



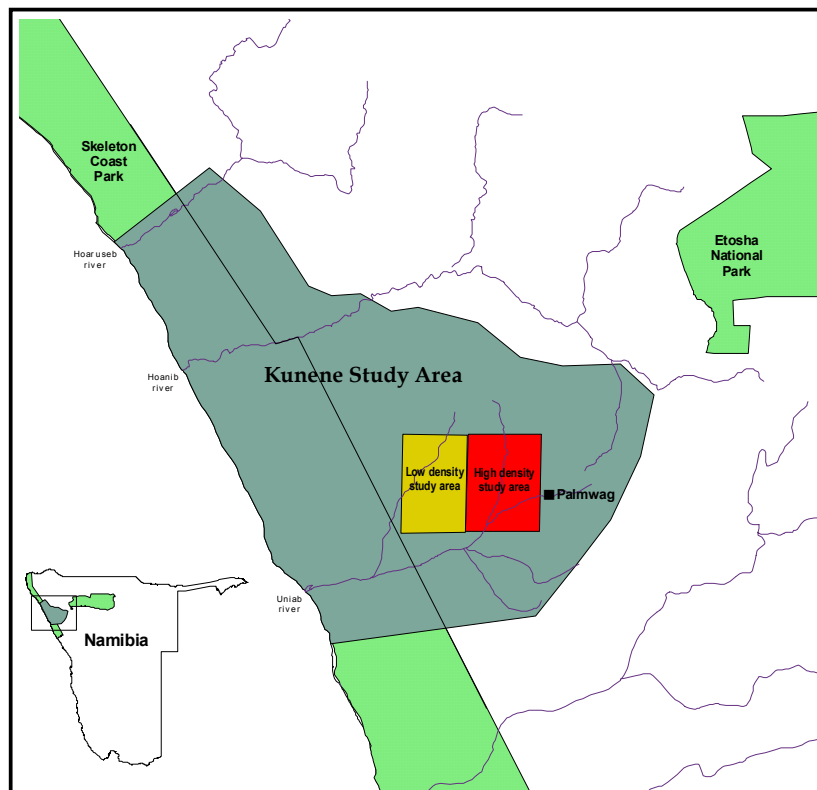
## ***Population ecology and distribution of lions in the Kunene and Erongo Regions, Namibia. June 2004***

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16 June 2004

Lions in the arid to semi-arid environment of the Kunene Region live at low densities and maintain large home ranges. In a classic example of adaptation to a harsh environment these lions exhibit unique behaviour, such as individual specialisation and cooperative hunting in Etosha (Stander 1992) and killing seals along the Skeleton Coast (Bridgeford 1985). Lions are of great aesthetic appeal and financial value due to the growing tourism industry in the Region. Baseline data on density, demography, and ecology of lions collected by this study contribute to our understanding of lion population dynamics and conservation status. These data are valuable and may be used to guide tourism development, management, and the development of long-term conservation strategies.

### **INTENSIVE STUDY AREA**

The study site of 15 440 km<sup>2</sup> is situated in the Palmwag Tourism Concession and extends into the Skeleton Coast Park and surrounding communal conservancies of the Kunene Region. The area falls in the Etendeka Plateau landscape of the northern Namib Desert, with an annual rainfall of 0 - 100 mm (Mendelsohn *et al.* 2002). The study area stretches from the Atlantic Ocean in the west to the edge of human settlement and livestock farming in the east. The Hoaruseb river runs along the northern boundary and Springbok river in the south.



## METHODS

Lions in the Kunene are difficult to locate and observe. To overcome this difficulty all known adult and sub-adult lions are captured and fitted with a radio-collar. The study area is covered systematically by tracking spoor, setting out bait and using sound play-backs to locate and capture individual lions. Radio-collared animals are located with the use of a fixed-wing aircraft. Aerial locations are then followed up by ground observations to record group composition in relation to individuals and age/sex structure, and the ratio of marked to unmarked individuals. Home range analyses are based on locating the daytime resting spots of lions by radio telemetry with at least 24 hours between fixes. Home range size is calculated using the Minimum Convex Polygon (MCP) and Kernel Contour methods (Harris *et al.* 1990).

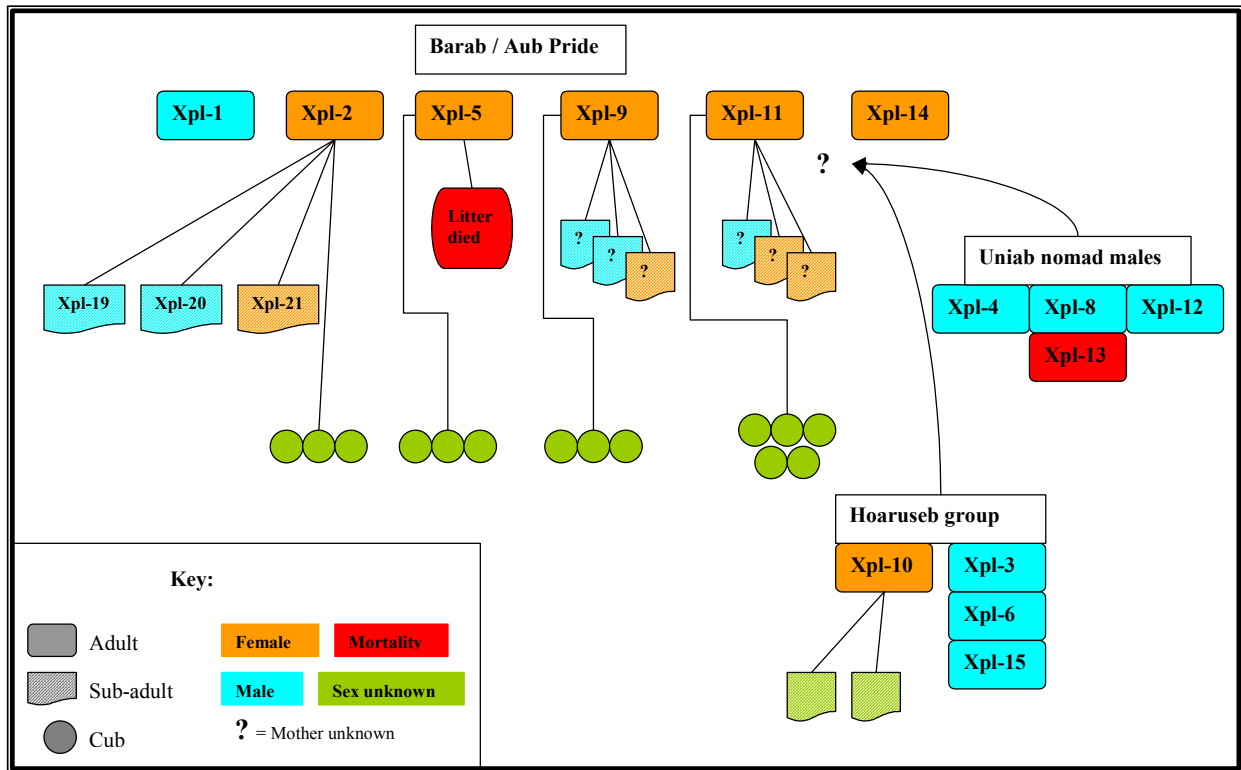


## RESULTS

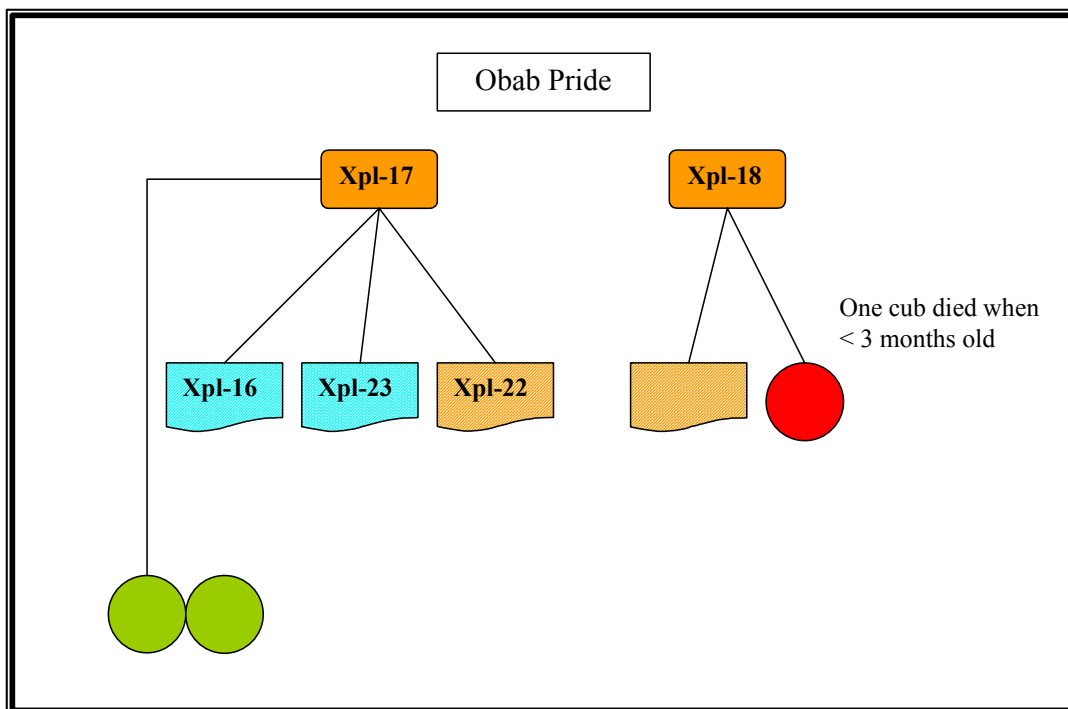
### ***Socio-ecology and population dynamics***

Since November 1999 a total of 28 lions have been radio collared and 62 lions are marked or individually identifiable. There are four distinct groups or prides of which the Barab/Aub pride is the largest (Genealogy chart). All known adult lions in the Kunene and Erongo Regions were born in the Barab/Aub pride and they have since dispersed permanently from the pride. Two additional sub-adult groups, Xpl-19, 20 & 21 (cubs of Xpl-2) and the first litters of Xpl-9 and 11 (6 lions), have recently left the pride and we are monitoring their movements. The Obab pride, however, appears independent and distinct from the Barab/Aub pride. The Obab pride consists of eight lions but we have substantial evidence that they form part of a larger pride.

**Group structures and genealogy of the Barab/Aub pride and related groups between November 1999 and December 2003.**



**Group structure and genealogy of the Obab pride between March 2001 and December 2003.**

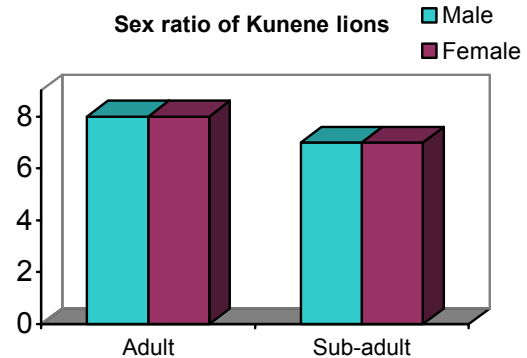




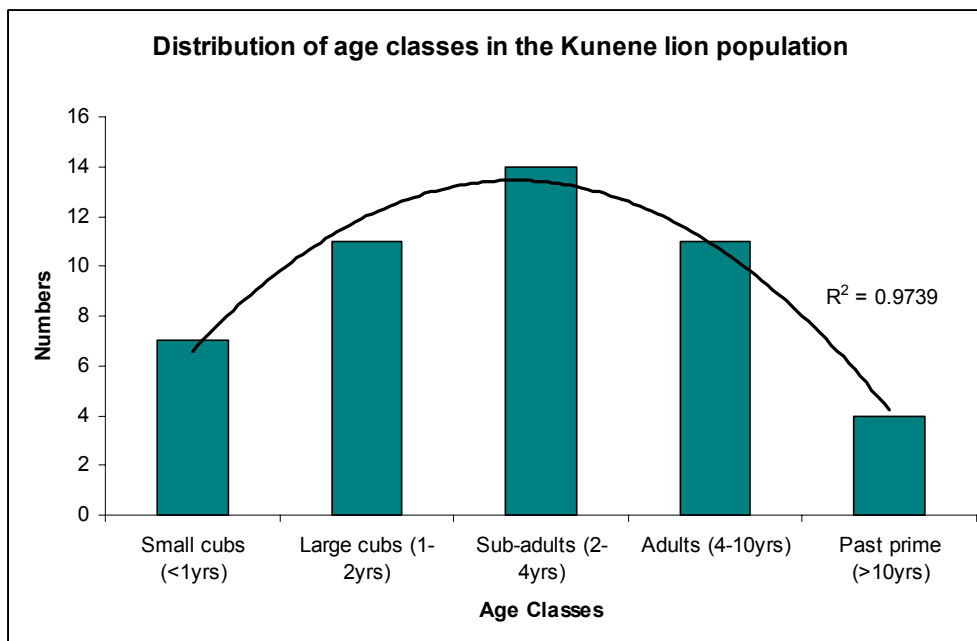
Population density was calculated in two intensive study areas (Study site map) that were surveyed intensively and where we were confident that there were no unmarked or unknown lions. We predicted that the western study area would support a lower density of lions since the habitat is significantly dryer and supports lower numbers of prey species than the eastern study area. Using the Kunene Sampling Method (Loveridge *et al.* 2001) lion densities were calculated at 0.49 lion 100 km<sup>-2</sup> for the low density area (west) and 0.71 lion 100 km<sup>-2</sup> for the high density area (east). Extrapolating these two density estimates, as a range of minimum to maximum, to the total study area the population estimate is between 76 and 109 lions.

**Population demography of Kunene lions**

Total Study Area (km <sup>2</sup> )	15440	
High density study area (km <sup>2</sup> )	875	
Low density study area (km <sup>2</sup> )	770	
Number of marked / known lions	62	
Number of radio-collared lions	28	
<i>Lion population estimate</i>	Low density	High density
Calculated number of lions	3.8	6.2
Lion density (lions 100 km <sup>-2</sup> )	0.49	0.71
Extrapolated estimate	76	109



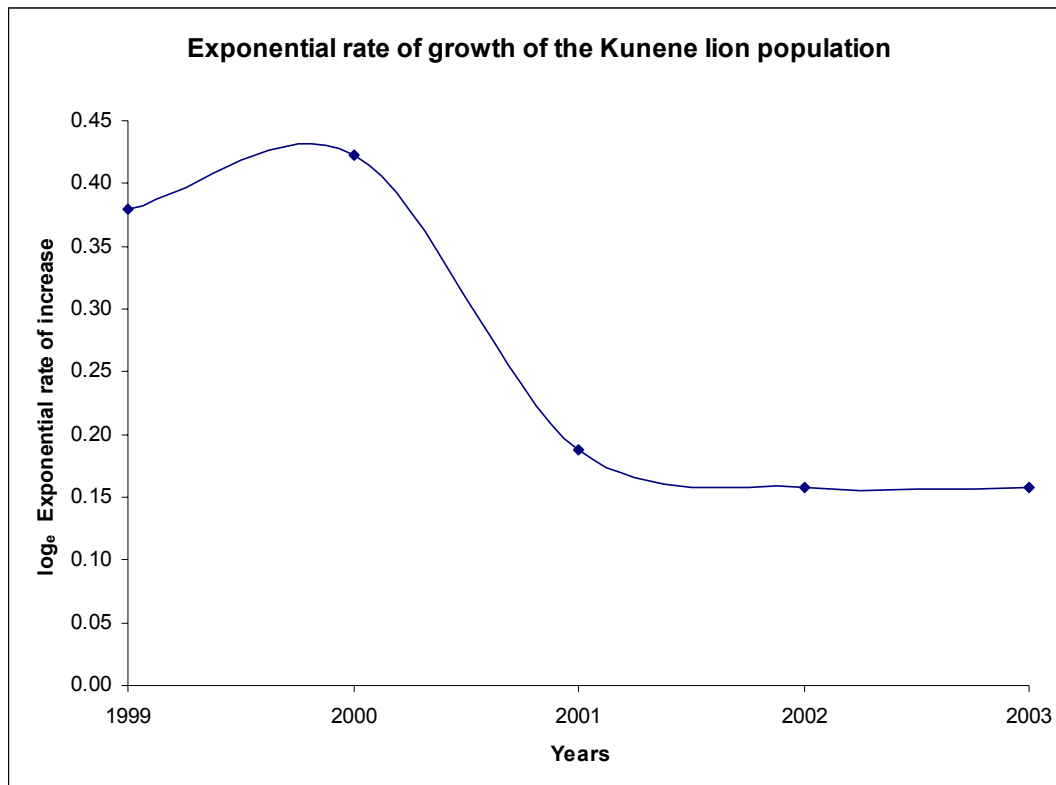
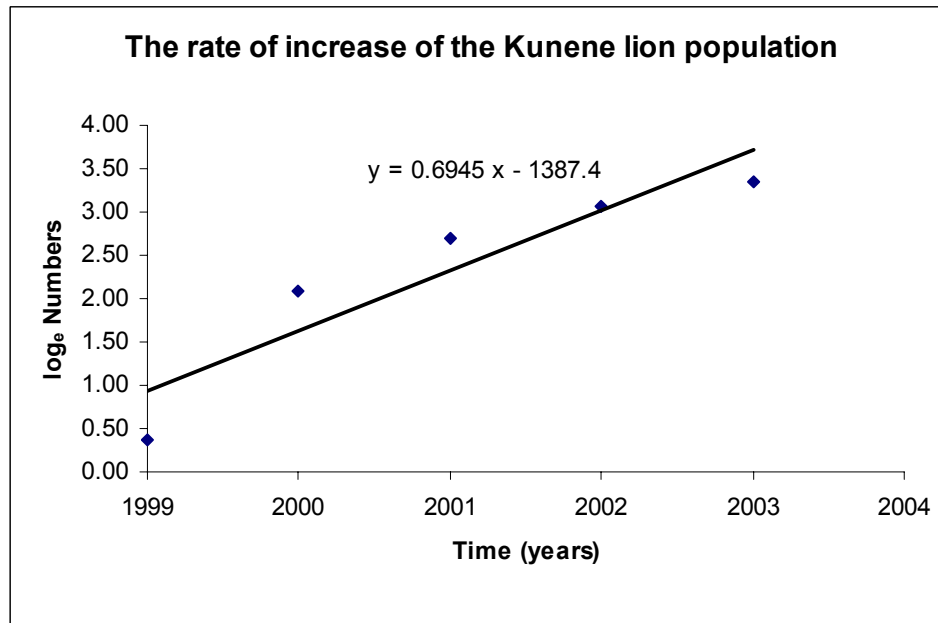
Of the seven radio-collared lionesses, six (85%) presently have dependant cubs. There are 16 cubs in total at an average of 2.8 cubs per female. The population dynamics of these lions were evaluated over a five year period (1999-2003) by analysing birth rates, mortality, fecundity, and rate of increase associated with 13 known adult lions. This population of 13 known lions in 1998 increased at an average rate of 22.5% (range 14.6 – 34.5%) to 48 lions in 2003, where the sex ratio is even. During the five year period six lionesses gave birth to 13 litters totalling 38 cubs. Litter sizes ranged between 2 and 5 cubs with the mean at 3.1 cubs. Cub survival was high, with only 9% mortality up to age of one year (n = 38) and none thereafter. With most cubs surviving, the mean birth interval was 2.2 years (SD = 0.28; range 1.9 – 2.7 years; (n = 6).





With this remarkably high fecundity rate there is a preponderance of young lions in the population when looking at an age distribution graph for 2003. However, when the same data is cast into broader age classes the result depicts the characteristics of a healthy and stable population.

The phenomenal increase of this lion population during the study period is best presented as a logarithmic rate of increase (top) and the annual exponential growth rate (bottom). Population growth was over 30% for both 1999 and 2000. Thereafter it dropped to around 15% for 2001, 2002, and 2003.

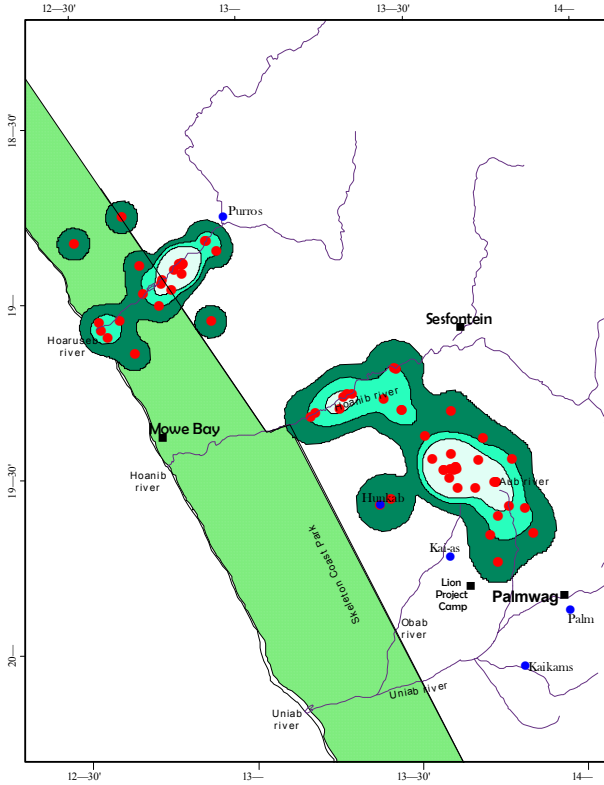




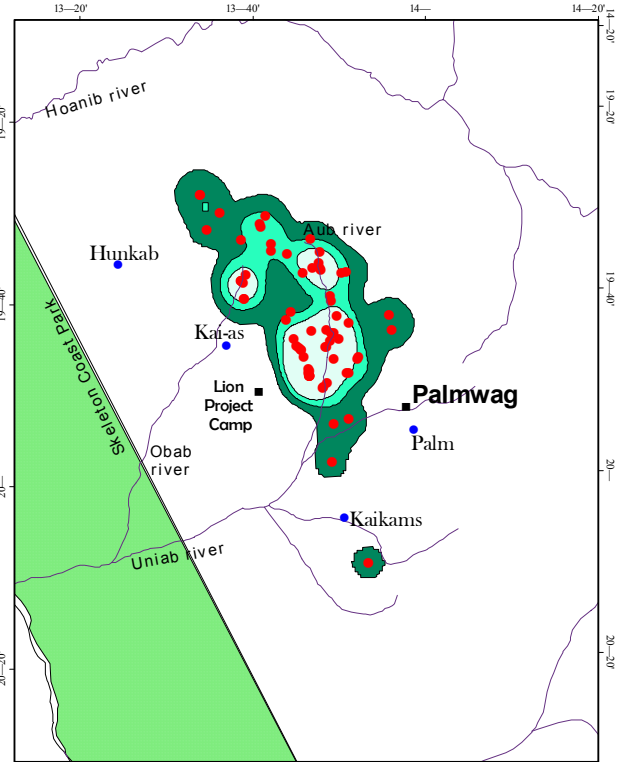
### Dispersal and expansion of the Kunene lion population

The highest concentration of lions (core area) in the Kunene region is found in the Palmwag Tourism Concession, between the Hoanib and Uniab Rivers.

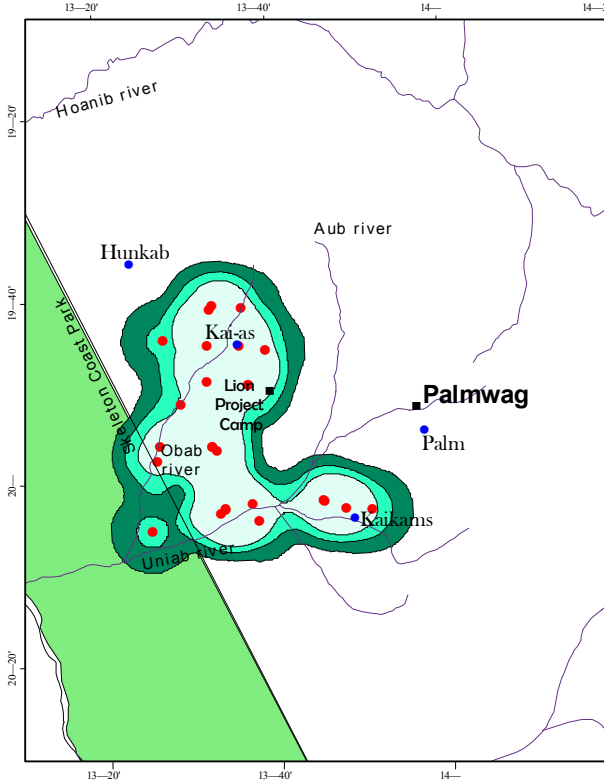
Northern and southern home ranges adult female Xpl-10



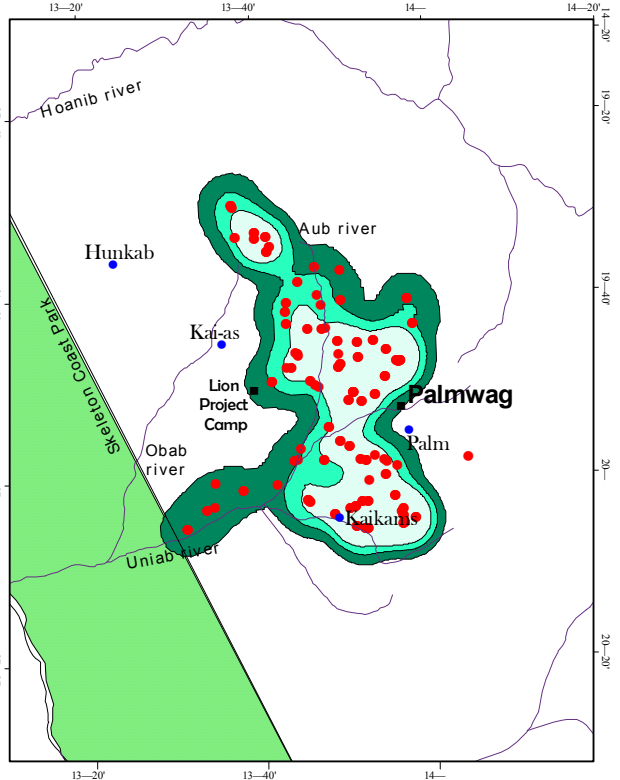
Home range of adult female Xpl-9



Home range of adult female Xpl-18



Home range of sub-adult group Xpl-4



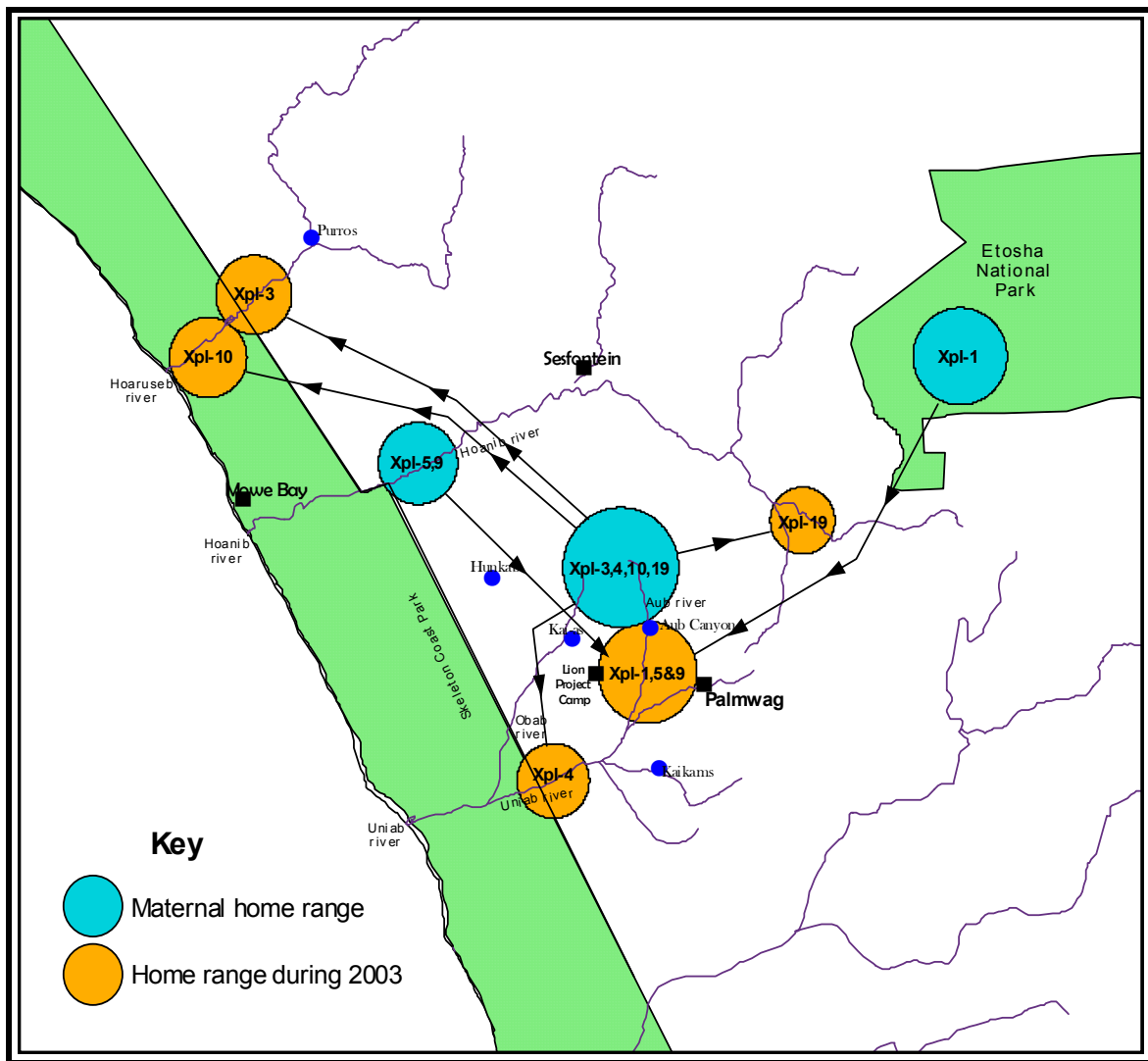


The dispersal patterns of six groups of lions have been monitored since the late 1990's. All the groups, with the exception of the most recent dispersal (Xpl-19 group), have settled in a new home range. With the exclusion of the Xpl-19 group, the lions moved an average of 104.6 km (SD = 30.8) from their maternal home range.

**Dispersal of Kunene lions from their maternal home ranges**

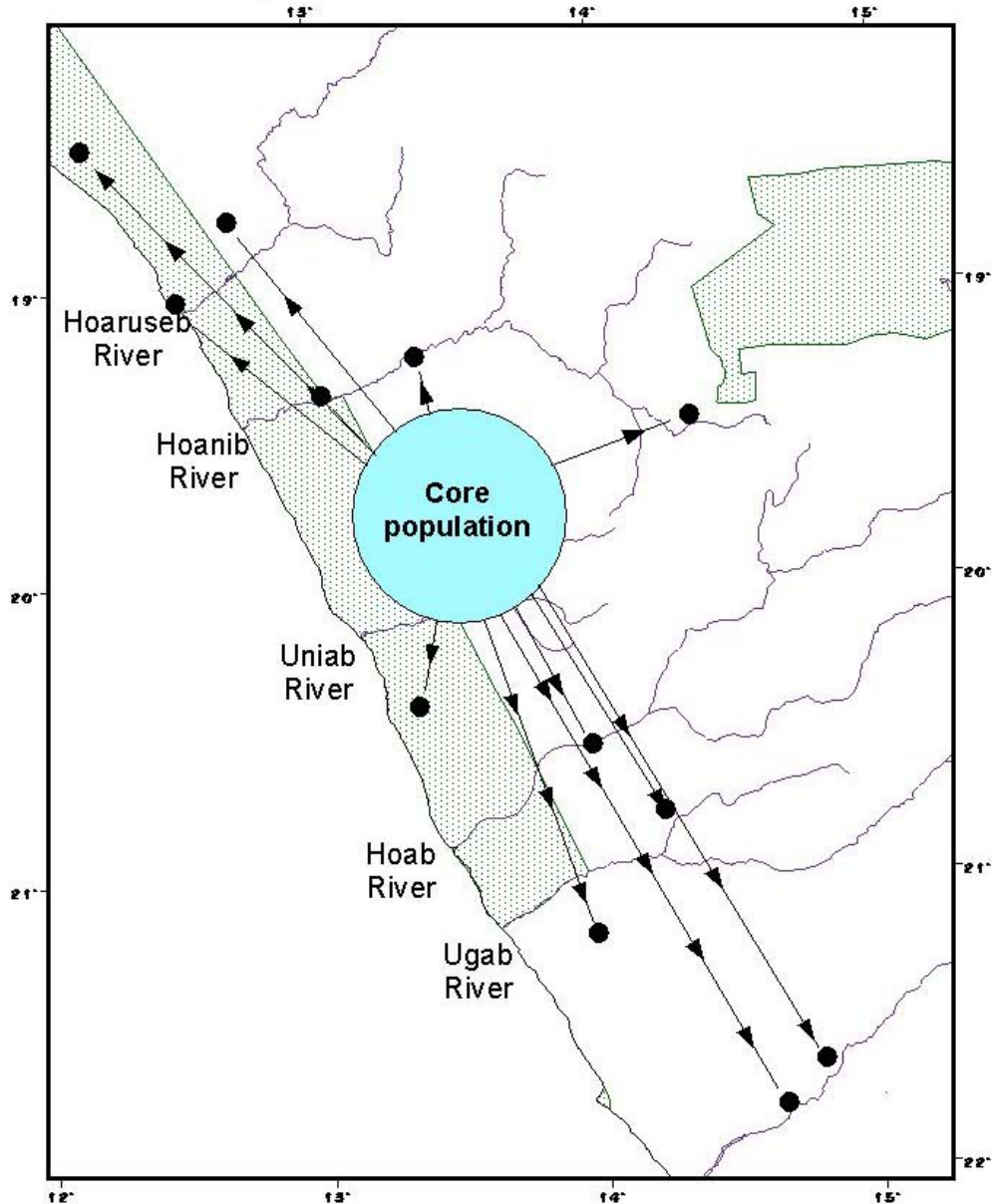
Lion ID	Group composition	Date occupying maternal home range	Direct distance to present home range (km)*
Xpl-1	Adult male	1998	120
Xpl-5 & 9	Adult females	1998	85
Xpl-3,6 & 15	Adult males	1999/2000	130
Xpl-10	Adult female	1999/2000	128
Xpl-4,8 & 12	Adult males	1999/2000	60
Xpl-19,20 & 21	Sub-adults	2001	51

\*Present home range is defined as the area occupied between January and July 2003.



With the rapid growth of the lion population in the core area between 2000 and 2003, the dispersal of individual lions and hence the expansion of the population is to be expected. During the later half of 2003 and in 2004 we have documented several events of dispersal and population expansion. Marked lions from the core population moved north and settled in the Hoanib and Hoaruseb Rivers. During late 2003 and early 2004 some individual lions also moved south to the Hoab and Ugab Rivers, and one individual has moved as far south as the Omaruru River.

### Dispersal of lions during 2003 and 2004 from the core population in the Palmwag Concession



Developing conservation strategies for the Kunene lions is, among many ecological parameters, dependent on a sound understanding of the factors that drive the distribution and dispersion of the population. Monitoring the dispersal of individuals from their maternal home ranges provides important information towards understanding these population characteristics.





## CONCLUSION

This desert adapted and coastal roaming lion population were believed to have disappeared totally after a low rainfall period in the 1980's when many were killed by pastoralists. This study therefore unveils significant features and characteristics of the population. These lions live in the most rugged and arid environment anywhere in Africa. Some aspects of their behaviour and ecology is markedly different to lions elsewhere. Under these low density conditions Kunene lions produce larger litters (3.1 cubs) than measured elsewhere in Africa (2.4 cubs, Schaller 1972), and cub survival is unusually high. These features contributed to an astounding growth-rate, population increase, and subsequent expansion.

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## ACKNOWLEDGEMENTS

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