Large Carnivore Survey

Bwabwata National Park, Namibia, July 2014

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Paul Funston[1], Lise Hanssen[2], Michelle Moeller[3]

[1] **Senior Director: Lion Program, Panthera**, 8 West 40th Street 18th Floor, New York, NY10018

[2] **Kwando Carnivore Project**, PO Box 8027, Kongola, Zambezi Region, Namibia

[3] **Program Assistant: Lion Program, Panthera,** 8 West 40th Street 18th Floor, New York, NY 10018

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INTRODUCTION

Although determining the abundance of large carnivores is inherently challenging (Balme, Hunter & Slotow 2009), knowing the size of large carnivore populations in protected areas is invaluable in guiding strategic conservation action and management decisions (Mills 1991). If repeated over time, surveys provide estimates of trends, which in large carnivore studies are often difficult to achieve, but are invaluable for conservation managers (Packer *et al.* 2005, 2011). Moreover, large carnivore density trends are a reflection of prey densities and anthropogenic influences and therefore serve respectively as a useful indicator of ecological health and human impact.

Thus the survey techniques chosen for large carnivores should ideally be cost effective, efficient and repeatable, especially if the goal is to achieve time series or trend data. Although camera-trap surveys (Karanth & Nichols 1998) and call-up surveys (Ogutu & Dublin 1998; Mills, Juritz & Zucchini 2001; Ferreira & Funston 2010) are very effective survey methods, they do have constraints when working with the guild of large carnivores. Camera trapping only works for individually recognizable species that can be readily photographed (e.g. leopards and spotted hyaenas) or known individuals, while call-up surveys are limited to only estimating densities of lions and spotted hyaenas. Furthermore camera trap surveys are expensive in terms of the equipment required and take a long time to complete over large areas, especially in areas where carnivores occur at low densities.

Several studies have identified strong linear relationships between large carnivore density and track-based abundance indices derived from spoor transects, (Stander 1998; Houser, Somers & Boast 2009; Funston *et al.* 2010). Thus spoor transects are a robust means to predicting large carnivore densities, especially in areas with suitable sandy substrate and provided suitably skilled trackers are available (Stander *et al.* 1997).

The first ever-comprehensive large carnivore survey of the Bwabwata National Park (BNP) was conducted in July 2014 using the spoor transect method during a collaboration between Kwando Carnivore Project, MET, Panthera and Kyaramacan Association.

STUDY AREA AND METHODS

As part of the Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA) the BNP (6000km^2) of Namibia forms a very important link connecting large carnivore and wildlife populations between Angola, Botswana and Zambia (Riggio *et al.* 2013, Funston 2014). Although it was known that all five large carnivore species occurred in the park

(and possibly brown hyaena), population estimates were only available for spotted hyaenas (Hanssen 2011), with some lion and wild dog monitoring being done by MET (Hanssen 2014). However, no systematic, simultaneous and comprehensive surveys had been conducted.

Indications prior to the survey where that:

1. Lions only occurred in the Kwando Core Area of BNP
2. Leopards probably occurred throughout BNP in reasonable numbers
3. Cheetahs occurred at extremely low densities in BNP mainly in the core areas
4. Spotted hyaenas were largely limited to the core areas of BNP with very few individuals in the multiple use area, and
5. Wild dogs occurred throughout BNP at low density

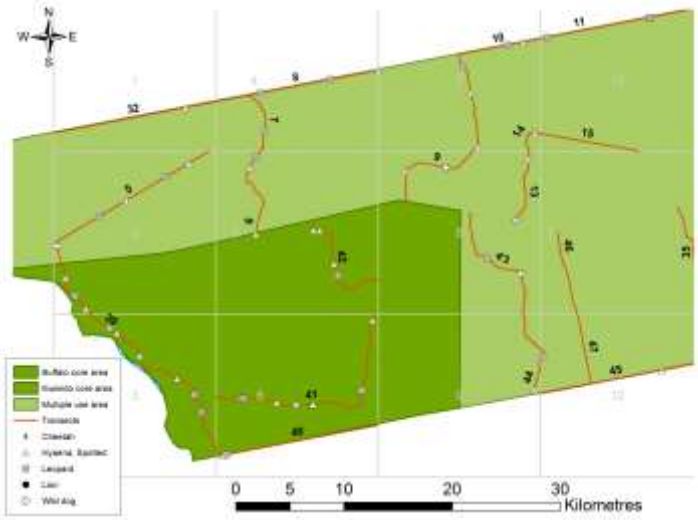
The BNP includes the rivers and floodplains of the Kavango and Kwando rivers, and the sandy ridges and omurambas of the largely teak (*Burkea* spp) and mixed woodlands in between. Although the park covers approximately 6000km^2, the area surveyed was 5794 km^2. We did not survey west of the veterinary fence near Divundu due to it being heavily settled.

Data collection

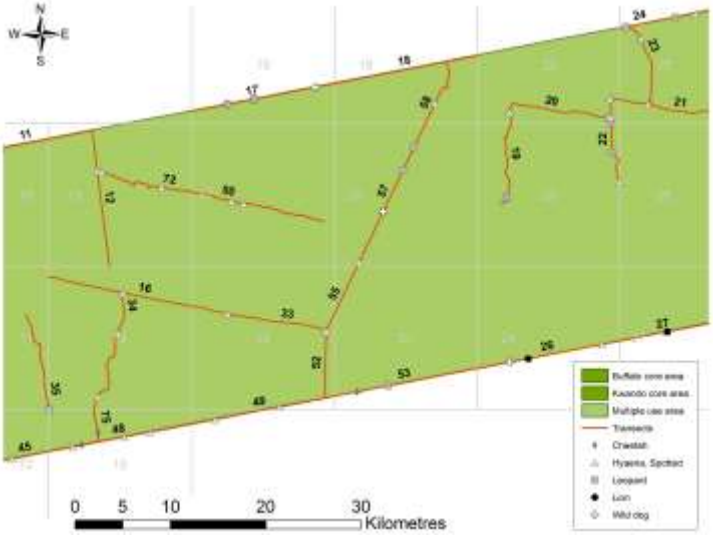
The entire area included suitable substrate for counting tracks although care had to be taken to drive slowly and check for spoor more carefully on calcrete roads and newly made hunting tracks. The survey area was divided into thirty-nine 15x15km grids with transects being conducted within each grid (see Figure 1A - C).

The track surveys comprised driving along sandy tracks in the park with two trackers seated on a specially made seat on the front of the vehicles. Driving at an average speed of 10-15 km/h the trackers recorded all fresh (<24hrs old) carnivore tracks observed along the route, determined the sex and age of some of the species, and importantly tried to minimize the double counting of individuals that might have used that, or subsequent, transects more than once the previous night. This is particularly problematic for spotted hyaenas, and wild dogs. Spotted hyaena walk such great distances at night that the probability of double or even triple counting the same hyaena (and thus inflating the estimate) is very real. This was factored into the estimate for both species by discounting the first sets of tracks on subsequent transects (i.e. transects that followed directly on from the previous transect).

A.



B.



C.

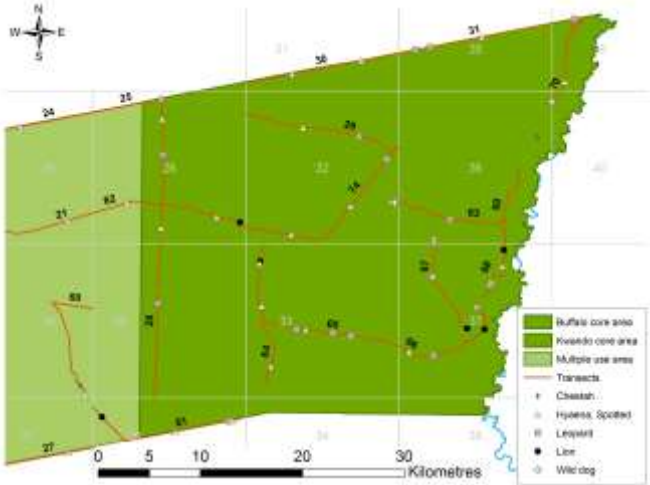


Figure 1. The areas surveyed during the July 2014 spoor surveys of Bwabwata National Park, Namibia, depicting transected covered, carnvore spoor observations and the 15x15 km grid (maps prepared by Michelle Moeller).

Transects were only driven in the morning. The typical start time was 07:00, generally completed by 11:00 where after the light for detection of tracks deteriorates. Two teams operated at the same time, one mostly north of the tar road that bisects BNP, and the other mostly south thereof. On most mornings two transects were covered by each team, but on some occasions three transects where completed by a team. Spoor was recorded for all mammalian carnivores equal in size to or larger than a genet. This included aardwolf, African wildcat, bat-eared fox, civet, caracal, side-striped and black-backed jackals, and serval; but abundance estimates were only derived for the large carnivores – lion, leopard, cheetah, spotted hyaena and wild dog (following Funston *et al*. 2010). All data was recorded using Cybertraker software on Trimble GPS handheld computers and backed up on data sheets. All transects where track logged by GPS and all mapping was done in ArcView version 10.2.

Data analysis

For each transect the number of track observations for each species was calculated, and transformed into "track frequencies", i.e. the number of tracks per 100 km of transect. As large carnivore track density is strongly and positively correlated with large carnivore population density in any given area (Funston *et al*., 2010), average track frequencies were transformed into population densities using the following equation $x_i = (t_i - 0.4)/3.15$, where x_i is carnivore density and t_i is carnivore track frequency (Funston *et al.* 2010). Track frequencies were calculated separately for sand ridges and omuramba's, as carnivores in the Zambezi region use the omuramba's disproportionately more often than the surrounding sand ridges (Lise Hanssen and Michelle Moeller *pers. obs*.). The estimates for each habitat type were summed to produce a total for the BNP.

RESULTS

During the survey a total of 66 transects were conducted, with an average transect length of 12.6 km (range 3.6 to 19.0 km), covering a total of 831 km; of which 632 km were conducted in the sand ridges (4961km^2), and 201 km where in omurambas (833km^2)(Table 1). Each transect was driven only once and the survey took 12 days to complete. The locations of transects and spoor observed along each transect are depicted in Figure 1 A - C.

During the survey lion tracks were only recorded in the Kwando Core Area and the immediate multiple use area to the west thereof, resulting in a population estimate of 16 lions.

Table 1. Summary of survey effort (kilometers) relative to habitat types in the Bwabwata National Park, Namibia in July 2014.

	Buffalo Core Area	Multiple-Use	Kwando Core Area
Size	629.7 km^2	4056.8 km^2	1344 km^2
Sand ridges	66.4	415.5 km	149.8
Omurambas	8.9	118.9	71.5
Total	**75.3**	**534.4**	**221.3**

By comparison 51 leopard tracks were recorded throughout BNP, resulting in a population estimate of 110 leopards. These data, and those for the other large carnivores, are summarized in Table 2.

Table 2. Summary of the results from the spoor survey of Bwabwata National Park, Namibia in July 2014.

Habitat	Metrics	Lions	Leopards	Cheetahs	Spotted hyaenas	Wild dogs
Sand ridges	Number tracks recorded	10	43	8	53	32
	Track frequency	1.42	6.09	1.10	4.24*	4.26
	Mean density	0.32	1.18	0.22	1.22	1.23
	Population estimate	16	90	11	60	61
Omurambas	Number tracks recorded	0	8	0	26	14
	Track frequency	0.00	7.69	0.00	6.25*	7.43
	Mean density	0.00	2.40	0.00	1.17	10
	Population estimate	0	20	0	10	19
Total population estimate		**16**	**110**	**11**	**70**	**80**

*corrected for double counting on subsequent transects

DISCUSSION

The survey largely confirmed the majority of our *a priori* assumptions about large carnivore abundances and distributions in BNP, and importantly highlighted slightly higher estimates of spotted hyaenas and especially wild dogs than might have previously been thought. BNP is thus a very important component of the range of the regionally endangered African wild dog within KAZA.

The estimate of 16 lions in the park is in line with our own personal observations with 12 known lions being recorded in the BNP (Hanssen 2014). There are no resident lions in

the middle of the multiple use area, or in the Buffalo Core Area. Although we have reports that lion's occasionally cross the Kavango River and enter the Buffalo Core Area, this seems to be limited to male lions and they are not resident (Piet Beytell *pers. comm*.). Given that the only resident lionesses in the BNP occur in the Kwando Core Area, it is unlikely that lions will colonize the Buffalo Core Area anytime soon, as a recent study by Dolrenry *et al.* (2014) shows that lionesses seldom move this far to settle in new areas. Thus it is our recommendation that MET considers the reintroduction of a pride of lions into the Buffalo Core Area. A community engagement program to address any future conflict mitigation issues before they arise should precede this.

In contrast to the low number and restricted distribution of lions, three of the large carnivore species occur widely and throughout the BNP. Estimates suggest a population of about 110 leopards, 70 spotted hyaenas and 80 wild dogs. These are encouraging estimates and suggest that leopards are doing well in the park, that there may be four to six packs of wild dogs, and that spotted hyaena numbers have increased, especially in the multiple use area. A clan of spotted hyaenas has established near Chetto, and an active den of wild dogs was found in the multiple use area, while tracking along the Angolan border. Furthermore, the known clans in the Kwando Core Area have increased slightly in numbers over the last six years, but are still limited mostly by road mortality. Considering the importance of BNP for an endangered species like the African wild dog, more needs to be done to slow traffic in key areas throughout the park. As expected the estimate for cheetahs is the lowest of the large carnivores in BNP, with no more than 8 cheetahs estimated to occur in the park. Most of these are found in the Kwando Core Area, where we know of a group of three adult males and a female with two large cubs.

This survey established a baseline for future large carnivore monitoring in BNP, and will be followed by a survey with a similar design in the Luiana National Park in Angola. Ultimately this could contribute to the development of carnivore conservation strategies for KAZA and conservation/management by MET in BNP. This survey could be repeated annually or biannually at a cost of about N$60,000, and can be completed in a period of less than two weeks. This method is scientifically sound, cost effective and repeatable, and employs the traditional tracking skills of the community residing in the park.

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