FONDATION INTERNATIONALE POUR LA SAUVEGARDE DE LA FAUNE
INTERNATIONAL FOUNDATION FOR THE CONSERVATION OF WILDLIFE

Conservation of the African Lion :
Contribution to a Status Survey

September 2002

CONSERVATION FORCE

FONDATION INTERNATIONALE POUR LA SAUVEGARDE DE LA FAUNE
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Back cover picture : Adult male lion paw

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"*From the standpoint of conservation and possible management of the lion no topic has more relevance than population dynamics, yet it was an aspect of the study for which it was difficult to obtain unbiased quantitative information. To estimate accurately the size of the lion population in 25,500 sq. km is a project in itself. Three years of work was clearly not long enough to elucidate such topics as birth patterns and mortality rates, much less to find out general trends in the population. Some of the conclusions in this chapter are therefore tentative rather than final.*"

George Schaller, 1972. The Serengeti Lion.

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ACRONYMS

ALWG	African Lion Working Group (IUCN/SSC/Cat Specialist Group)
BTB	Bovine Tuberculosis
CAR	Central African Republic
CDV	Canine Distemper Virus
CITES	Convention on International Trade in Endangered Species of Wild Fauna & Flora (Washington Convention)
CF	Conservation Force
CPUE	Catch-per-unit-effort
CSG	Cat Specialist Group (IUCN/SSC)
CU	Conservation Unit
DC	*Domaine de chasse*
DRC	Democratic Republic of Congo
HA	Hunting Area
FcaV	Feline Calici Virus
FeHV	Feline Herpes Virus
FeLV	Feline Leukaemia Virus
FIP	Feline Infectious Peritonitis and Pleuritis
FIV	Feline Immunodeficiency Virus
FL	Forest Land
FPV	Feline Panleukopenia Virus
GASP	Global Animal Survival Plan
GCA	Game Controlled Area, Game Conservation Area
GMA	Game Management Area
GR	Game Reserve
IGF	International Foundation for the Conservation of Wildlife
IR	Integral Reserve
IUCN	The World Conservation Union
MAB	Man and the Biosphere Program (UNESCO)
NGA	Non Gazetted Area
PAC	Problem Animal Control
PHVA	Population and Habitat Viability Assessment
PR	Partial Reserve
RP	*Réserve partielle*
SA	Safari Area
SSA	Sub-Saharan Africa
SSC	Species Survival Commission (IUCN)
SSP	Species Survival Plan
TB	Tuberculosis
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WCMC	World Conservation Monitoring Centre
WMA	Wildlife Management Area
WUA	Wildlife Utilisation Area
WWF	World Wildlife Fund
ZIC	*Zone d'Intérêt Cynégétique*

COMMON NAMES OF LION

***Panthera leo* (Linnaeus, 1758)**

REGION	LANGUAGE	NAME OF LION
Europe	English	*Lion*
	French	*Lion*
	German	*Löwe*
	Italian	*Leone*
	Portuguese	*Leao*
	Spanish	*Leon*
Western Africa	Adja	*Kinikini*
	Adrar, Ioullimmïden, Isekkemaren	*Aouekkas, ioukkâsen (pl.), toauekkast (fem. sing.), tiouekkasîn (fem. pl.)*
	Ahaggar/Rhät	*Ahar, iharren (pl.), tahart (fem. sing.), tihârrîn (fem. pl.)*
	Aïr	*Amekloul, imeklat* (pl.), *ahar*, *aouekkas*
	Bambara	*Ouraba, diara*
	Baoulé	*Guara*
	Bariba	*Gbéroussounon*
	Bassari	*Irane*
	Bobofing	*Wuru, zora*
	Bouzou (Filingué)	*Ahar, wan'tagorass*
	Dindi	*Gounou, moussou-béri*
	Dioula	*Dyra, jaralin*
	Djerma	*Moussou béri*
	Fon	*Kinikini, djanta*
	Fulfulde (Peuhl)	*Biladdè, Rawandu ladde, mbarooga*
	Gurma	*Yambol*
	Gouro	*Guizra*
	Hausa	*Zaki*
	Ibo, Yoruba	*Odun*
	Kassena (Po)	*Nyongo*
	Kissi	*Yarra*
	Koniagui	*Ivissin*
	Koulango	*Diara*
	Lobi	*Siduhu*
	Malinké	*Nian-fin, diara*
	Mandinka	*Diarinté, diato*
	Manga	*N'gam, n'garin*
	Maure	*Sebah*
	Mooré (Mossi)	*Guigemde, bongnega, ouèougo-naba*
	Nagot	*Kinihoun*
	Ngbandi-Yakoma	*Bamara*
	Ouolof	*Gaïndé, gaynde*
	Peul Foula	*Pio-oui, nga-iouri*
	Sarakolé	*Diarinté*
	Sénoufo	*Charao*
	Sérère	*N'diogoy*
	Somba	*Tchirli-tchirli*
	Sonraï	*Gandihaya*
	Soussou	*Yété*
	Tamachek (Touareg)	*Ahard, awakass*
	Toubou (Termit)	*Dogoule*

Central Africa	Apindji, Eviya, Okandais, Awandji, Mitsogo, Adouma	*Nzégo*
	Arab	*Assad, dutou baach, baach/doud*
	Bafia	*Kimondo*
	Bakaningui, Batéké	*Ngô*
	Bakota	*Ngoyi, nzé*
	Baloumbou	*Ikoumbou*
	Bamiléké	*Nopkema*
	Bamoun	*Gbayi*
	Banda	*Bamara*
	Bandjabi	*Ndzèguè, vevi*
	Bapounou	*Maguène, ma-gena*
	Bassa	*Mbondo ndjeé*
	Bavoungou	*Maguène, ma-gena*
	Baya	*Dila*
	Duma	*I-ngungu, bingungu*
	Eschira	*Meguène*
	Ewondo, ntumu	*Embgem*
	Fang	*N'zé, zeh, benze*
	Fulfuldé	*Mbarooga, njagaawu*
	Gambaye	*Tobeuye*
	Goula	*Ndjendjé*
	Goulaye	*Toboi*
	Iwum, ruumbu	*Ng-kosi*
	Kinyarwanda	*Intare, ntaré*
	Lingala	*Ntambu*
	Masa	*Zlona*
	Mpongwe	*Layoni, amale, ndjègo*
	Masango	*Maguiène, m-bungu*
	Mbuno	*M-kwe, le-kaga*
	Ndambomo	*Ngoyi*
	Nzakara	*Ndoulou* (maned lion), *Gbamakanga*or *Kinguilima* (no mane)
	Obamba	*Ngoô*
	Pidgin	*Lion*
	Pove, Simba, Nkomi, Galwa, Oroungou, Tsogo	*Ndjègo*
	Sango	*Bamara, dila*
	Saké	*N'zé, zeh*
	Sara	*Bohol, mbole, bole, basch, n'guessi*
	Shira	*Gi-bungu*
	Teke fumu	*N-kwe, ban-kwe, n-gombulu*
	Via, Kande	*Yé-mbogngo*
	Vouté	*Mbap, nir*
	Yakouma	*Mbatan*
	Zandé	*Ngbanguru, bahu*
Eastern Africa	Afar	*Lubaaka, madu, molta* (female)
	Amharic	*Ambessa*
	Gikuyu	*N-do, no-rothi, merothi* (pl.), *ngatia, mo-nyambo, me-nyambo*
	Luo	*Labwor*
	Maasai	*Olnyatuni*
	Oromo	*Leencha*
	Ruanda	*In-tare*
	Samburu	*Oiugatany*
	Somalia	*Aar, baranbarqo, libaax, gool, Davar*
	Swahili	*Simba*

Southern Africa	Afrikaans	*Leeu*
	Chichewa	*Nkharam*
	Ju/hoan Bushman	*N!hai*
	Nama/Damara	*Xaami*
	Ndebele	*In-gwenyama, i-bhubezi*
	Shangaan	*Nghala, n'shumba*
	Shona	*Shumba* (usual), *mhondoro* (spirit medium)
	Swati	*Si-Iwane, ti-Iwane*
	Sotho, Lozi, Setswana	*Tau*
	Venda	*Ndau*
	Yei	*Undavu*
	Zulu	*Ingonyama*

Chapter I
Introduction

Tanzanian lions, Masailand (Photo : Ph. Chardonnet).

"*The population of lions, like many other carnivores with the exception of the Ethiopian wolf, is a rather mysterious affair in Ethiopia….*"

Yilma Abebe & Thomas Mattanovich, 2002, pers. comm.

1. PURPOSE

The purpose of the survey is to provide interested parties with additional data on the conservation status of the lion in Sub-Saharan Africa (SSA).

This survey is considered as a contribution to the issue, which is already addressed by a number of scientists, managers and authorities, etc. The intention of the survey is to be much more a "food for thought" than a conclusive statement. The survey is attempting, not to be competitive with other surveys, but rather to be a source of complementary input. It is hopefully expected that some new sources of information and some innovative approaches will be provided and will help to improve the knowledge in this matter. A variety of views should stimulate the discussion on this important topic and, hopefully, better progress will be achieved by the entire conservation community.

It is understood that the present survey is limited to a general review of the global status of the lion. Therefore, the survey should not be regarded as a planning exercise, i.e. the study does not comprise any action plan or conservation strategy. The elaboration of a proper strategy for the long-term conservation of the lion would require a slightly different exercise with another methodology and involvement of appropriate authorities, etc. For this reason, no conservation measures are proposed, nor ranked priorities suggested or management plans recommended.

2. METHODOLOGY

2.1. CONTRIBUTORS

The survey has been carried out by a team of experts under the auspices of the *International Foundation for the Conservation of Wildlife* (IGF) since, given the magnitude of the scope, it could not be the product of a single author. So far, more than 40 persons have been directly involved to gather and analyse the data. In addition to the core group of direct authors, several members of the team have activated and consulted their own networks of African contacts, involving people with many years of field experience in wildlife conservation and management.

2.2. TIME AND DELAY

The survey began at the end of February 2002 and the final report was completed by the end of July. Within such a short period of time (5 months) it cannot be expected to provide an exhaustive survey with an entirely complete set of details and systematic cross-checking of all data. However, the output of the survey may hopefully be considered as a comprehensive review of the current situation as possible within the limits set by the available and accessible information.

2.3. SCOPE

- **Geographical scope**

The survey covers the entire continental Sub-Saharan Africa, i.e. a total of 42 countries, excluding islands where the lion does not occur.

The report includes maps of the 4 African Regions (Western, Central, Eastern and Southern) where sub-populations are delineated and defined by reference numbers corresponding to the figures produced in tables included in the text.

- **Thematic scope**

The survey includes *inter alia* the definition of the different lion sub-populations, and as much information as possible for each sub-population, including:

- The protection status and size of lion habitats;
- An estimate of lion population sizes, population densities and population trends;
- Lion habitat quality, main prey for lions (wildlife and/or livestock) and major constraints to lion conservation, and;
- The use of lion resources (whether consumptive or non-consumptive), as well as management and regulatory measures, problem animal control and poaching.

The trade in live lions and lion products has tentatively been analysed.

Relevant bibliographical references are given at the end of the report.

2.4. DEFINITIONS

- **Regions**

To remain consistent with the methodology used for the survey, the demarcation of the regions is based on ecological criteria, not on political boundaries. As a matter of fact, a given lion sub-population cannot be split in two simply because it is spread on both sides of a political border. It is not only a matter of definition, but it also addresses conservation issues; sub-populations should be considered as relevant entities for appropriate management purposes. For example, the lion populations of Virunga National Park in DRC and Queen Elisabeth National Park in Uganda should be considered as belonging to the same sub-population; consequently, both should belong to the same biological region in terms of lion conservation issues.

The definition of the regional demarcations could be discussed extensively, however some decisions had to be taken based on the available information, for instance:

- The Southern limit of the Eastern Africa region could have been set on the Rufiji river for biological reasons; nevertheless Mikumi National Park and both banks of Kilombero river were preferred to be included in the Selous Ecosystem within the Southern Africa region, and;
- A country such as the DRC has been split into 3 different "lion regions" (Central, Eastern and Southern) since it appears that they form distinctly different lion areas, each of them linked to those respective regions.

The definitions of the "lion regions" are given in Table 1.

It must be stressed that regional demarcations, which are convenient or appropriate for the lion, may not be relevant for other taxa.

For obvious reasons, political criteria (boundaries etc.) must be kept when it comes to addressing legal issues and to proposing the definition of lion Range States.

TABLE 1 - THE "LION REGIONS" USED FOR THE SURVEY

Regional breakdown	Demarcations			
	North	**South**	**West**	**East**
Western Africa	Sahara	Coast	Coast	Niger river estuary & Jos plateau
Central Africa	Sahara	Congo river lower course & extension North-eastward	Niger river estuary & Jos plateau	Nile river & DRC rain forest
Eastern Africa	Sahara	Lake Malawi & Northern limit of Selous ecosystem	Nile river, DRC rain forest & Lake Tanganyika	Coast
Southern Africa	Congo river estuary, DRC rain forest & Northern limit of Selous ecosystem	Coast	Coast	Coast

- **Protected Areas**

Protected Areas mentioned in the report are according to the IUCN criteria.

For the French and Portuguese speaking countries, the French and Portuguese word is used when it defines a specific status of protected area, for example:

- *Zone d'Intérêt Cynégétique* (French) and *Coutada* (Portuguese) may be slightly different concepts than that of a "Hunting Block", and;
- *Forêt classée* (French) has no real synonym in English.

A number of acronyms are utilized and their meaning is explained in the "List of acronyms".

- **Areas**

Distribution and size of ranges are given in km² (square kilometres).

The sizes of the Protected Areas are taken from two main sources:

- The IUCN Directory of Afrotropical Protected Areas (IUCN, 1987), and;
- The African Antelope Database 1998 (East, 1999).

The sizes of the non-gazetted areas are sourced from either literature or experts' opinions.

- **Sub-populations**

In this study, two lion sub-populations are considered as two separate lion populations with very few or without any exchanges. Sub-populations are defined here as distinct populations separated by:

- Natural barriers such as large rivers or mountain ranges, and/or;
- Extensive areas of human settlements, and/or;
- Very large distances.

The fact is acknowledged that this definition of sub-population reflects the situation at a particular time in the historical trends of the lion in the continent. This situation is likely to evolve further, hence needs modification to the classification proposed in the present study, and is open to discussion. Nevertheless, this geographical definition will help in the assessment of the lion status in the various regions.

- **Unit of measure**

The following rules have been applied:

- Range figures are given in km² with no decimal;
- Density figures are given in lions/100 km² with one decimal only;
- Population figures are given with no decimal, and;
- Percentages are given to break down the lion range and the lion population size. Given the low level of global accuracy, there would be no point in giving a precise %, which explains the reason why tables show % figures without a decimal.

- **Terms**

The words "lion" and "lions" are used as generic terms, unless lioness, sub-adult lion, lion cub or male lion are mentioned.

Various words are used to define non-sedentary lions: erratic, migrant, nomad, nomadic, occasional, temporary, transient, vagrant, wanderer, have been considered similar.

2.5. DATA COLLECTION

- **Difficulty**

As expected, collecting reliable information proved to be a complex exercise. One of the main difficulties appears to be the variable quality of information, some of it being more precise, more detailed, more reliable, etc. than others.

The lion belongs to a group of taxa that is difficult to study for a number of reasons. The densities of large predators are usually much lower than the densities of their prey species, in the rough order of 1 to 100, making them obviously less prone to be observed, either directly or indirectly. Furthermore, lions quickly become secretive and nocturnal as soon as they are subject to hunting pressure and even more so when and where they suffer from harassment. The counting methods by direct observation (with or without calling) provide results which

must be considered as minimum numbers with these shy and nocturnal lions. Under such conditions, the behaviour of the lion becomes similar to the one of leopard, a species which is rarely observed, although omnipresent in SSA. Furthermore, a particular counting method may be valid for a given case-study and not for another, e.g. (Loveridge, A.J., T. Lynam & D.W. Macdonald, 2001):

- the calling station technique is suitable for lion surveys in medium to high lion density areas, while the spoor frequency technique is more suitable and more cost/effort effective than calling station in low density areas;
- the level of interaction between lions and hyaenas may influence response to calling: (i) in areas with high-density hyaenas and low-density lions, the lions may not respond to calling with hyaena sounds, (ii) in areas with no hyaenas, the lions may not respond to calling with hyaena sounds.

Huge tracts of lion habitat are indeed remote wilderness regions, which are often difficult to access. The attention of conservationists inevitably focuses on the areas with easiest access, roads, and infrastructure etc., particularly those Protected Areas, which are well suited for tourism purposes. As a matter of fact, data on lion are available for these locations, while they are scarce or absent for the others. Pastoral rangelands with presence of lions are generally overlooked since they are (i) rarely studied, (ii) extensive areas with low lion densities and (iii) of difficult access. Also, due to the habit of the lions to walk on dirt tracks, the observation (and the counting) of lions is much more difficult in areas with a sparse road network, e.g. Protected Areas such as Faro National Park in Cameroon or Pendjari National Park in Benin.

Civil unrest, mass movement, settlement of refugees and any political turmoil represent other reasons for the difficult access to some lion distribution areas, which makes it necessary to base estimates of current status of lion populations on “educated guesses”.

During the rainy season, the situation of lion in terms of distribution and behaviour is not well known since access to many areas becomes very difficult, and often even impossible, at this particular time of the year.

- **Presence/absence**

On the one hand, a single observation of lion means presence of the species, either permanent or occasional. Conversely, no physical observation of lion does not necessarily confirm the absence of the species from an area.

However, "*as lions are great wanderers, they may be expected to turn up from time to time in areas where for many years they were unknown, often far from their present limits of distribution; there are many examples of this*" (Smithers, 1983). A considerable number of cases could be quoted in this regard. To mention only a single and recent example, a solitary adult male lion has settled down early 2002 in a ranch nearby Chinhoyi close to Harare, Zimbabwe, where the taxon had not occurred for decades (C. Coid, pers. comm.).

- **Abundance**

Information on density, pride size, hunting success, eventually hyena/lion ratio etc. provide data to estimate the abundance of a given lion population.

The concept of density (number of lions/100 km²) is difficult to use for a number of reasons:

- As censuses and indices of abundance are never fully accurate, a single figure of density is always appropriately subject to relevant criticisms;
- Uninformed persons are prone to make use of a single figure of density, even sometimes for an entire country, and;
- Lion density figures are not to be regarded as fixed in time, since lion populations are subject to significant fluctuations due to a number of factors such as:
    - Natural factors: *inter alia*, all predators adjust their population dynamics to the population dynamics of their prey basis;
    - Human factors: direct (predation and disturbance by humans) or indirect (decrease in prey availability and/or habitat quality), and;
    - Epidemic diseases, which can cause drastic reductions in lion numbers every so often.

Despite these limitations, it appears useful to present available figures of lion density with the intention of providing an indicator for comparing sites. But it must be borne in mind that:

- Some of these density figures originate from field studies;
- Others are calculated from the estimated population size and surface of habitat, and;
- The rest is evaluated from comparisons with available population assessments from either neighbouring or similar situations.

Admittedly, the density figures given are more often issued from experts' opinions than from precise field observations. Nevertheless, they provide useful benchmarks to avoid wild guesses of global population sizes.

Obviously, lion density figures always correspond to a given area. However, they are usually not calculated by country or by region, as densities in those broad geographic entities would not have much significance.

2.6. DATA ANALYSIS

- **Presence/absence**

Using the data of lion presence/absence it is possible to define:

- Distribution range;
- Sub-populations, and;
- Proposed Range States (countries where lion occurs, either permanently or occasionally).

This information is usually very reliable, as it is quite easy to collect.

- **Sub-populations**

The different sub-populations have been designated on the basis of the following criteria:

- Information on presence/absence (not abundance);

- The recent continuity of local populations with current or recently interrupted flows of animals;
- Some sub-populations have been considered as separate sub-populations even though they used to be linked historically, e.g. sub-population n° 4 in Cameroon and sub-population n° 5 in Chad and CAR used to make a single sub-population before they were fragmented to the point of having no more linkages;
- Some local populations very recently isolated (currently no more exchange of animals) have been considered belonging to the same sub-population, for example:
    - In Mali, sub-population n° 1.6 in the South-West used to be linked with sub-population n° 1.7 in Boucle du Baoulé National Park;
    - Sub-population n° 4.2 in Yankari National Park, Nigeria, used to be linked with sub-population n° 4.1 in Faro National Park, Cameroon, and;
- Some doubts remain for certain sub-populations, e.g. in Mozambique it is uncertain whether sub-population n° 27 is linked with sub-population n° 31; if it is the case, then they should be considered as a single sub-population.

- **Abundance**

Population size figures are given by several assessment modes (Table 2), which are ranked according to their reliability as follows:

- Assessment mode A:

The estimated population size is produced by total census or abundance index or density or intimate knowledge of an area including lions, prey availability, use, etc. Minimum and maximum figures are calculated with a 10% error on the estimate.

- Assessment mode B:

The estimated population size is produced by comparison of the given population with known population in a similar ecosystem, usually in a neighbouring area. Using hunting results following a calculation of ratio may also make this comparison. Minimum and maximum figures are calculated with a 20% error on the estimate.

- Assessment mode C:

The estimated population figures are produced by experts' opinions usually based upon first hand information, sometimes on "guesstimates" drawn from available information. Minimum and maximum figures are calculated with a 30% error on the estimate.

TABLE 2 - THE DIFFERENT ASSESSMENT MODES USED TO ESTIMATE LION POPULATION SIZES

Assessment mode	Population size		
	Minimum	**Estimated**	**Maximum**
A	- 10 %	Figure	+ 10 %
B	- 20 %	Figure	+ 20 %
C	- 30 %	Figure	+ 30 %

- **Complementary note on the assessment mode B**

Assessment mode B may consist of a comparison of the hunting results. The given lion population is assessed by comparison with an already assessed lion population using ratio of hunting results/efforts/sucess as measurements of catch-per-unit-effort (CPUE). The ratio of the number of lion obtained per hunter and per hunting day is considered as representative of the sampling effort made by an average hunter in a given area, thus it may be regarded as an interesting indicator of the lion population for this particular area. "*An advantage of CPUE estimates is that the rquired data can be collected by hunters* [and other local stakeholders]… *In cases of sustained-yield harvesting, CPUE estimates are probably sufficiently accurate because underestimates would lead to conservative management decisions*" (Lancia *et al.*, 1996).

For instance, the density of lions has been assessed in the hunting areas of Burkina Faso. In countries of the same region, the lion density in the hunting areas of a given country is estimated by multiplying the already assessed lion density in Burkina Faso hunting areas by the ratio of the hunting result in the hunting areas of the given country (number of hunted lions per 100 km²) divided by the hunting result in Burkina Faso hunting areas (Table 3). Such an approach might be of some validity if the hunting effort is constant year after year. In the present case study of Burkina Faso, the number of big game hunting permits was fairly constant for the last 5 years (roughly 180 per year), as well as the average period of a big game hunting trip (about 6 days of operational hunting in the field per hunter).

TABLE 3 - ESTIMATION OF LION DENSITIES BY COMPARISON OF THE HUNTING RESULTS: AN EXAMPLE FROM WEST AND CENTRAL AFRICA

Country	Lions hunted per 100 km²	Lion density (lions/100 km²)		
		Already assessed*	Estimated in the area hunted for lion**	Extended to the total hunting area***
Burkina Faso	0.16	5	5	5
Senegal	0.05		1.6	0.2
Benin	0.12		3.8	3.4
Cameroon	0.05		1.5	1.3
CAR	0.05		1.6	0.5
Chad	0.08		2.3	1.6

** Chardonnet, 1999*

*** The estimated lion density in the hunting areas of a given country is the already assessed lion density in Burkina Faso hunting areas, multiplied by the ratio of the number of hunted lions per 100 km² in the hunting areas of the given country by the number of hunted lions per 100 km² in Burkina Faso hunting areas, given that time factors remain constant*

**** The distribution area of lions does not match the surface of hunting areas*

- **Figures**

Since all efforts have been made to be as accurate and consistent as possible, careful precautions are taken in producing figures. Conservative estimates are given systematic preference. Averages are calculated when discrepancies appear between two or more sources for a given site. For instance, in the case of Ethiopia, discrepancies appear very high between

sources, with estimates differing by a factor of 5 for lion population numbers. In this particular instance, reasonable conservative decisions had to be taken upon basis of experts' opinions.

- **Trends and Constraints**

A summary of the trends and constraints facing the various populations by region are given in Tables 14, 17, 20 and 23.

- **Precision**

Tentatively, the minimum-maximum range assesses an indication of the precision level for the population size.

- **Accuracy**

At this stage, there is no way to know exact numbers of free-ranging lion population size. Excellent accuracy is to be expected for enclosed populations of lion in Southern Africa.

3. LIMITATIONS

3.1. GENERAL COMMENTS

This survey does not pretend to be:

- Exhaustive: some lion populations have certainly been forgotten, ignored, overlooked, etc;
- Perfect: most probably knowledgeable experts may notice some errors;
- Definitive/conclusive: improvements are hoped for, from better observation and fluctuations from future monitoring, and;
- Exclusive: other contributions are expected to complete this survey.

This survey is claiming to be:

- Based on honest assumptions to the best of available knowledge;
- As comprehensive as possible within the limits of the available capacity;
- Conservative in the way that cautious figures and prudent assumptions have been used, and;
- Valid only at the time of its publication. It should be considered as a snapshot in time, acknowledging that status, situations, figures, etc. may change over time. Nevertheless, it may be regarded as a bench mark of the 2002 situation for future studies.

It must be emphasised that exact data on the status of lions, as it is for most African mammals, is extremely difficult to secure, especially for those of the lion populations which are exclusively nocturnally active. Published data has been referred to where available, however, in many instances this report has had to rely on the "informed opinion" of local experts, resource managers and scientists based in the respective countries, or with long field experience of working with wildlife.

Numbers given in this report, in all other cases, are based on experts opinion, with cross-referencing whenever possible.

The present report aims at providing a picture of the conservation status of the species *Panthera leo* in Sub-Saharan Africa. It is not intended to represent an exact count of lions continent-wide.

Lion populations have fluctuated widely in the past, but show a remarkable degree of resilience and capacity to bounce back after a rapid decline, therefore the figures indicated for a given population/sub-population may be smaller or larger in a few months time.

3.2. MAPS

5 original maps are produced in this survey:

- 1 general map of the global distribution area of the African lion in SSA, and;
- 4 regional maps, 1 for each of the 4 identified regions, giving a more precise picture of the lion distribution in each region.

The maps are tentatively proposing the limits of the lion sub-populations identified in this study. The delineation of the different sub-populations tries to sketch out the lion distribution to the best of the available knowledge. These maps are indeed subject to discussion considering that:

- Some of the sub-populations are obvious and most probably will not be challenged, and;
- Others are more than questionable and open to interpretation.

It is certainly expected that these maps will be improved. Some of these improvements are already known, for instance:

- In Mozambique: a new National Park under creation, *Parque Nacional* das Quirimbas, on the Northern coast of the country, in Cabo Delgado Province, appears to host a quite large population of lions (H. Motta, pers. comm.);
- In Ethiopia: a small isolated area not mentioned on the map contains some lions in lower Tekeze river valley, Shire region, as far North as the Eritrea border (T. Mattanovich, pers. comm.), and;
- North-central Nigeria may apparently contain a small population centred on Kamuku National Park (about 1,500 km² but part of a much larger area of forest reserve, grazing reserve) which is contiguous with Kwiambana Game Reserve (J. Rudge, pers. comm.).

The positioning of frontiers on the maps in no way implies official recognition or acceptance by the editor or by the respective countries.

3.3. OFFICIAL VALUE

The information provided here has no political value, as it is not meant to appear endorsed by political authorities. It is only given as technical support to help decision-makers and other interested stakeholders.

4. PROSPECTS

It is not the primary intention of this survey to make recommendations. However, by conducting such a study, obvious prospects became apparent.

The first and main prospect to come out is the urgent need to conduct a planning exercise such as an action plan or similar guidance document. This action plan should be drafted by all appropriate and consensual means, involving every responsible and interested stakeholders, i.e. political authorities, specialised scientists, local communities living with lions, the private sector involved, development and conservation NGO's, etc.

Since the African continent carries by itself the burden of conserving this outstanding and charismatic species, Africans should be the primary stakeholders to design lion action plans and to take the strategic decisions.

The next prospect to come to light is the necessity to discuss the implementation of the designed action plan. This discussion should take place in the same framework as the planning exercise, since too many action plans are left without being implemented and adapted to changes over time.

Chapter II
Population Survey

Lioness of Benin, Konkombri Hunting Area (Photo : C. Morio & V. Morio).

"*In the bush the king of the animals is the lion. He roars once a year. The* toa *(blue duikers) are scared of being eaten. They hide themselves and they are so frightened that they eventually die in their refuge. The lion of Mounts Nimba used to be hunted but he did not stay; he was coming from Touba in Côte d'Ivoire, passing through Foumandou and finally reached the Mounts Nimba where he remained 6 months before leaving again.*"

A *Konon* hunter, the old chief of Gbakoré village,
Guinea, 01.08.1999,
Solange Chaffard-Sylla, 2002, pers. comm.

1. CONTINENTAL OVERVIEW

1.1. DISTRIBUTION AREA

1.1.1. Presence

- **Range borders**

- **Latitudes**

The extreme latitudes of the lion range are:

Highest latitudes

- Northern Hemisphere

The African lion has been extirpated from all the former high latitudes where it used to live, both in the Northern (North Africa) and Southern Hemisphere (the Cape). Rock paintings also attest to the former presence of lion deep inside what is now the Sahara Desert. The famous Theodore Monod reported in Northern Chad that a lion was shot in 1927 in the region of Erdi Dji (as far North as 19°N, just where the 3 borders Chad, Libya, Sudan meet), and another lion was shot in 1940 near Mourdi (18°30'N) (Smithers, 1983). Now lions are still present in Central Africa up to 15°N (Hoinathy Honimadji, pers. comm.; J. Tubiana, pers. comm.). The Northernmost lion populations are probably:

(i) The few remaining individuals of Boucle du Baoulé National Park in Mali (if they still exist);
(ii) The small relict population of Kapka mountain range, a non-gazetted area in North-Eastern Chad (the Ennedi mountain range seems to have lost its lion population), and;
(iii) The population of Dinder National Park, Sudan, and of the neighbouring area in Ethiopia.

- Southern Hemisphere

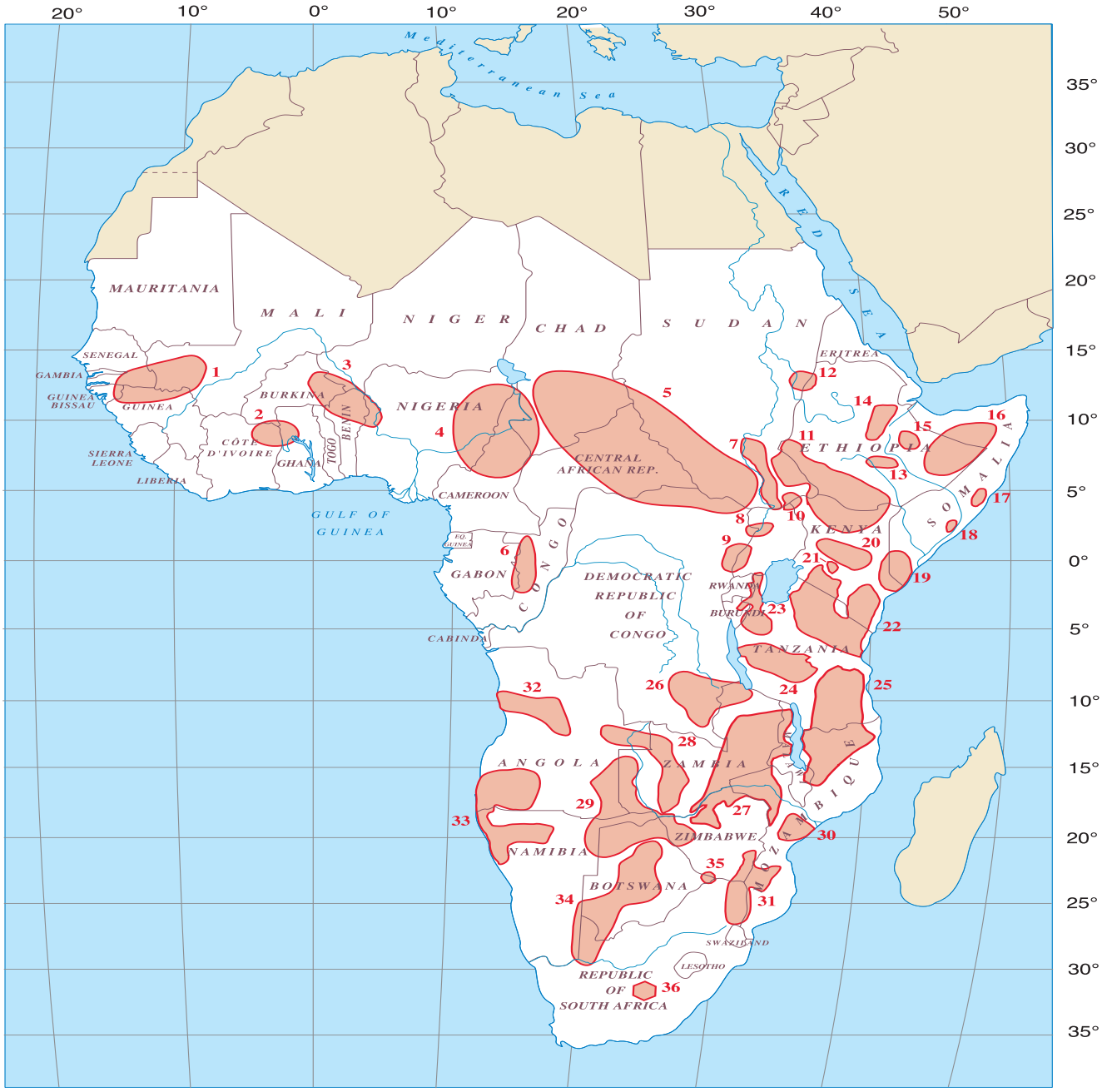
Free-ranging lions do not presently occur farther South of latitude 24° South. However, enclosed lions have been reintroduced as far South as the Southern coast of South Africa.

Lowest latitudes

6 lion sub-populations (see maps) have been identified to live on or near the Equator:

- Sub-population n°6: Congo and Gabon;
- Sub-population n°9: DRC and Uganda;
- Sub-population n°19: Somalia and Kenya;
- Sub-population n°20: Kenya;
- Sub-population n°21: Kenya, and;

The African Lion : global distribution area



Legend

International border	Lion subpopulation
GHANA Name of Country	2 Lion subpopulation reference number
Main river	

- Sub-population n°22: Kenya.

- **Longitudes**

The extreme longitudes of the lion range are:

- In the West, as far as Guinea Bissau where the lion penetrates westwards into the country along the course of the Corubal river (Ph. Chardonnet, pers. comm.), and;
- In the East, where in Somalia the map of the lion range by Laurent (2002) shows the presence of lion as far as the Indian Ocean coastline.

- **Range size**

Although it remains extremely difficult to assess the range size of large predators that may sometimes wander great distances and of which the density is always low compared to other mammals such as their prey, the range size of the African lion has been tentatively estimated as the following:

- The global African lion distribution range covers about 3 million km², and;
- The distribution area of the lion covers approximately 10 % of the whole continent, about 15% of SSA.

TABLE 4 - EXTENT AND STATUS OF LION DISTRIBUTION AREAS IN SUB-SAHARAN AFRICA

Lion range (km² & %*)		Total	Protected Areas			Non-gazetted areas
			Nat. parks	Reserves	Hunting areas	
Western Africa	**Km²**	121,980	43,190	14,690	18,400	45,700
	%	4	35	12	15	37
Central Africa	**Km²**	651,970	67,555	24,860	247,860	311,695
	%	22	10	4	38	48
Eastern Africa	**Km²**	1,137,205	149,347	139,594	116,730	731,534
	%	39	13	12	10	64
Southern Africa**	**Km²**	1,039,212	289,139	405,404	27,472	317,197
	%	35	28	39	3	31
Sub-Saharan Africa	**Km²**	**2,950,367**	**549,231**	**584,548**	**410,462**	**1,406,126**
	%		**19**	**20**	**14**	**48**

** % of the existing lion range in the sub-region, except for the last line, which is relative to the continent.*
*** excluding fenced Protected Areas.*

- **Lion range and status of Protected Areas**

About half of the lion range falls within Protected Areas, while the remainder is non-gazetted. This is noteworthy because of:

- The remarkable importance of so-called pastoral areas (nearly half of the lion range) to lions appears clearly, while it is often overlooked, and;

- Of Protected Areas, National Parks encompass nearly 20% of the lion range, the same for the Reserves and the remainder comprising of Hunting Areas.

However, these figures must be interpreted with caution since:

- Some of the "Reserves" are in fact Hunting Areas. For instance, in Tanzania Game Reserves are classified as reserves even though they are officially used for hunting;
- Some non-gazetted areas are conservation areas with or without hunting activity. For instance, in Zimbabwe commercial wildlife ranches and wildlife conservancies are classified as non-gazetted even though their main purpose is wildlife conservation with hunting operations, and;
- Non-gazetted areas are always difficult to assess or define in size.

- **Regions**

The lion is present in all four regions of the continent South of the Sahara.

In terms of range size:

- The strongholds of the lion are Eastern and Southern Africa with similar surfaces covering more than 1/3 of the total lion range each (39% and 35% respectively);
- Central Africa contains more than $1/5^{th}$ of the lion range (22%), and;
- Western Africa holds a bit less than $1/20^{th}$ of the lion range (4%).

1.1.2. Absence

- **Long-standing absence**

Historically the lion ranged throughout the entire continent from North to South. However, to the best of available knowledge, it has always been absent from some of the African regions such as what is now the Equatorial Guinea, the rain forest areas of the Gulf of Guinea and in the Congo basin.

- **Extirpations**

"*There is probably no other species whose distribution range has shrunk over historical times to the extent shown by the lion*" (Smithers, 1983). The contraction of the lion range is characterised by regional and local extinctions of the taxon.

- **Ancient extirpations**

  The lion has not always been an endemic African taxon as it has become today (if the relict Indian population is considered as separate from the African one). It used to live in South-eastern Europe, the Near-east, South-central Asia and the Indian sub-continent. Outside Africa now, it only remains in the Gir forest in India with a population ranging between 250 and 300 (Jackson, 1997).

- **Recent extirpations**

In Africa, the lion disappeared more recently from the two tips, North and South, of the continent. North of the Sahara, it was extirpated from Tunisia and Algeria about 1891, from Morocco in 1920; in Southern Africa, it disappeared from most of the Cape Province during the 1860s as well as from the greater part of Natal (Smithers, 1983).

- **Modern extirpations**

Within the recent distribution range of the lion, several countries have witnessed its extinction:

Western Africa:

Gambia

- The lion used to occur along the Gambia River (Bigourdan & Prunier, 1937) within the present borders of Gambia.

Mauritania

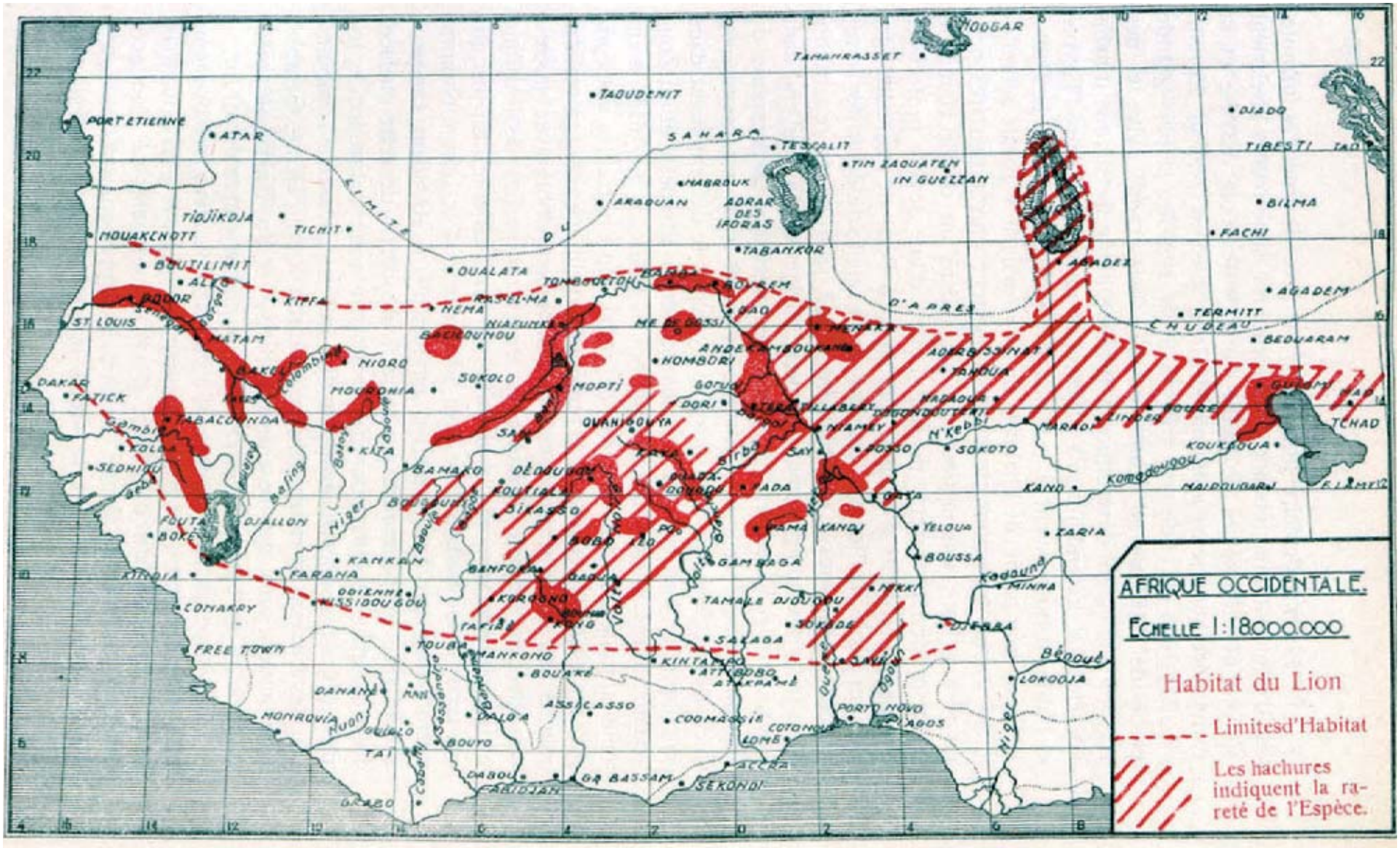
- In Mauritania, "*the lion used to be widespread from South to North of the wooded savannah's limit, penetrating even further North during the rainy season*" (Prévost, 1987);
- According to Chudeau (1920 *in* Le Berre, 1990), the lion was present in the Northern Tagant;
- Roure (1956) mentioned the presence of lions and abundant prey species in the Nema region, South-East Mauritania: "*the lion exists about everywhere South of the 17th parallel, in the Trarza, in the Brakna and mainly in the Guidikama, along the Karakoro Oued, and in the Hodh, South of the Timbedra-Nema line";*
- In the late 1980's, about 10 lions were still surviving in Guidimaka Region and South-East of the Affole mountain range where they were causing damage to cattle every year (Prévost, 1987), and;
- The lion may be considered extinct now in Mauritania.

Sierra Leone

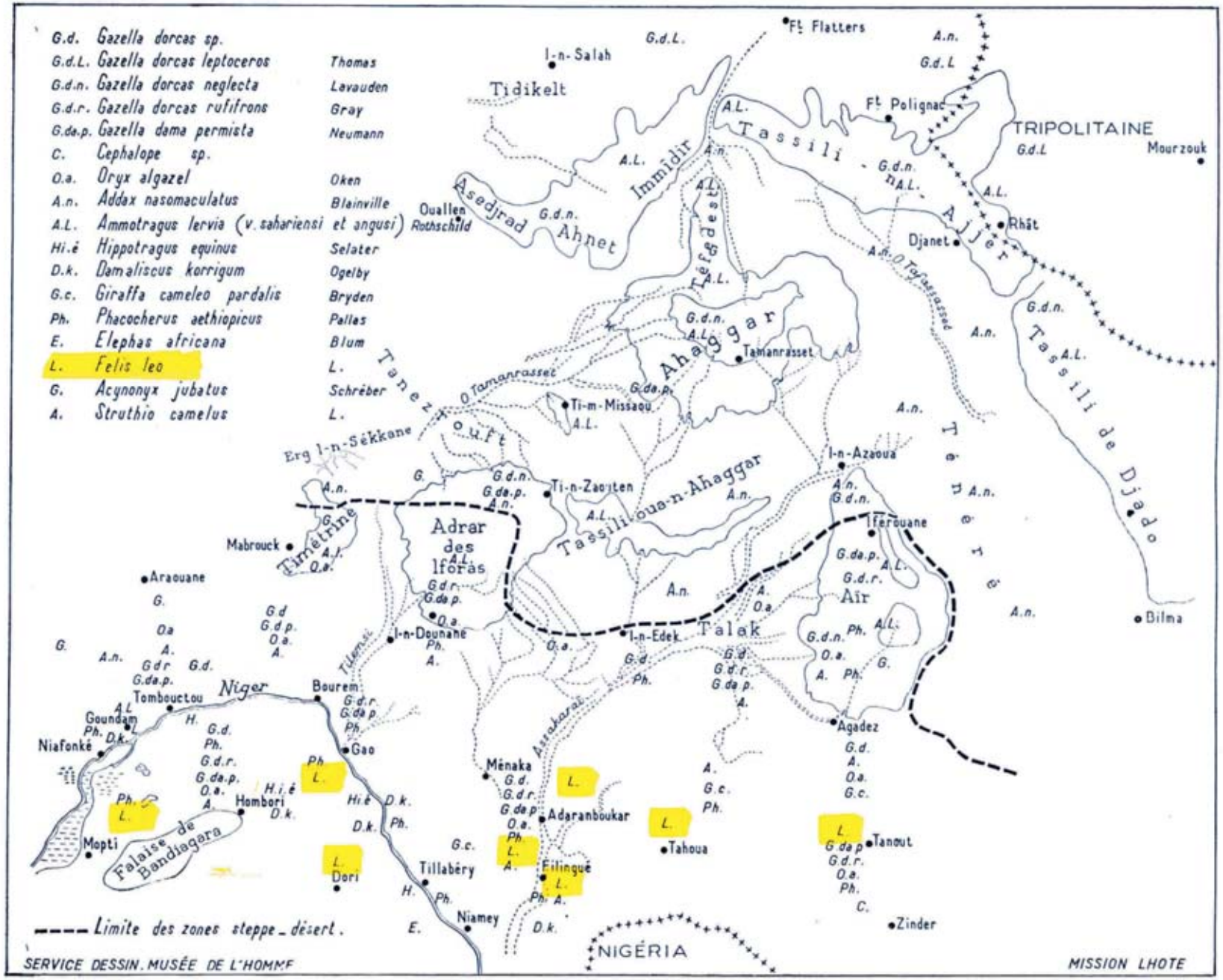
- According to Smithers (1983), the lion was found in the Northern parts of Sierra Leone.

Central Africa:

- No country has definitely lost the species in this region, neither in the tropical region of Central Africa, nor in the equatorial region.



Map of lion distribution in Western Africa in 1937 (Bigourdan & Prunier, 1937)



Map of lion distribution in Mali and Niger in 1951 (Lhote, 1951)

Eastern Africa:

Djibouti

- Alain & Danielle Laurent (2002) consider the lion as extinct in Djibouti. However A. Laurent (pers. comm.) does not exclude the possibility of erratic lions coming from Ethiopia following cattle herds along the Awash River.

Eritrea

- The lion was probably present in Eritrea during recent times, from where we have no record now. However, it must be mentioned that some lions remain in Northern Ethiopia, very close to the Eritrea border, precisely in lower Tekeze river valley, Shire region (T. Mattanovich, pers. comm.).

Southern Africa:

- As stated before, the "Cape" lion is definitely extinct;
- Lesotho has lost its lion population, and;
- Swaziland has reintroduced the species after having lost it in recent times.

1.2. PROPOSED RANGE STATES

The information provided here has no political value, since political authorities have not been asked to endorse it officially. The data are only given as guidelines to help decision-makers and other interested stakeholders.

Lions are present in 34 Range States (Table 5):

- They are permanently present in 32 States, and;
- Occasional in the other 2.

To the best of our knowledge at this stage, 8 countries in SSA are not Range States:

- 2 of them historically never had lions, and;
- The 6 others have lost their lions in recent history.

TABLE 5 - LION RANGE STATES (PROPOSED)

Region	Country	Presence of lion		Absence of lion	
		permanent	occasional	never present	recently extirpated
Western Africa (15 countries)	Benin	1			
	Burkina Faso	1			
	Côte d'Ivoire	1			
	Gambia				1
	Ghana	1			
	Guinea	1			
	Guinea Bissau	1			
	Liberia			1	
	Mali	1			
	Mauritania				1
	Niger	1			
	Nigeria	1			
	Senegal	1			
	Sierra Leone				1
	Togo		1		
	Sub-total	**10**	**1**	**1**	**3**
Central Africa (8 countries)	Cameroon	1			
	C.A.R.	1			
	Chad	1			
	Congo	1			
	D.R.C.	1			
	Equatorial Guinea			1	
	Gabon	1			
	Sudan	1			
	Sub-total	**7**	**0**	**1**	**0**
Eastern Africa (9 countries)	Burundi		1		
	Djibouti				1
	Eritrea				1
	Ethiopia	1			
	Kenya	1			
	Rwanda	1			
	Somalia	1			
	Tanzania	1			
	Uganda	1			
	Sub-total	**6**	**1**	**0**	**2**
Southern Africa (10 countries)	Angola	1			
	Botswana	1			
	Lesotho				1
	Malawi	1			
	Mozambique	1			
	Namibia	1			
	South Africa	1			
	Swaziland	1			
	Zambia	1			
	Zimbabwe	1			
	Sub-total	**9**	**0**	**0**	**1**
Continent (SSA)	**42 countries**	**32**	**2**	**2**	**6**

1.3. SUB-POPULATIONS

It may be assumed that the Western African sub-populations were once linked with the Central African sub-populations, the latter being contiguous with the Eastern African sub-populations, and therefore, the Southern African sub-populations. The assumption of a continuum of lions throughout Africa is not improbable, although not proved.

However, today the African lion population appears to be fragmented into:

- 36 sub-populations supported by an equivalent number of global distribution areas, and;
- 35 free-ranging sub-populations and 1 sub-population of enclosed lions (the latter in South Africa).

The different sub-populations of lions are distributed in the four regions as follows:

- 3 sub-populations in Western Africa;
- 3 sub-populations in Central Africa;
- 18 sub-populations in Eastern Africa, and;
- 12 sub-populations in Southern Africa.

Within these global distribution areas, the sub-populations are also fragmented in several areas.

Among the 36 different lion sub-populations, 23 of them (nearly 2/3) are positioned on 2 or more contiguous countries and should thus be considered as trans-frontier populations (Table 6):

- All the Western and Central African sub-populations are trans-frontier;
- 8 of the 18 Eastern African sub-populations are trans-frontier, and;
- 9 of the 12 Southern African sub-populations are trans-frontier.

TABLE 6 - TRANS-FRONTIER SUB-POPULATIONS OF LION

Region	Number of sub-populations shared by two or more countries			
	2 countries	3 countries	4 countries	5 countries
Western	1		1	1
Central	1	1	1	
Eastern	6	2		
Southern	3	4	2	
SSA = 23	11	7	4	1

1.4. ABUNDANCE

Densities are expressed in number of individuals per 100 km². Figures originate from the literature and from the present study (Tables 12, 16, 19 and 22).

Quite reliable density figures are sometimes available for some Protected Areas, which have been lucky enough to host lion studies. Unfortunately, this is not the case for most Protected Areas. The assessment of lion density is even worse for non-gazetted areas. As developed in chapter III (Driving forces), pastoral areas are a matter of special concern simply because they are commonly overlooked by conventional conservationists even though it may happen that their lion carrying capacity might sometimes be higher than in some wildlife-depleted Protected Areas.

It is important to stress that lion density figures are produced for a given ecosystem, a given year and a given season.

No density figure is given (calculated) per country or per region because it would not be meaningful, as it would not relate to respective local field situations.

Also, no figure is usually produced for a particular site within a given ecosystem since the variations existing between localities are too great. For instance, within Queen Elizabeth National Park ecosystem, Uganda (Table 7), where:

- In the early 1980's, lion density was 5 times higher in Ishasha area than in Mweya area, corresponding to a prey biomass also 5 times higher in Ishasha (14 tons/km²) than in Mweya (2.8 tons/km²) (Von Ordol, 1982), and;
- In the late 1990's, lion density was 7 times higher in Ishasha than in Kyambura (Dricuru, 1999)

TABLE 7 - LION DENSITIES IN DIFFERENT SITES OF QUEEN ELIZABETH NATIONAL PARK ECOSYSTEM

Source	Lion density (number of lions/100 km²)				
	Ishasha	Mweya	Katwe	Katunguru	Kyambura*
Von Ordol, 1982	52	11			
Dricuru, 1999	23		10	12	3

* *Kyambura Wildlife Reserve is adjacent to Queen Elizabeth National Park*

Similarly, no detailed figure is usually produced for a particular season within a given area since very broad seasonal variations exist during a single year, as shown below (Table 8) in NG 29 Controlled Hunting Areas, Botswana (Winterbach & Winterbach, 1999):

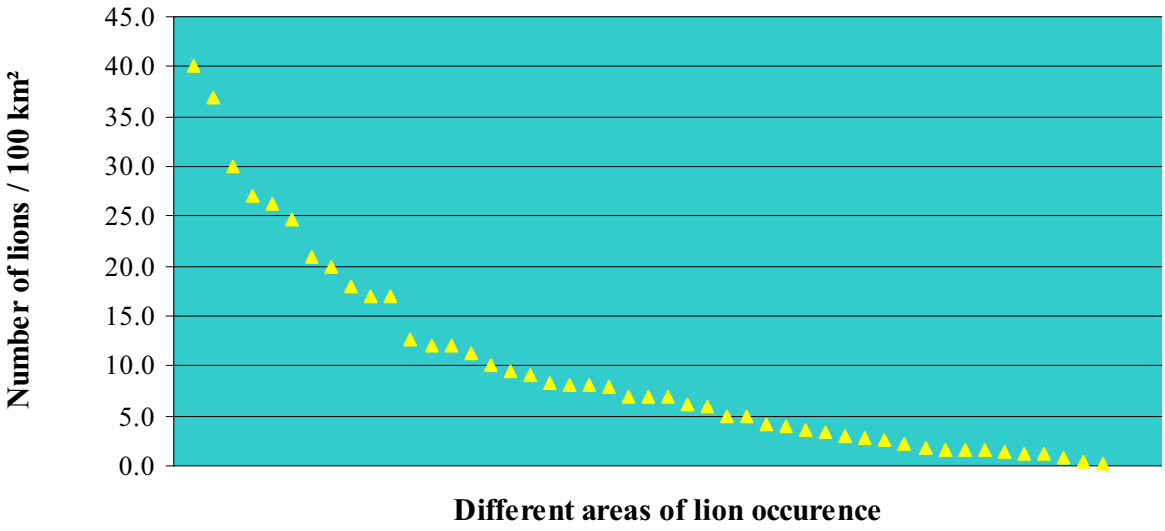
TABLE 8 - SEASONAL VARIATIONS OF DENSITY FOR THE LION POPULATION IN NG29 CONTROLLED HUNTING AREAS, OKAVANGO DELTA, BOTSWANA, (WINTERBACH AND WINTERBACH, 1999)

Season	Density (lions/100 km²)	Home range (km²)
Warm dry (Aug.-Dec. 1997)	38.7	33.6
Warm wet (Jan.-Apr. 1998)	18.8	69.1
Cold dry with floods (May-Aug. 1998)	33.0	39.4
Warm dry (Sept.-Dec. 1998)	24.6	52.8

TABLE 9 - SOME LION DENSITIES IN AFRICA

Category of lion density	Area	Lion density (lions/100 km²)	Source
Very high density	Manyara National Park, Tanzania	40.0	Makacha & Schaller, 1969
	Chobe N.P. (Riverfront, dry season), Botswana	37.0	Neo-Mahupeleng *et al.* , 2001
	Masaï Mara National Park, Kenya	30.0	H. Dublin, *in litt.* 1993 (*in* Nowell & Jackson, 1996)
	Ngorongoro Conservation Area, Tanzania	27.0	Schaller, 1972
	Nairobi N.P. & Kitengela C.U., Kenya	26.3	Rudnai, 1973
	Lupande Game Management Area, Zambia (1990)	24.7	Jachmann, 2001
	Chobe N.P. (Riverfront, wet season), Botswana	21.0	Neo-Mahupeleng *et al.* , 2001
	Ngorongoro Crater, Tanzania	20.0	Elliott & Mc Taggart Cowan, 1978
High density	Okavango delta (higher density), Botswana	18.0	Sechele & Winterbach, 2001
	Chobe N.P. (higher density area), Botswana	17.0	Viljoen, 1993
	Manyeleti Game Reserve, South Africa	16.9	Van Dyk, 1997 adapted from Van Schalkwyk, 1994
	Central District of Kruger N.P., South Africa	12.7	Smuts, 1976
	Queen Elizabeth National Park, Uganda	12.0	Dricuru, 1999
	Kafue National Park, Zambia	12.0	Mitchell, Shenton & Uys, 1965
	Kruger N.P. (higher density area), South Africa	11.2	Van Dyk, 1997 adapted from Van Schalkwyk, 1994
	Kruger National Park, South Africa	10.0	Bothma & Walker, 1999
Medium density	Serengeti N.P. (higher density area), Tanzania	9.4	Schaller, 1972
	Gounda plain, Central African Republic	9.1	Ruggiero, 1991
	Olifants River Game Reserve, South Africa	8.3	Van Dyk, 1997 adapted from Van Schalkwyk, 1994
	Gounda plain, Central African Republic	8.0	present study
	Selous Game Reserve (East), Tanzania	8.0	Rodgers, 1974
	Serengeti N.P. (lower density area), Tanzania	7.9	Schaller, 1972
	Katavi National Park, Tanzania	7.0	Caro, 1999
	Pilanesberg National Park, South Africa	6.9	Van Dyk, 1997 adapted from Van Schalkwyk, 1994
	Chobe N.P. (lower density area), Botswana	6.9	Van Dyk, 1997 adapted from Van Schalkwyk, 1994
	Umfolozi-Hluhluwe Complex, South Africa	6.2	Van Dyk, 1997 adapted from Van Schalkwyk, 1994
	Kruger N.P. (lower density area), South Africa	5.9	Van Dyk, 1997 adapted from Van Schalkwyk, 1994
	Garamba National Park (core area), RDC	5.0	present study
	Arly Total Reserve, Burkina Faso	5.0	Chardonnet, 1999
Low density	Zakouma National Park, Chad	4.2	present study
	Okavango delta (lower density), Botswana	4.0	Sechele & Winterbach, 2001
	Madikwe Game Reserve, South Africa	3.6	Van Dyk, 1997 adapted from Van Schalkwyk, 1994
	Pendjari complex, Benin	3.4	present study
	Gewane-Melka Worer area, Ethiopia	3.0	T. Mattanovich *in* Abebe & Mattanovich, 2002
	Waza National Park, Cameroon	2.7	present study
	Yankari National Park, Nigeria	2.5	present study
	Etosha National Park, Namibia	2.1	Berry, 1981 (year 1974-78)
	Etosha National Park, Namibia	1.8	Van Dyk, 1997 adapted from Van Schalkwyk, 1994
	Aouk Hunting Area, Chad	1.6	present study
	Kalahari Transfontier Park, Botswana & South Africa	1.6	Funston, 2002
	Kalahari Gemsbok N.P., South Africa	1.5	Mills, Wolff, Le Riche & Meyer, 1978
	Niokolo Koba National Park, Senegal	1.3	present study
	Etosha National Park, Namibia	1.2	Berry, 1996 (year 1994)
	Faro-Bubandjida-Benoue Complex, Cameroon	1.1	present study
Very low density	Makgadikgadi, Botswana	0.8	Hemson, 2001
	Masai Steppe, Kenya & Tanzania	0.3	Lamprey, 1964
	Pastoral areas in West & Central Africa	0.2	present study

FIG. 1 - LION DENSITY THROUGHOUT AFRICA (Sources: see Table 9)



1.5. POPULATION SIZE

1.5.1. Total population

The overall number of lions which is found today by the current survey in Sub-Saharan Africa is estimated to be about 40,000 individuals with the following tentative distribution (Tables 11, 15, 18 and 21):

- 10 % of the total population inhabits the Western and Central African regions with respectively 3% and 7%;
- 40% of the total population lives in the Eastern African region, and;
- 50% of the total population is situated in the Southern African region.

TABLE 10 - ESTIMATED LION POPULATION SIZE IN SUB-SAHARAN AFRICA

Regions	Estimated lion population size			% of estimated lions per region
	Minimum	Estimated	Maximum	
Western Africa	968	1,163	1,358	3
Central Africa	2,092	2,815	3,538	7.2
Eastern Africa	11,268	15,744	18,811	40
Southern Africa	14,526	19,651	23,425	49.9
Sub-Saharan Africa	**28,854**	**39,373**	**47,132**	

1.5.2. Trend

It appears extremely hard to objectively assess the global trend of the total population of lions as well as of the regional populations: "*population trends of low-density large predators like lions are difficult to monitor*..." (Funston, 2002). Trends may be locally assessed per site as it is proposed in the following chapters of the regional overviews. More precise surveys are needed to provide a general trend.

The most recent estimation of the lion population size was made in 1996 by the Wild Cats Status Survey and Conservation Action Plan (Nowell & Jackson, 1996; Jackson, 1997) with a figure of between 30,000 and 100,000 animals. If an estimated average of 65,000 lions was taken, a decrease of 25,000 lions could be speculated in 6-year time (between 1996 and 2002). Such an assumption is hardly credible since both estimations (1996 and 2002) remain very rough and the 1996 figure was more of a guesstimate.

A general trend cannot be assessed for the time being in view of very heterogeneous rates and tendencies in different subpopulations throughout the distribution area. What is apparent is that there have been local extirpations, as indicated above, but also populations that have remained stable over the last decade, and also some populations that have seen increases as well as a few reintroductions.

1.6. HABITAT

1.6.1. Habitat suitability

Too often the lion is inappropriately considered as being restricted to savannah habitats, probably because:

- It is more easily seen in this type of open landscape;
- Most of the lion studies have been, and are, conducted in savannahs, and;
- Non-savannah regions are not as frequently visited by people interested in lions and visitors in general.

"*Lions have a wide habitat tolerance*" (Smithers, 1983). As a matter of fact they occur in a large range of habitats from desert regions to rain forest, including woodland, dry forest, steppe, etc.

- **Lions in forests**

The lion may penetrate deep into the forest. In Central Africa, "*one of them was killed in April 1942 in a leopard trap, at M'fubenzork village, between Booué and Makokou, i.e. deep inside the rain forest…about 300 km away from the savannah area…they also quite often penetrate into the Etoumbi forest…and in the forest borders East of Zanaga district*" (Malbrant & Maclatchy, 1947).

Sub-population n°6 (see maps) lives in the equatorial part of Central Africa. These lions inhabit either the rain forest itself, or a mosaic of rain forest, clearings of savannah grassland and forest galleries. These lions are not vagrant individuals; they are permanent and constitute true sub-populations. In Odzala National Park (Congo), they are present but largely unknown

(C. Aveling, pers. comm.), while on the Batéké plateau (Gabon and Congo), they are present but remain totally ignored by most researchers.

Similarly, the lions of Aberdare National Park (Kenya) prey on rain forest dependent taxa such as bongo.

- **Lions in deserts**

"*The lions will penetrate deep into desert, where there are avenues of watercourses, and are common in semi-desert areas such as in parts of the sahelian zone of West Africa or the Kalahari in Botswana. Where water is available they will drink regularly, especially after feeding, but they are by no means dependent on this and they can subsist for long periods without it, getting their moisture requirements from their prey*" (Smithers, 1983).

- In the Southern hemisphere:

In Botswana "*lions have been observed going without drinking water for a period of nine months during a drought in the Kalahari*" (Owens & Owens, 1984 *in* de Waal *et al.*, 2001), where they are known to eat juicy tsama melon (*Citrullus lanatus*) and gemsbok cucumber (*Acanthosicyos naudinianus*) which contain respectively 94% and 91% of water (de Waal *et al.*, 2001).

- In the Northern hemisphere:

Lions were still roaming a few decades ago in remote Northern latitudes, apparently mainly in mountain ranges of the Sahara desert such as the Aïr Ténéré in Northern Niger, the Adrar des Ifhoras in Northern Mali, the Ennedi in Northern Chad, etc. In the Sahelo-Saharan region, the Touaregs used to traditionally hunt lions on a regular basis (Lhote, 1951).

1.6.2. Habitat availability

- **Habitats available**

In some regions, large tracts of suitable habitat for lions sustain very low or even zero density of lions. Two main reasons for this, both of human origin:

(i) Directly, through predation of lion by man, and;
(ii) Indirectly, through the depletion of lion prey species by man.

- **Habitats unavailable**

The degradation of wildlife habitat, even to the point of total desertification or transformation, is extensively described in the literature.

1.6.3. Habitat trends

In very extensive Protected Areas, the natural habitat of lion is still largely maintained. However, with a few exceptions, in smaller Protected Areas and in non-gazetted areas, wildlife habitats are generally decreasing on the continent due to three main causes, which are documented in the survey:

(i) Human population growth;
(ii) Agricultural encroachment, and;
(iii) Increase in domestic livestock numbers.

1.6.4. Legal status of habitats

Most of the lion sub-populations cover geographical ranges that include a mosaic of areas with different conservation status:

- Protected Areas, such as National Parks, Wildlife Reserves, Hunting and Game Management Areas, and;
- Non-gazetted areas, the latter being often pastoral rangeland utilised by cattle-herders for livestock grazing.

The management scheme applied to each one of these areas of course varies according to their respective legal status. Consequently the same applies to lion management: e.g. theoretically (on paper):

- Full protection is granted in National Parks;
- A quota of trophies is allocated to Hunting Areas, and;
- No management measures, except for problem animal control in some countries, are taken in non-gazetted areas, etc.

2. WESTERN AFRICA

2.1. LION RANGE

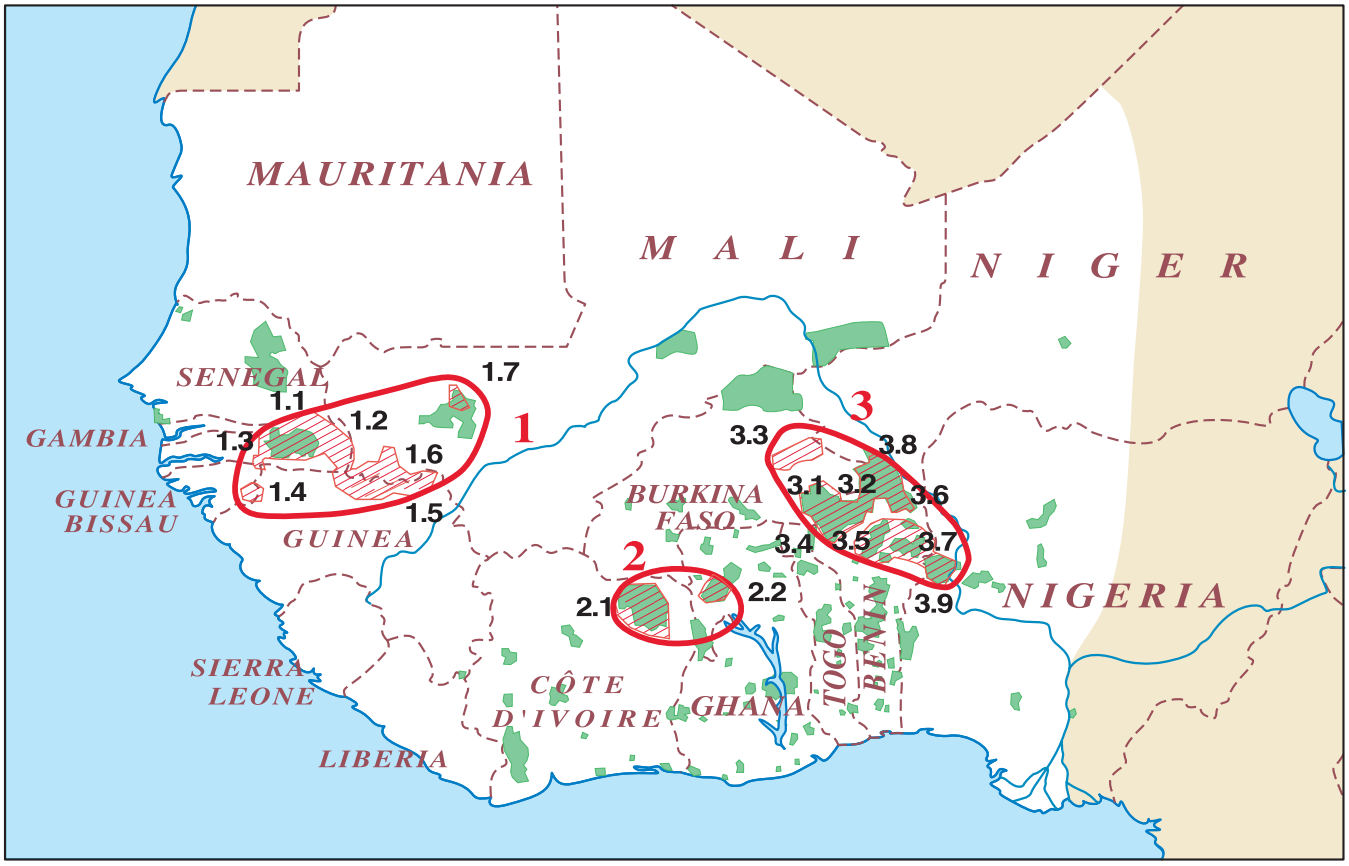
While the lion has been widely studied in Eastern and Southern Africa, very little has been published on its current status in the Western and Central Regions of the continent.

In Western Africa, the lion range probably covers an area of more than 12 million hectares (Table 11):

- About two thirds of the range are gazetted as Protected Areas including:
  . National Parks: about one third;
  . Reserves: 12%, and;
  . Hunting Areas: 15%.

- Even though the lion range outside Protected Areas is very difficult to evaluate, non-gazetted areas probably cover more than a third of the lion range.

Lion subpopulations in Western Africa



Legend

- International border
- GHANA Name of Country
- Main river
- Protected Areas (National Parks, Wildlife Reserves, Hunting Areas, etc.)
- Lion subpopulation
- 2 Lion subpopulation reference number
- Lion distribution
- 2.1 Subpopulation component, reference number

TABLE 11 - STATUS OF LION DISTRIBUTION AREAS IN WESTERN AFRICA

N° of sub-population	Country	Area	Conservation status & surface (km²)			
			Protected areas			Non gazetted areas
			Nat. Parks	Reserves	Hunting areas	
1	Senegal	1.1. Niokolo Koba National Park	9,500			
		1.2. Falémé Zone d'Intérêt Cynégétique			13,080	
	Guinea Bissau	1.3. Buruntuma region				550
		1.4. Boe & Beli regions				1,580
	Guinea	1.5. Sigirini & Fello Koundoua regions				10,400
	Mali	1.6. Haut-Bafing & Haut-Bakoy regions				8,950
		1.7. Kongosambougou Block (within Boucle du Baoule National Park)	1,500			
	Sub-total 1		**11,000**	**0**	**13,080**	**21,480**
2	Cote d'Ivoire	2.1. Comoé National Park	11,500			5,000
	Ghana	2.2. Mole National Park	4,560			
	Sub-total 2		**16,060**	**0**	**0**	**5,000**
3	Burkina Faso	3.1. Arly-Singou complex (National Parks, Faunal Reserves & Hunting Areas)		8,080		
		3.2. W National Park	2,250			
		3.3. Sirba valley				6,590
	Togo	3.4. Oti-Mandouri Faunal Total Reserve		370		
	Benin	3.5. Pendjari complex (National Park & Hunting Areas)	2,750		3,750	850
		3.6. W complex (National Park & Hunting Areas)	5,020		1,190	720
		3.7. Alibori supérieur & Trois rivières complex (Forêts classées)		6,240		11,060
	Niger	3.8. W National Park complex & South of Tamou Faunal Partial Reserve	2,250		380	
	Nigeria	3.9. Kainji Lake National Park	3,860			
	Sub-total 3		**16,130**	**14,690**	**5,320**	**19,220**
Total	**km²**	**121,980**	**43,190**	**14,690**	**18,400**	**45,700**
	%		**35**	**12**	**15**	**37**

2.2. LION POPULATION SIZE

The evaluation of the lion population in this region relies more on first hand information from managers and users, rather than on proper census methodology by scientists. Reasons for this are almost certainly mainly due to:

- The relative low number of Protected Areas, and;
- The few lion studies conducted in these regions.

However, it is estimated that the current lion population size in this region probably stands higher than one thousand individuals (Table 12).

TABLE 12 - LION POPULATION STATUS IN WESTERN AFRICA

N° sub-population	Country	Area	Lion range surface (km²)	Density of lions/100km²	Population size			Assessment mode
					minimum	estimated	maximum	
1	Mauritania					0		C
	Gambia					0		C
	Senegal	1.1. Niokolo Koba National Park	9,500	1.3	100	125	150	B
		1.2. Falémé Zone d'Intérêt Cynégétique	13,080	0.2	25	31	37	C
	Guinea Bissau	1.3. Buruntuma region	550					C
		1.4. Boe & Beli regions	1,580	0.6	7	10	13	C
	Guinea	1.5. Sigirini & Fello Koundoua regions	10,400	0.2	17	21	25	C
	Mali	1.6. Haut-Bafing & Haut-Bakoy regions	8,950	0.2	14	18	21	C
		1.7. Kongosambougou Block (in Boucle du Baoule National Park)	1,500	0.2	2	3	4	C
	Sierra Leone					0		C
	Liberia					0		C
	Sub-total 1		**45,560**		**165**	**208**	**251**	
2	Cote d'Ivoire	2.1. Comoé National Park	16,500	0.6	80	100	120	B
	Ghana	2.2. Mole National Park	4,560	0.3	12	15	18	B
	Sub-total 2		**21,060**		**92**	**115**	**138**	
3	Burkina Faso	3.1. Arly-Singou complex (NPs, FRs & HAs)	8,080	5.0	364	404	444	A
		3.2. W National Park	2,250	1.2	22	27	32	B
		3.3. Sirba valley	6,590	0.2	9	13	17	C
	Togo	3.4. Oti-Mandouri Faunal Total Reserve	370					C
	Benin	3.5. Pendjari complex (National Park & Hunting Areas)	7,350	3.4	198	248	297	B
		3.6. W complex (National Park & Hunting Areas)	6,930	0.6	33	42	50	B
		3.7. Alibori supérieur & Trois rivières complex (Forêts classées)	17,300	0.2	28	35	42	B
	Niger	3.8. W National Park complex & South of Tamou FPR	2,630	1.8	38	47	57	B
	Nigeria	3.9. Kainji Lake National Park	3,860	0.6	20	25	30	B
	Sub-total 3		**55,360**		711	**840**	969	
3 sub-pop.	**11 countries**	**Total**	**121,980**		**968**	**1163**	**1358**	

SUB-POPULATION N° 1

The sub-population n° 1 used to occur throughout the Western African region and was certainly historically linked with the sub-populations n° 2 and 3 as shown on the maps by Bigourdan & Prunier (1937) and Lhote (1951).

This sub-population is extremely important in terms of conservation:

- It is located far from any other lion stronghold;
- There is no realistic eventuality of any natural linkage between this sub-population and any other stronghold;
- It is not very large in terms of population size, maybe 200 individuals, and;
- It is spread over a large area, maybe close to 5 million hectares.

To be positive, it may be that small pockets of lions have been overlooked and that the global population size has been underestimated, since this region has not been studied extensively and accurately.

- **Senegal**

The lion used to be widespread in Senegal, occurring notably in the Senegal River valley (Bigourdan & Prunier, 1937; Roure, 1956).

After Independence in the early 1960s, the Niokolo Koba National Park (sub-population n° 1.1) was considered to host about 100 lions (Dupuy, 1972) with an estimated carrying capacity of 300 lions (Dupuy, 1971). Today, G. Mauvais (pers. comm.) who has been working in Niokolo Koba N.P. for a number of years estimates the lion population to number between 100 and 150 in the Park and about a similar number in the hunting area of Falémé *Zone d'Intérêt Cynégétique* (sub-population n° 1.2). According to him:

- The lions are more abundant around the periphery of the Park where they are used to preying on livestock, especially during the rainy season, and;
- The usual size of lion groups observed is 1 to 2 with a maximum of 6 animals seen together.

Therefore, for Niokolo Koba N.P., this report has retained the conservative figure of 100.

For Falémé Z.I.C., the survey has made its own estimation based on hunting efforts and cross-referencing, adopting a very conservative figure of about 30 individuals.

- **Guinea Bissau**

The lion is present in very small numbers in the North-eastern and South-eastern part of the country:

- In the North-east, according to Ph. Chardonnet (pers. comm.) who worked two years with cattle-herders in the Regiaõ de Leste, the lion is most probably erratic from Niokolo Koba complex (sub-population n° 1.3), and;

- In the South-east, according to A. Baldé (pers. comm.), a very small population of lion (maybe 10 individuals) is permanently present in Boé and Beli regions (sub-population n° 1.4).

Incidents of livestock killed by large carnivores are numerous and frequent, but mostly they are due to spotted hyenas, and sometime even to other ethnic groups disguising cattle robbery as cattle predation by carnivores (Ph. Chardonnet, pers. comm.).

- **Guinea**

During their time spent in Guinea, Bigourdan and Prunier (1937) considered the lion as very abundant and widespread along the Bafing and Tinkisso rivers.

Today, lions are definitely present in the Northern part of the country (sub-population n° 1.5), although with regional differences (S. Darroze, pers. comm.):
- lions (and hyaenas) seem to be more abundant in the North-western region, which is the Northern part of the Fouta Djalon massif, on the West bank of the Bafing river, and;
- lions are more scattered in the North-eastern region, which is the Siguiri *Préfecture*, on the East bank of the Bafing river.

A preliminary evaluation of the lion population size has been carried out in 2001 by the Bafing-Falémé transfontier project in a 1.5 million ha area of Northern Guinea (S. Darroze, pers. comm.). The method used is probably questionable since it transposed East African procedures with little ajustment to West Africa, e.g. it looks like the average lion group size set was 6 individuals, a figure much over the observed situation of less than 2 in West Africa. The results give a country-wide population size of 200-300 lions which is considered as probably over-estimated (S. Darroze, pers. comm.). Until further data are produced, a more conservative figure is given by this study.

Predation on livestock is regularly reported and attributed to the lion, although many local persons appear to mix up the three large predators: lion, leopard and spotted hyaena. Some ethnic groups do not hunt lions for mystic reasons while others do, and poison is widely used by cattle breeders. Lions find suitable refuge sites in the "*woula*" which are uninhabited dense bush areas also used by prey species including western giant eland (S. Darroze, pers. comm.).

In the the newly established *Parc National du* Haut Niger (PNHN), in Central Guinea, the lion is with no doubt present in the Mafou Forest (Brugière *et al.*, 2002) which is rapidly being colonised by lions after 20 years of absence (Hunter, 2001). According to D. Brugière (pers. comm.), who works in the PNHN, "*the lion is incorrectly listed by Ziegler* et al. *(2002) as "*a species formerly present [in the PNHN] but now disappeared*". Lions were only occasionally seen in the Park area in the 1980's but they returned in 1997-1998, probably from an area located about 100 km to the North of the Park, along the Tinkisso river where this species has always been present. We suspect that this return is a consequence of the Park creation in January 1997 and the consequent reduction in hunting pressure on the Mafou forest, which is one of park's core areas (554 km²). A population of resident lions is now well established in the Northern part of the Park. The number of specimens occurring in the Mafou forest is unclear but based on field observations a figure of 5-8 individuals seems reasonably reliable*". The same author reports increasing problems with damages by lions to livestock in the PNHN's buffer zone, especially since the settlement of cattle-herders from Sierra Leone. As the spotted hyena has been wiped out from the PNHN by farmers over the last ten years,

there is no competition for food to lions. Interestingly, the lion here is located in a transition area where savannah and forest species coexist, e.g. the giant forest hog, the yellow-backed duiker and the water chevrotain are present together with the western hartebeest, the common waterbuck and the Buffon's kob.

Some lions occur along the Tominé River (J. Capiod, pers. comm.), the upstream of the Corubal River in neighbouring Guinea-Bissau where lions are present as well.

In the Mount Nimba Biosphere Reserve, in South-eastern Guinea, the lion used to be encountered, but is no longer seen there (S. Chaffard-Sylla, pers. comm.).

The Mafou Forest, the Northern core area of PNHN in Central Guinea, is probably the current Southern limit of the lion's distribution range in the country; the lion does not exist in the Kouya Forest, the Southern core area of PNHN (D. Brugière, pers. comm.).

- **Mali**

Few lions are left in Mali where they used to be numerous. They disappeared from most of their former range, such as along the Niger River in the Gao area and the Gourma region where they were responsible of frequent losses of livestock (B. des Clers, pers. comm.). Lions even occurred in the Southern Ifhoras massif as far North as Bou Ghessa at the border with Algeria (Chudeau, 1920), which would mean that they also occurred in Southern Algeria. According to Lhote (1951), the presence of lions in the massif of Adrar des Ifhoras happened during the rainy season. The same author observed at that time that the lion was especially widespread in Meneka (Menaka) region (South-East Mali) and Goundam region (just South-West of Tombouctou, North-Central Mali). In 1937, Bigourdan and Prunier mentioned the abundance of lions in the interior delta of the Niger river, upstream of Tombouctou. These now extirpated lion populations were closer to the present sub-population n° 3 of this study in neighbouring countries, than to the Malian sub-population n° 1. In 1991 Jachmann (1991) was still considering that the lion had become rare in the Gourma but was still surviving there in parts of this vast ecosystem.

Today, lions only occur in the South-western part of the country. The main remaining sub-population lies on the Guinean border in the Haut-Bafing and Haut-Bakoy regions (sub-population n° 1.6).

It is said that very few individuals may still inhabit the *Parc National & Réserve de la Biosphère* de la Boucle du Baoulé (UNESCO/UNDP, 2000) where they remain in the North, within the Block I Kongosambougou (sub-population n° 1.7), even though they used to be abundant in the Park (Roure, 1956). 5 lions in 1991 and 4 lions in 1992 have been observed in the Park (Traoré, 1993).

SUB-POPULATION N° 2

The sub-population n° 2 is now fragmented in two areas (2.1 & 2.2) which are most probably not connected anymore, despite the existing suitable natural habitat, due to:

- The high incursion of fulani cattle in the corridor area between the two parks during the dry season, and;

- The Volta Noire (Borongo) river marking the border between the two countries.

This sub-population appears to be the weakest of the Western African region in terms of global population size.

- **Côte d'Ivoire**

The lion was formerly widespread in the Northern half of the country, including the so-called "Baoulé V" at the interface between savannah and forest, where it used to occur in the Lamto research station. Today, the lion of Côte d'Ivoire (sub-population n° 2.1) currently seems to be only restricted to the North-eastern savannahs in and around Comoé National Park.

In Comoé NP frequent lion spoor demonstrate a regular presence of the species in the different ecosystems (Poilecot, 1991). According to Lauginie (1990), most of the lion range lies in the valleys of the Comoé and the Iringou rivers; it is frequently spoted on the Kongo plateau, North of Kapkin and at the confluent of the two rivers Comoé and Iringou. In 2002, lions are regularly observed in the Gawi area and spoors are noticed nearly everywhere in the park (R. Gilon, pers. comm.). This year, lions have been heard roaring in the Kongo scientific camp where they had not been heard for years (F. Lauginie, pers. comm.). The population of the park is estimated at around 100 individuals (J-M. Pavy, pers. comm.).

Few observations of lions have been noted outside Comoé NP:

- in 1994, tracks of a lioness have been seen in the upper Kinkene basin in what is named the "desert of Kong" west of the park (H. Ressaire, pers. comm.);
- roars and tracks of lions are said to be regularly noticed by villagers in the Monts Tingui area, South-west of Comoé NP, nearby the formerly mentioned location; a lion pride is considered as permanent there (S. Diarrassouba, pers. comm.), and;
- a lioness and a cub have been observed in 1999 in the Warigue area, North of Comoé NP; roaring and footprints of lions are regularly noticed there, and the wildlife in general is recovering slowly due to better protection (D. Koffi, pers. comm.).

Interestingly, 3 lions have been seen in 1990 in the Odienné region, in North-West Côte d'Ivoire, close to the border with Guinea and the guinean *Réserve Partielle de Faune de* Kankan (S. Roux, pers. comm.; F. N'Golo, pers. comm.). As these lions were much too far from the Comoé NP lion sub-population n° 2.1, they may have been connected with the sub-population n° 1.5.

- **Ghana**

In Ghana (sub-population n° 2.2) the lion is now restricted to the North-western savannahs in and around Mole National Park.

In early 1990's, the lion population of Mole NP was considered "*certainly not high but at least sufficient to maintain a breeding population. […] It is suggested that the main lion population in the Mole N.P. is centred around Lovi and Nyanga camps extending towards the Mole River in the East and South to Brugbani camp and Samole River. There is no doubt that lions, perhaps in smaller numbers also occur around Gbanwele and Konkori and in the vicinity of Kwomwoghlugu. As lions are known to be great wanderers they will often travel great distances and no doubt some individuals also leave the Park from time to time. This*

Lions of Burkina Faso, Singou Faunal Reserve
(Photo : © DR)

Senegal lion, Faleme Hunting Area
(Photo : © DR).

Lions of Niger
(Photo : Ph. Chardonnet).

movement of lions out of the Park has already been reported by the staff in the Kanato, Gbanwele and Gbantala camps" (Wilson, 1993). According to the same source, at that time the largest prides observed were of 8 including 3 cubs, and 7 including 2 cubs.

Today, the lion population size in Mole N.P. is estimated between 15 (B. Chardonnet, pers. comm., 01.1999) and 50 (Abaka Haizel, pers. comm., 07.2002). The lions are actually rarely observed but they are heard roaring on a regular basis during surveillance patrols. They rarely venture outside the limits of the park, however it may eventually happen that some individuals wander:

- Northwards, close to the border with Burkina Faso: the Northern boundary of Mole NP is only 80 km away from the Southern boundary of the Nazinga game ranch in Burkina Faso, and;
- Westards, towards the Côte d'Ivoire border: the Western boundary of Mole NP is only 80 km away from Bouna, the head-quarters of Comoé NP in Côte d'Ivoire.

SUB-POPULATION N° 3

Sub-population n° 3 is the strongest of the West African region with:

- A population size of more than 800 individuals, and;
- A relatively good conservation status.

This sub-population is centred on the Arly-Pendjari-Niger ecosystem, which benefits from a large complex of Protected Areas. The lion density is locally quite high and may even be classified in the medium density category (Table 12).

- **Burkina Faso**

The lion used to be present everywhere in Burkina Faso (Roure, 1956). Today, the lions have been extirpated from Western and Central Burkina Faso even though some areas such as Comoé-Leraba or Nazinga reach prey availability levels which could probably sustain lion populations. The lion population of Burkina Faso is now restricted to the Eastern region, except for a very small population which remains in the upper basin of the Mouhoun river in North-western Burkina Faso, close to the border with Mali (Y. Iniyé, pers. comm.). Whether these few lions are linked to the sub-population n° 1 or n° 2 (or even n° 3) remains doubtful.

The lion population of Eastern Burkina Faso is the most important of the whole Western Africa region, with possibly as many as 450 individuals.

Lions are quite easy to observe in the Singou-Arly complex (sub-population n° 3.1) where they reach remarkable densities of about 5 animals per 100 km². This abundance is supported by a correlated biomass of prey species, for instance roan antelope (*Hippotragus equinus*), the second most important prey species of the lion, after buffalo. The correlation between lion density and roan antelope density is an interesting one: in fact the roan antelope density in the Singou valley appears to be the highest in Africa (Chardonnet *et al.*, 1999) (Table 13) and the lion density there is correspondingly the highest in the region. The Protected Areas of the Pendjari Basin (1.4 million ha) in Burkina Faso and Benin with their abundance of buffalo,

roan, hartebeest, etc. are often overlooked but, with the quite high lion densities, they are both continentally and regionally important.

TABLE 13 - DENSITY OF ROAN ANTELOPE IN AFRICA BY ORDER OF DENSITY (Sources: East, 1998; Chardonnet *et al.*, 1999)

Region	Country	Area	Density (n° of roan/km²)
Western Africa	Burkina Faso	Lower valley of Singou	1.5
		Eastern Burkina Faso	0.77
	Benin	Pendjari complex	0.61
Central Africa	Cameroon	Bénoué N.P.	0.56
Western Africa	Senegal	Niokolo Koba N.P.	0.26
Central Africa	Chad	Zakouma N.P.	0.23
Southern Africa	Zambia	South Luangwa N.P.	0.20
		North Luangwa N.P.	0.11
Central Africa	C.A.R.	Manovo Gounda St Floris N.P.	0.09
Southern Africa	Zambia	Kafue N.P.	0.03
	Botswana	Northern Botswana	0.02
Eastern Africa	Tanzania	Ruhaha N.P.	0.01
Southern Africa	South Africa	Kruger N.P.	0.002
	Zimbabwe	Hwange N.P.	0.005

In W National Park (sub-population n° 3.2), the density of lions is much lower than in Arly, as is the biomass of prey species.

In the hunting areas surrounding the National Parks (Ougarou, Singou, Pama, Tapoa Djerma, etc.), the abundance of lions is pretty high. "*The tourist hunting quota for lion is set at 20 individuals per year and the offtake averages 12 per year on a repeatable basis; there is no point to reduce the quota, otherwise the cattle-herders will poison and finish the lions*" (Y. Iniyé, pers. comm.).

The Sirba valley (sub-population n° 3.3) is a little-known non-gazetted area where a small sub-population of lions remains; these animals are probably connected with the population of Singou (B. Chardonnet, pers. comm.).

- **Benin**

In Benin today, lions are only found in the Northern part of the country.

The highest concentration of Benin lions is in the Pendjari ecosystem (sub-population n° 3.5) with local noticeable densities in Pendjari National Park and surrounding Hunting Areas such as Porga, Batia and Konkombri.

As with the W National Park in Burkina Faso, the W National Park in Benin faces conflicts between wildlife and livestock at the expense of taxa such as lions whose population is small (sub-population n° 3.6).

The *Forêts Classées* (gazetted forests) of Alibori Supérieur and Trois Rivières maybe also support a small lion population (sub-population n° 3.7). Covering more than half a million hectares, at least on paper, these Protected Areas probably share their lions with the Kainji Lake National Park in the neighbouring Nigeria, a National Park which is also more than half a million hectares in size.

- **Niger**

The lion was once spread throughout Southern Niger and used to be present as far North as the Aïr region on a permanent basis (Chudeau, 1920). It used to be common in the Aïr massif (Bigourdan & Prunier, 1937). *"The lion was especially widespread in Adamboukar (Anderamboukane) region at the border with Mali […]; in Adamboukar in 1939 there were still a lot of lions"* (Lhote, 1951). It was still present some years ago in the Termit massif, Eastern Niger, from where it has probably been extirpated by local hunters since wildlife is currently abundant there, not only prey species but also large predators like cheetah (J. Tubiana, pers. comm.).

Nowadays the lion in Niger is only found in W National Park and surrounding areas (mainly South of Tamou Partial Faunal Reserve) and its population size is assessed to about 50 (sub-population n° 3.8) even though some observers mention a population of 80 in W NP (O. Buttin, pers. comm.). According to Tiega & Price (1995), the lion population size in Niger reaches a bit less than 100 individuals in the areas of W, Tamou and Sirba.

It must be mentioned that this sub-population n° 3 used to be also present in neighbouring Mali, in the Gourma region and even as far as Southern Ifhoras Massif (Chudeau, 1920 *in* Le Berre, 1990).

- **Nigeria**

In terms of biodiversity, the Western bank of the Niger river is considered here to belong to the Western Africa region.

In Western Nigeria, the lion is present in Kainji Lake National Park (sub-population n° 3.9), mainly in the Borgu sector (the former Borgu Game Reserve established as a Native Authority Forest reserve in 1961). The remaining population is small in size.

A second population which was not recorded during the map production seems to exist in Kamuku National Park in North-central Nigeria (J. Rudge, pers. comm.; F. Hurst, pers. comm.). The area available, although the exact size is not known, is extensive, comprising the National Park and Kwiambana Game Reserve to the North-west and surrounding Forest Reserves and grazing reserves. It is said that cattle predation has been reported. According to J. Rudge (pers. comm.), the population may tentatively consist of 10 individuals and may even be higher. These have not been included in the population estimate for the country.

TABLE 14 - TRENDS AND CONSTRAINTS OF LION CONSERVATION IN WESTERN AFRICA

N° sub-population	Country	Area	Lion population trend		Lion habitat quality trend	Main prey for lions		Conservation efficiency (rate 0 to 3)	Lion conservation constraints
			Past	Present		Wildlife	Livestock		
1	Senegal	1.1. Niokolo Koba N.P.	D	S	S	X	X	2	tarmac road
		1.2. Falémé Z.I.C.	D	D	D	X		0	cotton, mining
	Guinea Bissau	1.3. Buruntuma region	S	S	S		X	0	livestock competition
		1.4. Boe & Beli regions	D	S	D	X	X	0	mining, road
	Guinea	1.5. Sigirini & Fello Koundoua regions	D	S	D		X	0	agriculture, livestock, poaching
	Mali	1.6. Haut-Bafing & Haut-Bakoy regions	D	S	D		X	0	agriculture, livestock, poaching
		1.7. Kongosambougou Block (Boucle du Baoule N.P.)	D	D	D	X	X	1	agriculture, livestock, poaching
2	Cote d'Ivoire	2.1. Comoé N.P.	D	S?	S	X		2	livestock, poaching
	Ghana	2.2. Mole N.P.	D	I	S	X		3	
3	Burkina Faso	3.1. Arly-Singou complex (N.P., F.R. & H.A.)	D	D?	S	X		2	poaching
		3.2. W N.P.	D	D	S	X	X	0	livestock
		3.3. Sirba valley	D	D	D		X	0	livestock
	Togo	3.4. Oti-Mandouri F.T.R.	S	S	S			1	
	Benin	3.5. Pendjari complex (N.P. & H.A.)	D	S	S	X		3	poaching
		3.6. W complex (N.P. & H.A.)	D	D	S	X	X	1	livestock, poaching
		3.7. Alibori supérieur & Trois rivières complex	D	S	S/D		X	0	livestock, poaching
	Niger	3.8. W N.P. complex & South of Tamou F.P.R.	D	S	S	X		2	poaching
	Nigeria	3.9. Kainji Lake N.P.	D	D	S	X		2	poaching

I = increasing
S = stable
D = decreasing
Rate 0 to 3: 0 =low; 3=high

3. CENTRAL AFRICA

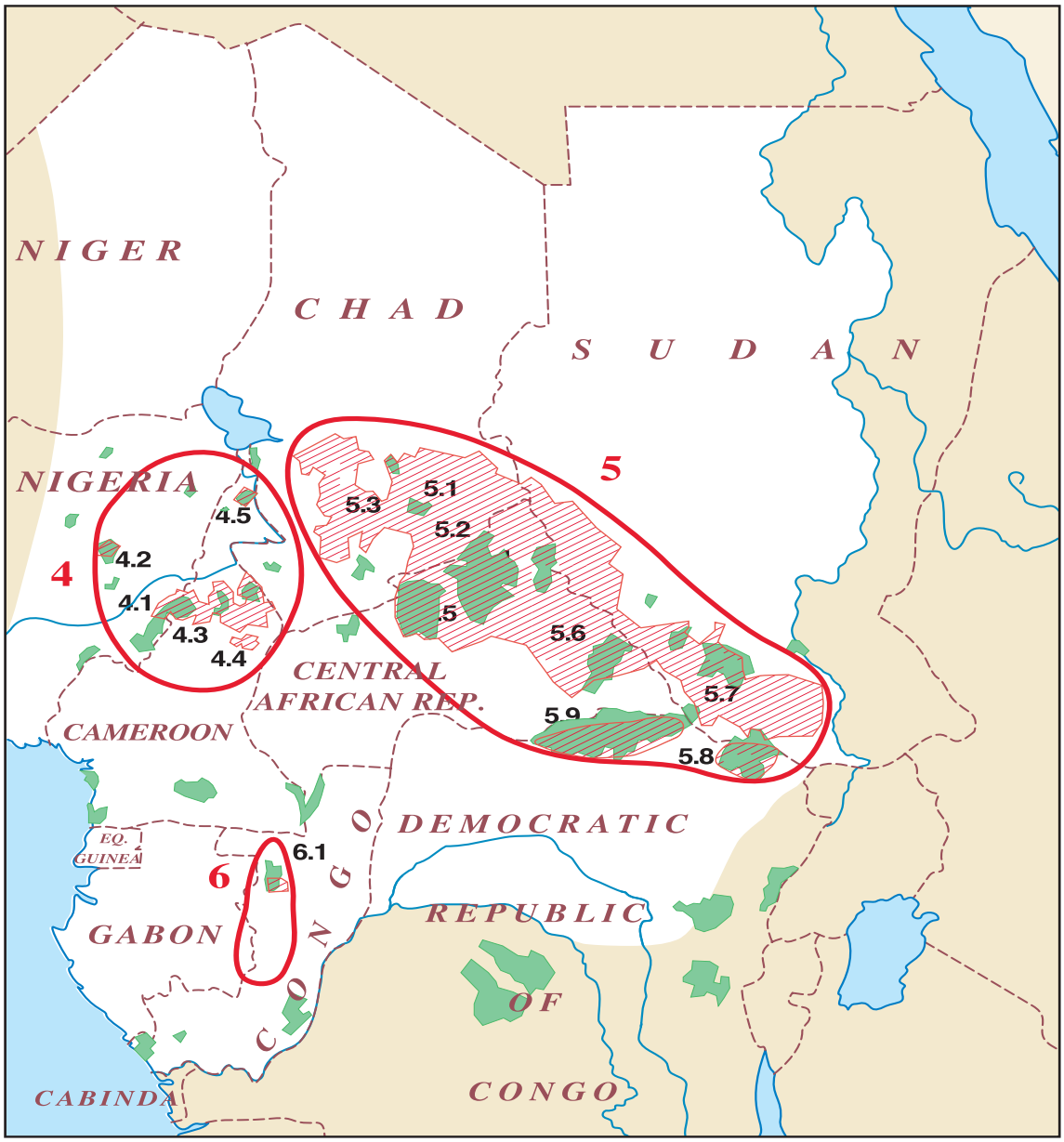
3.1. LION RANGE

In the Central Africa Region, the lion range probably covers an area of more than 65 million hectares (Table 15):

- About half of the lion range is gazetted as Protected Areas including:
  . National Parks: about 10%;
  . Reserves: about 4%, and;
  . Hunting Areas: approximately more than one third.

- Even though the lion range outside Protected Areas is very difficult to evaluate, non-gazetted areas probably cover nearly half of the lion range, which appears to be one of the most characteristic features of the region as far as lion (and large wildlife including prey species) is concerned.

Lion subpopulations in Central Africa



Legend

- International border
- GHANA — Name of Country
- Main river
- Protected Areas (National Parks, Wildlife Reserves, Hunting Areas, etc.)
- Lion subpopulation
- 2 — Lion subpopulation reference number
- Lion distribution
- 2.1 — Subpopulation component, reference number

TABLE 15 - STATUS OF LION DISTRIBUTION AREAS IN CENTRAL AFRICA

N° of sub-population	Country	Area	Conservation status and surface (km²)			
			Protected areas			Non gazetted areas
			Nat. Parks	Reserves	Hunting areas	
4	Nigeria	4.1. Gashaka-Gumti N.P. (Northern sector only)	1,860			
		4.2. Yankari N.P.	1,960			
	Cameroon	4.3. Faro-Bubandjida-Bénoué complex (N.P. & H.A.)	7,300		22,700	
		4.4. Vogzoum & Djivorke H.A.			3,820	
		4.5. Waza N.P.	1,880			
	Sub-total 4		**13,000**	**0**	**26,520**	**0**
5	Chad	5.1. Zakouma N.P.	2,400			
		5.2. Aouk H. A.			6,000	
		5.3. Guerra & Salamat regions		24,860		138,140
	C.A.R.	5.4. Gounda plain (within Manovo-Gounda-St Floris N.P.)	830			
		5.5. Manovo-Gounda-St Floris NP, Bamingui-Bangoran NP, Sangba P.Z.	28960		52,540	
		5.6. Zone d'Intérêt Cynégétique (Eastern CAR)			107,800	
	Sudan	5.7. Bahr el Gazal region including Southern N.P.	15,000			167,000
	R.D.C.	5.8. Garamba N.P.; Azande, Gangala na Bodio & Mondo Missa D.C.	4,920		10,000	
		5.9. Bomu & Bili-Uere D.C.			45,000	
	Sub-total 5		**52,110**	**24,860**	**221,340**	**305,140**
6	Gabon	Bateke plateau				2,500
	Congo	Bateke plateau				2,500
		6.1. Odzala N.P.	2,445			1,555
	Sub-total 6		**2,445**	**0**	**0**	**6,555**
Total	**km²**	**651,970**	**67,555**	**24,860**	**247,860**	**311,695**
	%		**10**	**4**	**38**	**48**

3.2. LION POPULATION SIZE

For very similar reasons to Western Africa, the evaluation of the lion population size in Central Africa relies more on first hand information from managers and users than on systematic counting by scientists. It is considered that the present lion population size in this region probably reaches a figure of just under 3,000 individuals (Table 16).

TABLE 16 - LION POPULATION STATUS IN CENTRAL AFRICA

N° sub-population	Country	Area	Lion range surface (km²)	Density of lions/100km²	Population size			Assessment mode
					minimum	estimated	maximum	
4	Nigeria	4.1. Gashaka-Gumti National Park (Northern sector only)	1,860					C
		4.2. Yankari National Park	1,960	2.6	40	50	60	B
	Cameroon	4.3. Faro-Bubandjida-Bénoué complex (National Parks & Hunting Areas)	30,000	1.2	276	345	414	B
		4.4. Vogzoum & Djivorke Hunting Areas	3,820					B
		4.5. Waza National Park	1,880	3.7	56	70	84	B
	Sub-total 4		**39,520**		**372**	**465**	**558**	
5	Chad	5.1. Zakouma National Park	2,400	4.2	80	100	120	B
		5.2. Aouk Hunting Areas	6,000	1.6	75	94	113	B
		5.3. Guerra & Salamat regions	163,000	0.2	228	326	424	C
	C.A.R.	5.4. Gounda plain (within Manovo-Gounda-St Floris National Park)	830	8.0	53	66	79	B
		5.5. Manovo-Gounda-St Floris NP, Bamingui-Bangoran NP & Sangba PZ	81,500	0.6	391	489	587	B
		5.6. Zone d'Intérêt Cynégétique (Eastern CAR)	107,800	0.4	302	431	560	C
	Sudan	5.7. Bahr el Gazal region including Southern National Park	182,000	0.2	255	364	473	C
	R.D.C.	5.8. Garamba N.P.; Azande, Gangala na Bodio & Mondo Missa D. de Chasse	14,920	1.2	126	180	234	C
		5.9. Bomu & Bili-Uere Domaines de Chasse	45,000	0.5	154	220	286	C
	Sub-total 5		**603,450**		**1664**	**2,270**	**2,876**	
6	Equatorial Guinea					0		C
	Gabon	Bateke plateau	2,500	0.8	14	20	26	C
	Congo	Bateke plateau	2,500	0.8	14	20	26	C
		6.1. Odzala National Park & surrounds	4,000	1.0	28	40	52	C
	Sub-total 6		**9,000**		**56**	**80**	**104**	
3 sub-pop.	**8 countries**	**Total**	**651,970**		**2,092**	**2,815**	**3,538**	

SUB-POPULATION N° 4

- **Nigeria**

In terms of biodiversity, the Eastern bank of the Niger river estuary and the Eastern side of Jos plateau are considered here to belong to the Central African region.

The Northern sector of Gashaka-Gumti National Park may still contain a small population of lion (sub-population n° 4.1).

A permanent population of lions lives in Yankari National Park (sub-population n° 4.2). Although the population is small in size, its conservation status is quite good (B. Chardonnet, pers. comm.).

Maybe a few lions still enter Sambisa Game Reserve in North-eastern Nigeria, coming from the Faro National Park in the neighbouring Cameroon.

- **Cameroon**

In Cameroon, the distribution area of the lion has been reduced to the Northern part of the country, while it used to cover some locations in Southern Cameroon (Vivien, 1991):

- Lion were present in 1935 in the Yaoundé region;
- In the 1970's lion were still present in the Yoko region, and;
- Lions have become rare in 1990 on the Adamaoua Plateau.

Today three areas are identified as having lion in Cameroon, all of them located in the Northern Province. The species has disappeared from the Far-North Province. The lion is not present anymore in the Kalamaloue National Park where the last individual was seen in 1979 (J. Thal, pers. comm.). To the South, it has also disappeared from the Adamaoua Plateau.

In the Faro-Bénoué-Bubandjida complex (sub-population n° 4.3.) there is still suitable and available lion habitat. This 3 million hectares region made of 3 National Parks, numerous Hunting Blocks and extensive surrounding non-gazetted areas, contains a large number of suitable prey species such as buffalo, giant eland, roan antelope, hartebeest, 3 kob species, bushbuck, small size antelopes, wild suids, without forgetting abundant livestock. According to Dr Jean Ngog Nje (pers. comm.), the former long-standing Director of the Wildlife School of Garoua, the lion population of the Faro-Bénoué-Bubandjida complex was on the increase during the years preceding 1997 when he left his position. In the *Parc National de la* Bénoué, wildlife censuses have been carried out (Planton, 1999): the population size was 30 lions in 1997 according to Planton (1997) and 22 lions in 1998 according to the WWF-FAC project (1998), giving densities of 1.7 and 1.2 lions per 100 km² respectively.

The lion population of Waza National Park (sub-population n° 4.5.) has been larger in the past, about 200 individuals in the 1960's (Flizot, 1971). Varying estimates are given for the current Waza lion population of 40 (J. Thal, pers. comm.), 50 (J. Ngog Nje, pers. comm.), 70 (H. Planton, pers. comm.), between 50 and 150 (F. Lamarque, pers. comm.), etc. These lions regularly move out of the park although staying in its vicinity. The lion has been persecuted to such an extent that, in the basin, it is now found mainly in the heart of the Protected Areas,

including in gazetted Hunting Blocks where they benefit from the protection of safari operators (J. Thal, pers. comm.).

- **Chad**

The lion used to cover the entire Southern part of Chad to the point that the present distinct sub-populations n° 4 and 5 were previously forming a single sub-population.

As far as the sub-population n°4 is concerned, very few lions remain on the Chadian side of the border. Today, a few lions sometimes cross the Chad border from Cameroon where they are abundant, notably from Boubandjida National Park and surrounding hunting areas.

The only Protected Area of the region concerned, the *Réserve de Faune de* Binder-Léré, used to contain lions. The taxon seems to have been extirpated in 1973 when Thal and M'Baissekim undertook their preliminary survey before the Reserve was gazetted in 1974 (Féron, 1995).

According to Thal (1973) the inhabitants of Binder Nairi would see lion footprints from time to time during the rainy season although the animals never settled in the area because, according to him, prey densities were too low.

SUB-POPULATION N° 5

- **Chad**

- **Northern Chad**

The long-standing desertification process and the recurrent cyclical drought phenomena at the end of the 20th Century have certainly contributed to the disappearance of lions from areas of Northern Chad where they used to be established.

According to Jérôme Tubiana (pers. comm.), an ethno-zoologist expert in North-eastern Chad:

- Until the 1950-60's, lion population was inhabiting the Zaghawa country, especially in the Kapka mountain range, as well as the South-eastern part of the Ennedi mountain range (Biltine *Préfecture*), and;
- Today, the lion has disappeared from the Ennedi, however it is said by local communities to be still present in small numbers in the Kapka massif around 15° North. Hoinathy Honimadji (pers. comm.) believes that in Chad, lions still occur as far North as the 15th parallel and he has seen lions hunting greater Kudus between Biltine and Guéréda, which is the Southern Kapka massif.

Otherwise, lions may still be present in the Ouaddaï *Préfecture* where wild prey species are locally abundant, such as warthog, roan, greater kudu, red-fronted gazelle, korrigum, ostrich, etc. In 2000, there were numerous official complaints by pastoralists of stock-raiding lions in the Lake Fitri area, around 13° North, in the Batha *Préfecture* (Ph. Chardonnet, pers. comm.).

- **Southern Chad**

Today, the distribution range of lion in Chad still remains huge, although lion density is low, except in a few Protected Areas (Chardonnet & Lamarque, 1997).

In the Lake Chad Basin, the lion used to be very common and was found even at the edge of the desert as far North as Nguigmi. They used to be common along the rivers Chari, Logone, Ba-Ili, Bahr Erguig and on the shores of Lake Chad (Jeannin, 1951). Lions are scattered in the vast pastoral areas, especially in the regions of the Chari, the Logone, the Ba-Illi and the Mayo Kebbi (Tinan Reouyo, pers. comm.). They prey on both the large herds of livestock and the remaining wildlife, notably the still abundant warthog populations.

The Salamat *Préfecture* is certainly the major region for lions in Chad today, mainly in the two Protected Areas (*Parc National de* Zakouma and *Domaine de Chasse de l'*Aouk), but also outside Protected Areas where difficult access especially during the rainy season helps protect the lions.

In Zakouma National Park the lion has always been quite easy to see (sub-population n° 5.1). There has not been any proper lion census there, although several large wildlife counting operations have been conducted in the last few years, all of them showing a positive trend in terms of wildlife conservation with increasing populations of lion prey species, within the limits of Zakouma NP but also outside with a re-colonisation of new territories (MEE *et al.*, 2001). For instance:

- In ten year period between June 1986 and February 1995, the lelwel hartebeest may have increased from 600 to 1,700 and the giraffe from 300 to 800 (Dejace *et al.*, 2000), and;
- Buffalo numbers may have increased from 200 in 1986 to 1,000 in 1995 (Dejace *et al.*, 2000) and 1,500 in 2000 (Planton, 2000 *in* MEE *et al.*, 2001).

In Zakouma NP, during the dry season, about 60 lions seem to concentrate in the Eastern part of the park (roughly 1,000 km² for a density of 6 lions/100km²) where most of wildlife preys reside nearby the *bahr* water sources (Djadou Moksia, pers. comm.).

In Aouk *Domaine de Chasse* (17 Hunting Blocks), there are still noticeable numbers of lion that are not very hard to spot (sub-population n° 5.2). Tourist hunters hunt a few individuals here. Prey species are locally in good numbers, some buffalo, a few giant eland, numerous roan and lelwel hartebeest, three species of kob, some korrigum and red-fronted gazelle, many bushbuck and warthog, etc.

In Central Chad (Guera and Moyen-Chari *Préfectures*) the lion is definitely present, notably in the large Siniaka-Minia *Réserve de Faune*, but also in pastoral rangelands and mountain ranges outside any Protected Area (sub-population n° 5.3). In *Parc National de* Manda, the lion was present on a permanent basis when the prey availability was high twenty years ago. Formerly created as a *Réserve de Faune Régionale* in 1951 for the conservation of the giant eland, then gazetted as a National Park in 1965, the Park was still containing a large population of giant eland in the 1970's. Today, the giant eland has been virtually extirpated from the park, just as the lion. Individual lions may appear there temporarily and their numbers do not exceed 3-5 (Chai, 1996).

Lion of Cameroon, Waza National Park (Photo : H. Planton).

Lions of Cameroon, Waza National Park (Photo : H. Planton).

Lions of Cameroon, Hunting area N°4 (Photo : F. Vannier).

Lion of CAR, Bamingui Hunting Area (Photo : M. Fusy).

Lion of CAR, Gounda valley (Photo : Club Faune).

- **Central African Republic (CAR)**

The distribution of lion in CAR used to be widespread and a few decades ago the taxon was represented everywhere except in the South Western rain forest area. It used to be abundant in regions were it is now excinct or rare such as the *Réserve de Faune de la* Nana Barya or even the surroundings of the capital Bangui, in the regions of Damara, Bossembélé and Boda (Gauze, 1958).

Very few lion studies have been carried out in this country. One exception must be mentioned for the Gounda Plain (sub-population n° 5.4) within *Parc National de* Manovo-Gounda-St Floris (PNMGSF), where the local lion density is high and probably the highest of the whole Western and Central African regions (Ruggerio, 1991; B. Chardonnet, pers. comm.; Ph. Chardonnet, pers. comm.). Consequently, in this study this particular area has been set apart from the rest of PNMGSF.

In the rest of PNMGSF and in the *Parc National de* Bamingui-Bangoran as well as in the *Zone Pilote de* Sangba and surrounding non-gazetted areas (sub-population n° 5.5), the lion population size has apparently shown a decline during recent years along with a decreasing average pride size (J. Lobao Tello, pers. comm.). Possible reasons may be:

(i) The poor conservation status of the formerly abundant prey such as the three taxa of kob;
(ii) The harassment by nomadic cattle-herders entering the region, including some of the Protected Areas, during the dry season, and;
(iii) The apparently poor ability of these lions to tackle buffalo as prey (J. Lobao Tello, pers. comm.); a noticeable number of live buffalo are observed by Professional Hunters with lion wounds, tending to support a high level of hunting failure (P. Roulet, pers. comm.);
(iv) The current bush encroachment phenomena may for lions make hunting more difficult than in formerly more open lanscape (P. Roulet, pers. comm.);
(v) There may be a reproduction problem in lion in this region and an evaluation study is about to be conducted in this field (A. Iokem, pers. comm.).

According to J. Lobao Tello (PDRN, 2000), the reduction in number of lions would be more due to ecological factors than to poaching: "*there has been an artificial increase of lion during the former period of heavy poaching (elephant, black rhinoceros and other species), which was responsible for an outstanding abundance of carcasses with the consequence of an "explosion" of the lion population and a very high cub survival rate. The reduction of prey and carcasses left by poaching has directly regulated the lion population as observed today with an exceptionnaly low cub survival rate and a rarefaction of old lions. One can consider that the lion population is returning to its natural level, in balance with the environment and the quite low prey abundance.*"

The Western limit of sub-population n° 5.5 seems to be located today around the river Gribingui, the Western border of the *Réserve de Faune du* Gribingui-Bamingui, while the Eastern limit may be nearby the *Forêt Classée de la* Zizi, North of Ouadda, both areas where lion tracks were spotted in January 2001 (P. Roulet, pers. comm.).

In the huge *Zone d'Intérêt Cynégétique* or ZIC, which covers the entire Eastern part of the country, the current lion population remains poorly known but is probably declining following

the negative trend of prey populations which are subject to heavy poaching pressure despite a very low human settlement (sub-population n° 5.6). As far as lion protection is concerned, there is probably not much difference between Protected Areas (e.g. *Réserve de Faune de* Zémongo) and non-gazetted areas. Cattle-herders established in the *Communes d'élevages* in the region of Mingala or Pombolo (G. Doungoube, pers. comm.), as well as cattle-herders penetrating more deeply within the ZIC in areas such as Derbissaka (F. Zowoy, pers. comm.), actually complain on a recurrent basis about lion predation on livestock. The Western limit of sub-population n°5.6 is most probably located on the Western side of the Bangassou rain forest (which is not that obvious on the map "Lion subpopulations in Central Africa) where lions are known to occur (J.-P. Leroux, pers. comm.; M. Tiran, pers. comm.), notably in Lipia Ngebe plateau, South of Bakouma (G. Doungoube, pers. comm.).

Interesting situations must be underlined regarding the CAR lion populations inhabiting the fringe of rain forest ecosystems:

- In the Bangassou rain forest and surrounding forest-savannah mosaic, South-center of CAR, lions are well established in some areas such as Mourou-Fadama and Ndanda (F. Zowoy, pers. comm.);
- In the Haut-Mbomou, the South-eastern corner of the country, lions inhabit areas of forest-savannah mosaic and may prey on both forest wildlife and savannah wildlife (P. Chardonnet, pers. comm.);
- In the Lobaye region, in the South-west of the country, lions were known to occur, at least until recently, under truly Guinean climate (A. Pénelon, pers. comm.; G. Doungoube, pers. comm.; Gauze, 1958).

- **Sudan**

The area situated on the left (Western) bank of the Nile is considered as belonging to the Central Africa region.

Very little is known on the status of the lion in Sudan. The overall figures of the lion population in this country have to be taken as highly speculative.

The lion presence and sub-populations in Sudan are indicated based on reasonable estimates according to geographical indicators using the following methodology:

- Physical constraints:

  River separation and suitable habitat have been considered when identifying the shape of the potential distribution area and subpopulations of lions. The lion is present in all the ecological zones of Sudan, including the arid zone but excluding the desert (Hillman, 1985). The wooded savannah is the most suitable habitat for lions on the West bank of the Nile River; it encompasses an immense area of 398,100 km² i.e. 17.1% of the country (Hillman, 1985). The savannah grassland also contains lions and is nearly twice the size of the former ecological zone. Lions also occur in the Sudd swamps and floodplain grasslands.

- Human constraints:

> Assuming that lions tend to avoid people, the location and density of villages (documented on published maps) have been superimposed on the suitable lion habitat obtained from the above-mentioned exercise. The output provides a rough estimate of the potential lion range, which still needs to be ascertained and improved. A similar method has been used by R. Martin (R. Taylor, pers. comm.) to map the leopard habitat in Sub-Saharan Africa.

According to Hillman (1985), the conservation status of the lion in Sudan is "satisfactory" (at the time of his publication), which means "reasonable numbers" in his mind. The same author mentions the presence of lions in all Protected Areas of the country.

Figures have been published of the numbers of wildlife in Sudan, based on a national census of wild animals including lions conducted from August 1975 to January 1977 on behalf of the National Livestock Census (Watson *et al.*, 1977 *in* C. de Jong-Boon & S. Babiker Tabidi, 1985). Watson's estimated the national lion population at 1,610 individuals; however, J. Hillman suggested that the population is actually more than twice as high as Watson's estimate (C. de Jong-Boon & S. Babiker Tabidi, 1985).

To the best of the available knowledge, there is no area with high density of lions in the country. In this survey, all the estimated densities for Sudan have been set below 1 lion/100 km². An average density of 0.2 lion/100 km² has been considered for the entire area of the sub-population n° 5, even in Protected Areas such as Radom and Southern National Parks. However, outside villages, huge tracts of suitable habitats for lion exist in the South-western part of the country with a large proportion of pastoral rangeland.

Lions are reported in the following regions of Southern Kordofan and Southern Darfur Provinces (El Rayah O. Hassaballa & Mutasim B. Nimir, 1985): Jebel Ed Dair in Central Kordofan, Radom area, the Garsila and South of Rehied el Bardi area and the areas South of Abu Matarik, the Jebel Marra area.

According to Sommerlatte (pers. comm.), there may be a few lions (3-5?) in Shambe Game Reserve, which lies on the west shore of the Nile. These have not been included in the population size figures.

Bar el Gazal region (sub-population n° 5.7) constitutes a large area of 182,000 km² of which 15,000 km² are gazetted as the Southern National Park. As with much of the information from Sudan, details are sketchy and this report puts lion densities in this area at a cautious 0.2 per 100 km² with an estimated total population of 364 animals.

- **Democratic Republic of Congo**

The situation has recently changed in Northern DRC as a result of:

- The collapse of the former large commercial livestock ranches and the newly established Fulani cattle herders who come from the North and cross the Mbomou river to graze in the Azande region, and;
- The civil unrest and consequent turmoil of the situation in respect to wildlife conservation in and around Garamba National Park.

According to B. Chardonnet and R. Kock (pers. comm.) who conducted buffalo captures in April 2002 in the Garamba region, the lion population there is concentrated in the core area of Garamba National Park of about 2,000 km² where the population size would not exceed a total of 100 individuals for a local density of 5 lions/100 km² (sub-population n° 5.8). Outside this range, the lion prey population drops to low levels and the lion density consequently diminishes (Muhindo Lessi & Nigilima, pers. comm.).

Bomu and Bili-Uéré *Domaines de Chasses* (sub-population n° 5.9) constitute a hunting area of 45,000 km². Thirty years ago there were a number of lions in this area, which also had large numbers of prey species such as giant eland (B. des Clers, pers. comm.). It consists of an extensive mosaic of forest patches and grassland, which previously contained some cattle ranches. Combined with some nearby refugee camps from the DRC there has been heavy poaching and the status of this subpopulation is estimated at 220 lions (E. Bashige, pers. comm., 2002)

SUB-POPULATION N° 6

The equatorial region of Central Africa used to host an abundant and widespread population of lion. In 1949, Malbrant & Maclatchy stated: "*In the South of the* [former] *A.E.F. (Afrique Equatoriale Française,* French Equatorial Africa*), the lion was restricted to the Congolese savannah* [ecosystem]*...It is more common in Moyen-Congo than in Gabon where it occurs only occasionally…Despite being widespread everywhere in this area, the lions are nowhere common…The largest numbers in this region are probably the quasi-desert area of the Bateke plateau…".*

- **Congo**

In Odzala National Park and surrounding areas, Congo, the lion is well known to occur (sub-population n° 6.1), even though the population size remains uncertain given the little information collected on this particular taxon (C. Aveling, pers. comm.).

- **Gabon**

Lions have always occurred in Gabon on the Batéké Plateaux, in the Haut-Ogooué Province. P. Rouquet (pers. comm.), a wildlife veterinarian posted in Franceville, witnessed the shooting of an adult male in 1995, South of Lekoni. The same person mentions the observation in 1996, also South of Lekoni, of a lioness with two lion cubs at the edge of a primary forest tract where they disappeared when approached.

TABLE 17 - TRENDS AND CONSTRAINTS OF LION CONSERVATION IN CENTRAL AFRICA

N° sub-population	Country	Area	Lion pop. trend		Lion habitat quality trend	Main prey for lions		Conservation efficiency (rating 0 to 3)	Lion conservation constraints
			past	present		wildlife	livestock		
	Nigeria	4.1. Gashaka-Gumti N.P. (Northern sector only)	S	S	S	X		1	
		4.2. Yankari N.P.	D	S	S	X		3	
4	Cameroon	4.3. Faro-Bubandjida-Bénoué complex (N.P. & H.A.)	D	D?	S/D	X		2	poaching, livestock
		4.4. Vogzoum & Djivorke H.A.	D	D	S	X		2	poaching
		4.5. Waza N.P.	D	D	S	X	X	2	poaching
	Chad	5.1. Zakouma N.P.	S	I	S	X		2	
		5.2. Aouk H. A.	D	S	S	X	X	1	livestock
		5.3. Guerra & Salamat regions	D	S	D	X	X	0	agriculture, livestock
	C.A.R.	5.4. Gounda plain (within Manovo-Gounda-St Floris N.P.)	D	D	S	X		2	poaching
5		5.5. Manovo-Gounda-St Floris NP, Bamingui-Bangoran NP, Sangba P.Z.	D	D	S	X		1&2	poaching, mining
		5.6. Zone d'Intérêt Cynégétique (Eastern CAR)	D	S	S	X		0	mining
	Sudan	5.7. Bahr el Gazal region including Southern N.P.	D	D	D	X	X	0&1	civil unrest
	R.D.C.	5.8. Garamba N.P.; Azande, Gangala na Bodio & Mondo Missa D.C.	S	S	S	X		0,1&2	civil unrest
		5.9. Bomu & Bili-Uere D.C.	S	D	S	X		0	civil unrest
	Gabon	Bateke plateau	D	D	S	X		0	poaching
6	Congo	Bateke plateau	D	D	S	X		0	poaching
		6.1. Odzala N.P.	S	S	S	X		2	

I = increasing
S = stable
D = decreasing
Rate 0 to 3: 0=low; 3=high

4. EASTERN AFRICA

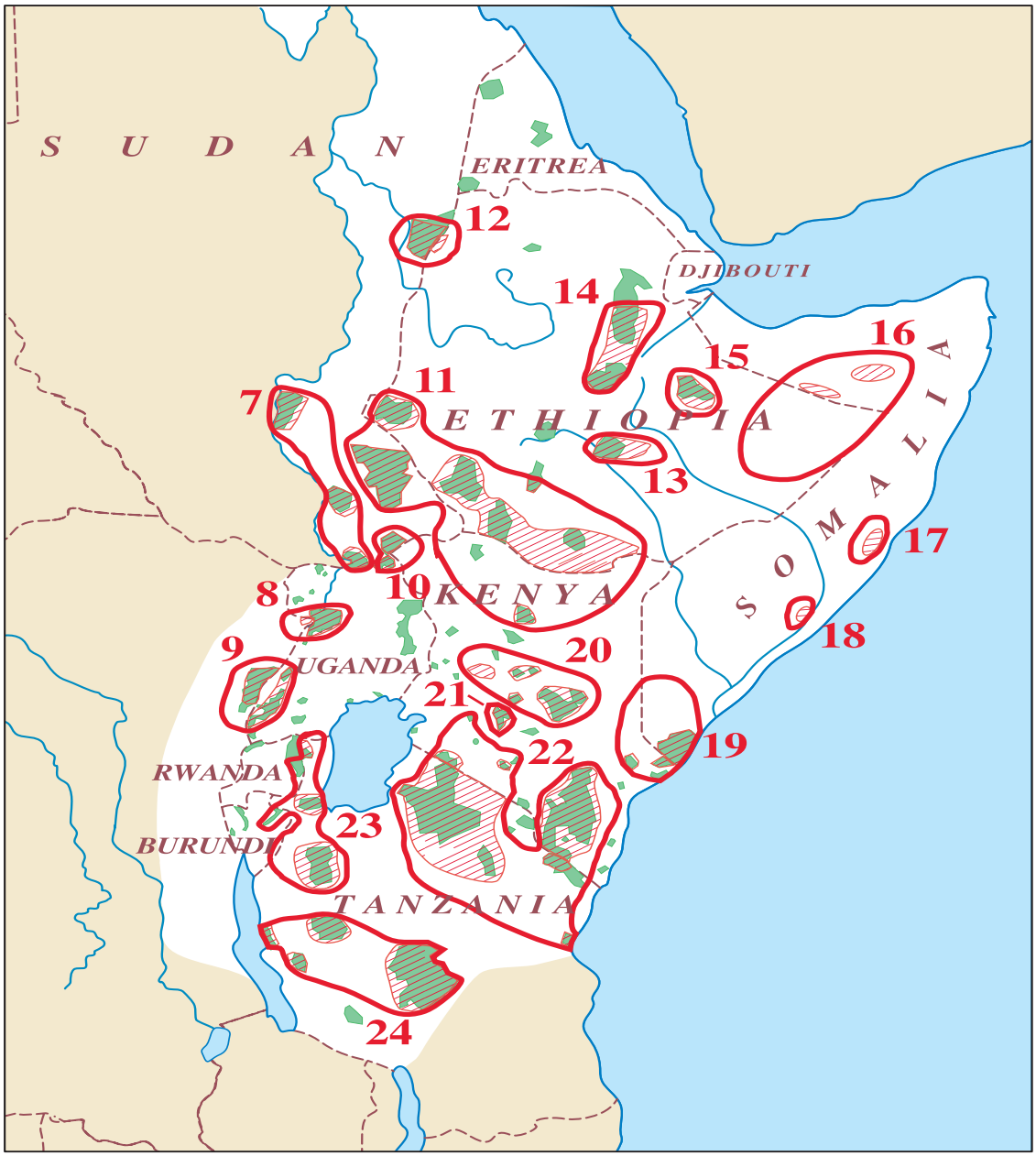
4.1. LION RANGE

The Eastern Africa region is definitely one of the main strongholds of the lion with a range for the taxon surpassing 100 millions hectares (Table 18):

- Protected Areas comprise just over one third of the lion distribution area (more than 40 million hectares) with:
  - . 13% for the National Parks;
  - . 12% for the Reserves, and;
  - . 10% for the Hunting Areas.

- Interestingly, it appears that non-gazetted areas form a major part of the lion range with an estimated area of more than 70 million hectares, encompassing a bit less than two third of their overall regional range.

Lion subpopulations in Eastern Africa



Legend

- International border
- GHANA Name of Country
- Main river
- Lion subpopulation
- 2 Lion subpopulation reference number
- Lion distribution
- Protected Areas (National Parks, Wildlife Reserves, Hunting Areas, etc.)

TABLE 18 - STATUS OF LION DISTRIBUTION AREAS IN EASTERN AFRICA

N° sub-population	Country	Area	Conservation status & surface (km²)			
			Protected areas			Non-gazetted areas
			Nat. Parks	Reserves	Hunting areas	
7	Sudan	Zeraf Game Reserve		9,700		
		Badingilo National Park & surrounds	8,400			8,100
		Nimule National Park	410			
	Sub-total 7		**8,810**	**9,700**	**0**	**8,100**
8	Uganda	Murchison Falls National Park & surrounds	3,839	520		839
	Sub-total 8		**3,839**	**520**	**0**	**839**
9	DRC	Virunga National Park	7,800			
	Uganda	Queen Elizabeth National Park	1,978			
		Toro Game Reserve & Semliki Controlled Hunting Area		549	504	
	Sub-total 9		**9,778**	**549**	**504**	**0**
10	Uganda	Kidepo Valley National Park	1,344			
	Sudan	Kidepo Game Reserve		1,200		
	Sub-total 10		**1,344**	**1,200**	**0**	**0**
11	Sudan	Boma National Park & surrounds	22,800			7,200
	Ethiopia	*Gambella NP & surrounding CHAs:*				
		Gambella National Park	5,061			
		Tedo & Jikao Controlled Hunting Areas			5,722	
		Omo & Mago NPs, Tama WR & CHAs:				
		Omo & Mago National Parks	6,230			
		Tama Wildlife Reserve		3,269		
		Omo West Controlled Hunting Area			4,561	
		Yabello Sanctuary, Chew Bahir WR, Borana & Murle CHAs:				
		Yabello Sanctuary	2,496			
		Chew Bahir Wildlife Reserve		4,212		
		Borana & Murle Controlled Hunting Areas			49,538	
		South-Western & Southern Ethiopia non-gazetted areas				60,000
	Kenya	Sibiloi National Park	1,571			
		Mount Kulal Biosphere Reserve		7,000		
		Marsabit National Reserve		2,088		
		Northern Kenya non-gazetted areas				100,000
	Sub-total 11		**38,158**	**16,569**	**59,821**	**167,200**
12	Sudan	Dinder National Park	8,960			
	Ethiopia	Sudan Border NGAs				30,000
	Sub-total 12		**8,960**	**0**	**0**	**30,000**

(continued)

13	Ethiopia	*Bale Mountain NP, Bale WR, Bale CHAs & surrounds:*				
		Bale Mountains National Park	2,471			
		Bale Wildlife Reserve		1,766		
		Bale & Arsi Controlled Hunting Areas			15,163	
		Non-gazetted areas to the South				15,000
	Sub-total 13		**2,471**	**1,766**	**15,163**	**15,000**
14	Ethiopia	*Afar Region:*				
		Awash National Park	752			
		Yangudi Rassa National Park	4,731			
		Awash West Wildlife Reserve		1,781		
		Alledeghi Wildlife Reserve		1,832		
		Gewane & Mille Serdo Wildlife Reserves		11,205		
		Afdem Gewane & Erer Gewane Controlled Hunting Areas			8,318	
		Awash West Controlled Hunting Area			9,136	
		Afar non-gazetted areas				15,000
	Sub-total 14		**5,483**	**14,818**	**17,454**	**15,000**
15	Ethiopia	*Babile Elephant Sanctuary & Eastern Hararghe HA:*				
		Babile Elephant Sanctuary	6,982			
		Eastern Hararghe Controlled Hunting Area			23,788	
		Non-gazetted areas to the South				25,000
	Sub-total 15		**6,982**	**0**	**23,788**	**25,000**
16	Somalia	Nogal Valley region				25,000
		Haud region				2,000
	Ethiopia	Ogaden non-gazetted areas				90,000
	Sub-total 16		**0**	**0**	**0**	**117,000**
17	Somalia	El Bur region				15,000
	Sub-total 17		**0**	**0**	**0**	**15,000**
18	Somalia	Swamp National Park	525			
	Sub-total 18		**525**	**0**	**0**	**0**
19	Somalia	Bush Bush Game National Park	1,510			
		Bush Bush Game Controlled Area		3,340		
		Far Wamo region				1,000
	Kenya	Arawale National Reserve		533		
		Boni, Dodori & Kiunga National Reserves		2,816		
		Eastern & North-Eastern Kenya non-gazetted areas				50,000
	Sub-total 19		**1,510**	**6,689**	**0**	**51,000**

(continued)

20	Kenya	*Laikipia ranchlands:*				
		Lewa Conservancy				182
		Il Ngwesi Group Ranch				67
		Borana Ranch				142
		Laikipia Ranching & Wildlife Forum				4,205
		Samburu, Shaba & Buffalo Springs National Reserves		535		
		Ewaso Nyiro (Shaba to Merti dispersal area)				1,350
		Nananyuk Widlife Conservation Trust/ Sera-Milgis area				304
		Meru National Park	870			
		Kora National Park	1,788			
		Bisanadi, Mwingi & Rahole National Reserves		2,621		
	Sub-total 20		**2,658**	**3,156**	**0**	**6,250**
21	Kenya	Aberdare National Park & Faunal Reserve	766	1,200		
	Sub-total 21		**766**	**1,200**	**0**	**0**
22	Kenya	Masai Mara National Reserve		1,670		
		Masai Mara group ranches				3,890
		Masai Mara dispersal areas				5,000
		Nairobi National Park	117			
		Hells Gate National Park	68			
		Former Kedong Ranch area				250
		Lake Nakuru National Park	117			
		Tsavo East & West National Parks & surrounding areas:				
		Tsavo East National Park	11,747			
		Tsavo West National Park	9,065			
		South Kitui National Reserve		1,833		
		Taita and other ranches				13,188
		Galana Ranch				4,167
		Amboseli National Park	392			
		Chyulu National Park	471			
		Amboseli dispersal area & group ranches				6,600
	Tanzania	*Masailand:*				
		Serengeti, Lake Manyara & Tarangire National Parks	17,683			
		Ngorongoro Conservation Area		8,292		
		Masailand Game Reserves & Conservation Areas		12,035		
		Masailand non-gazetted areas				100,000
	Sub-total 22		**39,660**	**23,830**	**0**	**133,095**

(continued)

	Tanzania	*North West Tanzania:*				
		Moyowosi-Kigosi Game Reserves & adjoining Conserv. Areas		23,000		
		Biharomolo-Burigi Game Reserves		2,850		
		Ibanda/Rumanyika Game Reserve		1,000		
23		North-Western Tanzania non-gazetted areas				50,000
	Rwanda	Akagera National Park	1,500			
	Burundi	Ruvubu National Park	500			
		Mosso region				2,000
	Sub-total 23		**2,000**	**26,850**	**0**	**52,000**
	Tanzania	*Central and Western Tanzania:*				
		Ruaha/Rungwa complex	12,950	13,000		16,050
		Katavi National Park & adjacent PAs	2,253	12,747		
24		Ugalla River Reserve & surrounding PAs		7,000		
		Mahale Mts National Park	1,200			
		Central & Western Tanzania non-gazetted areas				80,000
	Sub-total 24		**16,403**	**32,747**	**0**	**96,050**
Total	**km²**	**1,137,205**	**149,347**	**139,594**	**116,730**	**731,534**
	%		**13**	**12**	**10**	**64**

(end)

4.2. LION POPULATION SIZE

The lion population size is much better known and documented in the Eastern African region than in the two former regions. While this is true for the Protected Areas, especially the National Parks and a few other Protected Areas such as the Masai Mara National Reserve, non-gazetted areas remain poorly covered in terms of lion surveys. The estimated total population of lions in Eastern Africa probably exceeds 15,000 individuals (Table 19).

TABLE 19 - LION POPULATION STATUS IN EASTERN AFRICA

N° sub-population	Country	Area	Lion range surface (km²)	Density of lions/100km²	Population size			Assessment mode
					minimum	estimated	maximum	
7	Sudan	Zeraf Game Reserve	9,700	0.4	27	39	51	C
		Badingilo National Park & surrounds	16,500	1.0	116	165	215	C
		Nimule National Park	410	0.9	3	4	5	C
	Sub-total 7		**26,610**		**149**	**208**	**276**	
8	Uganda	Murchison Falls National Park & surrounds	5,198	7.0	255	364	473	C
	Sub-total 8		**5,198**		**255**	**364**	**473**	
9	DRC	Virunga National Park	7,800	2.0	109	156	203	C
	Uganda	Queen Elizabeth National Park	1,978	12.0	202	224	246	A
		Toro Game Reserve & Semliki Controlled Hunting Area	1,053	0.5	4	5	7	C
	Sub-total 9		**10,831**		**315**	**385**	**456**	
10	Uganda	Kidepo Valley National Park	1,344	1.9	18	25	58	C
	Sudan	Kidepo Game Reserve	1,200	0.5	4	6	8	C
	Sub-total 10		**2,544**		**22**	**31**	**66**	
11	Sudan	Boma National Park & surrounds	30,000	1.0	160	228	296	C
	Ethiopia	Gambella National Park & surrounding Controlled Hunting Areas	10,783	1.5	113	162	211	C
		Omo & Mago NPs, Tama WR & Omo West CHA	14,060	1.0	99	141	183	C
		Yabello Sanctuary, Chew Bahir WR, Borana & Murle CHAs	56,246	0.5	197	281	365	C
		South-Western & Southern Ethiopia NGAs	60,000	0.2	84	120	156	C
	Kenya	Sibiloi National Park	1,571	1.0	11	16	21	C
		Mount Kulal Biosphere Reserve	7,000	0.2	9	13	17	C
		Marsabit National Reserve	2,088	2.0	29	42	55	C
		Northern Kenya NGAs	100,000	0.2	140	200	260	C
	Sub-total 11		**281,748**		**842**	**1,202**	**1,564**	
12	Sudan	Dinder National Park	8,960					C
	Ethiopia	Sudan border NGAs	30,000	0.2	42	60	78	C
	Sub-total 12		**38,960**		**42**	**60**	**78**	
13	Ethiopia	Bale Mountains NP, Bale WR, Bale CHAs & surrounds	19,400	0.5	68	97	126	C
		NGAs to the South	15,000	0.2	21	30	39	C
	Sub-total 13		**34,400**		**40**	**97**	**60**	
14	Ethiopia	Afar PAs (NPs, WRs & CHAs)	37,755	1.0	265	378	491	C
		Afar NGAs	15,000	0.3	32	45	58	C
	Sub-total 14		**52,755**			**423**		

(continued)

15	Ethiopia	Babile Elephant Sanctuary & Eastern Hararghe CHA	30,770	1.0	210	300	390	C
		NGAs to the South	25,000	0.2	35	50	65	C
	Sub-total 15		**55,770**		**210**	**300**	**390**	
16	Somalia	Nogal Valley & Haud region	27,000	0.3	48	68	88	C
	Ethiopia	Ogaden NGAs	90,000	0.2	35	180	65	C
	Sub-total 16		**117,000**		**83**	**248**	**153**	
17	Somalia	El Bur region	15,000	0.9	90	128	166	C
	Sub-total 17		**15,000**		**90**	**128**	**166**	
18	Somalia	Swamp National Park	525	4.0	15	21	27	C
	Sub-total 18		**525**			**21**		
19	Somalia	Bush Bush Game NP, Bush Bush CHA & Far Wamo region	5,850	3.4	139	199	259	C
	Kenya	Boni & Dodori National Reserves	2,216	3.3	52	74	96	C
		Arawale & Kiunga NRs; Eastern & North-Eastern NGAs	51,133	0.2	70	102	130	C
	Sub-total 19		**59,199**		**191**	**273**	**355**	
20	Kenya	Laikipia ranchlands	4,596	5.7	211	264	317	B
		Samburu, Shaba & Buffalo Springs National Reserves & surrounds	2,189	4.5	69	98	127	B
		Meru & Kora National Parks & adjoining NRs	5,279	1.2	52	65	78	B
	Sub-total 20		**12,064**		**332**	**427**	**522**	
21	Kenya	Aberdare National Park & Faunal Reserve	1,966	8.2	113	162	211	C
	Sub-total 21		**1,966**		**130**	**162**	**194**	
22	Kenya	Masai Mara National Reserve & surrounding areas	1,670	32.8	492	547	602	A
		Masai Mara group ranches	3,890	8.2	282	319	422	B
		Masai Mara dispersal areas	5,000	1.5	35	75	65	C
		Nairobi National Park	117	18.8	20	22	24	A
		Hells Gate National Park & Former Kedong Ranch area	318	2.8	7	9	11	B
		Lake Nakuru National Park	117	31.2	33	37	41	A
		Tsavo East & West National Parks & surrounding areas	40,000	1.9	600	750	900	B
		Amboseli & Chyulu National Parks & surrounding areas	7,463	1.7	117	130	143	A
	Tanzania	Serengeti, Manyara, Tarangire National Parks & Ngorongoro CA	25,975	15.0	3,117	3,896	4,675	B
		Masailand Game Reserves & Game Conservation Areas	12,035	2.0	127	241	235	C
		Masailand NGAs	100,000	0.3	168	300	312	C
	Sub-total 22	4,437	**196,585**		**4,998**	**6,316**	**7,430**	

(continued)

23	Tanzania	Moyowosi-Kigosi Game Reserves & adjoining GCAs		23,000	2.0	322	460	598	C
		Biharamolo-Burigi Game Reserves		2,850	2.0	40	57	74	C
		Ibanda/Rumanyika Game Reserves		1,000	2.0	14	20	26	C
		North-Western Tanzania NGAs		50,000	0.2	70	100	130	C
	Rwanda	Akagera National Park		1,500	3.0	32	45	59	C
	Burundi	Ruvubu National Park		500					C
		Mosso region		2,000					C
	Sub-total 23		637	**80,850**		**477**	**682**	**887**	
24	Tanzania	Ruaha/Rungwa complex		42,000	8.0	2,352	3,360	4,368	C
		Katavi National Park & adjacent PAs		15,000	4.0	420	600	780	C
		Ugalla River Reserve & surrounding PAs		7,000	4.0	196	280	364	C
		Mahale Mts National Park		1,200	1.5	13	18	23	C
		Central & Western Tanzania NGAs		80,000	0.2	112	160	208	C
	Sub-total 24		4,418	**145,200**		**3,093**	**4,418**	**5,743**	
18 sub-pop.	**9 countries**	**Total**		**1,137,205**		**11,268**	**15,744**	**18,811**	

(end)

SUB-POPULATION N° 7

- **Sudan**

The area situated on the right (Eastern) bank of the Nile is considered as belonging to the Eastern Africa region.

Once again, the overall figures of the lion population in this country have to be taken as highly speculative. Among the eight individuals contacted for this survey, due to poor communications, accessibility, etc. only one was able to provide estimates.

The continuing civil war in the South has adversely affected wildlife in general, including lions. Most parks have been overrun by pastoralists and/or farmers (M. Sommerlatte, pers. comm.; A. Radcliffe, pers. comm.).

In South Sudan, the lion is distributed in nearly all National Parks, Game Reserves and some of the Hunting Blocks, and it is found in all types of habitats such as open and wooded grasslands, forest and rocky hills (Kenyi, 1985).

In the Upper Nile region, the lion is present in the Provinces of Sobat, Unity as well as Jonglei (Dennis Akwoch Obat, 1985).

SUB-POPULATION N° 8

- **Uganda**

Murchison Falls National Park (formerly Kabalega Falls National Park) is supposed to hold between 200 and 300 lions at present (A. Radcliffe, pers. comm.; R. Lamprey, pers. comm.). Movements of lions from this park to the neighbouring DRC (Ituri Province, Monts Bleus) are unlikely given the geographical constraints (a lake and a river).

Overall, the total estimate of 500-600 lions for Uganda seems reasonable (A. Radcliffe, pers. comm., R. Lamprey, pers. comm.).

SUB-POPULATION N° 9

- **Democratic Republic of Congo**

Even though the DRC, as a country, belongs to the Central African Region, Eastern lion populations of the DRC have been incorporated into the Eastern Africa region because they are historically connected with lion populations of Eastern Africa and not with those of Central Africa. Recent political turmoil in the region must put the continued well-being and the future of these lions in question.

In the Virunga National Park, consisting of 7,800 km², the La Rwindi plains section of the Park is a most suitable habitat for lions (Ph. Chardonnet, pers. comm., 2002). The Park is

thought to have between 100 and 200 lions (156; E. Bashige, pers. comm., 2002) which are however facing an uncertain future mostly as a result of political instability in the region.

- **Uganda**

The lions of Queen Elizabeth National Park (formerly, Ruwenzori National Park) have been extensively studied in the past (*inter alia*: Din, 1978; Van Orsdol, 1981, 1982) and currently as part of the LPP predator & scavenger project.

In 1998 the population of lions in Queen Elizabeth National Park ranged between 160 and 210 individuals for an overall density of 12 lions/100 km² (Dricucu, 1999). Today, according to a survey conducted more recently, there may be as many as 300 lions (Lamprey, 2000; R. Lamprey, pers. comm.; A. Radcliffe, pers. comm.). The population has been increasing over several years following better protection and greater prey availability. The reproductive potential of the lionesses has been studied and has been found good (Dricuru, 2000). In this Park, the pride size varies between 2 and 23 with an average of 9.5 (Dricucu, 1999).

The health status of lions in Queen Elizabeth National Park has been studied. Serological surveys have been conducted and found evidence of antibodies (Dricuru, 2000) given below:

- In lions (n=9): significant seroprevalence in lions for FIV, FcaV and FeHV; low seroprevalence for CDV and FPV, and;
- In domestic cats: high seroprevalence for FcaV, FeHV and FIP, no seroprevalence for CDV and FPV

It must be re-emphasised that the presence of antibodies does not mean that animals are sick. "*We don't have evidence so far that lions are disappearing in alarming numbers due to cat-AIDS*" (Siefert, 2000).

Vaccination of domestic dogs and cats in the vicinity of Queen Elizabeth NP was carried out to help prevent the spread of CDV and rabies in wild carnivores. Bovine tuberculosis is also known to occur, at least in buffalo, for many years in Queen Elizabeth NP (M. Woodford, pers. comm.), even though it has not yet been observed in lion there (Siefert, 2000).

Conflicts with neighbouring communities and their livestock are common, and a number of lions have been poisoned. Other threats to lions are armed conflicts on the DRC border (R. Lamprey & A. Radcliffe, pers. comm.)

Toro Game Reserve and Semliki Controlled Hunting Area have a gradually increasing lion population over recent years, possibly due to an influx from the Congo where they had been poisoned some years previously. This is largely due to increased protection (R. Lamprey & A. Radcliffe, pers. comm.).

SUB-POPULATION N° 10

- **Sudan**

The continuing civil war in the South has adversely affected wildlife in general, including lions. Most parks have been over run by pastoralists and/or farmers. (M. Sommerlatte, pers. comm.; A. Radcliffe, pers. comm.).

- **Uganda**

Among threats to lions in Uganda are armed conflicts on the Sudanese border, and infected livestock from South Sudan moving into Kidepo Valley National Park and apparently poisoning incidents as a result of stock raiding. The sub-population appears to be increasing at least in Kidepo Valley NP (R. Lamprey, pers. comm.; A. Radcliffe, pers. comm.).

SUB-POPULATION N° 11

- **Sudan**

Preliminary surveys are underway in Boma National Park, and others are planned (M. Sommerlatte, pers. comm.). However, this survey has no information on lions there.

- **Ethiopia**

It is worth mentioning that information on Ethiopia is hard to obtain and accurate information even harder. The present study has shown large discrepancies between the figures provided by sources, with up five-fold variance in estimates for the country as a whole. For instance two sources produced very different estimates of (i) 900 to 1050 lions, certainly unlikely to exceed 1,500 (A. Racliffe, pers. comm., 2002) and (ii) a "speculated" population of "roughly" 4,900 lions in total (Y.D. Abebe & T. Mattanovich, pers. comm., 2002). Both figures are useful considering the paucity of information and the respondents must be respected for bravely making a considered guess in the absence of any other data. In the case of sub-population n° 11 it exists in a very large area encompassing a number of National Parks, Controlled Hunting Areas (73,889 km²), and non-gazetted areas (67,200 km²) creating a total area of 141,000 km² which is estimated to hold a population of over 700 lions. These figures however, both the area and population estimates, must be treated with the utmost caution.

- **Kenya**

In the Northern Kenya, lions are present, but scattered in low densities. However, very little is known about the lions in this region. A figure of 180 lions has been tentatively suggested for an area of 185,000 km² (Radcliffe, pers. comm.) but should be treated with caution.

SUB-POPULATION N° 12

- **Sudan**

The lion is reported in Dinder National Park (Ernst & Elwasila, 1985) and in the adjacent Rahad Game Reserve (Mahgoub A., El Badawi & Salah A. Hakim, 1985). The IUCN Directory of Afrotropical Protected Areas (IUCN, 1987) mentions lions in Dinder NP. However, no recent information has been received on the lion numbers in this area.

In the late 1970's and early 1980's, a great deal of wildlife research effort in Sudan had been concentrated in Dinder National Park as it was considered as the most important wildlife area in Northern Sudan, even though the Park had to face tremendous pressures from entrance of livestock for grazing, mechanized cultivation in the wet season, felling of trees and poaching (El Gaily O. Ahmed *et al.*, 1985). However, the current situation is not clear.

- **Ethiopia**

There is no written record of lion on the Ethiopian side of the border, opposite to Dinder NP to the available knowledge. However, T. Mattanovich (pers. comm.) considers that lions are frequent nearly all along the Sudan-Ethiopian sides.

SUB-POPULATION N° 13

- **Ethiopia**

Little is known about this sub-population of lions. Much of their range falls within the protected area system, Bale Mountains National Park, Bale Wildlife Reserve and Bale and Arsi Controlled Hunting areas totalling approximately 19,400 km² and non-gazetted areas to the South totalling approximately 15,000 km². An estimated population size of 97 and 30 individuals is given for the two areas respectively, but again it should be treated with caution. The population is "disjointed" and may merge with the Wabi Shabelle sub-population (sub-population n° 15). Poaching and the presence of livestock are threats to their existence. While the habitat remains stable the lion populations may be stable or declining (S. Williams, pers. comm.).

SUB-POPULATION N° 14

- **Ethiopia**

In Ethiopia, there appear to be several places where lions are regularly seen. The Afar region in the North-eastern part of the country is one of them (Y.D. Abebe & T. Mattanovich, pers. comm.).

"[In Tellalak-Dawe and Fursi-Artuma proposed Hunting Blocks, Afar National Regional State] *the local people believe that the numbers of lion and hyena have increased and they have requested the Regional Agriculture Bureau to seek solutions for these problem-creating*

Tanzanian lions, Selous Game Reserve (Photo : O. Buttin).

South African lion, Kruger National Park (Photo : B. Chardonnet).

South African lion, Kruger National Park (Photo : B. Chardonnet).

South African lion, Madikwe Wildlife Reserve (Photo : B. Chardonnet).

South African lioness, Kruger National Park (Photo : O. Buttin).

animals. Leopard, lion and hyena were found to be problem animals for the local people. Recently these predators have attacked their livestock" (Cherie Enawgaw *et al.*, 2001).

SUB-POPULATION N° 15

- **Ethiopia**

Babile Elephant Sanctuary and Eastern Haraghe Controlled Hunting Area encompass over 55,000 km² of suitable lion habitat comprising 6,982 km² of National Park and 23,788 km² of Hunting Area. The population is stable or declining and subject to the familiar twin threats of poaching and livestock encroachment (S. Williams, pers. comm.).

Interestingly, this peculiar sub-population in the Harar Region contains a number of particularly small lion with very dark manes, reminiscent of the now extinct races of Barbary lions and Cape lions (T. Mattanovitch, pers. comm.).

SUB-POPULATION N° 16

- **Ethiopia**

Within the Somali Region of Ethiopia, the Ogaden desert tentatively comprises about 90,000 km² of non-gazetted habitat suitable for low densities of lion. Little is known about this population and it is tentatively estimated at 180 individuals, but this must be treated with caution.

- **Somalia**

The few experts with field knowledge in Somalia are quite consistent about the distribution of lions in Somalia.

The sub-population n° 16 is spread on both sides of the North-eastern border between Somalia and Ethiopia. Laurent (2002) considers that this sub-population expands as far East as the coastline along the Tug Darror valley.

Between 1984 and 1987, Chazée (1987) observed lions along the Djouba River, and especially in Sablale, Baidabo, Bardera, Gelib, Kisimoyo and Chiamboni.

SUB-POPULATION N° 17

- **Somalia**

The El Bur region of Somalia comprises approximately 15,000 km² of suitable lion habitat with estimated densities of 0.7 to 1.0 animal per 100 km². There is little information on their quarry species. Civil unrest and poor Government structures are seen as threats to this sub-population (A. Radcliffe, pers. comm.).

SUB-POPULATION N° 18

- **Somalia**

The Swamp National Park lion sub-population appears to occur at high densities. The national park itself is small (525 km²) with a wildlife population density of 4 animals per 100 km² giving a total population of about 20 lions. However, civil unrest and a lack of Government structure are cited as threats and, for a population contained in such a small area, it is hardly surprising that it is considered to be declining.

SUB-POPULATION N° 19

- **Somalia**

In the South of Somalia, lions are not considered rare. *"The lower Juba and the territories beyond this river, as far as the Kenya border, are still more favourable to the presence of this feline, even if with ample interruption due to human settlement"* (F. Fagotto, 1985).

- **Kenya**

Boni and Dodori National Reserves are hosting lions at a conservative estimate of 3.3 individuals per 100 km² in 2002, giving a total of 45 lions in Boni N.R. and 29 lions for Dodori N.R. (A. Pelizzoli, pers. comm.).

SUB-POPULATION N° 20

- **Kenya**

Several references provide information on the lion population in Laikipia District:

- According to a recent survey (Franck, 2001) on lion depredation, the Laikipia District has about 175 lions or about 0.06 lions/100 km², and;
- According to another source (Martin, 2001), "*perhaps 150 lions inhabit the 4,000 square-mile plateau*", which would mean a density of about 0.02 lions/100 km².

SUB-POPULATION N° 21

- **Kenya**

Aberdare National Park represents a special case as far as lions are concerned, due to the reintroduction of the species into the park, which is fenced, in the 1950's.

By 1996 there were estimated to be 149 (probably an overestimate). These were perceived to be having an adverse effect on the giant forest hog populations and that of the rare East African bongo. Consequently, culling was introduced. Approximately 70 were killed in total,

and by 1999/2000 culling stopped, as there were hardly any signs of lion (A. Radcliffe, pers. comm.).

Considerable discrepancies exist between sources of information regarding this Park. Some informants mention a lion population size of more than 150, while others quote less than 20 (Rotich, 2000; A. Radcliffe, pers. comm.).

SUB-POPULATION N° 22

- **Kenya**

In Nairobi National Park during the period 1960's to 1997, lions averaged around 30 and in 1997, prior to the El Niño rains, there were 4 prides and a total of 39 lions. During the rains the ungulate prey, with the lions following them, disperse to the South. Six lions were poisoned along Kitengela, and 22 were chased down with dogs and speared in nearby local communities. By 1999, there were 11 lions in the park. Following the rains in early 2000, 9 lions were poisoned along Kitengela. Those who returned following those rains have now managed to breed up, and total 22 in 2 prides. Many of the migratory ungulate prey have not however returned, having been poached. Ancient studies have shown that the Athi-Kapiti plains act as dispersal areas for the sub-adults from Nairobi NP who leave their prides (Rudnai, 1983; J. Cavenagh, pers. comm.; A. Radcliffe, pers. comm.).

The Masai Mara ecosystem contains the biggest share of the lion population of Kenya (Oguto & Dublin, 1998). The lion population of the Masai-Mara ecosystem certainly does not stay within the Reserve itself and ranges outside the boundaries, as do other large mammals which make up their prey species: "*an aerial count by the WWF done in May 1993, for example, showed that 26% of the elephants were in dispersall areas, and 21% of the buffaloes stayed outside the Reserve*" (Mbugua, 1994 *in* Singida, 1995).

In Amboseli National Park systematic poisoning by local communities reportedly in response to a perceived failure to react to stock killing lions, combined with habitat changes (reduction in swamp areas), and in prey availability, reduced the population to 2 lions by 1990. Between 1991-1993, there were no lion in the Park. In 1994, 2 lions entered from the Chyulus and neighbouring areas, followed by others. These have bred, and there are presently 40 lions in the park (D. Western, pers. comm.; C. Moss, pers. comm.; A Radcliffe, pers. comm.).

In Nakuru National Park in 1987, there was 1 male lion in the Park. In 1989 a female was brought from Nairobi, and more were added later. These have bred up, prey densities are high, and presently there are 33-40 lions in the Park (J. Dawson, pers. comm.; A. Radcliffe, pers. comm.).

The Hells Gate National Park and former Kedong Ranch area have a small population of approximately 9 lions within 318 km² (J. Dawson, pers. comm.).

Tsavo East and West National Parks and surrounding areas constitute approximately 40,000 km² of suitable lion habitat with an estimated density of 2.8 per 100 km² giving an overall population of 750 animals with a minimum of 600 and maximum of 900 within the given confidence limits (D. King, pers. comm.; M. Smeth-Smith, pers. comm.).

- **Tanzania**

In Masailand (Serengeti National Park, Lake Manyara and Tarangire National Parks, Masailand Game Reserves and Conservation Areas, Masai NGAs) populations are stable in Protected Areas, but there may be some range degradation caused notably by off road driving by tour operators. Changes in animal behaviour are noticeable due to habituation and disturbance due to high levels of game viewing tourism. Outside Protected Areas, numbers are decreasing due to competition with livestock (PAC, poisoning). However, some local communities are affording protection to lions as a result of income generation through community-based conservation programmes (L. Seige, R Baldus & V. Booth, pers. comm.).

SUB-POPULATION N° 23

- **Uganda**

No more Ugandan lions occur from this sub-population in Uganda. The lion has disappeared from Southern Uganda, even from Protected Areas such as Lake Mburo National Park due to the heavy competition with livestock, to farming encroachment by a growing human population and to illegal hunting (Averbeck, 2001). Lions have twice re-entered this Park coming from Tanzania, and twice been poisoned by local communities. Last time in 1999, 3 individuals were poisoned (A. Radcliffe, pers. comm.).

- **Rwanda**

Lions were abundant in Akagera National Park and Mutara Hunting Zone before the 1994 political events. During and after the conflict, many lions were chased away or killed by soldiers who established permanent camps in the Park and by livestock herders bringing large numbers of cattle from Uganda and settling down in these Protected Areas (Ph. Chardonnet, pers. comm.). Draulans (1997 *in* Draulans & Van Krunkelsven, 2002) observed large numbers of lions roaming Rwanda's Akagera National Park in 1995, a year after the civil war. Lions are still present in the Southern part of the Park where tsetse flies tend to keep the cattle away.

- **Burundi**

According to Ph. Chardonnet (pers. comm.) who worked 3 years with Burundian cattle-herders, the lions are no longer permanently resident in Burundi. However, occasionally lions may enter from Tanzania into:

(i) The Ruvubu National Park, East of Burundi, where they follow the Ruvubu river, and;
(ii) The Mosso region, South-east of Burundi, where they cross the narrow Malagarazi river into the marshes on the Burundi side.

- **Tanzania**

In North West Tanzania (Moyowasi-Kigosi Game Reserves and adjoining Conservation Areas, Biharomolo-Burigi & Ibanda/Rumanyika Game Reserves), the refugee crisis from 1994 onwards had a serious impact on the Miombo woodlands of the area. It can be expected to have impacted on wildlife numbers and hence on the lion populations. There are areas

where a lot of poisoning has been observed and/or there is high human pressure (e.g. in the South of Moyowosi GR, Ibanda GR). No lions known are to exist in Rumanyika GR. Burigi GR has a lion population considered to be "healthy" but there are no figures given. Kimisi is showing increasing reports of lion according to observations over 2 years. These populations are anticipated to remain stable in Protected Areas (L. Seige, R Baldus & V. Booth, pers. comm.; & Caro, 1999).

SUB-POPULATION N° 24

- **Tanzania**

In Central and Western Tanzania (Ruaha/Rungwa system, Katavi National Park/Rukwa, Ugalla, Mahale, NGAs), lion populations are stable in Protected Areas. Numbers are probably declining outside Protected Areas due to competition with livestock. Lions are locally destroyed through PAC and local poisoning.

These populations are anticipated to remain stable in Protected Areas (L. Seige, R Baldus & V. Booth, pers. comm.; Caro, 1999).

TABLE 20 - TRENDS AND CONSTRAINTS IN LION CONSERVATION IN EASTERN AFRICA

N° sub-pop.	Country	Area	Lion population trend	Lion habitat quality trend	Main prey for lions		Conservation efficiency (rating 0 to 3)	Lion conservation constraints
					Wildlife	Livestock		
7	Sudan	Zeraf Game Reserve			X	X		livestock, poaching, civil unrest
		Badingilo National Park & surrounds			X	X		livestock, poaching, civil unrest
		Nimule National Park			X	X		livestock, poaching, civil unrest
8	Uganda	Murchison Falls National Park & surrounds		S	X		2	poisoning, livestock
9	DRC	Virunga National Park		D	X			civil unrest
	Uganda	Queen Elizabeth National Park	S	S	X		3	poisoning, disease
		Toro Game Reserve & Semliki CHA	S	S	X		2	poisoning, disease
10	Uganda	Kidepo Valley National Park		S	X	X		poisoning, livestock
	Sudan	Kidepo Game Reserve			X	X		livestock, poaching, civil unrest
11	Sudan	Boma National Park & surrounds		S	X	X		livestock, poaching, civil unrest
	Ethiopia	Gambella NP and surrounding Hunting Areas	S	S	X	X	1	livestock
		Omo & Mago NPs, Tama WR & Omo West CHAs	S	S	X	X	1	livestock
		Yabello S, Chew Bahir WRs, Borana & Murle HAs			X	X		livestock
	Kenya	Sibiloi NP		S	X		2	
		Mount Kulal Biosphere Reserve			X			
		Marsabit National Reserve		S	X	X	2	
		North-western Kenya non-gazetted areas		S	X			livestock
12	Sudan	Dinder National Park			X			
	Ethiopia	Sudan Border			X			
13	Ethiopia	Bale Mountain NP, Bale WR & HAs	S	S	X	X	2	livestock
14	Ethiopia	Afar Region	S	S	X	X	2	livestock
15	Ethiopia	Babile Elephant S & Eastern Haraghe HA	S	S	X	X	1	livestock
16	Somalia	Nogal Valley			X	X		livestock, poaching, civil unrest
		Haud			X	X		livestock, poaching, civil unrest
		Ogaden			X	X		livestock, poaching, civil unrest
17	Somalia	El Bur region			X	X		livestock, poaching, civil unrest
18	Somalia	Swamp National Park			X	X		livestock, poaching, civil unrest

(continued)

19	Somalia	Bush Bush Game National Park			X	X		livestock, poaching, civil unrest
		Bush Bush Game Controlled Area			X	X		livestock, poaching, civil unrest
		Far Wamo			X	X		livestock, poaching, civil unrest
	Kenya	Arawale National Reserve			X			
		Boni, Dodori & Kiunga National Reserves			X			
		North-eastern Kenya non-gazetted areas		S	X	X		livestock
20	Kenya	Laikipia ranchlands	S	S	X	X	3	
		Samburu, Shaba & Buffalo Springs NRs	S	S	X		3	
		Ewaso Nyiro (Shaba to Merti dispersal area)	S	S	X			
		Nananyuk Widlife Conserv. Trust/ Sera-Milgis	S	S	X		2	
		Meru National Park	S	S	X		3	
		Kora National Park	S	S	X		2	
		Bisanadi, Mwingi & Rahole NRs	S	S	X		2	
21	Kenya	Aberdare National Park & Faunal Reserve		S	X		3	culling
22	Kenya	Masai Mara National Reserve	S	S	X	X	3	spearing
		Mara group ranches			X	X	2	spearing, poisoning
		Masai Mara dispersal areas		D	X	X	1	spearing, poisoning, habitat reduction
		Nairobi National Park	S	S	X		3	
		Hells Gate National Park			X			
		Former Kedong Ranch Area			X			
		Lake Nakuru National Park		S	X		3	
		Tsavo East & West NPs & surrounding areas	S	S	X	X	2	poaching of prey, poisoning
		Amboseli National Park	S	S	X	X	3	poisoning, spearing
		Chyulu National Park			X			poisoning, spearing
		Amboseli dispersal area & group ranches			X	X		poisoning, spearing
	Tanzania	Maasailand	S	S	X	X		poisoning, spearing
23	Tanzania	North West Tanzania	S	S	X	X	2	poisoning, livestock
	Rwanda	Akagera National Park	D	D	X	X	1	livestock, poaching, civil unrest
	Burundi	Ruvubu National Park		S	X	X		settlement
		Mosso region			X	X		livestock
24	Tanzania	Central and Western Tanzania	S	S	X	X	2	livestock

(end)

I = increasing
S = stable
D = decreasing

Rate 0 to 3: 0=low; 3=high
No information = missing or insufficient data

5. SOUTHERN AFRICA

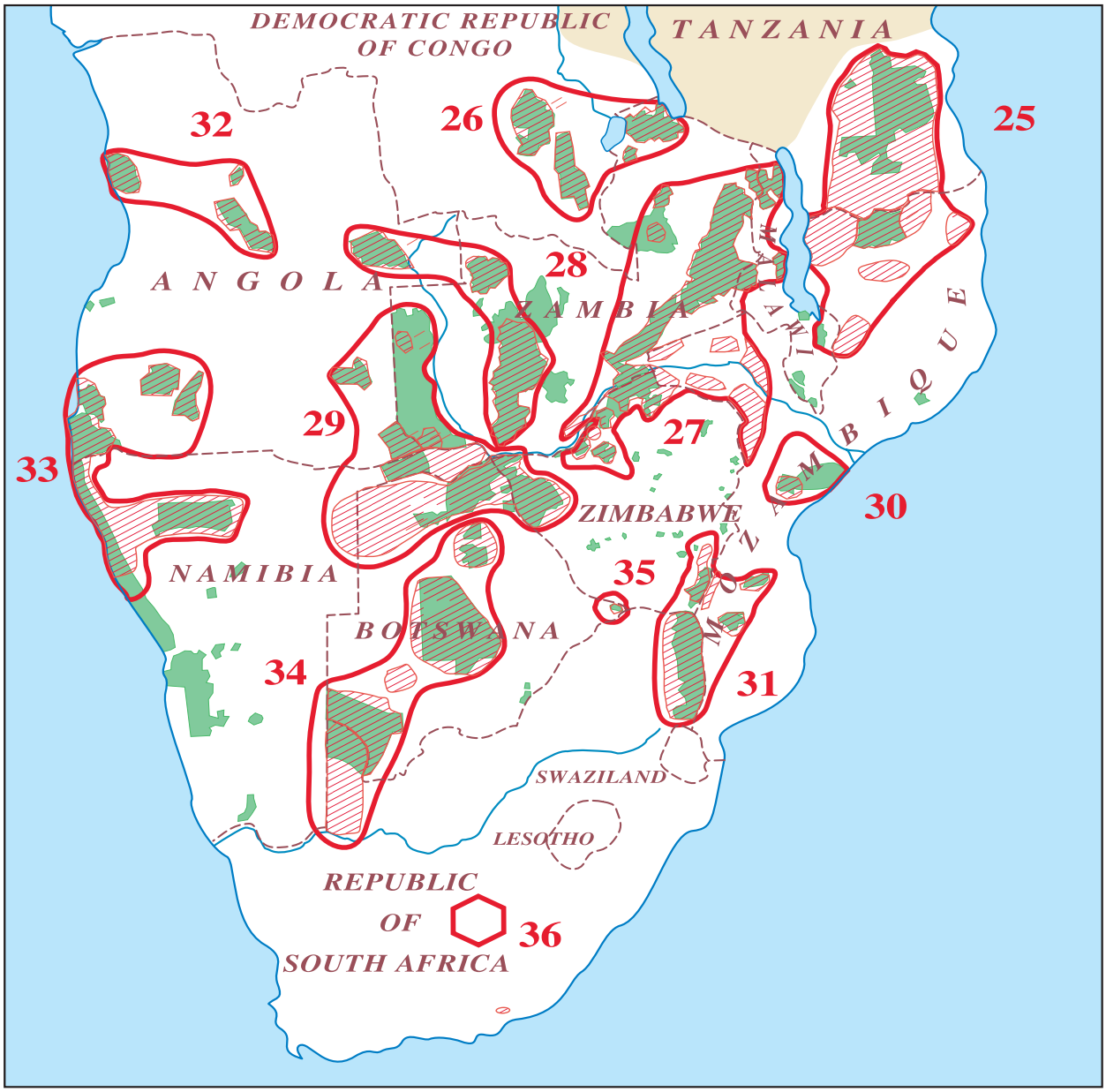
5.1. LION RANGE

Lion range in the Southern Africa Region surpasses 100 millions hectares, an area very similar to the Eastern African lion range (Table 21):

- Protected Areas cover 70% of the region's lion distribution area (about 70 million hectares) with:
  - . 28% in National Parks;
  - . 39% in the Reserves, and;
  - . 3% in Hunting Areas.

- Interestingly, it would appear that non-gazetted areas, which include conservancies, cover an estimated area of just over 30 million hectares, a very different situation from the three other regions.

Lion subpopulations in Southern Africa



Legend

- International border
- GHANA Name of Country
- Main river
- Lion subpopulation
- 2 Lion subpopulation reference number
- Lion distribution
- Protected Areas (National Parks, Wildlife Reserves, Hunting Areas, etc.)

TABLE 21 - STATUS OF LION DISTRIBUTION AREAS IN SOUTHERN AFRICA

N° sub-population	Country	Area	Conservation status & surface (km²)			
			Protected areas			Non gazetted areas
			Nat. Parks	Reserves	Hunting areas	
25	Tanzania	Mikumi National Park, Selous Game Reserve & Kilombero GCA	3 230	51 770		
		Southern Tanzania non-gazetted areas				45 000
	Malawi	Liwonde National Park & surrounds	548			252
	Mozambique	Nyassa Game Reserve		15 000		
		Northern Mozambique non-gazetted areas				50 000
	Sub-total 25		**3 778**	**66 770**	**0**	**95 252**
26	DRC	Upemba & Kundelungu National Parks	19 330			
	Zambia	Sumbu complex (National Parks & surrounding GMAs)	6 034	540		
	Sub-total 26		**25 364**	**540**	**0**	**0**
27	Zambia	North & South Luangwa complex	16 660	24 154		
		Chisomo, Luano & West Petauke Game Management Areas		16 460		
		Lower Zambesi National Park & Kariba Shore	4 140			5 000
		Nyika National Park (Zambia side)	80			
	Malawi	Nyika National Park (Malawi side) & Vwaza Marsh Wildlife Reserve	3 134	1 000		
		Nkhotakota Wildlife Reserve		1 500		
		Kasungu National Park	2 000			
	Zimbabwe	Mana Pools National Park, surrounding Safari Areas & Communal Lands	2 196		10 624	180
		Matusadona & Chizarira National Parks, surrounding SAs & CLs	3 280	269	2 794	7 657
	Mozambique	Tete Province and neighbouring regions				25 000
	Sub-total 27		**31 490**	**43 383**	**13 418**	**37 837**
28	Zambia	Kafue, Lochinvar & Blue Lagoon National Parks & surrounding GMAs	23 260	45 149		
		West Lunga National Park & surrounding Game Management Areas	1 684	10 070		
	Angola	Kameia National Park & Moxico non-gazetted areas	14 450			10 000
	Sub-total 28		**39 394**	**55 219**	**0**	**10 000**

(continued)

	Angola	Mavinga & Luiana Partial Reserves & Cuando-Cubango NGAs	14,350			15,000
	Zambia	Liuwa Plain & Sioma-Ngwezi National Parks & West Zambezi GMA	8,936	38,070		
	Botswana	*Northern Botswana:*				
		Okavango Delta (Moremi Game Reserve & Wildlife Manag. Areas)		14,741		
		Kwando/Chobe riverfront (Chobe NP & Wildlife Manag. Areas)	2,000	3,487		
29		Dry North (Chobe NP & surrounding Wildlife Management Areas)	7,980	38,096		
	Namibia	Kaudom Game Reserve & Nyae Nyae		31,833		
		Caprivi		5,300		19,637
	Zimbabwe	*North-West - Matabeleland:*				
		Hwange National Park	14,651			
		Matetsi complex (inc. NPs, SAs & FL) & Gwayi complex	877	600	3,500	5,372
	Sub-total 29		**48,794**	**132,127**	**3,500**	**40,009**
	Mozambique	Zambesia Province: Gorongosa National Park, Marromeu Reserve,	3,750	100	10,000	6,120
30		Zambezi Wildlife Utilization Area & NGAs				
	Sub-total 30		**3,750**	**100**	**10,000**	**6,120**
	Mozambique	Gaza & Ihambane Province inc. Zinhave & Banhire National Parks	12,000			28,000
31	Zimbabwe	Gonarezhou National Park, Malipati Safari Area & Conservancies	5,053	3,820	154	
	South Africa	Kruger National Park & surrounding Game Reserves	19,485	2,515		
	Sub-total 31		**36,538**	**6,335**	**154**	**28,000**
32	Angola	Kangandala & Kisama National Parks, Luando Integral Reserve & NGAs	10,560	8,280		21,160
	Sub-total 32		**10,560**	**8,280**	**0**	**21,160**
	Angola	Iona, Mupa & Bikuar National Parks, Mocamedes Partial Reserve & NGAs	29,650	4,450		30,000
33	Namibia	Etosha National Park	17,500			
		Kunene regions				38,819
	Sub-total 33		**47,150**	**4,450**	**0**	**68,819**
	Botswana	*Central Botswana:*				
		Nxai Pan & Makgadikgadi NP & Central Kalahari Game Reserve	6,730	51,800		10,000
		Southern Botswana:				
34		Kgalagadi Transfrontier Park & surrounding Wildlife Management Areas	24,800	36,400		
	South Africa	Kgakagadi Transfrontier Park	9,591			
	Namibia	Kgakagadi Transfrontier Park				
	Sub-total 34		**41,121**	**88,200**	**0**	**10,000**
	Zimbabwe	Tuli Safari Area			400	
35	Botswana	Tuli Game Reserves	1,200			
	South Africa					
	Sub-total 35		**1,200**		**400**	

(continued)

Fenced areas						
36	South Africa Swaziland **Sub-total 36**					
Total *	**km²**	**1,039,212**	**289,139**	**405,404**	**27,472**	**317,197**
	%		**28**	**39**	**3**	**31**

(end)

** excluding fenced areas*

5.2. LION POPULATION SIZE

This is probably the best-known lion population of all the regions. However, most of this understanding is still centred upon populations living in Protected Areas, especially National Parks and a few Wildlife Reserves. Those lions living in non-gazetted areas still remain, on the whole, poorly understood in terms of overall numbers, population dynamics and behaviour. The regional population of lions in Southern Africa probably exceeds 19,000 individuals (Table 22).

TABLE 22 - LION POPULATION STATUS IN SOUTHERN AFRICA

N° sub-population	Country	Area	Lion range surface (km²)	Density of lions/100km²	Population size			Assessment mode
					minimum	estimated	maximum	
25	Tanzania	Mikumi National Park, Selous Game Reserve & Kilombero GCA	55,000	8.0	3080	4,400	5,720	C
		Southern Tanzania non-gazetted areas	45,000	1.2	378	540	702	C
	Malawi	Liwonde National Park & surrounds	800	0.6	4	5	6	B
	Mozambique	Nyassa Game Reserve	15,000	3.3	350	500	650	C
		Northern Mozambique non-gazetted areas	50,000	0.3	105	150	195	C
	Sub-total 25		**165,800**		**3,917**	**5,595**	**7,273**	
26	DRC	Upemba & Kundelungu National Parks	19,330	0.3	35	50	65	C
	Zambia	Sumbu complex (NPs & GMAs)	6,574	0.6	27	39	51	C
	Sub-total 26		**25,904**		**62**	**89**	**116**	
27	Zambia	North & South Luangwa complex	40,814	4.0	1143	1,633	2,123	C
		Chisomo, Luano & West Petauke Game Management Areas	16,460	1.0	115	165	215	C
		Lower Zambezi National Park & Kariba shore areas	9,140	2.0	128	183	238	C
		Nyika National Park (Zambia side)	80	0.5				C
	Malawi	Nyika National Park (Malawi side) & Vwaza Marsh Wildlife Reserve	4,134	0.1	4	5	6	B
		Nkhotakota Wildlife Reserve	1,500	0.7	8	10	12	B
		Kasungu National Park	2,000	0.3	4	5	6	B
	Zimbabwe	Mana Pools National Park, surrounding SAs & Communal Lands	13,000	3.8	396	495	594	B
		Matusadona & Chizarira National Parks, surrounding SAs & CLs	14,000	2.2	248	310	372	B
	Mozambique	Tete Province and neighbouring regions	25,000	0.5	87	125	163	C
	Sub-total 27		**126,128**		**2,133**	**2,930**	**3,729**	
28	Zambia	Kafue, Lochinvar & Blue Lagoon National Parks & surrounding GMAs	68,409	1.5	718	1,026	1,334	C
		West Lunga National Park & surrounding Game Management Areas	11,754	1.3	107	153	199	C
	Angola	Kameia National Park & Moxico non-gazetted areas	24,450	0.4	69	98	121	C
	Sub-total 28		**104,613**		**894**	**1,277**	**1,654**	
29	Angola	Mavinga & Luiana Partial Reserves & Cuando-Cubango NGAs	29,350	0.8	165	235	305	C
	Zambia	Liuwa Plain & Sioma-Ngwezi National Parks & West Zambezi GMA	47,006	0.8	263	376	489	C
	Botswana	Okavango Delta (Moremi Game Reserve & Wildlife Manag. Areas)	14,741	11.5	1358	1,698	2,038	B
		Kwando/Chobe riverfront (Chobe NP & Wildlife Manag. Areas)	5,487	4.7	205	256	307	B
		Dry North (Chobe NP & surrounding Wildlife Management Areas)	46,076	0.5	156	223	290	C
	Namibia	Kaudom Game Reserve & Nyae Nyae	31,833	0.3	75	94	113	B
		Caprivi	24,937	0.7	144	180	216	B
	Zimbabwe	Hwange National Park	14,651	3.7	434	543	652	B
		Matetsi complex (inc. NPs, SAs & FL) & Gwayi complex	10,349	1.4	120	150	180	B
	Sub-total 29		**224,430**		**2,920**	**3,755**	**4,590**	

(continued)

30	Mozambique	Zambezia Province: Gorongosa NP, Marromeu GR, Zambezi WUA & NGAs	19,970	0.5	70	100	130	C
	Sub-total 30		**19,970**		**70**	**100**	**130**	
31	Mozambique	Gaza & Ihambane Provinces inc. Zinhave & Banhire National Parks	40,000	0.2	56	80	104	C
	Zimbabwe	Gonarezhou National Park, Malipati Safari Area & Conservancies	9,027	2.0	128	183	238	C
	South Africa	Kruger National Park & surrounding Game Reserves	22,000	11.5	2277	2,530	2,783	A
	Sub-total 31		**71,027**		**2,461**	**2,793**	**3,125**	
32	Angola	Kangandala & Kisama National Parks, Luando Integral Reserve & NGAs	40,000	0.4	112	160	208	C
	Sub-total 32		**40,000**		**42**	**60**	**78**	
33	Angola	Iona, Mupa & Bikuar National Parks, Moçamedes Partial Reserve & NGAs	64,100	0.4	179	256	333	C
	Namibia	Etosha National Park	17,500	1.8	252	315	378	B
		Kunene regions	38,819	0.3	82	102	20	B
	Sub-total 33		**120,419**			**673**		
34	Botswana	Nxai Pan & Makgadikgadi NPs & Central Kalahari Game Reserve	68,530	0.7	315	450	585	C
		Kgakagadi Transfrontier Park & Wildlife Management Areas	61,200	0.9	522	580	638	A
	South Africa	Kgakagadi Transfrontier Park	9,591	1.3	84	120	156	C
	Namibia	Kalahari						
	Sub-total 34		**139,321**		**921**	**1,150**	**1,379**	
35	Zimbabwe	Tuli Safari Area	400	1.2	2	5	7	C
	Botswana	Tuli Game Reserve	1,200	0.8	7	10	13	C
	South Africa	Tuli						
	Sub-total 35		**1,600**		**9**	**15**	**20**	
Fenced Protected Areas								
36	South Africa	Mpumalanga			11	13	14	A
		Eastern Cape			107	119	131	A
		Free State			450	500	550	A
		Gauteng			182	202	222	A
		Kwazulu Natal			143	159	175	A
		Northern Cape			19	21	23	A
		Northern Province			49	54	59	A
		North West Province			121	134	147	A
	Swaziland	Hlane Royal National Park			17	19	21	A
		Nisela Safaris			7	8	9	A
	Sub-total 36				**1,106**	**1,229**	**1,351**	
12 sub-pop.	**10 countries**	**Total**	**1,039,212**		**14,526**	**19,651**	**23,425**	

(end)

SUB-POPULATION N° 25

Sub-population n° 25 appears to extend on the ground beyond the barrier of the Ruvuma River. Efforts are presently underway to set up a trans-frontier conservation area to join the Selous Game Reserve in Tanzania and the Niassa Game Reserve in Mozambique.

- **Tanzania**

The Selous ecosystem (Selous GR, Mikumi National Park, Kilombero Valley and surrounding non-gazetted areas) is one of the main strongholds of the African lion, perhaps the most secure of all.

The various observers (Rodgers, 1974; Creel & Creel 1997; L. Seige & R. Baldus, pers. comm.; P. Jonqueres & J-P. Bernon, pers. comm.; Ph. Chardonnet, pers. comm.) agree on the outstanding fitness of the lion status in the Selous ecosystem. All the large predator taxa of the region, including the lion, are abundant in the ecosystem.

In this region, poaching is limited, but problem animal control is carried out because of high incidence of man-eaters in this region (L. Seige & R. Baldus, pers. comm.).

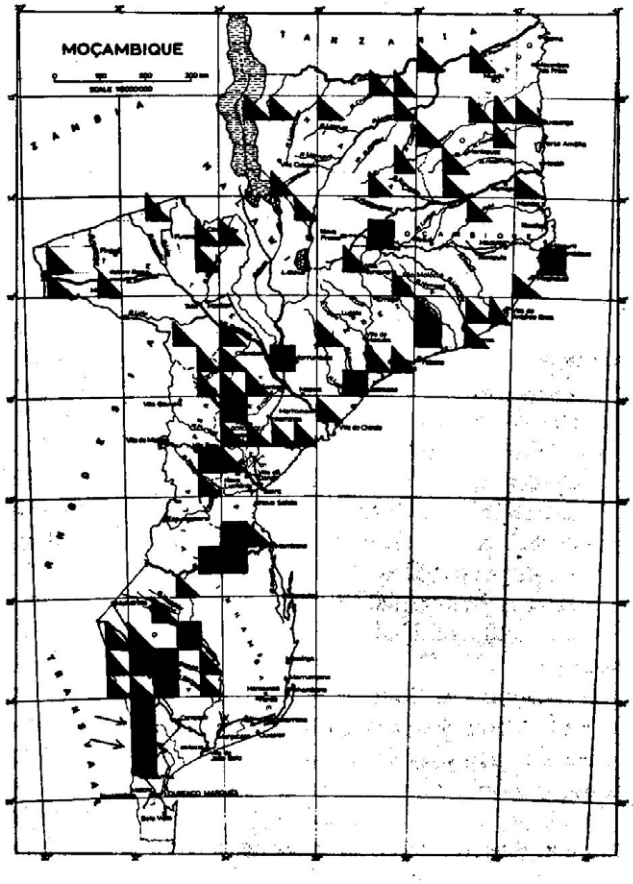
- **Mozambique**

In the 1970's, Smithers & Tello (1976) were considering that "*the lions have a wide distribution throughout Mozambique […] they have a wide habitat tolerance…"*.

Being one of the few remaining true wilderness areas in Africa, the Niassa GR has not suffered the same level of wildlife losses as other Protected Areas further South and North. The surveys indicate that there are healthy populations of antelopes, lion and leopard in numbers constituting viable populations (Michler, 1998). The Niassa GR and its surrounding areas constitute an important conservation area for the lion (R. Taylor, pers. comm.).

The *Parque Nacional* das Quirimbas, presently under creation in the Cabo Delgado Province, seems to host an important population of lions. In 2001, 70 people were reported to have been attacked by lions while they were sleeping in their fields to protect them against crop raiding elephants (H. Motta, pers. comm.).

FIG. 2 - LION DISTRIBUTION AREA IN MOZAMBIQUE IN THE 1970'S (SMITHERS & TELLO, 1976)



- **Malawi**

Generally speaking, the lion population of Malawi is very low. Lions have become locally extirpated, or very nearly so, in all but one of Malawi's nine Protected Areas. All but one of Malawi's PAs would have held lion populations, or transient animals, at their time of proclamation. In virtually all areas of the lion's previous range in Malawi, wildlife prey populations have also declined drastically (T. Ferrar, pers. comm.).

As sub-populations become smaller and more isolated, inbreeding may become an issue. Lions are possibly increasing through immigration from Mozambique. Trans-boundary movement of individual animals is still taking place, albeit at a very low frequency (T. Ferrar, pers. comm.).

Illegal hunting of prey species in the Protected Areas, particularly snaring, has speeded the species decline by forcing animals to prey on livestock (T. Ferrar, pers. comm.).

SUB-POPULATION N° 26

- **Democratic Republic of Congo**

Even though DRC is geographically seen to be part of Central Africa, Southern lion populations of DRC have been incorporated into the Southern Africa Region because they are connected with lion populations of Southern Africa and not with those of Central Africa.

Upemba and Kundelungu National Parks comprise just over 19,000 km² of Protected Areas and, by adding the other gazetted areas, so-called *Zone Annexe* and *Domaines de Chasse*, the entire ecosystem reaches 3 million hectares in size. The habitat there is suitable for lions, but their density is very low and a tentative estimate of 50 individuals is given for all these areas together.

In the early 1990's, D'Huart (1991) was considering that lions had disappeared from Upemba in 1985. Today, lions are observed there several times a year and their population is estimated between 10 and 15 (F. Bateshi Murotsi, pers. comm.). In the now contiguous Kundelungu a few individuals may remain as well (Nkulu Kalala, pers. comm.). According to B. Chardonnet (pers. comm.) who worked there in mid-2002:
- the lion's prey species appear to be rare and shy in the region, with a few exceptions such as southern reedbuck, oribi and warthog, and;
- it is highly doubtful there are as many as 50 lions in the whole region including surrounding non-gazetted areas.

- **Zambia**

The Mweru Wantipa and Sumbu National Parks have few lions as game populations have been massively reduced by poaching (C. & T. Stewart, 2001).

Zambia is one of the few remaining countries where lions are still widespread and regularly encountered close to human settlements. However, the distribution of lion outside the National Parks and the GMAs has undoubtedly dwindled significantly as a result of persecution and habitat degradation (R. Jeffery, pers. comm.).

SUB-POPULATION N° 27

- **Malawi**

Lion populations are very low. They have become locally extirpated, or very nearly so, in all but one of Malawi's nine Protected Wildlife Areas. Historically only one of Malawi's PAs would not have held lion populations, or transient animals, at their time of proclamation. In virtually all areas of the lion's previous range in Malawi, wildlife prey populations have also declined drastically due to illegal hunting. This has speeded the species decline by forcing animals to prey on livestock.

Only one sub-population is currently breeding well, namely that in Nkhotakota Wildlife Reserve. There are no estimates of frequency or survival rates of cubs, but young, or spoor of young, are occasionally seen. The lion population is probably stable in the short term.

In Kasungu National Park, only a single animal is known to occur in this Park.

In Nyika National Park and Vwaza Marsh Protected Area, lion populations are declining. Occasional visiting lions from Zambia enter these Protected Areas.

- **Zambia**

Historically, lion occurred throughout Zambia. Today, lions are still found more or less throughout the country, with a propensity for their occurrence in the larger more remote Protected Areas such as the North and South Lungwa, Lower Zambezi, etc. and their surrounding Game Management Areas, with higher densities occurring inside the National Parks (R. Jeffery & J.J. Pope, pers. comm.). However, Ansell (1978) noted that even where lions are no longer resident, they might still occur sporadically as transient individuals or groups.

Few contemporary density or population data are available for these or any other areas, although it may be assumed that densities of lion populations decrease with distance from the major rivers and floodplains of these refuges, except in the immediate areas surrounding permanent water, reflecting the relationships between the numbers and sizes of prides, the densities of resident concentrations of 'plains game' or prey species, and availability of water. In some areas it may well be that lion numbers are also affected by the hunting success of competing predators such as hyena.

The Luangwa complex may be considered as one of the main stronghods for the taxon in the whole coninent with a population presumably close to 1,500 lions.

In the early 1990's detailed studies have been carried out in the Nsefu Sector of South Luangwa National Park and the adjoining riverine part of the Upper Lupande Game Management Area totalling 355 km². "*The number of lions in the Hunting Block was estimated at 410 +/- 48 with 205 adults including 40 +/- 5 adult males*" (Jachmann, 2001).

There are no lions resident in Kasanka National Park, nor it seems in Lavushi Mande National Park. The last sighting of lion in Kasanka NP was of three animals in 1996, and it is felt that they came from the nearby Congo D.R. where human population is very low (C. & T. Stewart, 2001).

- **Zimbabwe**

In Mana Pools National Park, surrounding Safari Areas and neighbouring Communal Lands, lion populations are probably stable in Protected Areas, but decrease in the Communal Lands as a result of habitat loss (N. Monk, pers. comm.; G. Purchase, *in prep*.).

Lions in the un-flooded Middle Zambezi Valley are reproducing well (N. Monk, pers. comm.) even though no information is available on the factors that are influencing reproduction (V. Booth, pers. comm.).

In Matusadona National Park, lion numbers increased from 1990 to 1998 with a growing number of buffalo in the park, as drought years expanded the area of lakeshore grassland due to the drop of the lake level (G. Purchase, pers. comm.). Today the lion population is

estimated at around 110 with an average pride size of 11 (F. Buyeye & G. Matipano, pers. comm.).

Lion numbers are possibly stable in other Protected Areas, but wildlife poaching appears to be very common in Chirisa Safari Area, and so lion numbers may have decreased even though data are not available (V. Booth, pers. comm.). Lion numbers probably decreased in the Communal Lands during the past 22 years as a result of habitat loss (V. Booth, pers. comm.).

Lions of the Sebungwe region are reproducing well (G. Purchase, *in prep*.), but no information is available on the factors that are influencing reproduction.

According to R. Taylor (pers. comm.), the lion population on the shores of Lake Kariba:

- Had increased in 2000-2001 because the weakness of buffalo made them an easier prey; this was due to the flooding of the grasslands along the shores of lake Kariba, but;
- Is starting to drop in 2002 with the decrease of buffalo populations and therefore less available prey (lion infant mortality has been observed).

"A good example of the destruction and recovery of a lion population can be seen from the Zambezi Valley. After years of heavy hunting pressure, a "cat flu" epidemic has wiped out around 75% of the lions, and a VIP hunting scam removed a further 16 male lions just after the epidemic has passed its peak…Furthermore, the buffalo and impala populations crashed because of the lake and the hyena numbers built up to high levels…I seriously doubt that the carrying capacity for lion is more than half of what it was in 1985…My personal assessment of the Zambezi valley is that the lion population is recovering nicely. Numbers have built up to the point where they are beginning to club the hyena population into some semblance of normality…Also pride structure has begun to "normalise" (Heath, 2001).

- **Mozambique**

The Tete Province definitely has a substantial resident population of lions, however reliable numbers are not known. It shares lions with neighbouring Zimbabwe and Zambia. Hunting safari companies operate in the Province with uneven success as far as lion is concerned.

SUB-POPULATION N° 28

- **Zambia**

The sub-populations no° 28 and no° 29 are considered as separate populations here because they occur on opposite banks of the Zambezi River. While there may occasionally be crossover, this river represents a formidable barrier and as such these two populations are considered accordingly.

There is considerable variation throughout the Protected Areas system in Zambia. This population occurs in some 80,000 km² of suitable habitat comprising approximately 25,000 km² of National Parks and 55,000 km² of Reserves or Hunting Areas. Kafue National Park has high densities of lions, particularly around the river valleys where prey species are still

plentiful, particularly in the Busanga Plains, possibly as high as 20 per 100 km² in some places (R. Jeffery & J.J. Pope, pers. comm., 2002).

Elsewhere the densities are much lower in the West Lunga National Park and Lochinivar and Blue Lagoon National Parks are unlikely to support significant populations of lion (R. Jeffery & J.J. Pope, pers. comm.; Mitchell, Shenton & Uys, 1965).

- **Angola**

Little is known about the status of lions in Angola. Sub-population n° 28 occurs in Kameia National Park, an area of 14,450 km² and its surrounding non-gazetted area known as Moxico which is a further 10,000 km². A tentative estimate of 98 animals is given for the population size.

The status of lions in Angola as a whole is poorly understood. "*Crude estimates for some regions of the country do exist, but these, however, are not based on scientific surveys"* (W. van Hoven, pers. comm., 2002).

SUB-POPULATION N° 29

- **Zambia**

This population occurs in an area of approximately 9,000 km² of Liuwa Plain and Sioma-Ngwezi National Parks and a further 38,000 km² of Protected Areas (West Zambezi GMA). Lion densities in these areas are considered to be relatively low with a currently estimated lion population of 376 individuals (R. Jeffery & J.J. Pope, pers. comm.).

- **Angola**

There is a little known area comprising over 14,000 km² made up of Mavinga and Luiana Partial Reserves and Cuando-Cubango non-gazetted areas covering 15,000 km². The exact status of lions in these areas is not clear and hence their population estimate of 235 should be viewed with caution.

- **Namibia**

Reliable information on lion in Namibia is available from Stander (1997), Stander & Hanssen (2001), Loveridge, Lynam & Macdonald (2001). There may be between 500 and 1,000 lions in the whole country (465-914; V. Booth, pers. comm.).

In Caprivi, the past trends and present status of the lion population is poorly known. There are probably between 125 and 234 individuals. The wildlife habitat there is on the decrease due to livestock negative impact and civil unrest. There is some livestock depredation by lion in the Eastern Caprivi. In this region the mean annual quota is 1.4-2.8% of the lion population (1996-2001) and a stable average of 7.2 lions are trophy-hunted per year over the past 5 years.

In Kaudom Game Reserve the lion population is stable and a similar situation seems to occur now in Nyae Nyae after a recent decline (Stander, 1997). In Kaudom the mean annual quota is

0.7-2.2% of the population (1997-2001) and direct benefits are allocated to communities in the form of financial payments to conservancies.

- **Botswana**

It is safe to say that the Northern Botswana lion population (lions from Nxai Pan National Park and Makgadikgadi National Park excluded) is larger than 2,000 animals (Sechele & Winterbach, 2001).

The lion population of the Okavango is stable. Surveys were conducted in 1998 and 1999, supported by monitoring population dynamics of five prides for the period 1997 - 2001 (P. Funston & C. Winterbach, pers. comm.). The Okavango Delta lion range is made up of an area of 7,084 km² of high density (between 7.2 and 19.1 adults and sub-adults per 100 km²) and of another area of 7,676 km² of lower density (between 0.8 and 5.9 adults and sub-adults per 100 km²) (Sechele & Winterbach, 2001).

There is little data for the Dry North, but hunting pressure may be resulting in local declines. The lack of dry season prey in that area is the limiting factor in lion populations (P. Funston & C. Winterbach, pers. comm.).

A recent study (Neo-Mahupeleng *et al.*, 2001) was undertaken in the North-eastern tip of Botswana, along the Chobe River, in an area of about 245 km². According to the study, 45 lions occurred in the area with a outstandingly high adult density ranging between 21 and 37 individuals per 100 km².

On the Kwando/Chobe riverfront, populations are stable to declining. In 1999 and 2000 a survey showed a low proportion of sub-adults, indicating a low recruitment of cubs in the subpopulation (P. Funston & C. Winterbach, pers. comm.). In this particular area, the relatively small lion population (with a low density of 0.61 lion per 100 km²) is more vulnerable to disruption (Sechele & Winterbach, 2001). Normal population structures have been recorded during lion surveys in the Okavango Delta (1998 and 1999) and local surveys in parts of the Delta (1995 - 2000) and there is a large robust population.

- **Zimbabwe**

The stronghold of the Zimbabwe lion population lies in the Western corner of the country (North-West Matabeleland) in Hwange National Park, Matetsi complex and Gwayi complex, where the lion numbers are currently probably stable (V. Booth, pers. comm.).

In Hwange NP the lion population has been assessed on several occasions since 1928, when the park was launched:

- In 1973 it was estimated that the lion population in Hwange National Park was about 500 animals (Wilson, 1975);
- In 1989, some 16 years later, the same figure of 500 was quoted by Jones (1989 *in* Wilson, 1997);
- By 1997 it had grown; "*...the lion population in the entire Hwange N.P. could not be less than 1000 animals...the population figure should be regarded as an educated guess*" (Wilson, 1997), and;

Tanzanian lions, Selous Game Reserve (Photo : O. Buttin).

South African lion, Kruger National Park (Photo : B. Chardonnet).

South African lion, Kruger National Park (Photo : B. Chardonnet).

South African lion, Madikwe Wildlife Reserve (Photo : B. Chardonnet).

South African lioness, Kruger National Park (Photo : O. Buttin).

- In 2002 a study is currently being undertaken on the lion population of the Park and the population size is reaching 543 individuals with the following composition (Loveridge, 2002): 50 adult males, 250 adult females, 94 sub-adults, 199 cubs.

In the Gwayi complex, immigration from the neighbouring Hwange NP is the most likely source of replenishment (V. Booth, pers. comm.), since a very high quota of 37 male lions is attributed for a relatively rather small hunting area (Loveridge, 2002).

Lion number is probably stable in Hwange NP (V. Booth, pers. comm.). In the Matetsi complex, the lion population has been heavily hunted since 1973 and has been subject to heavy hunting to control stock killing lions (V. Booth, pers. comm.). In the Gwayi complex, the switch from cattle to wildlife production in the 1980's halted decline in lion populations (V. Booth, pers. comm.).

SUB-POPULATION N° 30

- **Mozambique**

Information from Mozambique is understandably sketchy and the effects of twenty years of conflict on the lion populations are yet to be researched. "*We don't have any idea how many lions are left in Mozambique"* (W. van Hoven, pers. comm., 2002).

According to Smithers and Tello (1976) in the 1970's, "*wanderers (lions) make their way, probably from the populations resident tin the Gorongoza National Park and surrounding areas, where they are abundant, westwards, over the Zimbabwe border, where they occur from time to time between 18°S and 20°S and from the Save River area north-westwards from 20°S to 20°30'S. These wanderers may become raiders of domestic stock and, when subject to hunting pressure, normally make their way back whence they came.*"

Lower Zambezi valley, Gorongosa NP, Marromeu Game Reserve, Zambezi Wildlife Utilisation Areas and surrounding non-gazetted areas consist of nearly 20,000 km² of available lion habitat most of which is Hunting Areas (10,000 km²) or non-gazetted areas (6,120 km²). A very tentative estimate of 100 animals has been given for this population.

It remains doubtful whether this sub-population is really separated from the sub-population n° 27 (P. Jonquères, pers. comm.)

SUB-POPULATION N° 31

- **Mozambique**

In the 1970's Smithers and Tello (1976) were stating: "*The lions have become extinct in the eastern parts of the Inhambane Province where, until 1950, they were known just South of the Save River and until 1966 just East of the Cabo de S. Sebastiao. They no longer occur in the Maputo Province, except as vagrants from the Transvaal which move eastwards to near Magude and into the extreme Southern parts of the Province from time to time."*

Gaza and Inhambane Province lion range covers about 40,000 km² of which 12,000 km² are made up of Zinhave and Banhire National Parks, the remaining 28,000 km² being non-gazetted lands. A cautious figure of 100 lions is provided here.

- **Zimbabwe**

In Zimbabwe this sub-population is tentatively put at approximately 180 with wide confidence limits (high 238 – low 128). Found mainly in Gonarezhou NP, Malapati Safari Area and Conservancies, an area of 5,053 km² of National Park and 3,970 km² of other Protected Areas (N. Monks, S. Clegg, A. Pole, V. Booth, pers. comm.; Pole, 2000).

Lions in the South-East Lowveld are reproducing (S. Clegg, pers. comm.), but no information is available on the factors that are influencing reproduction. There was most probably an increase in lion number after cattle ranches were converted to wildlife conservancies during the early 1990s (V. Booth, pers. comm.).

- **South Africa**

The Kruger National Park and surrounding populations are probably stable with fluctuations due to environmental conditions.

Past trends of Kruger NP and surroundings are unknown, but lions were virtually exterminated at the beginning of the 19th Century. Future trend predicted for Kruger and surrounds is stable with fluctuations, provided conservation measures continue to be employed.

There is great concern regarding the future of the lions in Kruger due to the high incidence of Bovine Tuberculosis (introduced by neighbouring cattle and spread by buffalo) which jeopardizes their general health and status (R. Bengis, pers. comm.).

The normal recruitment rate for Kruger NP and surroundings is about one cub/adult lioness/year on average. (G. Kamasho, G. Van Dyk, J. Kruger, D. Balfour, A. Shulto-Douglas, F. Funston, R. Slotow & V. Booth, pers. comm.).

SUB-POPULATION N° 32

- **Angola**

In the region of the *Reserva do Luando*, the lion was considered as widespread but never abundant. They had become rare in the 1970s (Silva, 1972).

SUB-POPULATION N° 33

- **Angola**

Lions were abundant in the 1960s in the Kuando-Kubango hunting concessions, in the South-eastern corner of Angola (B. des Clers, pers. comm.).

- **Namibia**

According to P. Stander, Carnivore Co-ordinator at the Ministry of Environment & Tourism of Namibia, the lion population of Etosha National Park is stable and has been so for the last 15 years. This is where most of the Namibian lions occur and the density in the park is quite high with 1.8 lions per 100 km² (Stander, 2000).

Lions in the Etosha NP have a potential growth rate of 10%, excluding violent mortalities (P. Stander, pers. comm.). However, in the longer run, the sustainability of this population is said to be somehow uncertain because of "*a shortage of scientific data on the ecological mechanisms that drive population regulation*". A peculiarity of the Etosha lions is that they appear to be free from the Feline Immunodeficiency Virus, which seems to be widespread among lions elsewhere (Cat News 24, 1996).

However the Etosha lions are subjected to constant persecution of lions by farmers in the intensive cattle farming areas along the Park's borders further to livestock losses (Stander, 2000). Between 1985 and 2000, 427 lions from Etosha were thus destroyed on the borders of the Park (Stander, 2000). Over the past 19 years an average of 28 lions have been shot along the border, this number has remained constant (V. Booth, pers. comm.). According to Cynthia Vernon (Vernon, 1996), *"these killings may have significant effects on the demography of Etosha lion population. About one-half of the mortality of adult lions is the result of the killing of lions on private lands. Of all lions killed, approximately 50% are sub-adults males. Therefore, there is a question as to the genetic and demographic prognosis for small isolated populations".*

The Kunene population is stable and has a potential growth rate of 10% (excluding violent mortalities) despite the extremely arid environment of the area, but its past trend is unknown (V. Booth, pers. comm.). *"Lions have always existed in the Kunene region, but their ecology and demography have never been studied"* (Hanssen & Stander, 2000). P. Stander and Lise Hanssen, Director of the Africa Cat Foundation, have initiated a study on the large carnivore of the Kunene region in 1999. Community conservation programmes such as communal conservancies are currently in place, notably to monitor and promote suitable habitat for lions.

SUB-POPULATION N° 34

Because of the harsh semi-desert conditions of the area, the Kalahari lions differ in many ways from other African lion populations, not in their appearance but in their behaviour. Their way of hunting and water consumption are unique. The size of their prides seldom exceeds 16 animals, in contrast, in Kruger NP, 40 lions were once counted in a single pride. The Kalahari lions have also the highest mortality rate among cubs in all of Africa (Cat News 26, reproduced from Custos 1997).

- **Botswana**

The Makgadikgadi National Park has a small [39 (28-59), 95% confidence] population of lions that lives at a quite low density (0.8 adult and sub-adult lion per 100 km²) (Hemson, 2001). The lion population of the Pans region is stable. However, this sub-population is locally threatened due to predator-human conflict that had a high impact on the small sub-population. The Southern Kalahari population is probably stable with fluctuations due to environmental conditions (Funston, 2001).

Past trends of the Southern Kalahari prides are unknown, but lions were virtually exterminated on the South African side of the Park (P. Funston & C. Winterbach, pers. comm.).

The Pans region shows a rapidly decreasing populations due to high level of conflict and problem animal control. However, future trends in the Pans indicate that populations are expected to increase after the ban on Problem Animal Control was implemented in November 2000. The Southern Kalahari population is expected to remain stable, provided that conservation measures continue to be employed (P. Funston & C. Winterbach, pers. comm.).

- **South Africa**

Quite reliable figures on lion's status in South Africa are available from G. Kamasho, G. Van Dyk, J. Kruger, D. Balfour, A. Shulto-Douglas, F. Funston, R. Slotow & V. Booth, pers. comm.; Mills, Wolf, Le Riche & Meyer, 1978; Funston, 2001.

In recent history the Kgalagadi Trans-frontier Park lion population was virtually exterminated on the South African side of the park. However, this population (the Kgalagadi Trans-frontier Park population) is predicted to remain stable, providing conservation measures continue to be employed. The normal reproductive rate for the Kgalagadi Trans-frontier Park is about one cub/adult lioness/year on average.

- **Namibia**

There appears to be no mention of any lion on the Namibian side of the Kalahari Desert by such authorities as P. Stander.

SUB-POPULATION N° 35

- **Zimbabwe**

In Zimbabwe there is a very small population in the Tuli Safari Area, a Hunting Block of 400 km² South of the country. The population spans three international borders and is tentatively put at 5 animals.

- **Botswana**

On the Botswanan side of the border this populations has 1,200 km² of habitat available in the Tuli Game Reserve and the estimated population is 10 individuals. This figure has not been reliably confirmed.

- **South Africa**

No information was available for the South African side of the border where this sub-population is concerned.

SUB-POPULATION N° 36

- **South Africa**

Accurate figures for enclosed lion populations in South Africa originate from Van Schalkwyk, 1994; W.& S. van Hoven, pers. comm.; G. Kamasho, G. Van Dyk, J. Kruger, D. Balfour, A. Shulto-Douglas, F. Funston, R. Slotow & V. Booth, pers. comm.

The lion populations found in South Africa can be characterised as being the most intensively managed populations in Africa. This highly interventionist approach has produced a wealth of useful information on the management of small populations and demonstrates just what can be done when there are sufficient resources and the will to carry out these projects. However, it also highlights the fact that this type of management is extremely difficult and it is better to never lose lions from an area than to try and re-introduce them having lost them in the first place, as it is unlikely that the monumental efforts that have gone into lion management in South Africa could be repeated across the continent.

In South Africa, there are a number of enclosed populations of lions which are not included here as sub-populations. The populations given in the present survey consist only of free-ranging animals and those that have been re-introduced under strict conditions to areas where they occurred historically or other reasons, for instance:

"*Lions were introduced into Pilanesberg National Park because the species was identified as a major draw-card for foreign tourists in particular and a crucial component for the socio-economic development of the region…A highly interventionist approach towards lion population management was adopted…. Lions have made a significant contribution to the park in direct economic returns from increased tourism, live sales and hunting.*" (Van Dyk, 2001).

The current status of these populations is given as:

- The Mpumalanga Parks lion population is declining;
- The North West Parks meta-population is increasing;
- The Hluhluwe-Umfolozi population is slowly decreasing, but Kwazulu Natal Wildlife started an introduction programme since 2000 and population is starting to increase, and;
- The Phinda, Kwandwe and Shamwari populations are increasing.

Their history is particularly important, given the intensive nature of their management:

- Both Madikwe and Pilanesberg populations were reintroduced from Etosha stock (22 founders);
- Before the recent introduction, the Hluhluwe-Umfolozi population's trend has been from stable to slowly declining. There have been 3 bottlenecks:
    (i) Small founder population introduced in the 1960s;
    (ii) During the 1980 drought years, herbivores were heavily culled. By the mid-1980s lions needed to be reduced because their numbers had increased to 200, and;
    (iii) Sub-adults started escaping and a policy was implemented to reduce these groups for the sake of good neighbour-relations. Consequently, pride males stayed too long in the pride and started breeding with their daughters and inbreeding resulted.

The original Phinda introductions were from the Sabi Sands while Kwandwe and Shamwari founder populations were from the Pilanesberg/Madikwe meta-population and are both very recent introductions, i.e. the last 18 months.

The future of these animals is not clear due to the mixed fortunes of the various groups:

- The outlook for Mpumalanga Parks does not look good. Disease, habitat fragmentation and destruction (due to unprecedented development), hunting and poaching (snaring, shooting from the road) are having a significant impact;
- The North West population has proved so successful that dozens of the progeny of the two populations have been relocated across the sub region (Mabula, Entabeni, Welgevonden, Shambala, Shamwari, Kwandwe and Hluhluwe-Umfolozi). A group was also made available to Oklahoma City Zoo and a game reserve in Zimbabwe;
- It is probably too early to tell whether the Hluhluwe-Umfolozi, Kwandwe and Shamwari introduction programme will be successful, and;
- The Phinda population is maintained at 15 - 16 lions, which is assumed to be the correct carrying capacity for a reserve of this size.

Interestingly their reproductive history is well documented:

- In Mpumalanga Parks, the Low-Hills population is doubling each year while the Mthetamusha population is stable;
- Rapid growth within the Pilanesberg/Madikwe populations has resulted in the implementation of population control (contraception) being applied in the form of vasectomies. Vasectomies are used to manipulate the genetic composition of the population as well;
- Of the three males and three females introduced to Hluhluwe-Umfolozi Park in 2000, one female was killed and the two others have produced two cubs each. Two of the males moved south and have joined up with existing prides, and;
- The Phinda lions have done very well and are on the increase. Both Kwandwe females are pregnant. Shamwari has experienced cub mortalities and one theory is that this may be due to male vasectomies in the founder population.

TABLE 23 - TRENDS AND CONTRAINTS IN LION CONSERVATION IN SOUTHERN AFRICA

N° sub-pop.	Country	Area	Lion population trend	Lion habitat quality trend	Main prey for lions		Conservation efficiency (rate 0 to 3)	Lion conservation constraints
					Wildlife	Livestock		
	Tanzania	Mikumi NP, Selous GR & Kilombero GCA	S	S	X	X	3	
		Southern Tanzania non-gazetted areas	S	S	X		2	predation on humans
25	Malawi	Liwonde National Park & surrounds	I	S	X		2	small population size, scarcity of prey
	Mozambique	Nyassa Game Reserve	S	S	X		3	
		Northern Mozambique non-gazetted areas			X			agriculture
26	DRC	Upemba & Kundelungu National Parks	D	D	X		1	agriculture, poaching
	Zambia	Sumbu complex (National Parks & surrounding GMAs)			X			
	Zambia	North & South Luangwa complex	S	S	X		3	
		Chisomo, Luano & West Petauke GMAs		S	X			
		Lower Zambesi National Park & Kariba Shore	S	D	X		2	agriculture, settlement
		Nyika National Park (Zambia side)			X			
27	Malawi	Nyika NP (Malawi side) & Vwaza Marsh WR			X			small population size, scarcity of prey
		Nkhotakota Wildlife Reserve			X			small population size, scarcity of prey
		Kasungu National Park			X		2	small population size, scarcity of prey
	Zimbabwe	Mana Pools NP, surrounding SAs & Communal Lands	S	S	X		3	agriculture, settlement
		Matusadona & Chizarira NPs, surrounding SAs & CLs	S	D	X	X	3	agriculture, livestock
	Mozambique	Tete Province			X	X	1	agriculture, settlement
	Zambia	Kafue, Lochinvar, Blue Lagoon NPs & surrounding GMAs	S		X		2	
28		West Lunga National Park & surrounding GMAs			X			
	Angola	Kameia National Park & Moxico non-gazetted areas			X			civil unrest, poverty
	Angola	Mavinga & Luiana PRs & Cuando-Cubango NGAs			X			civil unrest, poverty
	Zambia	Liuwa Plain, Sioma-Ngwezi NPs & West Zambezi GMA			X			
29	Botswana	Northern Botswana	S	S	X	X	3	
	Namibia	Kaudom Game Reserve & Nyae Nyae	S	S	X	X	2	livestock
		Caprivi			X	X	1	livestock
	Zimbabwe	North-West - Matabeleland	S	S	X	X	3	agriculture, livestock

(continued)

30	Mozambique	Zambesia Province			X	X	1	agriculture, livestock
31	Mozambique	Gaza & Ihambane Province inc. Zinhave & Banhire NPs			X	X	1	
	Zimbabwe	Gonarezhou NP, Malipati Safari Area & Conservancies			X	X	3	settlement
	South Africa	Kruger National Park & surrounding Game Reserves	S/D	I	X	X	3	disease
32	Angola	Kangandala & Kisama NPs, Luando IR & NGAs			X			civil unrest, poverty
33	Angola	Iona, Mupa & Bikuar NPs, Mocamedes PR & NGAs			X			civil unrest, poverty
	Namibia	Etosha National Park	S	S	X	X	3	livestock, settlement
		Kunene regions			X	X		
34	Botswana	Central Botswana	S	S	X	X	3	agriculture, livestock, mining
		Southern Botswana	S	S	X	X	3	livestock, over-harvest. of springbok
	South Africa	Kgakagadi Transfrontier Park	S	S	X	X	3	livestock
	Namibia	Kgakagadi Transfrontier Park			X	X	3	
35	Zimbabwe	Tuli Safari Area			X			
	Botswana	Tuli Game Reserve			X			
	South Africa	Tuli			X			
36	South Africa		S	S	X		3	
	Swaziland				X			

(end)

I = increasing

S = stable

D = decreasing

Rate 0 to 3: 0=low; 3=high

No information = missing or insufficient data

Chapter III
Driving Forces

Zambian lioness, Luangwa valley (Photo : B. Chardonnet).

"*A l'instant où King allait saisir le cou du* morane *entre ses crocs, une balle l'atteignit là où il le fallait, au défaut de l'épaule, droit au cœur. Il fut soulevé, rejeté par le choc et rugit de surprise plus encore que de colère… Et tout à coup ce fut le silence. Et tout à coup, à l'ombre des longues branches chargées d'épines, il y eut, couronnées de crinières, deux formes inertes : le corps d'un homme et le corps d'un lion.*"

Joseph Kessel, 1958. Le Lion.

1. COHABITATION OF MAN AND LION

1.1. LION HABITAT UNDER HUMAN PRESSURE

Human causes appear to be the prevailing factors responsible for the shrinkage of lion habitat. However non-human causes have impacted lion habitat, such as desertification and subsequent decline of lion prey availability. For instance, the desertification phenomena has certainly contributed to the withdrawal of lions from areas of the high Northern latitudes, such as the Adrar des Ifhoras in Mali, the Aïr Ténéré in Niger or the Ennedi in Chad.

The most important long-term threat to the presence of lion in any part of Sub-Saharan Africa lies with human settlements and particularly agriculture and livestock rearing in lion habitat. The distribution maps of lion subpopulations tend to confirm the direct inverse correlation of (i) lion density and numbers with (ii) human activity and presence.

The reduction of habitat might be considered as an indirect, although most powerful, effect threatening the lion taxon. Direct effects also originate from the presence of man as super-predator within lion habitat. If wildlife prey habitats are converted to agriculture or grazing for domestic livestock, human/lion conflicts are bound to increase. Unless conflicts are alleviated (compensation to local people for losses incurred, removal of problem animals, etc), locals will shoot, trap or poison them, leading to fewer lions in that area.

A common consequence of the human occupation of lion habitat is the development of negative perceptions of lion presence in the mind of local communities. A demonstrative example is the case study in Queen Elizabeth National Park, Uganda, where questioned local communities openly expressed their negative attitude towards lions (Dricuru, 2000), to the point that "*…in Queen Elizabeth NP…we are more concerned about the poisoning of wild carnivores and scavengers (lions, hyenas, vultures, etc)…this is extremely destructive - ecologically and economically*" (Siefert, 2000).

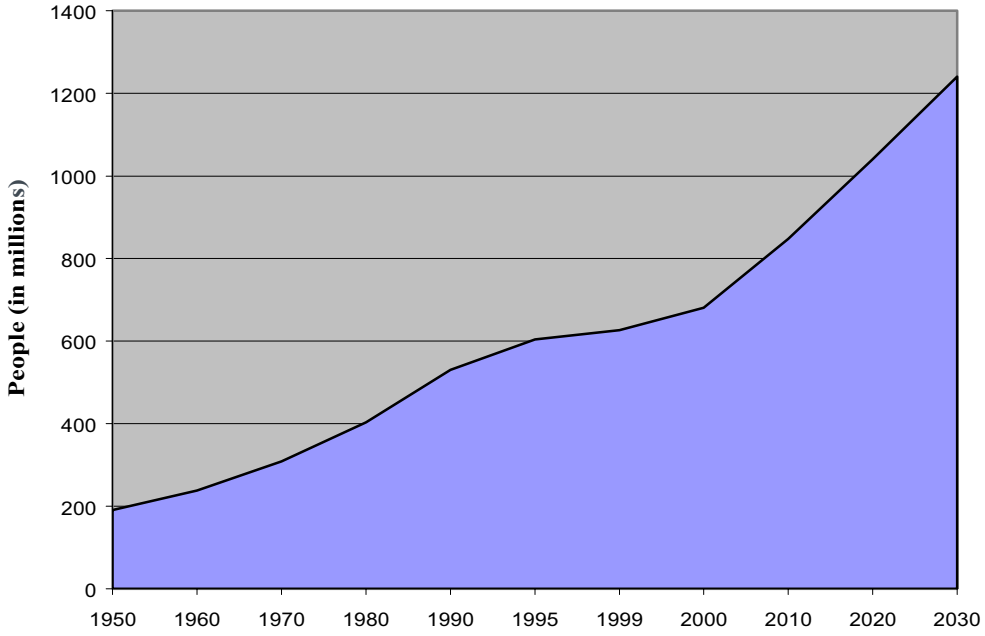
Man appears to be the main cause of the modification of lion habitat through a number of factors.

- **Human demographic growth**

In 1950, the human population of Sub-Saharan Africa (SSA) represented only 7.6% of the global population, but 11.3% in 2000, and it is expected to represent 15.3% in 2030 with more than 1.2 Billion people (Figure 3).

Furthermore, urbanisation is developing in SSA: between 1950 and 2000, urban populations of SSA were multiplied by 9.2, and will be again multiplied by 2.7 by 2030. During the same period, rural populations will however also increase. They have been and will be multiplied "only" by 2.7 and 1.3 respectively (FAO, 2000-2001 *in* Tacher *et al*, 2001).

FIG. 3 – HUMAN POPULATION GROWTH IN SUB-SAHARAN AFRICA (Source: FAO, 2001; *in* Tacher *et al*, 2001)



- **Agricultural and livestock encroachment**

With a land area of about 30 million km², Africa is the largest continent on earth and SSA represents about three quarters of it. This vast block of land is progressively being transformed by various human uses.

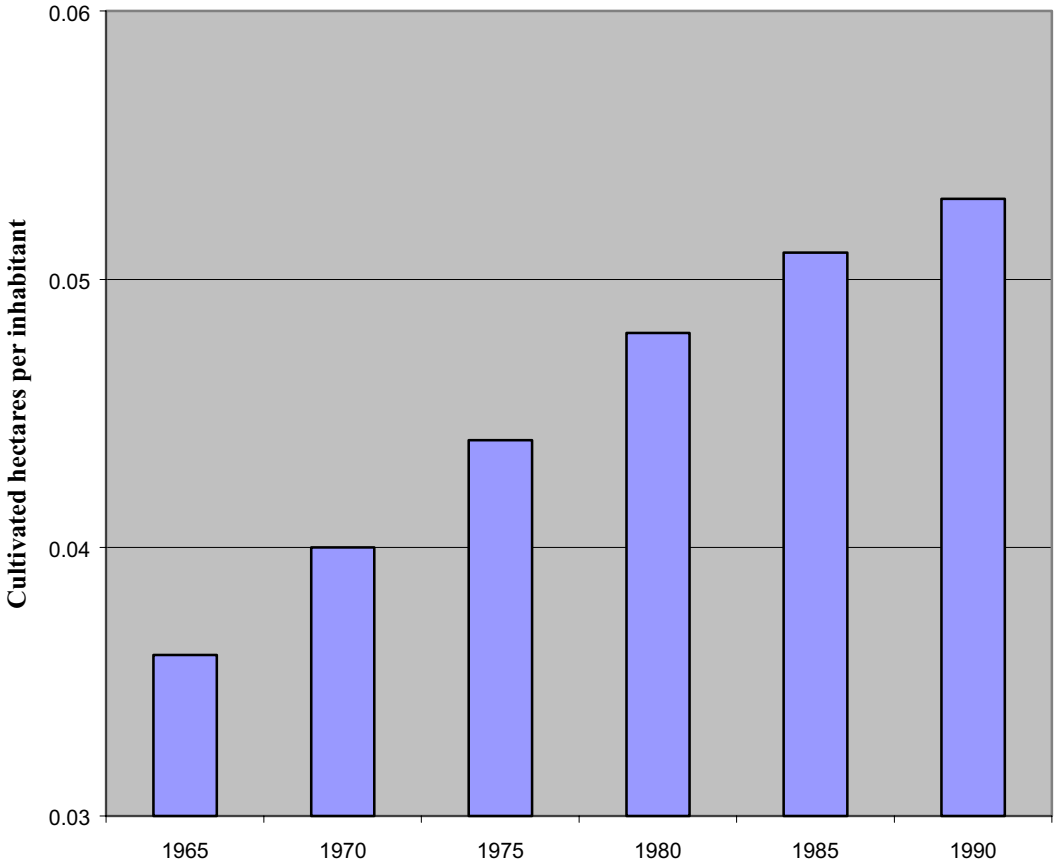
- **Cultivated lands**

For the whole planet, cultivated lands have been multiplied by 1.64 in the last 36 years. However, pressure on land has differed greatly between developed and developing countries. The total area of cultivated lands increased by 80% in developing countries while it has remained virtually the same in developed countries and actually decreased in Europe. In SSA it has been multiplied by 1.64, corresponding to the global average (Figure 4).

- **Pastoral rangeland**

The total area of pastoral rangeland remains stable in most parts of the world. During the last 25 years, however, the size of grazing area per inhabitant has decreased everywhere due to human demography, but it has decreased more rapidly in SSA. Nevertheless, SSA still has the most hectares of pastoral rangeland per inhabitant (1.8 ha/inhabitant in 1990).

FIG. 4 – RISE IN CULTIVATED LAND IN SUB-SAHARAN AFRICA (Source: Tacher *et al*, 2001)



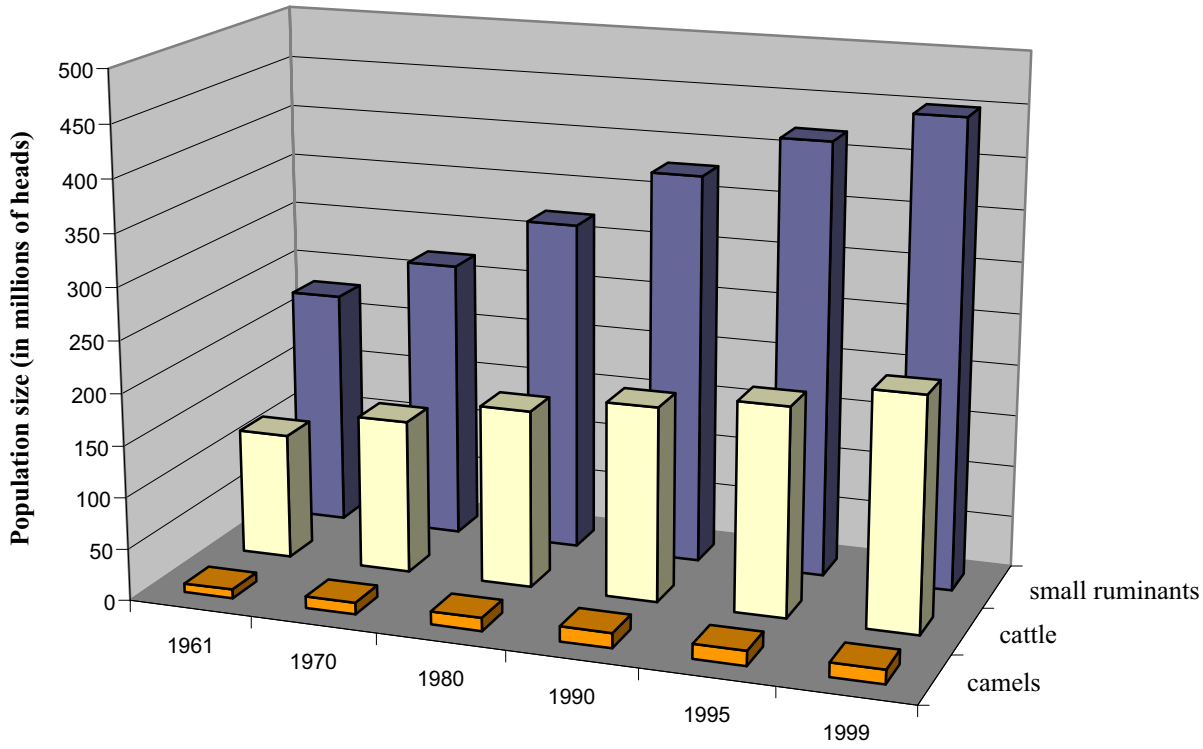
- **Livestock development**

Numbers of domestic livestock have increased in developing countries such as SSA (Figure 5) while they have decreased in developed countries. Furthermore, it looks like this trend is ongoing.

After Latin America, it is in SSA that the greatest numbers of cattle per inhabitant are found.

SSA has the greatest numbers of small ruminants (sheep, goats and camels) of all the developing countries (in particular, twice as many goats as the average seen in other developing countries). Today there are probably nearly 450 Million head of small ruminants in SSA and close to 200 Million head of cattle.

FIG. 5 – INCREASE IN NUMBERS OF DOMESTIC ANIMALS IN AFRICA (Source: FAO, 2001; *in* Tacher *et al*, 2001)



- **Pressure on lion prey habitat**

Change in lion prey availability can be a direct consequence of human development as exposed in the preceding paragraphs.

The availability of prey species, not surprisingly, has a direct effect upon the population density of lions (Schaller, 1972; Dunham, 1998; Dublin & Ogutu, 1998; many others). Low prey densities result in low lion densities.

In Northern CAR, for instance, the recent decline of lion populations may be partly due to the decrease of kob (Buffon's kob, bohor reedbuck, defassa waterbuck) populations submitted to severe poaching pressure (J. Tello, pers. comm.), even though another cause is the systematic shooting of lions by nomadic cattle herders entering Protected Areas during the dry season (B. Chardonnet, pers. comm.).

An adult female lion needs a minimum of 5kg of meat per day to maintain basic metabolic requirements (Schaller, 1972). Lions also need more room than any other predator. Their behaviour, predatory and reproductive strategies etc. show extensive regional variation. They are highly adaptable. Fundamental ecological and behavioural characteristics of carnivores such as density, grouping, pattern, range size and prey selection are influenced respectively

and individually by habitat and prey density, dispersion and richness (Stander, 1997). When wild prey availability is reduced, for instance because of drought or disappearance of wild habitat due to expanding human settlements and activities, lions, more so than in the case of other large predators, feel disposed to prey on domestic herds. This is particularly tempting when, as explained previously, they can easily access the farmlands just outside the conservation areas. Rudnai (1983) reports that a decreased availability of game in Nairobi National Park, Kenya, in 1974-75, due to a year of drought, which caused a massive die-off of wild ungulates, resulted in an increase in the hunting range of the resident lion prides and thus more regular excursions of lions into the surrounding areas. During the 1980s, fatal attacks by lions in Southern Tanzania were attributed to heavy poaching of wild ungulates, so that lions, deprived of natural prey, turned to livestock and entered villages (Nowell & Jackson, 1996).

- **Domestic animal/wildlife interface**

The fragmentation of lion habitat due to human encroachment has led to a growing overlapping of lion and human ranges and to a developing interface between lion and man's activities. One of the main consequences is an increasing sanitary impact on lion populations.

- **Prey diseases**

A number of diseases affecting lion prey species (wild, domestic or both) may have a significant impact on habitat quality:

- Directly, when the disease may be transmitted straight from the prey to the lion, which is consequently infected (e.g. bovine tuberculosis/BTB), and;
- Indirectly, when the disease is not transmitted to the lion itself, but causes wildlife die-offs and reduces prey availability with obvious consequences on the population dynamics of the lion (e.g. rinderpest/RP).

RP is an interesting case study as:

- To the best of current knowledge, the disease is transmitted by domestic animals to wildlife, and;
- One can observe at least two main development phases:

  (i) In the first phase, the occurrence of a RP outbreak kills a large number of susceptible species (such as giraffe, buffalo, antelopes and warthog). Predator numbers, not just lions, increase as a result of the surplus of easily available food resulting from sick and dead animals, and;
  (ii) In a second, later, phase, the crash in prey populations leads to a reduction of the number of predators as this exceptionally abundant food supply disappears.

Similar interactions happen when a prolonged drought causes massive wildlife or livestock die-off.

- **Lion diseases**

Domestic and feral cats may act as vectors for diseases such as FCaV, FeHV, FIP and rabies, while domestic and feral dogs may carry CDV and rabies. All of which can directly

contaminate lions. Furthermore, immunosuppressive disease agents such as FIV and FPV could predispose the lions to other opportunistic illnesses.

BTB appears to be a major threat to lions in some ecosystems such as Kruger National Park (KNP) (R. Bengis, pers. comm.), South Africa, and a potential one in Queen Elizabeth National Park, Uganda (M. Woodford, pers. comm.). In KNP, BTB is taking a heavy toll on lions. Sick animals are in bad physical condition, are attacked by other members of the pride, and disappear rapidly. In the Southern part of KNP, where BTB is supposed to have been introduced several decades ago (de Vos *et al.,* 2001) by domestic cattle grazing along the Crocodile river, out of 31 lions tested, all were found positive to a tuberculin skin-test, except for two cubs of approximately 5 months of age. The disease has been slowly spreading northwards in the Park, buffalo apparently acting as host, but affecting also greater kudu, cheetah and leopard (Bengis & Keet, 2001). If BTB becomes endemic in KNP, it could mean the end of its lion population, putting a stop to all export/sale of live animals to other wildlife reserves, and a stop to the opening of KNP's fence on the Mozambique and Zimbabwe borders, in order to protect these countries' cattle industry and people (Winterbach, 1998).

Lion populations affected by an epizootic disease, however, have shown remarkable resilience and potential for quick recovery, as demonstrated by the Serengeti ecosystem in Tanzania: the CDV, transmited by dogs, was considered responsible for a 33% die-off of lions in the Serengeti-Masai Mara ecosystem (Hofmann-Lehmann *et al.,* 1996), where the lion population is recovering dramatically after having been reduced by one third (Kelly, 2001).

1.2. LION VERSUS PEOPLE CONFLICTS

The African lions, as most large carnivores, require vast areas in which to roam. This tends to bring lions into direct competition with people whose need for land is increasing exponentially as human populations expand. Consequently, interactions between humans and these large predators in Africa are increasing and human-lion conflicts are intensifying accordingly. Human expansion and subsequent harassment by people have led to lions being increasingly confined to conservation areas and it is on the perimeter of these that most conflicts occur (Mills, 2000).

The interface between people and large predators in rural Africa most often consists of predation on livestock, but also of human injuries and death. This problem is particularly acute in the semi-arid rangelands of Africa where pastoralists compete with large wild herbivores and in contact with lions. Lions are dangerous predators whose existence is mostly at odds with human activities. In the mind of most rural communities in Africa, lions are considered as pests and should be eliminated. This hostility toward lion conservation is further exacerbated when local measures to prevent human-predator conflicts and to compensate the losses in livestock or human lives are absent or judged inappropriate by the affected communities. This leads to further persecution of lions by people. Different types of management measures for conflict mitigation are currently being devised and experimented in Africa. However, the apparent mutual exclusivity of lion cohabitation with people remains one of the main threats to lion conservation outside Protected Areas (Jackson, 1997).

- **Predation on livestock**

In the regions of Africa where lions occur, lion predation on livestock is reported as the main form of conflict between the predators and local people. The problem is particularly acute in semi-arid rangelands of the Sahel and Eastern and Southern Africa where human expansion and recent changes in land use practices have increased the competition between pastoralists, newly settled farmers owning livestock, and lions, especially around Protected Areas.

The following reports illustrate the extent of the problem and show that lion raiding incidents on livestock are not rare in Africa:

- In Cameroon, the lion population of Waza National Park is reported to cause serious damage to livestock, estimated annually at 700 cattle and over 1,000 small ruminants (sheep and goats). This amounts to an economic loss of around US$140,000 per year (Bauer & De Iongh, 2001).

- In Kenya, data on damage to livestock were collected for the years 1970-75 from the Kitengela Conservation Unit, an area adjoining the Southern boundary of Nairobi National Park. Fifty-eight head of livestock were killed during the study in the area (Rudnai, 1983). In Galana Ranch, over an approximately 20-year period (approx 1968-1988), lion killed about 1% of livestock per year, i.e. 250-300 head of cattle (A. Radcliffe, pers. comm.).

- In Uganda, in the vicinity of Northern Queen Elizabeth National Park, losses caused by lion predation on livestock between 1990 and 2000 are estimated at US$6,400 (Bauer & De Iongh, 2001).

- In Namibia, most of the lion population occurs in the North and North-East of the country where they are found mainly in Etosha National Park (ENP) and, to a lesser extent, in Kaudom Game Reserve, Nyae Nyae Conservancy and Western and Eastern Caprivi (Stander, 2000). With the intensive livestock farming that has developed around the borders of conservation areas, lion predation on livestock in these regions is a serious issue. Along the borders of ENP and in adjacent areas, 46 cattle, 13 goats, 8 donkeys and 3 horses were killed by lions between 1984 and 1988 (Stander, 1990). A study undertaken in the Kwando Region in East Caprivi evaluated the cost of stock raiding by lion in the area: between 1991 and 1993, the total economic value of stock losses amounted to US$9,073 (O'Connell-Rodwell *et al*., 2000). According to the same study, lions are considered as the animals inflicting the greatest financial losses to farmers, even more than crop raiding elephants.

- In Zimbabwe, a single example is given here for the sole District of Nyaminyami. During the past 3 years (1999, 2000 and 2001), a total of 32 incidents have been reported to the District wildlife officer with observed losses of 50 goats, 13 donkeys and 1 dog; 3 lions were destroyed by PAC operations during the period, with averages of 1 lion destroyed per year and 10 incidents per lion destroyed (Chamoko Snodia, pers. comm.). It must be emphasized that more incidents happen which are not registered.

The socio-economic impact of these losses is sometimes severe, but is especially hard to bear for impoverished communities with meagre income such as the Namibian Bushmen community. In the extreme North-East of Namibia, the Tsumkwe District, adjoining the

Kaudom Game Reserve, is the traditional land of the Ju/Hoan San. The Bushmen community, traditionally hunter/gatherers, resorted to small cattle farming in the early 1980s, but farming activities were low (Stander, 1997). From 1993, pastoralism intensified in the area, in the form of large-scale settlements, and the number of conflicts with lions increased dramatically (Stander, 1997). Stander (1997) reports that between January 1992 and December 1993, livestock were killed on 17 occasions. Twenty head of cattle and 5 horses (12.2% of total) were killed. 40% of the total number of villages of the Tsumkwe District suffered from livestock losses with an average annual loss by lion predation of US$18.75 for each affected village. This represents a severe drawback for subsistence farmers.

To conclude, the impact of lion predation on domestic animals is highly variable depending on the scale of the livestock operation. As mentioned above, it can be particularly devastating for small traditional farmers who depend on few livestock to sustain their living. It is thus a significant problem on a local level.

To fully grasp the growing importance of the livestock-lion conflict issue in some parts of rural SSA today, it is appropriate to review here some of the driving factors that have led to the current conflictive co-existence. These include in particular:

- **The vicinity and expansion of human settlement and activities**

In SSA, pastoralists and their livestock have co-existed with wildlife for some 7,000 years or more and it is likely that few of the tensions evident today were present in the past (Bourn & Blench, 1999). However, co-existence has become more difficult in recent times due to a combination of reasons and circumstances.

Over much of Africa, the general trend in the 20th century has been for livestock and wildlife to be managed separately. National Parks were set aside and livestock and people are excluded from the great majority of such areas in Africa today. Outside those Protected Areas, wildlife is extensively hunted and high pressure is exerted on predators as they impede human development. In the last few decades, demographic pressure in some parts of Africa has led to rural people moving progressively into wild lands that were former lion habitat. Pastoralists are gaining access to protected rangeland and villagers are farming up to park boundaries (Bourn & Blench, 1999) containing large carnivores, thereby accelerating the potential for lion attacks on livestock and sometimes people.

The periphery of conservation areas are therefore particularly exposed. This is where most of the reported clashes with lions occur. The immediate vicinity of human settlements and farmland with Protected Areas is often the direct cause of their occurrence. In some cases, local communities, living traditionally within the boundaries of the newly created park, were displaced right outside its borders. In this context, it is easy to understand that these communities object to lions coming from the park to kill their livestock and sometimes people. In addition, because of their resentment against the park system, these communities will not hesitate to intrude into the adjacent park to let their domestic animals graze. In Waza National Park, Cameroon, presence of cattle inside the park is increasing and people do not hide the fact that many of the lion predation incidents on domestic animals occur inside the park boundaries (Bauer *et al.*, 2001). This of course multiplies the possibilities of lethal encounters between lions and people and their livestock. Worse, according to Bauer *et al.* (2001), the increasing predation on cattle by lions both outside and inside the park could transform the entire lion population of the area into stock killers.

Movements of livestock and wildlife across protected areas boundaries are common in SSA as most of the areas having the largest lion populations are not fenced. In some regions, however, fences have been erected to prevent interaction of wild animals from the parks with people and livestock who live outside their boundaries, but fences are costly to maintain and are often damaged by erosion or animals like warthog. Lions can therefore move easily out of the parks to neighbouring farmlands. In other cases, surrounding communities deliberately destroy fences. In South Africa, on the border of Kruger National Park, the people of the adjacent village of Makoko were found eating roasted meat of four lions. The villagers claimed that lions coming from the park had killed eight of their cattle. According to the *South Africa's Sunday Time* of 23^{d} March 1997, which relates the incident, the villagers had taken 500 metres of the park fence for housing and crop protection (Cat News, 1997).

Another aspect of lion behaviour, which can further exacerbate human hostility toward lions and cause conflicts, is what is called "surplus killing". Similarly to some other large felids, a lion breaking into a fenced enclosure will sometimes kill many more domestic animals than it can eat (Nowell & Jackson, 1996). Nowell & Jackson (1996) refer to Guggisberg (1961) who reports that six lions killed 51 ostriches kept in an enclosure but only a small part of these animals were actually eaten.

- **Preying on humans**

The African lion also occasionally preys on people. Experts have noted that some individual animals can, in certain circumstances, develop abnormally aggressive behaviour. After several dangerous personal encounters with lions, the senior South African researcher, Ian Whyte, considers that old, sick or injured lions, or animals that have been pushed out of a pride were the animals that usually became man-eaters. "*It is generally accepted that lions avoid man because they have a great respect for him. This fear disappears however, after a lion has killed a human for the first time. Lions that are held in captivity and relocated in the wild are among the most dangerous animals in the world, purely because they have lost their fear of humans*" (CAT News, 1997).

Fatal lion attacks on local people inside or outside the perimeter of conservation areas have often been reported, however they are not always publicised. These incidents usually take place in or around areas with high lion density, such as the Kruger National Park (KNP) in South Africa or the Selous Game Reserve (SGR) in Tanzania:

- Between December 1996 and August 1997 in South Africa, at least 11 (possibly more) illegal immigrants making their way from Mozambique across the KNP on foot were killed by lions (Cat News, 1997). In March 2002, the *Star* of 4th March 2002 reports that another Mozambican immigrant was killed by a lion and the predator then dragged his body through the neighbouring town of Phalaborwa (Wildnet Africa, 2002).

- Between 1995 and 2000, some villages in Tanzania have suffered dramatic attacks by lions on people. The level of conflicts around the SGR is regarded as high with 15-30 people killed each year (V. Booth, comm. pers.). One single village, on the edge of the Selous Reserve, has had between 29 to 50 people killed a year during this period (E. Pasanisi *in* Strang, 2002). In 1999 alone, a total of 21 people were killed by lions in Southern Tanzania (J.J. Jackson, pers. comm.). However, not all the reported conflicts occur along the borders of Protected Areas. In South-eastern Tanzania human population

densities are low. Precisely because of this low human density, lion populations are widespread outside Protected Areas and the level of incidence of man-eaters in the region is high (V. Booth, pers. comm.).

- Similarly, the Luangwa Valley in the Eastern part of Zambia provides good lion habitat but it is also an area of human settlement, such as villages and cultivated areas. This situation increases the chances of conflicting encounters between lions and local people. Three fatal lion attacks on people were reported in August 1991 in the Luangwa Valley (Yamazaki & Bwalya, 1998).

- During the 1923 rainy season, 21 people were killed by a pair of lions near Po, Burkina Faso (Raynaud & Georgy, 1969).

- **Preventing or resolving conflicts**

It is apparent that locally lion predation is a significant problem in Africa, especially for rural communities with meagre resources. Domestic animals often represent the only wealth that a community has in rural Africa: (i) their milk and meat consitute a vital food component for their survival, (ii) the herd is a saving mechanism and a source of cash, (iii) the social role of livestock is of major importance in pastoralist cultures. The loss of this important resource to marauding lions represents a real hardship and understandably creates hostility towards lions and increased apathy and antagonism towards wildlife conservation *per se*. One can see here a relation between poverty alleviation and wildlife conservation success.

A common problem associated with many Parks and Reserves in Africa is the issue of cost and benefit. Local communities bear the costs of the protected area through the loss of stock due to lion predation and the opportunity costs as a result of loss of grazing and arable land. Few if any of the benefits from photographic or sport hunting tourism ever filter down to these communities. As a consequence, wildlife is illegally hunted and the Park is fraudulently used as pasture for cattle or as human settlement. More generally, with no tangible benefits to these communities, wildlife-human conflicts are intensifying and are threatening the survival of large predators inside and outside National Parks (Lichtenfeld, 2001).

Even in countries with small lion populations, the incentive to conserve the few lions left is low. For instance, Abdoulaye Kane (pers. comm.), the IUCN Country Representative in Senegal, mentioned "*a high pressure exerted by the local populations on authorities to allow and organise a lion killing campaign because of loss of domestic animals due to the lions*".

Many rural Africans have little or no sympathy for the predators. Additionally, responses from the conservation authorities to address the issues are absent or not always appropriate and compensation schemes to alleviate stock losses are often not functioning. A study carried out in 1974-75 in the areas bordering the Southern part of Nairobi National Park in Kenya showed that the Masai pastoralists who traditionally tolerated wildlife were less and less willing to suffer losses by predation without compensation. As Rudnai (1983) explains, "*while these losses may be low in statistical terms, resentment engendered by even a few kills may be out of proportion with real damage suffered, since the individuals feel they do not benefit from game in general and predators in particular, yet have to bear the brunt of the damage inflicted by wild animals. Even though compensation payment for livestock killed by lions is on the books, in practice it is virtually unavailable because of a cumbersome administration*".

Conservation strategies have recently been introduced in some African regions to alleviate lion-people conflicts by encouraging local participation in conservation. In Laikipia Plateau in Kenya, an innovative conservation project (L. Frank & R. Woodroffe) intends to reconcile local communities with predators and lions in particular. At the basis of the scheme is the development of cooperative ventures between commercial ranchers and local communities where the latter receive some of the benefits derived from commercial tourism operations. Ranchers and local communities are slowly realizing that there is more money to be made in keeping wildlife alive (Martin, 2001).

Similar schemes are being implemented successfully in Tanzania where sport hunting makes a positive contribution to the local economy. Under the new laws (Wildlife Policy of Tanzania, 1998 and the forthcoming Wildlife Management Area Regulations, 2001), benefits from trophy hunting and ecotourism go directly to local communities. Under this legislation, the communities can draw up contracts with hunting companies and lodges. In pilot projects this has proven a major incentive for villagers to conserve and protect game on their village land (V. Booth, pers. comm.). The Selous Game Ranch generated US$1.28 million in 1992 and lion generated 12%-13% of this income (Creel & Creel, 1997).

Similarly, in Namibia, a system for allowing conditional rights over wildlife and returning benefits to rural communities has been established. Through this policy, organised tourism enterprises directed at viewing or hunting lions with benefits going to pastoralists should be implemented: "*Revenue gained through lion-tourism is expected to exceed lion-related livestock losses, which will turn the large carnivores into a benefit for the communities in the Kunene region*" (Stander & Hanssen, 2001). These schemes, currently in place for the Kunene and Kaudom sub-populations (P. Stander, pers. comm.), are being designed as part of a long-term strategy to alleviate economic losses from lion predation and reduce indiscriminate persecution of lions by farmers outside Protected Areas.

Ultimately, the survival of wildlife and lion in particular depends on their acceptance by the people who must share their habitat. However, when the cost of cohabitation is high and compensation is low, there is little or no incentive for conservation. As Stander (1997) explains, "*the future of large carnivores outside conservation areas in Africa depends on the views and aspirations of the local people. Only when the local inhabitants…have a particular interest in conserving large carnivores will their future be ensured*".

- **Long-term threat to lion conservation**

While human/lion conflicts may have little effect upon high-density lion populations, the impact on smaller or fragmented lion populations that are vulnerable can be significant with additional factors such as low density or the aridity of habitats with low prey density exacerbating the effects. Stander (1997) considers that due to the intensity of pastoralism in the vicinity of Kaudom Game Reserve in Namibia, on the border with Botswana, by the end of 1995, almost all of the 27 lions present in the area had been killed: "*considering some basic ecological characteristics, such as a) low lion density, b) large home ranges, c) the relatively small size of the Reserve, and d) intensity of pastoralism on the borders, the conflicts are expected to have a catastrophic effect on this lion population*".

The prevention and resolution of human/lion conflicts is a complex problem and requires a holistic approach. Solving this problem is not the purpose of the present study and therefore only some of the main issues are outlined here.

- **Problem lion control**

The first direct response to lion-human conflict is the destruction of the offending lions by farmers and other affected local people. Lions are shot, trapped or poisoned to prevent further damaging incursions of the predators on their lands. A frequently used method of killing lions that have been raiding livestock is through the use of poisons either agricultural or natural. Farmers, particularly pastoralists in some areas have used this to great effect, even eradicating lions in some areas, as well as indiscriminately affecting other carnivores including birds. Given the availability of chemical pesticides in rural Africa today this is a serious threat to many populations. In most of SSA, it is legal to kill lions when they attack domestic animals or people. Official Problem Animal Control (PAC, *battues administratives*) is the responsibility of the wildlife authorities.

In the Pan region in Botswana, an average of seven lions are killed per year through PAC, which amounted to 14% per annum of the sub-population in 1999-2000. An average of 25 lions per year are killed in the Okavango Delta through PAC, which is less than 2% of the sub-population (V. Booth, pers. comm.). In Botswana, in August 2000, the Department of Wildlife and National Parks (DWNP) prohibited lion control and set a zero quota for trophy hunting for one year. According to Sarel van der Merwe (pers. comm.), chairman of the African Lion Working Group of the IUCN/SSC, reports from the Makgadikgadi Pan National Park already indicate that, as a result of clashes between lions and livestock owners, lions are now being illegally poisoned, snared and shot without these incidents being reported to the DWNP.

According to P. Funston (pers. comm.), in the areas bordering the Kgalagadi Transfrontier Park, angry South African and Botswana farmers eliminated 93 lions over a period of 4 years up to 2001, in response to losses due to lion predation. Although the Kalahari lion population would easily sustain the off-take (Funston, 2001), it does demonstrate the nature and size of the problem.

In Namibia, around Etosha N.P. alone, more than 30 lions are killed every year through PAC activities (Stander, 2000). This is confirmed by the Namibian Government biologist, Hu Berry (1996), who reports that during the period 1965-94, more than 1,000 lions were destroyed on farmlands bordering Etosha (Etosha Ecological Institute records). He further indicates that the number of animals killed may have been higher because before 1995, farmers were not legally bound to report the killing of lions to the administration. In the Caprivi, an average of 7.2 lions have been shot each year, for the last 5 years (P. Stander, pers. comm.).

In Galana Ranch in Kenya, between 1968 and 1988, persistent stock raiding lions were shot, and roughly 1 lion was shot for every 10 cattle killed. Approximately 25 lions per year were shot out of a stable population of 150. In the period 1988-1990 the Government prohibited the use of firearms, and numbers of livestock killed rose to roughly 250 to 800 per year; with approximately 70% of the stock raiding lions being young males. Around 1990, the ranch was handed over to ADC, a parastatal company, who now uses poison to control stock raiding lions (A. Radcliffe, pers. comm.).

Several non-lethal management options are also currently being tested and implemented. When it is deemed unnecessary to kill stock-raiding lions, they are either lured back into their normal range or translocated away from the area. The process involves capturing a specific, problem-causing lion alive in the area of conflict, transporting it to another area and releasing it (Linnell *et al.*, 1997). Translocation has been experimented with mixed results in Namibia (Stander, 1990). Extensive research on translocations of problem lions showed that this does not solve problems nor reduce the conflicts (Stander, 1990). When conflict persists, lions are generally destroyed (V. Booth, pers. comm.).

- **Improving management strategies**

Other methods employed besides removing the offending animals, consist of simply excluding lions through management practices. Erecting electric fences between conservation areas and densely populated human zones or farmlands can be an effective way to keep the lions away from humans (Yamazaki & Bwalya, 1999). On their side, cattle raisers have a responsibility to implement sound stock management practices to protect their animals from lion predation. Simple measures such as erecting lion-proof shelters for livestock at night can make a big difference (Mills, 2000). Changes in modern society also affect traditional husbandry methods, for instance, in rural Namibia, young boys used to protect herds at night. However, with the independence of Namibia in 1991 and increased access to schools, herds are now left unattended at night and they wander into predator areas (O'Connel-Rodwell *et al.*, 2000).

- **Financial compensation**

Financial compensation for losses resulting from lion predation can be the final step and a way to encourage local people to tolerate lions' presence. Compensation can be an effective tool when it is not abused (Nowell & Jackson, 1996). However, while it may be feasible to assess the level of livestock losses, the exercise relates to values which can only be accounted for with great difficulty in the case of loss of human life. Generally speaking, lethal and non-lethal control options for lion conflict resolution are costly. The system of compensation requires that the central wildlife authorities have the appropriate financial resources and the capacity to implement the scheme. This can be a major impediment for conflict resolution in African countries where budgets for conservation are low.

However, compensation is essentially a negative payment. It does little to remove the over-riding conflict of interest between local peoples' development aspirations and the conservation of lions. Ultimately, measures consisting of creating or increasing the value of lions to local people through ecotourism and hunting operations while ensuring that the benefits from such operations accrue to local communities might be a suitable option to alleviate conflicts and to improve people's perception of the predators, thus creating the local incentive to conserve lion populations.

2. LION AS A RESOURCE

Game viewing is often presented as "non-consumptive" use whereas other forms of use such as tourist hunting or live sales are presented as "consumptive" use. This distinction is certainly Manichaean and even possibly invalid as has been pointed out by the Southern Africa Sustainable Use Specialist Group of IUCN/SSC (SA/SUSG, undated): "*many uses which are non-consumptive at the level of the individual are consumptive at the level of the ecosystem. By the same token, certain uses which are consumptive of individuals are non-consumptive at the ecosystem level. Our primary concern is that use be sustainable at the level of the ecosystem".* However, despite its obvious ambiguity, the distinction between "non-consumptive" and "consumptive" is nonetheless used here because it is easily understandable and widely accepted.

Game viewing and tourist hunting are often presented as being exclusive one from the other. This is not always the case. There are many examples where both activities are carried out side-by-side, together with trekking, wildlife-watching and live capture. One of the best example is the outstanding Pilanesberg Reserve, South Africa, where all these activities are carried out simultaneously with great success in a small area. Even though less spectacular, many other cases exist, particularly in Southern African countries such as Botswana: *"...a combination of photographic and hunting safaris ensure the economic viability of the Wildlife Management Areas in Botswana in a way that neither can achieve on their own*" (Van der Merwe, 2001).

The income generated specifically by lions is poorly documented and publicised. Regardless of the distinction between consumptive and non-consumptive use, lions bring foreign currency through tourist wildlife viewing and consumptive tourist hunting as well as live sales. There are also non-monetary benefits due to (i) the key role lions play in the ecosystem and (ii) the spiritual value of the lion in local cultures.

TABLE 24 - STATUS OF LION USE IN WESTERN AFRICA

N° sub-population	Country	Consumptive use				Non-consumptive use	
		Hunting		Lion hunting			
		Local hunting	Tourist hunting	Local lion hunting	Tourist lion hunting	Wildlife viewing*	Lion viewing**
1	Mauritania	closed	small & medium game	closed		0	0
	Gambia	closed	small & medium game	closed		0	0
	Senegal	open	small, medium & big game	closed	open	1	0
	Guinea Bissau	open	small, medium & big game	closed	closed	0	0
	Guinea	open	small game	closed	closed	0	0
	Mali	open	small & medium game	closed	closed	0	0
	Sierra Leone			closed	closed	0	0
	Liberia			closed	closed	0	0
	Sub-total 1	**4**	**6**	**0**	**1**		
2	Cote d'Ivoire	closed	closed (due to reopen)	closed	closed	1	1
	Ghana	closed	big game limited to special licenses	closed	closed	2	0
	Sub-total 2	**0**	**1**	**0**	**0**		
3	Burkina Faso	open	small, medium & big game	open	open	2	2
	Togo	closed	limited authorization	closed	closed	0	0
	Benin	open	small, medium & big game	open	open	2	1
	Niger	closed	temporarily closed	closed	closed	2	1
	Nigeria	closed	closed	closed	closed	2	1
	Sub-total 3	**2**	**3**	**2**	**2**		
Total n° countries (out of 15)		**6**	**10**	**2**	**3**		

* *quality of current wildlife viewing (rating from 0 to 3)*

** *quality of current lion viewing (rating from 0 to 3)*

TABLE 25 - STATUS OF LION USE IN CENTRAL AFRICA

N° sub-population	Country	Consumptive use				Non-consumptive use	
		Hunting		Lion hunting			
		Local hunting	Tourist hunting	Local lion hunting	Tourist lion hunting	Wildlife viewing*	Lion viewing**
4	Nigeria	closed	closed			2	1
	Cameroon	open	small, medium & big game	closed	open	3	2
	Sub-total 4	**1**	**1**	**0**	**1**		
5	Chad	closed	small, medium & big game	closed	open	3	3
	C.A.R.	open	small, medium & big game	open	open***	3	3
	Sudan	closed	closed	closed	closed	0	0
	R.D.C.	closed	closed	closed	closed	0	0
	Sub-total 5	**1**	**2**	**1**	**2**		
6	Equatorial Guinea	closed	closed			0	0
	Gabon		closed	closed	closed	2	0
	Congo		closed	closed	closed	2	0
	Sub-total 6	**1**	**0**	**0**	**0**		
Total n° countries (out of 9)		**3**	**3**	**1**	**3**		

** quality of current wildlife viewing (rating from 0 to 3)*
*** quality of current lion viewing (rating from 0 to 3)*
**** quota 0 for the hunting season 2002*

TABLE 26 - STATUS OF LION USE IN EASTERN AFRICA

Country	Consumptive use				Non-consumptive use rate	
	Hunting		Lion hunting			
	Local hunting	Tourist hunting	Local lion hunting*	Tourist lion hunting	Wildlife viewing**	Lion viewing***
Sudan		closed			0	0
Uganda		open (2002)			2	1
Ethiopia	tolerated	open (2002)	closed	open	3	1-2
Kenya	closed	restricted to gamebirds only	closed		3	3
Somalia					0	0
Tanzania	open	open	closed	open	3	3
Rwanda	closed	closed			2	1
Burundi	closed	closed			0	0
Total (8 countries)	**2 open**	**3 open**		**2 open**		

* *except for problem animals*

** *quality of current wildife viewing (rating 0 to 3)*

*** *quality of current lion viewing (rating 0 to 3)*

TABLE 27 - STATUS OF LION USE IN SOUTHERN AFRICA

Country	Consumptive use				Non-consumptive use	
	Hunting		Lion hunting			
	Local hunting	Tourist hunting	Local lion hunting*	Tourist lion hunting	Wildlife viewing**	Lion viewing***
Angola		closed			0	0
Botswana	closed	open	closed	temp. closed	3	3
South Africa	open	open	closed	open	3	3
Namibia	open	open	closed	open	3	3
Zimbabwe	closed	open	closed	open	3	3
Malawi	closed	closed				
Zambia	open	open		open	3	3
Mozambique		open		open	2	1
Total (8 countries)	**3 open**	**6 open**		**5 open**		

* *except for problem animals*

** *quality of current wildife viewing (rating 0 to 3)*

*** *quality of current lion viewing (rating 0 to 3)*

2.1. LION VIEWING TOURISM

- *Western Africa*

The tourist infrastructures and trade are not well developed in this region, and wildlife-based tourism is considerably under-developed, as compared to other regions. The reasons are climatic as well as economic, in comparison with competition from Eastern and Southern Africa.

However, out of the 15 countries of the region, 7 (half) have been identified as having significant wildlife viewing, of which 5 allow some lion viewing. The two countries where one has the best chance to actually see lions in the region are (i) Burkina Faso and (ii) Benin (Table 24).

- *Central Africa*

Similarly to Western Africa, the tourist infrastructures and trade are not well developed in this region, and wildlife-based tourism is considerably under-evaluated.

However, out of the 9 countries of the region, 6 (two thirds) have been identified as offering significant wildlife viewing possibilities, of which 4 allow some lion viewing. The three countries where one has the best chance to observe lions in the region are (i) Cameroon, (ii) CAR and (iii) Chad (Table 25). It is too poorly publicised that lions are indeed quite easy to see by tourists in those last three countries, with a relatively high lion observation rate, as compared to other countries.

- *Eastern Africa*

Out of the 8 countries of the region, 5 (two thirds) have been identified as having significant wildlife viewing, all of them allowing some lion viewing. The two countries where one has the best chance to view lions in the region are (i) Kenya and (ii) Tanzania (Table 26).

In Kenya, the lion is recognised as one of the first wildlife viewing attractions (Thresher, 1981).

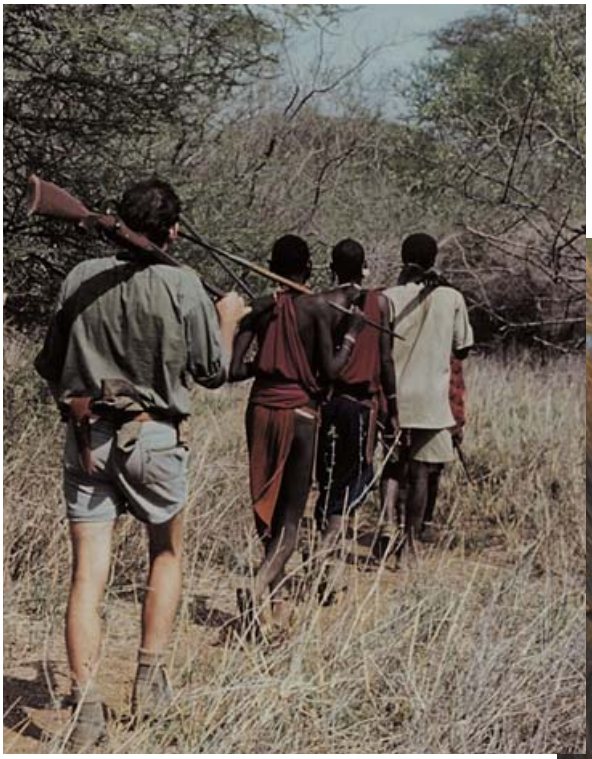
In Tanzania, lions are a major attraction in Protected Areas, particularly in the Northern tourist circuit (Serengeti, Lake Manyara and Tarangire National Parks, Ngorongoro Crater Conservation Area), but also in the Southern tourist circuit (Selous Game Reserve, Mikumi and Ruaha National Parks). The economic impact of tourism is certainly positive, but heavy non-consumptive pressure in some highly frequented areas is thought to adversely affect lions. Lion populations in Tanzania are also subject to research studies due to their easy accessibility.

- *Southern Africa*

Out of the 8 countries of the region, 6 (three quarters) have been identified as having significant wildlife viewing, all of them allowing some lion viewing. Five out of six offer a good chance to view lions (Table 27).

Lion viewing, Ngorongoro crater (Photo : S. Darroze).

South Africa Banknote (Photo : O. Buttin).



Lion hunting, Masailand (Photo : D. Roques Rogery).

Lion skull, Benin (Photo : O. Buttin).

In Botswana, there is a policy of low volume, high priced ecotourism and lions are a major draw card for tourists in the National Parks. Photographic tourism is concentrated in the areas with perennial water, i.e. the Okavango Delta and along the Linyanti/Chobe rivers. There are virtually no photographic camps in the dry areas of Northern Botswana and a limited number of camps in Central and Southern Botswana. In the Northern regions, the current ecotourism use is beneficial due to income generation. The Central regions presently have a low rate of ecotourism use that has little or no impact on lion conservation. There is a beneficial impact on lion conservation in the Southern Kalahari/Kgalagadi Region. The economic viability of community based Wildlife Management Areas in Southern Botswana (KD/1 and KD/2) depends on a sustainable lion hunting quota because of the low value of the areas for photographic tourism. No bids were received for photographic tourism in the KD/1 and KD/2 tenders until a lion hunting quota was allocated to these areas. If these areas return again to not being economically viable, the communities would no doubt want to change their pattern of land use from wildlife to livestock (P. Funston & C. Winterbach, pers. comm.).

In Malawi, active and good quality ecotourism is regarded as a positive factor in wildlife protection, but only a minute number of lions are present in this heavily populated country. The positive effect of ecotourism on lions is most noticeable in Liwonde National Park where a large and active game lodge at Mvuu Camp is central to the country's most successful wildlife protection efforts. Two immigrant lions have established themselves within the last year, presumably originating from Mozambique (T. Ferrar, pers. comm.). The tourism camp in Liwonde NP provides considerable benefits to local communities and to the conservation agencies and NGOs active in the area. It is the largest tourism operation in any of the Parks holding lions. A much smaller tourism operation at Vwaza Marsh Wildlife Reserve also has a beneficial effect on wildlife around Lake Kazuni, including lions.

In Zimbabwe, non-consumptive use of lion consists of wildlife viewing and wildlife photography:

- In State lands: National Parks and some other Protected Areas such as Matetsi Hunting Blocks;
- In some communal lands on the Kariba lake shore and in the Zambezi valley, and;
- Less so in private lands, except for a few conservancies.

The wildlife viewing tourism has declined steeply since 2000 following civil unrest, and currently, non-consumptive tourism is at a low level while tourist hunting is remaining quite stable.

In South Africa, most game reserves have tourism infrastructure and lions form an important component of the wildlife experience and serve as a major draw card for tourists to the Parks and Reserves. In general, the impact of use on lion conservation is positive in South Africa as this is a mechanism by which revenue is created. In Kwandwe, the reintroduction of lions will be beneficial provided the lions prey on the common species and do not kill the disease-free buffalo and black rhino. Currently at Kwandwe, the lions are feeding on the endemic and abundant kudu and warthog populations.

2.2. LION HUNTING

Several modes of hunting are practised in SSA, however two main categories are presented here:

(i) Local hunting which is understood as the offtake of lions by local communities for various purposes, either positive (source of any kind of benefit including social and cultural) or negative (e.g. destruction of problem animals) and;
(ii) Tourist hunting considered as the cropping of lion (essentially adult males) for sport and trophy collection by tourist hunters, either resident or expatriates.

- **Local hunting**

- *Western Africa*

In Western Africa there is probably relatively little local lion hunting occurring, although pastoralists may shoot or poison lions in order to protect their stock. But not much data is available about the overall effects of local hunting in the region. Data is sparse in this area, which may account for the small number of lions hunted each year.

- *Central Africa*

The situation of Central Africa may be slightly different from that of West Africa, in that more lions occur as well as more lion depredation. Very little quantitative data is available. However it is safe to assume that a number of lions are killed each year in defence of stock, especially in situations where transient cattle-herders enter into Protected Areas.

- *Eastern Africa*

In Kenya, there are widespread traditional cultural uses, notably of lions speared. In the Masai communities, when a particularly large-maned lion is killed, the mane is taken and used at ceremonies or hung upon the warrior's village flag pole. When a lion is killed, the tail is cut off and becomes the property of the warrior who put the first spear in. After the initial celebrations this tail is discarded. Paws are also cut off and used in the celebrations and then also discarded. Paws and teeth appear not to be kept. In the case of poisoning nothing is taken (A. Radcliffe, pers. comm.).

- *Southern Africa*

The lion does not appear as a common major species for local hunting in this region. However, more in-depth studies are needed to explore this interesting subject.

- **Tourist hunting**

- *Sub-Saharan Africa*

In SSA, out of 32 countries which are permanent lion Range States, a total of 13 countries (40%) operate lion tourist hunting activities (Tables 24, 25, 26, 27).

In 2001, the Executive Director of UNEP, Dr. Klaus Töpfer, declared: "*The sustainable utilisation of wild animals through trophy hunting offers economic incentives to the local rural population, reduces poaching and offers incentives to conserve critical habitat*". Tourist hunting has quite different characteristics from other forms of off-take in that the harvest is usually confined to a relatively minute segment of the population so that the impact on the population is very small (Bell & McShane-Caluzi, 1984). In most cases, it is preferable to

control lion numbers by trophy hunting, which provides a source of revenue which can then be allocated to wildlife conservation, rather than by poisoning, culling or PAC, which costs money and is a waste of the resource, giving no revenue to rural people.

The closure of all hunting, or only lion hunting, in a few countries, suppresses much needed income from nature-oriented activities in huge tracts of natural habitats which are unsuitable areas for photographic safaris (often several million hectares of wilderness) and consequently gives place to alternative activities which are detrimental to the whole biodiversity, e.g. agriculture or excessive grazing by domestic stock.

Lion hunting quotas should be allocated yearly, based on the knowledge of wildlife managers in the field, since lion populations can vary considerably from one year to the next, with a large increase if food is abundant or with a significant decrease in case of disease, excessive offtake or low abundance of prey. Quotas can then be adjusted accordingly (Table 28).

TABLE 28 - SUGGESTED LION QUOTA (% OF LION POPULATION PER YEAR)

Category	Maximum offtake (%)		Source
	Max. sustainable off.	Max. sport hunting off.	
Lioness	6	3	WWF, 1997
Male lion	6	5	WWF, 1997
Mature male lions	10		Greene *et al.* (1998) *in* Loveridge, 2002
	2-3		Creel & Creel (1997) *in* Loveridge, 2002
Total lion population	8		Jachmann, 2001
	10		Cumming *in* Bell & McShane-Caluzi (eds.), 1984

- *Western Africa*

Out of 15 countries in the Western Africa region, 3 countries (one fifth) allow lion tourist hunting (Table 24).

In this region, the lion is not the main species sought after by tourist hunters who preferably look for buffalo, roan, hartebeest and medium-size game. However, (i) to hunt other species in lion habitat, (ii) the little although real chance to see a lion during a hunting party, (iii) and the even smaller chance to collect a lion trophy, remain a powerful attraction for the tourism hunting market in these countries. When booking a hunting trip, the tourist hunter is not only buying a hunt he is also dreaming of the whole atmosphere and of remote opportunities of approaching flagship and charismatic animals such as lion.

The average total number of adult male lions taken by tourist hunters in the Western Africa region is about 18.5 per year (Table 29). The first destination for lion tourist hunting in Western Africa is Burkina Faso with a stable number of 12 animals collected per year on a regular basis since now 20 years, which is a good indication of an appropriate quota allocation system.

In the region, only one out of 16 tourist hunters is lucky enough to collect a lion, which is a rough assessment, since not all big game hunters are pursuing lion.

The total hunting area necessary to collect a single lion is about 26,000 km², the actual surface area hunted for lion being 14,000 km² per lion collected.

TABLE 29 - LION TOURIST HUNTING IN WESTERN AFRICA

		Senegal	Burkina Faso	Benin	Total Western Africa
Average lion offtake per year	**Number of individuals**	1	12	5.5	18.5
	% out of estimated population	3.2	2.8	2.2	
Big game tourist hunting	**Number of licenses per year**	15	200	80	295
	Average duration of a hunting safari (days)	6	6	9	
Surface (km²)	**Total hunting area**	13,080	7,500	5,100	25,680
	Area hunted for lion	2,000	7,500	4,500	14,000
Hunting success rates (n° of lions hunted)	**Per license & per day**	0.011	0.010	0.008	
	Per 100 km²	0.05	0.16	0.12	

- *Central Africa*

Out of the 9 countries in the Central Africa region, 3 countries (one third) allow lion tourist hunting (Table 25).

In this region, the lion is playing a similar role for tourist hunting as in the Western African region. The lion is not the main species sought after by tourist hunters who preferably look after elephant, giant eland, bongo, buffalo, roan, hartebeest, korrigum and medium-sized game.

The average total number of adult male lions taken by tourist hunters in the Central Africa region is about 17.4 per year, a number comparable to that of Western Africa (Table 30), so that the total number of lions taken by tourist hunters in the whole Western and Central Africa regions reaches about 36 animals per year.

The first destination for lion tourist hunting in Central Africa is Cameroon with a steady number of 9 animals collected per year on a regular basis over the last 20 years, which is an indication of a conservative quota allocation system.

In the region, only one out of 18 tourist hunters is lucky enough to collect a lion, which is a rough assessment, since not all big game hunters are searching for lions.

The total hunting area necessary to collect a single lion is about 59,000 km², the actual surface area hunted for lion being 34,000 km² per lion collected.

TABLE 30 - LION TOURIST HUNTING IN CENTRAL AFRICA

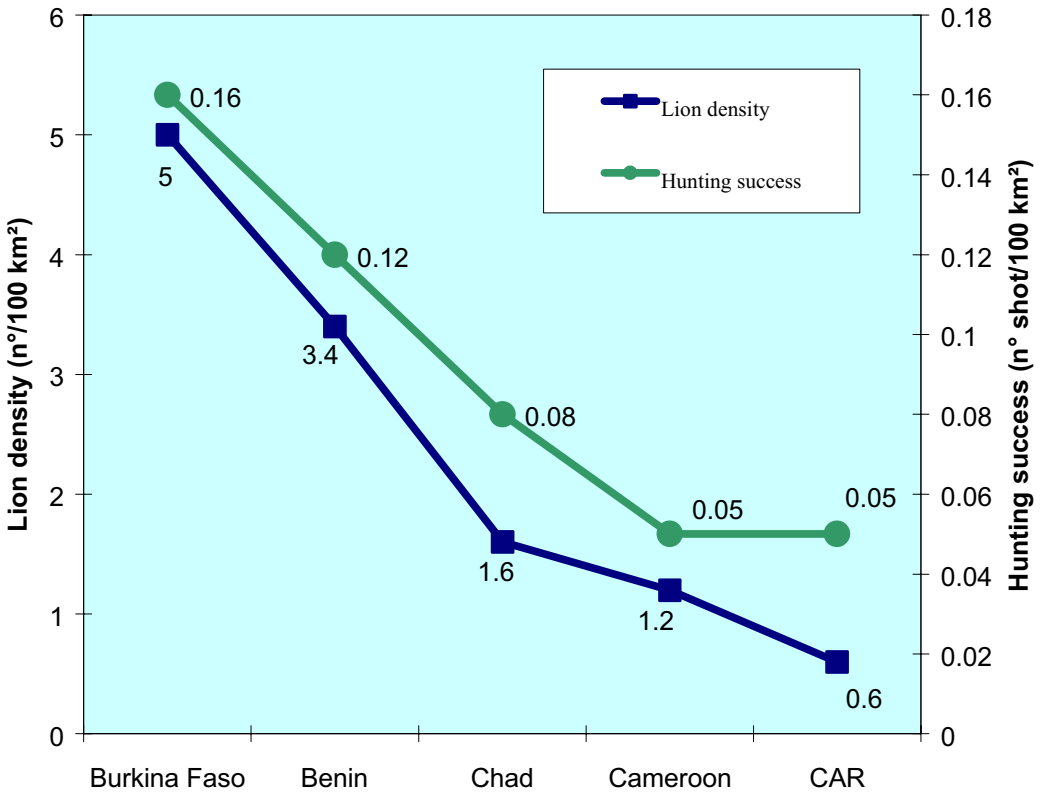
		Cameroon	Chad	C.A.R.	Total Central Africa
Average lion offtake per year	**Number of individuals**	9.4	3	5	17.4
	% out of estimated population	2.7	3.2	2.8	
Big game tourist hunting	**Number of licences per year**	150	10	150	310
	Average duration of a hunting safari (days)	12	10	13	
Surface (km²)	**Total hunting area**	23,000	6,000	30,000	59,000
	Area hunted for lion	20,000	4,000	10,000	34,000
Hunting success rates (n° of lions hunted)	**Per licence & per day**	0.005	0.030	0.003	
	Per 100 km²	0.05	0.08	0.05	

Lion hunting results in Western and Central Africa (Tables 20 & 30) provide interesting parameters to evaluate lion densities. Measuring the catch-per-unit effort (CPUE) is one way of assessing lion densities when the hunting efforts are stable year after year. In five countries where lion hunting is conducted, the lion density has been respectively compared with the lion hunting success (number of lions trophy-hunted per 100 km²) (Figure 6). The comparison is based on the following facts:

- The number of lions hunted is the average of the last 10 years (Benin) or 20 years (Burkina Faso) years, except for Chad (several years);
- The number of hunters is much higher than the number of lions hunted;
- The number of hunters is roughly stable, and;
- The number of hunting days per hunter is constant over the years.

Basically, the hunting effort may be considered as constant. In sustainable conditions, the 2 curves are closely parallel, which is the case for Burkina Faso, Benin and Cameroon. When the hunting pressure increases, the two curves diverge, which is the case for CAR and Chad. At this stage it may be useful to remind that an increase of hunting pressure may result from either an increasing total number of hunting days with a stable lion population, or a decreasing number of lions (for one reason or another) with a stable number of hunting days.

FIG. 6 - LION DENSITY AND HUNTING SUCCESS IN WESTERN AND CENTRAL AFRICA



- *Eastern Africa*

Out of 8 countries in the Eastern Africa region, 2 countries only (one quarter) allow lion tourist hunting (Table 26).

In Tanzania, consumptive use is not allowed in National Parks and in some Reserves (Mkomasi, Saadani). The major form of consumptive use is through trophy hunting by tourists, but lions are also destroyed through problem animal control (PAC) which is carried out by wildlife officials. Lions are also poisoned by herdsmen, and get caught in snares laid by poachers for other animals. Tourist hunters operate in allocated Hunting Blocks. Currently around 110 Hunting Blocks are being utilised (the number of Hunting Blocks varies slightly from year to year). The overall quota of lions is around 500 per year (516 in 1996). The trophy hunting offtake is around 50 % of the quota: on the average 250 lions are taken every year in Tanzania (236 in 1996). This offtake appears to be sustainable, as hunting success has remained fairly even since safari hunting was fully re-established in the late 1980's. The tourist hunting quotas are set for each species allowed to be hunted during the year for each Hunting Block. However, as hunting permits are issued on a block basis, hunting success varies between blocks depending on the occurrence and distribution of lions, which in turn depends on a multitude of environmental factors and can thus fluctuate from year to year. Unless problems as to the availability of lions and hunting success are reported, the same quota will be issued for the following season. This method implies that when there are problems reported from certain Hunting Blocks, such as sickness amongst the lions or non-availability of trophy males, the quota is adjusted downwards depending on local population dynamics. In some cases additional animals have been added to the quota in particular blocks.

In Tanzania, sport hunting generally makes a positive contribution to the local economy. Under the new laws (Wildlife Policy of Tanzania, WPT, 1998 and the new Wildlife Management Area (WMA) Regulations, 2001), benefits from trophy hunting and ecotourism will go directly to the local communities. Under these new laws, local communities can draw up contracts with hunting companies and lodges etc. In pilot projects this has proven a major incentive for villagers to conserve and protect game on their village land. Giving wildlife an economic value from the perspective of the primary stakeholders namely the villagers encourages sustainable management of the resource. At the same time socio-economic development is furthered, as more cash is available in the village, villagers are empowered and management capabilities strengthened. The Selous Game Reserve generated US$1.28 million in 1992. Lions generated 12% - 13% of this income (Creel & Creel, 1997).

In Somalia, tourist hunting was reported to occur during Siad Barre's regime up until 1991 with hunters coming from the Arab States. The continuing civil unrest in Somalia has reportedly stopped such hunting.

- *Southern Africa*

Out of 8 countries in the Southern Africa region, 5 countries (two thirds) allow lion tourist hunting (Table 27). In the Southern African region, tourist hunting is often the main source of profit generated by wildlife (Luxmoore, 1985).

In Namibia, the national total quota ranges between 0.4 and 0.9% of the overall lion population. Local quotas do not exceed 5% of the adult and sub-adult numbers. Trophy hunting quotas exist for Kaudom (Nyae Nyae Conservancy) and Caprivi sub-populations:

. Kaudom has a mean annual quota of between 0.7, which represents about 2.2% of the population (1997-2001), and;
. Caprivi has a mean annual hunting quota of 1.4, which is about 2.8% of the population (1996-2001).

In Namibia, lion quotas are often set based on the frequency of problems experienced with lions. According to P. Stander (pers. comm.), trophy hunting in this country does not have a measurable impact on lion conservation. An attempt is being made to involve local communities and redirect financial benefits from trophy hunting fees to curb losses due to lion predation on their livestock.

In Botswana, trophy hunting of lions with no baiting is traditionally allowed at a national level. Generally trophy hunting takes place in the areas less suitable for photographic safaris. Sustainable trophy hunting and problem animal control take place in the Okavango Delta. Lion survey data are used to set quotas in the Okavango Delta Wildlife Management Areas. The quota, set at less than 1% offtake for trophy hunting in the Okavango Delta, is determined by the DWNP. Problem animal control along the boundaries of Protected Areas (National Parks, Game Reserves and Wildlife Management Areas combined) forms the largest part of the offtake. Hunting of lion in the Dry North is considered not sustainable and the quota is to be reviewed after a proper survey has been conducted to ensure sustainability. There is no trophy quota in the Pans region, but problem animal control was not thought to be sustainable. A lion PAC and lion hunting ban was imposed in November 2000. The following sport hunting quotas were given for the year 2000:

- Okavango Delta:	12
- Linyanti/Chobe river:	3
- Dry North:	14
- Pans:	0
- Central and Southern Botswana:	10
Total (national):	39

In Botswana, commercial photographic and multiple use Wildlife Management Areas are on 15-year leases. An annual fee is paid to the Government and a resource utilisation fee to the local Government. Community Wildlife Management Areas with a Community Trust Fund are leased to operators or communities engaging in joint ventures with operators. A resource fee is paid to local Government. A trophy hunting licence fee is paid to Government. Financial benefits are not enough to accrue to the conservation body. Photographic camps and hunting camps are, however, the largest job providers. The Northern Region's economy is driven by tourism.

In South Africa, very limited hunting of lion takes place in Krugerís surrounding reserves. Quotas are based on advisory committee meetings with limited availabilty of data. In Mpumalanga Parks, offtake is reactive. The only offtake of lions in Hluhluwe-Umfolozi is for research purposes when animals are sick or in poor condition. The removals in the North West Parks are sporadic and no fixed annual quota exists for lion but rather animals are made available for hunting to achieve various management objectives. In such cases individual animals are identified for removal and then tendered to hunting operators who then offer a ìclassic huntî within the reserve (less than one lion per year on average). In South Africa, North West Parks and Hluhluwe-Umfolozi (Kwazulu-Natal) achieve their various management objectives through lion utilization. Very limited benefits are derived from lion

utilization in Mpumalanga Parks. Phinda gains exposure through their relocation programmes and revenue is derived (although lions are donated to state-owned reserves). In Kwandwe and Shamwari, lions are flagship species and essential for photographic tourism operations. Without them, benefits through revenue generation would be severely reduced as tourists want to see the 'Big 5".

In Zimbabwe, consumptive use mainly consists of trophy hunting mostly by foreign tourists, but also for problem animal control. Skins and skulls are taken as trophies. During the year 2000, foreign hunters paid a total of US$1,859,932 to the safari operators who conducted the hunts, for a total of 91 lions trophy-hunted. Lions account for only about 2% of sport hunting revenue earned by Rural District Councils in those Communal Lands where CAMPFIRE programmes operate (Bond, 1994). No precise data are currently available on the total annual offtake of lions, apart from the animals collected by tourist hunters. Therefore, no opinion can be offered on the sustainability of the annual offtake of lions, but quotas give an upper limit. At present, there is no evidence that consumptive and/or non-consumptive uses are having any measurable impact on the number of lions in Zimbabwe (V. Booth, pers. comm.). Lion sport hunting quotas for Parks and Wild Life Estate, Forest Lands and Communal Lands for the year 2002 were the following (N. Masulani, pers. comm.):

- Unflooded Middle Zambezi Valley:	40
- Sebungwe:	17
- North-west Matabeleland:	66
- South-east Lowveld:	12
- Southern Zimbabwe:	4
Total (national):	139

The quotas for year 2000 were reportedly similar to that planned for 2002 (above) (N. Masulani, pers. comm.). The quotas for 2001 were reported to have been 224 (N. Monk, pers. comm.). It is doubtful that the variation in these numbers actually closely reflects a variation in the number of lions:

- In the Parks and Wildlife Estate, the Department of National Parks and Wildlife Management (DNPWM) sets sport hunting quotas after consultation with stakeholders. Information that is considered during quota setting includes: survey results (if any), the perceived trend in lion numbers, trophy quality and animal condition data (if any) during the previous year, and stakeholders' opinions on lion numbers and trends;
- In the Communal Areas, the appropriate authority proposes sport hunting quotas, which are then sent to that DNPWM for approval, and;
- On privately owned land, sport-hunting quotas are proposed by the landowner and then sent to the DNPWM for approval.

In Zambia, interest in lion from safari hunters is substantial and growing. Over the 1995-2000 period, lions have been hunted successfully in the prime, secondary and even some of the under-stocked Game Management Areas (GMA's). It is interesting to note that fewer licences for lion were issued than were available on quota. Hunting pressure on lion and their prey (plains game species) in the GMA's is largely seasonal. Poor access by road and even on foot (particularly in the floodplain areas), dense vegetation, and the dispersed nature of wildlife populations during the wet season months between December and May, largely preclude successful hunting of lion and their prey during this period. In contrast, throughout the dry

season months, hunting pressure on lion and other species is sustained at high levels, not only from safari hunting, but also through hunting by Special Licence (often not accountable against quotas), local hunting, poaching and snaring activity. With many GMA's sharing boundaries with the principal National Parks, particularly along the major rivers, this hunting activity continues right along the boundaries of the National Parks. The total number of lions hunted in 2000 amounted to 78. In Zambia, based on more than 20 years' experience, it is estimated that trophy male offtake quotas can be set up to 8 % of the adult lion population, in order to obtain the best male trophy quality (Jachmann, 2001). The quotas allocated for safari and resident hunting are broadly based on prior hunting success rates, but in some cases purely on levels of demand. Systematic assessments of hunting returns can and have been used fairly successfully by the authorities to determine sustainable hunting quotas, but this procedure is likely to have lapsed in recent years during the process of institutional changes in the wildlife authorities (R. Jeffery, pers. comm.; J. Pope, pers. comm.).

In Malawi, no sport or trophy hunting of lions is permitted and none has been considered for many years, since lions are scarce in this country.

2.3. LION TRADE

An attempt is made to investigate the possible impact of both existing national and international trade in lion products.

- **Domestic trade**

There appears to be very little poaching activity specifically aimed at lions. However, lions are indirectly at risk as a result of illegal snaring operations, which are targeting large ungulates, and some lions will inevitably get caught accidentally. As discussed before, lions are also destroyed by cattle-herders for protection purposes and their by-products may then appear on the market. One can find a few skulls, skins and claws, mainly for medicinal or cultural purposes (the lion still carries a strong socio-cultural image for a number of ethnic groups), on local markets in Africa, but they are probably mainly by-products of poached stock-raiding lions. As far as lion is concerned, there is no evidence of any large-scale demand driven commercial activity such as is seen in the trade in tiger bones in Asia.

At the national level, there is practically no trade in lions or their products, with the exception in Southern Africa of some trade in live animals for translocation purposes from one wildlife reserve to another (reinforcement, reintroduction or even introduction).

- *Western and Central Africa*

In this region a few lion products may be seen exposed on local markets here and there, but never in large numbers. Claws are the most widespread, often in jeweller's shops. The odd skull appears also for sale, usually in traditional medicine stands in local markets, but they often look like they actually did not find any buyer for a number of years.

- *Eastern Africa*

In Tanzania, there is no legal trade of significant dimension and what does occur is unlikely to impact on the overall lion populations. However, there is some illegal domestic trade with a

demand for claws, teeth and tails, mostly used for witchcraft. Lion fat is used for medicinal purposes, e.g. to treat sore muscles. The extent of this trade cannot be estimated, but there are reports of lions killed for these products, even though the official version may oftent be PAC. The Wildlife Conservation Act 1974 controls the offtake and the trade in lion products. Ownership of any lion product requires a certificate, which is only issued for legally acquired lion products, for instance, from sales after PAC. Any change in ownership requires a change of certificate.

- *Southern Africa*

In Namibia, keeping and trade in lions in captivity is regulated through the Ministry of Environmental Affairs and Tourism Policy.

In Botswana, a limited number of lion pelts from PAC are sold at public auction by the Department of Wildlife and National Parks (DWNP).

In South Africa, no trade in lions/lion products to/from Kruger National Park takes place because the population is suffering from various diseases such as BTB or FIV, and very little trade takes place in the surrounding areas for the same reason. The Kgalagadi Transfrontier Park has no trade in lions/lion products. North West Parks lions have been sought after for relocation because (i) of the absence of lion disease, (ii) their lions are of known genetic origin (Etosha National Park) and (iii) their lions are tourist habituated. Phinda relocates excess lions to reserves in the Northern Province and Mpumalanga. Reintroduction of lions from Pilanesberg and Madikwe to Hluhluwe-Umfolozi has been ongoing since 2000.

- **International trade**

International trade is monitored to prevent trade from having a negative impact on the conservation status of species, even though, in some cases, international wildlife trade can provide a positive incentive for the conservation of wild fauna and flora (IUCN *et al.*, 1991).

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES or Washington Convention) was adopted in 1973 precisely to ensure that no species disappeared because of international trade. This Convention, which operates under the umbrella of the United Nations Environment Programme (UNEP) (158 countries are signatory to the Convention) regulates international trade of about thirty thousand species of wild fauna and flora listed under three Appendices.

Panthera leo was listed on CITES Appendix III in February 1976, at the request of Ghana. Later, it was transferred to Appendix II of the Convention on the occasion of the first session of the Conference of the Parties (Bern, Switzerland, November 1976).

This status implies that the export of any lion, alive or dead, or of parts or products of a lion, is submitted to the delivery of a CITES permit prior to export by the authorities of the country from where it is exported. Some countries or communities of countries have adopted a stricter legislation than CITES itself. According to these "stricter domestic measures", the introduction into their territory of specimens derived from species listed on Appendix II of the Convention also requires for an import permit to be issued.

Every CITES Party must report yearly to the World Conservation Monitoring Centre (WCMC) of the UNEP, on all permits delivered within the framework of the Convention. Therefore, the WCMC database constitutes the best source of information available to monitor legal international trade, notably from the point of view of the nature of trade, its volume and origin. As far as lion trade is concerned, this survey is based on the data relative to years 1991 to 2000, as provided by WCMC/UNEP.

The word "specimen" is used according to its CITES definition, i.e. it can refer to a live lion as well as to a complete stuffed lion, to a trophy made of the skull, the skin and the claws, only consisting of a skin, to a claw as jewellery or to a very small piece of skin collected for scientific analysis purposes (Table 31).

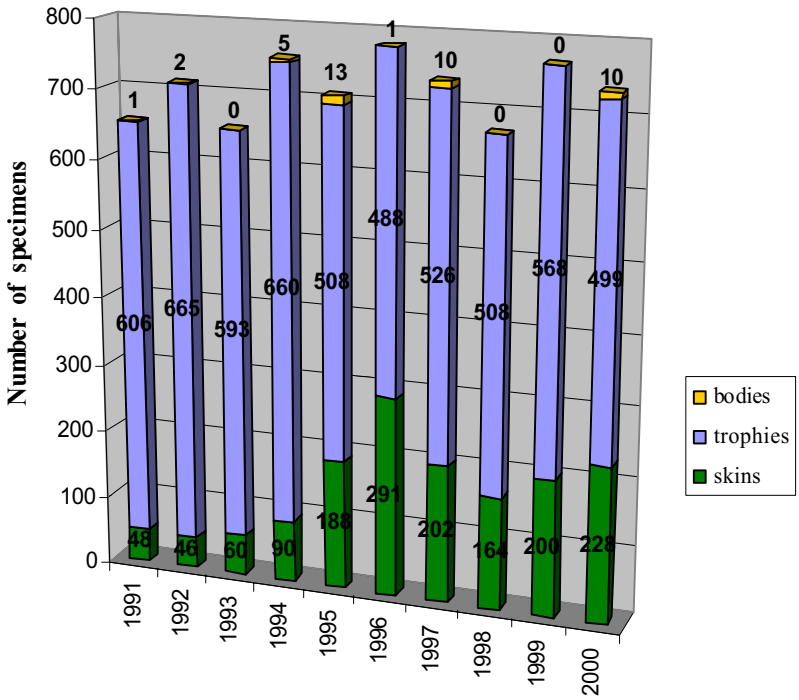
TABLE 31 - EXPORTS OF *Panthera leo* ALL TYPES SPECIMENS, 1991-2000 WORLDWIDE TRADE (Source: UNEP-WCMC CITES Trade Database, 2001)

Products	Code	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Bone carvings	BOC	0	0	0	1	1	1	0	0	0	0	**3**
Bodies	BOD	2	4	5	7	20	7	12	1	6	20	**84**
Bones	BON	1	1	0	0	6	1	2	3	0	6	**20**
Piece of bone	BOP	0	0	0	0	0	0	0	3	0	0	**3**
Bone products	BPR	2	0	0	0	0	0	0	0	0	0	**2**
Carvings	CAR	148	1	18	0	0	0	0	0	0	0	**167**
Claws	CLA	834	27	1,038	117	794	582	1,232	120	72	322	**5,138**
Cloth	CLO	0	0	0	0	0	0	0	0	8	0	**8**
Derivatives	DER	0	1	0	0	0	0	0	0	0	0	**1**
Feet	FOO	4	0	0	0	1	0	0	0	0	56	**61**
Garments	GAR	0	0	0	0	0	0	0	0	1	0	**1**
Hair	HAI	0	0	0	0	0	0	0	0	0	1	**1**
Handbags	HAN	0	0	3	0	0	0	1	0	0	0	**4**
Live specimens	LIV	146	188	196	163	209	178	217	253	278	176	**2,004**
Leather product (large)	LPL	0	0	0	0	0	0	1	0	1	2	**4**
Leather product (small)	LPS	0	0	0	43	0	0	0	1	4	6	**54**
Plates	PLA	0	3	0	0	2	1	0	0	0	1	**7**
Pairs of shoes	SHO	0	0	0	0	0	0	0	0	0	0	**0**
Skeletons	SKE	0	1	0	1	0	0	0	2	0	4	**8**
Skins	SKI	52	49	63	93	192	313	203	178	214	233	**1,590**
Skin/leather items	SKO	2	0	0	1	0	0	0	0	0	0	**3**
Skin pieces	SKP	0	0	0	1	3	0	0	2	0	0	**6**
Skulls	SKU	134	42	92	45	104	20	12	123	139	196	**907**
Scientific specimens	SPE	0	341	217	237	407	235	149	219	179	6	**1,990**
Tails	TAI	0	0	0	0	0	0	0	0	1	0	**1**
Teeth	TEE	18	0	0	2	7	0	0	0	231	4	**262**
Trophies	TRO	630	679	606	687	523	505	549	518	590	667	**5,954**
Unspecified	UNS	0	0	0	2	0	1	0	0	0	0	**3**
Wallets	WAL	1	0	0	0	0	0	0	0	0	0	**1**

It is safe however to assume that both a "live lion" (code LIV) and a "whole stuffed lion" (code BOD) obviously correspond to an entire animal. However, the other specimen categories unfortunately do not allow to determine an exact figure of animals collected since, for example, when a skin and a skull are exported separately, these two specimens can obviously correspond to the same lion. It is also possible that lion "parts" such as feet, teeth, claws and tails, even though exported under the corresponding codes (FOO, TEE, CLA et TAI), should be considered as "secondary" trophy components. Therefore, some of them can correspond to a lion whose "main" elements have been exported under code TRO, SKI or SKU. Consequently, the results below are based on the analysis of the exports registered by WCMC as corresponding to "main" elements of trophies (bodies, trophies, skins and skulls).

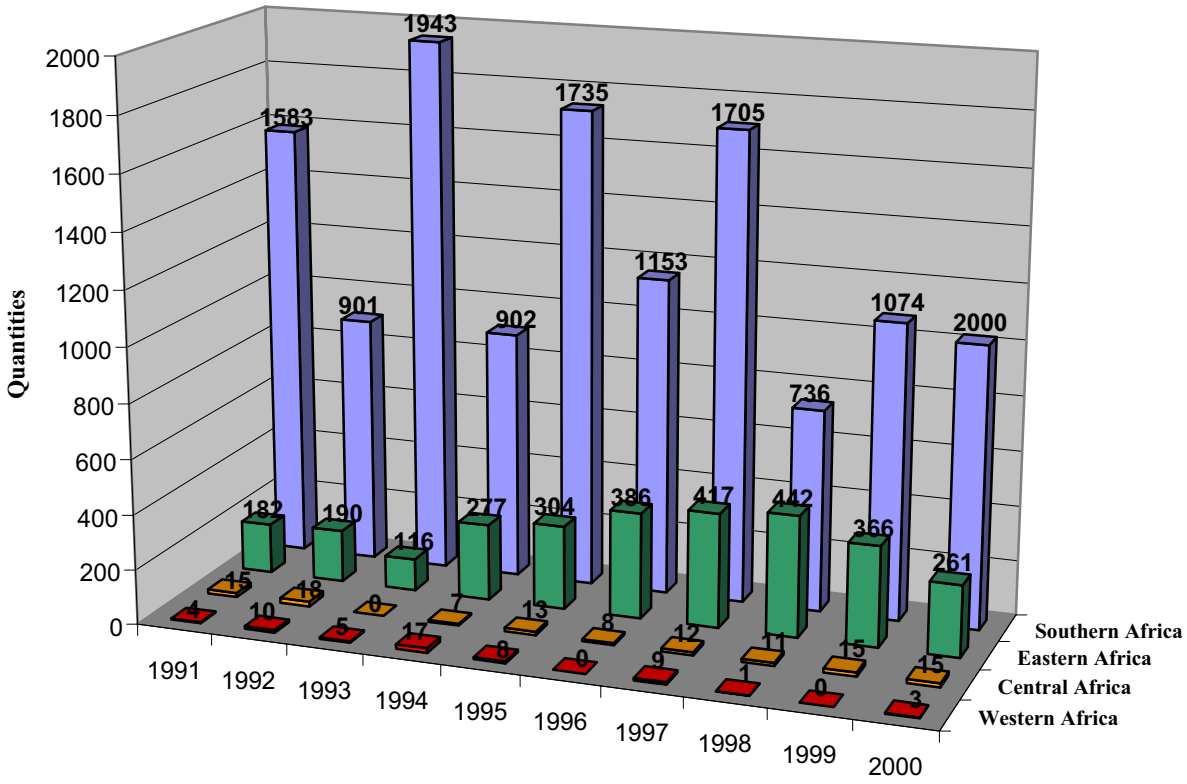
The respective role of the Range and non Range States in the trade is clear in the difference between live and non-live sales. While the hunting trophies obviously come from the Range States (Figure 7), 85 % of the live lions which have been internationally traded during the period under consideration (1991 - 2000) have been exported from non Range States of the taxon (Figure 9), and reflects the number of captive animals being traded between zoos and wildlife parks but is not necessarily germane to this report.

FIG. 7 - RANGE STATE EXPORTS OF *Panthera leo* HUNTING TROPHIES, 1991-2000 (Source: UNEP-WCMC CITES Trade Database, 2001)



The majority of the exports from Range States (all specimens considered) come from Southern Africa and, to a lesser extent (1 out of 4), from Eastern Africa (Figure 8). Western and Central Africa only account for less than 1 % in the number of lion products in international trade.

FIG. 8 - REGIONAL DISTRIBUTION OF ANNUAL RANGE STATES EXPORTS FOR ALL *Panthera leo* PRODUCTS 1991-2000 (Source: UNEP-WCMC-CITES Trade Database, 2001)



As it can be deducted from the table above (Table 31), the number of lions internationally traded is essentially made up of four main categories:

(i) Live specimens;
(ii) Specimens used for scientific purposes ;
(iii) Hunting trophies, and ;
(iv) Other specimens.

(i) Live specimens

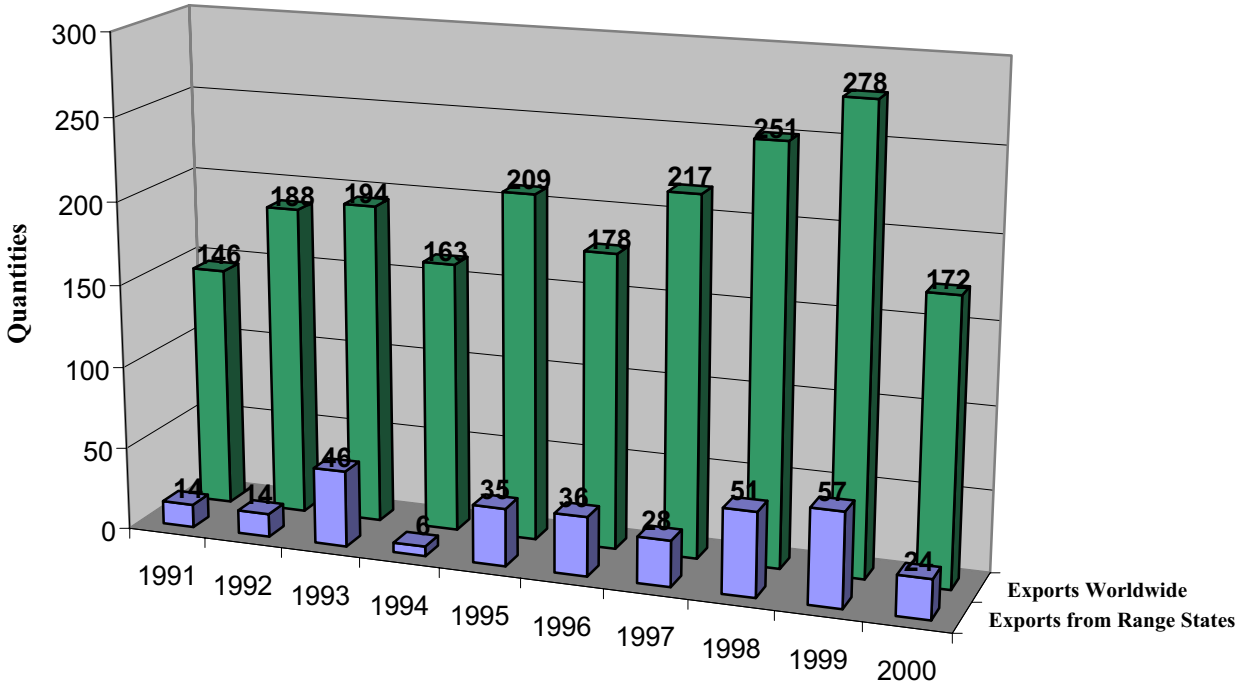
These specimens are mainly sold between zoos and wildlife parks, circuses or, for a very small number, to be translocated into the wild for reinforcement (to increase numbers of an existing population and to enlarge its gene pool), reintroduction or introduction purposes.

During the period under consideration (1991-2000) 2,004 live specimens (i.e. 2,004 lions) have been exported, i.e. about 200 live lions per year. Only few of these have originated from Range States: during the period under consideration, 10 Range States have exported a total number of 305 live lions, representing only 15 % of the worldwide trade in this category of specimens (Figure 9). South Africa (164), Namibia (84) and Zimbabwe (30) were the three main exporters of live lions, but it can be seen that, out of that total, only 87 were taken from the wild (Table 32). As a result, since exports of live lions mainly concern specimens originating from zoos, wildlife parks or other establishments where they are bred in captivity, it may be assessed that this trade has a negligible impact on free-ranging lion conservation status.

TABLE 32 - EXPORT OF LIVE AFRICAN LIONS BY RANGE STATES BETWEEN 1991 AND 2000 (Source: UNEP-WCMC CITES Trade Database, 2001)

Country	Number of live lions exported by Range States between 1991 and 2000	
	Total number	Number taken from the wild
Ethiopia	2	-
Kenya	13	4
Malawi	6	6
Namibia	84	25
Niger	2	-
Senegal	4	-
South Africa	164	29
Tanzania	4	2
Zambia	2	2
Zimbabwe	30	19
Total	305	87

FIG. 9 – SHARE OF RANGE STATES EXPORTS AS COMPARED TO WORLDWIDE TRADE IN *Panthera leo* LIVE SPECIMENS (Source: UNEP-WCMC CITES Trade Database, 2001)



(ii) Specimens used for scientific purposes

A total number of 1,990 “specimens” belonging to this category were exported over the same 10 year period, i.e. about 200 per year.

It is worth noting that:

- Some of these scientific specimens may have been collected on live lions, and;
- They often correspond to small pieces of skin, hair, etc.

(iii) Hunting trophies

CITES Notification 2002/022 of 9 April 2002 states the following guidelines:

- Exports "of substantially dead animals, […] whole stuffed hunting trophies" must be exported under code BOD;
- When all the trophy parts of one animal are exported together (as far as lion is concerned: the skin, the skull, the feet, the claws, the teeth, the tail), it has to be considered that they make up a trophy and that therefore they should be exported under code TRO; however, when the skull and the skin are the sole specimens of an animal which are exported, they should also be registered together as a trophy (TRO);

- A skin alone should be registered under code SKI, and;
- Similarly, a skull alone should be registered under code SKU, claws under code CLA, etc.

Therefore, a specimen exported under code BOD, either may be a hunting trophy, fully mounted by a taxidermist in the Range State of origin, or it can be a whole stuffed lion which is exchanged from one Museum to another.

Very often, CITES permits do not mention separately the different parts which make up a hunting trophy. As far as lion are concerned, hunting trophies are essentially made up of the skin, skull and claws (UNEP-WCMC CITES Trade Database, 2001). In spite of the guidelines set out by the Convention, the skull, the skin and the claws exported as "hunting trophy" can eventually be registered under three different codes (SKU, SKI or CLA) rather than under the single code TRO (hunting trophy). This largely depends on the personal interpretation of the agent in charge of the export permit issuance. For this reason, the annual average figure of 700 lions/year, exported by tourist hunters, is probably overestimated for the two main following reasons:

- More than one permit may be issued under code TRO for a number of specimens which are parts of the same lion, rather than corresponding to different lions, and;
- It is possible that some permits delivered under code BOD do not correspond to hunting trophies.

The exporting Ranges States of lion hunting trophies may be classified in three categories, over the ten-year period under consideration (1991-2000) (Table 33):

1st: 14 countries have exported less than 100 African lion hunting trophies over the period, i.e. an average of 10 lions per year: Mali (0); Niger (0), Chad (1), DRC (1), Sudan (2), Senegal (4), Malawi (11), Kenya (12), Benin (13), CAR (20), Burkina Faso (34), Ethiopia (42), Mozambique (84), Cameroon (98);

2d: 2 countries exported between 100 and 1000 hunting trophies over the 10 year period: Namibia (188) and Zambia (368), and;

3d: 4 countries exported more than 1000 trophies over the period: Botswana (1,008), Zimbabwe (1,078), South Africa (1,990) and Tanzania (2,226).

TABLE 33 - EXPORTS OF *Panthera leo* HUNTING TROPHIES BY RANGE STATES (Source: UNEP-WCMC CITES Trade Database, 2001)

Years	**1991**				**1992**				**1993**				**1994**				**1995**			
Products	**SKI**	**TRO**	**BOD**	**Sub-t.**	**SKI**	**TRO**	**BOD**	**Sub-t.**	**SKI**	**TRO**	**BOD**	**Sub-t.**	**SKI**	**TRO**	**BOD**	**Sub-t.**	**SKI**	**TRO**	**BOD**	**Sub-t.**
Burkina Faso		1		**1**		8		**8**		3		**3**		14		**14**		8		**8**
Benin				**0**				**0**				**0**		3		**3**				**0**
Botswana	15	71		**86**		123		**123**	13	149		**162**	31	1		**32**	28	13		**41**
Cameroon		15		**15**		18		**18**				**0**		1		**1**		6		**6**
Chad				**0**				**0**				**0**				**0**				**0**
CAR				**0**				**0**				**0**		6		**6**		7		**7**
DRC				**0**				**0**				**0**				**0**				**0**
Ethiopia				**0**	2			**2**	12	3		**15**		13		**13**	4	1		**5**
Kenya	2			**2**	1	2		**3**	3			**3**		1		**1**				**0**
Malawi				**0**				**0**	3			**3**	5			**5**	2			**2**
Mali				**0**				**0**				**0**				**0**				**0**
Mozambique		1		**1**				**0**				**0**				**0**		1		**1**
Namibia				**0**		30		**30**	6	14		**20**		21		**21**		23		**23**
Niger				**0**				**0**				**0**				**0**				**0**
Senegal		2		**2**	1	1		**2**				**0**				**0**				**0**
Sudan				**0**	2			**2**				**0**				**0**				**0**
South Africa	9	134		**143**	31	165	2	**198**	14	151		**165**	22	263	5	**290**	75	122	12	**209**
Tanzania	1	165	1	**167**		170		**170**		95		**95**	5	249		**254**		205		**205**
Zambia		51		**51**		12		**12**				**0**	7	50		**57**	6	61	1	**68**
Zimbabwe	21	166		**187**	9	136		**145**	9	178		**187**	20	38		**58**	73	61		**134**
Total	**48**	**606**	**1**	**655**	**46**	**665**	**2**	**713**	**60**	**593**	**0**	**653**	**90**	**660**	**5**	**755**	**188**	**508**	**13**	**709**

(continued)

Years	1996				1997				1998				1999				2000			
Products	**SKI**	**TRO**	**BOD**	**Sub-t.**	**SKI**	**TRO**	**BOD**	**Sub-t.**	**SKI**	**TRO**	**BOD**	**Sub-t.**	**SKI**	**TRO**	**BOD**	**Sub-t.**	**SKI**	**TRO**	**BOD**	**Sub-t.**
Burkina Faso				**0**				**0**				**0**				**0**				**0**
Benin				**0**		9		**9**		1		**1**				**0**				**0**
Botswana	234	9	1	**244**	79	15		**94**	63			**63**	94	13		**107**	56			**56**
Cameroon		8		**8**		12		**12**		9		**9**		15		**15**		14		**14**
Chad				**0**				**0**				**0**				**0**		1		**1**
CAR				**0**				**0**		2		**2**		5		**5**				**0**
DRC				**0**				**0**				**0**				**0**		1		**1**
Ethiopia	2			**2**				**0**	2			**2**		3		**3**				**0**
Kenya				**0**				**0**		1		**1**	1	1		**2**				**0**
Malawi	1			**1**				**0**				**0**				**0**				**0**
Mali				**0**				**0**				**0**				**0**				**0**
Mozambique	1	16		**17**		11		**11**		13		**13**	12			**12**		29		**29**
Namibia	21	3		**24**	17	7		**24**	10	8		**18**	6	7		**13**	6	9		**15**
Niger				**0**				**0**				**0**				**0**				**0**
Senegal				**0**				**0**				**0**				**0**				**0**
Sudan				**0**				**0**				**0**				**0**				**0**
South Africa	19	21		**40**	97	123	10	**230**	87	107		**194**	75	145		**220**	101	196	4	**301**
Tanzania		297		**297**		268		**268**		263		**263**		261		**261**		246		**246**
Zambia		31		**31**				**0**		80		**80**	1	68		**69**				**0**
Zimbabwe	13	103		**116**	9	81		**90**	2	24		**26**	11	50		**61**	65	3	6	**74**
Total	**291**	**488**	**1**	**780**	**202**	**526**	**10**	**738**	**164**	**508**	**0**	**672**	**200**	**568**	**0**	**768**	**228**	**499**	**10**	**737**

(end)

(iv) Other specimens derived from the African lion

As far as the lion is concerned, 23 other types of products (specimens) such as bones, small items made of leather, teeth, feet, etc. enter in this category. Out of these 23 types of specimens, 17 are the object of a very small number of exports, which, in the scope of this study, can be considered as negligible with less than 10 specimens during the whole ten year period of this study (Table 31).

Lion's bones and feet (respectively 20 specimens under code BON and 61 specimens under code FOO), as well as small items made of lion leather (54 specimens, under code LPS) and teeth (262 specimens under code TEE) also appear in the trade over the period of the present study.

In fact, only the claws (5,138 specimens under code CLA) are exported in relatively high numbers (510 claws on average per year), probably as jewellery items.

If it seems hazardous to assume that each claw of a single lion is exported, which would make possible to deduce a corresponding number of animals from this figure, claws, teeth, feet and tails have generally to be considered as secondary elements of a trophy and therefore the number of corresponding lions are probably already accounted for in other categories.

3. LION CONSERVATION POLICIES

- **International status**

The African lion is categorised as vulnerable by IUCN in the Red List of Threatened Species of the World (IUCN SSC, 2000).

The lion is currently listed in appendix II of CITES. This allows for continued international trade in the species under the export permit system.

- **Continental status**

This study does not find evidence that the African lion, as a species, is threatened with extinction.

However, the conservation status of the taxon appears clearly very uneven throughout its range. The different situations faced by each respective sub-population demonstrate different levels of threat. By breaking down the taxon into sub-populations, it appears that the different sub-populations may be classified in all the various categories of conservation status: some sub-populations are extinct, some are extinct in the wild, some are critically endangered, some are endangered, some are vulnerable, some are near threatened, some are of least concern, some have deficient data and some are not evaluated.

As a consequence, while a continental overwiew is no doubt useful, a more in-depth approach is definitely needed to design a sound action plan for the long-term conservation of the lion. Such an action plan is now urgently required to:

(i) Determine conservation priorities;
(ii) Define appropriate strategies on a continental, regional, national and sub-population basis, and;
(iii) Design effective ways to implement these strategies.

- **Regional and National status**

The level of protection given to lions differs between Range States from strict protection to very little protection at all. National legislation determines whether the lion may be hunted for sport, be the object of PAC, or not at all. Most Range States allow the control of problem animals. Traditional lion hunting is generally prohibited nowadays even though it is still often practised. Some examples of the conservation status are given below in a limited number of Range States.

- *Western Africa*

In Burkina Faso, by far the main "lion country" of the region, the taxon is managed by the *Direction de la Faune et des Chasses* (Direction of Wildlife and Hunting) under the authority of the *Ministère de l'Environnement et de l'Eau* (Ministry of Environment and Water).

In Senegal, the *Direction des Parcs Nationaux* (Direction of National Parks) is responsible for the management of the lion. Two special licences for hunting lion may be issued annually by the President of the Republic.

- *Central Africa*

In Central African Republic, maybe the main "lion country" of the region, wildlife in general and lion in particular, fall under the responsibility of the *Ministère des Eaux, Forêts, Chasses, Pêches, Tourisme et Environnement* (Ministry of Water, Forestry, Hunting, Fishing, Tourism and Environment).

In Chad, the lion is managed by the *Direction de la Protection de la Faune et des Parcs Nationaux* (Direction of Wildlife Protection and National Parks) under the auspices of the *Ministère de l'Environnement et de l'Eau* (Ministry of Environment and Water). In this country, the powerful *Ministère de l'Elevage* (Ministry of Livestock) has a say in the problem of cattle depredation by lions and other predators.

- *Eastern Africa*

In Tanzania, lion management falls under the general management plans for the respective habitats (Selous, Serengeti etc.) and hence under the respective responsible authorities:

- The Tanzania National Parks Authority (TANAPA), a para-statal organisation for National Parks;
- The Wildlife Division (WD), a Government department of the Ministry of Natural Resources and Tourism (MNRT) for all game outside National Parks and Ngorongoro Crater, and;
- Ngorongoro Crater Area Authority (NCAA) for the Ngorongoro Crater.

There are no specific monitoring programmes of lion populations/habitat apart from the registered research programmes discussed below. Lion monitoring falls under the general monitoring activities of the respective authorities. The hunting offtake is monitored by the respective area (Game Reserve or District) by controlling the hunting licenses issued by the Wildlife Division, accompanying the hunting parties and checking the trophies taken out of the hunting area against the licenses. The appropriate institution, depending on the CITES-status of the animal, then issues certificates of ownership. Several lion research programmes are active in Tanzania, e.g.:

- "Project Life Lion", Serengeti NP (Sarah Cleveland, Principal Researcher);
- "Serengeti Lion Project", Ngorongoro Crater, Lake Manyara NP, Serengeti NP (Craig Packer, Principal Researcher);
- "Maswa Game Reserve Lion Project" (Karyl Witman, Principal Researcher);
- "Tarangire Lion Monitoring Programme" (Fondo per la Terra, Malcolm Ryen), and;
- Selous Game Reserve (Nancy M. Creel, Scott Creel, Goran Spong).

The general approach is to manage habitats to ensure that wildlife populations and wild areas are retained. In this way, free ranging lion populations will continue to survive. Use of drugs and other direct physical control methods are not favoured (L. Seige & R. Baldus, pers. comm.).

In Sudan, hunting licences are reported as being issued by the Government in the North, but are apparently not recognised in rebel controlled areas in the South, who are issuing their own licences. It is not known if or how many licences are issued for lion. There are recent moves to improve conservation in Southern Sudan, preliminary surveys being underway in Boma National Park, and others are planned.

In Uganda, there is no hunting of lion. The Government recently reintroduced the licensing of the trade in animal products, and it remains to be seen whether this will involve trade in lion products.

In Kenya, the lion is classified as fully protected, but is subject to PAC.

- *Southern Africa*

In Zambia, in 2001, a Presidential Order banned all safari hunting for one year while the new Zambia Wildlife Authority (ZAWA) was being set up. Safari hunting is now partly reopened and will probably be fully so in May 2003, once the safari hunting concessions have been allocated.

In Namibia, the lion is a protected species under Ordinance 4 of 1975. Trophy hunting is authorised and regulated by permit. Lions may be shot in protection of livestock but any such incident has to be reported to the authorities within ten days. There is no specific national lion management plan in the country, although research and monitoring activities have been launched in the mid-1990's (Predator Research Program) and are currently directed at developing such a plan in 2002/3. A Namibia Large Carnivore Atlas has been produced in 2001. Detailed population ecology and demography studies are being conducted in Etosha, Kunene and the Kaudom sub-populations. Community-based conservation programmes are currently in place in all three areas to monitor and promote suitable habitat for lions (Stander, 1990).

In Malawi, all lions are protected. No form of hunting is permitted. There is only sparse information available on lion utilisation, hunting or even Problem Animal Control in Malawi. In this country, all lion conservation, management and monitoring is carried out by the State conservation agency (DNPW) as an integral part of its management of all Protected Areas. There is no specific official programme to manage or monitor lions and no available reports on their status and trend within Malawi. What monitoring of lion activity does take place is ad hoc/circumstantial by visitors and local staff. Problem animals are closely monitored but most end up being shot.

In Zimbabwe, the hunting, capture and translocation of lions is permitted under permits issued by the relevant Minister - Parks & Wildlife Act, Chapter 20:14, Revised edition 1996. Notwithstanding this, the killing of lions in defence of human life is permitted without possession of a permit. Landowners are permitted to kill lions that are a threat to domestic livestock. There is no specific national management plan for lion. Generally, there is no formal monitoring of lion population numbers or lion habitats. However, monitoring is a by-product of some short to medium term research projects on predators. Sport hunting quotas are set annually by area. Sport hunting quotas are set by, or subject to approval by the Department of National Parks & Wildlife Management (DNPWM). Some data is collected for exported lion trophies (NP9 forms). If the DNPWM records offtakes for reasons other than sport hunting, it appears that these data are not readily available. More information is needed

on all offtake of lions (trophy hunting in all land categories, problem animal control and poaching), as well as the annual trends in these data (V. Booth, pers. comm.).

In Botswana, a National Predator Management Strategy is in the process of being developed by the Department of Wildlife and National Parks (DWNP). There is limited monitoring in the Northern regions and little protection in the Central regions. Policies in place in the Southern Kalahari/Kgalagadi region are primarily for the management of stock-raiding lions. In Botswana, trophy hunting of lions is restricted to quota per Wildlife Management Area. A temporary national ban on problem animal control and zero quota for trophy hunting of lions was instituted in January 2001. The Northern regions had a hunting quota until 2000. In the Southern Kalahari, a zero quota in Wildlife Management Areas surrounding the Kgalagadi National Park has been imposed for about 8 years prior to the nationally imposed zero quota. Lion surveys, utilizing calling stations, have been conducted by the DWNP in collaboration with private researchers to establish population estimates and structure in Northern Botswana. The proposed management strategy includes surveys every three years using calling stations in high-density areas and spoor surveys in low-density areas. The wildlife off-take policy in Botswana is one of sustainable use as long as it does not influence the conservation status of those species utilised in conservation zones. Lethal PAC is normally allowed but a temporary national ban on lethal problem animal control was established in November 2000. The proposed strategy for healthy sub-populations is one of sustainable quotas and allowance of lethal problem animal control. However, in areas adjacent to locally threatened populations, lethal off-take would be prohibited and conflict resolution measures put in place. Between 1995 and 2000, in the Okavango Delta, localised surveys were conducted and comprehensive surveys occurred in 1998 and 1999. Comprehensive surveys were also conducted in the Kwando/Chobe river area in 1999 and 2000. The Dry North had a low sampling intensity in 1999 (the calling station technique is not suitable for low-density populations). The Southern Kalahari/Kgalagadi region has very little sustained monitoring: population surveys have been conducted in 1976 and again in 1998-2001. The surveys show little change in the population size/structure. As a result, the population is not, nor does it maybe need to be, actively managed. The current ban on killing lions resulted probably from an excessive destruction of lions by livestock owners and farmers. Several poisoning incidents occurred, killing lion, hyenas, jackals and vultures. The proposed predator management strategy is based on the current mainstream thinking regarding predator conservation and conflict resolution. The management measures taken in the Northern areas are probably sufficient, although habitat destruction and increasing human population are of concern. The management measures taken in the central areas are considered to be insufficient. In the Central region, the main management issues are an increasing human population and reduced migratory ungulate population. The vast migratory wildebeest populations of Central and Southern Botswana were interrupted in the 1980's due to expansion of the cattle farming industry and the erection of game control fences. Springbok populations are now showing similar declines in this country and are not receiving much conservation attention. The collective effect of this will be (i) decline in lion, and other large predator populations, especially outside Protected Areas, and (ii) increase in lion/livestock conflicts. There is little understanding of the impact of PAC mortality, or the effect of high human densities and livestock populations in designated conservation areas (Wildlife Management Areas). In the Southern Kalahari/Kgalagadi region, current management measures manage situations in an *ad hoc* or crisis manner. In the Northern and Central regions, PAC officers are insufficiently trained and equipped. There is limited extension training. Management recommendations from a detailed study (Funston, 2001) have been made for the Southern Kalahari/Kgalagadi region. Community extension programs and the capacity to deal with stock raiding lions are seen as imperative, but remain

insufficient. Improving capacity and working more closely with communities, especially in Botswana, have been identified as crucial in terms of long-term lion conservation (P. Funston & C. Winterbach, pers. comm.).

In South Africa, hunting of lion is allowed in some parts of the country. This is controlled and regulated by the nature conservation authorities in the various Provinces. Generally hunting is restricted to private and provincial Game Reserves. Hunting of lion is forbidden in Kruger National Park (KNP), Kgalagadi Transfrontier Park, Hluhluwe-Umfolozi Game Reserve (HUGR), Phinda, Kwandwe and Shamwari. Hunting is restricted in Madikwe and Pilanesberg. In Mpumalanga Parks (MP), hunting of lion is legal provided that the size of the reserve is larger than 2000 ha and lions are wild (i.e. not captive-bred or hand-reared). KNP has no specific lion management programme in place. KNP believes that their current management policies are appropriate, but that sub-populations in the park itself and surrounding areas should be monitored more closely. Closure of artificial water points may lead to a slight (10%) reduction in the over-inflated lion population. Disease monitoring and research are currently conducted to evaluate the threat of bovine tuberculosis. MP believe that Kruger lions are a non-reliable source for reintroduction due to disease and would like to see more reintroductions from disease-free areas. HUGR, Kwandwe and Shamwari have been the recipients of individuals from the Pilanesberg/Madikwe metapopulation. The motive behind the recent introductions of 4 and 6 females from Pilanesberg/Madikwe into HUGR and to other reserves in Zimbabwe has been to minimise the disturbance to pride dynamics. Introduced females and resident females are captured and kept in a boma together to bond and encourage pride integration and reduce escapes from the reserve. Kwandwe and Shamwari have not yet reached the stage where they need to consider off-take of lions: the reserves' carrying capacities are estimated to be approximately 15 lions based on similar-sized reserves with comparable prey density. Introductions have been conservative because of the fear of possible impact on cheetah. Kwandwe and Shamwari monitor what prey species are being focused on through scat analysis studies. They are also monitoring the lion's home range development. At Kwandwe, lions are routinely inoculated against rabies as a precautionary measure because of surrounding domestic stock. HUGR's *ad hoc* reintroduction programme is to enlarge the gene pool of lions in the HU complex. Lions are collared and monitoring takes place both through tracking and regular call-ups. North West Parks believe their management measures to be appropriate as lion populations are increasing, disease-free and bringing in revenue. The recent introductions into HUGR have had a moderate success rate and the females do settle down: they have not broken out of the Reserve (G. Kamasho *et al.*, pers. comm.).

4. CHALLENGES

4.1. CONTROVERSY AND PARADOX

- **Divergent perceptions of lion conservation**

Historically, lions have captured our imagination to the point that, in some societies, especially in the North, they have become cultural icons and have been incorporated into literature and language. As a result, their conservation is often a highly emotive issue. This extra interest in the species can be a force in their favour when it comes to conservation. Certainly, focusing on a single flagship charismatic species can often conserve a whole suite of species and their habitats.

However, for those rural African communities that have to share their lives with lions, the perception of the "*King of Beasts"* is often very different from those who do not live side by side with wildlife. Lions may represent loss of livelihood, threat to life and suffering to rural African communities. The communities therefore often view them in a negative perspective. For instance, a study conducted in and around Queen Elizabeth National Park, Uganda, showed the following results when asked about the best way to deal with stray lions that come into the village (Dricuru, 2000):

- 37% of the respondents (156 questionnaires returned and analysed) advocated the stray lions should be killed;
- 35% said a fence should be erected around the Protected Area, and;
- 28% felt people should be taught how to avoid lions.

- **Adverse impact of lion conservation on rare species**

When lions become over-abundant in comparison to the availability of wild prey species there may be conflict between different conservation goals. In some cases, rare taxa may be threatened due to too high predation by lions. However, this situation may arise in the context of populations and other human induced factors and have possibly more to do with people's perceptions and values than any real ecological rationale. For instance:

Antelopes

- Bongo (*Boocercus euryceros*)

"*…the Kenya Wildlife Service has, over several months, culled some (30) lions from the Aberdares National Park which is fenced, [where] the total number of lions is estimated to be between 145 - 180. The principal reason for the culling is their having been the main predators of the rare bongo population as well as inflicting serious depredation on the bushpigs (and giant forest hogs) within this particular habitat…*" (Nehemiah Rotich, *in litt.* anon., 2001a).

- Giant sable (*Hippotragus niger variani)*

In Angola in the 1940s and 1950s, the lion was regarded as a pest in the *Reserva do* Luando, threatening the giant sable, especially old males. Later, more accurate observations were

considering the lion as quite rare in the region with low impact on the giant sable (Silva, 1972).

- Roan antelope (*Hippotragus equinus*)

In South Africa, predation by lions is considered to be one of the causes of the roan antelope's decline in the Kruger National Park, South Africa (Harrington *et al.*, 1999).

Carnivores

- Wild dog (*Lycaon pictus*)

In Botswana, "*lions are known to be the single largest natural source of mortality of wild dogs, with lion predation resulting in more than 80% of known mortality in this study. Lion distribution and abundance is an important, and probably the most important, population-limiting factor for the wild dog*" (McNutt, 2001).

- Cheetah (*Acinonyx jubatus*)

In Tanzania, the lion factor plays a substantial role in the viability of the cheetah:

> . "*Of great importance is the heavy toll exacted by lions and hyenas on cheetah cubs; for example, in the Serengeti, cubs have only a 5% chance of survival to independence*" (Laurenson, 1994 *in* Jackson, 1997).
>
> . "*At low lion density [in the Serengeti ecosystem], the cheetah population has very low risk of extinction. At average and at high lion density, however, cheetah extinction risk is very high*" (Kelly, 2001).

Suids

The giant forest hog (*Hylochoerus meinertzhageni*) appears heavily predated by the lion in Aberdares NP, Kenya.

4.2. INTENSIVE MANAGEMENT ISSUES

- **Contraception**

In response to some of the problems of managing small populations, particularly in South Africa, there have been a number of attempts to sterilize male lions by vasectomy in order to reduce the number of births to prevent overpopulation. However, these operations have met with mixed results and generally seem to have resulted in more problems than they have resolved. Most of these are as a result of the complex, and seemingly brutal, nature of social hierarchy within lion society.

Apart from the cost implications and the logistical impossibility of carrying out such surgical interventions over vast areas, the population structure of lions is highly dynamic and anything that attempts to freeze this is in time is likely to throw up other problems. This technique is

probably most useful for managing small captive populations but is too intensive, costly and intrusive to have any useful field application to wild populations.

- **Captive breeding**

There are more than 1,500 African lions in captivity worldwide, including breeding populations in many wildlife parks. This figure probably registers "official" lions only, overlooking lions kept by individuals. The value of these populations to conservation is dependent on the quality of their management. Certainly in the future the captive management of some small populations may benefit genetically the long-term survival of other small populations and races that have become fragmented in their distribution.

- **Reduction of lion population size and gene pool impoverishment**

When wild populations of a species become small and geographically isolated, there is room for some concerns about the genetic consequences of this isolation (Simberloff, 1988). In lions, dispersal patterns of sub-adult males and the high turnover of breeding males in female prides normally minimise the risk of inbreeding. Habitat fragmentation, human persecution and in some instance epidemics have divided the former range of lion into distinct sub-populations, some of them being almost 'island' populations. In these small isolated populations, the rate of inbreeding can reach a level that may cause a decrease in reproductive performance. This has been observed for the most isolated lion population, the unique Asiatic population in the Gir forest, India, where the males show high levels of developmental sperm abnormalities and diminished testosterone levels (O'Brien et al. 1987, Wildt *et al.* 1987). On the other hand, in Africa, male lions get kicked out of their maternal pride and roam around or migrate looking for available females, this mobility ensuring a mixture of genes, even over long distances. For instance, in Etosha NP, where lion densities are estimated between 1 and 3 per 100 km2 according to the various authors, the home range of one pride of lions was stated as covering 2,075 km² and overlapping the home range of a number of other prides (Stander 1991).

Long-term studies have been carried out in the Ngorongoro Conservation Area, demonstrating that inbreeding does not have a significant effect on the survival of those populations. However in this area, one of the best studied lion populations shows a low level of heterozygosity compared to that of the Serengeti NP, as well as higher proportion of morphologically abnormal spermatozoa (Packer *et al.*, 1991). However, the low level of heterozigosity may in fact reflect the history of the Ngorongoro population which developed from a restricted set of founders (15 individuals), although its isolation may have amplified its original low genetic variation (Packer *et al.*, 1991). There is certainly an effect on reproductive performance but the long term consequences for the population are difficult to foresee, as there are several examples of large felids that have undergone such genetic impoverishment as a consequence of population fragmentation or population bottlenecks and are still widespread, although not all in a favourable conservation status (e.g. cheetah, puma) (O'Brien *et al.*, 1985, 1990).

Today, the risk of reduced genetic variability, and its consequences for the conservation of lion populations, is still the focus of many researchers particularly because of the development of introduced or re-introduced populations. The number of these 'artificial' populations has increased in the last decade, promoted by the increasing demand of the tourism industry. Small founder populations in public or private game reserves in South

Africa have shown good reproductive rates, but the initial genetic variability is low and hence managers of these small fenced populations are giving much attention to ensuring gene pool diversity through translocation and introduction of new genetic stock from different origins (Hunters and Slotow, 1999).

In small populations residing in unfenced areas, the occasional wandering lion could be enough to promote heterozygosity. In a simulation 'experiment' based on lion population dynamics and genetics, it was shown that only few exchanges (once every 5 years) could maintain a reasonable level of heterozygosity (Starfield *et al.*, 1981). The exercise of Population and Habitat Viability Assessment (PHVA) may be of help to provide guidelines in this regard.

Wildebeest as prey, Masai Mara National Park (Photo : Ph. Chardonnet).

Eland as prey, Kalahari (Photo : H. Fritz).

Cattle-raider, Serengueti National Park (Photo : H. Planton).

Elephant as prey, Namibia (Photo : B. Chardonnet).

Buffalo as prey, Luangwa valley (Photo : B. Chardonnet).

Porcupine, Masai Mara (Photo : Ph. Chardonnet).

Buffaloes, Virunga National Park (Photo : Ph. Chardonnet).

Ankole cattle, Akagera National Park (Photo : Ph. Chardonnet).

Roan antelopes, Waza National Park (Photo : H. Planton).

"*Alors King s'en alla vers ses femelles qui le réclamaient. D'abord, et comme par politesse envers nous, d'une foulée lente et digne. Mais à mesure qu'il s'éloignait, il allongea le pas. Enfin, il s'élança et rejoignit en quelques bonds lionnes et lionceaux. Ils s'enfoncèrent ensemble dans les fourrés.*"

Joseph Kessel, 1958. Le Lion

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