the village is already enclaved in Lake Malawi National Park; hence the Park boundary needs to be re-demarcated to include this village and the other three villages. Secondly, it is within the context of co-management strategy that BVCs are mandated to institute and enforce fishing regulations. Thirdly, the study found willingness of acceptability for the restriction by Chembe Village to be high. Further, this regulation has already been introduced in the village by several stakeholders, though illegally. Hence, the present task can only be to formalize the restriction and implement it using acceptable measures with involvement of the community.

It was appreciated that it is difficult for poor and hungry people to make the critical trade-offs necessary for long term sustainability of fish resources because of their pressing immediate needs. It is therefore, important to include economic and social development programme in the conservation measures of fish resources at Chembe Village to prevent the resulting adverse effects on the livelihood of the people. In the past, the government, LMSRP and other researchers have attempted to address

the problem of over fishing in shallow waters at Chembe Village, but often mistakenly by putting additional and undue restrictions on subsistence fishermen. For instance, the illegal enforcement of shallow water fishing along the entire beach of Chembe Village. While these efforts would yield good results, the fear is that these efforts may be enforced outside the enforceable area.

For government policies to work, people must be sensitized on the importance of the lake and the serious threat they pose to its survival. This will motivate communities which directly benefit from the lake to cooperate and protect the lake and its fish and other species through good management and conservation measures.

5.2 RECOMMENDATION

The shallow water fishing restriction at Chembe Village is crucial for a successful investigation of the relationship among abundance of fish molluscivores, the abundance of snail vectors and the prevalence of the infection carried out by Lake Malawi Schistosomiasis Research Programme. Therefore, options for legitimising this restriction at Chembe Village need to be taken. Either the BVCs should be used to establish the restriction or the boundary of Lake Malawi National Park should be redefined and re-demarcated so that the enclave villages become integrals of the Park in order for shallow water fishing restriction to apply and be enforceable.

Current government regulations aimed at protecting the most vulnerable fish at the most vulnerable times of the season must be strongly enforced. With the current declining trend of fish resources, it is unrealistic to expect fishermen to manage their catch effectively without the Fisheries Department actively taking a role in enforcement of fishing regulations. While it is important to let fishermen make their own decisions and conserve the natural resources, it is also important for the authorities to work with local people in the management of the fisheries. Furthermore, the BVCs at Chembe Village were not trained since they were

formed. It would therefore be irrational to expect them to discharge their roles effectively. Hence, they can not be expected to be effective.

Projects aimed at improving the ecological habitats and bringing behavioural change through improving the environmental sanitation, provision of piped water supplies, construction of improved latrines, sensitizations on improved sanitation facilities and hygiene practices among others are required at Chembe Village.

Issues of offering alternative sources of living for the fishermen at Chembe also need to be seriously looked into. This can offer fishermen various options for living. If some fishermen can engage themselves in other businesses other than fishing, then the pressure on fish can be reduced.

Presence of Lake Malawi Schistosomiasis Research Programme is an opportunity towards capacity building of the Chembe Village Trust. Capacity for the trust needs to be enhanced so that the natural resources from the Park can be harnessed to benefit the whole village. Tourism activities in the Park also need to be improved while the relationship of the trust with LMNP, which is currently weak, needs to be strengthened so that it benefits from the tourism proceeds from the Park.

Family planning programme at Chembe Village also need to be intensified to reduce the current rapid population growth. However, it is important to understand that the population problem in Malawi is compounded by poverty. Government policies on family planning and other measures for population reduction have not been effective in most rural areas because the people still consider a large family as security in the uncertain conditions of the country- where high infant mortality rates and low life expectancies persist. This makes people in the rural areas consider large families as the source of cheap labour.

5.3 PROPOSED AREAS FOR FURTHER RESEARCH

Further research work is needed on:

1. The actual extent and economic impact of artisanal fishing on the 100 metre zone of the LMNP.
2. Assessment of Social economic status of Chembe Village.
3. Effectiveness of the shallow water fishing restriction measures on the management of Lake Malawi National Park.

6.0 REFERENCES

1. Ambali, A., Malekano, L., Mkoko, B., Mwale G. and Changadeya W. 2002, Assessment of impacts and potential mitigative interventions of fishing and other anthropogenic activities on the 100 meter aquatic zone of Lake Malawi National Park, Malawi- A consultancy Report Submitted to Department of Parks and Wildlife
2. Barbour A.D. 1982, Schistosomiasis. In R.M. Anderson (ed) *Population Dynamics Of Infectious Diseases*. Theory and Application. Springer-varlag, New York.
3. Bertram, C.K.R., H.J.H. Borley and E. Trewavas 1942, Report on the fish and fisheries of Lake Nyasa. London, Crown Agents.
4. Brown, D.S. 1980, Freshwater snails of Africa and their medical importance. Tylor and Francis Ltd, London.
5. Chiotha , S.S. 1990, Biological Control of Human Schistosomiasis using Snail eating fish. PhD thesis, University of Maryland, Canada.
6. Chiotha, S.S., K.R. McKaye, and J.R. Stauffer, Jr. 1991. Prey handling in *Trematocranus placodon*, a snail-eating cichlid fish from Malawi. *Ichthyological Exploration of Freshwaters* 2 (3): 203-208.
7. Chitsulo, L.A. 1984, Three Successful Years. World Health, WHO magazine.
8. Cremylin, R. 1978, *Pesticides: Preparation and mode of action*. John Wiley and sons. New York.
9. Croft, T.A. 1981, Lake Malawi National Park Master Plan. Malawi Department of National Parks and Wildlife, Malawi.
10. Dye, W.H. 1924, *Schistosomiasis and Splenomegaly in Central Africa*. J. Roy Army. Med. Corps. 43 (3).
11. Economist Intelligence Unit. *Malawi-Country Profile 1993/94*, Economist Intelligence Unit Limited, London, 1993.
12. Falkenmark, M, Rockström, J and Earthscan, M. T. (2004), *Balancing Water for Humans and Nature: The New Approach in Ecohydrology*, Earthscan Publications Ltd.

13. Goddard and Jordan (1980) On the longevity of Schistosomiasis mansoni in man on St. Lucia, West Indies.
14. Jackson, P.B.N., 1963, Report on the survey of Northern Lake nyasa 1945 – 1955. Joint Fisheries research organisation. Government. Printer, Zomba, Nyasaland.
15. Jordan, P. and Webbe, G. 1969. Human Schistosomiasis. Charles Thomas. Springfield.
16. Jordan, P., 1980, Schistosomiasis transmission with particular reference to ecological and biological methods of control. Asta Tropica pp37.
17. Kalanda – Sabola M.D. (2002) A Survey of Knowledge, Attitudes and Practices in Forest and Lake Resources Management. A case of Chisi Island, Lake Chilwa, Zomba. MSc (Env. Sc) Thesis, University of Malawi.
18. Lewis, D.S.C., P.N. Reinthal and J. Trendall 1986. A guide to the fishes of Lake Malawi National Park. Creda Press for WWF, Gland, Switzerland.
19. Lake Malawi Schistosomiasis Research Project, 2005
20. Lake Malawi Schistosomiasis Research Project, (1998) Schistosomiasis: Ecological Interventions Among Schistosomes, Snail Hosts, Human Hosts And Fish Predators In Lake Malawi. Research Plan.
21. Madsen H, Stauffer J.R., Bloch P, Konings A, McKaye K.R. and Likongwe J.S. (2004) Schistosomiasis Transmission in Malawi, African Journal of Aquatic Sciences, 29, 117-119, South Africa.
22. Malawi Government, 1993, *Malawi: A Situation Analysis of Poverty*. Government of Malawi and United Nations, Lilongwe, p.100.
23. Malawi Government, 1996, Fisheries Policy, Government Print, Zomba.
24. Malawi Government, 1997, Fisheries Conservation and Management Act, Government Print, Zomba.
25. Malawi Government, 2000 a, *The Constitution of the Republic of Malawi*, (Reproduced), Public Affairs Committee, Lilongwe, Malawi.
26. Malawi Government, 2000 b, Fisheries Conservation and Management Regulations 2000, Government Print, Zomba.

27. Malawi Government, 2002 a, *Malawi Poverty Reduction Strategy Paper (Final Draft)*, Malawi Government, Lilongwe, Malawi.
28. Malawi Government, 2002 b, Natural Resources Management Policies, Laws and Institutional Framework in Malawi, Environmental Affairs Department, Lilongwe.
29. Malawi Government, 2002 c, Parks and Wildlife Policy, Government Print, Zomba.
30. Malawi Government, 2002 d, State of the Environment Report, Government Print, Zomba.
31. Malawi Government, 2003, *The Annual Review of the Malawi Poverty Reduction Strategy 2002/03*, Malawi Government, Lilongwe, Malawi.
32. Malawi Government, 2004 a, Malawi Demographic and Housing Survey, National Statistics Office, Government Print, Zomba.
33. Malawi Government, 2004 b, *National Environment Policy*, Environmental Affairs Department, Lilongwe.
34. Malawi Government, 2006, Annual Economic Report – Budget document No. 2, Ministry of Economic Planning and Development, Government Print, Lilongwe.
35. Malawi Government /DANIDA, 2002)
36. MDA (Mangochi District Assembly) (2004). Mangochi State of the Environment Report, Mangochi District Assembly, Malawi.
37. Muller R. (1975) Worms and diseases: A manual of Medical of Helminthology. William Heinemann Medical Books Limited, London.
38. Mwale G.P., (2002) Indigenous Knowledge and Natural Resources Management. Towards the Renaissance of Indigenous Fishing Practices in Chembe Village along the Coast of Lake Malawi. MSc (Env. Sc) Thesis, University of Malawi.
39. NSO (National Statistical Office) (2004). Malawi Demographic and Housing Survey, NSO, Zomba, Malawi.
40. NSO (National Statistical Office) (2002a). *1998 Malawi Population and Housing Census*, Analytical Report, NSO, Zomba, Malawi.

41. NSO (National Statistical Office) (2002b). *Statistical Yearbook*, National Statistical Office, Zomba, Malawi.
42. NSO (National Statistical Office) (2004-2005). *Integrated Household Survey*, National Statistical Office, Zomba, Malawi.
43. NSO (National Statistical Office) (2005) [Malawi], ORS Macro. 2005. *Malawi demographic and Housing Survey 2004*. Calverton, Maryland: NSO and Macro.
44. Office of the President and Cabinet-Department of Economic Planning and Development. *Malawi Government: Economic Report 1994*. Lilongwe, 1994, p.22'.
45. Schimdt, G.D. and Roberts, L.S. 1985, *Foundations of parasitology*. Times mirror/mosby college publishing. St Louis.
46. Smith L. (1993 a) *The Artisanal fishery of Lake Malawi National Park*, Malawi Government, Malawi.
47. Smith, L. (1993 b) "A historical Perspective on the fishery of Chembe Village Enclave Village in Lake Malawi National Park." *Nyala*, 17(2)49-60, p.58.
48. Schimdt and Jordan (1969)
49. Stauffer J.R, Madsen H, McKaye K, Konings A, Bloch P, Ferreri C.P, Likongwe J, and Makaula P, (1997), *Schistosomiasis in Lake Malawi: Relationship of Fish and Intermediate Host Density to Prevalence of Human Infection*, Springer New York.
50. Taylor M.G. (1994) *Schistosomiasis vaccines: Farewell to the God of Plague?* J Trop Med Hygiene.
51. The UNDP-World bank-WHO special program for research and training in tropical diseases (TDR); *Schistosomiasis* <http://www.who.int/tdr/diseases/schisto/default.htm>. (Oct, 2006)
52. The UNDP-World bank-WHO special program for research and training in tropical diseases (TDR), *TDR news: Important progress in Schistosomiasis vaccine development* <http://www.who.int/tdr/publications/tdrnews/news63/schistovaccine.htm>. (Oct, 2006)

53. Trewavas, E. (1983). Tilapiine fishes of the genera *Sarotherodon*, *Oreochromis* and *Danakilia*. Publ. Br. Mus. (Nat. Hist.)
54. WHO (1980), Epidemiology and control of Schistosomiasis. Tech. Rep. Ser 643.
55. (WHO, 2005)
56. WHO, 2006
57. WHO Schistosomiasis fact sheet www.who.int/inf-fs/en/fact115.html. (Oct, 2006)
58. WHO Partners for Parasite control Schistosomiasis fact sheet http://www.who.int/wormcontrol/documents/fact_sheets/schistosomiasis/en/. (Oct, 2006)
59. WHO, 1965 Snail Control in the prevention of bilharziasis, Mon. ser. No. 50. Geneva.
60. World Bank (2003). Millennium Development Goals, <http://www.developmentgoals.org/Environment.htm>. (Oct, 2006)
61. WRI (World Resources Institute), UNEP, UNDP and World Bank (1996). *World Resources 1996-97*, Oxford University Press, New York & Oxford.
62. World Resources Institute. *World Resource 1994-95: A Guide to the Global Environment*. p.270.

7.0 LIST OF APPENDICES

Appendix 1: Household Level Questionnaire

(To be administered to the Household Head or in his/her absence to the next most senior Household member)

1. Official information

- a. Questionnaire Number:
- b. Name of Enumerator: Enumerator Code:.....
- c. Date of interview:
- d. Name of Respondent:

2. Household Information

a. Household roster

ID	Name of HH Member	A1 Sex	A2 Age	A3 Relationship to HH Head	A4 Marital Status	A5 Highest level of Educ.	A6 Main Occupation	A7 Years in Occupation	A8 Origin of HH members
01									
02									
03									
04									
05									
06									

Codes

A1. Sex

Education

- 1= Male
2= Female

A3 Relationship to HH Head

- 1= Head
2= Spouse
3= Son/Daughter
4= Grand child
5= Other relatives

A4 Marital Status

- 1= Married
2= Widowed
3= Divorced
4= Separated
5= Never Married
5= Tech Coll
6= University

A5

- 0= None
1= Std 1-4
2= Std 5-8
3= Lower Sec(1-2)
4= Upper Sec(3-4)

A6 Main Occupation

- 1= Fishing
2= Fish trader

A8 Origin of HH members

- 1= Chembe Village
2= Within Nankumba Peninsula

3= Farming

4= Labourer

5= Own business

6= Unemployed

7= Pupil

8= Other specify)

3= Within Mangochi district

4= Outside Mangochi district (**Specify**)

(b) What basic assets and livestock does the household have?

Commodity	Number (Qty)
Bicycle	
TV	
Radio	
Car	
Maize mill	
Grocery	
Fishing gear	
Livestock	
Poultry	

3. Fishing Activities

a. Has this Household ever been involved in fishing activities

1. Yes

2. No

b. List all the major fishing practices that you know used at Chembe Village.

1. 4.

2. 5.

3. 6.

c. What is the main difference between now and 10 years ago in terms of fish catches?

.....
.....

d. Why do you think that the situation is like that today?

.....
.....

e. What do you think will be the future of fishing activities?

1. Good

2. Worse

3. Don't know

f. What factor(s) do you think will likely lead to the selected situation in (e) above?

.....
.....

g. Would you wish your children to become fishermen?

1. Yes
2. No

h. Explain your answer in (j) above?

.....
.....

i. What fishing problems do fishermen face in Chembe Village?

.....
.....

j. Do you intend to stay/become a fisherman in future? **(to be administered to male respondents only)**

1. Yes
2. No

k. Explain your answer in (g) above?

.....
.....

l. If no in (g) above, then what would you wish to become?

.....
.....

4. Fishing Rules and Regulations

a. Do you know of any regulation (including norms or codes of practice) guiding the management of fish resources in the village?

1. Yes
2. No

b. If yes list them, if no go to (c) below.

.....
.....

c. What do you think about the fairness and effectiveness of the available fishing regulations?

1. Fair and effective
2. Unfair and ineffective
3. Fair but ineffective
4. Unfair but effective

d. In your opinion, who do you think institutes fishing regulations?

1. Fisheries Department/Government
2. Village chief
3. Community at a village meeting
4. Fishermen
5. BVC
6. Other (specify)

e. In your opinion, who do you think should be instituting fishing regulation(s).

1. Fisheries Department/Government
2. Village chief

3. Community at a village meeting
 4. Fishermen
 5. BVC
 6. Other (specify)
- g. In your opinion, who do you think can best enforce the fishing regulations?
1. Fisheries Department/Government
 2. Village chief
 3. Community at a village meeting
 4. Fishermen
 5. BVC
 6. Other (specify)
- h. In your opinion, do you think it is possible for local fishermen to manage fishing regulations themselves?
1. Yes
 2. No
- i. In your opinion, do you think the fishermen here at Chembe Village comply with the regulations?
1. Yes
 2. No
- j. If no, what do you think makes them not follow the rules?
-
-
- k. In your opinion what would you think of a rule saying that:

No	Rule	Response		
		Good idea	Bad idea	Don't know
1	Fishing using mosquito nets should be banned			
2	All fishing within 100 m from shore line should be banned			
3	All nkacha nets should be banned			
4	All trawlers should be banned			
5	Closed seasons should strictly be enforced and followed			
6	Fishing of juvenile fish is strictly prohibited			

5. Shallow Water Fishing Restriction

- a. Have you ever heard of the fishing restriction in shallow waters?
1. Yes
 2. No
- b. In your opinion, who do you think instituted this restriction?
1. Fisheries Department/Government

2. Village chief
 3. Community at a village meeting
 4. Fishermen
 5. BVC
 6. Other (specify)
- c. In your opinion, why do you think the restriction was instituted?

- d. In your opinion, do you think the restriction will increase fish resources:
1. Yes
 2. No
- e. What do you think are the disadvantages of this fishing restriction?

- f. How far from the shoreline is the ban instituted.
1. 50 meters
 2. 100 meters
 3. 1 Km
 4. 2 Km
 5. Don't know
- g. Is this regulation complied with in Chembe Village?
1. Yes
 2. No
- h. What measures are taken against those that don't comply?

- i. Do you find it sensible to restrict shallow water fishing in Chembe Village?
1. Yes
 2. No
- j. Give an explanation to the answer in (i) above.

- k. If yes in (i) above, how best should (what is the best strategy) this restriction be implemented in Chembe Village?

6. Institutional Framework

(To be administered to only those who are fishermen)

- a. Have you ever heard of a BVC
1. Yes

2 No

b. In your opinion, do you think your BVC in this village is effective and efficient

1 Yes

2 No

c. Do you get advice on fishing from any local institutions/committees on fishing management?

1 Yes

2 No

d. If yes, what institution usually advises you on fish resources management?

1. Fisheries Department / Government.

2 2 Beach Village Committees (BVC)

3 Village Natural Resource Management Committee (VNRMC)

4 Village Development Committee (VDC)

5 Other (Specify).....

e. Who conducts the daily monitoring of your fishing activities in Chembe Village?

.....
.....

7. Schistosomiasis Infection and Control

a. Have you ever heard of bilharzia infection

1 Yes

2 No

b. In your opinion, what do you think is the vector for bilharzia?

.....
.....

c. How does the infection spread?

.....
.....

d. What are the effects of Schistosomiasis infection?

.....
.....

e. What control measures of the infection do you know?

.....
.....

f. Do you think that restriction of shallow water fishing can control Schistosomiasis infection?

1 Yes

2 No

g. Have you ever received any message on Schistosomiasis?

1 Yes

2 No

h. If yes, who delivered the information/message?

.....

 i. What is your perception on the trend of Schistosomiasis infection in the area?

- 1 Constant
- 2 Increasing
- 3 Declining
- 4 Don't know

j. What do you attribute to the observed status in (h) above?

.....

 k. How do you rate the seriousness of Schistosomiasis infection?

- 1 Very serious
- 2 Moderate
- 3 Not serious at all

Do you have any general comments about this interview?

.....
THANK YOU.

Appendix 2a: List of Key informants

No	Category	Name	Designation	Reason
1	Village Headman	Chief Chembe Village	Group Village Headman (GVH)	Historical changes in the area, the history of schistosomiasis infection, the cultural and traditional control (if there is any) of the infection, policies and regulations guiding fishing activities.
2	WWF	Mponda Joseph	Project Manager	Roles of NGOs on management of fisheries and control of schistosomiasis
3	Parks and Wildlife	Nyanyale Samuel	Senior Parks and Wildlife Officer (SP&WO)	policies and regulations guiding fishing activities including their enforcement regimes and the actual fishing practices.
4	Parks and Wildlife Dept.	Chinguwo Joe	Parks and Wildlife Officer	policies and regulations guiding fishing activities including their enforcement regimes and the actual fishing practices.
5	Fisheries Department	Lipato Ignatius K	Assistant Fisheries Officer (Inspectorate Section).	Policies and regulations guiding fishing activities including their enforcement regimes and the actual fishing practices.
6	Beach Village Committee (BVC)	Mr. Jali	A prominent fisherman And BVC chairperson	Policies, rules and regulations guiding fishing activities and actual fishing practices. History and development of fisheries

No	Category	Name	Designation	Reason
7	Chembe Village Clinic	Dr. Vanos Janet	Medical doctor	history and trend of schistosomiasis infection, the cultural and traditional control (if there is any) of the infection
8	Health and Population Dept.	Anubi Adamson	Health Surveillance Assistant (HAS).	History and trend of schistosomiasis infection, the cultural and traditional control (if there is any) of the infection

Appendix 2b: Key Informant Interviews Guiding Questions - fisheries and Parks and Wildlife.

(To be administered to technical personnel involved in fisheries and Parks and Wildlife activities)

1. Background Information

a. Name of Institution:

b. Information for the respondent:

Name	Sex	Position	Highest Level of Education	Duration of work

a. Number of employees the institution currently have? Male:Fem:

b. How many, among these, are directly responsible for fish resources management in Chembe Village (fill in the table below).

Officers Directly Involved in Fish Resources Management at Chembe Village

Position/Designation	1. Un trained in fish resources mngt		2. Trained in fish resources mngt	
	Male	Fem	Male	Fem

2. Institutional framework

a. What institutions (Government, NGOs and Committees) currently exist within Chembe Village to facilitate effective and efficient fish resources management?

.....
.....

b. Which among these do you closely work with?

.....
.....

c. How do you plan and implement your activities in the fish resources management at Chembe Village.

d. What conflicts do you face with other stakeholders in implementing your activities?

Name of Institution	Conflicts

e. What role does your institution play in the management of fishing activities in the area?

f. Are you satisfied with the current status of fish resources and availability management? (Explain why)

1. Yes
2. No

g. What measures should be taken to improve the availability of fish resources?

h. What do you consider the trend of fish resources availability?

- 1 Declining
- 2 Improving
- 3 Constant

i. What factors do you think lead to your conclusion in (h) above?

j. If it is declining trend, what can be done to reverse the trend?

3. Fishing Rules And Regulations

a. What are the major fishing practices at Chembe Village

b. What policies (laws, rules and regulations) guide fishing activities at Chembe Village?

c. Who enforces the above fishing regulations?

d. How often do you monitor compliance to fishing rules at Chembe Village.

.....
.....

e. Are the regulations complied with? (Explain the reason)

.....
.....

f. What are the common offences relating to violation of fishing rules in the area and how are the offenders dealt with?

.....
.....

g. If no offenders have ever been apprehended, what treatment would they be given if they were caught?

.....
.....

h. Do fishermen comply to the shallow water fishing ban at Chembe Village. Explain

.....
.....

Do you have any general comment about this interview?

.....
.....

THANK YOU

Appendix 2c: Key Informant Interviews Guiding Questions - Schistosomiasis control.

(To be administered to technical personnel involved in Schistosomiasis control)

1. Background Information

a. Name of Institution:

b. Information for the respondent:

Name	Sex	Position	Highest Level of Education	Duration of work

a. Number of employees the institution currently have? Male:Fem:

b. How many, among these, are directly responsible for Chembe Village (fill in the table below).

Officers Directly Involved in Health delivery

Position/Designation	Un trained in health delivery		Trained in health delivery	
	Male	Fem	Male	Fem

2. Institutional framework

a. What institutions (Government, NGOs, Committees) currently exist within Chembe Village to facilitate effective and efficient health services delivery?

.....
.....

b. Which among these do you closely work with?

.....
.....

c. How do you plan and implement your activities in health delivery at Chembe Village.

.....
.....

d. What conflicts do you face with other stakeholders in implementing your activities?

Name of Institution	Conflicts

e. How are the programmes and activities in Schistosomiasis control coordinated?

.....
.....

f. Are you satisfied with the current status of Schistosomiasis control? (Explain why)

Yes

No

.....
.....

g. What role does your institution play in the control of Schistosomiasis infection in the area?

.....
.....

h. What measures should be taken to control Schistosomiasis?

.....
.....

i. What do you consider the trend / prevalence of Schistosomiasis infection?

Declining

Improving

Constant

j. What factors do you think lead to your conclusion in (i) above?

.....
.....

Do you have any general comments about this interview?

THANK YOU

Appendix 3a: Focus Group Discussions Guide

1. Fishing Practices

- a. Major fishing practices in the area.
- b. Observed trend for availability of fish resource stocks in the area.
- c. Perceived factors that have contributed to the observed fish stocks trend.
- d. Problems that are coming about due to the observed trend for fish stocks availability.

2. Fishing Rules and Regulations

- a. Listing of norms, rules and regulations or codes of practice guiding fishing activities at Chembe Village and how these were instituted (Legitimacy)
- b. Institutions involved with the enforcement and the compliance (Mode of enforcement).
- c. Nature of punishments for people that go against the regulations.
- d. Effectiveness of the measures in improving availability of fish resource.
- e. Effects (advantages and disadvantages) of decentralised fish management in regulating fish stocks.
- f. Listing of problems that come about as a result of shallow water fishing.
- g. Do you find it sensible to restrict shallow water fishing in Chembe Village? (explain the answer)
- h. If yes, which practical and sustainable restrictive measures would be most appropriate and acceptable to people living in Chembe Village?
- i. What can be community's perceptions if shallow water fishing is restricted.

3. Institutional Framework

- a. Listing of all local level institutions (e.g. committees, organisations etc) currently existing within Chembe Village to facilitate effective and efficient utilisation and management of fish resources.
- b. Membership for the committees. (Gender issues, dominance).
- c. Functions and roles of BVC regarding fish resources management.

4. Schistosomiasis Infection And Control

- a. Knowledge of Schistosomiasis infection, its vector, ways of spread, effects and control measures.
- b. Perception on the trend of Schistosomiasis infection in the area including the factors contributing to this trend?
- c. How the community rate the seriousness of Schistosomiasis infection?
- d. Community's ideas and suggestions about acceptable, practical and sustainable measures to take to control schistosomiasis.
- e. Community's ideas on how to limit the extent to which people urinate in lake water.

Appendix 4a: Participant Observations for October 2005

Date	Time Observed	Gear	Fish Type	Origin of fishermen
17/11/05	19.32	Hooks	Not known	Chembe Village
18/11/05	16.03	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Chembe Village
19/11/05	14.10	Hooks	Juvenile <i>Oreochromis</i> spp and <i>R. longiceps</i>	Chembe Village
20/11/05	04.12	Fish traps	Cat fish, <i>S. njassae</i> , <i>B. meridionalis</i>	Chembe Village
21/11/05	04.08	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Chembe Village
24/11/05	05.30	Hooks	Not known	Msaka
	12.12	Hooks	Blue fish, Nyingwi, <i>Trematocranus</i> spp	Kamphande
25/11/05	06.39	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Kamphande
	14.53	Hooks	Not known	Mangombo
26/11/05	08.15	Hooks	Not known	Chembe Village
	18.25	Hooks	Blue fish, <i>Oreochromis</i> spp, <i>R. longiceps</i>	Mbwadzulu
27/11/05	09.13	Beach seine	Various	Chembe Village
	18.14	Hooks	Not known	Chembe Village
28/11/05	05.59	Beach Seine	Not known	Kasankha
	05.59	Hooks	Not known	Malembo
31/11/05	05.18	Hooks	<i>R. longiceps</i> , <i>Trematocranus</i> spp, <i>B. meridionalis</i>	Chembe Village

Appendix 4b: Participant Observations for November 2005

Date	Time Observed	Gear	Fish Type	Origin of fishermen
01/11/05	Nil			
02/11/05	Nil			
03/11/05	Nil			
04/11/05	10.13	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Chembe Village
07/11/05	19.06	Hooks	Not known	Chembe Village
08/11/05	16.17	Hooks	Not known	Chembe Village
09/11/05	Nil			
10/11/05	07.22	Hooks	<i>R. longiceps</i> , <i>Trematocranus</i> spp, <i>B. meridionalis</i>	Chembe Village
11/11/05	Nil			
14/11/05	Nil			
15/11/05	16.25	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Chembe Village
16/11/05	Nil			
17/11/05	Nil			
18/11/05	17.17	Hooks	<i>B. meridionalis</i> , <i>Trematocranus</i> spp	Kamphande
	17.22	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Chembe Village
21/11/05	06.00	Hooks	Not known	Msaka
22/11/05	05.05	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Kamphande
23/11/05	09.22	Hooks	Blue fish, <i>Oreochromis</i> spp, <i>R. longiceps</i>	Mbwadzulu
24/11/05	09.20	Beach seine	Various	Chembe Village
	18.19	Hooks	Not known	Chembe Village

Date	Time Observed	Gear	Fish Type	Origin of fishermen
25/11/05	05.12	Beach Seine	Not known	Kasankha
	05.14	Hooks	Not known	Malembo
28/11/05	06.07	Hooks	<i>R. longiceps</i> , <i>Trematocranus spp</i> , <i>B. meridionalis</i>	Kholowere
29/11/05	Nil			
30/11/05	Nil			

Appendix 4c: Participant Observations for December 2005

Date	Time Observed	Gear	Fish Type	Origin of fishermen
01/12/05	07.42	Hooks	Juvenile <i>Oreochromis spp</i> and <i>R. longiceps</i>	Chembe Village
02/12/05	15.17	Hooks	<i>Oreochromis spp</i> , <i>S. njassae</i>	Kasankha
	18.37	Fish traps	Not known	Not known
05/12/05	Nil			
06/12/05	15.34	Mosquito net	Juvenile <i>Oreochromis spp</i> , <i>C. viginalis</i>	Chembe Village
07/12/05	15.41	Hooks	Not known	Not known
08/12/05	Nil			
09/12/05	10.21	Hooks	Not known	Not known
	17.32	Hooks	Not known	Not known
10/12/05	06.12	Hooks	<i>R. longiceps</i> , <i>Trematocranus spp</i> , <i>B. meridionalis</i>	Chembe Village
13/12/05	10.22	Hooks	Not known	Not known
14/12/05	09.13	Hooks	Not known	Not known
	13.41	Hooks	Blue fish, <i>Oreochromis spp</i> , <i>R. longiceps</i>	Chembe Village
15/12/05	16.17	Mosquito net	Juvenile <i>Oreochromis spp</i> , <i>C. viginalis</i>	Chembe Village
16/12/05	Nil			
17/12/05	04.45	Hooks	Cat fish, <i>S. njassae</i> , <i>B. meridionalis</i>	Chembe Village
	19.26	Fish traps	Not known	Not known
20/12/05	Nil			
21/12/05	05.14	Hooks	Not known	Not known
	19.45	Hooks	Blue fish, Nyingwi, <i>Trematocranus spp</i>	Kamphande
22/12/05	05.34	Mosquito net	Juvenile <i>Oreochromis spp</i> , <i>C. viginalis</i>	Kamphande
	17.52	Hooks	Not known	Not known

Appendix 4d: Participant Observations for January 2006

Date	Time Observed	Gear	Fish Type	Origin of fishermen
04/01/06	15.46	Hooks	Juvenile <i>Oreochromis</i> spp and <i>R. longiceps</i>	Chembe Village
05/01/06	17.17	Hooks	<i>Oreochromis</i> spp, <i>S. njassae</i>	Kasankha
	18.47	Fish traps	Not known	Chembe Village
06/01/06	06.45	Hooks	<i>B. meridionalis</i> , <i>Trematocranus</i> spp	Chembe Village
09/01/06	15.34	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Chembe Village
10/01/06	16.00	Hooks	Not known	Not known
11/01/06	18.41	Hooks	Not known	Not known
12/01/06	11.12	Hooks	Not known	Not known
	17.39	Hooks	Not known	Not known
13/01/06	05.27	Hooks	<i>R. longiceps</i> , <i>Trematocranus</i> spp, <i>B. meridionalis</i>	Chembe Village
16/01/06	10.24	Hooks	Not known	Not known
17/01/06	09.21	Hooks	Not known	Not known
	18.19	Hooks	Blue fish, <i>Oreochromis</i> spp, <i>R. longiceps</i>	Chembe Village
18/01/06	14.53	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Chembe Village
19/01/06	14.40	Hooks	Juvenile <i>Oreochromis</i> spp and <i>R. longiceps</i>	Chembe Village
20/01/06	04.45	Hooks	Cat fish, <i>S. njassae</i> , <i>B. meridionalis</i>	Chembe Village
	16.30	Hooks	<i>Oreochromis</i> spp, <i>S. njassae</i>	Kasankha
	18.20	Fish traps	Not known	Not known
23/01/06	04.45	Hooks	<i>B. meridionalis</i> , <i>Trematocranus</i> spp	Chembe Village
	15.53	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Chembe Village
24/01/06	04.50	Hooks	Not known	Not known
	19.45	Hooks	Blue fish, Nyngwi, <i>Trematocranus</i> spp	Kamphande
25/01/06	05.45	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Kamphande
	16.50	Hooks	Not known	Not known
26/01/06	11.25	Hooks	Not known	Not known
	18.50	Hooks	Blue fish, <i>Oreochromis</i> spp, <i>R. longiceps</i>	Mbwadzulu
27/01/06	08.30	Beach seine	Various	Chembe Village
	09.18	Hooks	Not known	Not known
	17.49	Hooks	Not known	Not known
30/01/06	05.30	Beach Seine	Various	Chembe Village
	05.49	Hooks	Not known	Not known
	15.39	Hooks	Not known	Not known
31/01/06	06.07	Hooks	<i>R. longiceps</i> , <i>Trematocranus</i> spp, <i>B. meridionalis</i>	Chembe Village
	08.49	Hooks	Not known	Not known

Appendix 4e: Participant Observations for February 2006

Date	Time Observed	Gear	Fish Type	Origin of fishermen
01/02/06	15.46	Hooks	Juvenile <i>Oreochromis</i> spp and <i>R. longiceps</i>	Chembe Village
02/02/06	17.17	Hooks	<i>Oreochromis</i> spp, <i>S. njassae</i>	Kasankha
	18.47	Fish traps	Not known	Chembe Village
03/02/06	06.45	Hooks	<i>B. meridionalis</i> , <i>Trematocranus</i> spp	Chembe Village
04/02/06	15.34	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Chembe Village
06/02/06	16.00	Hooks	Not known	Chembe Village
07/02/06	18.41	Hooks	Not known	Chembe Village
08/02/06	11.12	Hooks	Not known	Chembe Village
	16.09	Hooks	Not known	Chembe Village
	17.39	Hooks	Not known	Chembe Village
09/02/06	05.27	Hooks	<i>R. longiceps</i> , <i>Trematocranus</i> spp, <i>B. meridionalis</i>	Chembe Village
10/02/06	10.24	Hooks	Not known	Kholowere
13/02/06	09.21	Hooks	Not known	Chembe Village
	18.19	Hooks	Blue fish, <i>Oreochromis</i> spp, <i>R. longiceps</i>	Chembe Village
14/02/06	14.53	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Chembe Village
15/02/06	14.40	Hooks	Juvenile <i>Oreochromis</i> spp and <i>R. longiceps</i>	Chembe Village
16/02/06	04.45	Hooks	Cat fish, <i>S. njassae</i> , <i>B. meridionalis</i>	Chembe Village
	16.30	Hooks	<i>Oreochromis</i> spp, <i>S. njassae</i>	Kasankha
	18.20	Fish traps	Not known	Chembe Village
17/02/06	04.45	Hooks	<i>B. meridionalis</i> , <i>Trematocranus</i> spp	Chembe Village
	15.53	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Chembe Village
20/02/06	04.50	Hooks	Not known	Msaka
	19.45	Hooks	Blue fish, Nyingwi, <i>Trematocranus</i> spp	Kamphande
21/02/06	05.45	Mosquito net	Juvenile <i>Oreochromis</i> spp, <i>C. viginalis</i>	Kamphande
	16.50	Hooks	Not known	Mangombo
22/02/06	11.25	Hooks	Not known	Chembe Village
	18.50	Hooks	Blue fish, <i>Oreochromis</i> spp, <i>R. longiceps</i>	Mbwadzulu
23/02/06	08.30	Beach seine	Various	Chembe Village
	09.18	Hooks	Not known	Chembe Village
	15.13	Hooks	Not known	Chembe Village
	17.49	Hooks	Not known	Chembe Village
24/02/06	05.30	Beach Seine	Not known	Kasankha
	05.49	Hooks	Not known	Malembo
	15.39	Hooks	Not known	Chembe Village
	16.54	Hooks	Not known	Chembe Village
27/02/06	06.07	Hooks	<i>R. longiceps</i> , <i>Trematocranus</i> spp, <i>B. meridionalis</i>	Chembe Village

Appendix 4f: Participant Observations for March 2006

Date	Time Observed	Gear	Fish Type	Origin of fishermen
01/03/06	17.50	Hooks	<i>B. meridionalis</i> and <i>R. longiceps</i>	Chembe Village and Kasankha
02/03/06	05.56	Hooks	Not known	Chembe Village and Kasankha
	06.08	Fish traps	<i>C. viginalis</i> and Juvenile <i>Oreochromis spp</i>	Chembe Village
	08.35	Hooks	<i>B. meridionalis</i> , <i>Trematocranus spp</i> and <i>R. longiceps</i>	Chembe Village
	09.28	Hooks	Not known	Chembe Village and Kamphande
03/03/06	14.54	Beach seine	Various	Chembe Village
	17.01	Hooks	Not known	Chembe Village
	17.06	Beach seine	Various	Malembo
06/03/06	17.19	Hooks	Not known	Chembe Village
	15.06	Hooks	Not known	Chembe Village
	15.14	Hooks	<i>C. viginalis</i> , matemba and cat fish	Chembe Village
	16.03	Mosquito nets	<i>C. viginalis</i> , cat fish, Juvenile <i>Oreochromis spp</i> and matemba	Chembe Village
07/03/06	06.15	Hooks	<i>Copadichromis eucinostomus</i>	Chembe Village
	14.48	Hooks	Juvenile <i>Oreochromis spp</i> , cat fish and <i>C. viginalis</i>	Chembe Village
	16.48	Hooks	Not known	Mbwadzulu
08/03/06	06.02	Hooks	Not known	Chembe Village
	06.30	Mosquito nets	<i>Copadichromis eucinostomus</i> , Milamba and Juvenile <i>Oreochromis Spp</i>	Chembe Village
	09.02	Hooks	Not known	Chembe Village
	11.10	Hooks	Matemba	Mbwadzulu
09/03/06	15.30	Hooks	Not known	Chembe Village and Kamphande
	17.20	Hooks	Blue fish	Chembe Village
10/03/06		Nil	Nil	Nil
13/03/06	15.36	Hooks	Not known	Not known
14/03/06	05.36	Hooks	Not known	Chembe Village and Kamphande
	17.12	Beach seine	Micheni, <i>C. viginalis</i> and Zimbenje	Chembe Village
15/03/06	11.20	Khoka	<i>B. meridionalis</i> , <i>C. viginalis</i> , Micheni and <i>Trematocranus spp</i>	Chembe Village
	12.02	Hooks	Not known	Chembe Village
16/03/06	07.47	Hooks	<i>S. njassae</i> , <i>C. viginalis</i> and <i>B. meridionalis</i>	Chembe Village
17/03/06	07.42	Beach seine	<i>C. viginalis</i> , Chimbenje and <i>Copadichromis eucinostomus</i>	Chembe Village
	08.04	Hooks	Micheni and Milamba	Chembe Village
20/03/06	05.50	Hooks	Not known	Masasa
21/02/06		Nil	Nil	Nil

Date	Time Observed	Gear	Fish Type	Origin of fishermen
22/03/06	06.58	Beach seine	<i>Copadichromis eucinostomus</i> , <i>C. viginalis</i> , Zimbenje and Mfwiliri	Chembe Village and Kamphande
	07.08	Hooks	<i>Trematocranus spp</i>	Chembe Village
	18.06	Hooks	<i>Trematocranus spp</i>	Chembe Village and Masasa
23/03/06		Nil	Nil	Nil
24/03/06	08.50	Hooks	Not known	Dedza
	11.33	Matchera	<i>C. viginalis</i> , <i>Trematocranus spp</i> , Micheni and milamba	Chembe Village
27/03/06	16.40	Matchera	Not known	Chembe Village
28/03/06	06.59	Hooks	Not known	Not known
	10.50	Hooks	Micheni, <i>B. meridionalis</i> and <i>C. viginalis</i>	Chembe Village
29/03/06		Nil	Nil	Nil
30/03/06	15.40	Hooks	<i>Trematocranus spp</i>	Chembe Village and Masasa
	16.02	Hooks	Micheni, <i>Trematocranus spp</i> and <i>B. meridionalis</i>	Chembe Village
31/03/06		Nil	Nil	Nil

Appendix 4g: Participant Observations for April 2006

Date	Time Observed	Gear	Fish Type	Origin of fishermen
03/04/06	7.20	Beach seine	Tetezani, Mlamba, <i>Trematocranus spp</i> , <i>D. kiwinge</i>	Chembe Village
04/04/06	7.45	Hooks	<i>Copadichromis eucinostomus</i> and Chimbenje	Chembe Village
05/04/06	06.40	Hooks	Not known	Masasa
	11.20	Hooks	Not known	Kamphambe
06/04/06	11.20	Hooks	Mlamba and <i>B. meridionalis</i>	Chembe Village
07/04/06	Nil			
10/04/06	Nil			
11/04/06	01.20	Gill siene	Not known	Not known
	15.41	Hooks	Not known	Not known
12/04/06	06.32	Beach seine	Fwiliri, <i>Copadichromis eucinostomus</i> and Chimbenje	Chembe Village
	17.51	Hooks	Not known	Masasa
13/04/06	Nil			
14/04/06	Easter	Friday		
17/04/06	Nil			
18/04/06	17.58	Hooks	Chimbenje, <i>C. viginalis</i> and <i>Copadichromis eucinostomus</i>	Kamphambe and Kasankha
19/04/06	17.47	Hooks	Not known	Not known
20/04/06	16.40	Mosquito nets	Juvenile <i>Oreochromis spp</i> , Chimbenje, Bebina and <i>Copadichromis eucinostomus</i>	Chembe Village

Date	Time Observed	Gear	Fish Type	Origin of fishermen
21/04/06	Nil			
24/04/06	08/04/06	Hooks	<i>D. kiwinge</i> and Chimbenje	Kasankha
	08.35	Chitenje	Juvenile <i>Oreochromis spp.</i> , <i>Bebina</i> and <i>Copadichromis eucinostomus</i>	Chembe Village
	09.15	Hooks	Not known	Not known
25/04/06	11.45	Hooks	<i>Oreochromis spp</i>	Chembe Village

Appendix 4h: Participant Observations for May 2006

Date	Time Observed	Gear	Fish Type	Origin of fishermen
03/05/06	11.50	Hooks	<i>B. meridionalis</i> , <i>C. viginalis</i> , <i>Oreochromis spp</i>	Chembe Village, Dedza
04/05/06	16.30	Mosquito nets	<i>Copadichromis eucinostomus</i> , Juvenile <i>Oreochromis spp.</i> , <i>Zimbenje</i> , <i>D. kiwinge</i>	Chembe Village, Masasa
	17.00	Bottles	<i>C. viginalis</i>	Chembe Village
05/05/06	16.30	Beach seine	<i>D. kiwinge</i> , <i>Zimbenje</i>	Chembe Village
	13.40	Hooks	Not known	Not known
08/05/06	07.15	Hooks	Not known	Not known
	11.10	Beach seine	Juvenile <i>Oreochromis spp.</i> , <i>Copadichromis eucinostomus</i> , <i>C viginalis</i> , <i>Mlamba</i> and <i>Oreochromis spp</i>	Chembe Village, Dedza
	17.10	Hooks	<i>Zimbenje</i> , <i>Trematocranus spp</i>	Chembe Village
09/05/06	06.30	Mosquito nets	<i>Chimbenje</i>	Chembe Village
10/05/06	Nil			
11/05/06	17.10	Hooks	<i>Trematocranus spp</i> , Blue fish, <i>Oreochromis spp</i>	Chembe Village, Masasa
12/05/06	11.10	Hooks	<i>Micheni</i> , <i>C. viginalis</i>	Chembe Village
	15.22	Chitenje	<i>Copadichromis chrysonotus</i> , Juvenile <i>Oreochromis spp.</i> , <i>zimbenje</i>	Chembe Village
	17.25	Hooks	<i>Trematocranus spp</i> , <i>Oreochromis spp</i>	Chembe Village, Kamphambe
15/05/06	09.50	Mosquito nets	<i>Matemba</i> , <i>Zimbenje</i> , Juvenile <i>Oreochromis spp</i>	Chembe Village
	10.25	Mosquito nets	<i>Copadichromis chrysonotus</i>	Chembe Village
	17.30	Mosquito nets	<i>Copadichromis chrysonotus</i> , <i>Chimbenje</i>	Chembe Village
	17.45	Beach Seine	Blue fish, <i>Trematocranus spp</i>	Chembe Village
16/05/06	10.20	Mosquito nets	<i>Copadichromis chrysonotus</i> , <i>Copadichromis eucinostomus</i> , <i>matemba</i>	Chembe Village

Date	Time Observed	Gear	Fish Type	Origin of fishermen
17/05/06	06.45	Hooks	<i>Trematocranus spp</i> , Blue fish	Chembe Village
	11.01	Mosquito nets	<i>Copadichromis chrysonotus</i>	Chembe Village
18/05/06	06.20	Mosquito nets	<i>Copadichromis chrysonotus</i> , Mpalu, <i>Copadichromis eucinostomus</i>	Chembe Village, Kamphambe
	07.25	Mosquito nets	<i>Copadichromis chrysonotus</i> , Chimbenje	Chembe Village
	10.35	Mosquito nets	<i>Copadichromis eucinostomus</i> , Mpalu, Chimbenje, Juvenile <i>Oreochromis spp</i>	Chembe Village, Dedza
19/05/06	Nil			
22/05/06	12.01	Beach seine	Various	Chembe Village
	15.40	Hooks	<i>R. longiceps</i> , <i>Oreochromis spp</i> , Blue fish, Mpalu	Kamphambe
	17.10	Hooks	<i>Trematocranus spp</i> , Chimbenje	Chembe Village
	17.15	Hooks	Blue fish, Chimbenje, <i>B. meridionalis</i>	Chembe Village
23/05/06	06.10	Mosquito nets	Juvenile <i>Oreochromis spp</i> , <i>Copadichromis chrysonotus</i>	Chembe Village, Kasankha
24/05/06	10.25	Beach Seine	<i>C. viginalis</i> , <i>Trematocranus spp</i> , Chimbenje, mpalu, <i>Copadichromis chrysonotus</i>	Chembe Village
	17.15	Hooks	Chimbenje, <i>Oreochromis spp</i> , Blue fish	Chembe Village
25/05/06	14.25	Mosquito nets	<i>Copadichromis chrysonotus</i> , Mpalu, Chimbenje, <i>Copadichromis eucinostomus</i>	Chembe Village
	16.50	Hooks	<i>Oreochromis spp</i> , <i>B. meridionalis</i>	Chembe Village
	16.59	Hooks	Blue fish, <i>B. meridionalis</i> , Chimbenje	Chembe Village
	17.02	Hooks	Mpalu, Chimbenje, Blue fish	Chembe Village
26/05/06	06.40	Beach seine	Various	Chembe Village
	11.20	Mosquito nets	Juvenile <i>Oreochromis spp</i> , <i>Copadichromis eucinostomus</i>	Chembe Village
	15.20	Hooks	<i>Oreochromis spp</i> , Blue fish, Chimbenje	Chembe Village
	16.10	Hooks	<i>Oreochromis spp</i> , Blue fish, Chimbenje	Chembe Village
	17.30	Hooks	<i>Oreochromis spp</i> , Blue fish, Chimbenje	Chembe Village
Date	Time Observed	Gear	Fish Type	Origin of fishermen
29/05/06	08.40	Hooks	<i>B. meridionalis</i>	Chembe Village
30/05/06	15.00	Hooks	<i>Oreochromis spp</i> , Blue fish	Chembe Village
	17.22	Hooks	<i>Oreochromis spp</i> , Blue fish	Chembe Village
31/05/06	16.10	Hooks	Chimbenje	Salima
	16.50	Hooks	Chimbenje, <i>Oreochromis spp</i>	Chembe Village

Appendix 4i: Participant Observations for June 2006

Date	Time Observed	Gear	Fish Type	No of Fishermen	Origin of fishermen
01/06/06	09:10	Hooks	<i>Oreochromis spp</i> , Chimbenje, Mbuna	2	Chembe Village
	13.01	Hooks	<i>Copadichromis chrysonotus</i>	1	Chembe Village
	16.00	Mosquito net	<i>Copadichromis chrysonotus</i>	4	Chembe Village, Masasa
	17.20	Hooks	Chidzam'bango, Blue fish	3	Salima, Chembe Village, Blantyre
02/06/06	17.03	Hooks	Mpalu , Chidzam'bango	2	Chembe Village
03/06/06	09:30	Beach seine	Various	3	Chembe Village
	12:04	Hooks	Not known	2	Not known
06/06/06	11:30	Beach seine	Various	2	Chembe Village
	14:00	Beach seine	Various	4	Chembe Village
	14:40	Hooks	<i>Trematocranus spp</i>	6	Chembe Village, Mangombo, Msaka, Blantyre
	15:00	Hooks	<i>Trematocranus spp</i> , Mbuna, Blue fish	4	M'pimbi, Mangombo, Chembe Village,
	15:23	Hooks	Blue fish	1	Blantyre
	15:30	Beach seine	Various	8	Chembe Village
07/06/06	13:15	Mosquito net	<i>Copadichromis chrysonotus</i> , Chimbenje, Mpalu	6	Chembe Village
	17:30	Hooks	Blue fish, <i>Trematocranus spp</i>	2	Chembe Village, Msaka
08/06/06	16:00	Hooks	Blue fish, <i>Copadichromis chrysonotus</i>	2	Chembe Village
	16:42	Mosquito net	<i>Copadichromis chrysonotus</i> , Mbuna, <i>Trematocranus spp</i>	4	Chembe Village
09/06/06	08:22	Hooks	Chimbenje	1	Chembe Village
	08:26	Hooks	Chimbenje	1	Chembe Village
	17:50	Hooks	Chimbenje, <i>Trematocranus spp</i>	3	Chembe Village
	17:57	Hooks	Blue fish	2	Chembe Village
12/06/06	07:20	Hooks	<i>Trematocranus spp</i> , Chimbenje	4	Chembe Village
	11:45	Hooks	Mpalu, chimbenje	2	Chembe Village
	13.05	Beach seine	Various	4	Chembe Village
	16.00	Hooks	Blue fish, Juvenile <i>Oreochromis spp</i> , <i>B. meridionalis</i>	1	Msaka

Date	Time Observed	Gear	Fish Type	No of Fishermen	Origin of fishermen
13/06/06	05.20	Beach seine	Various	5	Chembe Village
	10:30	Hooks	<i>Trematocranus spp</i> , Mbuna	1	Kamphande
	13.13	Mosquito net	<i>Copadichromis chrysonotus</i> , Mpalu, Chimbenje	3	Masasa, Chembe Village
	16.02	Bottle	Chimbenje	1	Chembe Village
	16.30	Hooks	Blue fish, Chidzam'bango, <i>Trematocranus spp</i>	2	Chembe Village
14/06/06	07:20	Hooks	Mpalu, Chimbenje, Chidzam'bango <i>Trematocranus spp</i>	3	Chembe Village
	09.45	Hooks	<i>Trematocranus spp</i> , Chimenje	2	Chembe Village
	17.03	Hooks	Blue fish	5	Chembe Village
	17.09	Hooks	Blue fish, <i>Trematocranus spp</i>	1	Blantyre
	17:25	Hooks	Blue fish, Chimbenje	3	Chembe Village
15/06/06	08.10	Hooks	Chimbenje, <i>Trematocranus spp</i> , Thondo	2	Chembe Village
	17.20	Hooks	Not known	5	Chembe Village
	17.30	Hooks	<i>Trematocranus spp</i> , Thondo	1	Kasankha
	17.45	Hooks	<i>Trematocranus spp</i> , Chimbenje, Mpalu	2	Kasankha, Chembe Village
16/06/06	11.10	Hooks	Chimbenje	1	Chembe Village
	12:30	Beach seine	Various	4	Kasankha, Chembe Village
	15.41	Mosquito net	<i>Copadichromis chrysonotus</i> , Mpalu	3	Chembe Village
19/06/06	07.58	Hooks	<i>Oreochromis spp</i> , Chimbenje, Blue fish	1	Chembe Village
	09.40	Hooks	Blue fish, Mpalu, Thondo	2	Kamphande, Chembe Village
	14.405	Mosquito net	<i>Trematocranus spp</i> , Chimbenje, <i>Copadichromis chrysonotus</i>	3	Chembe Village
	17.01	Mosquito net	Chimbenje, <i>Copadichromis chrysonotus</i>	5	Chembe Village
	17.10	Hooks	Juvenile <i>Oreochromis spp</i>	3	Chembe Village

Date	Time Observed	Gear	Fish Type	No of Fishermen	Origin of fishermen
20/06/06	05:45	Hooks	Cat fish, Chimbenje	1	Kasankha
	06:30	Hooks	<i>Copadichromis chrysonotus</i> , <i>Copadichromis eucinostomus</i>	3	Chembe Village
	11:00	Mosquito nets	<i>Copadichromis chrysonotus</i> , <i>Trematocranus spp</i> , Mbuna	2	Chembe Village, Kamphamba
	14:50	Beach Seine	Various	4	Chembe Village
	17:45	Hooks	Blue fish, <i>Trematocranus spp</i>	2	Chembe Village
21/06/06	07:20	Beach seine	Various	3	Chembe Village
	09:30	Hooks	Blue fish, Chimbenje, Thondo	2	Kasankha, Balaka
	14:30	Mosquito nets	<i>Copadichromis chrysonotus</i> , Mpalu	5	Chembe Village
	17:41	Hooks	Blue fish	1	Chembe Village
22/06/06	08:20	Hooks	Fwiliri, Chimbenje, Thondo	1	Chembe Village
	10:30	Hooks	Blue fish	1	Masasa
	16:30	Mosquito net	<i>Copadichromis chrysonotus</i>	8	Chembe Village
	16:56	Hooks	Fwiliri, <i>Trematocranus spp</i> , Chidzambango	1	Chembe Village
	17:00	Mosquito net	<i>Copadichromis chrysonotus</i>	3	Chembe Village
	17:03	Hooks	Blue fish, <i>Trematocranus spp</i>	2	Chembe Village
23/06/06	09:45	Hooks	Fwiliri, Chimbenje	1	Kasankha
	10:50	Hooks	Chidzam'bango,	2	Kasankha
	13:54	Beach seine	Various	7	Chembe Village, Msaka
	15:15	Hooks	Blue fish, Thondo, <i>Trematocranus spp</i>	1	Chembe Village
	15:51	Mosquito net	Chimbenje	4	Chembe Village
26/06/06	06:52	Hooks	<i>B. meridionalis</i> , Chimbenje, Mpalu	1	Chembe Village
	08:01	Hooks	Not known	2	Not known
	11:30	Beach seine	Various	9	Chembe Village
	14:10	Hooks	Fwiliri, Chimbenje, Blue fish	2	Chembe Village

Date	Time Observed	Gear	Fish Type	No of Fishermen	Origin of fishermen
27/06/06	09:30	Hooks	Blue fish, Chimbenje	1	Chembe Village
	12:01	Mosquito net	<i>Copadichromis eucinostomus</i> , Chidzam'bango, Chimbenje	4	Monkey bay, Chembe Village
	16:40	Hooks	Fwiliri, Blue fish	1	Kasankha
28/06/06	09:10	Chitenje	Chimbenje	2	Kamphambe
	10:00	Hooks	Blue fish, Fwiliri	1	Chembe Village
	17:00	Hooks	Chidzam'bango, Chimbenje	4	Chembe Village
	17:21	Hooks	Blue fish, Chidzam'bango, <i>Trematocranus spp</i>	3	Chembe Village
29/06/06	06:45	Hooks	<i>Copadichromis chrysonotus</i>	1	Chembe Village
	07:50	Hooks	Chimbenje, Fwiliri, Mbuna	2	Chembe Village
	11:50	Hooks	Chidzambango, Chimbenje	1	Kasankha
30/06/06	11:21	Hooks	Chimbenje, <i>Trematocranus spp</i> , Fwiliri	1	Chembe Village
	13:02	Hooks	Blue fish, Chidzambango	3	Chembe Village
	16:58	Hooks	Chidzambango	6	Chembe Village

Appendix 4k: Vernacular and scientific names of some common fishes discussed in the study.

Family	Genus	Vernacular	Species
Cichlidae (cichlids)	Oreochromis	chambo	<i>O saka</i>
	Ramphochromis	ncheni	<i>R. longiceps</i>
	Copadichromis	Utaka	<i>C. viginalis</i>
	Dimidiochromis	mayani	<i>D. kiwinge</i>
	Pseudotropheus	mbuna	<i>P. zebra</i>
Cyprinidae (Cyprinids)	Engraulicypris	Usipa	<i>E. sardella</i>
	Synodontis	nkholokolo	<i>S. njassae</i>
	Bagrus	kampango	<i>B. meridionalis</i>
	Bathylarias	bombe	<i>Bathylarias spp</i>
		ningwe	<i>Labeo cychndriscus</i>
		mdyamphipe	<i>Copadichromis eucinostomus</i>
		tondo	<i>Lethrinops spp</i>
		Chendammwamba	<i>Copadichromis chrysonotus</i>