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## **The Ecology of Lions and Cheetahs Re-introduced to the Kalahari Game Lodge, Namibia**



Dr P Stander  
Predator Conservation Trust  
Box 90427  
Windhoek, Namibia

[flip@predatortrust.org](mailto:flip@predatortrust.org)  
[www.predatorconservation.com](http://www.predatorconservation.com)



## **Introduction**

Large carnivore populations, especially lions and wild dogs, have declined considerably over the last few decades due to conflict with livestock farmers. This conflict also led to a reduction in the distribution of large carnivores and they are now mainly restricted to protected areas. One of the long-term objectives for large carnivore conservation in Namibia, stipulated by the Ministry of Environment and Tourism, is to identify key areas for the reintroduction of large carnivores, such as lions, cheetahs and wild dogs.

The fast growing tourism industry in Namibia has in many cases led to a change in land-use practises from livestock farming to eco-tourism activities that is frequently based on wildlife safaris. This shift in land tenure systems have created suitable habitat for many wildlife species, including large carnivores. This development has led to opportunities and demand for the reintroduction of large carnivores.

The Kalahari Game Lodge (KGL), as a prime example of the eco-tourism revolution, transformed 270 km<sup>2</sup> of traditionally sheep farming land into a wildlife area that generates income from tourism and hunting. The land supports approximately 8000 medium to large-sized animals, ranging from springbok to eland. The land is surrounded by a sound game-proof fence that, in conjunction with its size and the size of the prey population, makes it an ideal location for the reintroduction of large carnivores. The owner of the Kalahari Game Lodge, Mr Marius Els, became interested in reintroducing lions and initiated the process in 1998.

Reintroducing large carnivores into a new habitat is especially complex and there are many factors to consider (Stanley Price 1991). Although not attempted previously in Namibia, lions have successfully been reintroduced in South Africa (van Dyk 1997). With reference to these studies and building on our previous experiences of reintroducing wild dogs and cheetahs, members of the Predator Conservation Trust assisted KGL in the reintroduction of three lions and two cheetahs during 2002.

## **Study area and infrastructure**

The Kalahari Game Lodge is situated in the south east of Namibia (see map) with its coordinates centring at S25<sup>0</sup> 35'/E19<sup>0</sup> 55'. Its falls within the Kalahari Sandveld landscape and the average annual rainfall lies between 150 and 200 mm (Mendelsohn *et al.* 2002).

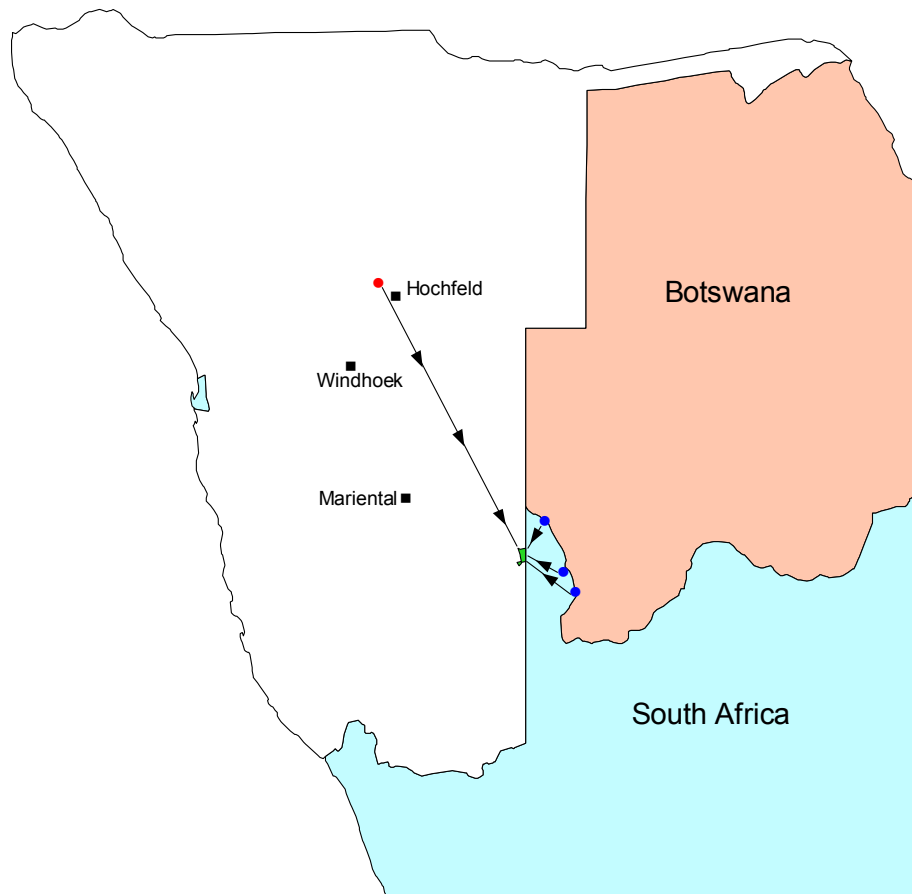
A game-proof fence that complies with the requirements of the Ministry of Environment and Tourism surrounds the property. The entire fence is electrified



and there is jackal-proof mesh wire along the bottom. The mesh wire stretches from one metre above the ground and has been buried below the ground to the depth of 0.5 metres.

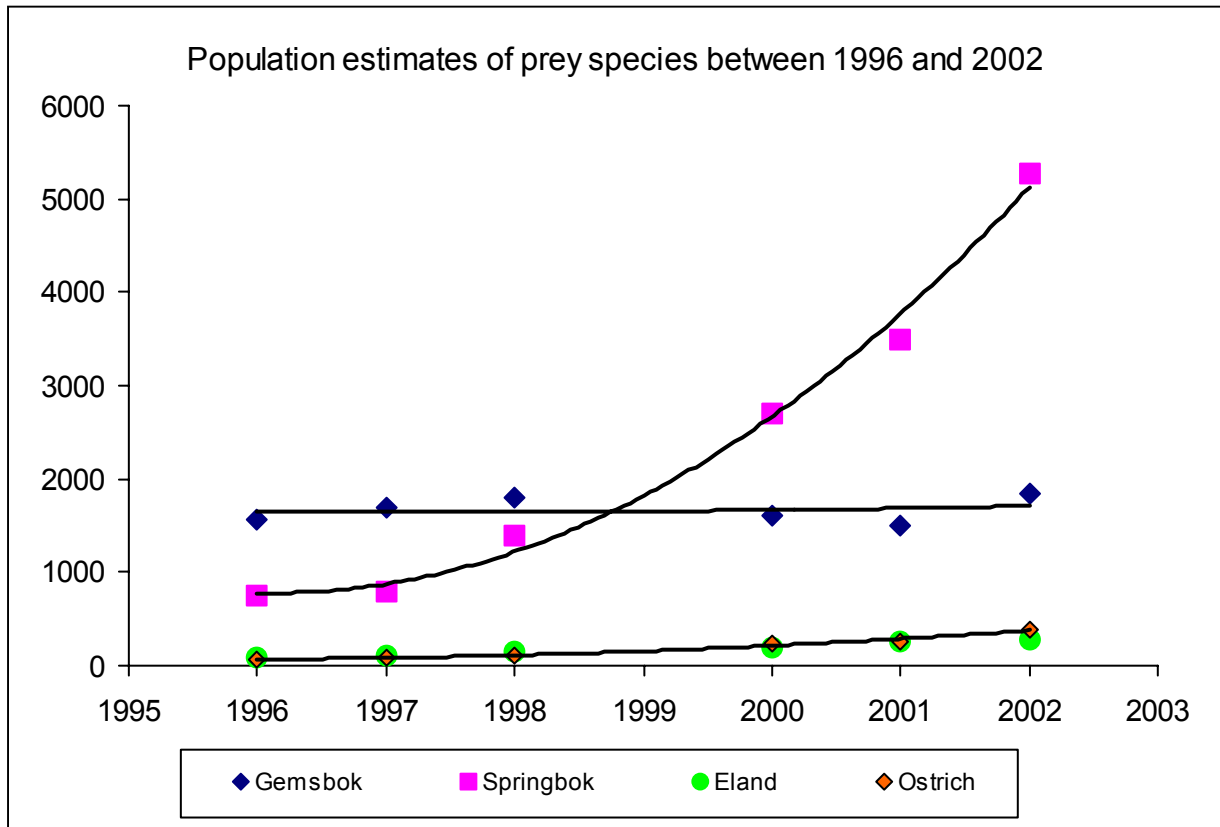
Temporary holding facilities were erected to facilitate the reintroduction of the lions and cheetahs. For the lions two bordering holding facilities, each a minimum of one hectare in size, were built to house them for up to three months. A smaller camp (220 m<sup>2</sup>) was erected to house the cheetahs for 2 weeks before release.

*The location of Kalahari Game Lodge and the origin of the re-introduced cheetahs (●) and lions (●).*



### ***Prey population***

The Kalahari Game Lodge has maintained an active level of wildlife monitoring and management. Aerial surveys of wildlife populations were done regularly since 1996. Since the method of aerial survey (total helicopter count) was similar between all surveys the comparison of population estimates between years was possible (see graph).



The gemsbok population remained stable at approximately 1700 animals throughout the 7-year period. The springbok population shows a dramatic and exponential increase. Although not evident in Fig. 2 both ostriches (66 to 392) and eland (85 to 269) increased significantly from 1996 to 2003. These population data were valuable during the planning phase and allowed us to develop prediction models on the number of large carnivores that can be sustained in the system. Future and regular aerial surveys will be essential as a monitoring tool to maintain a balanced predator/prey relationship/

### ***Lion reintroduction procedure***

The re-introduction process was initiated by developing a prediction model based on expected lion densities and per capita food intake, using data from Etosha National and the Kgalagadi Transfrontier Park. Conservative calculations indicated that KGL can carry between 4 and 6 lions. It was decided to reintroduce three lions (1 male & 2 females) from the Kgalagadi Transfrontier Park. The lions, purchased from National Parks Board, SA, were captured from three different prides in the Kgalagadi Transfrontier Park. In July 2002 when they were captured the male was between 3-3.5 years old and the two females were 4-5 years and 18 months old respectively.



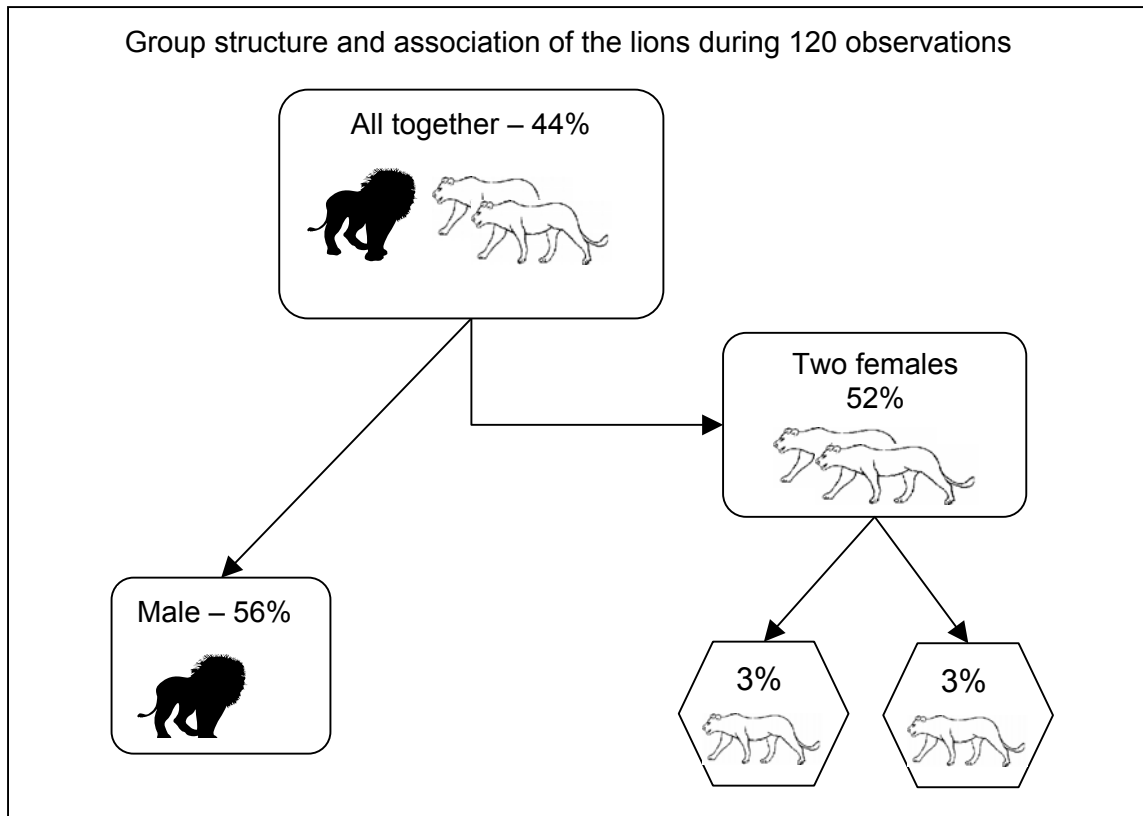
The male and adult female were released in one camp of the boma and the young female in the bordering camp. After one week they were joined without conflicts. They interacted well and soon formed cohesive unit. The lions did not make concerted efforts to escape from the enclosure. Extensive efforts were made to limit habituation to humans and feeding. After two months the lions were passively released from the boma.

### Cheetah reintroduction procedure

The process was initiated by developing a prediction model based on expected number of cheetah hunting groups, kill frequency per group, and expected impact on springbok birth rate, using data by Bill Gasaway from Etosha NP. Conservative calculations, that did not include steenbok and duiker populations, indicated that KGL could carry up to 6 cheetahs. As were unsure of the accuracy of the springbok surveys it was decided to reintroduce only two (1 male & 2 fem) cheetahs. The cheetahs, acquired from the Africat Foundation, were originally captured in the Hochveld area and were transported to KGL by means of an aircraft. The cheetahs were both 2 years of age. They were held in a 200 m<sup>2</sup> enclosure for two weeks before passive release.

### Lion ecology

After release the lions settled into normal and expected behavioural patterns. Their grouping patterns were similar to that of lions elsewhere. The male lions spent almost half his time alone and the two females were almost always together.

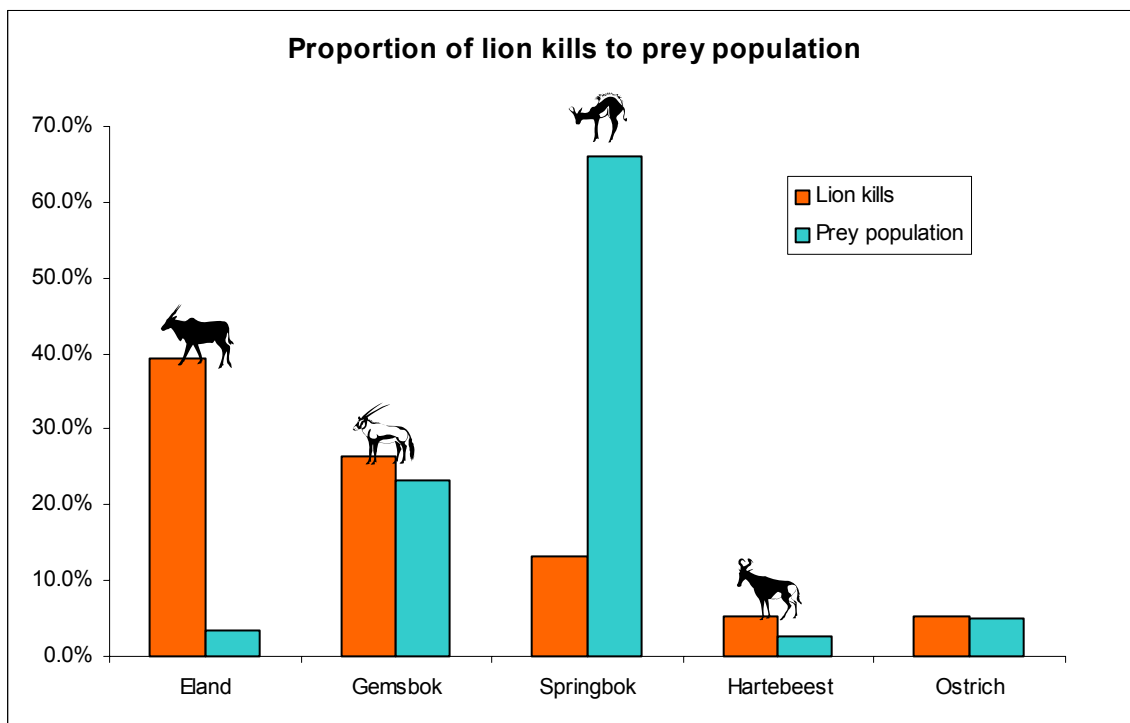




The lions killed a wide range of species but eland and gemsbok were their main prey.

Prey selection by lions				
Prey	Total	Adult	Sub-adult	Young
Eland	15	6	3	6
Gemsbok	10	8	1	1
Springbok	5	5		
Duiker	3	3		
Hartebeest	2	2		
Ostrich	2	1		1
Steenbok	1	1		
<b>Total</b>	<b>38</b>	<b>26</b>	<b>4</b>	<b>8</b>

If we compare these predation data to the known prey population data (earlier graph) lions kill less springbok but more eland than what is present in the population. However it is well known that small species, like springbok, are often underrepresented in estimates of lion predation. Lions generally capture and consume small prey animals quickly and leave little evidence of the event. Therefore, if we only compare species of roughly the same mass (eland, gemsbok, hartebeest and ostrich) lions kill significantly more eland than any other species ( $\chi^2_3 = 54.62; P < 0.001$ ).







**Home ranges**

After release the lions settled in the northern sector of KGL (see maps). It would appear that they quickly found ideal habitat with sufficient prey since their home range use did not change much between March 2003 (6 months after release) and October 2003 (one year after release). The lions utilise almost 50% (126.4 km<sup>2</sup>) of the KGL when using the MCP method to calculate their home range. The Kernel method showed that they spend 95% of their time in a smaller area of 76.1 km<sup>2</sup> and that they concentrate (65% of their time) in only 11.1 km<sup>2</sup>. Despite the fact that the male lion spend more than 50% of his time alone, he utilises roughly the same area as the females (see map) and their home range sizes are similar.

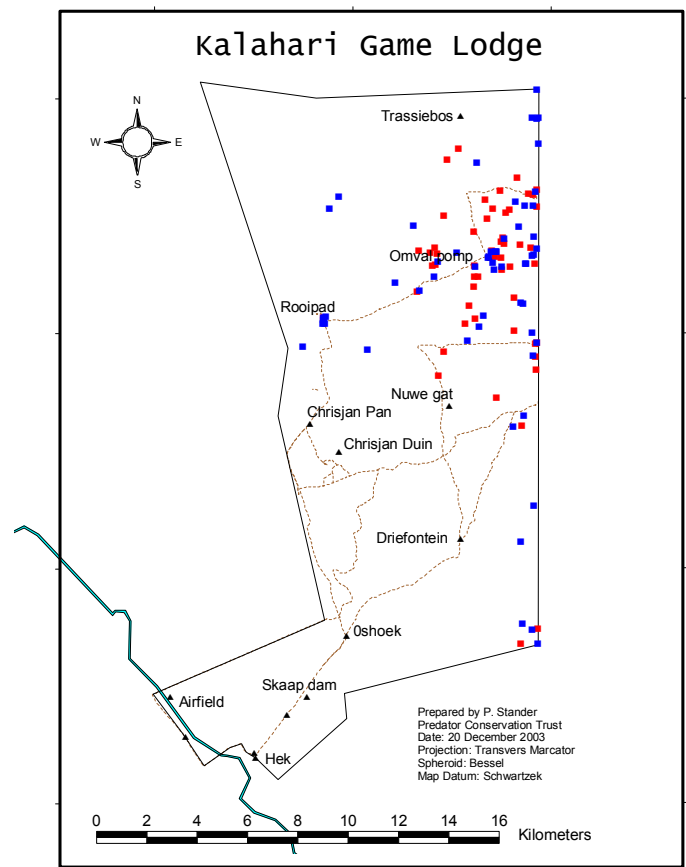
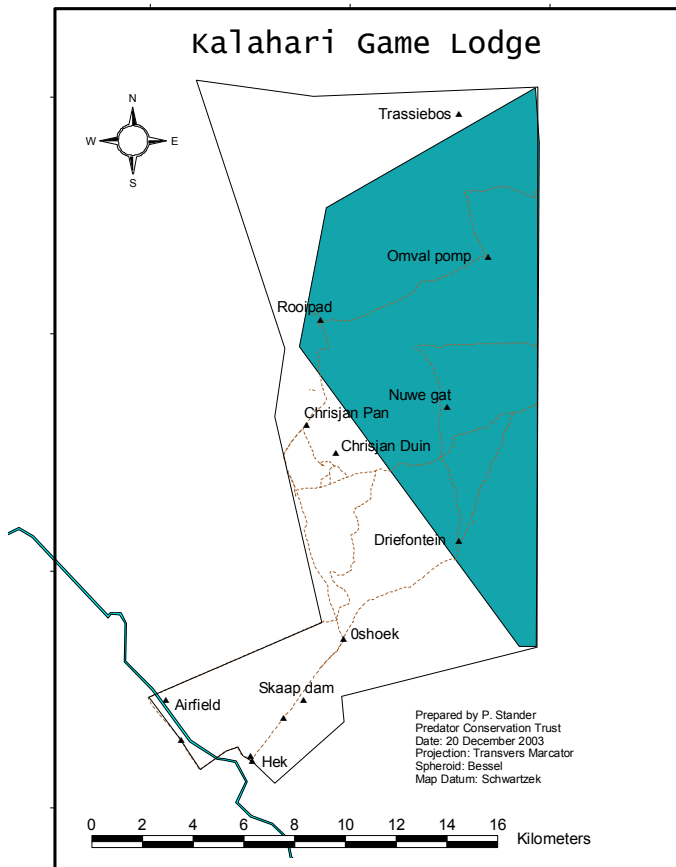
**Home range estimates of KGL lions using two methods of calculation (n=181)**

MCP*	Kernel Density Estimate		
	95%	80%	65%
<b>126.4</b>	<b>76.1</b>	<b>23.7</b>	<b>11.1</b>

\*MCP = Minimum Convex Polygon

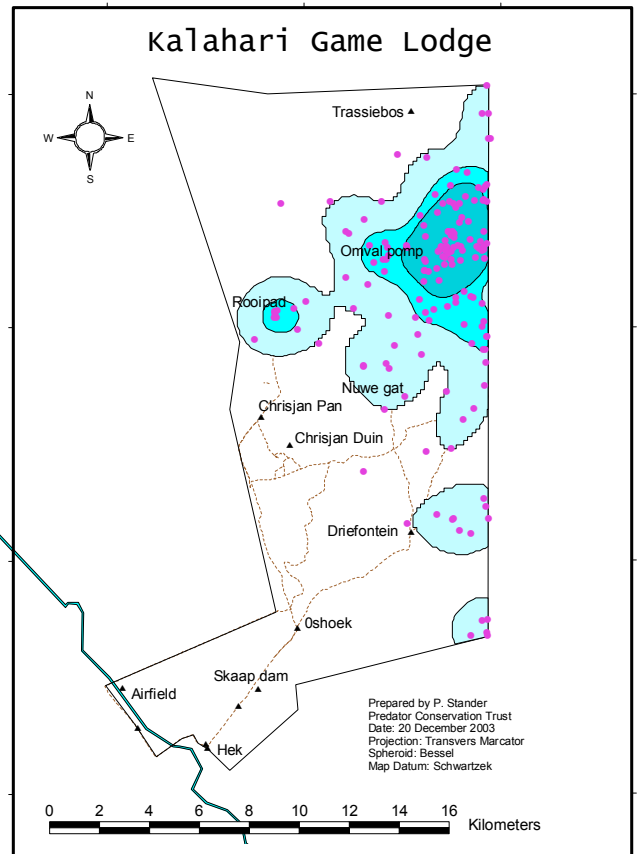
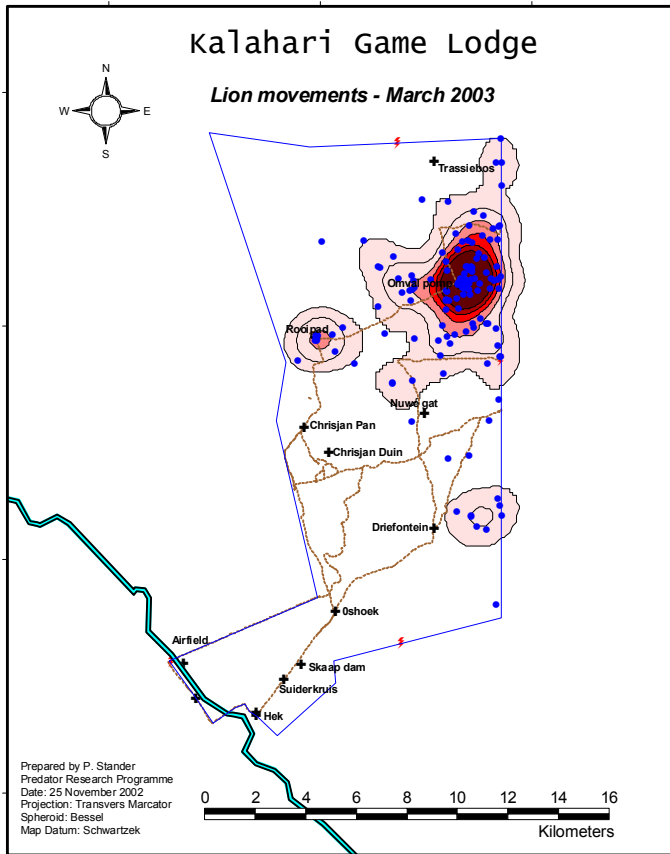
*MCP home range estimate of lions*

*Locations of the male (●) and two female lions (●)*



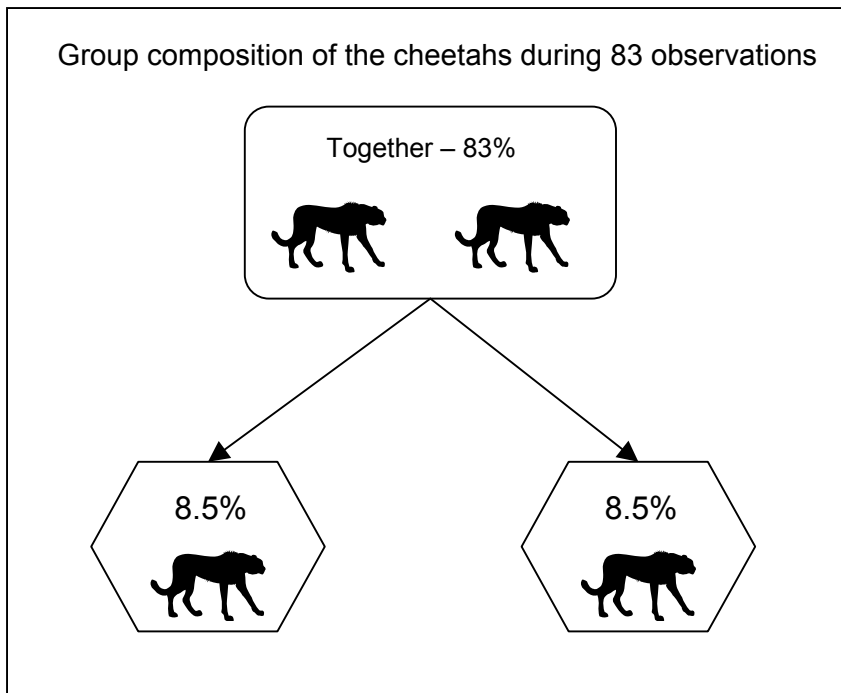


The Kernel distribution of lions at six months and one year after release



**Cheetah ecology**

After release the cheetahs were rarely found apart.

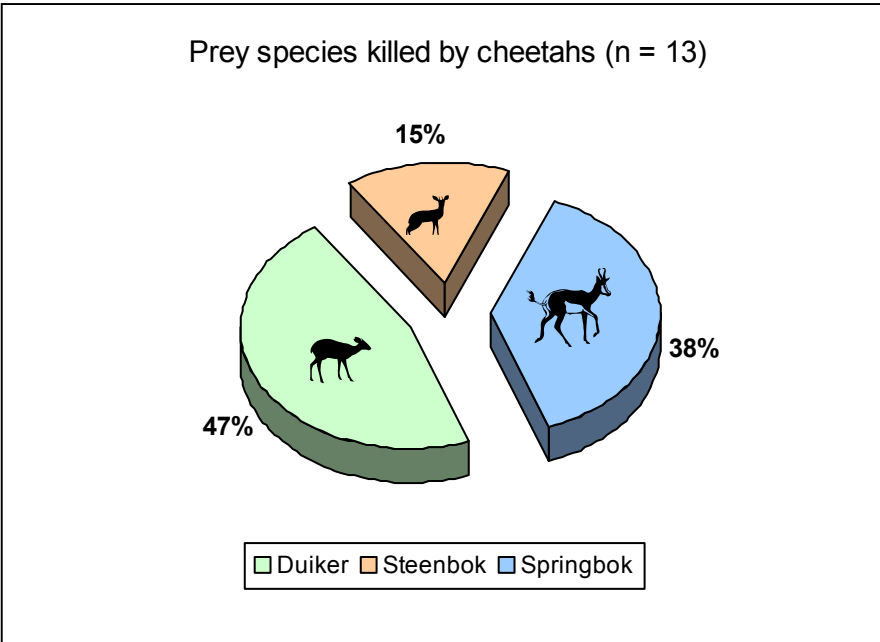






The cheetahs killed only small prey species with a tendency to favour duikers and young springboks

<b>Prey selection by cheetahs</b>				
<b>Prey</b>	<b>Total</b>	<b>Adult</b>	<b>Unknown</b>	<b>Young</b>
Duiker	6	2	4	
Springbok	4	1	1	3
Steenbok	2	1	1	
<b>Total</b>	<b>12</b>	<b>4</b>	<b>6</b>	<b>3</b>



*Home ranges*

After release the cheetah moved east and settled along the border fence with Kgalagadi Transfrontier Park (see maps). During 91 observations the cheetahs were found within 100 metres of the fence on 65 (71%) occasions. Attempts by the cheetahs to cross the fence and leave KGL were never observed. Similar to the lions their habitat utilisation remained stable throughout the post-release period. As the result of a few excursions by the male (see map), the cheetahs utilise almost the entire property (225 km<sup>2</sup>), when using the MCP method to calculate their home range. The Kernel method showed that they spend 95% of their time in a much smaller area of 57.2 km<sup>2</sup> and that they concentrate (65% of their time) in only 13.6 km<sup>2</sup>.

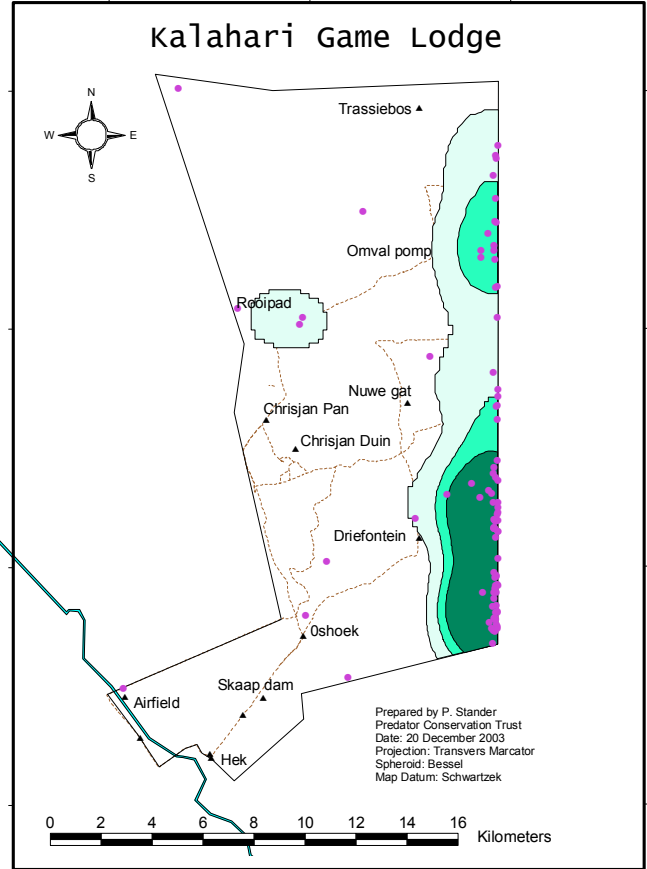
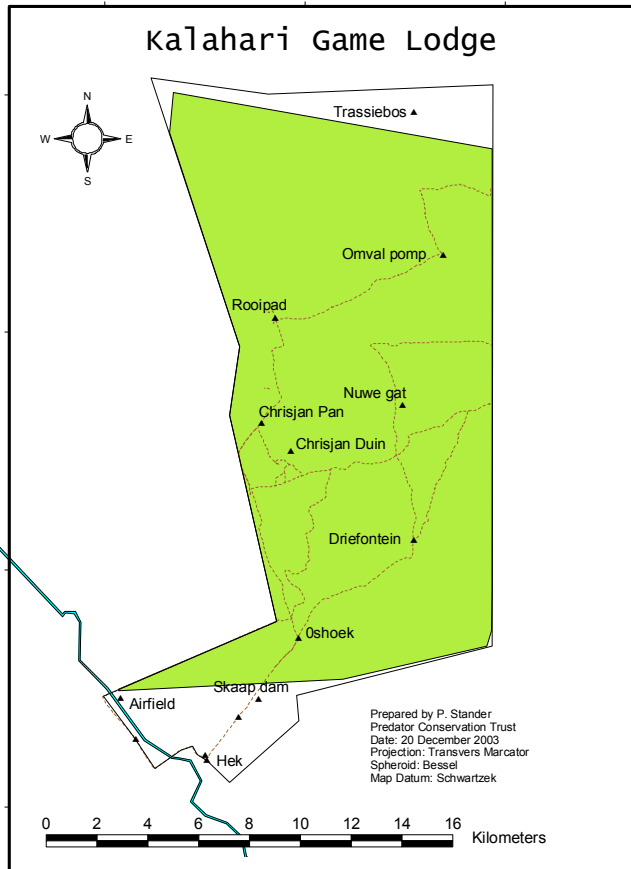
*Home range estimates of KGL cheetahs using two methods of calculation (n=90)*

MCP*	Kernel Density Estimate		
	95%	80%	65%
<b>225</b>	<b>57.2</b>	<b>24.5</b>	<b>13.6</b>

\*MCP = Minimum Convex Polygon

MCP home range estimate for cheetahs

Kernel distribution of cheetahs



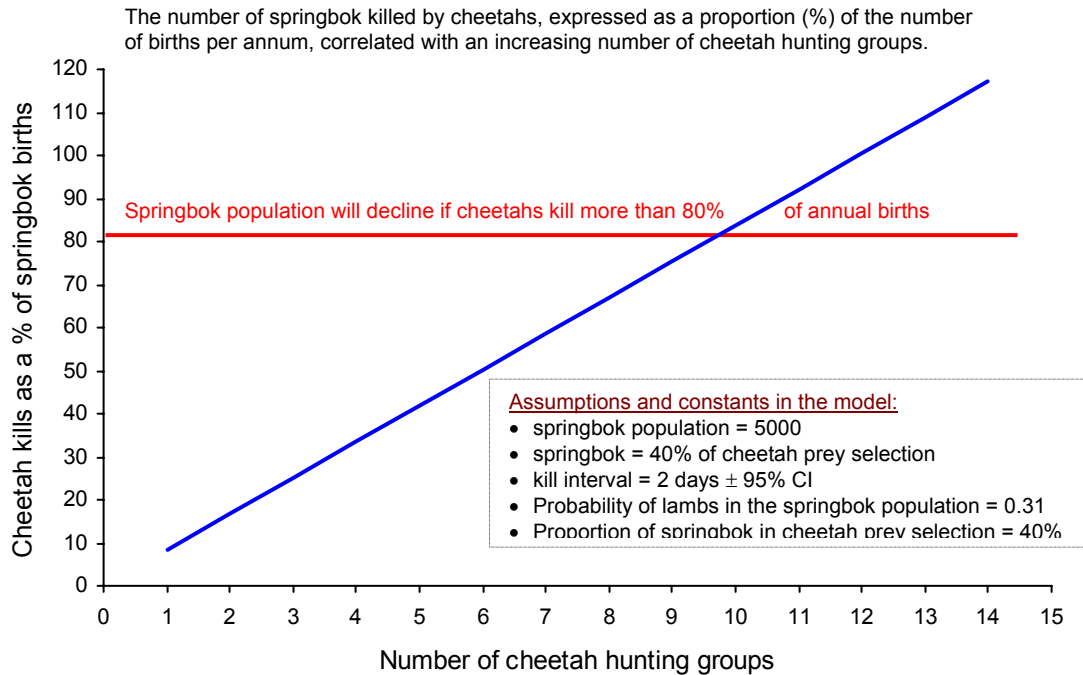


### Predator / prey models

With the availability of new data and a better understanding of the system it was appropriate to re-visit and improve the predator/prey models.

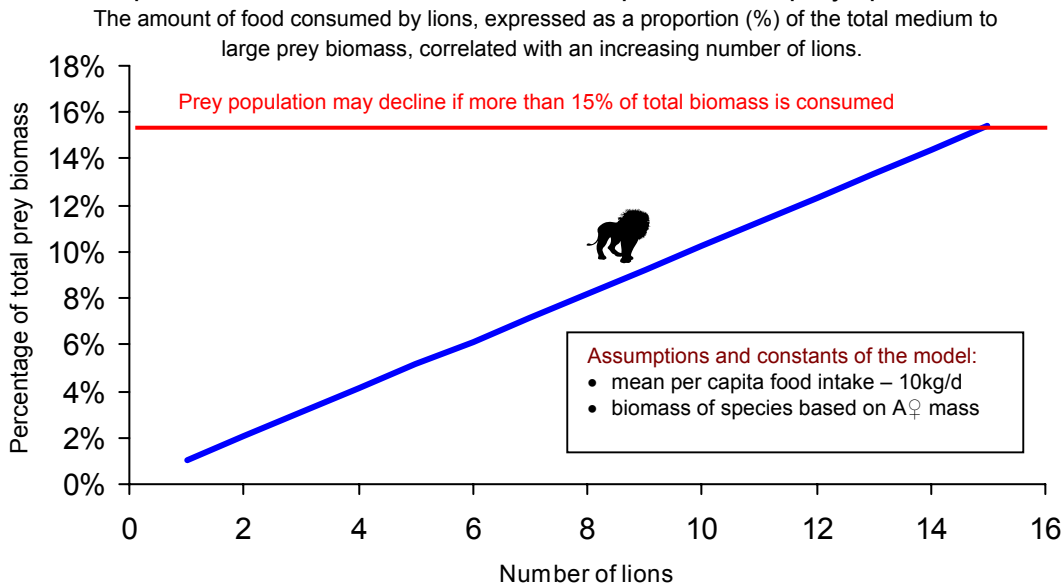
Based only the springbok population as their prey-base the new model suggest that KGL can theoretically support up to 9 cheetah hunting groups.

A predictive model on the affect of cheetah predation on the springbok population



The model for lions was even more favourable and suggests that up to 15 lions can theoretically be sustained by the prey-base at KGL. The high numbers of eland killed by the lions does however raise concern. Although previous studies in larger ecosystems suggest that the impact on prey populations is negligible, more research is needed to ensure that the eland population does not decline.

A predictive model on the affect of lions predation on prey species



### **Wild dogs**

The Kalahari Game Lodge appears to be suitable, if not ideal, for the introduction of wild dogs. The predator/prey models suggest that many more large carnivores can be sustained by the prey populations. A feasibility study for the introduction of wild dogs needs to be done. To achieve this, it is of great importance to obtain a) reliable estimates of the steenbok and duiker populations, and b) objective data on prey selection by both lions and cheetahs.

### **Acknowledgements**

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