CONSERVATION STATUS OF THE LION (*Panthera leo*) IN MOZAMBIQUE

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PHASE 1: PRELIMINARY SURVEY

Final Report - October 2008

TITLE:	**Conservation status of the lion (*Panthera leo*) in Mozambique – Phase I: Preliminary survey**
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ABSTRACT:

The IUCN-SSC organised two regional workshops, one for West and Central Africa (2005) and one for Eastern and Southern Africa (2006), with the intention to gather major stakeholders and to produce regional conservation strategies for the lion. Mozambican authorities, together with local stakeholders, took part in the regional exercise for establishing the Regional Conservation Strategy for the Lion in Eastern and Southern Africa. They recognised the importance of establishing a National Action Plan for the Lion in Mozambique and realized the lack of comprehensive information for reviewing the lion profile in the country.

A survey has been launched to update the conservation status of the lion in Mozambique. The final report of this survey is expected to become a comprehensive material for submission as a contribution to a forthcoming National Action Plan workshop.

The current report is the product of only the preliminary phase of this survey. The methods used are explained and preliminary results are proposed. A database has been set up to collect and analyse the information available as well as the information generated by specific inquiries. Tentatively, 9 thematic maps have been drawn. At first glance, the lion range in Mozambique seems to be still quite extensive with a surface, to be refined, ranging between 380,000 and 530,000 km². The lion population size is not yet assessed at this stage, however, it already appears unevenly distributed: although more lion range lies in non-gazetted areas outside Protected Areas (65%), a majority of the lion observations come from Protected Areas (named Conservation Areas in this country) including National Parks, National Reserves, Hunting Blocks, *Coutadas* and Community Programmes. In line with the regional Lion Conservation Units (LCU), 5 national LCUs are suggested for Mozambique. Human/lion conflicts are of great concern, especially in northern (Niassa and Cabo Delgado Provinces) and western (Tete Province) Mozambique. Major geographic and thematic gaps in knowledge are identified. Every single result proposed in this preliminary phase is considered as provisional and in need of exploration and refinement during the next phase.

Cover picture: Lions in Niassa National Reserve *(©Colleen Begg; ©Keith Begg)*

CONTENTS

ACRONYMS

ALWG	African Lion Working Group
CSG	Cat Specialist Group (IUCN-SSC)
DNAC	Direcção Nacional de Áreas de Conservação (National Directorate of Conservation Areas, MITUR)
DNTF	Direcção Nacional de Terras e Florestas (National Directorate of Land and Forests, MINAG)
DPA	Direcção Provincial da Agricultura (Provincial Bureau of Agriculture)
DPT	Direcção Provincial do Turismo (Provincial Bureau of Tourism)
IGF	Fondation Internationale pour la Gestion de la Faune (International Foundation for the Management of Wildlife)
IUCN SSC	International Union for the Conservation of Nature, Species Survival Commission
LCU	Lion Conservation Unit
MINAG	Ministério da Agricultura (Ministry of Agriculture)
MITUR	Ministério do Turismo (Ministry of Tourism)
SGDRN	Sociedade para a Gestão e Desenvolvimento da Reserva do Niassa (Society for the Management and Development of Niassa Reserve)

I. INTRODUCTION

1. BACKGROUND

Until mid XXth century, the conservation of the African lion (*Panthera leo*) was not a matter of concern since the species was widespread and abundant. With a few local exceptions, the overall situation has largely changed. In 2004, the international community in general and the lion Range States in particular, decided to develop regional conservation strategies for the lion. IUCN-SSC organised two regional workshops, one for West and Central Africa in 2005 and one for Eastern and Southern Africa in 2006, with the intention to gather major stakeholders and to produce two regional strategies which were published in 2006. These regional strategies state that "*[they] must be followed by the development of national lion action plans because it is on this level that the strategy actions are implemented)*" (IUCN SSC Cat Specialist Group, 2006).

Mozambican authorities, together with local stakeholders, took part in the regional exercise for establishing the regional strategy and recognised the importance of establishing a national action plan. Mozambican authorities expressed the will to embark on a lion action plan exercise in Mozambique. They envisaged conducting this exercise by holding a national workshop using the most recent participative approaches in planning conservation. By doing so, they realized the lack of comprehensive information for reviewing the lion profile in Mozambique. This study is attempting to provide the forthcoming national workshop with comprehensive material on the lion status within the country.

2. PLANNING

The final purpose of the present study is to assess the conservation status of the lion in Mozambique. The study is made up of three phases:

- **Phase 1: Preliminary survey**

Phase 1 aims to gather data available on the lion conservation status in Mozambique. This phase is providing a general picture of the current knowledge on the lion conservation status in the country. By doing so, it is paving the way to carry out the next two phases.

The current report presents the results of this phase.

- **Phase 2: Filling in the gaps**

Phase 2 will investigate the gaps which have been identified by Phase 1.

- **Phase 3: Status review**

Phase 3 will analyze all the information collected by Phases 1 & 2 leading to the production of a comprehensive evaluation of the conservation status of the lion in Mozambique. Expectedly, the final document produced by the study will be presented as a contribution to the national workshop. It is worth to stress that the production of the final status review (also named either status report or species profile) will be an output of the national workshop.

3. FOLLOW UP

The final product of phase 3 is expected to propose a sound comprehensive status review of the lion in Mozambique within the obvious limits of the knowledge at that time.

According to the IUCN/SSC/Species Conservation Planning Task Force, the classic academic structure of a species status review comprises the following chapters:

1. Species description
2. Species functions and values
3. Historical account
4. Current distribution and demographics
5. Habitat and resource assessment
6. Threats
7. Conservation and management

Since this report will be the product of a limited team of experts, it will be presented to the forthcoming national workshop participants as a contribution to their participative debate during the first session of the workshop (Status review). During this session, the participants will get the opportunity to validate, amend, update, refine and revise the report.

The purpose of the foreseen national workshop will be to produce a national Action Plan.

According to the IUCN/SSC/Species Conservation Planning Task Force, the classic academic structure of a species conservation planning workshop comprises the following sessions:

1. Status review
2. Vision and goals
3. Objectives
4. Conservation actions

II. METHODOLOGY

1. DATA ACQUISITION

Two categories of information have been collected during the survey (Table I):

- **Existing information**

Existing information come from:

  - Scientific literature;
  - Existing databases run by Mozambican authorities, mainly the DNAC [*Direcção Nacional de Áreas de Conservação,* National Directorate for Conservation Areas: MITUR (*Ministério do Turismo*, Ministry of Tourism)] and the DNTF [(*Direcção Nacional de Terras e Florestas,* National Directorate of Land and Forests: MINAG (*Ministério da Agricultura*, Ministry of Agriculture)].

- **Information generated**

Information generated by this survey come from:

  - Personal communications of resource persons;
  - Inquiries conducted among Mozambican authorities and safari operators.

The information was collected during a mission carried out specifically for this survey between 28 May and 07 June 2008. The contact network established long before this period helped completing the data acquisition until the end of July 2008.

1.1. Existing information

- **Literature**

Peer-reviewed literature and technical reports provide information about lion issues in Mozambique. To make it more convenient, information has been organized according to the geographical scale of their respective scopes: continental, regional, national and local (Conservation Area and others). In all cases, only information related to Mozambique has been used. By convention, all the information dated more than 5 years ago (before 2003) has been considered as historical accounts, not as contributions to the current status of the lion.

  - **Continental scale**

Information on lion in Mozambique may be found in two recent surveys conducted at continental scale (Chardonnet, 2002; Bauer & Van Der Merwe, 2004). The two surveys were based on published papers, unpublished reports and personal communications of informed persons (wildlife managers, experts, etc.). Bauer & Van Der Merwe (2004) compiled estimates of 100 known African lion populations, mostly located within Protected Areas (Map A, Appendix I). Lion populations of unknown or unestimated size were not included. Chardonnet (2002) compiled estimates for 144 lion populations grouped into 36 isolated subpopulations (Map B, Appendix I). Both gazetted and non-gazetted areas were considered.

Table I: Sources of information used in the survey

Source of information		Information	Type of information	Period
Existing information	MITUR	Map of Conservation Areas (Except for Community Programmes)	GIS tool	
		Aerial surveys in National Parks or Reserves	Technical report	2004-2007
		Surveys of Carnivores in Niassa Reserve (SGDRN)	Technical report	2004-2008
		Human/lion conflicts reported in Conservation Areas	Existing database	2007-2008
		Lion hunting (quotas and offtakes)	Existing database	2007
	MINAG	Map of Provinces and Districts	GIS tool	
		National forest inventory	Existing database	2007
		Conflict reported in non-gazetted areas	Existing database	2006-2008
	Various	Historical data, scientific papers	Literature	
Information generated	Study team: IGF Foundation, MITUR, MINAG	Provincial Directions of Tourism	Inquiry	2008
		Provincial Directions of Agriculture	Inquiry	2008
		Safari operators	Inquiry	2008
		Park / Reserve administrators; NGOs; Others	Personal communications	2008

Based on habitat suitability models, a putative lion range across Africa has been proposed by the African Mammal Databank (1999; http://www.gisbau.uniroma1.it/amd/homespec.html; Map C, Appendix I).

Information about Human/lion conflicts throughout Africa were recently reviewed by FAO, based on published papers, unpublished reports and personal communications of resource persons (Chardonnet *et al.*, 2008).

- **Regional scale**

The Eastern and Southern African Lion Conservation Workshop held in Johannesburg in January 2006 provides the best available source of information at regional level (IUCN SSC Cat Specialist group, 2006). A working paper was prepared on purpose by Bauer, Chardonnet, Nowell & Crosmary (2005) based on the continental surveys carried out by Chardonnet (2002) and Bauer & Van Der Merwe (2004). During the workshop, participants refined the proposed lion ranges. Through a Range Wide Priority Setting exercise, workshop participants identified ecological units of importance for lion conservation (Lion Conservation Unit [LCU]; Map D, Appendix I).

A recent study has reviewed the status and distribution of carnivores, and levels of human/carnivore conflict in the Protected Areas and surrounds of the Zambezi Basin (Purchase *et al.*, 2007).

- **National scale**

According to the National Archives of Mozambique, historical information on lion in Mozambique exist as far back as the XVIIth century. During the second half of the XIXth century, numerous information were provided on lions in Mozambique thanks to explorers and hunters such as David Livingstone in 1857, Edouard Foa in 1895, Frederick Vaughan Kirby in 1896, and later R. Maugham in 1910.

However, only papers published from mid XXth century were used here to assess the historical distribution of lion across Mozambique. Galvão (1943) collated his observations of wildlife including lions (Map E, Appendix I). In their "Check list and atlas of the mammals of Mozambique", Smithers & Lobão Tello (1976) wrote a brief chapter on lion in Mozambique with a lion range map (Map F, Appendix I).

More recently, within the framework of a national forest inventory carried out by the MINAG, a predictive model based on habitat suitability was used to draw a putative lion range in Mozambique (Ghiurghi & Urbano, 2007; Map G, Appendix I): the presence of lion was assessed from direct and indirect observations made during the forest inventory survey and from interviews of informed persons (Ghiurghi & Urbano, 2007; Map H, Appendix I).

Human/wildlife conflicts, including lion, were recently surveyed in Mozambique (Magane, 2004; FAO, 2005). Data were collected from interviews of senior officials of *Direcção Provincial do Turismo* (Provincial Bureau of Tourism; DPT) and *Direcção Provincial da Agricultura* (Provincial Bureau of Agriculture; DPA), Districts administrators, as well as local communities where human/wildlife conflicts had been reported.

- **Local scale**

  - **Conservation Areas**

A few historical surveys have been conducted in some Conservation Areas, notably in Gorongosa National Park (De Alcantara, 1956), Gilé National Reserve (Dutton *et al.*, 1973), Chimanimani National Reserve (Dutton & Dutton, 1973) and in several spots across the country (Tinley *et al.*, 1976).

Most of the information on wildlife in Conservation Areas come from aerial surveys: Banhine National Park (Stalmans, 2004 and 2007a), Gorongosa National Park (Dunham, 2004), Limpopo National Park (Whyte & Swanepoel, 2006), Maputo Special Reserve (Matthews & Nemane, 2006) and Zinave National Park (Stalmans, 2007b). Since aerial surveys are not appropriate to observe lions, only a few records of lion presence come from these sources.

Since 2004, a long-term carnivore monitoring programme is ongoing in Niassa National Reserve (Begg & Begg, 2005, 2006, 2007, 2008; Begg *et al.*, 2007). Another long-term programme has recently been set up to monitor African wild dog in Quirimbas National Park (André, 2006).

  - **Others**

A wildlife survey has been carried out in the northern part of Machaze District, Manica Province (Ghiurghi & Pariela, 2007). Information provided in this report come from an aerial survey and a ground survey including structured interviews, spot light sessions by car at night and a few additional transects by foot.
Historical accounts of lion records were provided in a survey of the history of Mozambican populations in Cabo Degaldo Province (Liesegang, 2003). Recent accounts of Human/lion conflicts in Muidumbe District were found in a report focusing on lion-killings and witchcraft (Israel, *in prep*.)

- **Existing database**

The Mozambican authorities in charge of wildlife do record information on lion management issues, mainly human/lion conflict and lion hunting.

For information, the direct technical management of Mozambican wildlife falls under the responsibility of two ministries, according to their respective areas of competence:

  - MITUR: the DNAC is in charge of National Parks, National Wildlife Reserves and Hunting Areas;
  - MINAG: the DNTF is responsible for National Forest Reserves, Game Ranches and non-gazetted areas.

Nota: Conservation Areas in Mozambique ("*Áreas de Conservação*") comprise: National Parks, National Reserves, Game Reserves ("*Coutadas"*) and Hunting Blocks, the latter being located within the Niassa National Reserve. Other Protected Areas [understood as areas gazetted for conservation (IUCN, 1994)] comprise Game Ranches ("*Fazendas do bravio")* and Community Programmes (apart from the Tchuma Tchato and Chipenje Chetu community Programmes, classified as Conservation Areas).

- **Human/lion conflict**

Both DNAC and DNTF keep records of human/wildlife conflicts in their respective areas of responsibility. The DNTF's database started in 1997 at Provincial scale and has been set at District scale from 2006 onwards. The DNAC database started directly at District scale in 2007.

- **Lion hunting quota/offtake**

Hunting quotas are published every year, including for lions (established for Coutadas, hunting blocks and Community Hunting Areas). The number of lions hunted in 2007 has been provided by DNAC.

- **Digital maps**

DNAC has provided the digital outlines of all Conservation Areas except for Community Programme Areas (Map 1).

DNTF has provided the digital outlines of Provinces and Districts (Map 2).

1.2. Information generated

- **Personal communications**

During the mission, direct interviews were carried out with 17 resource persons and 3 more persons sent detailed information in electronic format.

- **Inquiries**

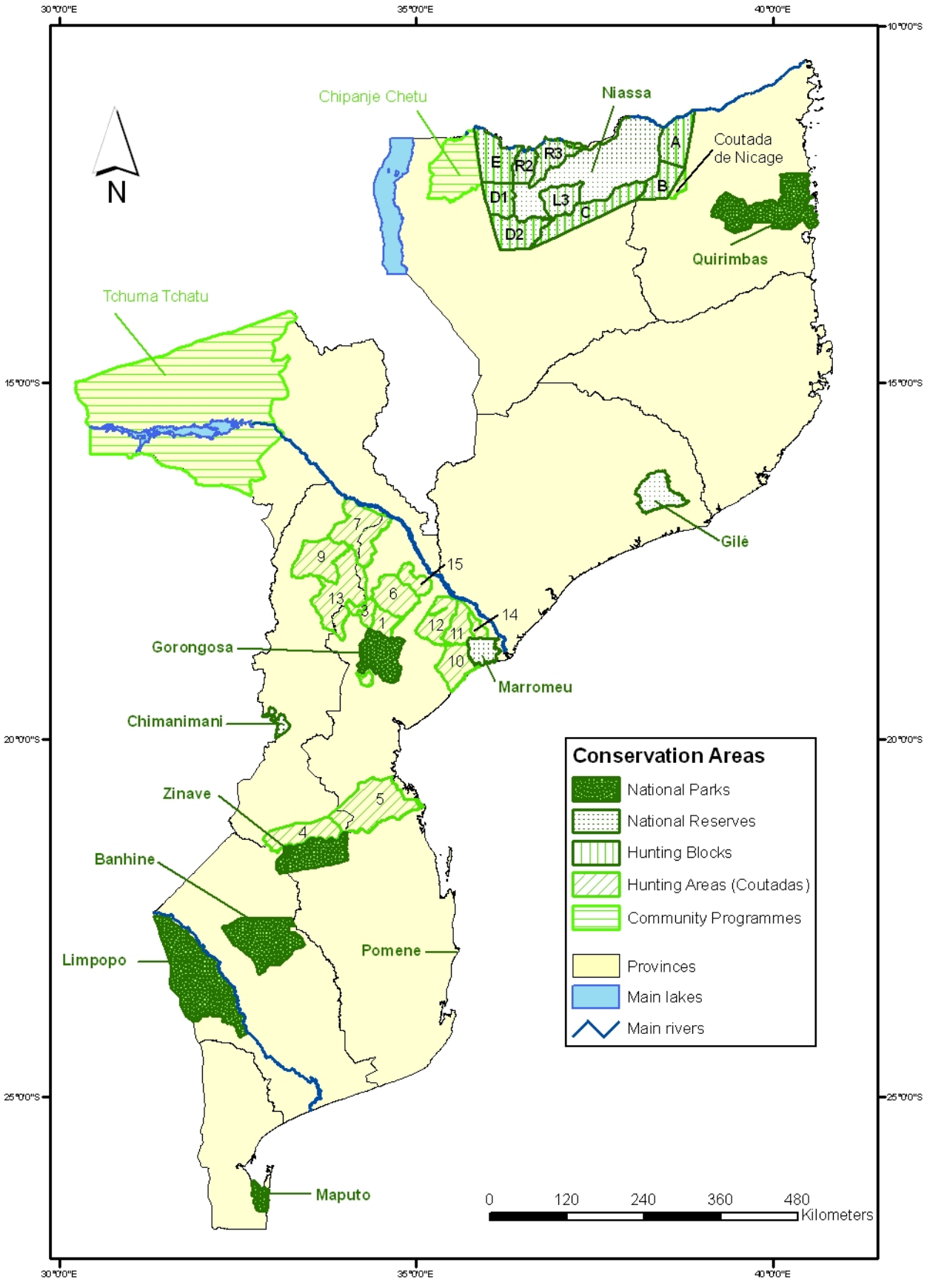
Inquiries were prepared with the DNAC and targeted towards: (i) DPTs (MITUR), (ii) DPAs (MINAG) and (iii) safari operators.

Informants were asked to provide information about:

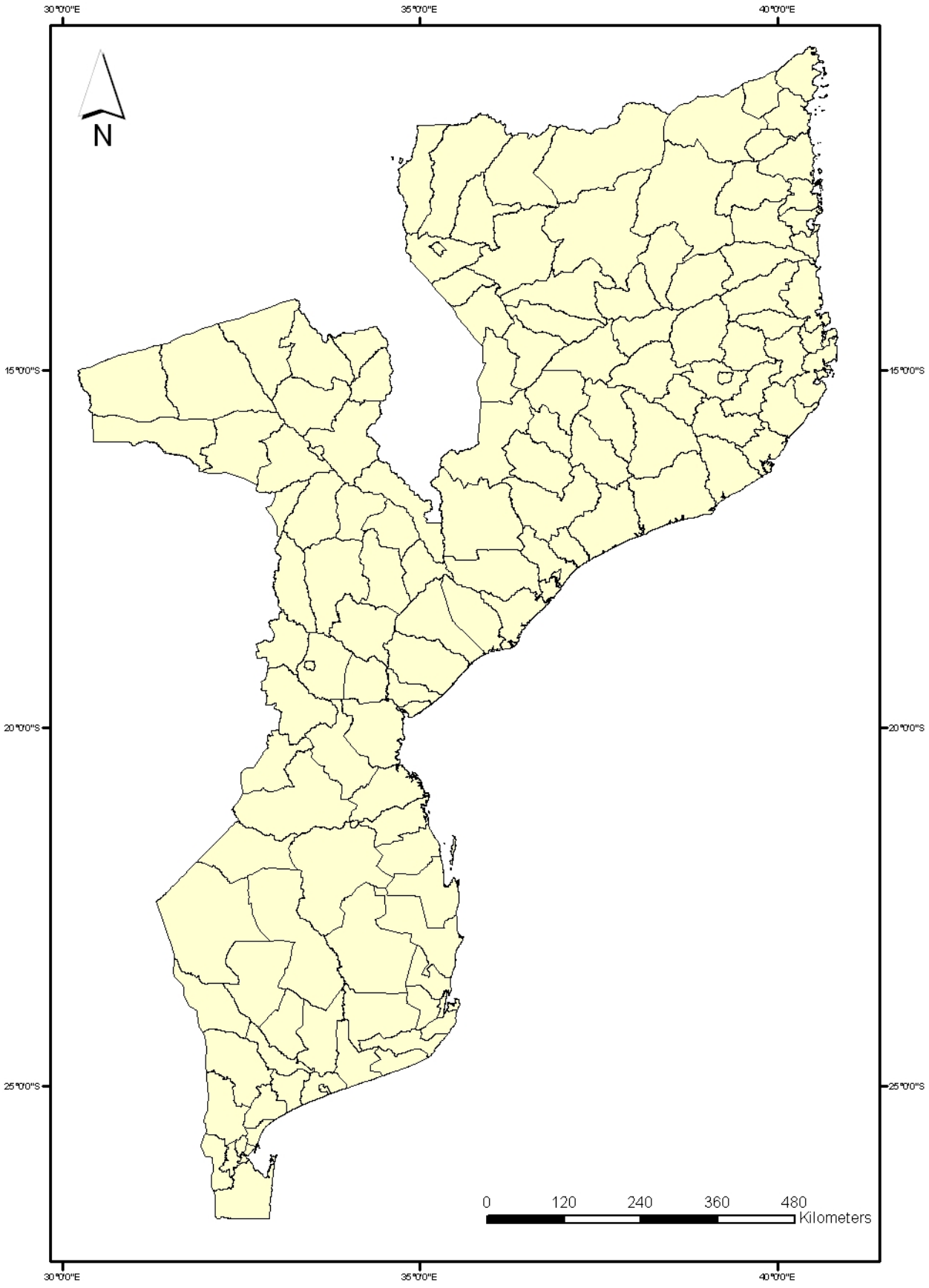
- Lion presence over the past 5 years;
- Frequency of lion's observations;
- Lion population size estimates when appropriate;
- Periodicity and type (livestock losses or human casualties) of Human/lion conflicts;
- Hunting quotas and offtakes when appropriate.

- **DPT inquiry**

Questionnaire forms (Appendix II) were officially sent by the DNAC to DPT directors with instructions to fill the form. Most of the information was collected at District level within the respective Provinces. Some informants provided information at the level of specific Conservation Areas.



Map 1: Network of Conservation Areas considered in this survey (from DNAC)



Map 2: Administrative network of Districts (from DNTF)

- **DPA inquiry**

Questionnaire forms (Appendix II) were filled directly with the DPAs Directors during their annual meeting held in Namaacha, Maputo Province, on June 04th 2008. Information were collected at District level. A map of Districts was added to the questionnaire form to help informants to report the presence and relative abundance of lions in the Districts within their respective Provinces.

- **Safari operator inquiry**

Questionnaire forms (Appendix II) have been sent by DNAC to safari operators. Additionnaly, instructions to fill the form were presented during the safari operator annual meeting held in Tete on May 21st 2008. Information has been collected at the level of each Hunting Area.

2. DATA ANALYSIS

2.1. Database

Every single information collected was entered into a simple database. The database is made of two tables:

- **Table at the level of the Districts**

This table [139 lines & 45 columns (04.08.08)] gathers information from all the Districts about lion presence, frequency of lion observations, frequency and type of conflicts and level of knowledge.

The raw data in this table have been used to build synthetic thematic maps (see below).

- **Table at the level of Conservation Areas**

This table [42 lines & 44 columns (04.08.08)] gathers information on lion at the level of the Conservation Areas.

This table has been used to assess the lion range in Conservation Areas and, combined with the first table, to assess the lion range outside Conservation Areas, i.e. in non-gazetted areas. Using a GIS platform (Arcview 3.2), Conservation Area surfaces were excluded from the District surfaces in order to estimate the lion range in non-gazetted areas.

This table was also the basis for estimating the minimal abundance of lions in Mozambique. The lion abundance has been estimated by two methods:

- Available lion censuses that only concerned lions ranging in Conservation Areas;
- Frequency of lion observations assessed by the inquiries.

2.2. Maps

The data collected during the present study (database, technical or scientific reports, inquiries, personal communications) were used to build thematic maps. The Arcview 3.2 GIS software was used for data mapping and analysis. Five thematic maps have been produced:

- **Lion range**

The estimate of lion range derived from a binary system of records' occurrence or absence. The lion was considered present when at least one direct or indirect observation had been recorded during the past 5 years only. The lion was considered absent when no observation had been made during the past 5 years.

- **Frequency of lion observations**

The frequency of observations was recorded over the past 5 years and categorized into four classes defined as follows:

  - **Absent**: lion presence not recorded in the area;
  - **Yearly**: lions were seen only about once a year or not every year;
  - **Monthly**: lions were observed about every month or seasonally;
  - **Weekly**: lions were noticed on a regular basis throughout every year.

- **Level of Human/lion conflict**

The level of Human/lion conflict was estimated according to the frequency of conflicts reported since 2006 (3 years of data recording) and impact of conflict (number of human casualties and/or livestock losses). It was categorized into four classes defined as follows:

  - **Absent**: lion presence not recorded in the area;
  - **None**: conflict presence not recorded in the area;
  - **Low**: conflicts were reported once or twice and losses involved only a few heads of livestock;
  - **Medium**: conflicts were reported every year and/or involved at least one human casualty;
  - **High**: conflicts were reported several times and involved human casualties and/or high number of livestock losses.

- **Types of Human/lion conflict**

The types of Human/lion conflicts were recorded over the past 3 years and categorized into four classes defined as follows:

  - **Absent**: lion presence not recorded in the area;
  - **None**: conflict presence not recorded in the area;
  - **Livestock**: when cattle, goat or sheep were killed by lions;
  - **Human**: when humans were wounded or killed by lions;
  - **Both**: when both livestock and human losses were attributed to lions, not necessarily during the same year.

- **Level of knowledge**

Because a wide variety of information type was used, a classification of data accuracy was applied when lion presence was reported. The level of knowledge was evaluated for the whole database. Three categories were defined based on both quantitative and qualitative criteria:

- **Questionable:** only one (1) information or two (2) contradictory information;
- **Poor:** two (2) unpublished information;
- **Medium**: three (3) or more information;
- **High**: three (3) or more information including a specific lion survey or more than six (6) information without specific lion survey.

- **Gaps in knowledge**

One of the purposes of this preliminary study (Phase I of the whole study) is to identify the gaps in knowledge to be explored during the next Phase. Gaps in knowledge worth to investigate have been identified on the basis of two criteria which have been matched:

- **Criterion 1:** level of knowledge

A gap is considered where the knowledge is insufficient. The rationale is that only Districts with low level of knowledge are worth investigating. A score is given to each District in respect to this criterion: a high score is attributed where the knowledge is questionable, a low score where the knowledge is high.

- **Criterion 2:** frequency of observation

A valuable area to investigate is considered where the frequency of observation is high. The rationale is that it is not cost-effective to investigate Districts with low frequency of observation. A score is given to each District in respect to this criterion: a high score is attributed where the frequency of observation is high (*i.e.* weekly), a low score where lions are rarely observed (*i.e.* yearly).

Every single District is scored 1°) for each of the two criteria, and then 2°) by adding both criteria. This scoring becomes a ranking mechanism for segregating the Districts in need to be explored (major gaps) from the other Districts (minor gaps) (Table II a & b).

Table IIa: Criteria used for identifying gaps in knowledge (per District) and their scoring mechanism

Criterion	Class	Score per criterion
A: Level of knowledge	High	0
	Medium	0.5
	Poor	1
	Questionable	1
B: Frequency of observations of lions	Absent	0
	Yearly	0
	Monthly	0.5
	Weekly	1

Table IIb: Global scoring and ranking of the gap in knowledge in each District

For each District:	
Total score of the gap = criterion A + criterion B	**Ranking of the gap**
0	Minor
0.5	Mild
1	Mild
1.5	Major
2	Major

- **LCUs**

As a reminder, according to the IUCN SSC Cat Specialist Group (2006): "*A LCU is defined as an area of known, occasional and/or possible lion range that can be considered an ecological unit of importance for lion conservation*".

The proposed national LCUs were obtained by matching regional LCUs (IUCN SSC Cat Specialist Group, 2006) with our assessment of the lion range.

III. RESULTS

1. LION RANGE

1.1. Historical range

Historical reports on lion presence in Mozambique are numerous, although, to our knowledge, little information is available on a precise historical distribution. In addition, the lion range was considered difficult to determine in Mozambique because of a long history of civil unrest (Novell & Jackson, 1996). However, most historical accounts tend to show a widespread distribution to the point that, anciently, very few locations in Mozambique did not have lions.

- **Before mid XXth century**

Very old sources of information on lion in Mozambique have not been considered here. However, it is interesting to notice that, during the late XIXth and the early XXth century, many explorers and hunters reported abundant lion stories all along the Zambezi valley from the Tete area to the rivermouth (Livingstone, 1857; Foa, 1895; Frederick Vaughan Kirby, 1896; Maugham, 1910).

- **1943**

In his hunting tourism map, Galvão (1943) pointed out the lion presence in the following areas: center of Gaza Province, north-western of Inhambane Province, south-western and west center of Manica Province, north-eastern of Tete Province, west center of Niassa Province and north-eastern of Cabo Delgado Province (Map E, Appendix I).

- **1947**

The presence of lion in Tete Province was mentioned by Matheson (1947).

- **1956**

The lion was included into the mammals check list of National Park of Gorongosa by De Alcantara (1956).

- **1976**

Smithers & Lobão Tello (1976) proposed a map for the lion range showing a very widespread distribution of the species throughout the country at that time (Map F, Appendix I). Very few locations were devoid of lion: the lion was present in the whole country except southern Inhambane Province, northern Sofala Province, western Zambezia Province and center of Niassa Province.

- **1990**

In their impressive encyclopaedia on the Mammals of the Southern African Subregion, Skinner & Smithers (1990) stated: "*Lion occurs widely north of the Zambezi River in Mozambique [...] In Mozambique South of the Zambezi River, they occur widely, except*

along the Zimbabwe border in the west, in the eastern Inhambane District and not south of about 24°S except as vagrants from Kruger National Park."

- **2002**

Out of the two recent continental surveys on lion status (Chardonnet, 2002; Bauer & Van Der Merwe, 2004), only the first one was precise enough for allowing to address the lion range in Mozambique (Maps A and B, Appendix I). According to the criterion of the current study (§II.3.2), these two publications are recorded as historical accounts because they are older than the threshold of 5 year-old. In both cases the information dated 2002 even though the publication of Bauer & Van Der Merwe dated 2004. Chardonnet (2002) considered 4 subpopulations of lion in Mozambique (Map B, Appendix I):

- **Subpopulation n° 25**: most of Niassa Province, western Cabo Delgado Province, Nampula and Zambezia Provinces;
- **Subpopulation n° 30**: north-eastern Sofala Province;
- **Subpopulation n° 27**: most of Tete Province and north-eastern Manica Province;
- **Subpopulation n° 31**: southern Manica Province and the western Gaza Province.

Still from the same source (Chardonnet, 2002):

- **Transfontier subpopulations**: 3 of the 4 subpopulations identified were regarded as transfrontier ones;
- **Distinct subpopulations**: whether sub-population n° 27 was separated from sub-population n° 30 was considered as doubtful.

1.2. Current range

- **Range**

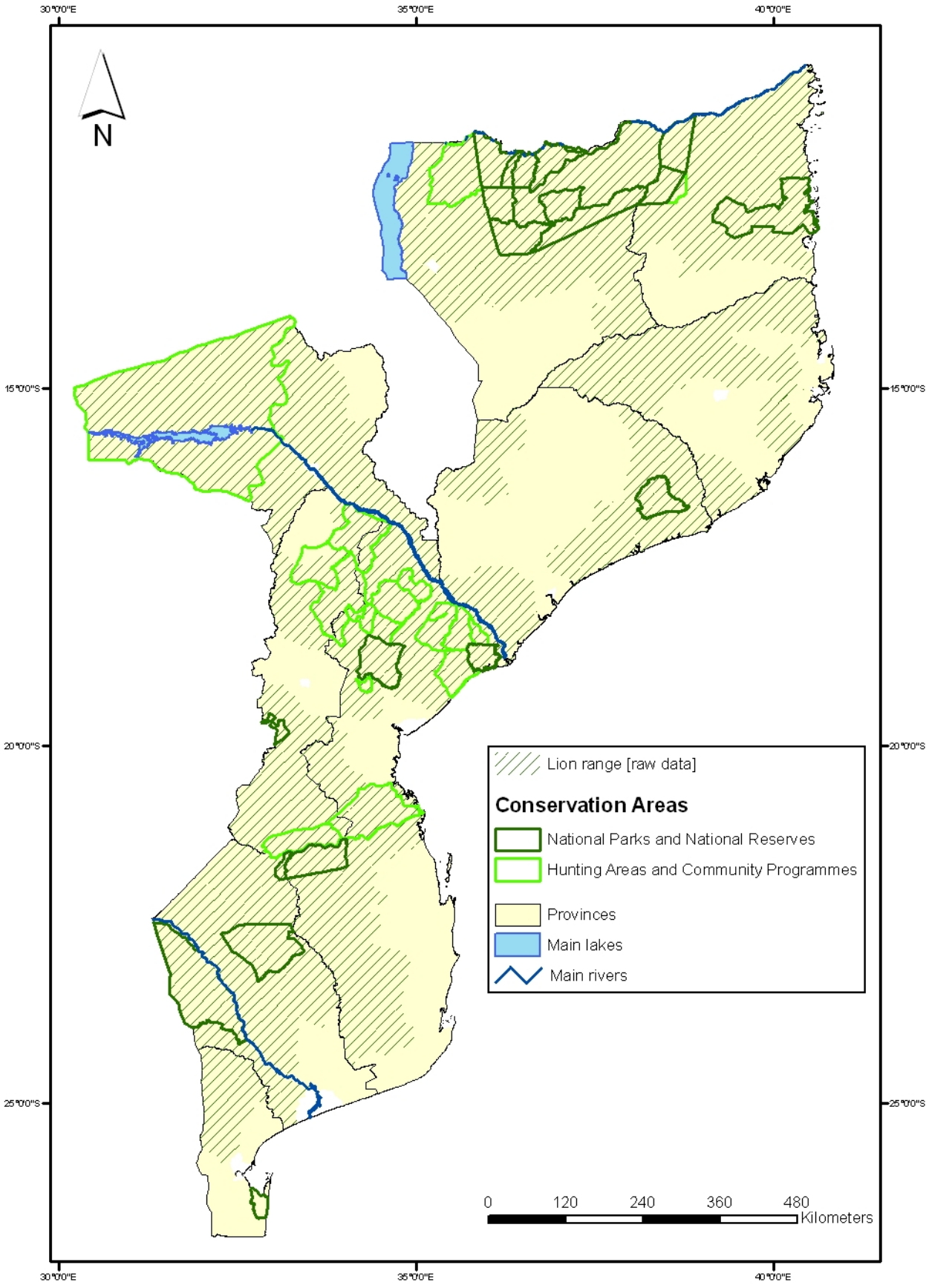
The current lion range (or distribution area) in Mozambique has been estimated by using the database of information collected on lion records during the past 5 years (after 2003).

Two estimations have been proposed, based on the robustness of the data:

- **Range estimation based on raw information** (*i.e.* the entire database) (Map 3; Appendix III)

The lion range encompasses:

- A global surface of about 530,000 km², i.e. 68% of the total surface of Mozambique, excluding lakes and islands;
- 80 out of the 128 terrestrial Districts, i.e. 63% of all terrestrial Districts.



Map 3: Lion range in Mozambique (estimated at District scale by July 2008) based on raw data (100% of the database) during the last 5 years.

Since this map is based on the entire database, it includes some data which are not robust and tends to overestimate the lion range.

- **Range estimation based on refined information** (*i.e.* excluding questionable information) (Map 4; Appendix III)

The lion range encompasses:

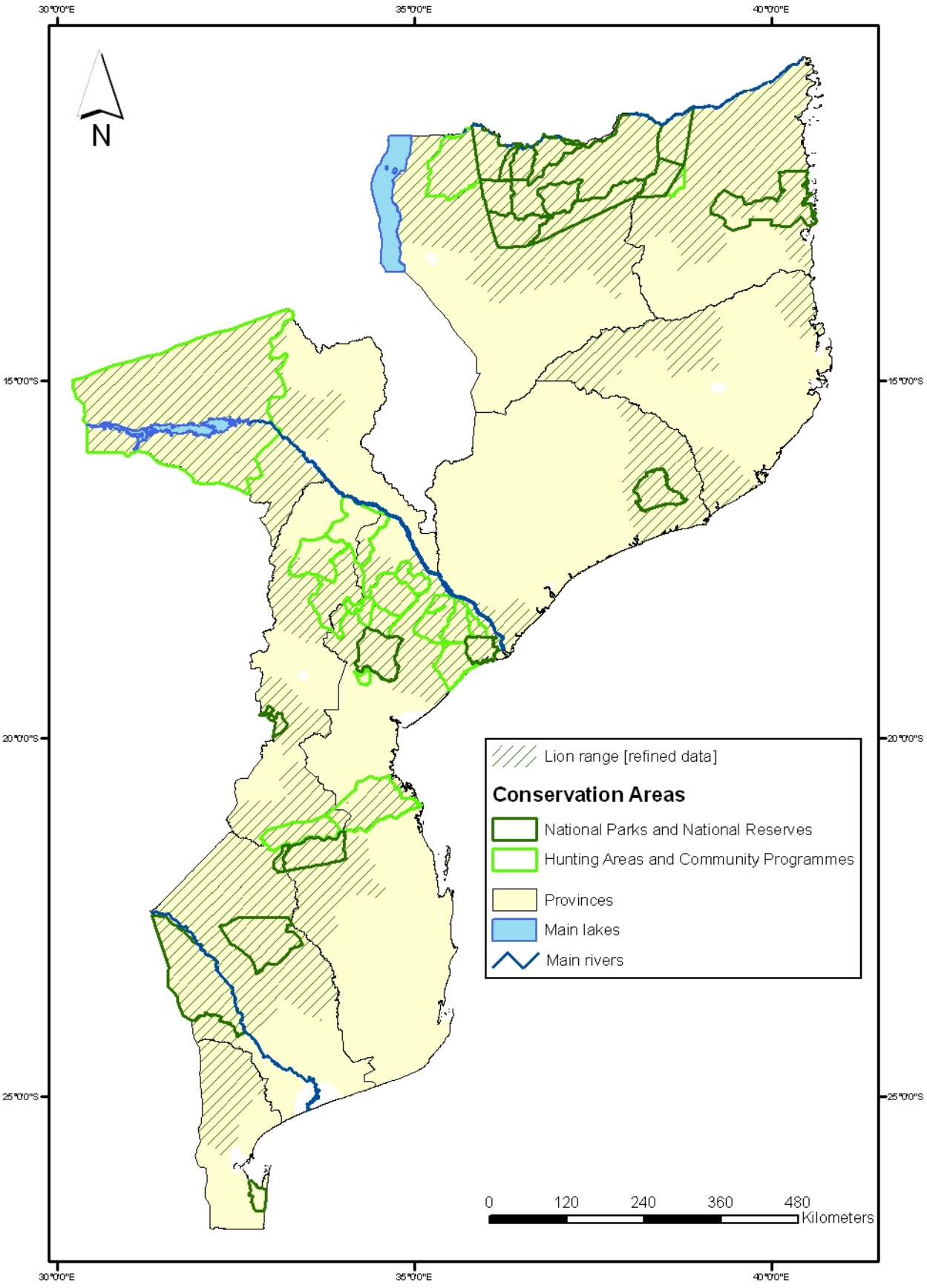
- A global surface of about 380,000 km², *i.e.* 48% of the total surface of Mozambique, excluding lakes and islands (Table III);
- 53 out of the 128 terrestrial Districts, i.e. 41% of all terrestrial Districts.
- A surface of 244,000 km² in non-gazetted areas (*i.e.* 65% of the lion range) and of 136,000 km² (*i.e.* 35% of the lion range) within Conservation Areas (Table III).
- 37 out of the 41 Conservation Areas listed; the absence of lion is attested in only 2 Conservation Areas (Pomene National Reserve and Maputo Special Reserve) and remains questionable in 2 Conservation Areas (Chimanimani National Reserve and Coutada 7).

- **LCUs**

Regarding LCUs, the regional Eastern and Southern Africa Lion Workshop (Johannesburg, 8-13 January 2006) contributed to refine the subpopulations formerly proposed by Chardonnet (2002) by identifying 6 (six) LCUs in Mozambique (IUCN SSC Cat Specialist Group, 2006; Map D, Appendix I):

- **LCU 25**: Niassa National Reserve;
- **LCU 26**: surroundings of Niassa National Reserve;
- **LCU 42**: Gilé National Reserve and surroundings;
- **LCU 35**: south western Tete Province;
- **LCU 43**: Gorongosa National Park, Marromeu National Reserve and surroundings;
- **LCU 49**: Limpopo National Park and surroundings.

In addition, the same source considered a potential range linking LCUs 42, 35 & 43 where lion might occur (IUCN SSC Cat Specialist Group, 2006; Map D, Appendix I).



Map 4: Lion range in Mozambique (estimated at District scale by July 2008) based on refined data (excluding questionable information) during the last 5 years.

Table III: Lion range and minimal population size in Mozambique (July 2008)

National LCU	Gazetted area	Non-gazetted area	Surface (Km²)	Minimal population size	Source of population size estimate
LCU 25/26 Niassa	Niassa National Reserve core area		16 737		
	Hunting block A		3 022		
	Hunting block B		2 215		
	Hunting block C		4 649		
	Hunting block D1		2 407		
	Hunting block D2		3 620		
	Hunting block E		3 660		
	Hunting block R2		2 427		
	Hunting block R3		2 834		
	Hunting block L3		2 476		
	Subtotal Niassa National Reserve		44 047	800	Begg & Begg, 2008
	Quirimbas National Park		9 013		
	Chipenje Chetu Community Programme		6 358		
		Sanga District	4 084		
		Muembe District	5 275		
		Marrupa District	13 149		
		Majune District	8 394		
		Lago District	6 557		
		Macomia District	2 086		
		Mecufi District	1 254		
		Meluco District	1 558		
		Mocimboa da Praia District	3 524	100	IUCN, 2006
		Montepuez District	14 613		
		Mueda District	8 618		
		Muidunbe District	2 123		
		Nangade District	3 005		
		Palma District	3 576		
		Pemba District	631		
		Lalaua District	4 562		
		Malema District	6 082		
		Mecuburi District	7 257		
		Memba District	4 517		
	Subtotal Niassa		**160 284**	**900**	
LCU 35 Tete province	Daque Community area*		N/A		
	Bawa Community area*		N/A	35	Yann le Bouvier, *pers.com.*
	Ntunda Community area*		3 120		
	M'phangula Community area*		1 850		
	Chawalo Community area*		2 275		
	Contengo Community area*		3 342		
	Nhenda Community area*		2 945		
	Tongue Community area*		1 316		
	Chissete Community area*		1 583		
	Magné-Chinfopo Community area*		N/A	32	Safari operator inquiry
		Cahora Bassa District	334		
		Changara District	6 486		
		Chifunde District	847		
		Chiuta District	6 800		
		Luenha District	2 246		
	Subtotal Tete Province		**33 143**	**67**	
LCU 42 Gilé	Gilé National Reserve		2 861		
		Gilé District	8 342		
		Pebane District	8 021		
		Moma District	5 814		
	Subtotal Gilé		**25 038**	**50**	IUCN, 2006
LCU 43 Gorongosa/Marromeu	Gorongosa National Park		3 750	60	DPT inquiry; Carlos Lopes Fereira, *pers. com.*
	Marromeu National Reserve		1 561	15	Carlos Bento, *pers. com.*
	Hunting Area (*Coutada*) n°6		3 042		
	Hunting Area (*Coutada*) n°9		3 761		
	Hunting Area (*Coutada*) n°10		2 600		
	Hunting Area (*Coutada*) n°11		1 868	3	DPT inquiry
	Hunting Area (*Coutada*) n°12		2 734	5	Carlos Bento, *pers. com.*
	Hunting Area (*Coutada*) n°13		5 904		
	Hunting Area (*Coutada*) n°14		646	6	DPT inquiry; Tony Wickler, *pers. com.*
		Chinde District	4 246		
		Caia District	1 439		
		Cheringoma District	3 248		
		Gorongosa District	2 842		
		Maringue District	1 667		
		Marromeu District	1 148		
		Muanza District	5 185		
		Barue District	5 472		
		Macossa District	2 402		
		Sussundenga District	4 745		
	Subtotal Gorongosa/Marromeu		**58 259**	**89**	
LCU 49 Greater Limpopo	Limpopo National Park		10 781		
	Bahine National Park		7 047		
	Zinave National Park		4 618		
	Hunting Area (*Coutada*) n°4		3 194		
	Hunting Area (*Coutada*) n°5		5 727		
		Machaze District	9 429		
		Machanga District	760		
		Magude District	6 961		
		Moamba District	4 577		
		Mabote District	11 821		
		Chicualacuala District	9 577		
		Chigubo District	11 936		
		Mabalane District	7 059		
		Massangena District	7 053		
		Massingir District	2 400		
	Subtotal Greater Limpopo		**102 939**	**0**	
	TOTAL		**379 664**	**1 106**	

From the proposed lion ranges (Map 3 and 4), 5 (five) LCUs are suggested for Mozambique (Table III):

- **LCU 25/26**: Niassa including Niassa National Reserve, Quirimbas National Park, surrounding areas and part of Cabo Delgado Province;
- **LCU 42**: Gilé National Reserve and surroundings;
- **LCU 35**: Western Tete Province;
- **LCU 43**: Gorongosa National Park, Marromeu National Reserve, the surrounding network of Coutadas and surroundings, maybe including the District of Sussundenga nearby Chimanimani National Reserve;
- **LCU 49**: Limpopo National Park, Bahine National Park, Zinave National Park and western Gaza Province.

- **LCU connexions**

Two types of connexion were considered:

- **Connexions beyond borders:** Transfontier LCUs: 3 LCUs (25/26, 35 and 49) are considered as transfrontier LCUs (Chardonnet, 2002; IUCN SSC Cat Specialist Group, 2006).
- **Connexions within Mozambique:** We considered that regional LCUs 25 and 26 are connected. However, whether and to which extent the other LCUs are interconnected still has to be investigated.

2. LION ABUNDANCE

2.1. Historical abundance

Historical reports on lion abundance in Mozambique are numerous, especially in the Zambezi valley, both upstream and downstream, mainly on the southern bank of the river (Livingstone, 1857; Foa, 1895; Kirby, 1896; Maugham, 1910; Matheson, 1947). All historical accounts mention that the lion was a widespread and abundant species throughout Mozambique. In 1896, Frederick Vaughan Kirby (quoted by Shortridge, 1934) even stated: "*In parts of Portuguese East Africa, Lions are probably more numerous than in any other part of South Africa*".

However, no precise figure of historical estimates of Mozambican lion abundance were found before 2002 when two surveys supplied the first assessments of lion population sizes in Mozambique:

- 400 lions [min: 240 - max: 560] (Bauer & Van Der Merwe, 2004);
- 955 lions [668 - 1242] (Chardonnet, 2002).

The discrepancy between both estimates originated from major methodological differences already explained, namely the extent of geographical coverage and the types of methods used (Bauer *et al.*, 2005).

2.2. Current abundance

- **Regional workshop 2006**

The last estimate of lion abundance in Mozambique originated from the Eastern and Southern Africa Lion Workshop (IUCN SSC Cat Specialist Group, 2006). According to this source, by adding all lion population sizes per LCU concerning Mozambique, the cumulative estimate for all LCUs related to Mozambique was 3,325 lions [3,100 – 3,550].

However, because three of these LCUs included transfrontier lion populations, this value cannot be accepted as a figure for Mozambique since it comprises contiguous lions on other sides of the Mozambican border.

- **This study 2008**
    - **Lion censuses**

Proper lion census attempts have been made using conventional techniques only in Niassa National Reserve (Begg & Begg, 2005, 2006, 2008; Begg *et al.*, 2007): the long term monitoring survey conducted since 2004 by the Niassa Carnivore Project gives a lion population estimate of 800-1000 individuals within the Reserve.

In Gorongosa National Park, the individual identification of the lion prides (Carlos Lopes Pereira, *pers. com.*) may be considered as a global inventory of the lion population in the Park. In the intensive management area (covering a surface of about 630 km²), where lions are monitored on a regular basis, the lion population size is estimated at 34 individuals. In the whole Park, the minimum lion population is estimated at 60 individuals.

To date, Gorongosa National Park and Niassa National Reserve are the only areas in Mozambique where reliable estimates of lion densities are available (Table IV).

This study has attempted to review all available figures of minimal estimates of lion abundance per location documented (Table III). By adding all these figures, the total minimal estimate of lions in Mozambique comes to 1,100 individuals.

Table IV: Available estimates of lion density in Conservation Areas

Conservation Area	Specific area	Density (/100km²)	Surface (km²)	Minimal population size	Reference
Niassa National Reserve	Within 10km of primary and secondary rivers	3	-	-	Begg & Begg, 2006
	Beyond 10km of primary and secondary rivers (inland)	1	-	-	
	Whole Reserve	2	42 000	800	
Gorongosa National Park	Intensive management area	5	628	34	Carlos Lopes Fereira, *pers. com.*
	Other areas	1	3 122	26	
	Whole Park	2	3750	60	

If this figure can be considered as minimal, it cannot be accepted as a global population size since most of lion areas are not yet documented in terms of lion abundance.

- **Frequency of lion observations**

Lions were observed (Appendix III):

- Once or twice a year in 20 Districts (i.e. 38%);
- Monthly in 19 Districts (i.e. 36%);
- Weekly in 14 Districts (i.e. 26%).

Districts where lions were most often observed (lion strongholds) were located (Map 5):

- In and around Niassa National Reserve;
- In the northern part of Cabo Delgado Province;
- In the southern part of Tete Province;
- In the Gorongosa National Park/Marromeu National Reserve complex;
- Within Limpopo National Park.

Except for the north-eastern part of Cabo Delgado Province, lions were reported episodically in non-gazetted areas.

3. HUMAN/LION CONFLICT

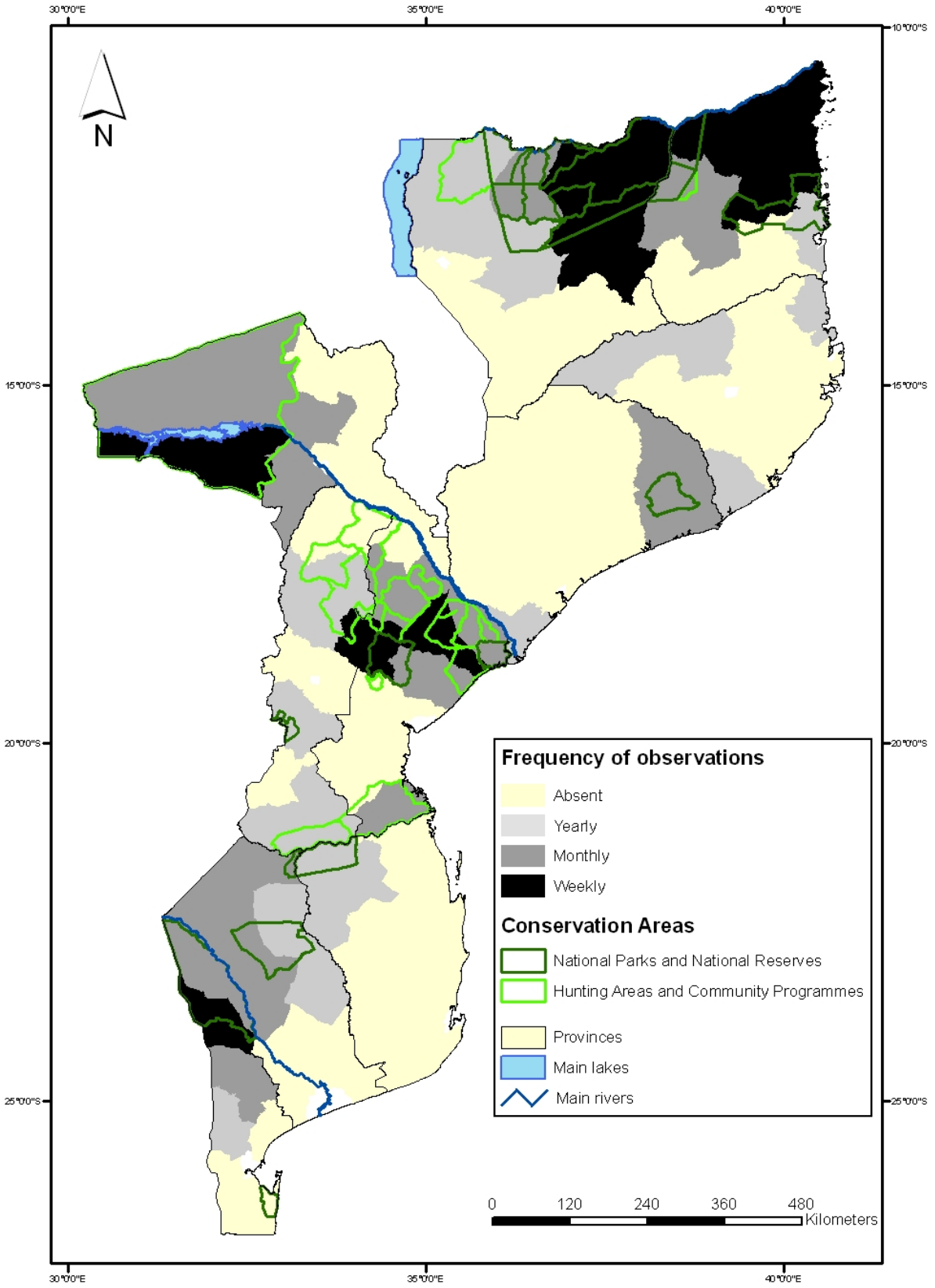
3.1. Magnitude of the conflict

- **Historical account**

As far back as one studies the historical relationship between humans and lions in Mozambique, conflicts resulting from the cohabitation with lion come up as prevalent throughout the country.

In the mid-XIXth century, Livingstone stated that the lions were so abundant that his party often passed little huts made in trees, indicating the places where some of the inhabitants had slept when benighted in the fields. As numbers of his men frequently left the line of march to take out certain birds from their nests, or to follow the honey guides, "*they excited the astonishment of our guides, who were constantly warning them of the danger they thereby incurred from Lions*" (Livingstone, 1857). This was south of the Zambezi near the rivulets Kapopo and Ue, slightly north of the Lobole Hills; and describing conditions about twenty miles farther on in his journey he again refers to the abundance of lions (Matheson, 1947).

According to Matheson (1947), on both the north and the south banks of the lower Zambezi dwelt natives whose beliefs made them refrain from killing Lions and allowed these carnivores to multiply unchecked. We may note that it is of this precise region that Maugham, English consul to Portuguese East Africa, wrote more than half a century after Livingstone's journey (1910): *"South of the Zambesi and near the Mozambique Company's boundary on the Mupa River, Lions are particularly abundant, and many man-eaters occur. To such an extent, indeed, do they carry their depredations that it is no uncommon experience to pass*



Map 5: Frequency of lion observations in Mozambique (estimated at District scale by July 2008). Absent: lion presence not recorded in the area; Yearly: lions were seen only once a year or not every year; Monthly: lions were seen every month or seasonally; Weekly: lions were seen regularly throughout every year.

large well-built villages which have been completely abandoned owing to the number of people taken. In these districts it is not unusual for the native huts to be enclosed in a high palisading designed as a protection, and interwoven with thorn bushes, but in spite of these precautions great casualties occur." Similarly, of Bandar on the northern bank of the Zambezi, lower down the river and nearer the junction of the Zambezi and the Shiré, in the country of the Makanga tribe, Maugham was informed that *"Lions are especially and unpleasantly numerous."* (*in* Matheson, 1947). The belief which protected the Lion, and permitted its unchecked increase even in an area where it was frequent and dangerous, as recorded by Livingstone and Werner, shows the caution necessary in assessing the probable reaction of primitive man to his animal environment (Matheson, 1947).

Gerhard Liesegang (2003) gave the following account on lion occurrence in Mavago District, Cabo Delgabo Province: "*After WWI, ca. 1925, lion populations had very much increased apparently due to the confiscation of firearms and some outlying areas were abandoned due to the "war of the lions". Lion hunters were prominent to ca. 1930. The Niassa company paid a prime on lion and leopard shots. This ceased when the state took over and as a result around 1934 lion populations have increased very much*."

- **Human/lion conflicts throughout Mozambique**

Today, southern Tanzania and northern Mozambique appear on top of the list of all African regions with serious human/lion conflicts (Chardonnet *et al.*, 2008).

In Mozambique, the lion has been and is still involved in recurrent conflicts with people and human activities. However, in this country the lion does not come first on the list of problem animals: it is not mentioned as the most conflicting animal when compared to crocodile and elephant.

In our inquiries, 38 out of the 53 Districts included within the lion range (*i.e.* 72%) have reported Human/lion conflicts during the last 3 years (Appendix III).

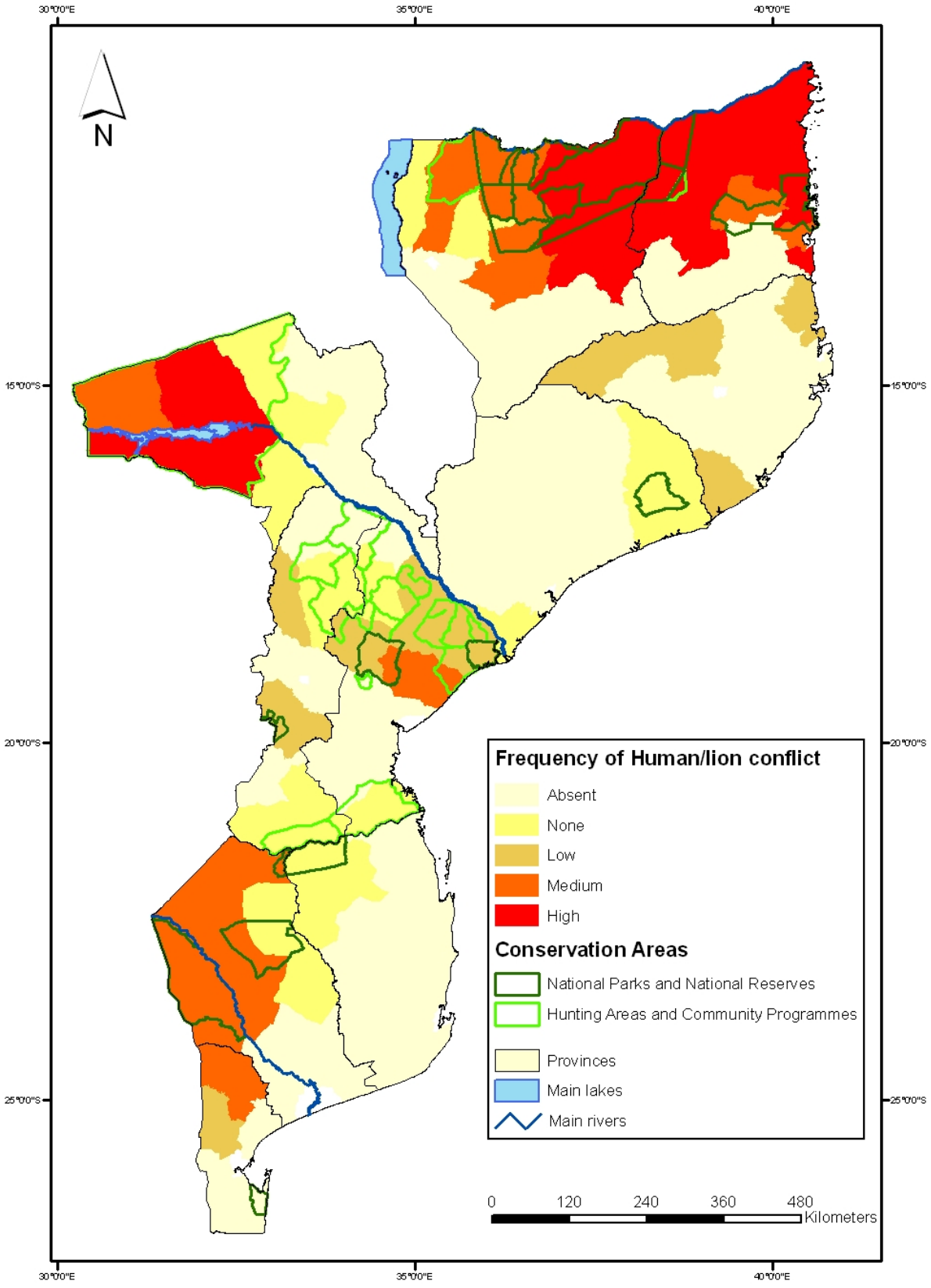
Across Districts where conflicts had been recorded:

- Frequencies of conflicts were evenly distributed (Map 6), i.e. 14 Districts faced conflicts at high frequency (i.e. 36%) and 12 Districts faced conflicts respectively at low and medium frequencies (i.e. 32%);
- Human casualties were reported in 17 Districts (i.e. 45%) while conflicts only involved livestock losses in the remaining 21 Districts (Map 7).

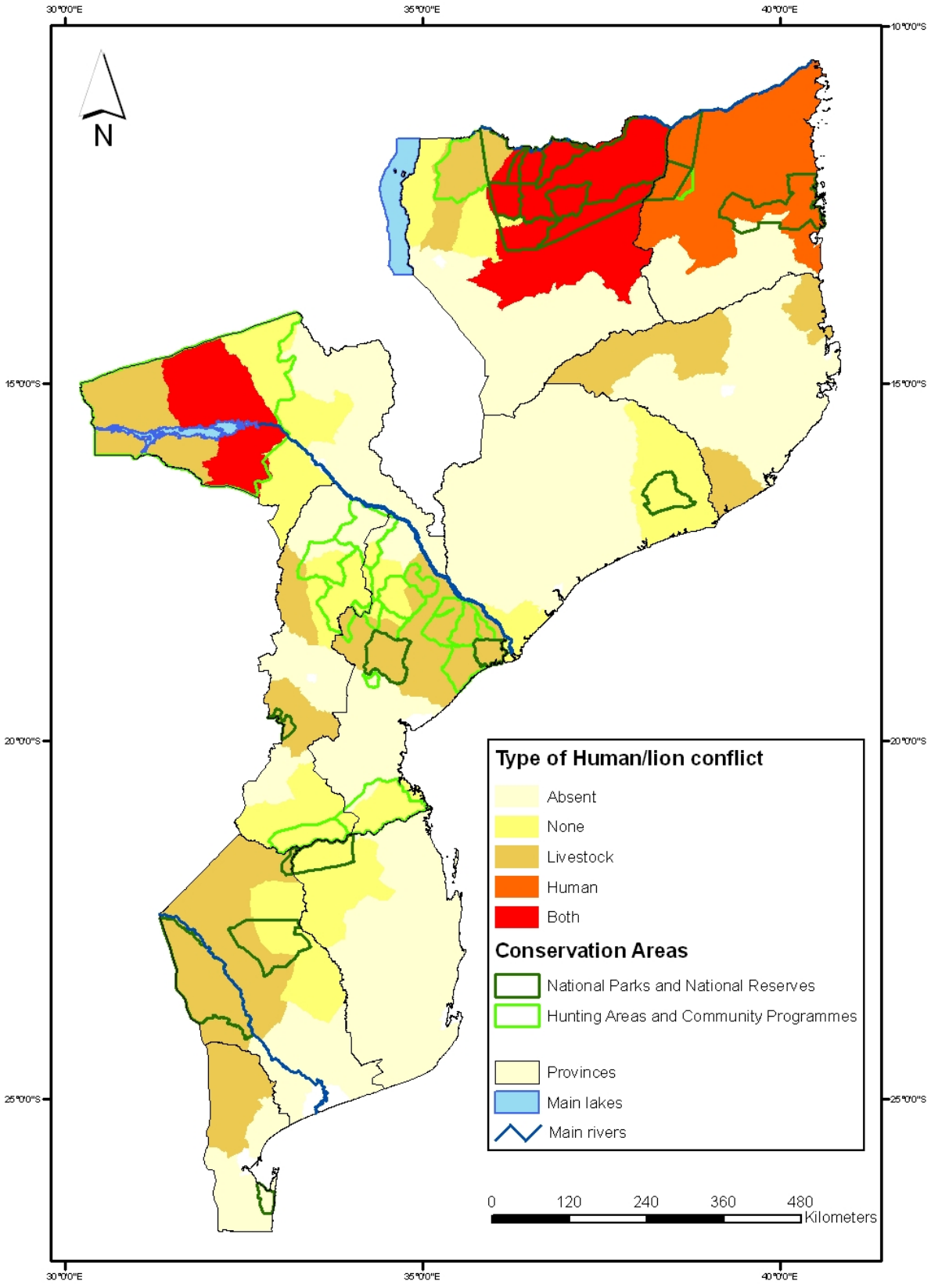
- **Human/lion conflicts at Province level**

Our inquiries show that 4 Provinces face a relative high level of conflicts between lion and human activities (Maps 6 and 7):

- Cabo Delgado;
- Niassa;
- Tete;
- Gaza.



Map 6: Frequency of Human/Lion conflict in Mozambique (estimated at District scale by July 2008). Absent: lion presence not recorded in the area; None: conflict presence not recorded in the area; Low: conflicts were reported once or twice and losses involved only a few livestock; Medium: conflicts were reported every year and/or involved at least one human casualty; High: conflicts were reported several times and involved human casualties and/or high number of livestock losses.



Map 7: Type of Human/Lion conflict in Mozambique (estimated at District scale by July 2008). Absent: lion presence not recorded in the area; None: conflict presence not recorded in the area; Livestock: when cattle, goat or sheep were killed by lions; Human: when human were killed by lion; Both: when both livestock and human losses were attributed to lions, not necessarily during the same year.

As a reminder, both maps on conflicts (Maps 6 and 7) only refer to the last three years: 2006, 2007 and 2008 until June.

Cabo Delgado appears as the Province most affected by lion depredation (Table V).

An apparent increase in conflicts with lions is reported by some informants (inquiries of this survey) in southern Tete Province, Limpopo complex of Gaza Province and some locations in Cabo Delgado Province.

Table VI: Official records of Human casualties in Mozambique between 1997 and 2004 (Courtesy Magane, 2004)

Province	Human casualties	Lion killed
Cabo Delgado	48	13
Niassa	3	1
Nampula	3	1
Zambezia	1	2
Tete	0	1
Manica	0	0
Sofala	1	2
Inhambane	0	0
Gaza	3	4
Maputo	3	1

- **Cabo Delgado Province**

The Human/lion conflict problem appears more severe in Cabo Delgado than in any other Province. 48 people were officially killed by lions between 1997 and 2004 (Table VI; FAO, 2005). According to Begg *et al.* (2007), an escalation in lion attacks has been experienced in Cabo Delgado Province particularly on the Mueda plateau. Reports suggested that 46 people were killed between 2002 and 2003 in Muidimbe district on the Makonde plateau (Israel, *in prep*.) with 70 people killed between 2000 and 2001 by lions in Cabo Delgado (Begg *et al.*, 2007).
This survey confirmed that Cabo Delgado has the most severe problem with man-eating lions (Maps 6 and 7). A specific issue of concern about lion attacks on humans in this Province was raised by most sources of information. The district of Palma has often recorded human casualties and several stories of human killing lions are commonly heard (Baldeu Chande, *pers. com*.; Carlos Bento, *pers. com*.). Lions were even killed within the city of Palma, in 2004 (for injuring a person coming out of the casino; Colleen Begg, *pers. com*.) and in 2007 (Resia Cumbi, *pers. com*.). The lion population in Cabo Delgado is connected with the south-eastern Tanzanian lion population where there have been at least 500 attacks on human since 1990 (Packer *et al.*, 2005).

Table V: Available official records on Human/Lion conflicts in Mozambique, for the past three years only (2006, 2007, 2008 until June)

Province	Conservation Area	District	Livestock losses			Human casualties			Lion killed as PAC*			Source
			2006	2007	2008	2006	2007	2008	2006	2007	2008	
Cabo Delgado		Palma					4	7		2		MINAG
		Mecufi								5		MINAG
		Meluco								1		MINAG
	Quirimbas NP	Meluco Macomia Quissange					4	6			2	MITUR
Niassa		Marrupa									1	MINAG
Nampula		Moma								1		MINAG
		Mecuburi		1 cattle; 1 goat								MITUR
Manica		Barue								1		MINAG
Sofala		Marromeu					1					MITUR
Gaza		Bilene							1			MINAG
		Chicualacuala								1		MINAG
	Limpopo NP	Chicualacuala Massingir		32 cattle; 4 donkeys; 2 goats								MITUR
Maputo		Magude		18 goats & sheep					1		2	MINAG and DPA inquiry
		Moamba								2		MINAG
Tete		Maravia					2					DPT inquiry
		Cahora Bassa		cattle & pigs			1					Saf op inquiry
Total of available records				**58**			**12**	**13**	**2**	**13**	**5**	

* Problem Animal Control

- **Niassa Province**

Human/lion conflicts have been reported yearly in the Niassa Province and FAO (2005) mentions at least 9 people killed and 6 injured between 1987 and 2006. Within the Niassa National Reserve there have been at least 73 lion attacks for a minimum of 34 people killed and 37 injured since 1974 with a minimum of 11 people killed and 17 injured in the last 6 years alone (Begg *et al.*, 2007). No casualty was recorded in Niassa villages in 2007 (Begg & Begg, 2008); there has been only one person injured so far in 2008 but the lion was caught in a snare, broke free and so provoked attack (Colleen Begg, *pers. com*.). However this area has not been comprehensively surveyed and several more attacks may remain unreported (Begg *et al.*, 2007). 50% of these attacks have occurred in the village with the lions entering living areas and on 4 occasions pulling people out of the huts, 34% have occurred in the fields and only 18% in the bush (Begg *et al.*, 2007).

- **Tete Province**

Although only little information was available for the Tete Province, frequent Human/lion conflicts were reported there (DPT inquiry). Conflicts involved both livestock losses and human casualties (2 in Moravia District, 2007, DPT inquiry). According to FAO (2005), the Province has a healthy lion population and the problem appeared lower than one might expect.

- **Gaza Province**

Both people and cattle had been killed in the Province (FAO, 2005). 3 people were killed between 1997 and 2004 (Table VI; FAO, 2005). Problem lions are said to have increased when lions started to move out of the Kruger and Gonarezou National Parks. Although no human casualty has been recorded since 2006 (MINAG), livestock losses to lion have been increasingly reported in the past three years (DPA inquiry).

- **Maputo Province**

Apparently, there is an emerging Human/lion conflict in Maputo Province. 3 people have been killed between 1997 and 2004 (Table VI; FAO, 2005), none after. Occasionally lions are forced out of the Kruger National Park into the Province where considerable killing of livestock have been reported (FAO, 2005). It has been assumed that "diminished lions infected with tuberculosis in Kruger National Park, South Africa, have been observed killing livestock in adjacent areas of Mozambique" (Bartolomeu Soto, *pers. com.* in Chardonnet *et al.*, 2008). In December 2004, lions from the Kruger National Park killed 18 heads of Brahman cattle in the Province (FAO, 2005). 18 goats/sheep were recently killed by lions in Magude District (DPA inquiry).

3.2. Biases in conflict assessment

- **Under-reporting**

Numerous observers such as Anderson and Pariela (FAO, 2005) or Begg (Begg *et al.*, 2007) consider tremendous under-reporting of Human/lion conflicts in Mozambique. As an

example, over 18 months, between 2000 and 2001, 70 human casualties are known to have occurred in Cabo Delgado Province (Begg *et al.*, 2007) while Table VI only reports 48 between 1997 and 2004. As a matter in fact, casualties of isolated persons in remote wilderness are most likely overlooked. Furthermore, some people might be reluctant to report a casualty when witchcraft is suspected.

- **Overestimation**

Historical accounts are confirmed by recent reports to assume that, in some rural societies of the sub-region, witchcraft may be responsible for disguised casualties unduly attributed to the lion, thus overestimating the number of accidents due to real lions.

In the late XIXth century, David Livingstone, travelling in Mozambique along the southern bank of the Zambezi towards its mouth, found himself, although approaching the Portuguese settlement of Teté, in a district where there were « *a great many Lions and Hyaenas, and there is no check upon the increase of the former, for the people, believing that the souls of their chiefs enter into them, never attempt to kill them; they even believe that a chief may metamorphose himself into a Lion, kill anyone he chooses and then return to the human form; therefore when they see one they commence clapping their hands, which is the usual mode of salutation here*…» (Livingstone, 1857).

Later in Malawi, just next to Mozambique, Norman Carr described the so-called "spirit-lions" named "*walenga*", which are locally regarded as former revengeful chiefs (Carr, 1969).

More recently in Mozambique (in the 1980s), some lion attacks were believed to be the work of witchcraft and "spirit-lions" not bush lions; this appears to have declined within the Niassa National Reserve in the 1990s, due to the death of the powerful traditional healer who lived in Mecula (Begg *et al.*, 2007). In the 2000s, the same phenomenon appeared in Cabo Delgado Province, and led to a sort of political rebellion (Israel, *in prep.*).

Similarly, in Southern Tanzania, on the other side of the Mozambique border, Rolf Baldus (2004) describes the connection for local people between human-eating by lions and superstition: a "*simba-mtu*" (a human lion) is an invisible person turned into a lion and killing for revenge. When reported, these cases are real human/lion conflicts although perceived as magical. However, the same author reports opposite situations where real men carried out killings disguised as if they had been done by lions. When reported, these cases tend to overestimate the Human/lion conflict and to accuse the lion unfairly.

In Niassa National Reserve, spirit lions are named "*lisimba liancuzunza*" in Cyao; "*caramo otantusia*" in Makua and "*samba wa kuzusha*" in Swahili (Colleen Begg, *pers. com*.).

3.3. Conflict mitigation

Like in many countries, the control of problem animals in Mozambique is considered by the Law (Artigo 25, Capitulo IV, Lei n°10/99 de 7 de Julho 1999 : Lei de Florestas e Fauna Bravia; Artigo 68, Capitulo IV, Decreto n°12/2002 Aprovando o Regulamento da Lei n°10/99 de 7 de Julho 1999 : Lei de Florestas e Fauna Bravia).

Anderson and Pariela (FAO, 2005) stated: "*while lions are a sought after species for tourists and trophy hunters, under the present circumstances in Mozambique it is obvious that costs*

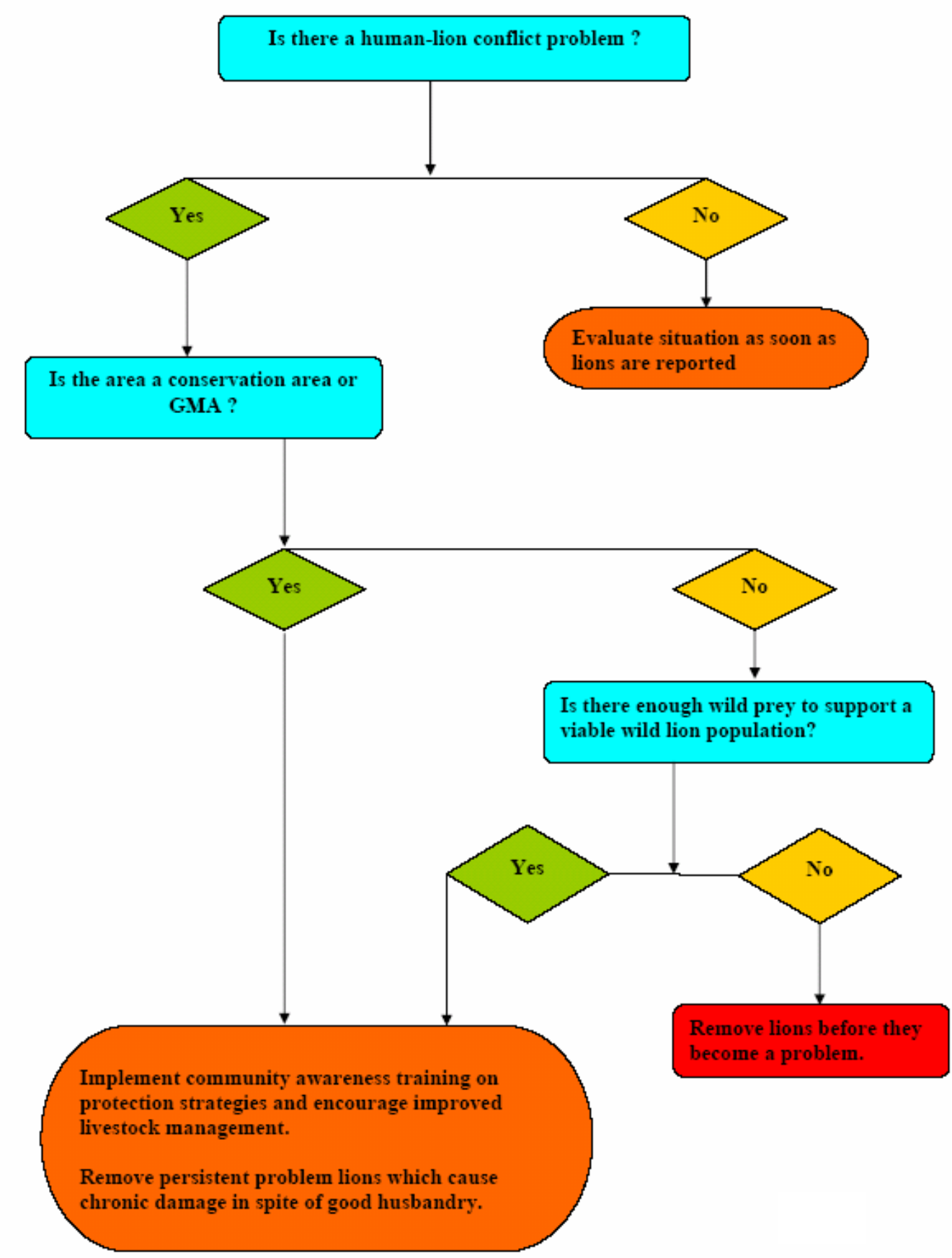


Figure 1: Decision making process for managing Human/lion conflict in Mozambique (Courtesy FAO, 2005)

exceed benefits for lions living amongst people in communal areas". The same authors have proposed an interesting scheme for a decision process to manage problem lions in Mozambique. (Figure 1).

4. LION HUNTING

Informal harvesting of lion is not allowed in Mozambique. If practised, it is treated as poaching and subject to fines and penalties as any illegal activity.

Formal harvesting of lion is strictly controlled within the framework of the tourism hunting activity. Each hunting area is considered individually: a specific lion quota is attributed per hunting season and revised annually by the relevant wildlife authority (DNAC/MITUR & DNTF/MINAG) according to a set of criteria. Only adult males are considered for quota. A specific programme is set up and monitored in the Niassa National Reserve where only lions older than 6-year-old can be hunted by trophy hunters.

- **Lion quota**

In 2007, the national quota for lion has been set to 52 animals (DNAC database; Table VII), attributed as follows:

  - 58% to Hunting Areas (N=30);
  - 13 % to Game ranches (N=7);
  - 29% to non-gazetted areas (N=15).

In 2007, the Niassa Province is the Province with the highest lion quota, representing 39% (N=20; Table VII) of the national quota. In all other Provinces, the respective lion quotas per Province represented less than 15% of the national quota (Table VII).

- **Lion offtake**

In 2007, the national offtake of lion was 9 animals, with an overall offtake percentage of 17% (Table VII). Lions were mainly hunted in Niassa National Reserve hunting blocks, where 8 out of the 18 lions in quota were taken in 2007 (offtake percentage of 44%), against 9 out of 16 in 2006 (offtake percentage of 56%) (Begg & Begg, 2007). Only 1 out of the 7 lions on quota in all Coutadas was harvested (offtake percentage of 14%). No lion was harvested in the Tete Community Programme area.

Table VII: Hunting quotas and lion offtakes in 2007 for Conservation Areas and non-gazetted areas. N/A indicates that quotas were not set for this year (Source: DNAC).

			Lion hunting in 2007		
Province	**Area category**	**Area name**	**Quota**	**Offtake**	**Offtake ratio (%)**
Niassa	Hunting Block	Bloco A	2	1	50.0
		Bloco B	3	2	66.7
		Bloco C	4	1	25.0
		Bloco D1	3	0	0.0
		Bloco D2	3	2	66.7
		Bloco E	3	2	66.7
		Bloco L3	0	0	0.0
		Bloco R2	0	0	0.0
		Bloco R3	0	0	0.0
	Community Programme	Ch. Chetu	N/A		
		B. Lurio	N/A		
		Nungo	N/A		
		Messalo	N/A		
		B. Lureco	N/A		
	Non-gazetted Area		2	0	0.0
Cabo Delgado	Game ranch	N. Safaris	2	0	0.0
	Non-gazetted Area		5	0	0.0
Nampula	Non-gazetted Area		1	0	0.0
Zambezia	Game ranch	M.G.F.	0	0	0.0
	Non-gazetted Area		1	0	0.0
Tete	Community Programme	Bawa	2	0	0.0
		Daque	3	0	0.0
		Chiridzi	0	0	0.0
		Muze	0	0	0.0
		Chawa	0	0	0.0
		Thuvi	0	0	0.0
		Chiputo	0	0	0.0
		Nhenda	0	0	0.0
		Chipera	0	0	0.0
		Chioco	0	0	0.0
		Bungu	0	0	0.0
		Capoco	0	0	0.0
	Non-gazetted Area		2	0	0.0
Manica	*Coutada*	*Coutada* 4	1	0	0.0
		Coutada 5	0	0	0.0
		Coutada 7	1	0	0.0
		Coutada 9	1	1	100.0
	Non-gazetted Area		0	0	0.0
Sofala	*Coutada*	C.10	N/A		
		C.11	N/A		
		C.12	N/A		
		C.14	N/A		
		Coutada 6	0	0	0.0
		Coutada 10	0	0	0.0
		Coutada 11	0	0	0.0
		Coutada 12	0	0	0.0
		Coutada 13	1	0	0.0
		Coutada 14	2	0	0.0
		Coutada 15	1	0	0.0
	Game ranch	M. Safaris	2	0	0.0
	Non-gazetted Area		2	0	0.0
Inhambane	Non-gazetted Area		0	0	0.0
Gaza	Non-gazetted Area		2	0	0.0
Maputo	Game ranch	Game Park	3	0	0.0
	Non-gazetted Area		0	0	0.0
Total			**52**	**9**	**17.3**

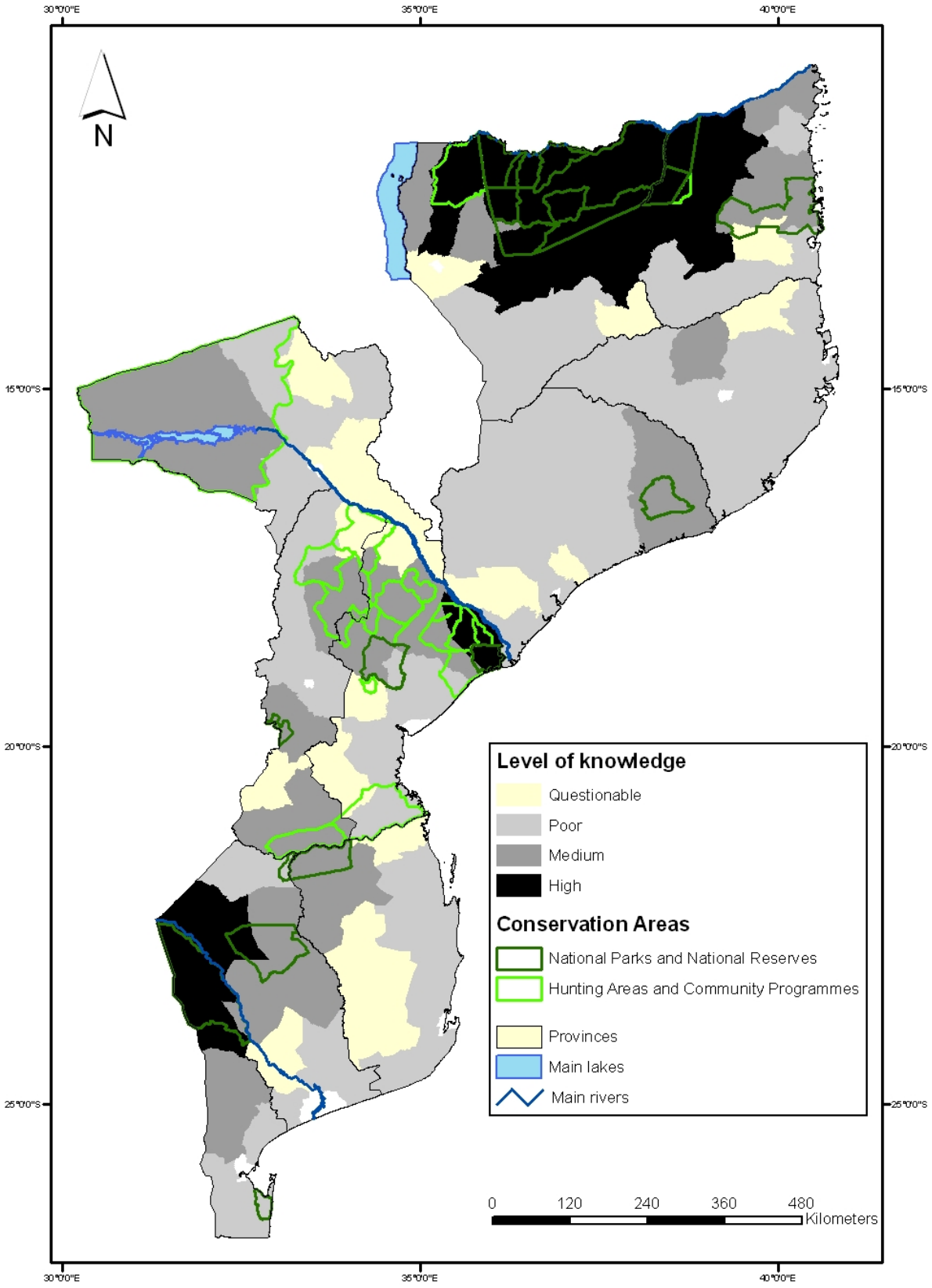
5. LEVEL OF KNOWLEDGE

- **Low level of knowledge**

The level of knowledge was considered as questionable or poor in 91 out of the 128 terrestrials Districts, *i.e.* in 71% of the Districts (Appendix III; Map 8). This demonstrates the relative lack of knowledge in respect to lion in the country.

- **Higher level of knowledge**

Districts with more than 3 converging sources of information represented 21% and 8% of the terrestrial Districts, respectively for the Medium and High level of knowledge categories (§II.3.2). A few Districts appear better documented than others: the lion status was better known in the Districts located around Niassa National Reserve, Marromeu National Reserve and Limpopo National Park (Map 8).



Map 8: Level of knowledge of collated information (estimated at District scale by July 2008). Questionable: only one (1) information or two (2) contradictory information; Poor: two (2) unpublished information; Medium: three (3) or more information; High: three (3) or more information including a specific lion survey or more than six (6) information without specific lion survey.

IV. DISCUSSION AND PERSPECTIVES

1. COMMENTS ON METHODS AND RESULTS

- **Data acquisition**

By looking at Map 8, the relatively poor level of knowledge on lion in Mozambique appears obvious. From there, the difficulty to collate data is clearly understandable. This explains the strategy of this survey, not to rely solely on existing data, but rather to also generate some more information by meeting resource persons and conducting inquiries.

The foundations of this survey are the database which has been set up by/for this study. To be more informative and to remain alive, the database must be incremented by feeding with more information. This process has to be completed during the second phase of the study.

The current literature review is incomplete and more information remain to be collated. The databases on Human/lion conflicts and lion hunting would certainly be improved by precisely checking if more data are available. More resource persons need also to be consulted.

In respect to the inquiries of the survey, the rate of answers so far (Table VIII) could certainly be improved during the next phase. DPA directors were personally interviewed during their annual meeting which was not the case with DPT directors and safari operators (most of the latter being in their hunting areas for the starting season).

Table VIII: Number of answers to the inquiries

	Inquiries sent	**Answers**	**Rate of answers (%)**
Safari operators	18	4	22.2
DPTs and DPAs	20	13	65.0

- **Data analysis**

A first bias for estimating the lion range lies in the sampling unit used for this preliminary survey. The database and the maps have been established at the Administrative level of the District. As a result, the entire District was included in the lion range as soon as lion observations were reported in that District, which does not implies that lions occur in the entire given District. It might be too ambitious to refine the lion range at the level of the Administrative Post within Districts. However, more details could certainly improve the current distribution map.

A second bias in respect to the lion range is the lack of accurate digital outlines for *fazendas do bravio* (game ranches) and for Community Programmes (Tchuma Tchato in Tete Province and Chipanje Chetu in Niassa Province). As a consequence, the proposed relative estimates of

the lion range in Conservation Areas *vs*. non-gazetted areas should be considered as tentative so far.

- **Results**

As a reminder, this preliminary phase of the survey is only the first step of a larger work aiming at updating the conservation status of the lion in Mozambique. The main objectives of the current phase I of the survey were to:

- Gather information about lion status;
- Compile a database from the different sources of information;
- Identity the gaps in knowledge that would have to be addressed to document the conservation status of the lion in Mozambique.

Again, all the results presented at this stage must be considered as provisional and subject to refinement in the second phase of the survey.

The second phase of the study is expected to enhance the level of knowledge on the current situation of the Mozambican lion.

2. GAPS IN KNOWLEDGE

- **Geographical gaps**

  - **Gaps regarding the lion range**

The Districts have been ranked according to the method previously described (§II.3.2) in order to identify Districts with major gaps in knowledge. Major gaps were located (Map 9):

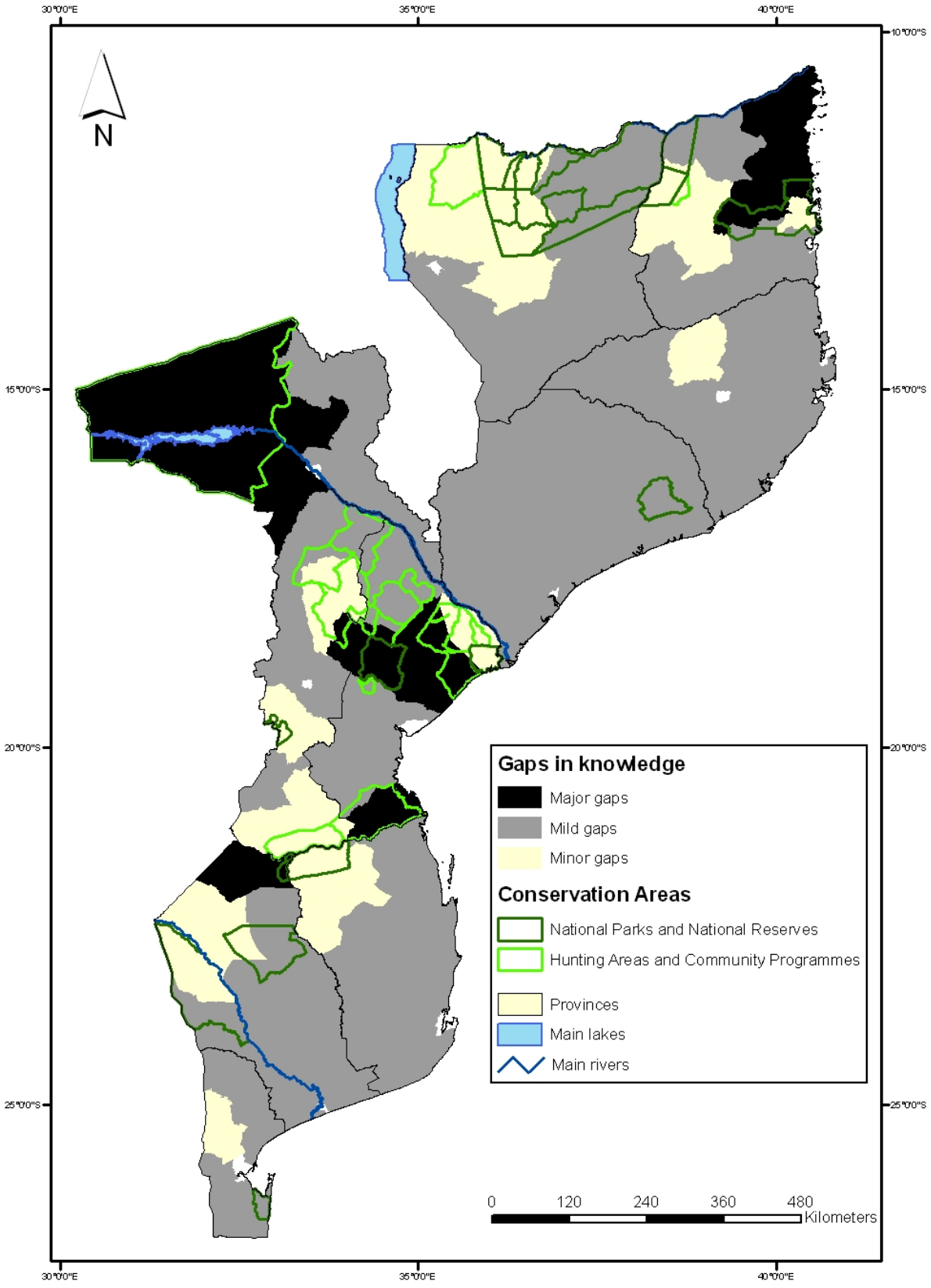
- in north-eastern part of Cabo Delgado Province;
- in Tete Province;
- around Gorongosa National Park;
- within Coutada N°5;
- in Massangena District.

Specific investigations should be carried out in these areas to clarify the status of lion.

Districts with questionable information (N=19; Appendix III) have not been prioritized in map 9 when lions were rarely observed. However, these Districts need some investigation to cross-check the little existing information with additional data. For each of these Districts, one of the four following situations is expected:

- lion presence confirmed;
- lion absence confirmed;
- lion presence invalidated;
- lion absence invalidated.

Both Coutada N°7 and Chimanimani National Reserve raised specific concerns:



Map 9: Gaps in knowledge

- According to this survey, lion presence was not recorded in Chimanimani National Reserve (Sussundenga District). However, three informants reported lion presence in the District of Sussundenga, and the District was therefore included within lion range. However, lion's presence in the District and within Chimanimani National Reserve is still questionable and needs to be clarified.

- Although lion presence has been reported in the Conservation Areas and Districts neighbouring Coutada n°7, only one informant has reported the presence of lions in Coutada n°7. Further investigation would help clarifying the lion status in this Conservation Area.

At this stage, it is assumed that the current lion range in Mozambique probably lies in between the two proposed ranges (Map 3 & 4).

- **Gaps regarding the lion abundance**

In respect to the lion abundance, the gaps in knowledge are huge. The pattern of these gaps is quite similar to the pattern of the gaps in regards to the lion range, although with a larger magnitude since it is much more difficult to estimate a lion population size in a given area than to attest the presence of the lion there.

With a few exceptions, wildlife monitoring has mainly been carried out through aerial surveys in Mozambican Protected Areas. Because aerial surveys are not appropriate to census lions, there is a need to conduct specific lion surveys. Of special concern is the Tchuma Tchato Community Programme where very few quantifiable data were available to assess the abundance of lions despite numerous evidences of an important lion population in this area. Since most of lion areas are not yet documented in terms of lion abundance, we acknowledge that the minimum population size proposed in this survey is still far from reality, and needs to be refined.

This survey was documented by a wide range of resource persons, although with a proportion of people away from the field. More local stakeholders with genuine knowledge of their living/working areas need to be interviewed. It is expected that more reasonable assessments can be obtained from some of these persons.

However, it must be noted that absolute population sizes are note considered as compulsory to properly manage and conserve a given species. Trends are often regarded as more efficient tools. The monitoring of trends need to install a set of valuable indicators to be applied on a long enough period of time. This comment is also valid for hunting quota setting. By the way, in terms of lion hunting monitoring, the quota system can also be replaced by biological constraints such as setting a minimum age for example (Whitman *et al.*, 2004) or be completed by combining the quota system with the minimum age constraint as currently implemented in the Niassa National Reserve (Beg & Begg, 2008).

Finally, since the demographic trend of the lion population in Mozambique remains very poorly known, it has not been properly addressed here by lack of information.

- **Thematic gaps**

A number of gaps need to be filled in for completing a comprehensive review of the lion status in Mozambique. The expected structure of the final status review of the lion in Mozambique provides with the checklist of issues to be covered. According to the IUCN/SSC/Species Conservation Planning Task Force (in press), the classic academic structure of a species status review comprises 7 chapters:

1. Species description
2. Species functions and values
3. Historical account
4. Current distribution and demographics
5. Habitat and resource assessment
6. Threats
7. Conservation and management

Some thematic gaps would have to be filled to document the different chapters:

- **Species description**

The ecology of the lion in general has received considerable attention and is reasonably documented despite many research prospects remaining. However, specific information on the lion in Mozambique is still scarce with a single notable exception in Niassa National Reserve. Furthermore, given the size of the country, regional differences are highly probable.

As an instance, the prey basis is a very important ecological topic to take into account when addressing the conservation prospects of the lion. The currently on-going National Wildlife Survey, carried out under the auspices of MINAG, is promising to provide insights in this matter. For example, the on-going Niassa Carnivore Project shows the prime importance by far of wild suids (bushpig first, then warthog) as preys for lions (Begg & Begg, 2008). Since these particular prey species are widespread and abundant in the whole country even outside gazetted areas (let's wait for the forthcoming results of the above-mentioned National Wildlife Survey), it may be assumed that some lions could be able to sustain themselves in non-gazetted areas. A more anecdotic detail is the hippopotamus as a lion prey species, even though of secondary importance: the case is mentioned in Niassa National Reserve (Begg & begg, 2008) as well as in Tchuma Tchatu Community Programme in Tete Province (Yann Le Bouvier, *pers. com*.).

- **Species functions and values**

The ecologic functions of the lion are reasonably known (*e.g.* Miller *et al.*, 2001), however the values of the lion in Mozambique have to be documented, *e.g.*:

- Cultural value: attitudes and perceptions, regional differences;
- Economical value: economical assets generated by lion viewing and lion hunting. The database on lion hunting should be completed and consistent information on wildlife viewing tourism should be collated.

- **Historical account**

Historical accounts might be completed with more bibliographic references.

- **Current distribution and demographics**

As mentioned earlier, the lion distribution proposed here has to be refined by adding more data to the database. By doing so, a more precise definition of the 5 proposed LCUs will come up. Furthermore, the issue of putative connexions between these LCUs will be clarified (Map 10) and we should remain humble at this stage and wait for the final results of the survey before excluding the possibilities of making a single LCU out of two or considering the lion in Mozambique as a single population. The lion population trend will also have to be evaluated.

- **Habitat and resource assessment**

Lion habitat suitability is mainly driven by the natural habitat integrity and the prey base availability. In this regard, the expected outcomes of the ongoing National Wildlife Survey will be very valuable to help assessing the ecosystem suitability for lions.

- **Threats**

During this preliminary survey, the Human/lion conflict is the only threat to lion which as been considered and partially addressed. The databases on Human/lion conflicts should be completed.

In the regional conservation strategy for the lion in Eastern and Southern Africa, the top threats to lion include, in order of importance (IUCN SSC Cat Specialist Group, 2006):

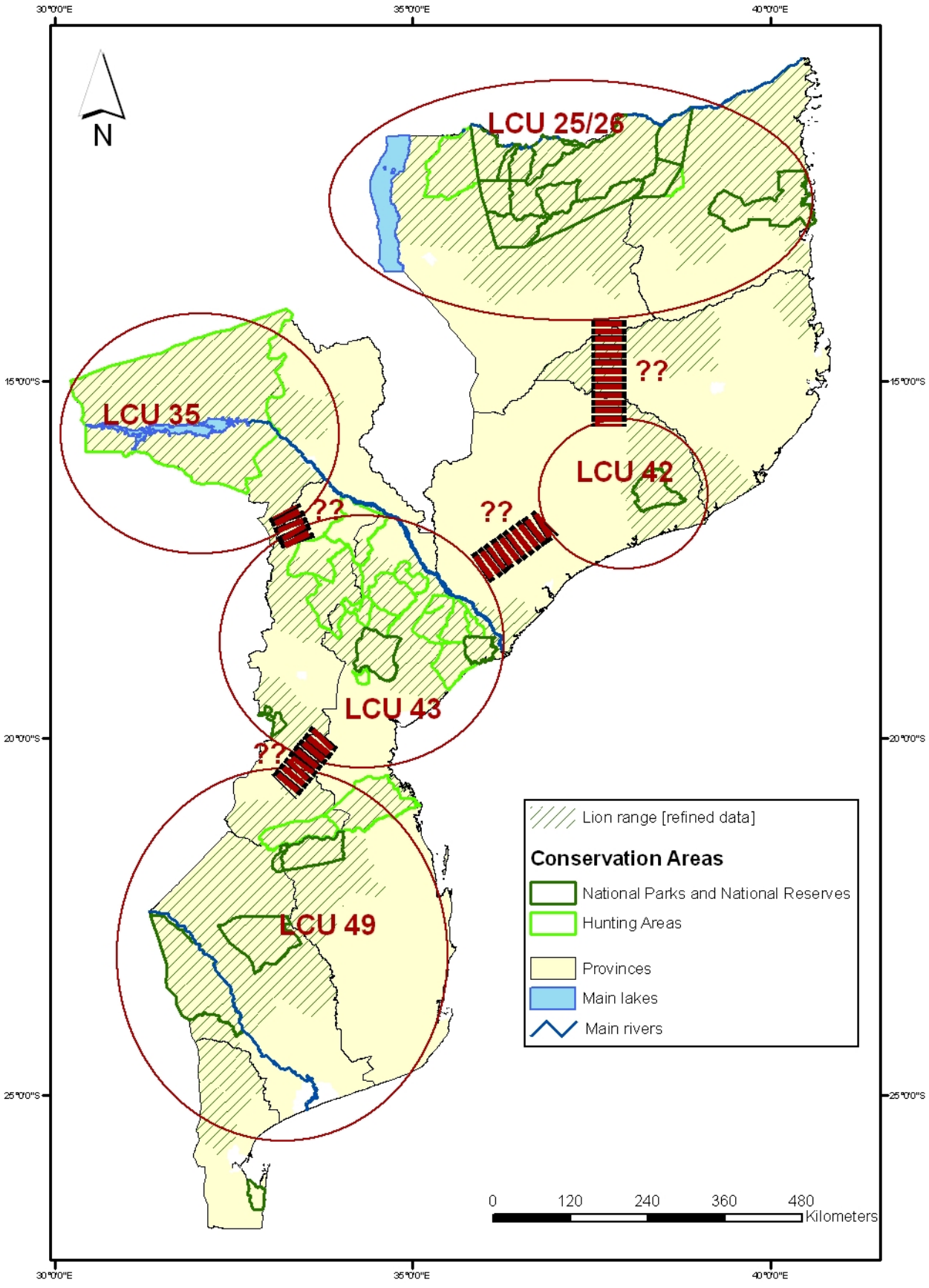
- Prey availability;
- Indiscriminate killing of lions (e.g. inadvertent snaring);
- Size and extent of the lion population;
- Amount of wild habitat available;
- Efficacy of management for lion conservation.

Other important factors include habitat quality, lion population status, presence of domestic livestock. The low genetic diversity of the small and isolated populations of carnivores is also mentioned as a possible factor responsible for the decline of these species (O'Brien *et al.*, 1985; Wildt *et al.*, 1987). Lastly, diseases can cause demographic catastrophes threatening large predators with a developed social way of life (*e.g.* Berry, 1993; Hofmann-Lehmann *et al.*, 1996; Keet *et al.*, 1998; Gaydos & Corn, 2001). Because human population inhabits inside many Protected Areas in Mozambique, domestic dogs also range inside Protected Areas where they act as reservoirs for rabies and probably canine distemper.

All these threats have to be considered and presented for prioritization to the national workshop.

- **Conservation and management**

To document this chapter, a brief review of the current measures taken by Mozambique for the conservation and management of the lion has to be carried out.



Map 10: Preliminary set of National LCUs proposed

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APPENDICES

APPENDIX I: Lion range maps published in literature

- **Map A**: African lion range according to Bauer & Van Der Merwe (2004);
- **Map B**: Southern African lion range according to Chardonnet (2002);
- **Map C**: African lion range according to African mammal databank (1999);
- **Map D**: Eastern and Southern African lion range according to IUCN SSC Cat Specialist Group (2006);
- **Map E**: Mozambican lion occurrence according to Galvão (1943);
- **Map F**: Mozambican lion range according to Smithers & Tello (1976);
- **Map G**: Proposed habitat suitability for lions in Mozambique (Ghiurghi & Urbano, 2007);
- **Map H**: Mozambican lion records in Ghiurghi & Urbano (2007).

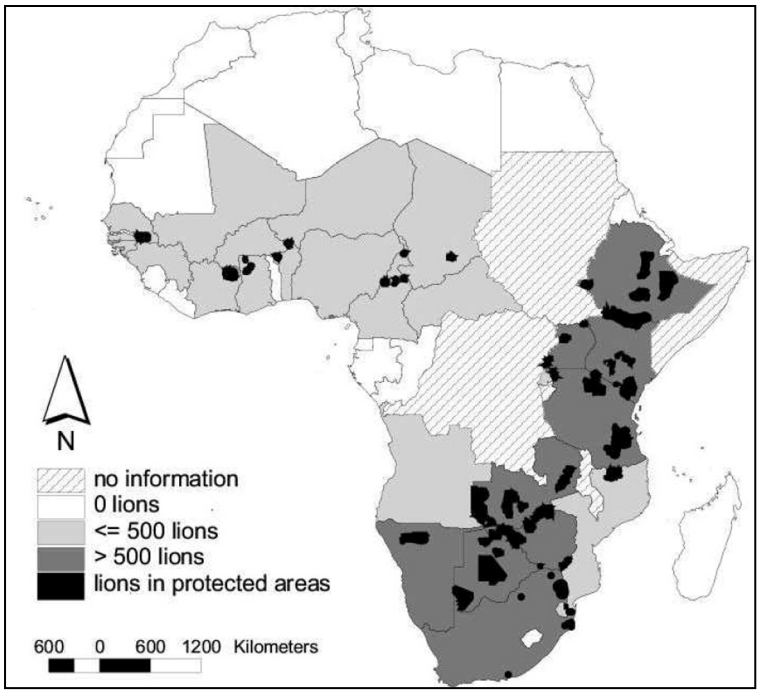
APPENDIX II: Inquiry forms

- DPT & DPA inquiries;
- Extra material used for DPA inquiry;
- Safari operator inquiry.

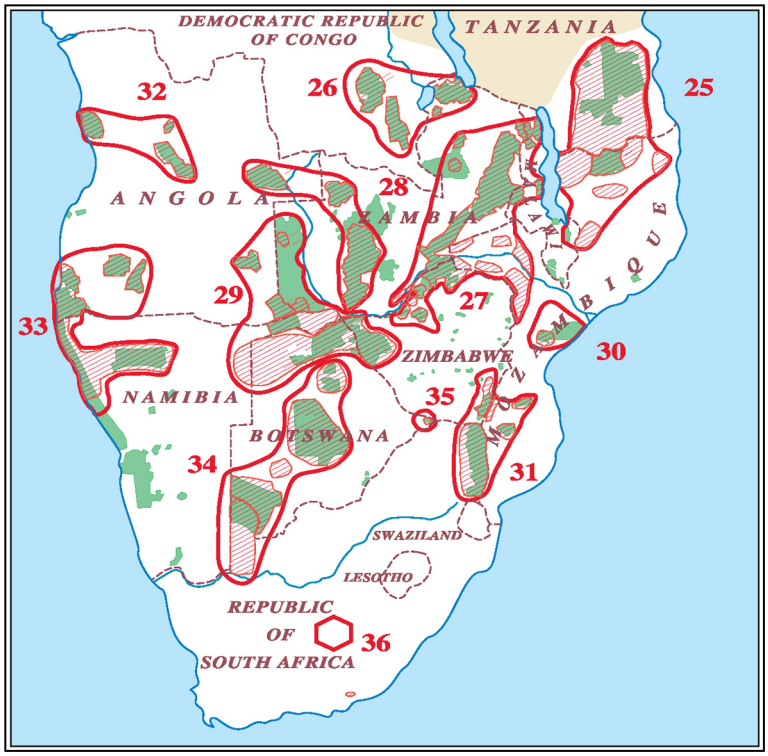
APPENDIX III:

- Preliminary results of the survey's database

APPENDIX I



Map A: African lion range according to Bauer & Van Der Merwe (2004)



Map B: Southern African lion range according to Chardonnet (2002)

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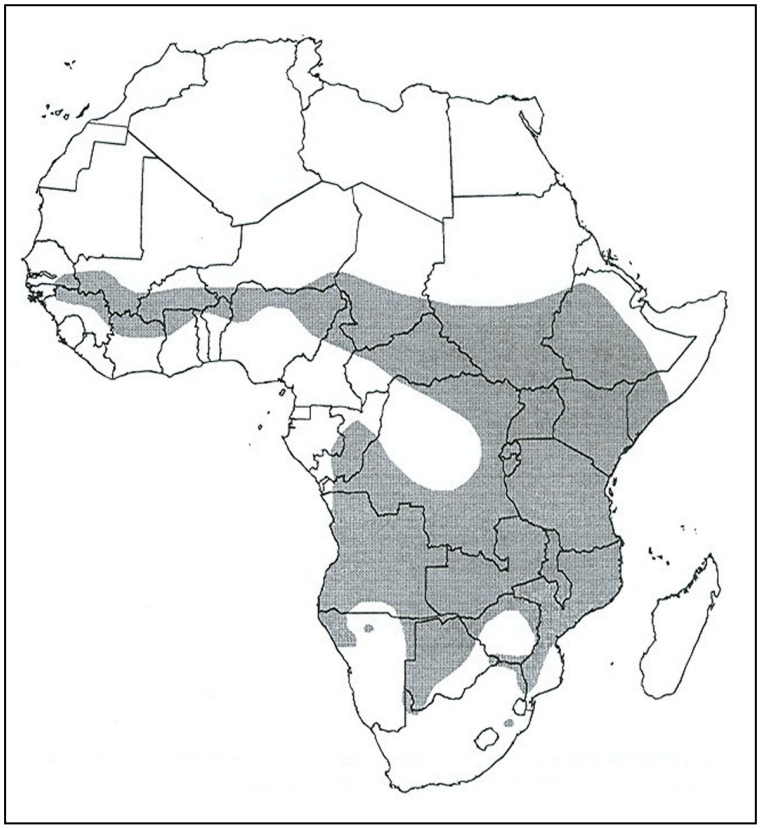
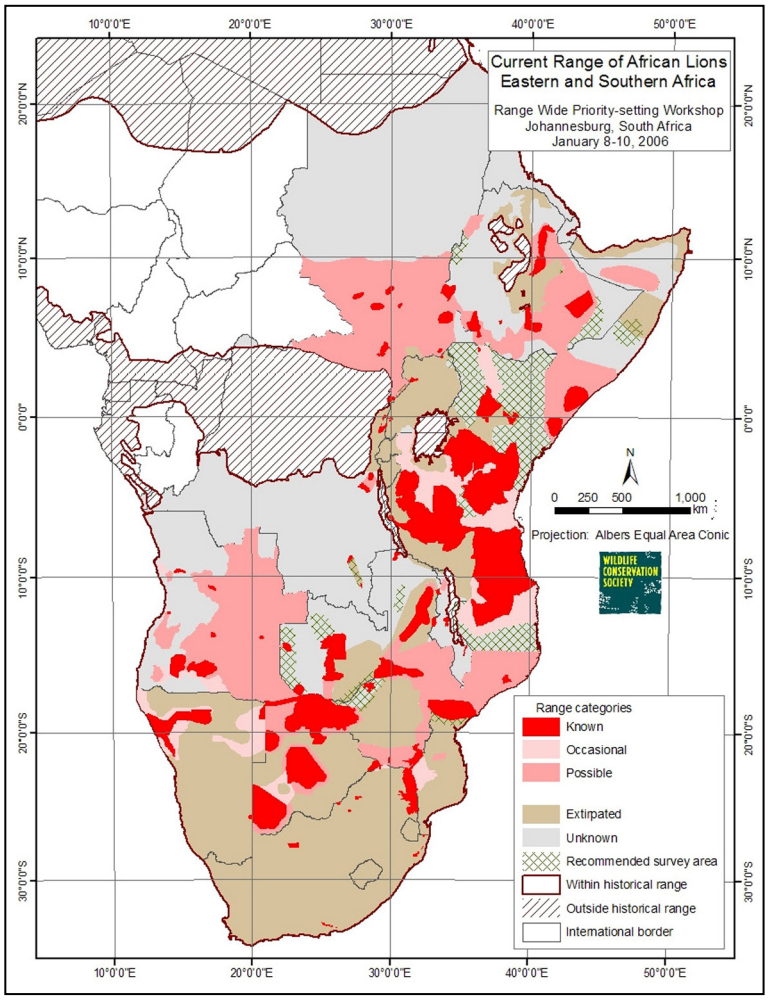
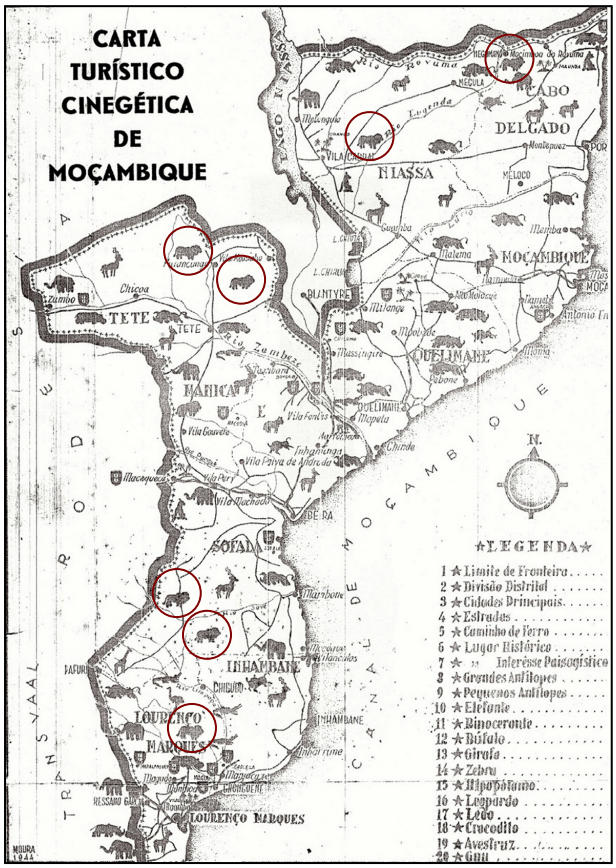


Map C: African lion range according to African mammal databank (1999)

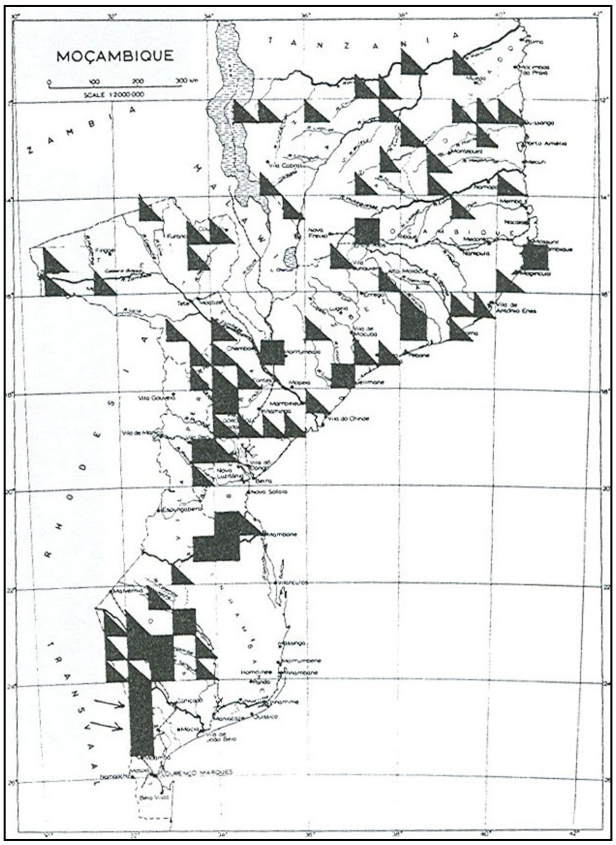


Map D: Eastern and Southern African lion range according to IUCN SSC Cat Specialist Group (2006)

APPENDIX I

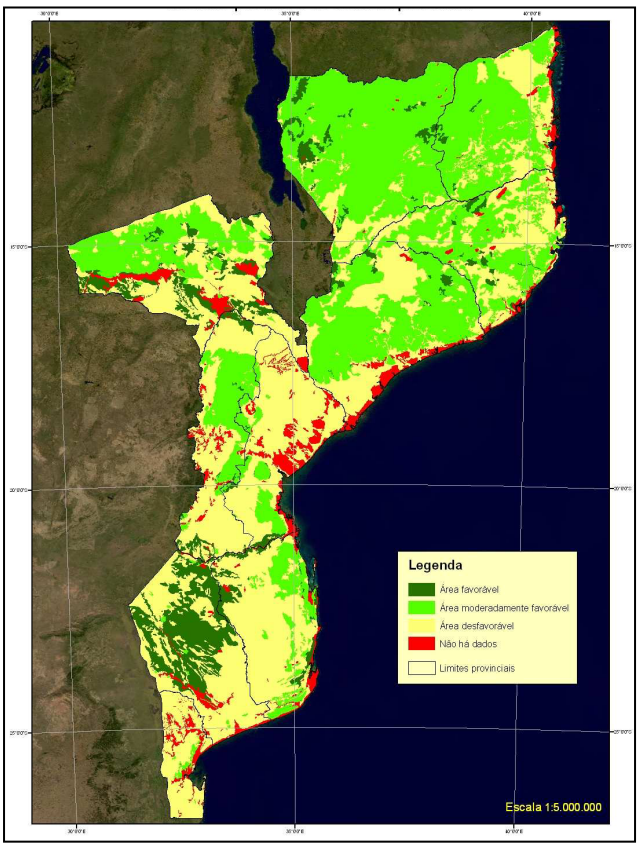


Map E: Mozambican lion occurrence according to Galvão (1943). Lion quotations inside red circle.

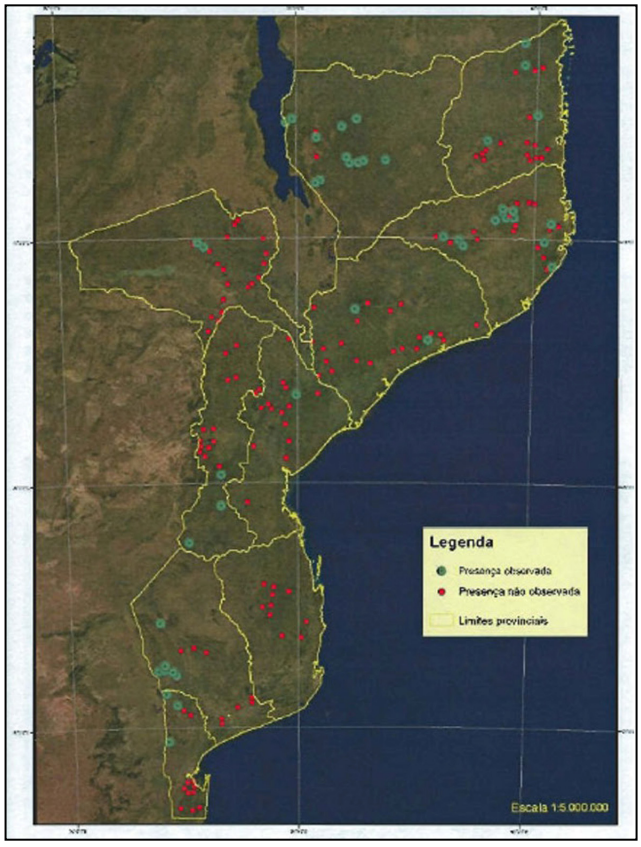


Map F: Mozambican lion range according to Smithers & Lobão Tello (1976)

APPENDIX I



Map G: Proposed habitat suitability for lions in Mozambique (Ghiurghi & Urbano, 2007)



Map H: Mozambican lion records in Ghiurghi & Urbano (2007)

APPENDIX II - DPT and DPA inquiries

Primeiro Censo Nacional do Leão
Questionário de levantamento de dados nas provincias

Provincia_____

1. Tem alguma informação de ocorrência de leões

	Sim	Não
Mês passado		
Ano passado		
Á 5 anos		
A mais de 5 anos		
Nunca		

2. Tem alguma informação de frequencia de leões ?

	Sim	Não
Cada semana		
Cada mês		
Cada 6 meses		
Cada ano		
Esporadicamente		

3. Em que zona da Provincia tem informação da ocorrência de Leões? (indicar distrito e/ou localidade). Favor colocar os distritos com mais leões em primeiro. Por favor, pode usar o mapa na pagina 3 para marcar os distritos.

Distrito	**Localidade**
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____
7. _____	_____
8. _____	_____

4. Tem alguma informação de ocorrência de conflitos entre leões e população:

	Sim	Não	Numero de animais domésticos afectados (indicar o tipo de animal)	Número de pessoas afectadas	Distrito
Mês passado					
Ano passado					
Á 5 anos					
A mais de 5 anos					
Nunca					

5. Tem alguma informação sobre o tipo de presa do leão na sua área:

Tipo de presa (espécie)	**Periodicidade**	
	Frequente	Ocasional

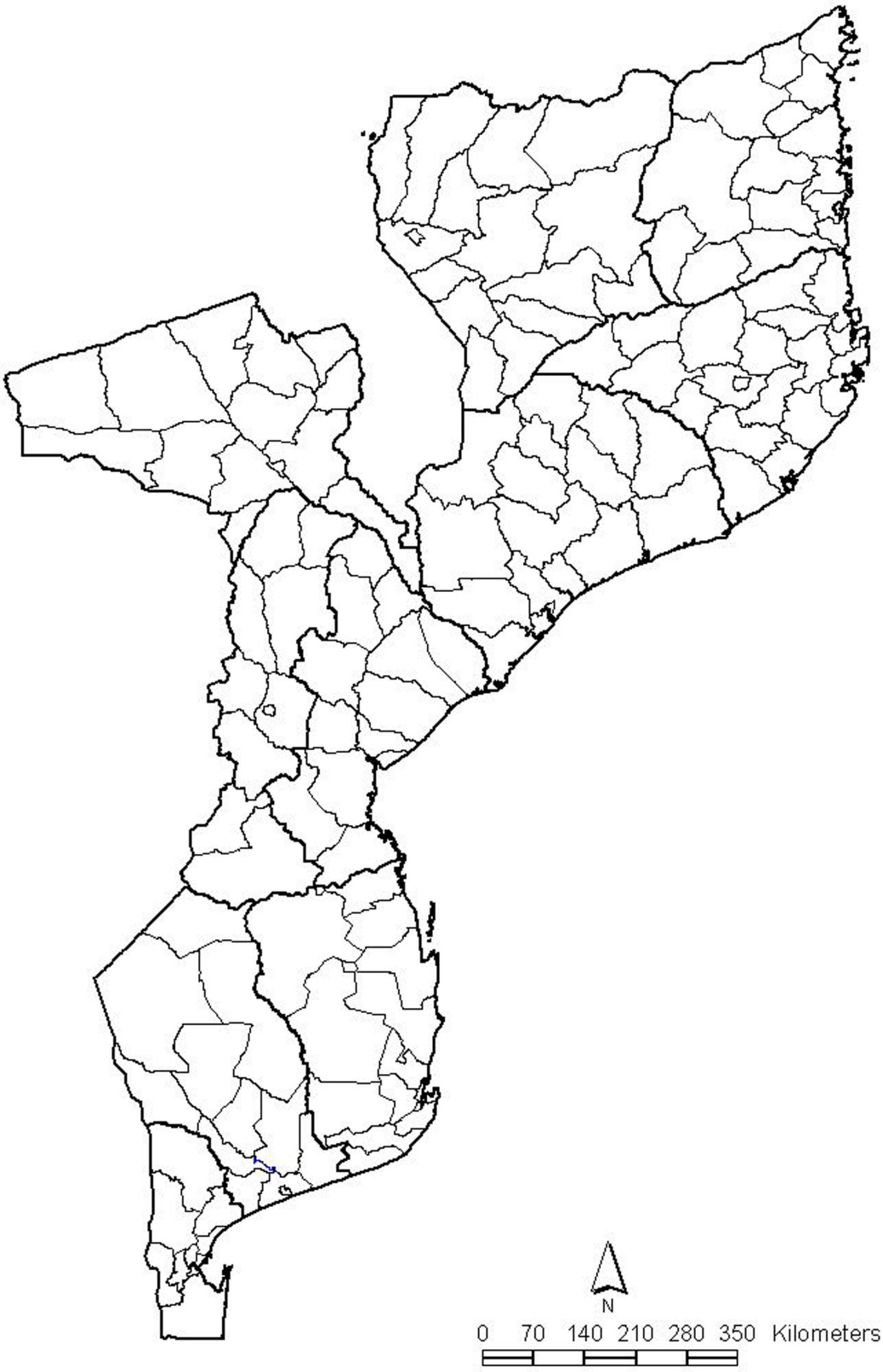
6. Contagens efectuadas

Ano	**N.º Observado**	**Local (coordenadas)**	**Data**

7. Observações

Preenchido por_____Data_____

APPENDIX II – Extra material used for DPA inquiries



Mapa: nos distritos onde não tem leão põe **"0"**, onde tem pouco leões põe **"1"**, onde tem numero razoável de leões põe **"2"** e nos distritos com muito leões põe **"3"**

APPENDIX II - Safari operator inquiry

Primeiro Censo Nacional do Leão
Questionário de levantamento de dados nas Áreas de caça

Área_____ Nome da Empresa_____

8. Tem alguma informação de ocorrência de leões

	Sim	**Não**
Mês passado		
Ano passado		
Á 5 anos		
A mais de 5 anos		
Nunca		

9. Em que zona da Coutada tem informação da ocorrência de Leões? (indicar Posto Administrativo e/ou Localidade)

Posto Administrativo	**Localidade**
9. _____	_____
10. _____	_____
11. _____	_____
12. _____	_____

10. Tem alguma informação de ocorrência de conflitos entre leões e população:

	Sim	**Não**	**Numero de animais domésticos afectados (indicar o tipo de animal)**	**Número de pessoas afectadas**
Mês passado				
Ano passado				
Á 5 anos				
A mais de 5 anos				
Nunca				

11. Tem alguma informação sobre o tipo de presa do leão na sua área:

Tipo de presa (espécie)	**Periodicidade**	
	Frequente	Ocasional

12. Informação sobre a quota de abate do leão e troféus

Ano	**Quota**	**Consumo**	**Peso do troféu**	**Dimensões do Troféu**		**Comprimento da pele**
				Comprimento	Circunferência da base	
2003						
2004						
2005						
2006						
2007						

13. Contagens efectuadas

Ano	N.º Observado	Local (coordenadas)	Data

Preenchido por_____Data_____

APPENDIX III

Preliminary results of the survey's database (continued)

Province	District	Range		Frequency of observation	Frequency of conflict	Type of conflict	Level of knowledge	Gaps in knowledge ranking
		Raw data	Refined data					
CABO DELGADO	ANCUABE	1	0	Absent	Absent	Absent	Questionable	Mild
	BALAMA	0	0	Absent	Absent	Absent	Poor	Mild
	CHIURE	0	0	Absent	Absent	Absent	Poor	Mild
	MACOMIA	1	1	Weekly	High	Human	Medium	Major
	MECUFI	1	1	Yearly	High	Human	Poor	Mild
	MELUCO	1	1	Weekly	Medium	Human	Medium	Major
	MOCIMBOA DA PRA	1	1	Weekly	High	Human	Poor	Major
	MONTEPUEZ	1	1	Monthly	High	Human	High	Minor
	MUEDA	1	1	Weekly	High	Human	High	Mild
	MUIDUMBE	1	1	Weekly	High	Human	Medium	Major
	NAMUNO	0	0	Absent	Absent	Absent	Poor	Mild
	NANGADE	1	1	Weekly	High	Human	Medium	Major
	PALMA	1	1	Weekly	High	Human	Medium	Major
	PEMBA	1	1	Yearly	Medium	Human	Poor	Mild
	QUISSANGA	1	1	Yearly	High	Human	Medium	Minor
GAZA	BILENE	1	0	Absent	Absent	Absent	Poor	Mild
	CHIBUTO	0	0	Absent	Absent	Absent	Poor	Mild
	CHICUALACUALA	1	1	Monthly	Medium	Livestock	High	Minor
	CHIGUBO	1	1	Yearly	None	None	Medium	Mild
	CHOKWE	1	0	Absent	Absent	Absent	Questionable	Mild
	GUIJA	1	0	Absent	Absent	Absent	Questionable	Mild
	MABALANE	1	1	Monthly	Medium	Livestock	Medium	Mild
	MANDLAKAZE	0	0	Absent	Absent	Absent	Poor	Mild
	MASSANGENA	1	1	Monthly	Medium	Livestock	Poor	Major
	MASSINGIR	1	1	Weekly	Medium	Livestock	High	Mild
	XAI-XAI	0	0	Absent	Absent	Absent	Poor	Mild
INHAMBANE	FUNHALOURO	1	0	Absent	Absent	Absent	Questionable	Mild
	GOVURO	1	0	Absent	Absent	Absent	Questionable	Mild
	HOMOINE	0	0	Absent	Absent	Absent	Poor	Mild
	INHARRIME	0	0	Absent	Absent	Absent	Poor	Mild
	INHASSORO	0	0	Absent	Absent	Absent	Poor	Mild
	JANGAMO	0	0	Absent	Absent	Absent	Poor	Mild
	MABOTE	1	1	Yearly	None	None	Medium	Minor
	MASSINGA	0	0	Absent	Absent	Absent	Poor	Mild
	MORRUMBENE	0	0	Absent	Absent	Absent	Poor	Mild
	PANDA	1	0	Absent	Absent	Absent	Questionable	Mild
	VILANKULO	0	0	Absent	Absent	Absent	Poor	Mild
	ZAVALA	0	0	Absent	Absent	Absent	Poor	Mild
MANICA	BARUE	1	1	Yearly	Low	Livestock	Poor	Mild
	GONDOLA	0	0	Absent	Absent	Absent	Poor	Mild
	GURO	0	0	Absent	Absent	Absent	Poor	Mild
	MACHAZE	1	1	Yearly	None	None	Medium	Minor
	MACOSSA	1	1	Yearly	None	None	Medium	Minor
	MANICA	0	0	Absent	Absent	Absent	Poor	Mild
	MOSSURIZE	1	0	Absent	Absent	Absent	Questionable	Mild
	SUSSUNDENGA	1	1	Yearly	Low	Livestock	Medium	Minor
	TAMBARA	1	0	Absent	Absent	Absent	Questionable	Mild
MAPUTO	BOANE	0	0	Absent	Absent	Absent	Poor	Mild
	MAGUDE	1	1	Monthly	Medium	Livestock	Medium	Mild
	MANHIÃA	0	0	Absent	Absent	Absent	Poor	Mild
	MARRACUENE	0	0	Absent	Absent	Absent	Poor	Mild
	MATUTUINE	0	0	Absent	Absent	Absent	Poor	Mild
	MOAMBA	1	1	Yearly	Low	Livestock	Medium	Minor
	NAMAACHA	0	0	Absent	Absent	Absent	Poor	Mild

APPENDIX III
Preliminary results of the survey's database (end)

Province	District	Range		Frequency of observation	Frequency of conflict	Type of conflict	Level of knowledge	Gaps in knowledge ranking
		Raw data	Refined data					
NAMPULA	ANGOCHE	0	0	Absent	Absent	Absent	Poor	Mild
	ERATI	1	0	Absent	Absent	Absent	Questionable	Mild
	LALAUA	1	1	Yearly	Low	Livestock	Poor	Mild
	MALEMA	1	1	Yearly	Low	Livestock	Poor	Mild
	MECONTA	0	0	Absent	Absent	Absent	Poor	Mild
	MECUBURI	1	1	Yearly	Low	Livestock	Medium	Minor
	MEMBA	1	1	Yearly	Low	Livestock	Poor	Mild
	MOGINCUAL	1	0	Absent	Absent	Absent	Poor	Mild
	MOGOVOLAS	0	0	Absent	Absent	Absent	Poor	Mild
	MOMA	1	1	Yearly	Low	Livestock	Poor	Mild
	MONAPO	1	0	Absent	Absent	Absent	Poor	Mild
	MOSSURIL	0	0	Absent	Absent	Absent	Poor	Mild
	MUECATE	1	0	Absent	Absent	Absent	Poor	Mild
	MURRUPULA	0	0	Absent	Absent	Absent	Poor	Mild
	NACALA A VELHA	0	0	Absent	Absent	Absent	Poor	Mild
	NACAROA	0	0	Absent	Absent	Absent	Poor	Mild
	NAMPULA	0	0	Absent	Absent	Absent	Poor	Mild
	RIBAUE	1	0	Absent	Absent	Absent	Poor	Mild
NIASSA	CUAMBA	0	0	Absent	Absent	Absent	Poor	Mild
	LAGO	1	1	Yearly	None	None	Medium	Minor
	LICHINGA	1	0	Absent	Absent	Absent	Questionable	Mild
	MAJUNE	1	1	Yearly	Medium	Both	High	Minor
	MANDIMBA	0	0	Absent	Absent	Absent	Poor	Mild
	MARRUPA	1	1	Weekly	High	Both	High	Mild
	MAUA	0	0	Absent	Absent	Absent	Poor	Mild
	MAVAGO	1	1	Monthly	Medium	Both	High	Minor
	MECANHELAS	0	0	Absent	Absent	Absent	Poor	Mild
	MECULA	1	1	Weekly	High	Both	High	Mild
	METARICA	0	0	Absent	Absent	Absent	Poor	Mild
	MUEMBE	1	1	Yearly	None	None	Medium	Minor
	NGAUMA	1	0	Absent	Absent	Absent	Poor	Mild
	NIPEPE	1	0	Absent	Absent	Absent	Questionable	Mild
	SANGA	1	1	Yearly	Medium	Livestock	High	Minor
SOFALA	BUZI	0	0	Absent	Absent	Absent	Poor	Mild
	CAIA	1	1	Monthly	Low	Livestock	Medium	Mild
	CHEMBA	1	0	Absent	Absent	Absent	Questionable	Mild
	CHERINGOMA	1	1	Weekly	Low	Livestock	Medium	Major
	CHIBABAVA	1	0	Absent	Absent	Absent	Questionable	Mild
	DONDO	0	0	Absent	Absent	Absent	Poor	Mild
	GORONGOSA	1	1	Weekly	Low	Livestock	Medium	Major
	MACHANGA	1	1	Monthly	None	None	Poor	Major
	MARINGUE	1	1	Monthly	None	None	Medium	Mild
	MARROMEU	1	1	Monthly	Low	Livestock	High	Minor
	MUANZA	1	1	Monthly	Medium	Livestock	Poor	Major
	NHAMATANDA	1	0	Absent	Absent	Absent	Questionable	Mild
TETE	ANGONIA	0	0	Absent	Absent	Absent	Poor	Mild
	CAHORA BASSA	1	1	Weekly	High	Both	Medium	Major
	CHANGARA	1	1	Monthly	None	None	Poor	Major
	CHIFUNDE	1	1	Monthly	None	None	Poor	Major
	CHIUTA	1	1	Monthly	None	None	Poor	Major
	LUENHA	1	1	Monthly	None	None	Poor	Major
	MACANGA	1	0	Absent	Absent	Absent	Questionable	Mild
	MAGOE	1	1	Weekly	High	Livestock	Medium	Major
	MARAVIA	1	1	Monthly	High	Both	Medium	Major
	MOATIZE	1	0	Absent	Absent	Absent	Questionable	Mild
	MUTARARA	1	0	Absent	Absent	Absent	Questionable	Mild
	TSANGANO	0	0	Absent	Absent	Absent	Poor	Mild
	ZUMBU	1	1	Monthly	Medium	Livestock	Medium	Major
ZAMBEZIA	ALTO MOLOCUE	0	0	Absent	Absent	Absent	Poor	Mild
	CHINDE	1	1	Yearly	None	None	Poor	Mild
	GILE	1	1	Monthly	None	None	Medium	Mild
	GURUE	0	0	Absent	Absent	Absent	Poor	Mild
	ILE	0	0	Absent	Absent	Absent	Poor	Mild
	INHASSUNGE	0	0	Absent	Absent	Absent	Poor	Mild
	LUGELA	0	0	Absent	Absent	Absent	Poor	Mild
	MAGANJA DA COST	1	0	Absent	Absent	Absent	Poor	Mild
	MILANGE	1	0	Absent	Absent	Absent	Poor	Mild
	MOCUBA	0	0	Absent	Absent	Absent	Poor	Mild
	MOPEIA	1	0	Absent	Absent	Absent	Questionable	Mild
	MORRUMBALA	0	0	Absent	Absent	Absent	Poor	Mild
	NAMACURRA	1	0	Absent	Absent	Absent	Questionable	Mild
	NAMARROI	0	0	Absent	Absent	Absent	Poor	Mild
	NICOADALA	0	0	Absent	Absent	Absent	Poor	Mild
	PEBANE	1	1	Monthly	None	None	Medium	Mild