REPUBLIC OF ZAMBIA

LAKE MWERU-WA-NTIPA
PILOT FISHERY SURVEY
September 2004

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Preface

The Mweru wa Ntipa pilot fishery survey was undertaken in September 2004 by the Environment Branch of the Central Statistical Office and the Ministry of Agriculture and Co-operatives, Department of Fisheries. There was need to undertake this survey due to the fact that currently, most of the fisheries production data is unreliable. This is because the sampling frames are outdated and catch assessment surveys are rarely done. Mweru wa Ntipa was chosen as the first in the series of these fisheries surveys because it had the least updated information. The last frame and catch assessment surveys were last done in 1992 and 1996, respectively.

Special appreciation goes to the Department of Fisheries for their technical and material contribution to the success of the survey. I wish to take this opportunity to highly commend the professional and technical staff, both from Central Statistical office and Department of fisheries, for their contribution to this survey.

Finally, it is my sincere hope that the cooperation between Central Statistics Office and the Department of fisheries will continue in order to make fisheries statistics in Zambia more reliable and up-to-date.

Dr. Buleti G. Nsemukila
DIRECTOR OF CENSUS AND STATISTCS

June, 2005

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The following individuals contributed immensely to the preparation of this report:

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Glossary

Primary Sampling Units (PSUs) At inland waters where fishing is taking place the population is concentrated in "fishing sites", called Primary Sampling Units.

Strata In the design process of a Frame Survey (FS) the area under consideration is arbitrary divided into a number of smaller areas called strata. Field operations of the survey are taking place within the established strata.

Fishing Camp This is a place where fishermen live for a relatively short period of time and intend to live the place in the near future, either to go back to their home fishing site or to another place.

A fisher is a person who engages in actual operation of capture or culture of aquatic resources. Therefore family members or others who assist the works relating to the fishing operation such as unloading fish, net repairing, processing, etc who do not participate in fishing operations are not considered as fishermen. Therefore, a fisher is one owning a fishing boat or fishing gear or both.

Fishing Economic Unit(FEU) This consists of the fisher(s), the fishing craft and the fishing gear in use at a given time.

Fishing gear These are tools used in catching fish. These are gears used in small-scale or subsistence fishing as well as in commercial fishing. For instance, traps, baskets, hooks are used in small scale fishing while gillnets, seine nets ,hand nets, long line are used in commercial fishing.

Fishing Method This is determined   by the main type of fishing gear that particular fisher is using at a particular time.

1. Introduction

Throughout the world, governments have recognized the importance of prioritizing environmental concerns. The Millennium Development Goals (MDGs) adopted by Heads of States at the Millennium Summit in 2000 included halving of poverty by 2015. One way in which poverty can be reduced at national and international level is through sustainable utilization of natural resources.

One of the natural resources available in Zambia is fish. Like in many African countries, fish is a popular part of the diet in Zambia. In recent years, however, demand for fish has been increasing partly due to increases in population sizes as communities have increased. With the increasing demand for fish, its availability has been dwindling. In order to monitor the numbers of fish and the status of the fishery as a whole, availability of fisheries statistics is of great importance. Statistical information is essential for effective decision-making and policy formulation. When provided in a timely manner, such information can also provide early warning signals of any looming crisis and a basis for timely intervention. Most fisheries statistics are drawn from two surveys namely, frame and catch assessment surveys even though there are other fisheries surveys from where fisheries statistics can be drawn.

Types of surveys

Fisheries statistics are divided into three categories namely,
- Primary phase (fish production), this phase includes surveys such as Frame Surveys (FS), Catch Assessment Surveys (CAS) and Cost and Earning Survey (CES).
- Secondary phase (fish processing) includes Fish Processing Survey (FPS) consisting of two components, (1) an inventory survey where the main objective is to determine the structure, capacity and organisation of the processing industry; (2) a production survey where the main objective is the collection of information about the volume and value of fisheries products.
- Tertiary phase (fish marketing). Fish Marketing Statistical Survey (FMSS) is the main survey under tertiary phase. The main objectives of the FMSS are the collection of information on quantity of fish transacted and the corresponding price of fish at the wholesaler stage. Other objectives of the FMSS are to trace the marketing routes of fish transacted and to study the structure of retail, fish markets and the price of fish purchased by the consumer. For more information, refer to Appendix B

This study only covered the frame and catch assessment surveys because these surveys are where most of the fisheries statistics are drawn. A Frame Survey (FS) is an inventory survey, which provides accurate information about the size and structure of the fishery under study. A Frame Survey can also be described as a census survey based on the complete enumeration from which a sample for other surveys like the Catch Assessment Survey can be drawn. The primary objective of the Catch Assessment Survey (CAS) is to obtain estimates on a current and seasonal basis of the total fish catch in a fishery. Secondary objectives include the estimation of the species composition of the catch and the fishing effort involved in obtaining the catch. FS and CAS information is vital to decision makers and planners if sustainable utilization of the fishery resource is to be achieved.

1.1. Objectives

The main objective of the study is to determine the biological potential of Mweru-wa-Ntipa fishery and it's contribution to Zambia's annual fish catch.

Specific objectives were to:

(i) Develop the Fisheries Frame for Mweru-wa-Ntipa fishery.
(ii) Estimate fish production in Mweru-wa-Ntipa fishery
(iii) Create a geographic information system of the Mweru-wa-Ntipa fishery.

1.2. Background

Lake Mweru-wa-Ntipa is located in Kaputa District in the Northern Province of Zambia. It is 73.5km in length and 43.3km in width. The fishery includes lakes Mweru-wa-Ntipa and Chishi, a small lake that adjoins it. Mweru-wa-Ntipa meaning "Lake of Mud,"is surrounded by a marsh and lies wholly within Zambia. It is located between grids 29°00′ and 30°00′ east and 8°10′ and 9°10′ south and drains a catchment's basin which has no exit although in times of very heavy rainfall there can be a connection from Kalungwishi river overflowing into Mofwe dambo. The lake's water level varies according to rainfall patterns. In times of drought, the lake can dry up almost completely. Between 1964 and early 1980's the lake had expanded to its largest size of about 1,600 square km due to above average rainfall in those years. In recent years, however, the lake has decreased both in area and depth due to periods of drought.

Mweru-wa-Ntipa fishery supports both artisanal gillnet and Chisense fishery. It's contribution to the annual fish production of Zambia declined from 24% in 1976 to 14% in 1985 and to only 5% in 1995. The current contribution to Zambia's annual catch is not known due to lack of Frame Survey (FS) and Catch Assessment Survey (CAS) data on the lake. The last FS was conducted in 1992 and the last CAS was in 1996.

The Department of Fisheries through the statistics section is required to carry out regular FS and conduct CAS on quarterly basis. This however has not been happening since the mid 1990's due to financial constraints. Data collected during these surveys are stored in MS-Access Database in Chilanga for planning purposes and copies of the data are also stored at the Central Statistics Office (CSO).

Since the mid 1990's the Department of Fisheries has not been submitting data to the Central Statistics Office. The Ministry of Finance and National Planning through the Central Statistics Office has therefore not been able to assess with precision the contribution of the fisheries sector to the Gross National Product (GDP).

Realizing the lack of fisheries data at the Central Statistics Office, the Agriculture and Environment Division at CSO sourced finances to conduct a pilot fisheries survey on Lake Mweru-wa-ntipa with technical assistance from the Department of Fisheries (DOF). This fishery was chosen as the study area because out of the 14 fisheries in the country it had the least information pertaining to its size and structure.

Since these surveys are meant to come up with estimates of fish production in the lake at a point in time, they will be continuous. Once the frame, which is linked to the census 2000 frame, is in place, it will be used for a period of 5 years. The Catch Assessment Surveys, however, will be conducted quarterly in a year based on this frame.

1.3. Survey Methodology

1.3.1. Frame Survey

Frame surveys conducted in commercial lakes and rivers provide data on the size and structure of the areas covered. The main characteristic associated with fishing units in Zambia is the density of such units usually spread along the shorelines. Furthermore, various tribes are engaged in fishing with varying fishing techniques and capacities. This means that regional variation in terms of fishing effort, fishing craft and settlement comprise a different pattern of fishing economy both between and within the various regions of the shorelines. There is also a great deal of mobility of fishers within the year especially in riverine and swampy fisheries. For the purpose of this survey, a fishing village or camp is defined as one, which has at least one or more fishers. A fisher was defined as either male or female aged 10 years or above.

Sampling and survey design

The process is based on complete enumeration of survey characteristics in each fishing village. All villagers within 1.5 kilometres of the lakeshore were visited. Coverage was done by two teams; one on land and the other on water. The fishery was divided into two strata (zones), based on geographical features, from which each survey team collected frame information. As the survey dealt with potentially sensitive issues, appropriate codes of conduct were always observed when starting interviews in a village. Initial contact with a fishing village was made through the headmen or, in some cases, the village secretary to whom the goals and practical details of the frame survey were explained. The headman would then mobilize the fishers and explain the importance of the survey to them. Two types of questionnaires were then administered, one about the general characteristics of the village was administered to the headman while information pertaining to fisher and gear characteristics were obtained from individual fishers present at the time of the interview using the other survey instrument.

Location of Mweru Wantipa Fisheries, Kaputa District

Key

- Health Centres
- Major Rivers
- Kaputa Town
- Fishing Villages/Camps
- Main Roads
- Mweru_wantipa.shp
- National Park
- District Boundary
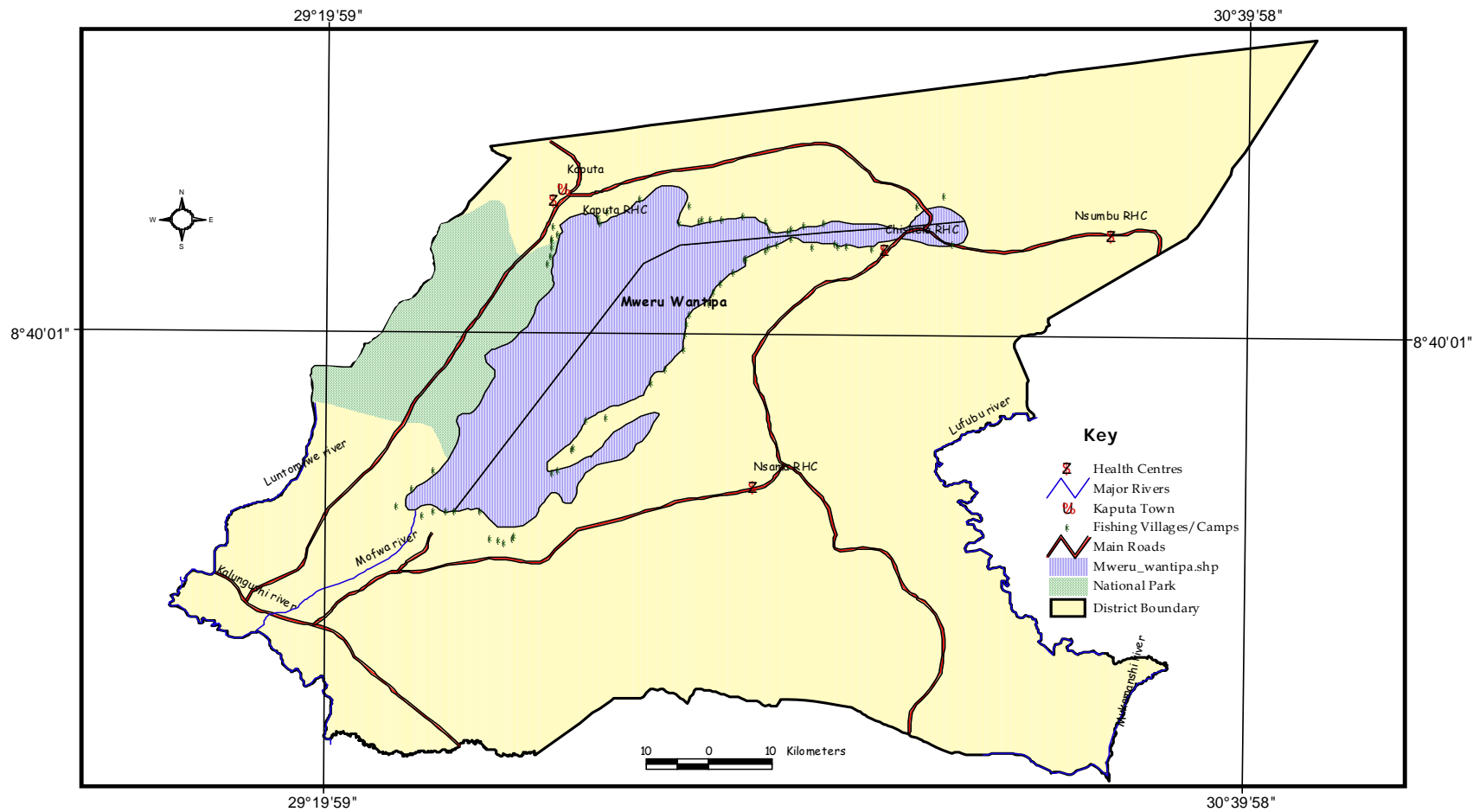
Survey Instrument

There were two types of survey instruments (questionnaires) used in the frame survey. The first survey instrument administered to the headman had questions on village level characteristics while the other instrument administered to the individual fisher had questions on fisher, gear and fishing level characteristics.

Village level characteristics

Under this level, data such as name of village, age of village, population, number of households, chiefdom, number and type of boats, number of fishers and headman of the village were collected. Data pertaining to other activities apart from fishing was also collected. This information gave an indication of the size of the village and was later used in categorizing these villages in different strata depending on the number of boats within that village.

Fisher level characteristics

Fisher level characteristics included specific data collected on each fisher interviewed. Data such as Age, Sex, ethnic origin, marital status Fisher status, Years fished, years living in the village, catch disposal methods was collected from each individual fisher. This information was vital in analysing the demographics and social aspect of the fishery.

Gear and fishing level characteristics

This level, included data on Boat and gear ownership (number, type, use, and life span of the gear), Fishing time and area, permission needed and interactions. For detailed information refer to appendix C and D.

Catch Assessment Survey

Sampling and Survey design

The sample design was done in three stages. The first stage was the delineation of the whole lake into two strata. This was done arbitrary into two halves from the southern tip of the lake to the northern tip of the lake. The second stage was to divide the two strata into minor stratum depending on the number of boats in the village. The final stage was to select randomly in each minor stratum using probability equal to size. The size referred to here was the number of boats. In order to give each village an equal chance of being selected, they were classified into small medium and large scale depending on the number of boats. In each stratum 2 villages were randomly selected.

(a) Minor stratification

Within each stratum the villages were sub divided into groups according to their sizes. For sampling purposes, the size of the village was expressed in terms of the number of boats currently operating from each fishing site. Each village fell either in small, medium or large-scale category.

Table 1. Delineation of minor stratum

STRATUM	MINOR STRATUM	REMARKS
X	I	1-15 boats
	II	16-29 boats
	III	30+ boats

From minor stratum I which is the small scale category, only two villages were randomly selected to represent that category while in minor stratum II and III, three villages each were randomly selected to represent those categories. Due to financial constraints and limited time on two or three villages were covered in each minor stratum.

Location of Fishing Villages/Camps around Lake Mweru Wantipa

Key

Fishing Villages
Lake

10   0   10   Kilometers

Sampling

Data on input and output characteristics of fishing were collected by working groups of two recorders who covered each selected primary sampling unit (PSU) in a given minor stratum for three days. Ten fishers were randomly selected if there were more than 10 fishers on a given day in a village or camp. In cases where a fishing village/camp had less than or equal to 10 fishers on a given day, all of them were covered.

Information was collected on:

(a) Particulars of a fisher
(b) Fishing activity during the last three days
(c) Fishing method
(d) Total length of net(s) used.
(e) Total number of landed fishing boats.
(f) Total number of nets used according to sites
(g) Species caught.
(h) Quantities caught

In this regard, the reporting unit of the survey was the fishing economic unit (FEU) (boat, gear and the fisher)

(b) Fish catch

The following equation developed by FAO(adopted in Zambia through the work of Professor G.P Bazigos, FAO-Fishery Statistical consultant) was used to estimate the total fish catch for Mweru-wa-Ntipa fishery during the survey period.

Catch = CPUE x E x T x AR which is the same as (A/B) x E x T x (C/Dx3)
Where;
CPUE is the Catch per unit effort and is computed as A/B

A = Sample catch in minor stratum
B = Sampled boats in minor stratum
E = Frame survey boats in minor stratum
T = Number of days in the reference period

AR is the activity rate computed as C/Dx3

C = Total landings in minor stratum
D = Total boats for selected PSUs in minor stratum

1.3.2. Fisheries Mapping

A total of 79 location points namely fishing villages, camps and schools were collected using the Global Positioning System (GPS) during the Frame Survey data collection phase. In addition over three hundred waypoints were collected for use in plotting the road infrastructure in the fishing villages/camps. These are latitude longitude points that have been converted into Decimal Degrees (DD) for down loading into the ARC View mapping software. The digital frame from the census 2000 was used to plot these locations.

Mapping of the fishing villages was done independent of the frame and catch assessment data processing. The location points were converted into DD and provisional maps produced. Data pertaining to fishing villages/camps was linked to the maps after completion and special theme maps were created depending on the variables that was generated from frame and catch assessment survey data sets.

2. RESULTS

2.1. Fishery characteristics

 The results are divided into three parts namely; the frame survey component, the catch assessment survey component and the mapping component

(A) Frame Survey

A total of 52 fishing villages and 3 fishing camps, distributed along the shoreline were recorded in this survey. (See Appendix 6, Table 14). This information was then plotted by the use of topographic maps (1: 50,000), G.P.S. (Garmin 12) and 2000 statistical maps to delineate the frame limits for stratification purposes. The data collected enabled large amounts of analysis relevant to the description of the artisanal gillnet fishery of Lake Mweru-wa-ntipa.

Population

According to the results 2000 Census, Kaputa District has a total of 18,520 households and a total population of 87,233. This represents seven percent of Northern Province's population. Between 1990 and 2000 the district recorded a population annual growth rate of 5.0 percent and population density increased from 4.1 persons per sq km in 1990 to 6.4 persons per sq km in 2000. This particular survey revealed that ,the estimated number households and population in the Mweru-wa-Ntipa fisheries survey is 7,265 and 33,859 respectively. As compared to the total district population, 38.8 percent of the district has a direct impact on the lake resources. The map below shows the distribution of estimated population by villages. Using the lake stratum it is observed that there is a high concentration of population in Stratum II than in Stratum I. Notable concentration of above 800 persons per village are observed in Kashikishi, Shimashinda, Cholwe and Chitipa among others in Stratum II while Kawama and Kasongole are some villages with high population in Stratum I. Generally, low population is observed in the north-eastern part of the lake in both strata. The main reason why there is a lower concentration of people in stratum I as compared to stratum II is because almost half of stratum I is covered by Nsumbu game park.

Population Distribution by Villages

Map labels (as shown): Kaleula, Chilombwa, Selemani, Fula, Kakomo, Kapala, Ilembwe, Chingoyu, Mwaba, Katwatwa, Mintanga, Kateshi, Muchanga, Mwendanansapato, Sichapi, Amoni, Kateshi, Musonda, Kaseka, Kanada, Chishela, Chilemba, Chikoyi, Munwa, Kawama, Nsenga, Milalantanga, Kalimba, Kapaipi, Musanzala, Mutundu, Chiponga, Cholwe, Kapilimusha, Chefu/Gabone, Kepike, Kataya, Bangala, Mikose, Chisanse, Chipipa, Chansa, Chibota, Mununu, Kashikishi, Chikoya, Kasongole, Kashikishi Habour, Mibalo, Chimpati, Ikeleshyafye, Mubangale Camp, Kanakakonge, Musata, Shimashinda, Mutakashya Camp

Stratum I

Stratum II

KEY

Population Size

Symbol	Range
#	Less than 120
8	121 - 380
8	381 - 800
8	801 - 2883

10   0   10   Kilometers

Map Produced by CSO Geographic Information Branch

Ethnicity

According to the 2000 Census (Table 2), 61.6 percent of the population in Kaputa use Bemba as the predominant language followed by Tabwa, Lungu and Mambwe with 31, 0.6 and 0.3 percent, respectively (CSO; Census 2000).

Table 2. Predominant Language in Kaputa District, Northern Province 2000

S/No	Predominant Language	Percent
1.0	Bemba	61.6
2.0	Ushi	0.1
3.0	Tabwa	31.0
4.0	Nyanja	0.1
5.0	Lungu	0.6
6.0	Mambwe	0.3
7.0	Namwanga	0.1
8.0	Tumbuka	0.1

Table 3 below shows the percentage distribution of fishers ethnic groups in the Mweru-wa-Ntipa Fishing villages. Of the 2,337 fishers , more than half or 54.5 percent belong to the Tabwa ethnic group followed by the Bemba at 24.2 percent. The Lungu and Lunda group made a combined percentage of nearly six percent of the fishers interviewed while the Ushi and Shila made up the least representation of 1.9 and 2.0 percent respectively. Even though, Bemba was the predominant language in Kaputa District as seen from the 2000 census results, almost half of the fishers around Mweru-wa-Ntipa used Tabwa as the predominant language. Bemba was the second largest ethnic group among the fishers.

Table 3. Percentage Distribution of Fishers by Ethnic background

S/No	Tribe/Ethnic Group	Number	Percent
1.0	Tabwa	1,274	54.5
2.0	Bemba	567	24.2
3.0	Lungu	70	3.0
4.0	Lunda	67	2.9
5.0	Namwanga	57	2.4
6.0	Bwile	50	2.1
7.0	Shila	47	2.0
8.0	Ushi	43	1.9
9.0	Others	163	7.0
	Total	**2,337**	**100.0**

2.3. Ages, Sex and Marital status

2.3.1. Age and sex

Table 4 shows that fishing is male dominated with only about three percent of the fishers interviewed representing females. The age cohort 30-34 has the highest percentage of fishers (19 percent) for both sexes. For both sexes participation in fishing is peak in the age range 25-49 and a general decline is observed for the higher age cohorts. Only male children (0.7 percent) were involved in fishing.

Table 4. Age and Sex of Fishers

Age Cohort	Total	Male		Female	
		Number	% Of Total	Number	% Of Total
15-19	17	17	0.7	0	0.0
20-24	163	163	7.0	0	0.0
25-29	300	287	12.3	13	12.8
30-34	450	443	19.0	7	19.3
35-39	307	300	12.8	7	13.1
40-44	297	290	12.9	10	12.8
45-49	263	250	10.7	13	11.3
50-54	240	230	9.8	10	10.3
55-59	130	123	5.3	3	5.4
60+	170	170	7.3	0	0.0
Total	**2,337**	**2,274**	**97.3**	**63**	**2.7**

2.3.2. Marital Status

The majority of fishers were married (87.6 percent) followed by those that have never married at 8.3 percent (see figure 4). Divorcées accounted for 2.6 percent of the respondents followed by the widowed at 0.9 percent, separated (0.6 percent) and least those who were cohabiting (0.1 percent).

Figure 4: Marital Status of Fishers
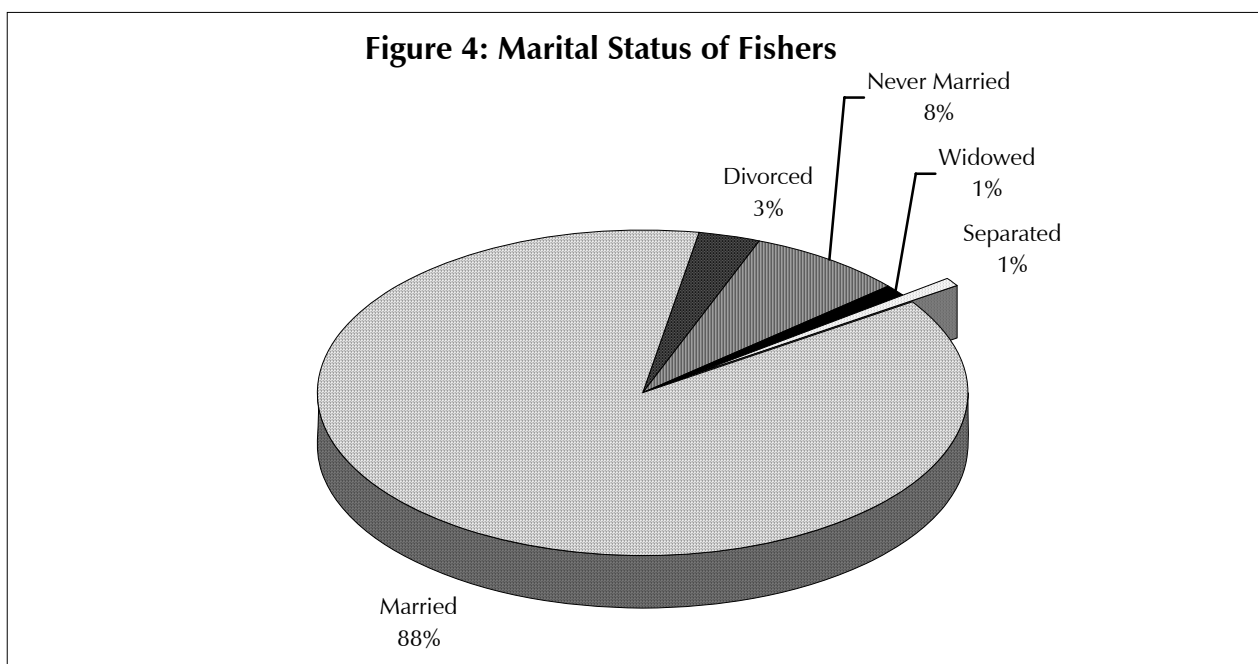
Table 5 shows the marital status of fishers by sex. The majority of the male fishers are married (88.1%) while married females make up 68.4 percent of the fishers. Although the number of females for divorcees is much smaller as compared to that of males the table shows that there was a much higher divorce rate of 15.8 percent for females as compared to 2.2 percent for males.

Table 5. Marital Statuses of Fishers by Sex

Sex	Marital Status									
	Divorced		Married		Never married		Separated		Widowed	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Male	50	2.2	2003	88.1	186	8.2	11	0.5	23	1
Female	10	15.8	43	68.4	7	10.5	3	5.3	-	-

2.4. Village characteristics

Most of the fishing villages were established in the 1960's, 70's and 80's. This is the period when the lake was very productive and people where moving into the area to engage in fishing. However, some villages and camps emerged in the 90's and after 2000 (see figure 5 below).

Figure 5: Age of Fishing Villages
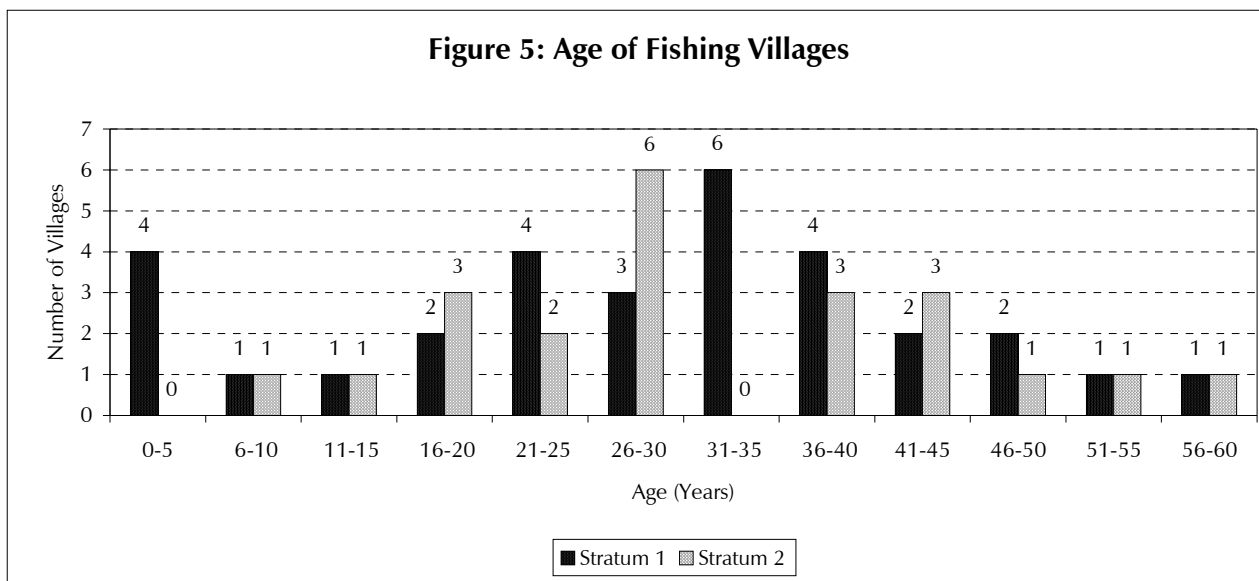
Catches may vary periodically in an area and fishers tend to set up camps where the catches are better and these over time become permanent villages. The reduction in water levels in the lake has also led to setting up of new camps. This is particularly the case in Mubangale and Loleshafwe were fishers have moved from their original villages which are now too far from the lakeshore. Table 6 below shows that of the 55 fishing areas, 52 were permanent villages and 3 were fishing camps. All the fishing camps were located in stratum I.

Table 6. Number of fishing villages per stratum

Stratum	Permanent Village	Temporary Camp/Village	Total	Remarks
1	30	3	33	From Kanakakonge to Kanada
2	22	-	22	From Katai to Chimpatika
Total	52	3	55	

Figure 6. Number of fishers staying in the villages around Lake Mweru-Wa-Ntipa September-October 2004
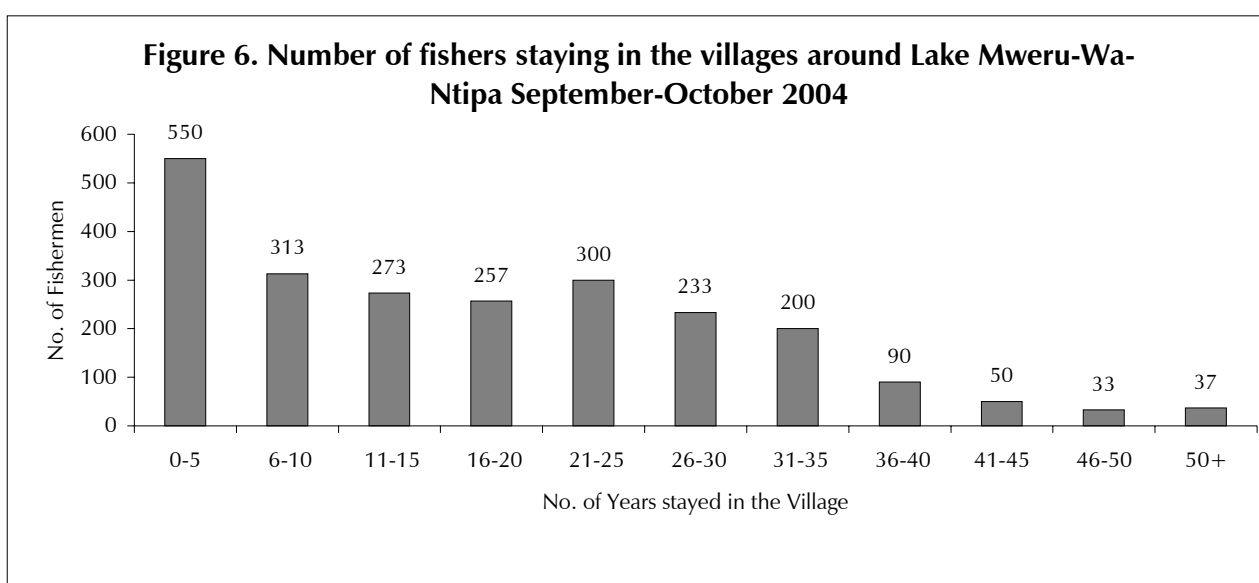
Figure 6 shows the number of years fishers have lived around lake Mweru-Wa-Ntipa. There was an estimated 2,337 fishers around lake Mweru-Wa-Ntipa in September-October, 2004 fisheries survey. About 550 fishers have lived in the villages around the lake for less than 6 years and these are the least experienced in fishing. The most experienced have lived and fished around the lake for over 50 years.

Gear Characteristics

A total of 73,367 fishing gear were recorded during the September-October, 2004 Mweru-wa-Ntipa fisheries survey. The most predominant of these were the gill nets, which accounted for 99.86 percent. The second most common fishing gear was the chisense net and this only accounted for 0.10 percent of the total fishing gear recorded. The least common were the baskets and long lines, which together accounted for 0.04 percent.

Table 7. Fishing gear

Gear Type	Number
Basket	30
Chisense nets	67
Long Line	3
Gill Nets	73,267
Total	73,367

2.4.1. Fishing nets

As seen in table 7 Mweru-wa-ntipa fishery is predominantly a gill net fishery. From the 2,337 fishers, there were 73,267 gill nets of sizes ranging from 1 to 6 inch stretched mesh, in their possession. The most common gill net used in the Mweru-wa-Ntipa fishery is the 3-inch net, which accounts for 27.6 percent of the total gill nets used. This is followed by the 3½-inch net accounting for 26.9 percent. At 24.6 percent is the illegal mesh size of 2½ inches. A total proportion of 41 percent of the gill nets recorded during the survey, were small meshed and below the minimum legal size of 3 inches.

Table 8. Fishing nets by size

Mesh size (Inches)	Number of nets	% Overall
1	47	0.06
1½	2,677	3.65
2	9,208	12.57
2½	18,036	24.62
3	20,206	27.58
3½	19,713	26.91
4	2,124	2.90
4½	797	1.09
5	263	0.36
6	197	0.27
Total	**73,267**	**100.00**

2.4.2. Boats

During the September-October, 2004 fisheries survey, a total of 1,798 boats were recorded. Of these, the most common boat type were the plank boats, which accounted for 89.3 percent. Dugout canoes were the second most common boat types used with a proportion of 10.2 percent. Fibreglass boats were not so common.

Table 9. Composition of fishing boat types

Boat Type	Number of Boats	% Overall
Dugout canoes	183	10.2
Fibreglass boat	10	0.5
Plank boat	1,605	89.3
Total	**1,798**	**100.0**

2.6. Economic activities

2.6.1. Fishing

The people living around Mweru-wa-ntipa depend on fishing as one of the major means of their livelihood. Table 10 below show that a total of 8,918 people, which represents 26.3 percent of the population, are directly involved in fishing. The distribution of these is also shown, 6.9 percent of the population are fishers i.e. those who own nets, fishing boats or both, 7.1 percent are family assistants who may or may not be paid a proportion of the catch and 12.3 percent of the population is used as hired labour and are paid part of the catch. The age of labour force used was not captured in this study, however fishing skills are learnt at an early age especially in the family assistant category where boys as young as ten years old are used.

Table 10.   Number of Fishers, Labour and Population of the Mweru wa ntipa Fishery

		Percent of Population
Fishers	2,337	6.9
Hired Labour	4,194	12.3
Family Assistants	2,390	7.1
Total number of people directly involved in Fishing	8,921	26.3
Population	33,859	100.0

Most of the fishers of Lake Mweru wantipa reported having sold, bartered and or consumed their catches. Only 3.0 percent of the fishers consumed their entire catches as can be seen in the diagram bellow. Fresh fish is mostly sold within the villages around the Lake or to nearby communities including Kaputa urban as there are no refrigeration facilities in the area around this fishery. Most of the fish is either smoked and dried or salted and dried, and is then transported to urban markets like Kasama, Mporokoso, Mansa, Kitwe etc. Chisense is sun-dried on concrete slabs or sand by the lakeside and transported to the markets.

Figure 7. Percentage Distribution of the Catch Disposal Methods.

Barter, Sell & Home Consumption 36%

Barter and Home Consumption 1%

Home Consumption 3%

Sell and Barter 1%

Sell & Home Consumption 59%
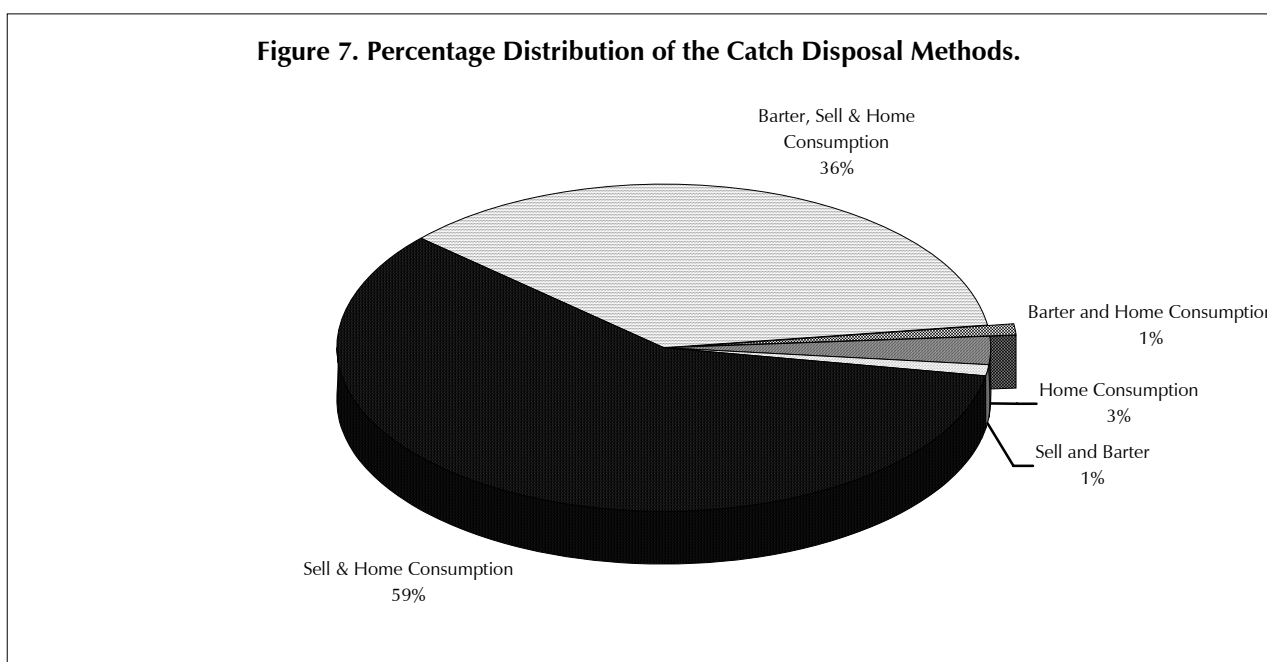
2.6.2. Agriculture

Apart from fishing, agricultural activities play an important role around the shores of lake Mweru-wa-Ntipa. The two-major crops grown around the villages of Mweru-wa-Ntipa are cassava and maize. During the September-October 2004 Mweru-wa-Ntipa fisheries survey, a total of 51 fishing villages/camps reported growing crops. Cassava and maize were each reported in 51 fishing villages/camps. The second most important crop grown in 37 villages was groundnuts. Pumpkins were reported in 29 villages. This shows that there were 27.6 percent more villages growing groundnuts than pumpkins. Bananas and vegetables were each reported in 22 fishing villages/camps. For the rest of the crops grown, refer to figure 3.

Figure 8. Crops Grown by Villages around Lake Mweru-wa-Ntipa

Crop Grown	Number of Villages
Vegetables	22
Sweet Potatoes	6
Sugar Cane	15
Sorghum	1
Rice	27
Pumpkin	29
Millet	9
Maize	51
Groundnuts	37
Cassava	51
Beans	21
Banana	22
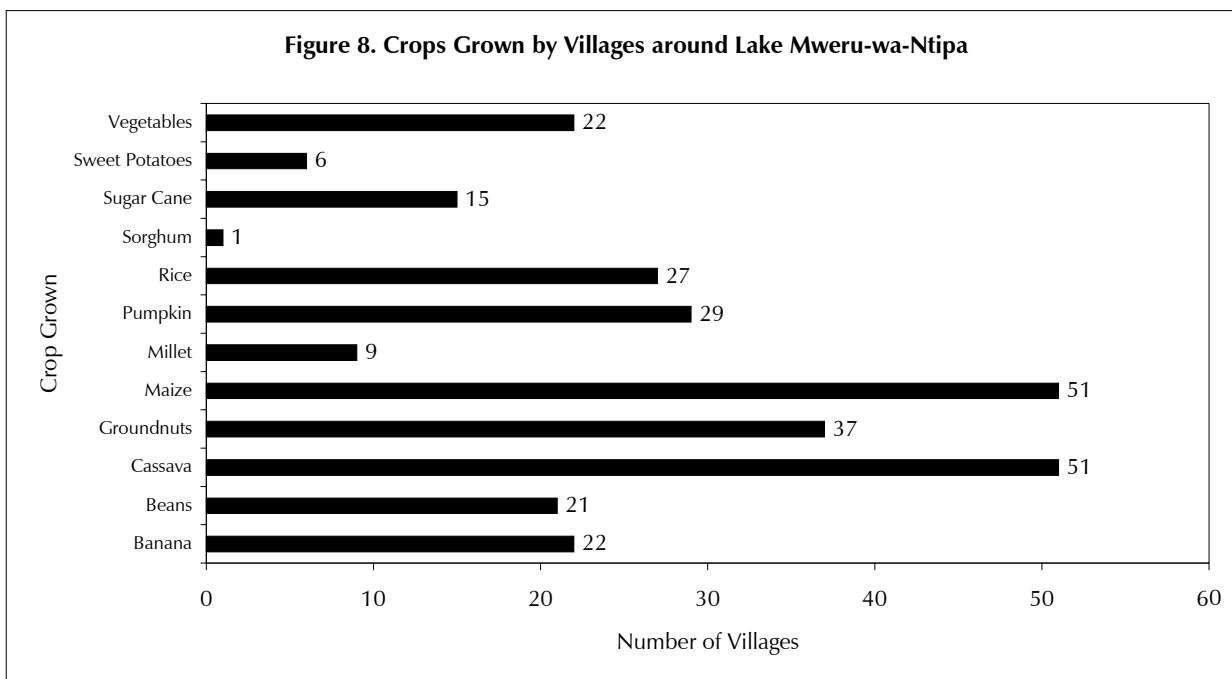
Other agricultural activities around the shores of lake Mweru-wa-Ntipa during the September-October fisheries survey included rearing of livestock. Almost all the fishing villages/camps reported rearing some kind of poultry such as chickens, guinea fowls, ducks, pigeons and geese. Seventy-three percent of the villages reported rearing goats while pigs were reported by 12 percent of the villages. Sheep rearing is not common around the fishing villages/camps of Mweru-wa-Ntipa as only 2 percent of the villages reported rearing sheep.

Figure 9: Proportion of Villages Rearing Livestock

Forest Product	Proportion of Villages Rearing Livestock
Goats	73.7
Pigs	11.8
Poultry	98.0
Sheep	2.0
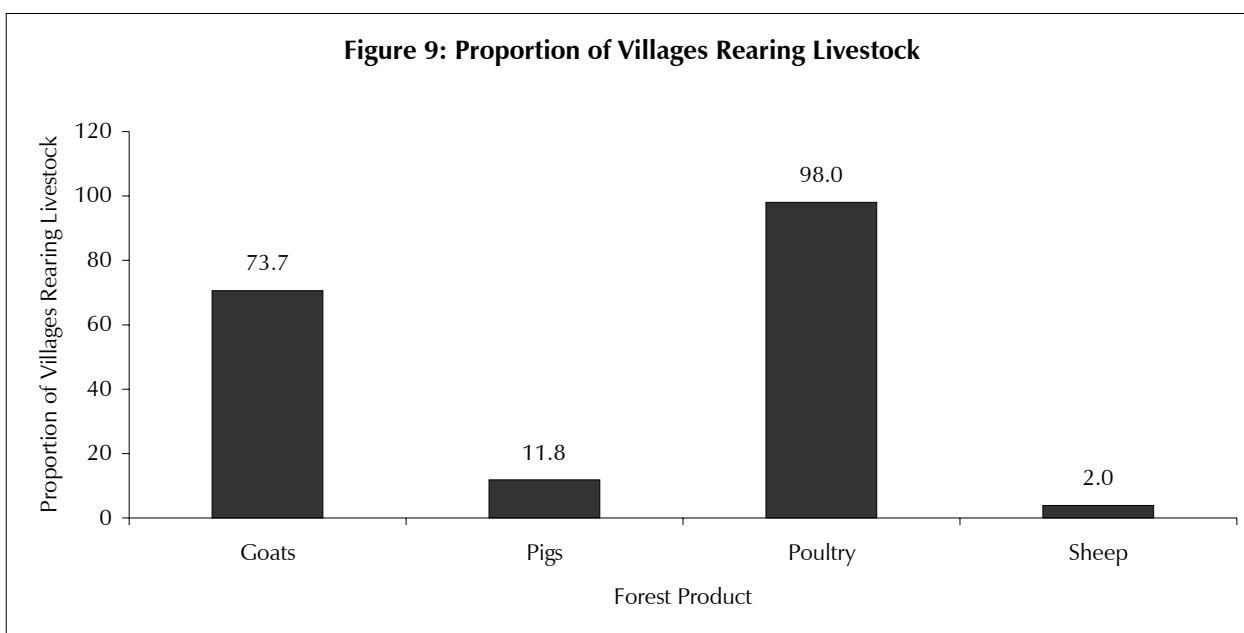
Other economic activities

An estimated 35 fishing villages and camps out of the total 54 villages and camps that were surveyed around lake Mweru-wa-Ntipa, reported being involved in making and selling of forest products to boost their household income. The most common forest products, which more than 40 percent of the fishing villages/camps were involved in, were baskets, charcoal, mats and timber. These accounted for 46, 49,49 and 46 percent respectively. Twenty three percent of the fishing villages were involved in collecting and selling of firewood while 14 percent of the fishing villages/camps reported being involved in collecting and selling of honey. Only 9 percent of the villages were involved in blacksmithing.

Figure 10: Proportion of Camps involved in Forest Activities
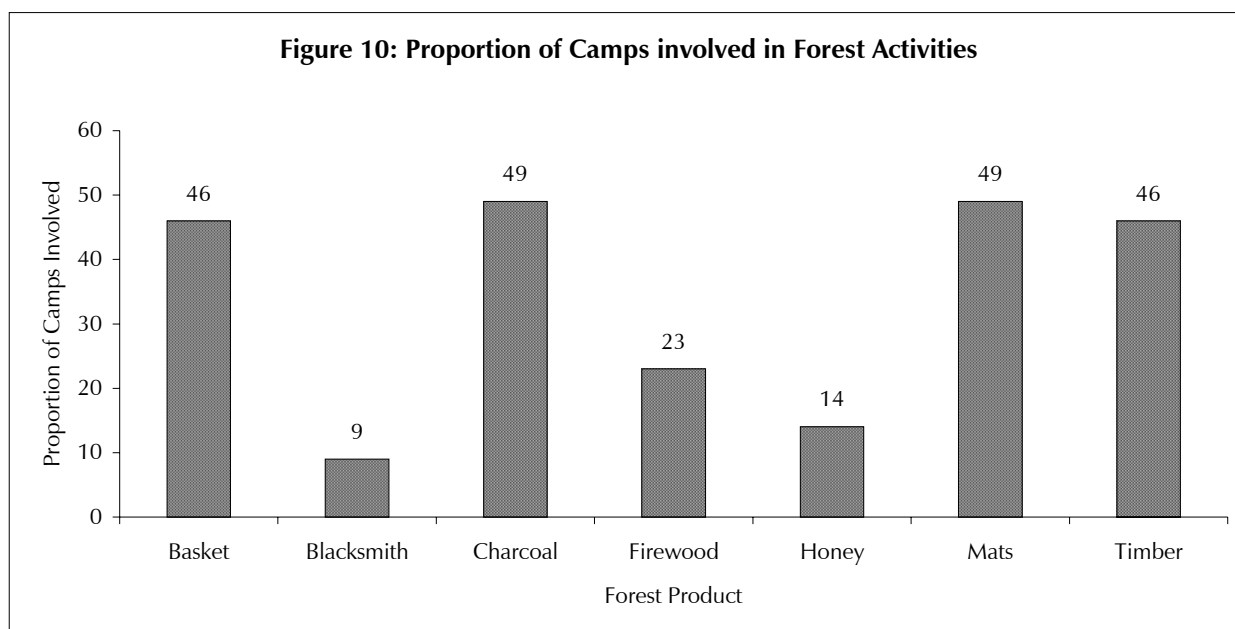
(B) CATCH ASSESSMENT SURVEY

Estimated Fish Production

A 30-day fish catch of 351.34 metric tonnes was estimated from the survey. More catches were recorded in stratum I than in stratum II. Stratum I recorded a total of 260.13 metric tonnes while stratum II had 91.21 metric tonnes.

Table 11. Total estimated 30-day catch

Stratum	Minor Stratum	Catch (Kg)
	I	9012.96
I	II	57,391.07
	III	193,723.00
	I	23,514.78
II	II	10,333.73
	III	57,360.45
TOTAL		**351,335.51**

The majority of the catch in both strata was from Minor stratum III, in stratum I, the catch in minor stratum III accounted for 74.5percent of the total catch in that stratum while in stratum II, the catch in minor stratum III had a proportion of 62.9 percent of the total within stratum II. In stratum I, the proportion of the catches in each minor stratum increased from minor stratum I to III while in stratum II, minor stratum I recorded a much higher catch than in minor stratum II.

Table 12. Estimated monthly Fish Catch by Species and Weight

Species	Weight (kg)	Percent
Barbus	1,382.4	0.4%
Clarius	10,787.5	3.1%
Hydrocynus vittatus	68.9	0.0%
Labeo	86.1	0.0%
Tilapia macrochir	78,659.9	22.4%
Sargochromis codringtonii	53.4	0.0%
Schilbe intermedius	278.9	0.1%
Serranochromis	17,154.0	4.9%
Synodontis species	77,993.6	22.2%
Tilapia rendalli	24,154.0	6.9%
Poelothrissa mwerensis	138,719.6	39.5%
Auchenoglnis occidentalis	671.4	0.2%
gnathonemus spp	1,136.3	0.3%
shrysichthys mabusi	189.4	0.1%
Total	**351,335.51**	**100.0%**

The catch comprised mainly of *Poecilothrissa spp.* (Chisense), which accounted for 39.5 percent of the total catch during the survey period. *Tilapia macrochir* (pale) and *Synodontis spp.* (Bongwe) accounting for 22.4 and 22.2 percent respectively were also quite common while the red breasted bream (*Tilapia rendalli)* accounted for 6.9 percent. Other species of minor commercial value included *Serachromis macrocephalus* (Makobo), having a proportion of 4.9 percent, *Clarias mossambicus* (Milonge), with a percentage of 3.1, *Schilbe mystus* (Lupata), and *Chrysichthys mabusi* (Kabombola). For details refer to table 12 above.

3.0.   Conclusion

The number of villages has remained more or less constant over the 1992 to 2004 period due to the re-grouping of villages exercise, which took place around the fishery in the 1990's. Despite the poor catches, there has been an increase in the number of gillnets from 7,097 in 1992 to 73,267 in 2004. The number of fishers have correspondingly increased from 1,570 in 1992 to 2,337 in 2004. Fishing is still the main activity for people's livelihood around lake Mweru-wa-Ntipa fishery. There has however, been an increase in activities pertaining to agriculture with noticeable increases in banana, rice and cassava production. The most experienced fishers who have lived in the villages around the lake for more than 50 years, are very few. This could be as a result of the fact there could be a high rate of migration in search of better living conditions this includes searching for better fishing grounds. Due to low fish catches, fishers that have lived in the villages longer are turning to other activities such as agriculture. Relatively large banana plantations were found in villages between Mikose and Cholwe. These bananas are a major source of income in this area and are sold to traders within and outside Kaputa district. There is a significant rice production on northern shores of the lake. However, some fishers are still present in these villages.

It is clear from this survey that the plank boat predominates the fishing craft of the fishery. The fishery has very few dugout canoes an indication that the communities adopted FAO's recommended plank boat introduced to the fishery in the early 1970's. The fishery also has very few fibreglass boats due to high cost of these boats. No marine engines were encountered during the survey.

The chisense nets could have been more than the number recorded. This is so because some of the fishers interviewed indicated that the majority of the fishers who owned chisense nets were afraid of giving the exact numbers they owned, in some instances they refused owning any because they thought their nets would be taken away from them. The fact is, catches in Mweru-wa-Ntipa fishery are poor and small in size; therefore the nets are increased in number and reduced in mesh size in the bid to catch more.

About 41 percent of the gill nets recorded during the survey, were small meshed and below the minimum legal size of 3 inches. This shows that the catch is therefore composed of small sized and juvenile fish.

Table 13. Frame Survey of Mweru-wa-Ntipa Fishery.

Year	No. Of Villages	Gear				No. Of Boats	No. Of Fishers
		Nets	Long Lines	Traps	Chisense nets		
1977	78	-	-	-	-	2,124	1,407
1986	77	-	-	-	-	1,519	1,658
1992	55	7,097	44,220	335	724	1,246	1,570
2004	55	73,267	3	-	67	1,832	2,337

While the fishery was very productive during the 70`s and 80`s contributing an average of 24% of national production with *Tilapia machrochir* (Pale) being the main species both by weight and number, catches have declined so drastically over the past years due to an increased fishing pressure that is, from 7,097 to 73,267 nets between 1992 and 2004 an increase of over 1,000 percent. The number of fishers also increased by 48.9 percent, which is from 1,570 to 2,337. Changes in rainfall patterns for the past few years because of this, the lake has become smaller and shallower meaning the capacity of fish it can carry is reduced. The commercialisations of Chisense fishing were mesh-less potato sack nets are used for fishing and this destroys fish nests and cropping fry. Poor fishery management practices-leading to extensive use of nets below the legal mesh size of 3 inches. However there has been a reduction in the use of other gear types mainly Long line and traps due to changes in species composition from a fishery dominated by *Claria spp.* and *Tilapia machrochir* to current predominance of *Synodontis spp.* and *Poecillothrissa spp* (chisense)

Figure 11: Historical Catch Statistics for Mweru-Wa-Ntipa Fishery
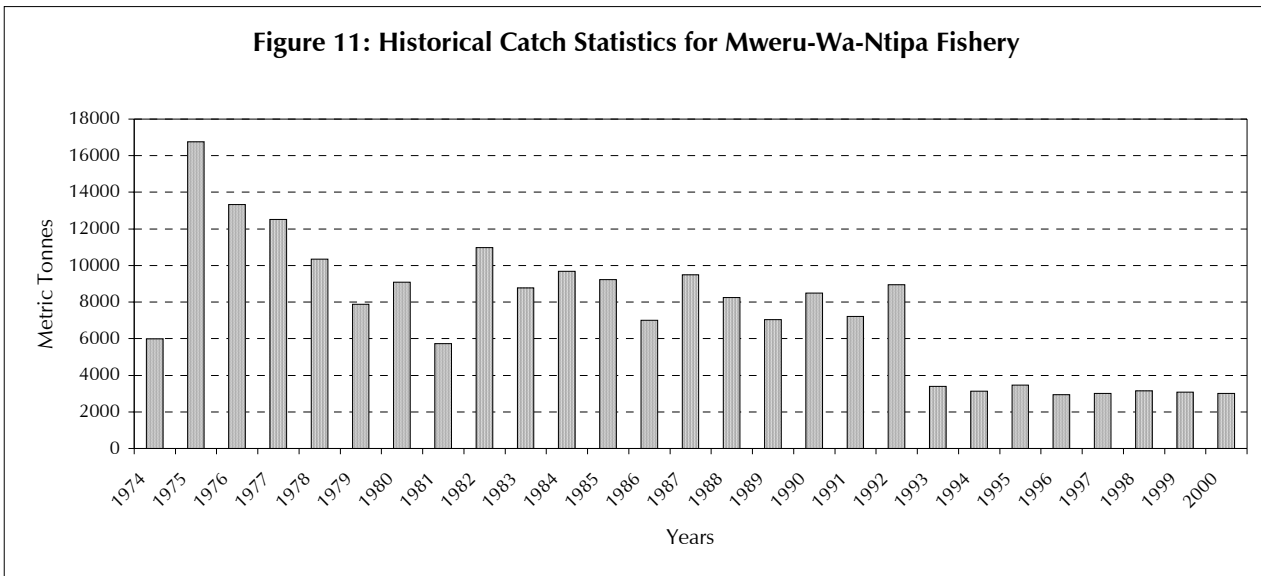
The last time a frame survey was conducted on Mweru-wa-Ntipa was in 1992. There was, therefore, little information on the status of the fishery until this pilot survey was conducted. The pilot survey was successful, the Mweru-wa-Ntipa fisheries frame was obtained which was linked to the Census frame and a database in MS-Access was also created both at the DOF offices in chilanga and at CSO headquarters. Location maps showing fishing villages and other themes like fisher population distribution were also produced. With the latest frame in place, the Mweru-wa-Ntipa fishery has now been empowered to conduct seasonal catch assessment surveys for up to 5 years based on this frame.

Even though an estimate for the fish production for the month of September was made and the results were extrapolated for the whole year, these estimates are shallow because they did not take into consideration seasonal changes. In order to determine the annual fish catch for lake Mweru-wa-Ntipa, seasonal changes have to be taken into consideration. This means four runs of catch assessment surveys need to be conducted annually, one in each quarter. Fish catches are different in different seasons; therefore seasonal changes are important in determining the annual catches. From the last time the surveys were done, there has been a reduction in the fish catch. This shows that the Mweru-wa-Ntipa fishery is heavily fished because the catch is mainly small sized fish and the catch is also not bountiful.

This study shows clearly that in depth studies of individual fisheries are important in understanding the causal-effect relationships of the fishing industry in Zambia. Such studies are needed to capture the unique aspect of a fishery, which may not apply in other fisheries.

4.0. Recommendations

1. Department of fisheries, Kaputa, should during 2005 concentrate on collecting Catch Assessment data, which will enable the computation on annual catches for 2005 since annual estimates cannot accurately be made based on a single survey.

2. Department of fisheries should staff and equip the two fisheries stations, Nsama and Kaputa adequately for them to manage the Mweru Wantipa fishery effectively.

3. Other secondary and tertiary surveys should be conducted regularly for the proper assessment of the fishery.

4. Fishing in Zambia can increase if measures that are in place are enforced. These include measures such as:
    - Fish barn
    - Control on chisense fishing

Appendix   A

Table 14.   Number of fishing villages by age group and stratum

Age (Years)	Stratum 1	Stratum 2	Total
0 – 5	4	-	4
6 – 10	1	1	2
11 – 15	1	1	2
16 – 20	2	3	5
21 – 25	4	2	6
26 – 30	3	6	9
31 – 35	6	-	6
36 – 40	4	3	7
41 – 45	2	3	5
46 – 50	2	1	3
51 – 55	1	1	2
56 – 60	1	1	2
61+	3	2	5
Total	**33**	**22**	**55**

Table 15.   Distribution of selected villages.

Stratum	Minor Stratum	Number Of Selected Villages	Selected Villages
I	I	2	Chipukula
			Chefu
	II	3	Kasela
			Mikose
			Kachese
	III	3	Chitipa
			Cholwe
			Mununu
			Chitemene
II	I	2	Chokoye
			Kateshi
	II	3	Ilembwe
			Kakomo
			Kawama
	III	3	Chilombwa
			Kasongole
	Total	**16**	

A total of 16 fishing villages were selected for Catch Assessment Survey.

Appendix B

SURVEY ITEMS AND TYPE OF SURVEYS

Phase	Type of Survey	Survey Unit	Survey Item (Groups)

A. Primary Phase	1. Frame Survey	Fishing Site/Fishing Economic (FEU)	1. Number of FEU's
			2. Area distribution of FEU's
			3. Ingredients of the FEU's:
			   i. No. of Fishing craft
			   ii. No. of fishermen
			   iii. No. of fishing gear
			4. Mobility of the FEU's
			5. General information on processing and marketing habits of the FEU's

	2. Catch Assessment Survey	Fishing Economic Unit	1. Fish catch (total, regional basis) 2. Species composition of catch 3. Fishing effort items

	3. Cost Earning Survey (CES)	Fishing Economic Unit (by type)	1. Total revenue
			2. Cost:
			   a. Running costs
			   b. Wages, etc.
			   c. Maintenance and repai boats/engine
			   d. Repair or renewal fishing gear
			   e. Other charges
			   f. Depreciation cost (hull, engine
			3. Estimated amount of capital invested and interest of amount of capital invested
			4. Amount of taxes (levies) paid

B. Secondary Phase	1. Fish Processing Survey (FPS)	Processing unit	1. Number of processing units by type 2. Processing capacity 3. Processing products
C. Tertiary Phase	1. Fish marketing statistical surveys	Marketing unit	1. Number of markting units 2. Quality of fish transacted 3. Price of fish at wholesaler 4. Price of fish paid by customer

Appendix   C

Questionnaire

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Confidential
MWERU-WA-NTIPA FISHERY FRAME SURVEY DATA SHEEP

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NAME OF RECORDER:_____   DATE:_____/_____/_____

VILLAGE ☐   CAMP ☐   STATUS: ☐ PERMANENT

☐ TEMPORARY PERIOD CAMP OCCUPIED ☐

Name of Village/Camp:_____ Age of Village/Camp:_____(Yes) No. of Households_____

Population:_____   Headman:_____ Chief_____

GPS: S:_____   E:_____

Number of Fishing Boats by type: **Number**

1:	Dugout Canoes	☐
2:	Plank Boats	☐
3:	Fibreglass	☐
4:	Aluminium	☐

Number of Fishers by type:

5:	Boat and Net owner	☐
6:	Net Owners	☐
7:	Boat Owner	☐

8:     Others:_____ (Specify)

Agricultural Activities

Is there any agricultural activity: YES ☐   NO ☐

Type of agriculture: Crop ☐   Livestock ☐   Both ☐

Crops Planted: Maize ☐   Cassava ☐   Millet ☐

Sorghum ☐   Pumpkin ☐   Beans ☐

Vegetable ☐   Rice ☐

Others:_____ (Specify)

Livestock kept: Cattle ☐   Goats ☐   Pigs ☐   Sheep ☐

Poultry ☐   Others _____ (Specify)

Other Economic Activities/Source of Income

Forestry products   Honey ☐   Timber ☐   Firewood ☐   Charcoal ☐   Basket ☐

Other (Specify)_____

Appendix D

MWERU-WA-NTIPA FISHERY FRAME SURVEY DATA SHEET

Name of Recorder:_____   Village/Camp Name:_____   Date:___/___/____

PART ONE: DEMOGRAPHICS

Fisher ID	Age	Sex (M/F)	Ethnic Original	Marital Status	Fishers Status	Year express as a year fraction		Cach Disposal
						Fished	Living in Village	
			6. Tabwa 7. Shilla 8. Bemba 9. Lungu 10. Lunda 11. Bisa 12. Ushi 13. Others (Specify)	1. Never married 2. Married 3. Cohabit 4. Separated 5. Divorced/ 6. Widowed 7. Other Specify)	1. Full Time 2. Part Time			1. Sell 2. Barter 3. Home Consumption 4. Sell & barter 5. Sell & home consumption 6. Barter & home consumpti on 7. All of the above

MWERU-WA-NTIPA FISHERY FRAME SURVEY DATA SHEET

Name of Recorder:_____ Village/Camp Name:_____ Date:___/___/____

PART ONE: BOATS AND FISHING NETS

Fisher ID	Boat Parametres					Gear Parameters						People Hired to Fish		Gear lifespan
	Type	No.	Use	Prpulsion	Own (Y/N)	Type	Total No.	No. in use	Mesh Size	Gear use	Own (Y/N)	Number E	Number FA	
	1. Dugout canoe 2. Plank 3. Fibreglass 4. Aluminium 5. Other (specify)		1. Fishing 2.Transport 3.Both fishing and transport 4. other (specify)	1. Motorised 2. Non Motorised		1. Gillet 2. Dragnet (seine) 3. Long line 4. Chisense net 5. Basket & traps 6. Other (Specify)				1. All Year round 2. Seasonal 3. Occassional		E-employee FA – Family Assistant		

MWERU-WA-NTIPA FISHERY FRAME SURVEY DATA SHEET

Name of Recorder:_____   Village/Camp Name:_____   Date:___/___/____

PART ONE: FISHING ACTIVITY

Fisher ID	Fishing time Best	Fishing time Worst	Permission needed (Y/N)	Fishing Place/Area	Who do you ask	Do you pay (Y/N)	Who shares the areas you fish in
	1. Rainy season (Anmainsa) 2. Cold season (lupepo) 3. Hot season (ulusuba)				1. Headman 2. Relatives 3. Neigbours 4. No one 5. Government		1. Family 2. Neighbour 3. Everyone 4. No one 5. Others (Specify)

Appendix   E

MWERU-WA-NTIPA FISHERY CATCHMENT SURVEY DATA SHEET

Date:___/___/____ (dd/mm/yy)

Recorder's name:………………………………………..

Fisherman's name:…………………………………………   Village:……………………..

Fishing method:…………………………………………

Total net length (m)…………………………………………..   Number of days fished in the last 3 days:……………

Total Landings (6 days):…………………………………..   GPS: South:……………..   East:………………

No. of nets											
Mesh size	1½	2	2½	3	3½	4	4½	5	5½	6	6½

Species Group name	Parameter	
	Total number	Weight (Kg)

Data entered by:…………………………………..   Date:…………………………

Data Checked by:…………………………………   Date:…………………………