Shared Resource Management on the Zambezi/Chobe Systems in Northeast Namibia: Current Practices and Future Opportunities
River fisheries study: February 2002–February 2003

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Acronyms

cpue	catch per unit effort
MFMR	Ministry of Fisheries and Marine Resources
SRM	Shared resource management on the Zambezi/Chobe systems in northeast Namibia: Current practices and future opportunities

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1. INTRODUCTION

1.1 Background

The Shared Fisheries Resource Management Project on the Zambezi and Chobe Rivers in the Eastern Caprivi (SRM) aims to improve our understanding of the fishery in this area and to promote sustainable freshwater fisheries in the region. The SRM project works closely with stakeholders in Namibia and adjacent countries to achieve these objectives. The project is concerned with the collection and analysis of information (biological, social and economic) which can be used in developing long-term management systems for the floodplain areas. At the same time as collecting information for management, the project aims to develop capacity within the Ministry of Fisheries and Marine Resources (MFMR) to continue the collection of data on the social aspects of the fishery. The transboundary component of the project aims to work with neighbouring countries in the development of methodologies and skills to ensure some consistency in survey methods used, and to develop working relationships between stakeholders on different sides of the river.

The MFMR is active in the Caprivi Region through a number of projects, primarily addressing the lack of information on fish resources and the biological aspects of the fishery. In the past, little attention has been paid to the fishing methods used, effort and catch in the subsistence and recreational fisheries or the social–community component of the fishery. With pressure on the Zambezi/Chobe fishery increasing, the lack of up-to-date management information is becoming a serious bottleneck to the development of local and international co-management of the resource for the benefit of people in the region.

The background, motivation, goal and method descriptions of the project Shared Resource Management on the Zambezi/Chobe Systems in Northeast Namibia: Current Practices and Future Opportunities is described in the Project Proposal and in Næsje et al., 2000 (NINA Project Report No.18). The river survey (reported here) is one component of the SRM project.

1.2 Objectives of the river survey

The purpose of the river survey is to collect information on the subsistence and recreational fisheries in the Zambezi and Chobe river systems, independently and in collaboration with neighbouring riparian states, to enable an effective and practical management system to ensure the sustainable utilisation of the fish resources for the benefit of local communities.

The objectives of the river survey are to:

- collect quantitative, qualitative and replicable data regarding the nature and characteristics of the subsistence and recreational fisheries on the Zambezi and Chobe rivers;
- develop a system for data collection and analyses of subsistence and recreational fisheries for future use by MFMR;
- train MFMR personnel and project staff in data collection and analysis while developing working relationships with colleagues in the Department of Fisheries, Zambia.

It is hoped the that the river survey will answer the following key questions (among others):

- Who (nationality, sex, age) is participating in the subsistence and recreational fisheries?
- What is the fishing effort with different gears in the subsistence and recreational fisheries?
- What are the catches in different gears in the subsistence and recreational fisheries?
- Where and to what extent does fishing with different gears take place in different areas and habitats?

1.3 Objectives of this report

This report uses the first 12 complete months of data and the developed systems of data analysis (GIS and Access) to present the preliminary results for these 12 months of field work. It is stressed that this report is a presentation of results only – there are further steps to be taken in the analysis of this information and in the integration with other components of the SRM project, which will be addressed in the future. The final survey for the 12 month period reported in this document was conducted in February 2003.

1.4 Linkages to other research components

As explained earlier, the River Fisheries Study is just one component of the SRM project. Other components include surveys of the fish market, household surveys (questionnaires and focused group discussions), village consultations on future management systems and work with neighbouring countries. The MFMR has also been conducting biological research in similar study areas in eastern Caprivi. In order to get the full benefit of increased understanding of fishing systems, these different pieces of research should be combined, with cross-tabulations and further analysis of the data and the broader environment. Many of these linked pieces of research are currently being written up (in some cases surveys are still being completed), so at this point there is insufficient time to allow integrated analysis. However, the MFMR and various partners have stated their full commitment to further work and resources have been allocated to ensure that the different components can be integrated and provide an extremely valuable tool for future decision-making.

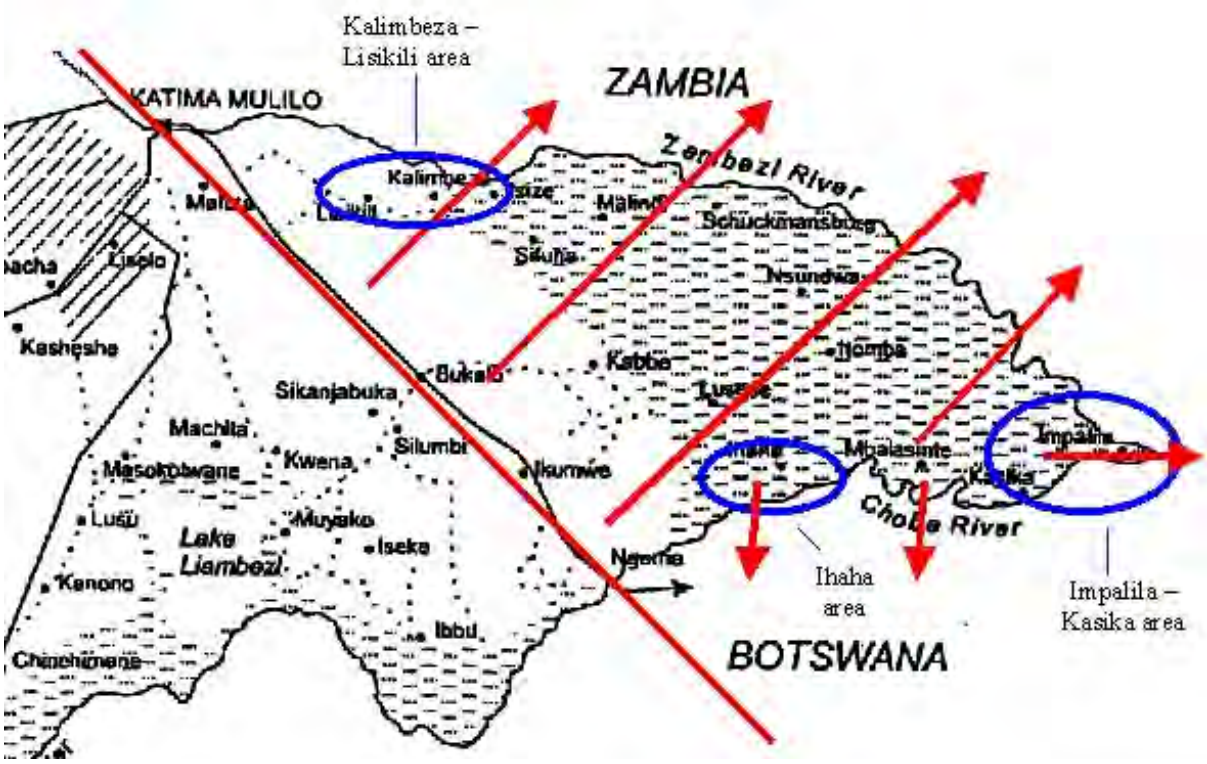
During this integrated analysis using data and information from the SRM project and other work undertaken by the MFMR, the following questions should be answered:

- What is the resource status of fish populations in the Zambezi and Chobe rivers?
- What will be the effects of different regulations on people and fish resources?
- What are the potential effects of different management regimes in the riparian countries?
- What might the impact of banning foreign fisherfolk from Namibian waters and vice versa be?

2. METHODS

The River Fisheries Study was performed in three areas of the Zambezi and Chobe river systems (Figure 1). These three areas, *Kalimbeza* – Lisikili (including *Lake Lisikili*) in the upper area of the Namibian part of Zambezi River; *Impalila* – Kasika in the area where the Zambezi and Chobe Rivers meet; and *Ihaha* in the Chobe River, are representative of larger areas of these river systems in terms of biophysical and demographic characteristics. Information from the River Fisheries Study can be extrapolated to most of the Zambezi–Chobe system. (The tables below present results only for these four study areas, they have not been extrapolated.)

Figure 1 Study area of the Shared resource management on the Zambezi/Chobe river systems in northeast Namibia project



The River Fisheries Study was done on a monthly basis. During the surveys, information regarding subsistence fishing, fisherfolk, fishing effort with different gears and catches and recreational fishing activity were described and recorded (see Næsje et al., 2002).

To optimise data collection, each area was surveyed both in the evening (when gill nets are set) and in the morning (when the gill nets are emptied). Whenever the survey activities were be restricted due to logistical constraints, the morning survey was given priority. During the survey period, the registration/recording of subsistence fishing activities taking place during other parts of the day, e.g. seining, drag netting and the use of traditional gears was given priority. Due to time constraints in the morning, as people remove their nets, priority was also given to collecting data on fishing effort (description of gears used) rather than on catches. Catch data have, however, been sampled when not in conflict with the effort study.

Depending on the season and weather conditions, the time spent in the different areas to get a representative sample varied between three and five days. Most variables and information can be studied with respect to monthly variations in sampled parameters and spatial variations (between the three sampling areas).

The documented survey methods used in the River Fisheries Study have been maintained after some small adjustments made following the initial survey by the SRM team in February 2002 (Næsje et al., 2002; Annex 1). On all regular river fisheries surveys, the survey team has also registered the recreational fishing activity.

2.1 Subsistence fisheries

In the study of the subsistence fishery data was collected with regard to:

- characteristics of the fisherfolk (sex, age, nationality);
- fishing gear in use and that owned but not currently in use;
- where and in which habitat gears are used;
- which side of the river (i.e. in which country) fisherfolk of different nationalities fish;
- availability of gears (in use by, and in possession of, fisherfolk);
- description of different gears (e.g. mesh size, gill net length);
- the location (GPS) of fishing gear; and
- the catch of fish in different gears (where possible).

The difficulties of recording fishing effort and catch while trying to maintain a fixed survey route and time have been mentioned already. Information on the catch per unit effort (cpue) of gill nets was obtained from other activities of the MFMR/SRM project e.g. the Community Catch Data Collection project (where fishermen on Impalila Island record their catches five days a month for the MFMR).

2.2 Data storage

Data has been stored and compiled in the use–relation database programme, Microsoft Access. Tables have been created (Tables 1 to 5) to simplify the compilation and analysis of the survey data. Data stored in the Access database is easily be transferable to Microsoft Word, Microsoft Excel and SPSS. Data can also be compiled and analysed in Access. Questions (formulas) to select or analyse stored data can be saved and used repeatedly on existing and new databases.

Spatial analysis has been carried out on the results by the MFMR using ArcView. At this stage the results from this analysis are limited but should be further advanced with the detailed analysis.

2.2.1 Survey description

The data from the River Fisheries Study is compiled in five main data tables. Each of these tables are connected or linked to make analyses simple. Table 1 contains information relating to the morning and evening surveys (e.g. date, a.m. or p.m., survey area, name of the place the survey started from and ended, total kilometres surveyed, etc.).

Table 1 Survey description

SurveyId	Survey identification number
Survdate	Survey date
Mnd	Month of survey (letters)
Mndtall	Month of survey (number)
From	Start of survey (name)
To	Turning point of survey (name)
Area	Main area of survey – one of four areas.
AM/PM	Morning or evening survey
Timestart	Time at start of survey
Timeend	Time at end of survey
GPSstarS	GPS position of survey start, south
GPSstarE	GPS position of survey start, east
GPSturnS	GPS position of turning point of survey south
GPSturnE	GPS position of turning point of survey, east
GPSendS	GPS position of survey end, south
GPSendE	GPS position of survey end, east
Weather	Weather during survey
Totalkm	Total km driven by boat during survey
Watertemp	Water temperature
Ways	One or two ways survey of the study area

2.2.2 Fishery description

Table 2 contains information related to each specific interview of fishers, or observation of fishing gears, (e.g. time of observation, position of gear, information collected from interview or own observations, adult or juvenile, sex, where the fisher lives, position of the gears, etc.).

Table 2 Fishery description

SurveyId	Survey identification number
FisheryId	Fishery identification number
Time	Date and time of registration
Reg	Gill net registered previous evening
GPSS	GPS – south position of gear
GPSE	GPS – east position of gear
Interview	Information obtained from interview or not
Activity	The activity of informant when interviewed
Gearuse	Number of gears in use
GearLand	Number of gears not in use
FishersN	Number of fisherfolk
Male	Number of males
Female	Number of females
Adult	Number of adults
Juvenile	Number of juveniles
Village	Name of informants village/fishing village
Border	Fishing on Namibian/Zambian/Botswanan side of river
Habitat	Habitat: Mainstream/backwater/lake
Current	Is the gear placed in current? Yes/no
Water flow	Water flow: Still/running
PosVeg	Position of vegetation
Angle	Angle of the gear (gill net) from shore
Waterdepth	Water depth (m) where the gear is placed

2.2.3 Gear description

The gear description table (Table 3) contains information related to each recording of the gears registered (e.g. type of fishing gears, if the gear is in use or not in use, mesh size of gill nets or seine nets, etc.).

Table 3 Gear description

SurveyId	Survey identification number
FisheryId	Fishery identification number
GearId	Gear identification number
Geartype	Type of fishing gear, e.g. gill net, drag net, *siyandi* etc.
Use	Gear in use/not in use, On land=0; In use (in water)=1
Mesh size	Stretched mesh of gill nets and drag nets (mm)
Length	Length of gill net or drag net
Fishtime	Hours fish with drag net
Catchnet	Registered catch caught in one (1) or more (2) mesh sizes

2.2.4 Catch description

The table (Table 4) contains information related to catch in the recorded gears (e.g. name of species caught, fish length, fish weight, etc.).

Table 4 Catch description

SurveyId	Survey identification number
FisheryId	Fishery identification number
GearId	Gear identification number
Catch Id	Catch identification number
Species	Name of fish species caught
Length	Length of fish (mm)
Weight	Weight of fish (g)

2.2.5 Species description

This table (Table 5) contains information on the common (English), local and Latin names of the species caught.

Table 5 Species name

Species	English name of species
Local	Local name of species
Latin	Latin name of species

2.3 Recreational fisheries

In the study of the recreational fishery data was collected with regard to:

- number of recreational boats fishing on the rivers;
- number of anglers per boat and number of rods in use;
- fishing method (trolling, worms or spinning);
- anglers fishing from land or boat;
- catch description (species, size);
- catch per unit effort;
- proportion of fish released and kept;
- location of recreational fishing boat (GPS);
- daily fishing effort (time fishing).

Information on the recreational fisheries is collected on every River Fisheries Study performed by the project team (see Næsje et al., 2002). In addition, in some months information on fishing activity and catch has been recorded at one fishing lodge in the Kalimbeza area.

Information from the annual fishing competition held on the Zambezi River, based in Kalimbeza, will be used in the final analyses. Information will also be sought from other fishing lodges.

2.4 Survey overview

In the period between February 2002 and February 2003, 242 surveys were conducted by the river research team to register subsistence and recreational fishing activity on the Zambezi and Chobe Rivers (Table 6). During these surveys approximately 7,850km of river was examined and 4,895 gears were registered and described. The majority of surveys were conducted in the Kalimbeza and Impalila areas (88 and 81 respectively). While 39 and 34 surveys were conducted in the Ihaha and Lake Lisikili area respectively. Generally the same areas were monitored both in the evening and the following morning, resulting in 356 gears being registered twice, and subsequently omitted from this analyses.

The data collected enables a large amount of analysis relevant to the description of subsistence fisheries in the Zambezi and Chobe River systems. For example, data can be sorted by survey area or separate surveys, fishing gears can be separated, the fisherfolk and their activity described (sex, where they live and fish, where they use their gears), catches in different gears and annual (monthly) variations described.

Table 6 Number of surveys, kilometres surveyed, and number of gear registrations, February 2002–February 2003

A Kalimbeza

Area	Month	No. of surveys	km surveyed	No. of gears registered
2002	February	4	134.9	44
	March	11	537.9	363
	April	6	338.2	204
	May	6	257.1	76
	June	7	314.2	204
	July	6	217.5	273
	August	7	360.5	231
	September	7	166.4	159
	October	6	94.7	107
	November	7	247.2	181
	December	7	262.3	105
2003	January	7	257.8	117
	February	7	305.4	217
Total		88	3,494.1	2,281

B Lisikili

Area	Month	No. of surveys	km surveyed	No. of gears registered
2002	Feb/March	3	26.5	27
	Feb/March	2	Not registered	18
	May	4	41.3	20
	October	11	45.7	55
	November	4	30.6	32
	December	3	19.5	32
2003	January	4	30.1	38
	February	3	23.4	38
Total		34	217.1	260

C Impalila

Area	Month	No. of surveys	km surveyed	No. of gears registered
2002	March	9	381.5	206
	April	5	235.8	86
	May	6	280.8	74
	June	7	348.1	109
	July	7	297.0	265
	August	6	296.4	265
	September	7	236.1	175
	October	7	151.8	169
	November	6	275.2	105
	December	7	333.0	139
2003	January	7	347.6	154
	February	7	363.8	277
Total		81	3,547.1	2,049

D Ihaha

Area	Month	No. of surveys	km surveyed	No. of gears registered
2002	March	3	32.7	21
	April	3	60.4	19
	May	4	74.9	18
	June	3	41.4	35
	July	4	70.4	112
	September	2	18.9	9
	October	4	28.6	11
	November	4	59.9	18
	December	4	66.0	13
2003	January	5	74.5	22
	February	3	57.7	27
Total		39	585.4	305

3. RESULTS

3.1 Subsistence fishing

3.1.1 Gears used

Gill nets were the most common gear used in the subsistence fisheries within the surveyed areas of the Zambezi and Chobe rivers, constituting 80 per cent of all gears in use (Table 7). Drag netting was also a frequently registered activity (seven per cent). One should notice, however, that due to repeated surveys in the same areas, the actual number of drag nets and drag net parties are much smaller than the drag net activity registered (as for the other gears). The number of people fishing with hand lines constituted six per cent. The stationary traditional fish trap, *siyandi*, was the most frequently registered traditional gear, although only in certain months of the year.

Table 7 Total number of gears registered and the number in use, February 2002–February 2003

Gear	Bashing	Dragnet	Drift	Gillnet	Hand line	Light and spear	Spear	Mosquito net	*Siyandi*	Total
No. in use	3	282	10	3,172	230	5	4	6	247	3,959
No. registered	3	321	13	3,704	230	5	4	8	256	4,544

NB: Gears registered both during evening and morning surveys are only counted once.
Gears may be registered several times due to multiple surveys periods (months) in the same area.

Fisherfolk encountered on or along the river were asked what kind of fishing gear they used and whether any gear was stored on land. In total, 1,652 interviews mere conducted. Omitting people interviewed both in the evening and the consecutive morning, 1,202 people were fishing with gill nets (Table 8), though not all gill nets were in use. Based on this information, the proportion of gill nets in use was 57–97 per cent in Kalimbeza, 92–100 per cent in Lake Lisikili, 72–90 per cent in Impalila and 0–100 per cent in Ihaha. The number of people interviewed varied greatly between the areas (between 44 and 621 interviews). The results from Kalimbeza (621 interviews) and Impalila (474 interviews) are the most representative for the variations in the proportion of gill nets in use (Figure 2). In the Impalila area, more than 80 per cent of gill nets were in use in most periods, while the variation was larger in the Kalimbeza area. In both areas, most gill nets were in use July, August and December 2002. However in the Kalimbeza area, the proportion of gill nets in use was lower than in the Impalila area in March, April, September and October, being lowest in October with approximately half of the gill nets in use (57 per cent).

Table 8 The proportion of gill nets in use, February 2002–February 2003[1]

A Kalimbeza

Area	Month	Gill nets in use	Gill nets not in use	Total no. of gill nets	% of gill nets in use	No. of gill net fishers interviewed
2002	February	15	8	23	65.2	12
	March	190	82	272	69.9	102
	April	131	52	183	71.6	62
	May	38	9	47	80.9	22
	June	132	24	156	84.6	70
	July	126	8	134	94.0	63
	August	103	10	113	91.2	54
	September	66	28	94	70.2	47
	October	25	19	44	56.8	25
	November	76	19	95	80.0	49
	December	29	1	30	96.7	20
2003	January	35	10	45	77.8	27
	February	97	35	132	73.5	68

B Lisikili

Area	Month	Gill nets in use	Gill nets not in use	Total no. of gill nets	% of gill nets in use	No. of gill net fishers interviewed
2002	February	2	0	2	100.0	1
	March	11	1	12	91.7	8
	May	16	1	17	94.1	7
	October	10	0	10	100.0	7
	November	15	0	15	100.0	9
	December	13	0	13	100.0	8
2003	January	22	0	22	100.0	10
	February	19	0	19	100.0	13

1 Data is based on interviews of fisherfolk along the rivers. The numbers of persons interviewed are people only registered once during the evening and morning survey in an area, and people that have gill nets in use or stored on land.

C Impalila

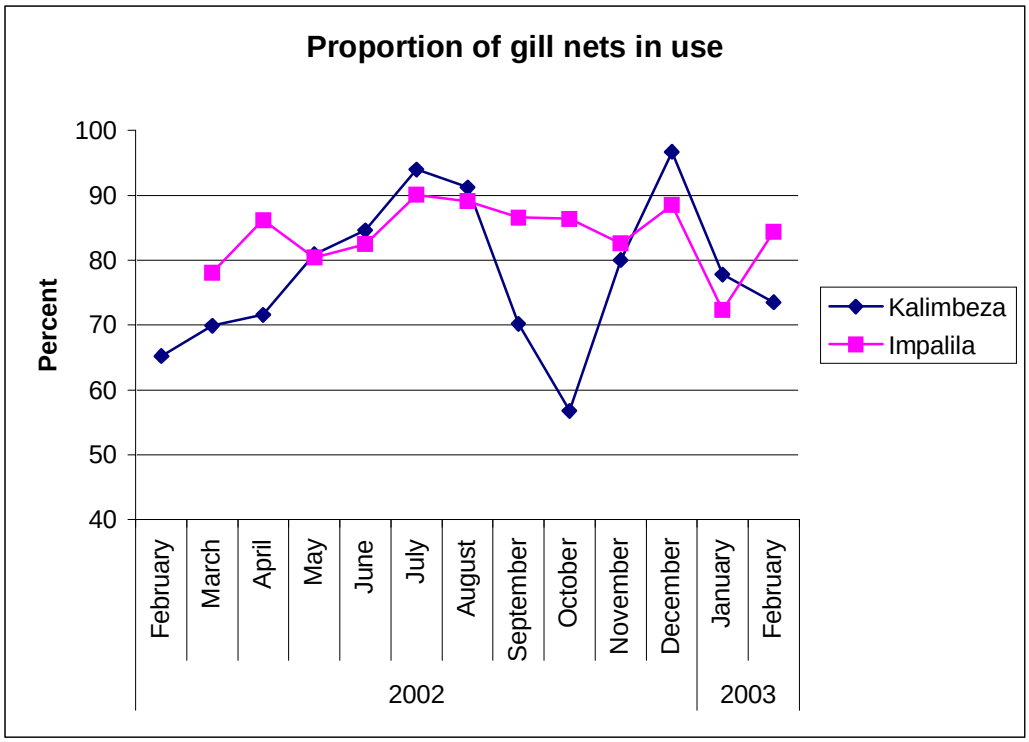
Area	Month	Gill nets in use	Gill nets not in use	Total no. of gill nets	% of gill nets in use	No. of gill net fishers interviewed
2002	March	107	30	137	78.1	59
	April	50	8	58	86.2	30
	May	41	10	51	80.4	19
	June	66	14	80	82.5	34
	July	173	19	192	90.1	70
	August	196	24	220	89.1	70
	September	84	13	97	86.6	39
	October	70	11	81	86.4	41
	November	38	8	46	82.6	22
	December	23	3	26	88.5	13
2003	January	47	18	65	72.3	33
	February	76	14	90	84.4	44

D Ihaha

Area	Month	Gill nets in use	Gill nets not in use	Total no. of gill nets	% of gill nets in use	No. of gill net fishers interviewed
2002	March	4	3	7	57.1	4
	April	4	2	6	66.7	5
	June	16	3	19	84.2	7
	July	32	1	33	97.0	18
	September	0	3	3	0.0	1
	November	2	3	5	40.0	2
2003	January	6	0	6	100.0	3
	February	5	2	7	71.4	4

1 Data is based on interviews of fisherfolk along the rivers. The numbers of persons interviewed are people only registered once during the evening and morning survey in an area, and people that have gill nets in use or stored on land.

Figure 2 Proportion of gill nets in use in Kalimbeza and Impalila areas, February 2002–February 2003 (based on interviews of fishermen)



3.1.2 Gill nets and mesh sizes

Most frequently, gill nets were set in or close to vegetation (i.e. stationary). However, several times (10), gill nets were used as floating drift nets in the Kalimbeza area. Since stationary and drifting nets are both gill nets, they are pooled in our analysis. Total number of gears in use – especially gill nets – and the number per kilometre varied between the survey periods (Table 9 and Figure 3) (see Annex 2 for the mapped results of gear registrations).

In the periods February–May 2002 and November 2002–February 2003, the number of gill nets in use per kilometre was low and less than 0.5 in all three river areas (Table 9 and Figure 3). In most of the sampling within this period, the density of gill nets in the Ihaha area was lower than in the two other areas. In April and May 2002 and September 2002–February 2003, densities were less than 0.2 gill nets per kilometre. In all three areas, maximum densities of gill nets were registered in July. The highest density – 1.5 gill nets per kilometre – was registered in the Ihaha area. In the Impalila area, the densities of gill nets were at similar high levels in the period July–October (0.6–0.8 gill nets/km).

Table 9 Numbers of gears and gill nets (including drift nets) in use and per km, February 2002–February 2003[1]

A Kalimbeza

Area	Month	km surveyed	No. of gears in use	No. of gears in use/km	No. of gill nets in use	No. of gill nets in use/km
2002	February	134.9	30	0.22	23	0.17
	March	537.9	248	0.46	216	0.40
	April	338.2	147	0.43	139	0.41
	May	257.1	59	0.23	46	0.18
	June	314.2	173	0.55	156	0.50
	July	217.5	260	1.20	240	1.10
	August	360.5	209	0.58	181	0.50
	September	166.4	125	0.75	94	0.56
	October	94.7	88	0.93	42	0.44
	November	247.2	141	0.57	92	0.37
	December	262.3	94	0.36	41	0.16
2003	January	257.8	94	0.36	63	0.24
	February	305.4	141	0.46	124	0.41
Total		3,494.1	1809	0.52	1,457	0.42

B Lisikili

Area	Month	km surveyed	No. of gears in use	No. of gears in use/km	No. of gill nets in use	No. of gill nets in use/km
2002	Feb/March	26.5	27	1.02	26	0.98
	Feb/March	Not registered	18		17	
	May	41.3	20	0.48	20	0.48
	October	45.7	48	1.05	29	0.63
	November	30.6	32	1.05	22	0.72
	December	19.5	31	1.59	24	1.23
2003	January	30.1	34	1.13	28	0.93
	February	23.4	35	1.50	33	1.41
Total		217.1	245	1.13	199	0.92

1 Gears registered both during evening surveys and surveys the following morning are only counted once.

C Impalila

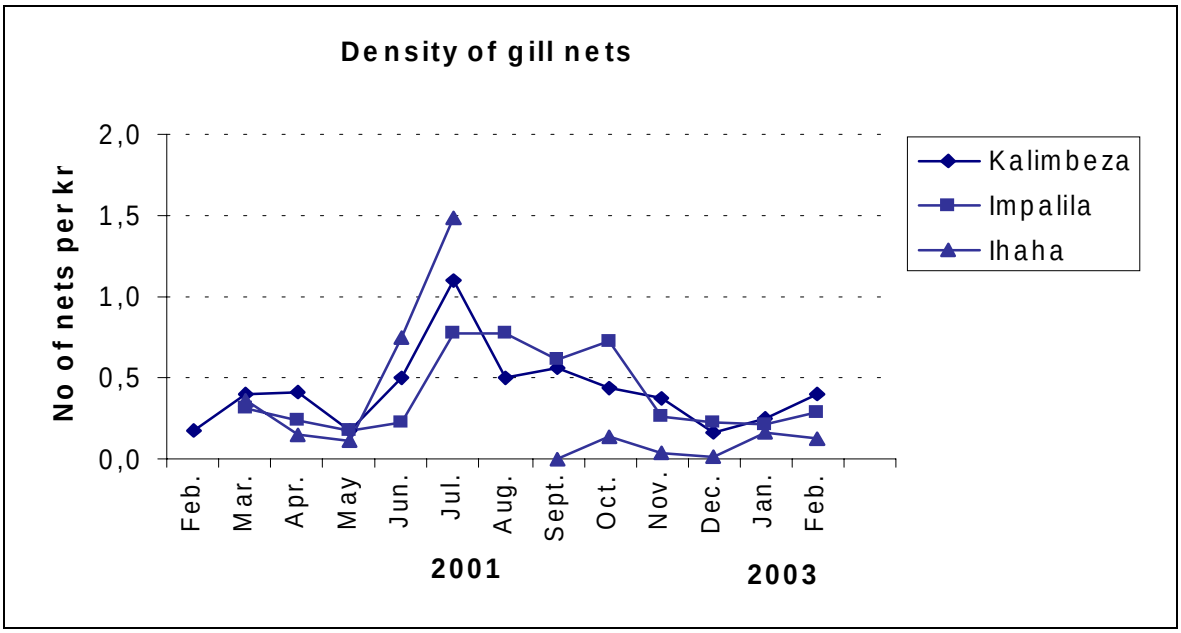
Area	Month	km surveyed	No. of gears in use	No. of gears in use/km	No. of gill nets in use	No. of gill nets in use/km
2002	March	381.5	153	0.40	117	0.31
	April	235.8	65	0.28	55	0.23
	May	280.8	52	0.19	49	0.17
	June	348.1	80	0.23	79	0.23
	July	297	236	0.79	231	0.78
	August	296.4	233	0.79	231	0.78
	September	236.1	161	0.68	144	0.61
	October	151.8	143	0.94	110	0.72
	November	275.2	85	0.31	72	0.26
	December	333	112	0.34	75	0.23
2003	January	347.6	119	0.34	73	0.21
	February	363.8	209	0.57	103	0.28
Total		3,547.1	1648	0.46	1,339	0.38

D Ihaha

Area	Month	km surveyed	No. of gears in use	No. of gears in use/km	No. of gill nets in use	No. of gill nets in use/km
2002	March	32.7	18	0.55	12	0.37
	April	60.4	12	0.20	9	0.15
	May	74.9	11	0.15	8	0.11
	June	41.4	32	0.77	31	0.75
	July	70.4	111	1.58	105	1.49
	September	18.9	6	0.32	0	0.00
	October	28.6	8	0.28	4	0.14
	November	59.9	15	0.25	2	0.03
	December	66	11	0.17	1	0.02
2003	January	74.5	20	0.27	12	0.16
	February	57.7	13	0.23	7	0.12
Total		585.4	257	0.44	191	0.33

1 Gears registered both during evening surveys and surveys the following morning are only counted once.

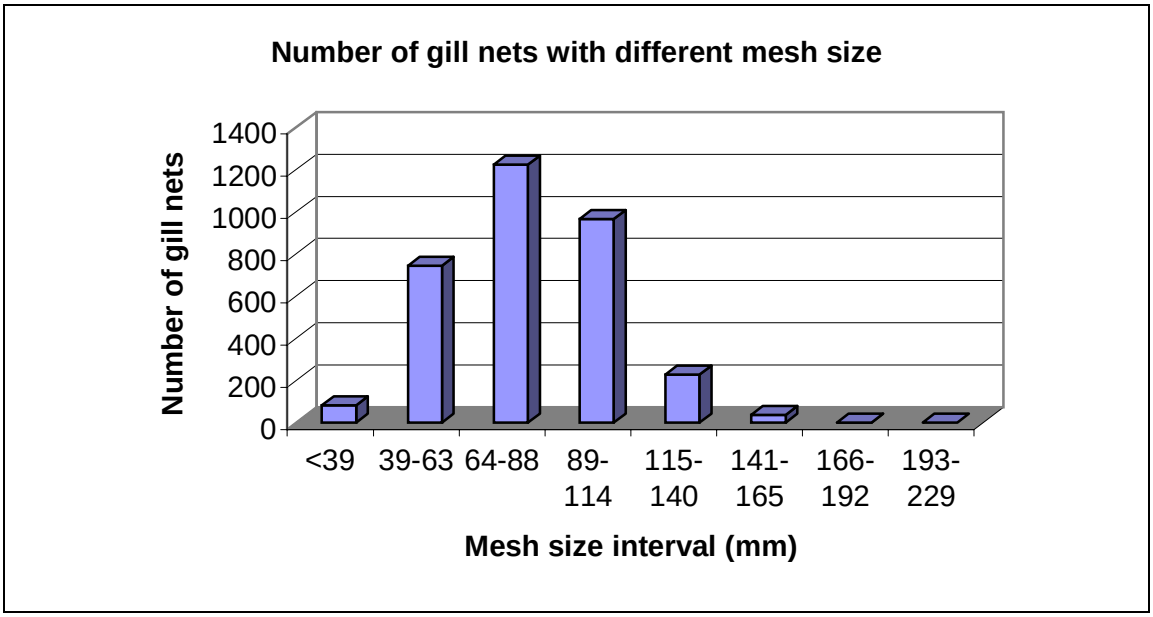
Figure 3 Number of gill and drift nets registered in use per km, February 2002–February 2003[1]



1 Gill nets n=3,172; drift nets n=10. Lake Lisikili is not included in the Kalimbeza area. Gears registered both during evening surveys and surveys the following morning are counted only once.

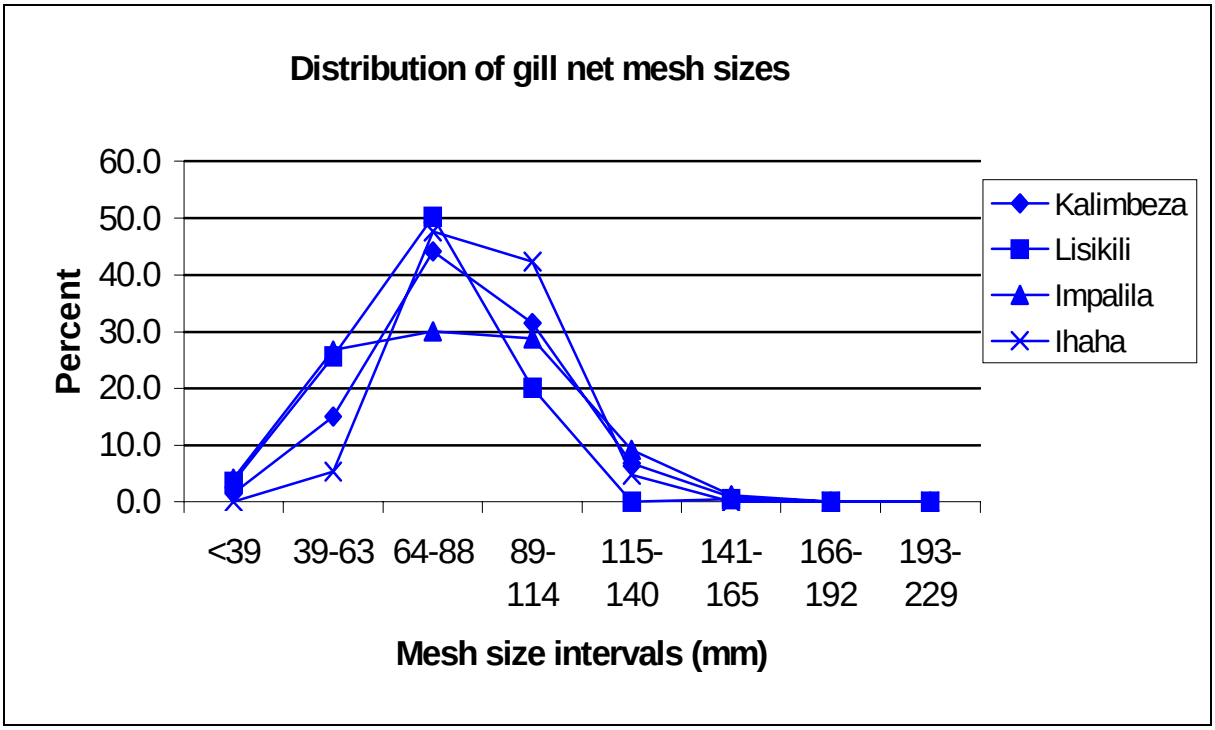
The most frequent mesh sizes used in the subsistence gill net fisheries were mesh size groups 64–88mm (2.6–3.5 inch) and 89–114mm (3.6– 4.5 inch), each constituting between 20 and 50 per cent of the gill nets registered in the four survey areas (Figure 4 and Figure 5). When pooling the results from all sampling periods, these mesh sizes were most common in the Ihaha area (90%), Kalimbeza (76%) and Lisikili (70%), but constituted only approximately half of the gill nets (59%) in the Impalila area. In the Impalila area, smaller mesh sizes (39–63mm or 1.6–2.5 inch) were as common as the two larger groups of mesh sizes, constituting between 27 and 30 per cent.

Figure 4 Number of gill and drift nets of different mesh size ranges used, February 2002–February 2003[1]



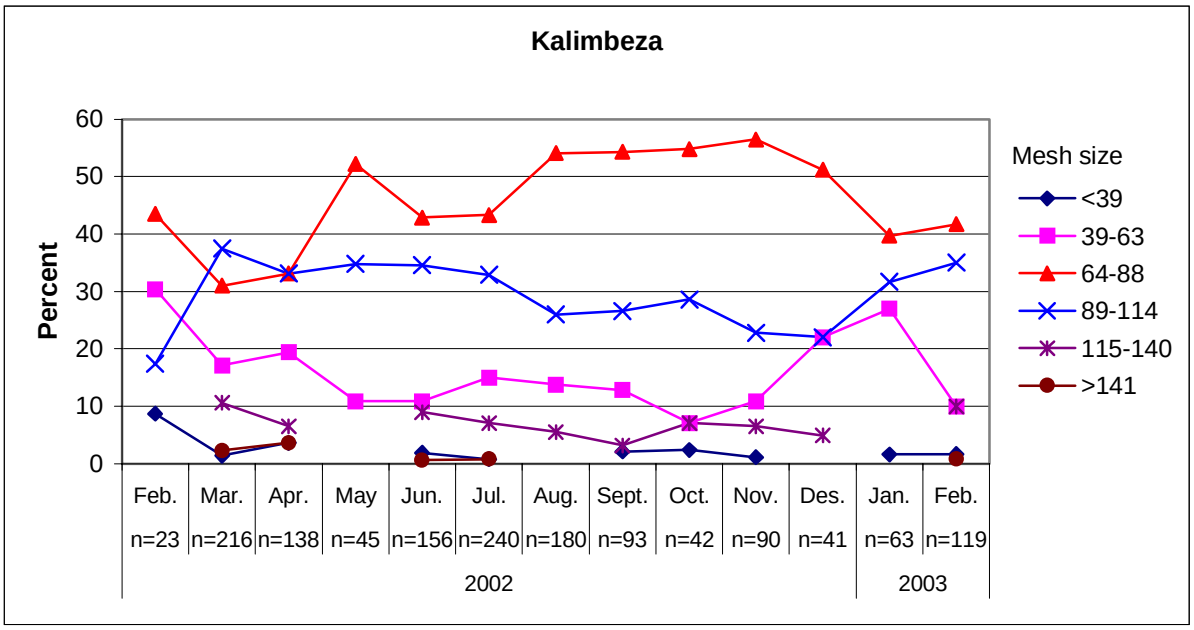
1 Gill nets n=3,172; drift nets n=10. One inch equals 25.4mm, and the mm groups equals inch groups 1 to 8. Nets registered both during evening surveys and surveys the following morning are only counted once.

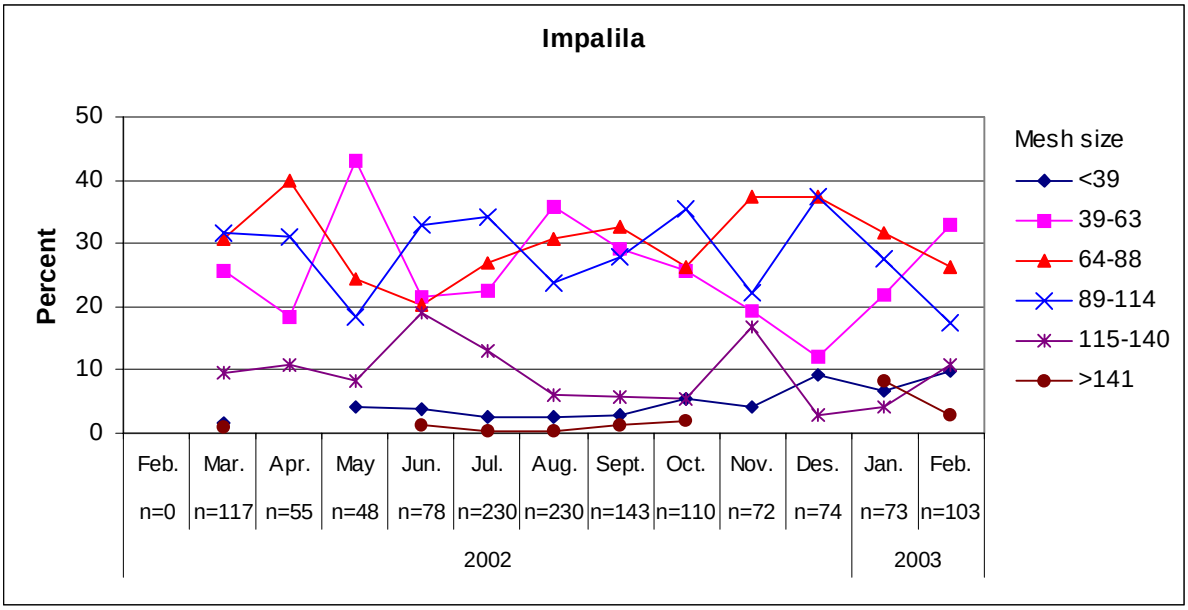
Figure 5 Frequency (%) of gill and drift nets of different mesh size ranges used, February 2002–February 2003

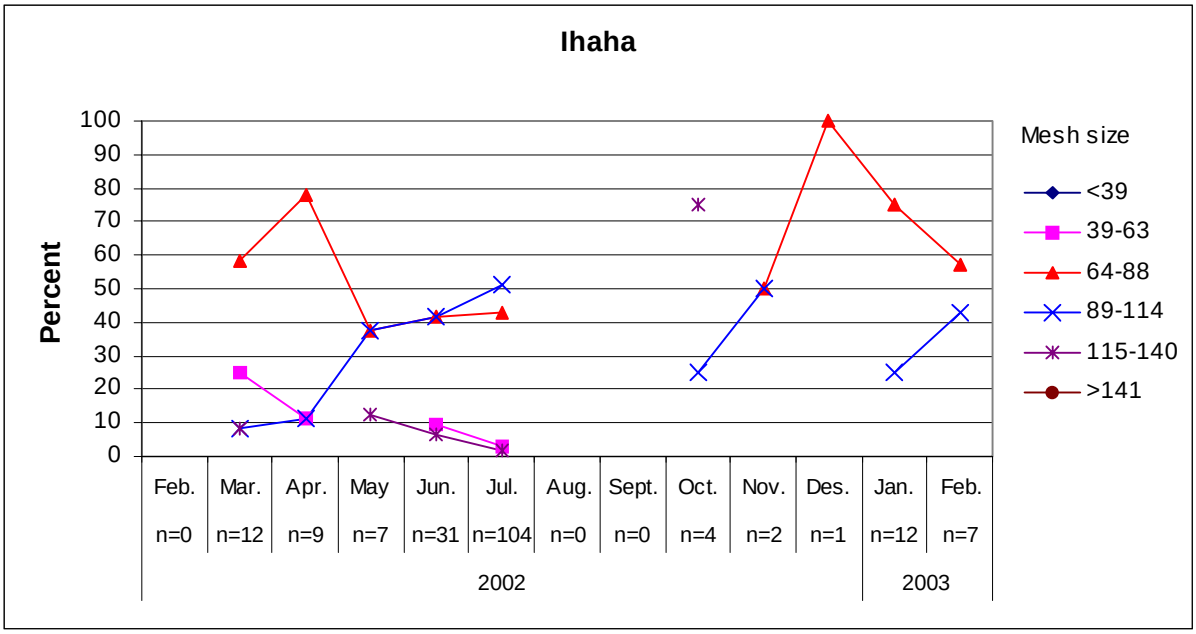


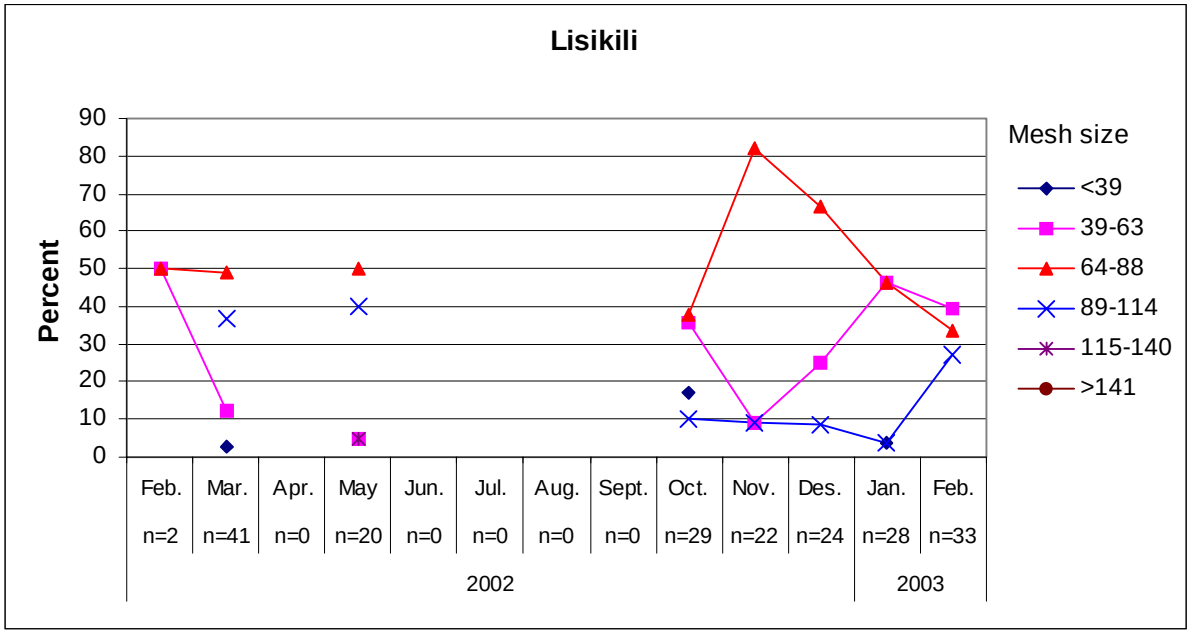
1 Gill nets n=3,172; drift nets n=10. One inch equals 25.4mm, and the mm groups equals inch groups 1 to 8. Nets registered both during evening surveys and surveys the following morning are only counted once.

Figure 6 Monthly variation in use of different gill net mesh sizes (mm), February 2002–February 2003 (n is the number of gill nets registered)




Impalila
Percent
50
40
30
20
10
0
Feb. n=0
Mar. n=117
Apr. n=55
May n=48
Jun. n=78
Jul. n=230
Aug. n=230
Sept. n=143
Oct. n=110
Nov. n=72
Des. n=74
Jan. n=73
Feb. n=103
2002
2003
Mesh size
<39
39-63
64-88
89-114
115-140
>141


Ihaha
Percent
100
90
80
70
60
50
40
30
20
10
0
Feb. n=0
Mar. n=12
Apr. n=9
May n=7
Jun. n=31
Jul. n=104
Aug. n=0
Sept. n=0
Oct. n=4
Nov. n=2
Des. n=1
Jan. n=12
Feb. n=7
2002
2003
Mesh size
<39
39-63
64-88
89-114
115-140
>141


Lisikili
Percent
90
80
70
60
50
40
30
20
10
0
Feb. n=2
Mar. n=41
Apr. n=0
May n=20
Jun. n=0
Jul. n=0
Aug. n=0
Sept. n=0
Oct. n=29
Nov. n=22
Des. n=24
Jan. n=28
Feb. n=33
2002
2003
Mesh size
<39
39-63
64-88
89-114
115-140
>141

The variations in use of different mesh sizes between most periods within the study areas were small (Figure 6) – thus the majority of the available gill nets were in use in most periods (Table 8). The proportion of the different mesh sizes used varied between the areas. In the Kalimbeza area the 64–88mm mesh sizes (2.6–3.5 inch) were the most frequently used in all periods except March and April (when larger gill nets, 89–114mm (3.6–4.5 inch) were used as or more frequently). In the Impalila area, smaller mesh sizes of 39–63mm (1.6–2.5 inch) were more important in most periods compared to 64–88mm nets. In the Ihaha area, most gill nets used had mesh sizes between 64 and 114mm in all months except October. In Lake Lisikili the mesh sizes 39–63mm, 64–88mm and 89–114mm were all important but to a varying degree in the different periods.

3.1.3 Fishing activity on Namibian and Zambian side of the Zambezi River

With the exception of Lake Lisikili, the rivers in the study areas border two or three countries – Kalimbeza (Namibia and Zambia), Impalila area (Namibia and Zambia in the upper part, Zambezi River, and Namibia and Botswana in the lower part, Chobe River), Ihaha area (Namibia and Botswana). In addition, most of the studied part of the Chobe River (Ihaha and Impalila areas) borders Chobe National Park in Botswana, where fishing is prohibited on the Botswanan side. Therefore, the Kalimbeza area is the best area to study the trans-boundary subsistence fishing activities.

The location of villages (i.e. country) where fisherfolk live was registered when they were interviewed. These data are not yet analysed due to some logistical problems. This information will enable the study of Namibian and Zambian fisherfolks' activities, and to what extent they fish on the other opposite side of the river (i.e. in their neighbouring country).

In the Kalimbeza area, subsistence fishing activity took place on both sides of the river (Table 10). Registration may underestimate the percent of gears on the Zambian side, as a larger number of backwaters and channels (Kalimbeza Channel) were studied on the Namibian side. In spite of this, approximately half of gill net fishing took place on the Zambian side of the river, while 40 per cent of the registered drag net activity took place on the Zambian side, and traditional fish traps (*siyandi*) were more commonly registered on the Zambian side of the river (65%).

The closed fishing season in the Western Province of Zambia (with a river frontage from Sesheke to Mwandi) occurs between December 1 and 28 February. However, due to the recent drought, the level of enforcement of the closed season restrictions in recent years has been 'less strict than usual' (pers. comm., Department of Fisheries, Zambia).

Table 10 Different gears registered on the Namibian and Zambian side of the Zambezi River in the Kalimbeza area, February 2002–February 2003[1]

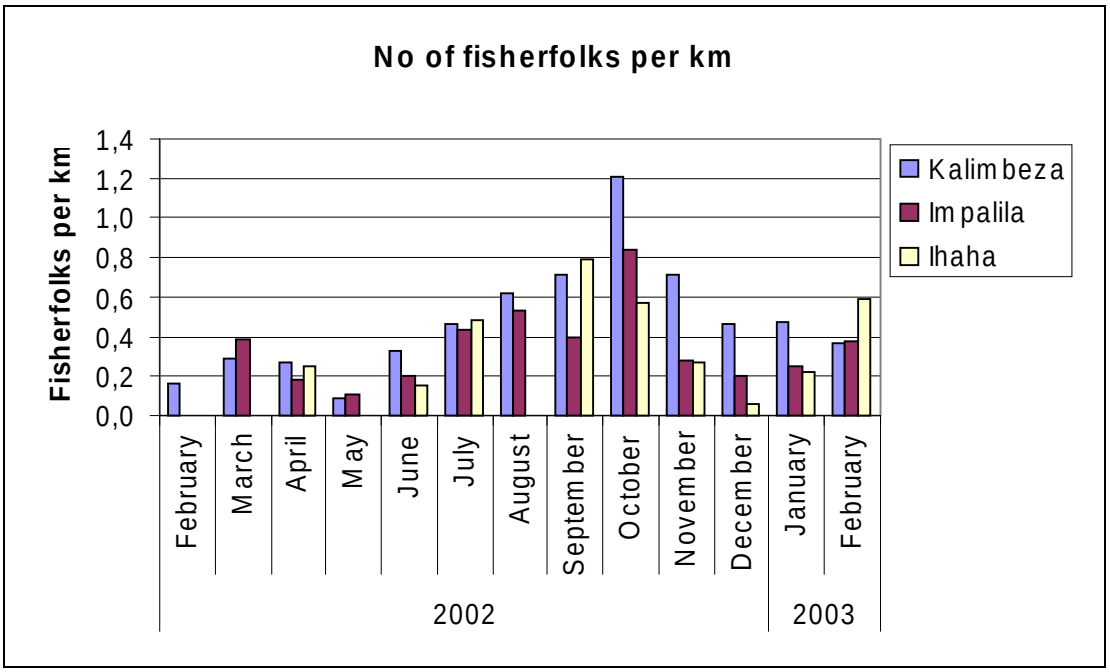
Area	Gears	No. of gears	% Namibian side	% Zambian side	% unknown
Kalimbeza	Dragnet	20	60	40	
	Drift net	7		100	
	Gill net	994	45	53	2
	Hand line	55	37	87	
	Siyandi	48	27	65	8
	Spear	2	50	50	

1 Gears registered both during evening surveys and surveys the following morning are only counted once.

3.1.4 Registration of fisherfolk

The number of fisherfolk registered per kilometre during the morning surveys varied between February 2002 and February 2003 (Figure 7). The general trend was similar in all the three river study areas. The lowest numbers were registered in May (approximately 0.1 fisherfolk per km), increasing to a peak in October (1.2 fisherfolk per km in the Kalimbeza area), and then decreasing towards November/December. There were not large differences in the density of fisherfolk between areas, except for the period October 2002–January 2003 where there appear to have been more fisherfolk per kilometre in the Kalimbeza area.

Figure 7 Mean number of fisherfolk per kilometre registered during morning surveys in the three river study areas, February 2002–February 2003



3.1.5 Habitat fished with gill nets

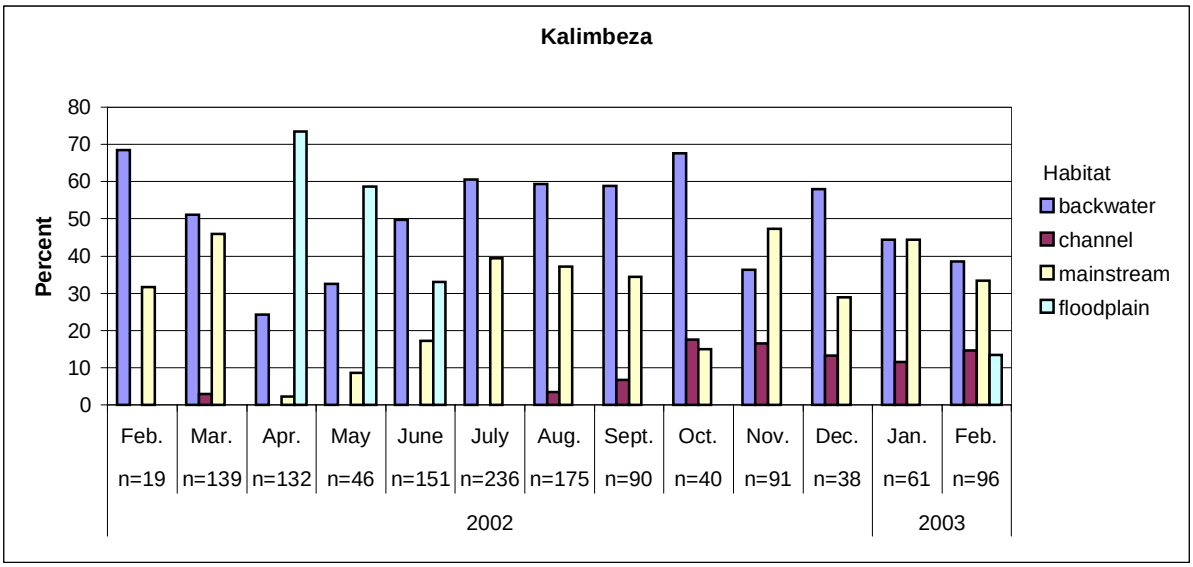
The number of registrations of fishing gears in the different habitats depends on the different habitats found in each of the study areas (e.g. the higher number of channels in the Impalila area when compared with Kalimbeza), as well as differences resulting from changes in the availability of different habitats through the year (e.g. floodplain) due to different water levels.

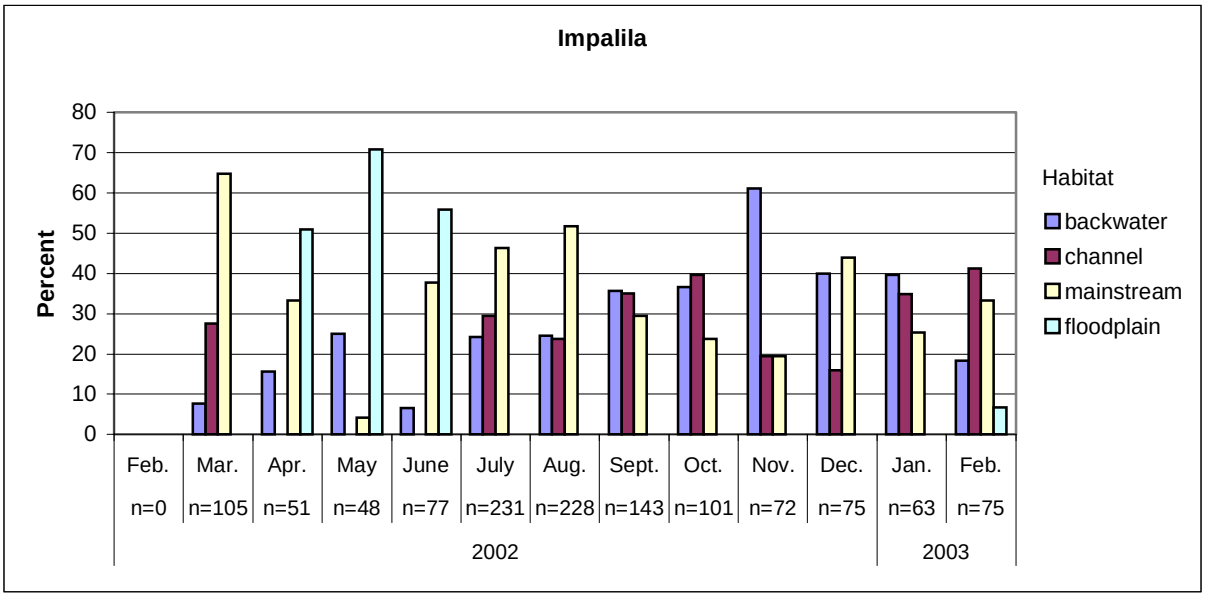
The number of gill nets registered in the Impalila area was small in most months, except in June and July. It is therefore difficult to describe the actual habitat fished in this area.

In the Kalimbeza and Impalila areas, gill netting took place in the main stream of the river, in channels, backwaters and on the floodplain. The habitat fished with gill nets varied between stations and periods studied (Figure 8). In general, more gill nets were registered in the backwater habitat in Kalimbeza than in the Impalila area, while channels were a more frequently fished habitat in the Impalila area. The main stream was a commonly used fishing habitat in both areas in most periods, except during April/May – the period when fishing on the floodplain (April–June) was most common.

The difficulty of recording fishing activity on the floodplains during April, May and June should be noted. At this time, the registration of gear can generally only be recorded when the fisherman is at the nets and can be observed. Consequently the number of registrations for fishing on the floodplains may be under-represented.

Figure 8 Habitat fished with gill nets in the Kalimbeza and Impalila areas, February 2002–February 2003





3.1.6 Catches in gill nets and drag nets

Gill net catches and drag net (seine net) catches have been recorded 93 and 39 times, respectively. All together, 1,353 fish were registered from gill net catches (Table 11), while 938 fish were registered from drag net catches (Table 12). While noting that that the number of catches studied are small compared with the number of periods and areas studied, there seem to be certain trends in the results.

More fish were caught in the average drag net catches than in gill net catches. The average catch in each gill net registration was 14.5 fish, while the registration for drag nets was 24.1 fish. However, more species were recorded in the gill net catches than in drag net catches. In the subsistence gill net fisheries, 24 species or species groups were recorded, while 17 species or species groups were recorded in the drag net fisheries. The reason for the larger number of species in the gill net catches may be that gill nets are set in a larger variety of habitats (e.g. in or close to vegetation) while drag nets can only be used in open water without vegetation or other physical obstacles.

The number of gill net catches sampled and fish registered varied between the four study areas –752 fish were registered in the Kalimbeza area, 285 in the Impalila area, 145 in the Lake Lisikili area and 171 fish in the Ihaha area. In the gill net catches in Kalimbeza and Impalila areas *Hydrocynus vittatus* (tigerfish) and *Synodontis* spp. (squeakers) were among the most important species with regard to numbers (Table 11). However, taking into account the size difference, tigerfish seem to be the most important species in the gill net catches. In the Kalimbeza area, several cichlids as *Oreochromis macrochir (*greenhead tilapia*), Tilapia rendalli* (redbreast tilapia), *Oreochromis andersonii* (threespot tilapia) and *Tilapia sparmanni* (banded tilapia) were also important. In the Impalila area, *Schilbe intermedius* (silver catfish) constituted a more important part of the gill net catches (Table 11). In both Kalimbeza and Impalila areas a large number of cichlid species were caught – 12 in Kalimbeza and 10 in Impalila – but in the Impalila area, the total number of individual cichlids in the catches were approximately half that of Kalimbeza, constituting 25 and 54 per cent respectively.

In Lake Lisikili *Hydrocynus vittatus* and *Synodontis* spp. were important species in the gill net catches, in addition to the cichlids *Serranochromis robustus* (nembwe) and *Pharyngochromis acuticeps* (Zambezi happy) (Table 11). In this area, the nine species of cichlids registered in the catches constituted 50 per cent of the total catches studied.

In the Ihaha area, furthest up in the Chobe River, *Hydrocynus vittatus* was less important in the gill net catches while *Clarias* spp. was the most important species caught, especially when taking size into account (Table 11). The cichlids *Oreochromis macrochir, Serranochromis macrocephalus* (purpleface largemouth), *Oreochromis andersonii*, and *Sargochromis giardi* (pink happy) were also important species in the catches. The cichlids (nine species) in this area constituted a larger part of the catches (70 per cent) than in the other areas.

The proportion of cichlids in the drag net catches was higher than in gill nets and constituted the majority of fish sampled – 71 per cent of the catches in the Kalimbeza area, 88 per cent in the Impalila area, 98 per cent in Lisikili area, and 96 per cent in the Ihaha area (Table 12). Among the cichlids, *Oreochromis andersonii* and *Oreochromis macrochir* were among the most important species in all areas. In addition, *Tilapia rendalli* was important in Kalimbeza and Impalila areas, and *Sargochromis giardi* in the Impalila area. Of the other species *Schilbe intermedius* was important in the drag net catches in the Kalimbeza area and *Hydrocynus vittatus* in the Impalila area.

Table 11 Catch characteristics of gill net catches, February 2002 –February 2003

Local name	Latin name	No. of individuals	Mean length (mm)	Standard deviation	Total no. caught
Kalimbeza					
Linyonga	Cyprinids	19	246	58	19
Ngweshi/Kangwelele	*Hydrocynus vittatus*	99	348	115	111
Nembele	*Marcusenius macrolepidotus*	10	195	50	17
Ndikusi	*Mormyrus lacerda*	10	344	60	10
Mulumesi/Mwelu	*Hepsetus odoe*	10	307	44	11
Lubango	*Schilbe intermedius*	25	204	24	25
Ndombe	*Clarias* spp.	17	421	127	18
Lihwetete	*Clarias stappersii*	2	215	28	2
Singongi	*Synodontis* spp.	55	223	56	128
Liulyungu	*Hemichromis elongatus*	0	-	-	1
Njinji	*Oreochromis andersonii*	29	203	63	77
Muu	*Oreochromis macrochir*	53	269	72	91
Ngandi	*Pharyngochromis acuticeps*	1	140	-	1
Nalucha	*Serranochromis altus*	6	256	99	6
Mushuna	*Serranochromis angusticeps*	8	289	93	8
Nembwe	*Serranochromis robustus*	9	260	35	9
Ngenga/Njenga	*Serranochromis macrocephalus*	16	173	39	27
Mbuma	*Sargochromis carlottae*	17	185	27	32
Siyeo	*Sargochromis giardi*	6	240	26	6
Mbufu	*Tilapia rendalli*	19	230	68	90
Situhu	*Tilapia sparrmanii*	14	146	22	63

Local name	Latin name	No. of individuals	Mean length (mm)	Standard deviation	Total no. caught
Impalila					
Linyonga	Cyprinids	1	240	-	1
Ngweshi/Kangwelele	*Hydrocynus vittatus*	49	299	118	49
Nembele	*Marcusenius macrolepidotus*	12	141	17	12
Ndikusi	*Mormyrus lacerda*	2	328	11	2
Ninga	*Pollimyrus* spp.	2	180	57	2
Mulumesi/Mwelu	*Hepsetus odoe*.	6	269	38	6
Siabela	*Parauchenoglanis ngamensis*	4	207	17	4
Lubango	*Schilbe intermedius*	29	194	42	29
Ndombe	*Clarias* spp.	10	452	171	10
Lihwetete	*Clarias stappersii*	5	364	64	5
Singongi	*Synodontis* spp.	70	183	38	94
Njinji	*Oreochromis andersonii*	9	287	60	9
Muu	*Oreochromis macrochir*	13	250	62	13
Nalucha	*Serranochromis altus*	11	364	81	11
Mushuna	*Serranochromis angusticeps*	1	335	-	1
Nembwe	*Serranochromis robustus*	7	352	81	7
Ngenga/Njenga	*Serranochromis macrocephalus*	13	256	62	13
Mbuma	*Sargochromis carlottae*	1	200	-	1
Siyeo	*Sargochromis giardi*	6	259	54	6
Mbufu	*Tilapia rendalli*	5	251	30	5
Situhu	*Tilapia sparrmanii*	5	133.4	15	5
Lisikili					
Linyonga	Cyprinids	2	2201	1	2
Ngweshi/Kangwelele	*Hydrocynus vittatus*	8	241	50	19
Nembele	*Marcusenius macrolepidotus*	6	166	19	6
Ndikusi	*Mormyrus lacerda*	2	272	3	2
Mulumesi/Mwelu	*Hepsetus odoe*	13	199	58	16
Lubango	*Schilbe intermedius*	9	214	25	9
Ndombe	*Clarias* spp.	2	338	139	2
Singongi	*Synodontis* spp.	17	132	28	17
Njinji	*Oreochromis andersonii*	8	226	30	8
Muu	*Oreochromis macrochir*	4	187	23	6
Ngandi	*Pharyngochromis acuticeps*	17	152	4	17
Nalucha	*Serranochromis altus*	1	211	-	1
Nembwe	*Serranochromis robustus*	21	150	0	21
Mbuma	*Sargochromis carlottae*	5	188	15	5
Siyeo	*Sargochromis giardi*	3	240	27	3
Mbufu	*Tilapia rendalli*	2	182	41	2
Situhu	*Tilapia sparrmanii*	9	134	9	9

Local name	Latin name	No. of individuals	Mean length (mm)	Standard deviation	Total no. caught
Ihaha					
Ngweshi/Kangwelele	*Hydrocynus vittatus*	3	293	8	3
Lubango	*Schilbe intermedius*	9	196	21	11
Ndombe	*Clarias* spp.	29	461	110	29
Singongi	*Synodontis* spp.	6	168	14	9
Njinji	*Oreochromis andersonii*	24	248	42	24
Muu	*Oreochromis macrochir*	34	194	47	34
Ngandi	*Pharyngochromis acuticeps*	1	165	-	1
Nalucha	*Serranochromis altus*	1	260	-	1
Nembwe	*Serranochromis robustus*	2	235	21	2
Ngenga/Njenga	*Serranochromis macrocephalus*	33	240	32	33
Mbuma	*Sargochromis carlottae*	1	190	-	1
Siyeo	*Sargochromis giardi*	21	199	27	21
Mbufu	*Tilapia rendalli*	2	180	7	2
Total		815			1,353

Table 12 Catch characteristics of drag net catches, February 2002–February 2003

Local name	Latin name	No. of individuals	Mean length (mm)	Standard deviation	Total no. caught
Kalimbeza					
Ngweshi/Kangwelele	*Hydrocynus vittatus*	9	437	56	9
Ndikusi	*Mormyrus lacerda*	2	249	36	2
Lubango	*Schilbe intermedius*	23	144	35	23
Ndombe	*Clarias* spp.	4	650	95	4
Njinji	*Oreochromis andersonii*	17	347	490	17
Muu	*Oreochromis macrochir*	23	233	77	24
Nalucha	*Serranochromis altus*	2	241	13	2
Mushuna	*Serranochromis angusticeps*	1	130	-	1
Nembwe	*Serranochromis robustus*	2	415	35	2
Ngenga/Njenga	*Serranochromis macrocephalus*	2	240	14	2
Mbuma	*Sargochromis carlottae*	1	190	-	1
Siyeo	*Sargochromis giardi*	4	261	90	4
Mbufu	*Tilapia rendalli*	40	272	85	40
Impalila					
Ngweshi/Kangwelele	*Hydrocynus vittatus*	12	354	67	12
Ndombe	*Clarias* spp.	2	675	21	2
Njinji	*Oreochromis andersonii*	45	239	130	45
Muu	*Oreochromis macrochir*	16	263	94	16
Nalucha	*Serranochromis altus*	2	309	12	2
Nembwe	*Serranochromis robustus*	6	397	85	6
Ngenga/Njenga	*Serranochromis macrocephalus*	3	224	19	3

Local name	Latin name	No. of individuals	Mean length (mm)	Standard deviation	Total no. caught
Impalila cont …					
Mbuma	*Sargochromis carlottae*	1	304	-	1
Siyeo	*Sargochromis giardi*	12	358	38	12
Mbufu	*Tilapia rendalli*	17	315	43	17
Lisikili					
Mulumesi/Mwelu	*Hepsetus odoe*	1	220	-	1
Njinji	*Oreochromis andersonii*	12	276	69	12
Muu	*Oreochromis macrochir*	34	208	25	34
Mbufu	*Tilapia rendalli*	2	190	14	2
Ihaha					
Ngweshi/Kangwelele	*Hydrocynus vittatus*	2	275	35	2
Nembele	*Marcusenius macrolepidotus*	1	220	-	1
Mulumesi/Mwelu	*Hepsetus odoe*	1	330	-	1
Lubango	*Schilbe intermedius*	2	220	0	2
Ndombe	*Clarias* spp.	9	444	93	14
Singongi	*Synodontis* spp.	8	131	20	8
Njinji	*Oreochromis andersonii*	135	273	84	369
Muu	*Oreochromis macrochir*	90	243	148	222
Ngenga/Njenga	*Serranochromis macrocephalus*	4	259	51	4
Siyeo	*Sargochromis giardi*	2	217	5	2
Mbufu	*Tilapia rendalli*	13	238	65	16
Situhu	*Tilapia sparrmanii*	1	160	-	1
Total		563			938

3.2 Recreational fishing

In the period February 2002–February 2003, a total distance of 12,383 km of the Zambezi and Chobe rivers was surveyed and controlled for recreation fishing activity. Recreational fishing was registered on most of the surveys on the river (Table 13). The numbers of recreational fishers was low, with an average of between 0 and 3.3 fishing parties registered per survey in the different months. The number of recreational fishers were lowest in January–June (0.1–0.9 fishing parties per survey) increasing to a peak in August (3.3 fishing parties per survey) for thereafter decreasing (1.6–2.3 fishing parties per survey).

Table 13 Overview of recreational fishing activity registered, February 2002–February 2003

Month	No. of surveys	No. of fishing parties	Total people	No. of rods	No. of parties per survey	No. of fishers per survey
2002						
February	1	0	0	0	0.0	0.0
March	22	15	50	29	0.7	2.3
April	11	5	17	14	0.5	1.5
May	21	14	44	35	0.7	2.1
June	16	14	50	30	0.9	3.1
July	17	27	96	63	1.6	5.6
August	15	50	162	137	3.3	10.8
September	17	27	82	62	1.6	4.8
October	20	35	112	78	1.8	5.6
November	3	7	24	19	2.3	8.0
December	0					
2003						
January	15	6	22	17	0.4	1.5
February	14	1	4	1	0.1	0.3
Total	172	201	663	485	1.2	3.9

The average number of fishing parties per km showed the same general pattern as the total number, being highest in the period July–November. The density of fishers was approximately twice as high in August and November as in July, September and October. However, the results from November might be biased and less correct due to the small area surveyed compared with the other periods.

Table 14 Recreational fishing activity per km, February 2002–February 2003

Month	Total km	Total parties	Parties per km
2002			
February	314	0	0
March	1,511	15	0.010
April	763	5	0.007
May	1459	14	0.010
June	1,282.1	14	0.011
July	1,333.4	27	0.020
August	1,060.7	50	0.047
September	1,067.9	27	0.025
October	1,677.8	35	0.021
November	146.4	7	0.048
December	-		
2003			
January	942.8	6	0.006
February	824.6	1	0.001
Total	12,382.7	201	0.017

4. RECOMMENDATIONS

This report presents the results from the 12 months (March 2002 to February 2003) of the River Fisheries Study on the Zambezi and Chobe rivers. The following recommendations are made with regard to the future conduct of the survey and analysis.

4.1 Future surveys' methodology and intensity

The MFMR have already given their commitment to continue survey work in the rivers/floodplains with subsistence fisherfolk and recreational fishers. It is recommended that the river surveys be done at least on a quarterly basis, surveying all the stations, and that catch recordings be done between the surveys with emphasis on the Kalimbeza and Lisikili areas. However, the surveys should be flexible enough to follow the fisheries trend in a particular year with more frequent sampling when needed – e.g. in periods with more intensive fishing activity (August–November). It is further recommended that the fisher group involved in the Community Catch Data Collection project be visited once a month to discuss problem areas and to collect the data. This will supplement the catch data from the subsistence fisheries aspect of the river survey.

4.2 Further detailed analysis

The huge amount of data collected makes a full and detailed analysis impossible within the time frame for this report. Further funding and training of MFMR staff is needed to undertake a detailed analysis of all data collected and to produce a comprehensive report. A continued study to assess the effect the Inland Fisheries Legislation may have of the fisheries would be of further of value. The data from the River Fisheries Study should also be linked with the demographic and socio-economic studies performed in fish markets, villages and other settlements collected as part of the SRM project. Based on all studies, a comprehensive data compilation may be performed and recommendation for local and regional management given.

4.3 Collaboration with Zambia

The work done to date should be used as a framework for the Upper Zambezi, to include people and institutions from Zambia, Botswana and Zimbabwe in future work. Harmonised baseline work could then be done for the entire Upper Zambezi System. The Fisheries Working Group as established by the African Wildlife Foundation for the Four Corners Project, should be used to initiate the process.

5. CONCLUSION

Very little information is available regarding the subsistence fisheries in the Zambezi and Chobe rivers. With the MFMR developing new inland fisheries legislation, it was imperative that this critical information be collected to be incorporated into the newly proclaimed regulatory measures (which are yet to be introduced).

The different types of fishing gear as well as the number of fisherfolk were recorded during the twelve month period (March 2002–February 2003). This highlights the changes in fishing intensity and gear use during a one year period, and also between different parts of the system. Fishing intensified between August and November, indicating the period when fishing plays a major part of the communities' daily activities. This may also relate to when fish protein is needed the most. Another important fact is the preference recorded for certain mesh sizes used by fisherfolk, which is information to the development of regulations. Fishing communities invest a considerable amount of money in fishing nets (such as certain mesh sizes) and fishing regulations may impact on these preferences are not carefully considered in the development of regulations.

The backwater habitats are the most important areas for the fisherfolk, with a change toward the floodplains during the high water periods. This however may also vary between the different regions on the Zambezi and Chobe rivers. This will need to be taken into account when considering possible protected areas or fishing reserves (no fishing zones).

The recreational fishery seems to have very little impact on the resource at present, with very low numbers of fishing parties located during the study period. The impact is even less considering that a large percentage of the catch is released, with only some fish kept for consumption, or large individuals for trophies.

The present study was done over a one year period to include all the seasons and water levels. The inter-year variation, may be considerable, as for example floods and precipitation needed for agricultural activities varies. It is therefore important to continue the river surveys for several years (although these are likely to be less intensive due to financial constraints) to identify trends between years. The fishing community will react to any changes in the fish resource, which in turn will be an indication of changes in the fish population.

6. THE WAY FORWARD

The dynamic nature of the Zambezi and Chobe river systems and the fish populations make it imperative that a continuous monitoring system of the exploitation of the fisheries is put in place. Once legislation is in place, it will be necessary to monitor the effect of the regulations on the resource and the only way to do this is if quantitative as well as qualitative data are available.

The good co-operation which was built up between the fisherfolk from Namibia and Zambia, as well as between the two government institutions, must continue by regular visits and communication. The research in this area must also be linked and harmonised to ensure efficient management of the resource to the benefit of both parties.

ANNEX 1 SURVEY MANUALS AND FORMS: RIVER FISHERIES SURVEY

The following manuals and forms have been prepared to study the fishing effort and catches of subsistence and recreational fisherfolk as the River Survey:

- Recording of Subsistence Fishing Effort (*Sheet 1, page 1*)
- Recording of Subsistence Catch (*Sheet 1, page 2*)
- Recording of Own Recreational Fishing (*Sheet 2*)
- Recording of Observed Recreational Fishing Activity (*Sheet 3, page 1*)
- Recording of Recreational Fish Catches (*Sheet 3, page 2*)
- Recording of Observed Seining and Drag-Net Fishing on additional trips (*Sheet 4*)

Forms and sheets must be stored in a safe place after information has been filled in. Never take them back out in the field or on the water. Make photocopies as often as possible. Data can not be reproduced, and lost data sheets are the loss of important information!

Filled in forms should always be given to the main responsible of the activity for photocopying. Three photocopies should be taken of each filled data-form (one for Hardap, one for Norway and one for Caprivi) that is filled in. The originals should be kept in the Ministry of Fisheries and Marine Resources office in Katima Mulilo ***Please note that the results from the river survey are confidential, and should not be communicated to persons outside the project team. It is important to create good relationships and some results may cause unnecessary concern.***

Recreational fishing and seining (drag netting) may be registered on additional trips on the river. However, to avoid biased results please decide before you go out if you are going to record fishing activity. Data should be registered in the appropriate form and please remember date, distance and area travelled (GPS and/or name), time and where the activities were registered (GPS and/or name), and please describe the activity.

Forms to be completed on the regular AM/PM survey in the survey area:

- Recording of subsistence fishing effort (*Sheet 1, page 1*)
- Recording of subsistence catch (*Sheet 1, page 2*)
- Recording of observed recreational angling (*Sheet 3, page 1*)
- Recording of observed recreational catch (*Sheet 3, page 2*)

Forms to be completed on additional trips (decide before going out)

- Recording of observed seining/dragnetting fishing activity (not record catches unless appropriate)
- Recording of observed recreational fishing activity (not recording catches unless appropriate)

*Subsistence Fishing Effort (*Sheet 1; Page 1*)*

Instruction for use:

The heading on the form should be filled in on page 1. Do not forget to put date and AM (morning) or PM (evening) on all sheets from each survey. Explanation to form:

1) **No:** Each record or interview is given separate numbers (record no) to identify the source of information. Start with 1 on each survey. *Example: Evening (PM) 1, 2, 3, 4, 5, 6; Morning (AM) 1, 2, 3, 4, 5, 6, 7, 8, 9.*
   If the same gear, e.g. gill net is recorded both in the evening and morning, please write it down. *Example: No 7 the same as No 2 PM (evening)*
2) **Time:** Time when record was taken.
3) **GPS position:** GPS position of gear in water, on land or position where interview was taken. Mark clearly the units that are being used.
4) **Information from:** Information can be obtained from interview with fisherfolk, gears in water or on land. The activity of people when interviewed shall also be written down. *Examples: a) Setting out net,* or *b) Mending net on land,* or *c) Preparing to set out net*
5) **Gear in use:** Give name of gear recorded. *Examples: Gill net,* or *Siyandi,* or *Seine,* or *Rod and line.* **Mesh size – length:** For each net or fisherman interviewed write down mesh size and total length of gill net or dragnet with this mesh size. *Example: 2 inch 100 m, 3 inch 200 m etc.*
6) **Gear not in use:** If you are told that some of the gill nets or drag nets are not in use, i.e. stored for use next month or later, please make a note of gear type, mesh size and length. Note down additional gear. *Example: If the person interviewed tells you that he has a seine net in addition to the gill nets recorded you may write it down here.*
7) **No, sex and age of persons fishing with gear: Male (M)/Female (F) Adult (A)/Juv. (J):** Give the number, sex and age of person(s) using the fishing gear. *Example: 3 M A and 1 F J*.
8) **Village/fishing camp:** Give the name of the village or fishing camp where the persons using the fishing gear is living in when interviewed. *Example: Lisikili*
9) **Fishing Nam./Zamb./Bot.:** Write down where the fishing activity takes place. *Example: Namibian side of the river NOT the nationality of the fisherman..*
10) **Mainstr./backwater/floodplain:** Write down the description of where the gears are set either in mainstream, backwater or floodplain.
11) **Running/still water:** Write down if the fishing gear is standing or being used in running water (current) or in still water (water without directional current). *Example: Still water*
12) **Position of gear-vegetation:** Position of gear with respect to vegetation. *Examples: a) Out from vegetation, or b) In vegetation, or c) Along vegetation.*
13) **Water depth:** Write down the water depth(s) where the fishing gear is used. *Example: 1.5-3.0 m taken from the echosounder*
14) **Comments:** Here you may write down whatever remarks you may have, or make a note for example use a letter and write your note on the backside of the record form. *Example:* Write *a)* in the form and comments like *Gill nets set on bottom, sinking. Fisherman's name was Jonatan (Zambian).*

SUBSISTENCE FISHING EFFORT:

Sheet 1; Page 1

Date:..... AM/PM……. From-to:.....……. Time start:.....… Time end.....… ***Page no:*** ____

GPS start: S…….. E…….. GPS turning: S…….. E…….. GPS end: S…….. E……..

Weather:.....…… Water temp.: …… Total km…… One or two ways:…… (Describe route on separate sheet)

	1) No:	**Example:**					
	2) Time	17 hrs 45					
	3) GPS position	S 17º31,428 E 24º36,564	**S** **E**	**S** **E**	**S** **E**	**S** **E**	**S** **Es**
INFO FROM	**Interview**	X					
	Activity of person interviewed	Setting gill nets					
	Gear in water						
	Gear on land						
DESCRIBE GEAR	**5) *Gear in use* (mesh size – length):**	Gill net 2 inch 100 m					
		Gill net 3 inch 300m					
		Dragnet 3 inch 300m					
	6) *Gear not in use:*	Gill net 2 inch 200 m					
		Drag net, 3 and 4 inch, 300 m					
	7) No, sex (M/F) and age(A/J)	2 M A, 1 F J					
	8) From village/fishing camp	Kalimbeza					
	9) Nam./Zamb./Bot. Side	Zambian					
POS. GEAR	**10) Mainstre/backwa/floodpl**	Mainstream					
	11) Running/still water	Running					
	12) Position of gear-vegetation	Along veg.					
	13) Water depth	1-5 m					
	14) Comments						

*Subsistence Fishing Catch (*Sheet 1; Page 2*)*

Instruction for use:

When a fisherman is met on the river (in the survey area or not) and if there is a catch, then this form should be used to record the catch. If the catch is from a net which is recorded as part of the standard survey (sheet 1, page 1) then there should be a cross-reference and the form attached to the other form. If there is no record to cross-reference to match then the date, position, etc should be noted.

Write down for each fishing party or fisherman: **1) Gear type used, 2) Mesh size (gill net or drag net/seine) the fish were caught in, or all mesh sizes if fish are pooled, 3) Length of fishing time, 4) The length of each gill net for each mesh size or drag net, 5) Species and body length of each fish caught.**

Minimum 15 fish of each species caught in each mesh size must be length measured. If more than 15 fish of one species, 15 randomly selected individuals should be measured and the number of unmeasured fish written down. Information on the gear can be left out if recorded on effort form. Reference **must** be given to **Record no** in effort form.

Example: a) Gill net, 2 inch, 100 m: Tigerfish: 34.0 cm, 35.5 cm 32.0 cm Redbreast: 24.5 cm, 25.2 cm

b) No 5, 16 Feb (reference to effort form): Tigerfish: 34.0 cm, 35.5 cm 32.0 cm Redbreast: 24.5 cm, 25.2 cm

c) Seine 4 inch, 300 m, 3 hours fishing: Tigerfish 34.0 cm, 35.5 cm, Greenhead 34.4 cm, 24.5 cm, 34.2 cm, 34.3 cm, 34.5 cm, 35.2 cm, 37.4 cm 35.3 cm, 35.4cm, 35.3cm 34.2 cm, 34.5 cm, 35.2 cm, 37.4 cm, 35.3 cm, plus 29 more greenhead (altogether 44 greenhead)

SUBSISTENCE FISHING CATCH: *Sheet 1; Page 2*

Gear in use	*Fishing time*	*Mesh size*	*Length of net*	*Species*	*Body-lengths*

*Recreational Fishing Activity (*Sheet 2*)*

Instruction for use:

Sheet 2 should be used to record recreational fishing activity. This form is mainly to be used by lodge owners to record the fishing activity based from the lodge or by recreational/sport fishermen to record their catches. To avoid biased results please do decide **before** you go out if you are going to record all the fishing activity. Please use one form for each trip on the river. It is important to be able to register the fishing effort of the fishing teams. Therefore, it necessary to write down the time spent on the river and how many rods that are used to catch the fish. **All fish of all species**, large or small, landed or released should be recorded. Please, do not forget to make a note whether the fish is landed or released.

If two or more fishing parties are fishing at the same day, separate sheets should be used to be able to separate catches and efforts.

RECREATIONAL FISHING ACTIVITY: *Sheet 2*

Page no:……..

Fill in one form for every trip. *All* fish, released or landed, must be recorded. Decide *before* the trip if you are going to record catches!

Date:..... Fishing from-to:.....…… Fishing started (time):.....……. Fishing ended (time):.....……

Weather:.....…….. Water temp.: …….. Total km.……..……. No fish caught (X):……

Species	**Body length (cm)**	**Weight (not necessary)**	**Time caught**	**Where was the fish caught Name or GPS**	**Trolling, spinning, or worms**	**Released or landed**	**Comments**
Example: Threespot	34.5 cm		17 hrs 45 min	Kalimbeza, Isl. View Lodge	Spinning	Released	Male
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

*Observed Recreational Fishing Activity (*Sheet 3)

Instruction for use:

Sheet 3 is to be filled in to record observed recreational fishing activity performed by other persons when being out on the river. Page 1 is for the activity observed, and page 2 is to record the details of the catch etc after conducting the interview.

One form should be filled in for every trip. To avoid biased results, please decide whether you are going to record the recreational activity before you start your trip, and remember, no activity is also an important result.

Registration of recreational activity shall be registered on all trips on the river. Remember to write down start and end time of trip/survey. Sheet 3, page 1 Write down for each boat or boats if together:

1) **Number of persons in boat/fishing party,**
2) **Number of fishing rods in use,**
3) **Type of fishing activity (trolling or stationary i.e. spinning or worm),**
4) **Time when the fishing activity was observed,**
5) **Area where the fishing activity was observed (or GPS position).**

Example: *a) 1 speedboat, 4 persons in party, 2 rods in use, trolling, 14 hrs 45, Kalimbeza*
b) 2 boats, 6 persons in party, 3 rods in use, fishing from land (stationary), 15 hrs 25, S 24º35,354 E 14º35,987

Sheet 3, page 2 can be used to record the catches and other details from the recreational fishermen after a short interview. But, subsistence fishing effort is the main focus so not too much time should be spent on the recreational aspect

OBSERVED RECREATIONAL FISHING ACTIVITY: ***Sheet 3; Page 1***

Fill in one form for every trip. All observed recreational fishing must be recorded. Decide *before* you go out if you are going to fill in form.

Date:..... Trip from, to and back:.....……Trip started (time):.....…… Trip ended (time):.....……

Weather:.....…….. Water temp.: …… Total km.…… No recreational fishing observed (X):……..

Number of people in boat/party	Number of rods in use	Time fishing observed	Where was the fishing observed, name or GPS	Trolling, spinning, or worms	Fishing from land or boat	Comments
Example: 6	2	17 hrs 45 min	Kalimbeza, Isl. View Lodge	Spinning	Land	No catch after 2 hrs fishing
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

REGISTRATION OF RECREATIONAL CATCH: ***Sheet 3; Page 2***

Fill in one form for every trip. *All* fish, small or large, released or landed, must be recorded. Decide *before* trip if you are going to record catches!

Date:..... Fishing from-to:.....…… Fishing started (time):.....…… Fishing ended (time):.....……

Weather:.....…….. Water temp.: …….. Total km.……..…… No fish caught (X):……

Species	**Body length (cm)**	**Weight (not necessary)**	**Time caught**	**Where was the fish caught Name or GPS**	**Trolling, spinning, or worms**	**Released or landed**	**Comments**
Example: Threespot	34.5 cm		17 hrs 45 min	Kalimbeza, Isl. View Lodge	Spinning	Released	Male
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

*Observed Seining Activity (*Sheet 4*)*

Instruction for use:

Sheet 4 is to be filled in to record observed seining and dragnet activity in addition to the regular survey recordings. Decide whether you are going to record your observations **before** you go out on the river to avoid biased results.

For example these forms may be used on the long river trips to Impalila or Ihaha.

Recreational fishing and seining (drag netting) may be registered on additional trips. However, to avoid biased results please do decide **before** you go out if you are going to record fishing activity. Please remember to fill in date, distance and area travelled (GPS and/or name), time and where the activities were registered (GPS and/or name), and please describe the activity as above.

OBSERVED SEINING ACTIVITY: *Sheet 4*

Fill in one form for every trip. All observed seining or drag netting must be recorded.

Decide *before* you go out if you are going to fill in the form.

Date:..... Trip from, to and back:.....……

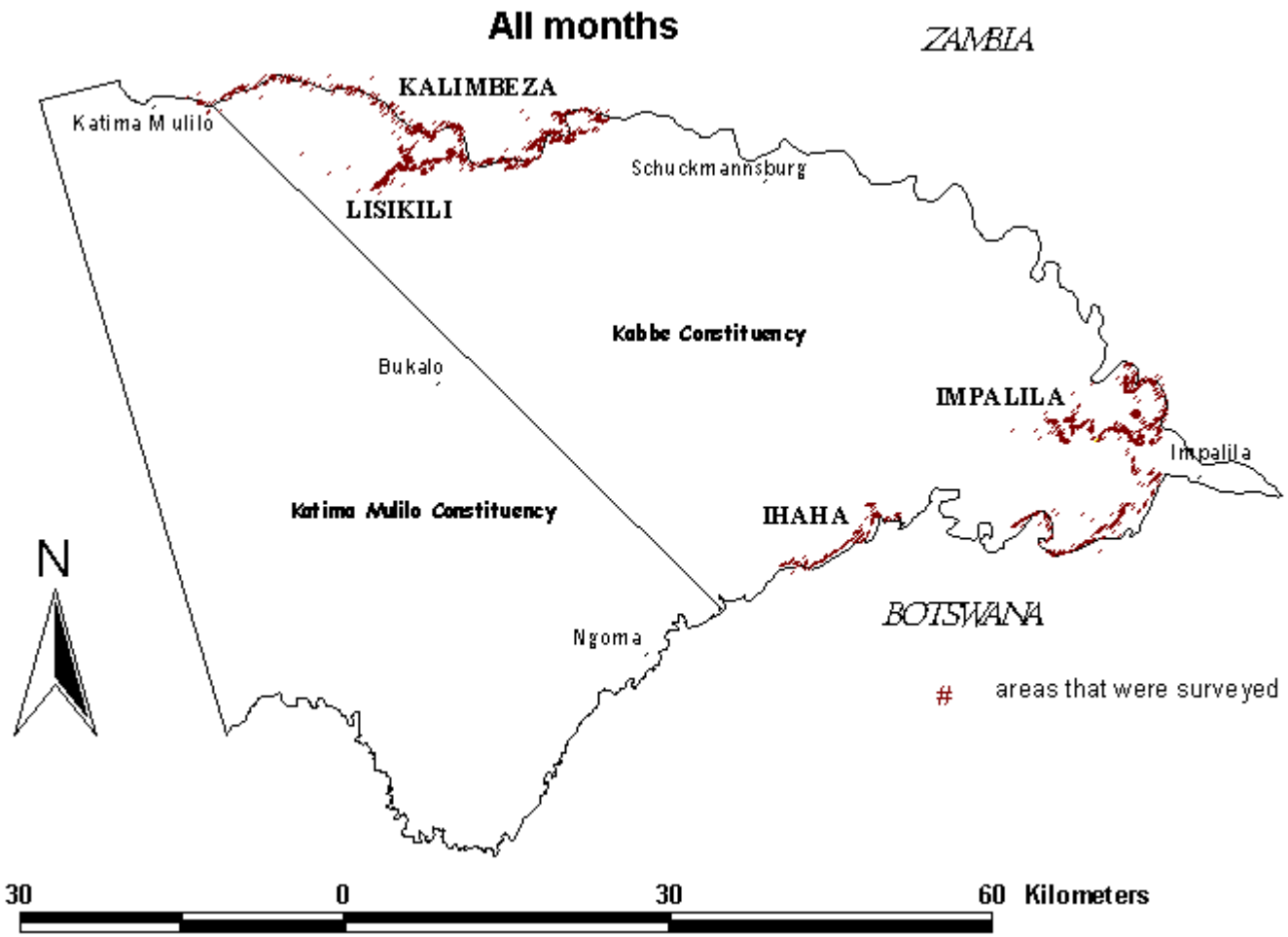
Trip started (time):.....……. Trip ended (time):.....……

Weather:.....…… Water temp.: …….. Total km……

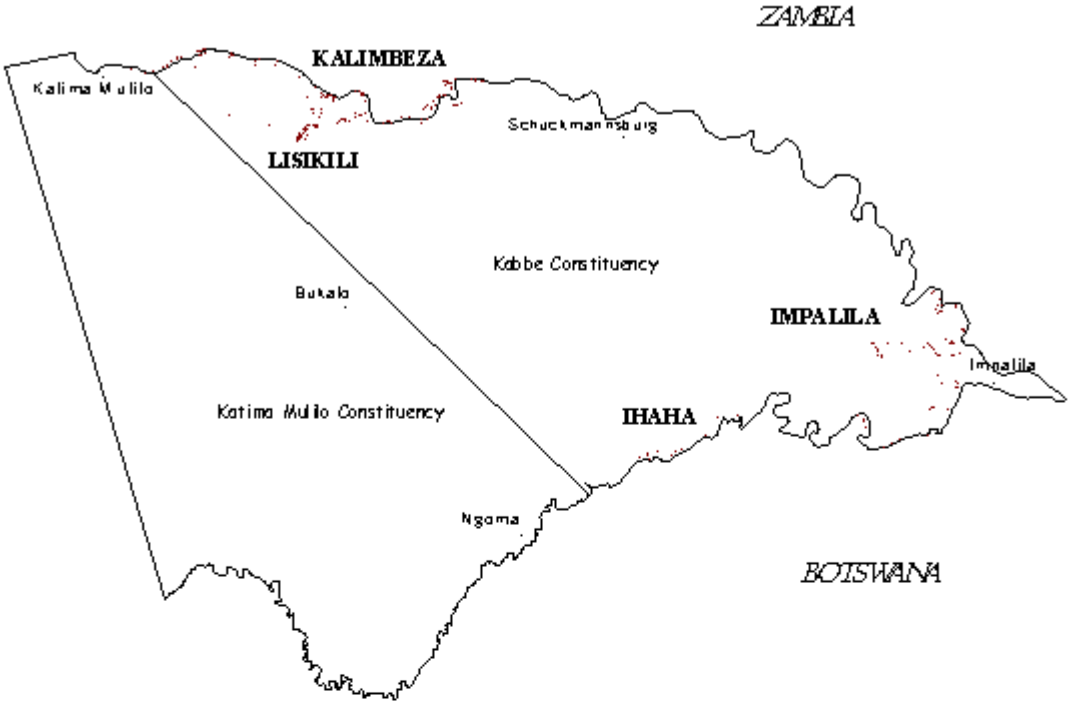
No seining activity observed (X):……..

Number of people in seining party	Time fishing observed	Where was the fishing observed, name or GPS position	Fishing on Nam./Zamb./ Botsw. side of river	Comments
Example: 6	17 hrs 45 min	Kalimbeza, Isl. View Lodge	Namibian	Approx 300m long seine

ANNEX 2 MAPPED RESULTS


All months
ZAMBIA
KALIMBEZA
Katima Mulilo
Schuckmannsburg
LISIKILI
Kabbe Constituency
Bukalo
IMPALILA
Impalila
Katima Mulilo Constituency
IHAHA
N
BOTSWANA
Ngoma
areas that were surveyed
30
0
30
60 Kilometers

March 2002



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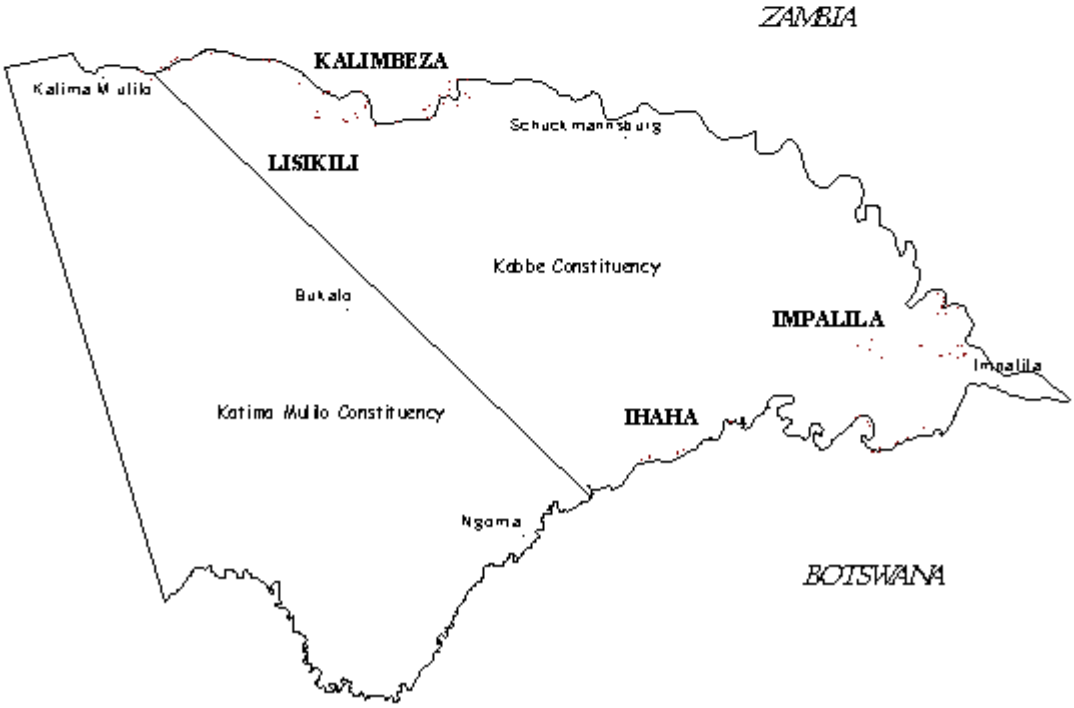

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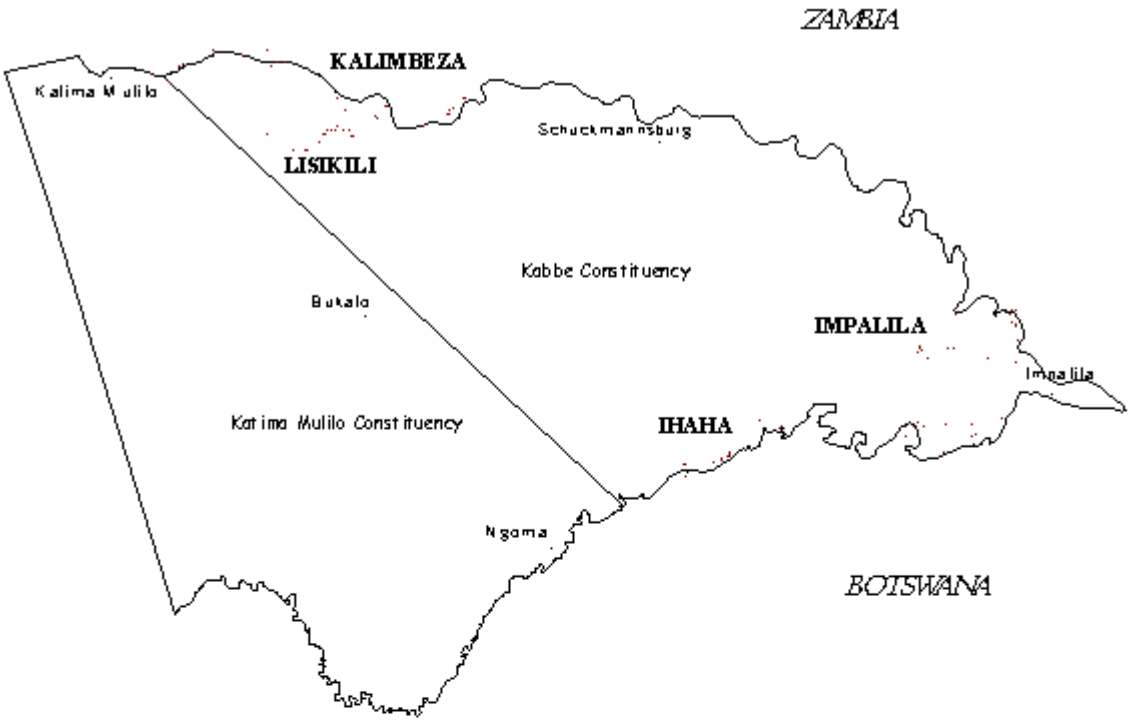

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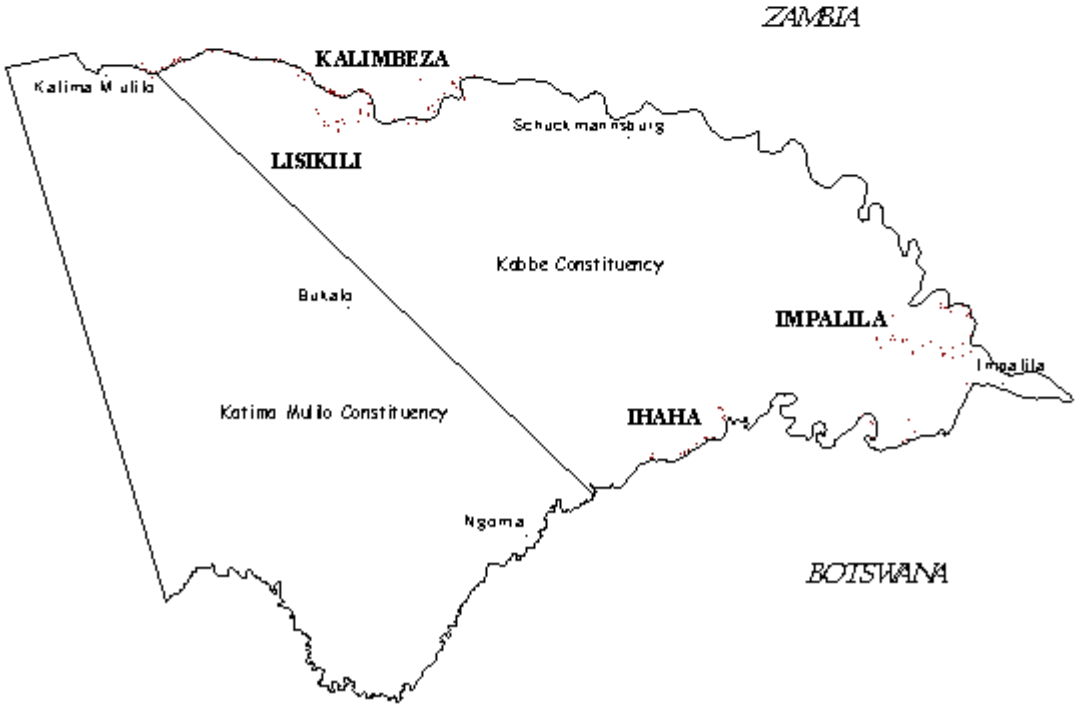

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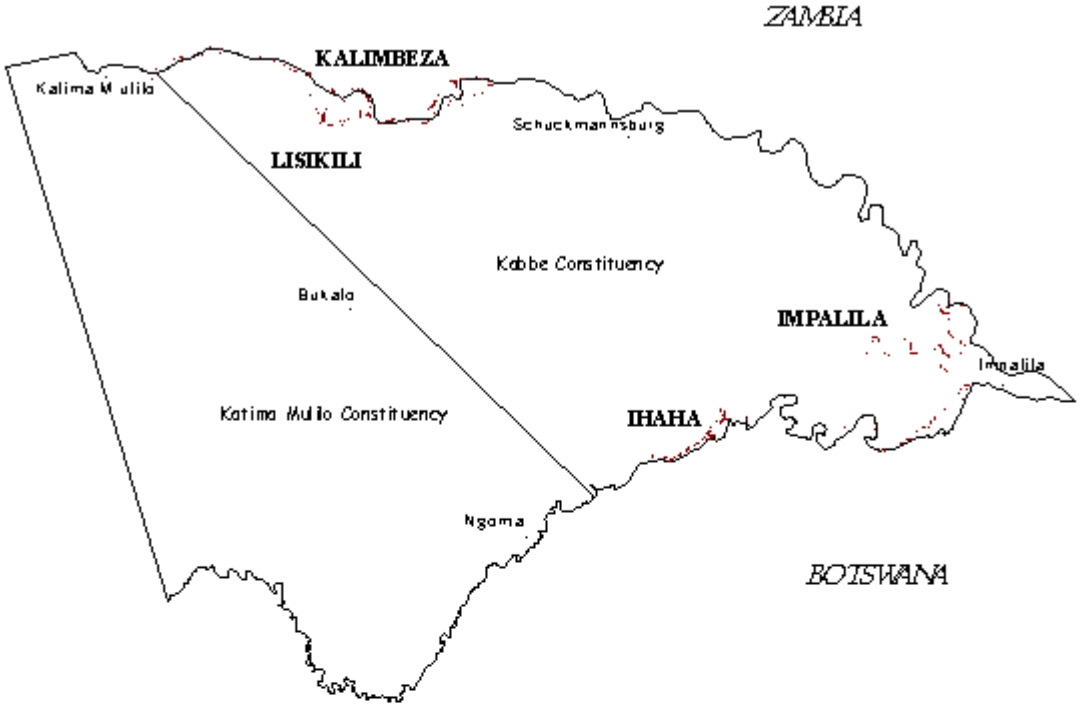

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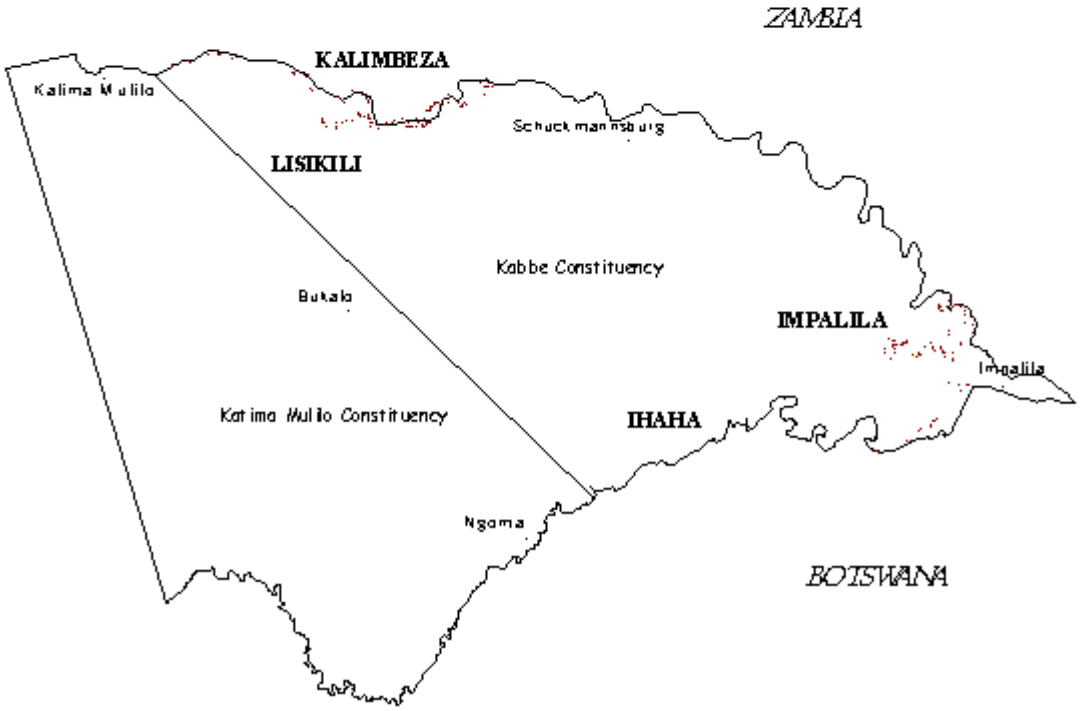

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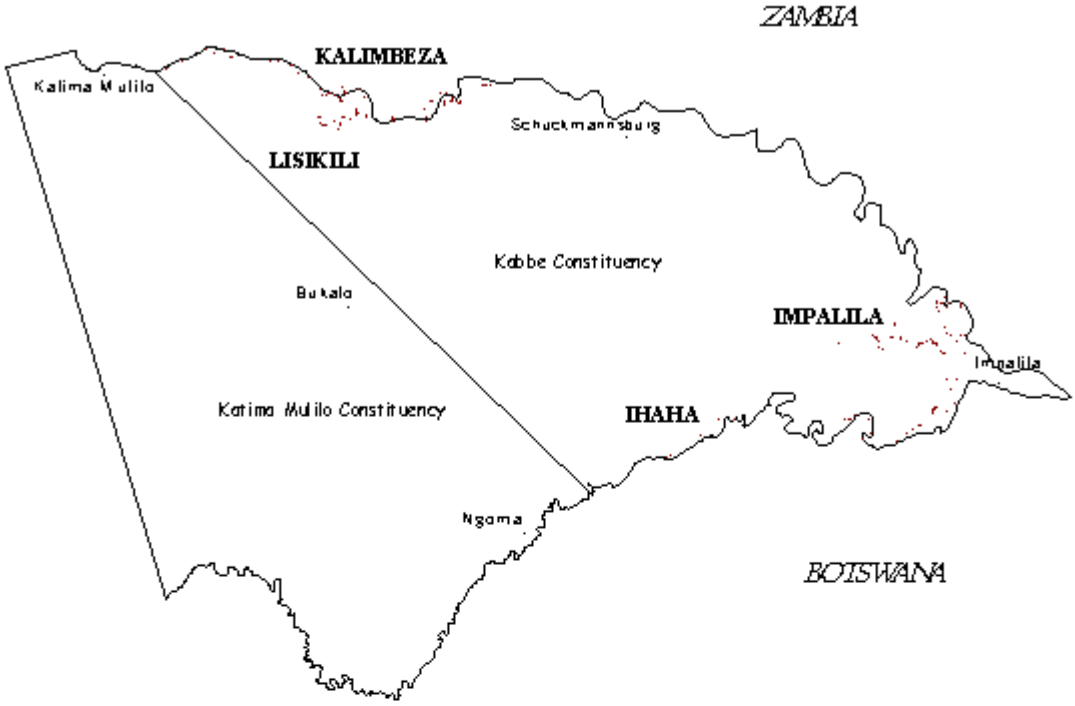

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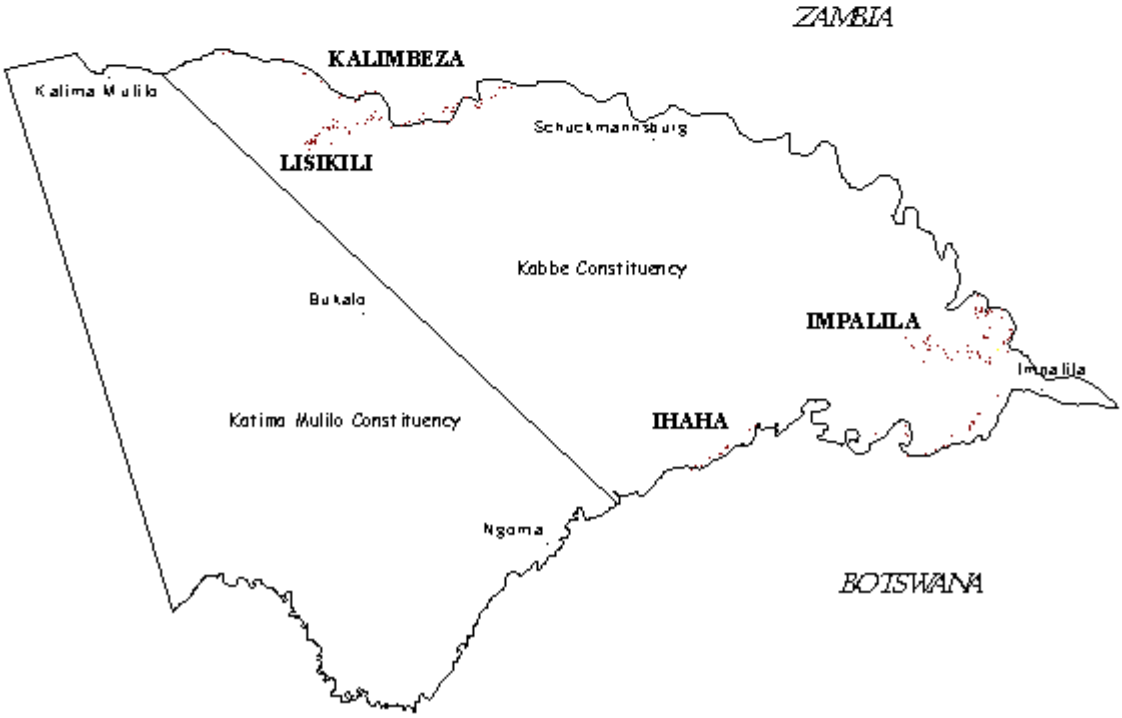

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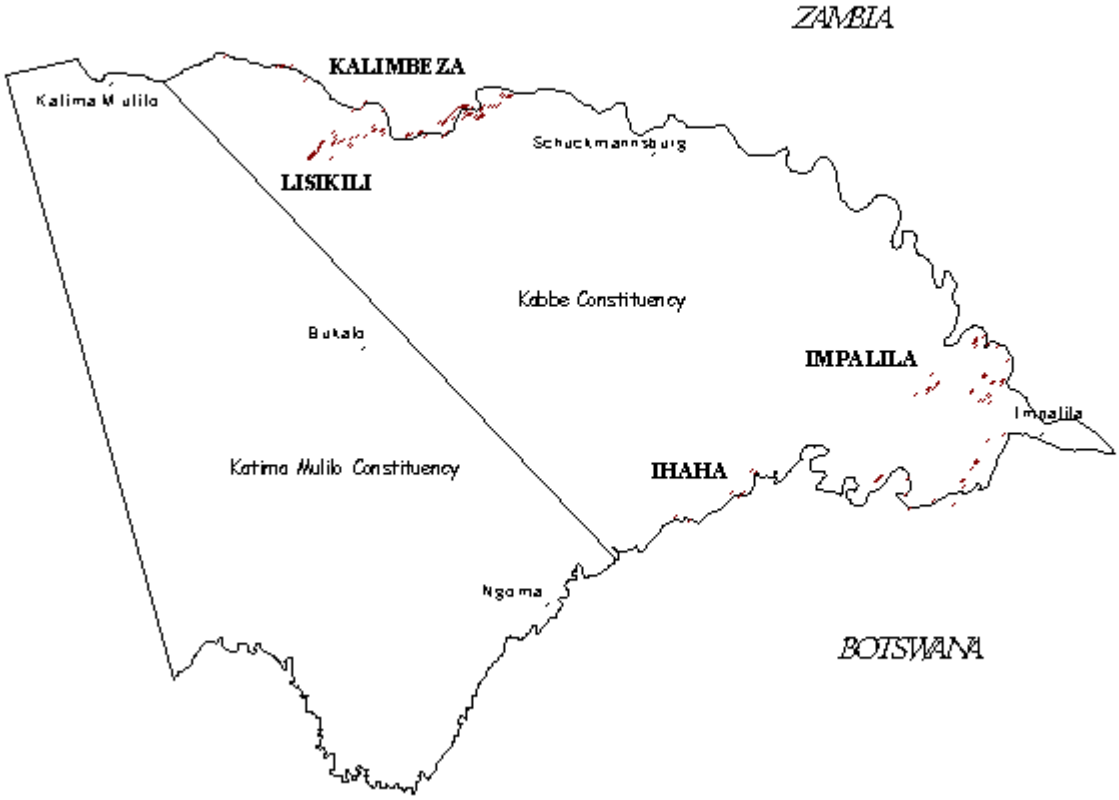
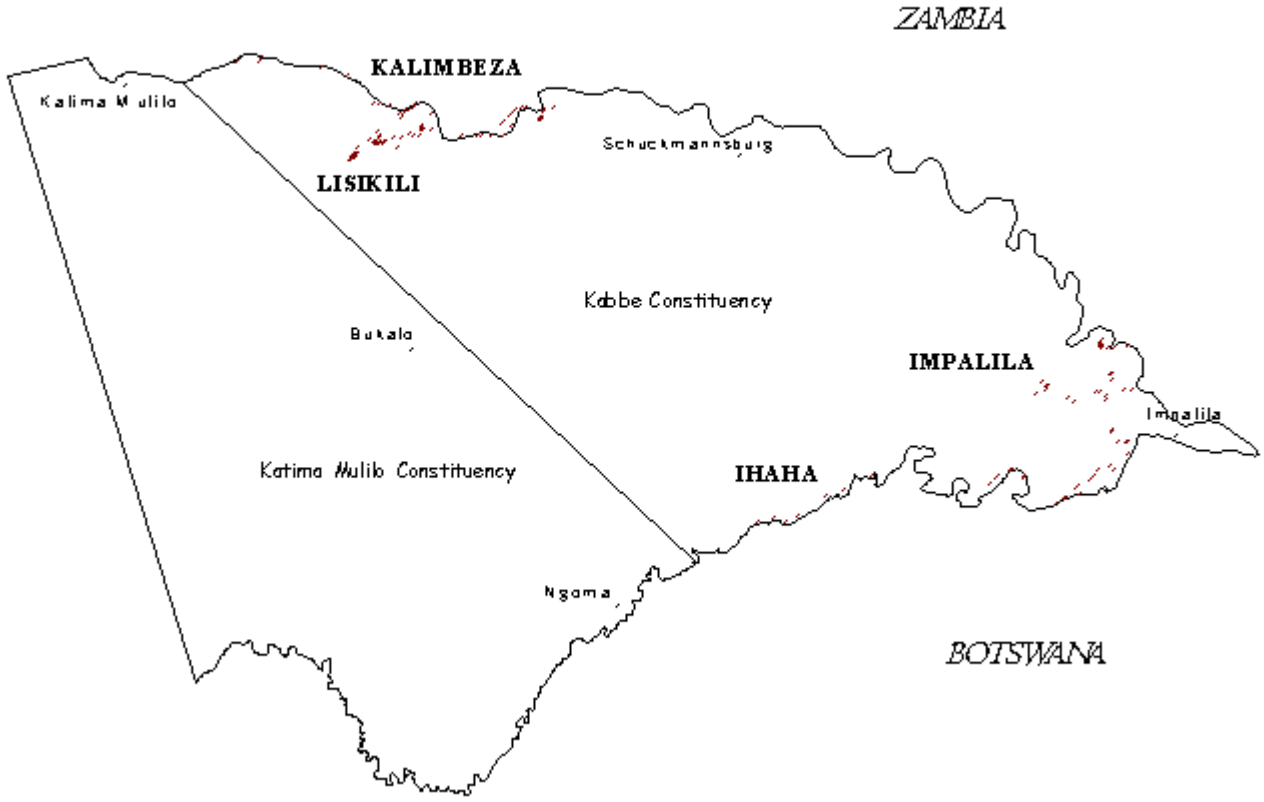
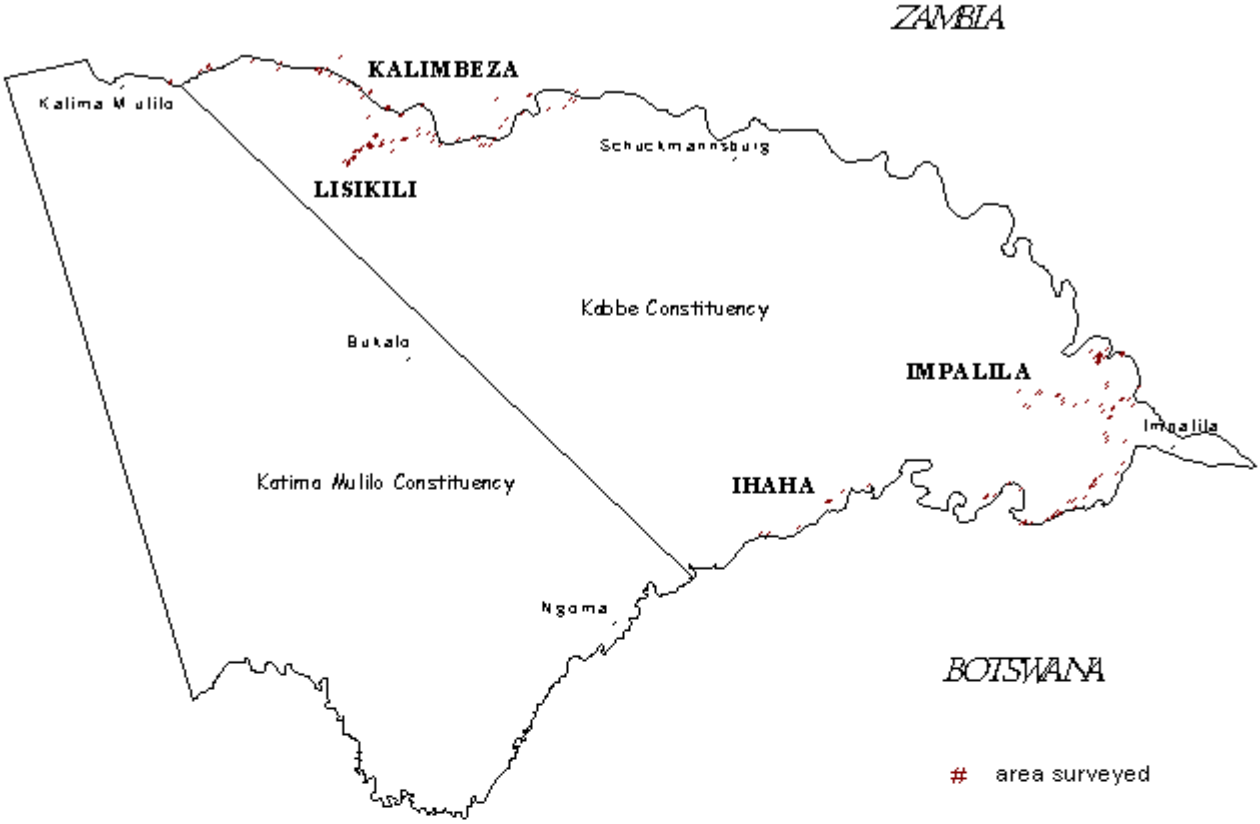
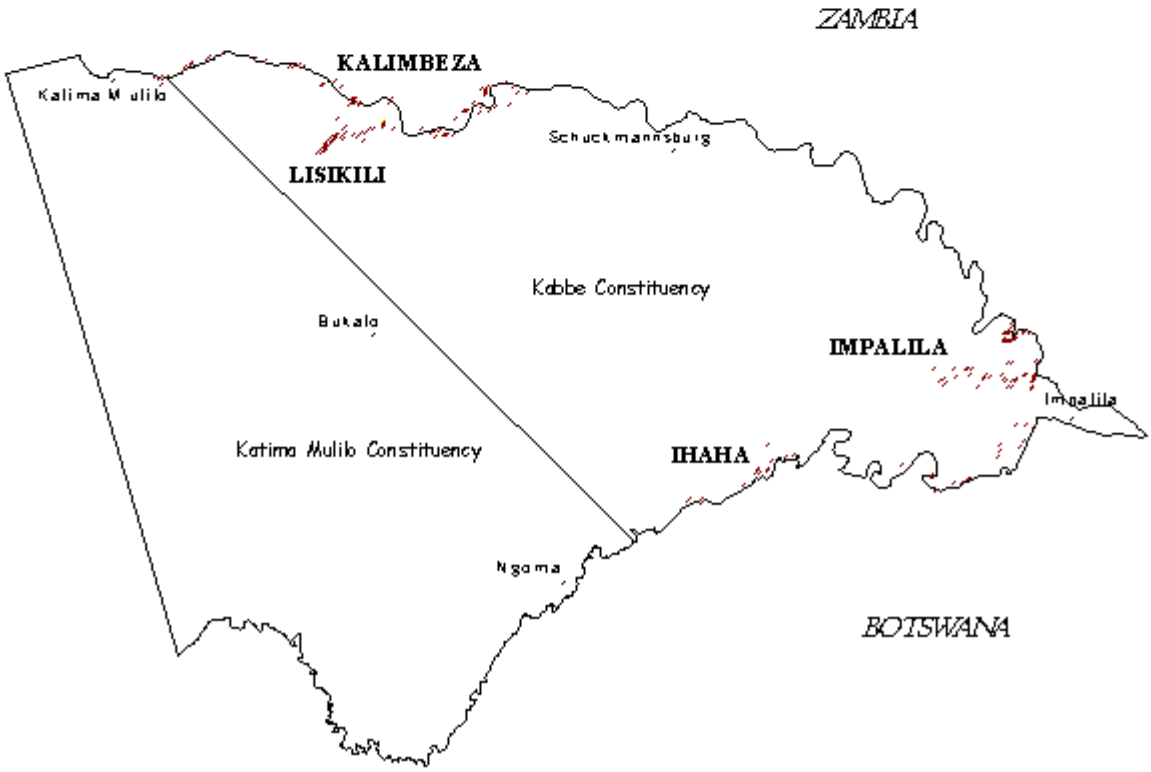


December 2002



January 2003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