



# Realistic population estimates of wildlife species inhabiting SO2-KW6 Wildlife Management Areas (WMAs)

*Updated scientific guidance for Land Use Change proposals*

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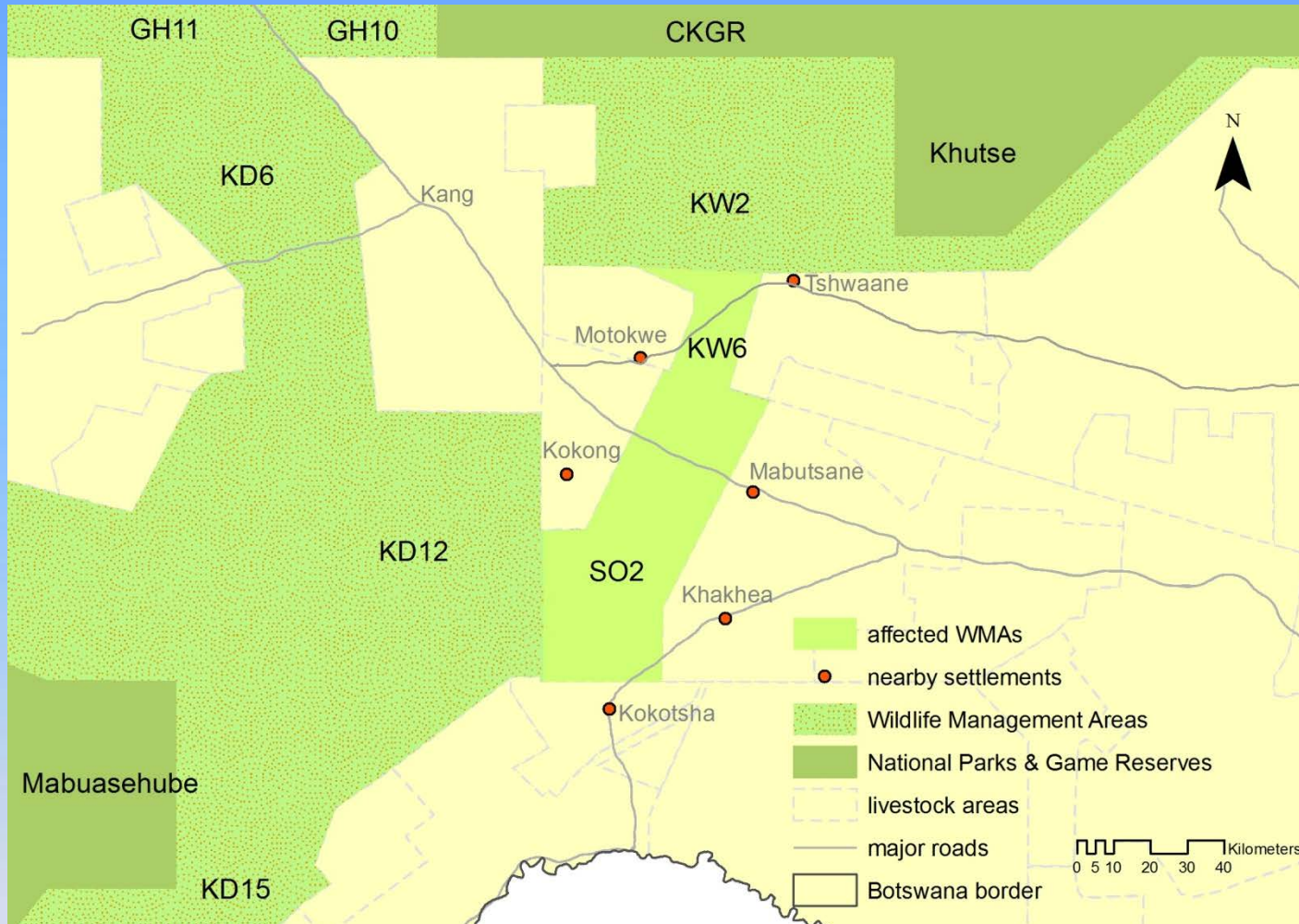
# Summary

- It is conventional practice to count large mammals throughout Africa from airplanes.
- Botswana has an exceptional opportunity to do better. Counting animals indirectly via their tracks has been proven a rigorous method of estimating wildlife densities and population sizes (Keeping & Pelletier 2014).
- The future status of SO2-KW6 as WMAs comprising a southern wildlife movement corridor connecting KTP to CKGR is in question. This is approximately 3,000 sq km of free-ranging wildlife habitat.
- Information about wildlife in SO2-KW6 available to decision-makers is based almost entirely on the aerial survey record. We contend that this is inadequate. The aerial survey is an unreliable indicator of wildlife distributions at the spatial scale of WMAs. The sampling rate in the Kalahari is too low (3-4% area coverage), and too few animals are observed.

# Summary

- We conducted an alternative track-based ground survey of SO2-KW6 during years 2015-16, and herein briefly summarize the results of those surveys.
- In significant contrast to aerial survey results, we find that SO2-KW6 presently supports approximately **1,700 large free-ranging herbivores** and **22 large carnivores** (3 species of which have either Vulnerable or Endangered IUCN Red Listing).
- The disparity between wildlife detected by their tracks and by the aerial surveys may be illustrative of other areas in the Kalahari believed to be "marginal" wildlife estate and therefore vulnerable to livestock expansion schemes.
- We recommend that track-based ground surveys of wildlife populations be conducted in vulnerable wildlife habitats in Botswana before decisions to relinquish such habitats for livestock expansion are made.

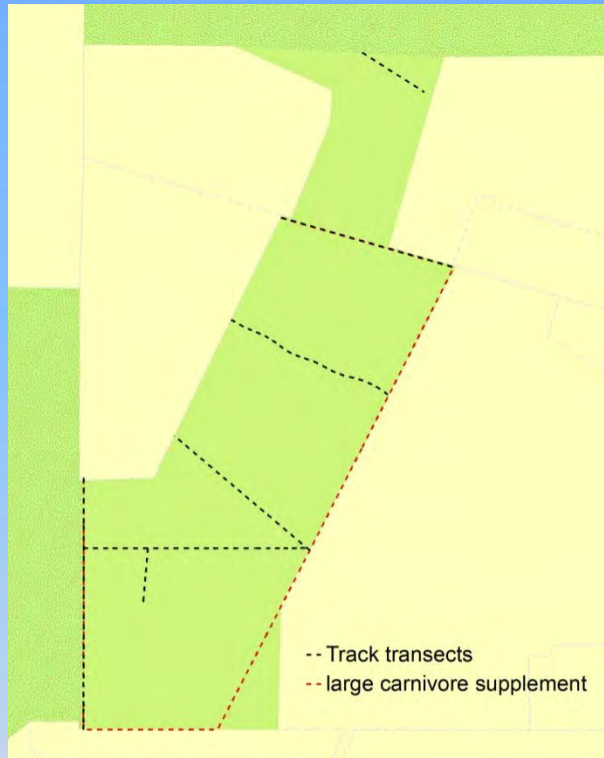
# Orientation



- SO2-KW6 is the only “green” corridor linkage remaining between KTP and CKGR south of Ghanzi District.
- The non-green space is largely compromised by boreholes, cattleposts, and fences, creating unfavourable conditions for large wildlife.

# Methods

## Track survey

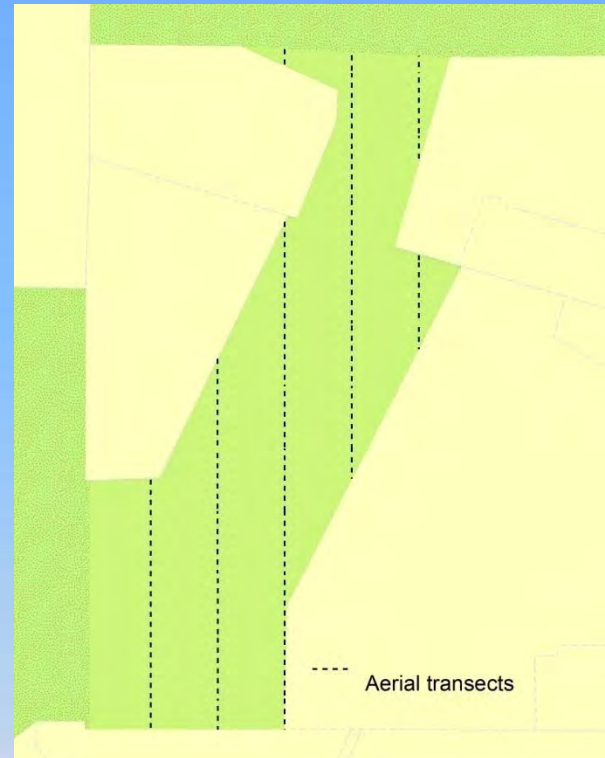


180 km sample coverage  
(353 km for carnivores)

Transects sampled once,  
opportunistically during  
Jan 2015, Dec 2016

(some transect overlap with  
carnivore supplement in May 2013)

## Aerial survey



293 km sample coverage

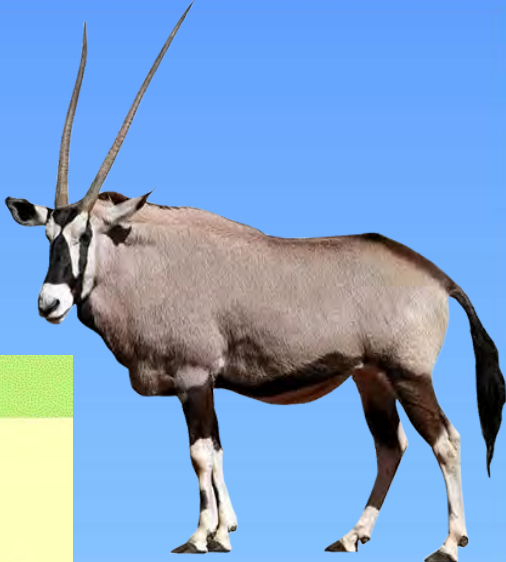
Transects sampled twice,  
once during Oct/Nov 2012,  
and again during Oct 2015

# Methods

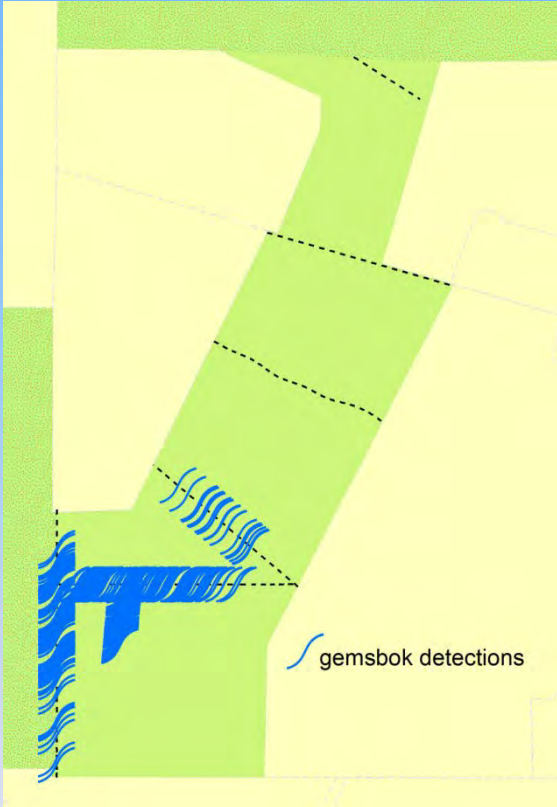
- Track transects were driven slowly with PS and NM seated on front of the vehicle scanning for tracks.
- In the interest of time, species other than large herbivores and large carnivores were ignored, with the exception of pangolin.
- All track interceptions of target species were recorded including species, numbers and GPS locations. Trackers estimated the age of tracks to the nearest day.
- Conversion of track counts to density and population size estimates followed methods outlined in Keeping (2014) – see reference appended.
- Aerial survey followed standardized methods by DWNP with analysis using the program BASIS.

# Results

# Gemsbok



### Tracks

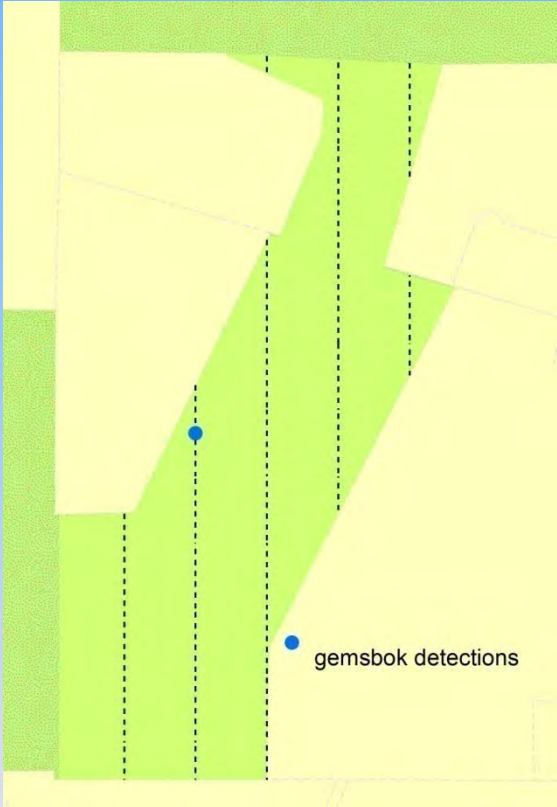


376 detections

Population estimate:

398 (178-656)

### Aerial



1 detection

Population estimate:

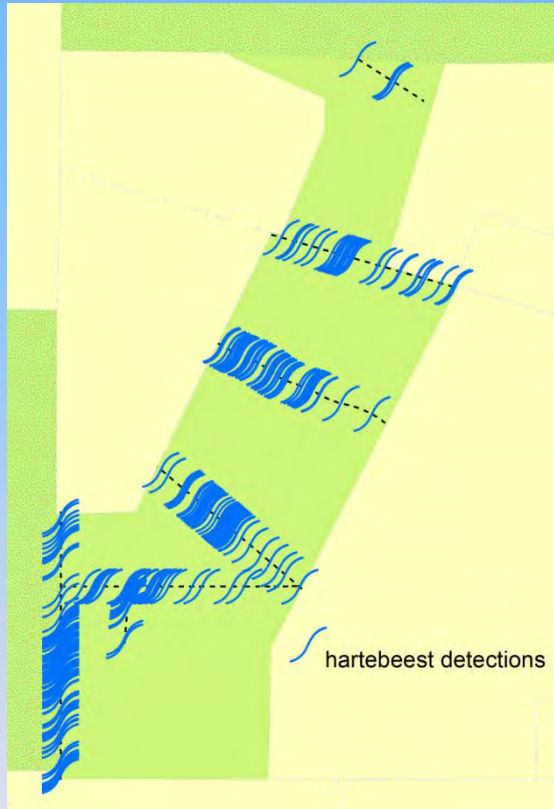
37 (0-83) 2012 survey  
0 2015 survey

# Results

# Hartebeest



## Tracks

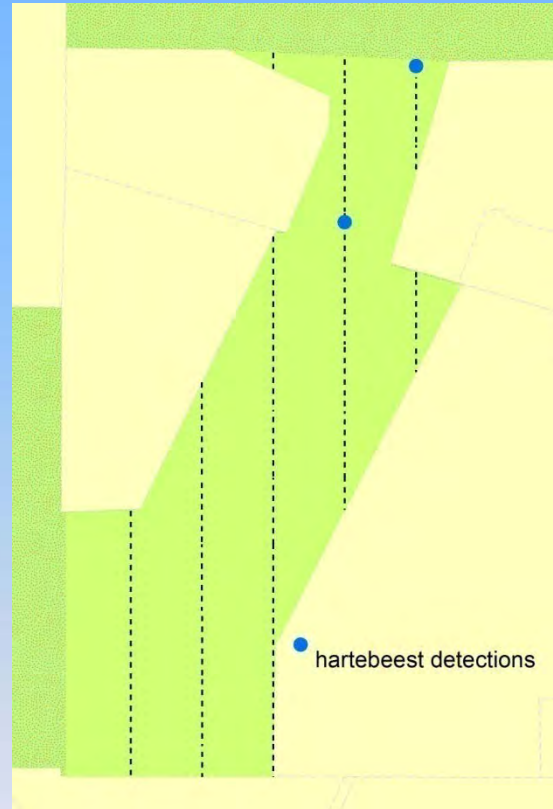


374 detections

Population estimate:

540 (213-780)

## Aerial



2 detections

Population estimate:

173 (0-346) 2012 survey

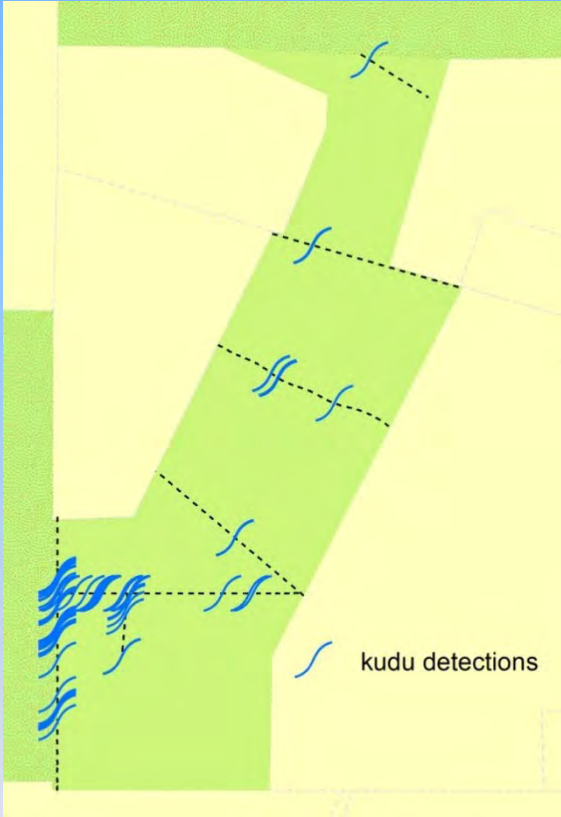
94 (21-167) 2015 survey

# Results

# Kudu



Tracks



78 detections

Population estimate:

367 (134-601)

Aerial



0 detections

Population estimate:

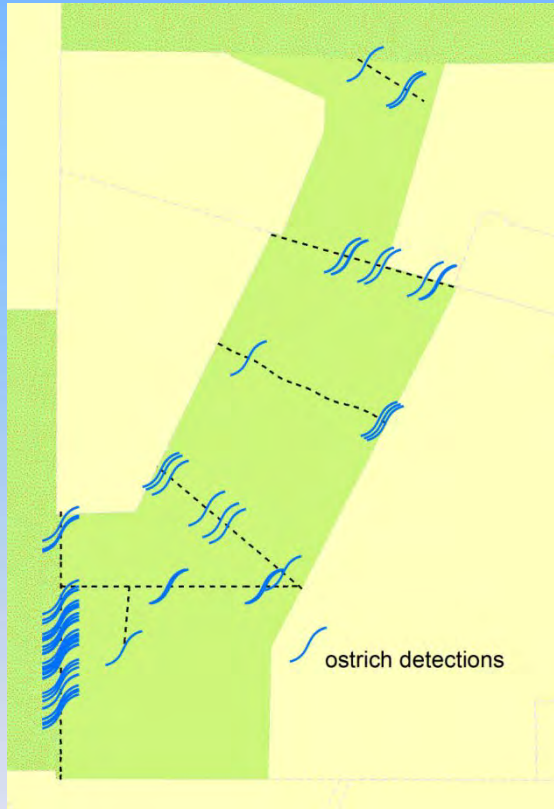
0 2012 survey  
0 2015 survey

# Results

# Ostrich



## Tracks

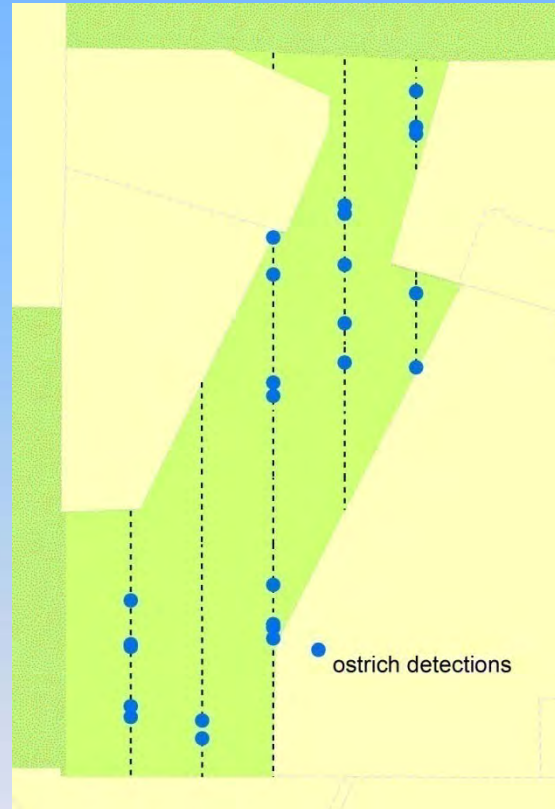


63 detections

Population estimate:

411 (167-649)

## Aerial



25 detections

Population estimate:

320 (77-563) 2012 survey  
1812 (1758-1866) 2015 survey

# Results

# Wildebeest



### Tracks

### Aerial



11 detections

0 detections

Population estimate:  
Not attempted

Population estimate:

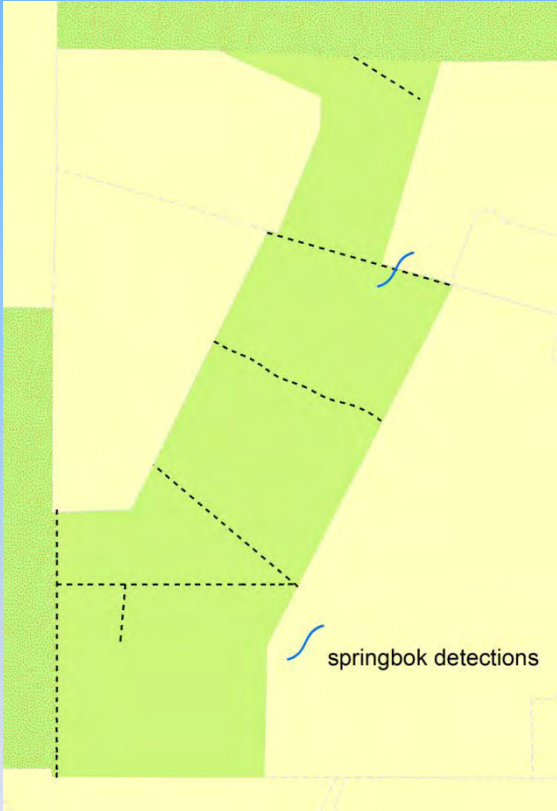
0 2012 survey  
0 2015 survey

# Results

# Springbok



### Tracks



1 detection

Population estimate:  
Not attempted

### Aerial



0 detections

Population estimate:

- 0 2012 survey
- 0 2015 survey

# Results

# Eland



Tracks



1 detection

Population estimate:  
Not attempted

Aerial



0 detections

Population estimate:

0 2012 survey  
0 2015 survey

# Results

## Brown hyaena



Tracks



46 detections

Population estimate:

13 (6-22)

Aerial



0 detections

Population estimate:

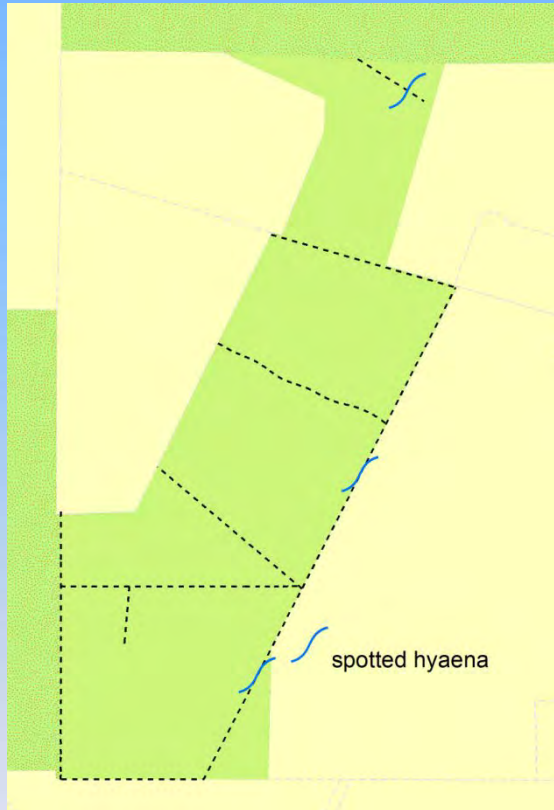
0 2012 survey  
0 2015 survey

# Results

# Spotted hyaena



### Tracks



3 detections

Population estimate:

(0-2)

### Aerial



0 detections

Population estimate:

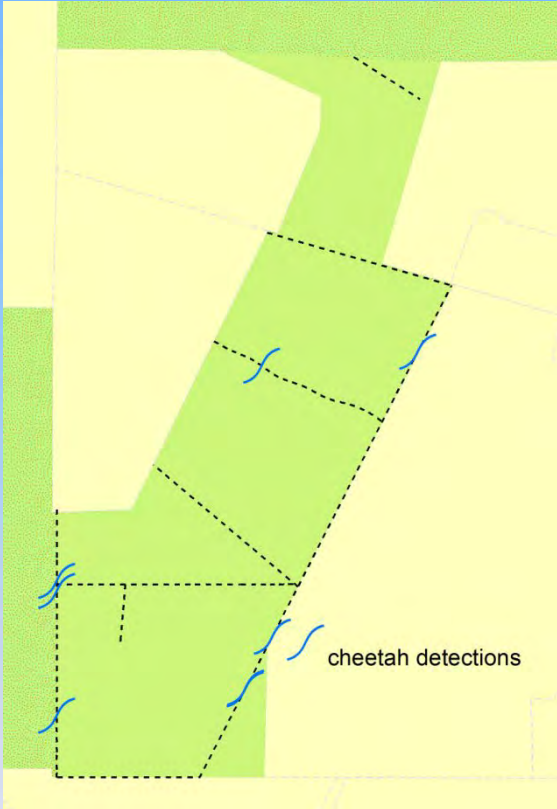
0 2012 survey  
0 2015 survey

# Results

# Cheetah



Tracks



8 detections

Population estimate:

4 (1-6)

Aerial



0 detections

Population estimate:

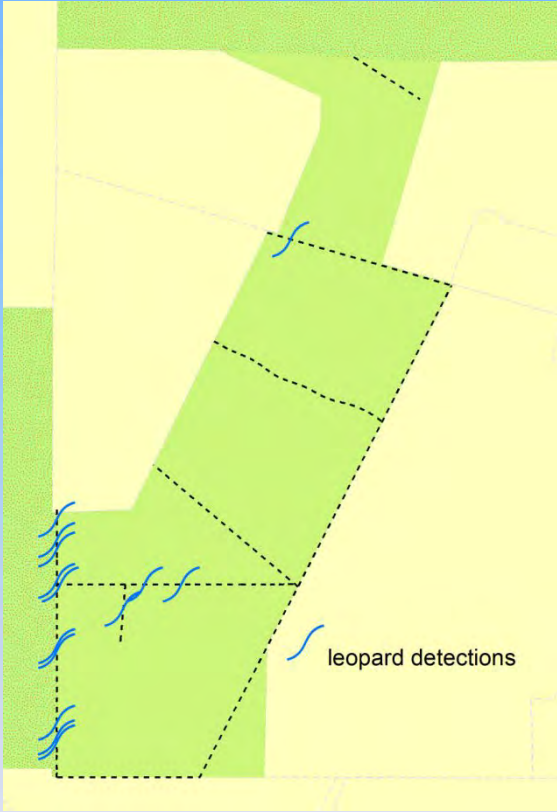
0 2012 survey  
0 2015 survey

# Results

# Leopard



Tracks



15 detections

Population estimate:

3 (1-6)

Aerial



0 detections

Population estimate:

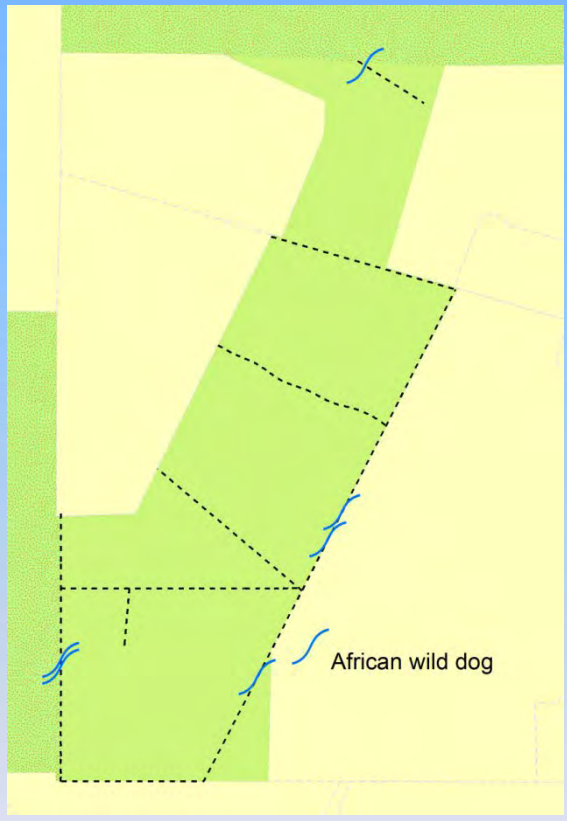
0 2012 survey  
0 2015 survey

# Results

# Wild dog



Tracks



6 detections

Population estimate:

2 (1-6)

Aerial



0 detections

Population estimate:

0 2012 survey  
0 2015 survey

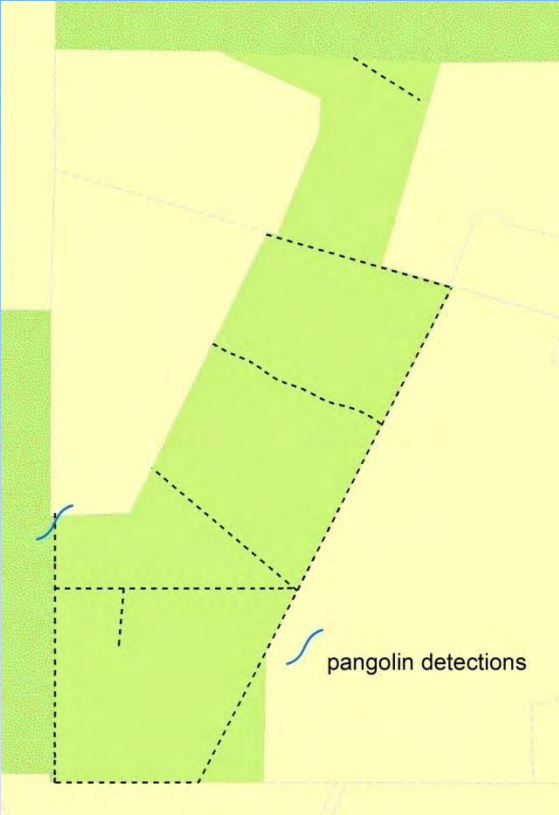
# Results

# Pangolin



Tracks

Aerial



1 detection

0 detections

Incidental observation of a data-deficient conservation priority species

# Results – Smaller wildlife species

Smaller species were not counted during the track surveys. However, comprehensive track surveys from nearby KD WMAs provide some insight to the populations occupying SO2-KW6. Potential population size estimates for SO2-KW6 are provided in the following table, adapted from Keeping (2014):

Species	Density (100 km <sup>2</sup> )	SO2-KW6 Potential Population numbers
steenbok	222.6	<b>6645</b> (4519 - 8445)
duiker	17.3	<b>516</b> (194 - 803)
springhare	101.6	<b>3033</b> (949 - 6060)
hare <i>spp.</i>	376.1	<b>11227</b> (3973 - 20764)
porcupine	14.2	<b>424</b> (110 - 1104)
ground squirrel	16.1	<b>481</b> (152 - 916)
African wild cat	11.4	<b>340</b> (170 - 496)
black footed cat	0.5	<b>15</b> (3 - 30)
Cape fox	16.9	<b>504</b> (355 - 734)
caracal	3.2	<b>96</b> (39 - 149)
honey badger	3.4	<b>101</b> (45 - 173)
jackal	63.9	<b>1907</b> (1113 - 2573)
slender mongoose	1.1	<b>33</b> (3 - 78)
small spotted genet	7.1	<b>212</b> (81 - 349)
striped polecat	29.7	<b>887</b> (397 - 1448)
suricate	6.9	<b>206</b> (21 - 445)
yellow mongoose	18.9	<b>564</b> (233 - 830)
aardvark	4.6	<b>137</b> (78 - 191)
aardwolf	3.3	<b>99</b> (48 - 149)
bat-eared fox	62.8	<b>1875</b> (1012 - 2710)
ground pangolin	0.6	<b>18</b> (0 - 78)
kori bustard	13.8	<b>412</b> (197 - 612)
secretary bird	0.8	<b>24</b> (2 - 51)
tortoise <i>spp.</i>	30.0	<b>896</b> (301 - 1618)

# Discussion

- One possible explanation for the discrepancy in counts is that wildlife moved into SO2-KW6 from neighbouring areas shortly following the aerial survey in Oct 2015.
- More likely, gemsbok are resident in the core of SO2, as they are in other wild areas of the Kalahari, and the aerial survey does a poor job of detecting wildlife at moderate densities when 3-4% area coverage is flown.
- While the aerial survey reveals valuable insights at the country-wide or regional scale, at the scale of SO2-KW6 it failed to return useful numbers. Aerial transect spacing in the Kalahari is necessarily wide (10-11km between them), observers note animals in 150m strips either side of the airplane, and typically not every animal within the sample strip is seen, for example those hidden underneath trees (undercounting bias).

# Discussion

- By contrast, passive track surveys are time-integrated, thus detecting animals that have moved from much farther away than 150m, and therefore effectively increasing the total landscape area sampled.
- Further, while the aerial survey provided a snapshot of seconds, the track survey provided a window of about 1 week of wildlife movement, in other words capturing roughly 2% of an annual cycle of wildlife movement through the area.
- Within this relatively short window one sees where species are consistently distributed. While SO2-KW6 is obviously a movement corridor for hartebeest, kudu and ostrich, given the gemsbok distribution in southern SO2 plus eland and wildebeest detections there, it seems likely that some of these animals move through the corridor from time to time (during the 98% of the annual cycle not sampled).

# Discussion

- It is therefore probable that SO2-KW6 continues to function as a genetic corridor linking CKGR and KTP for all large herbivores and carnivores, despite cattlepost encroachment forming a pinchpoint in KW6.
- Predictable cumulative impacts for free-ranging Kalahari wildlife include reduced dispersal, seasonal movements, and genetic connectivity with loss of access to SO2-KW6 - which is the most direct linkage between CKGR (Khutse) and KTP (Mabuasehube). This reduces the potential population sizes, resilience, and long-term viability of free-ranging populations throughout the Kalahari.
- Livestock expansion will predictably exacerbate human-wildlife conflict considering the large carnivores that presently occupy SO2-KW6 and adjacent KD12. Continued displacement and habitat loss for these species is of global conservation significance as cheetah and wild dog are the two most endangered large carnivores in Africa.

# Discussion

- If free-ranging wildlife and habitat in SO2 are lost to livestock expansion, KD12 will become the new edge.
- Presently buffered by SO2, the pristine KD12 will invariably be subject to negative impacts spilling over from the new intensified livestock and human activities along its border.
- In some years' time agricultural proponents will perhaps argue for further expansion into KD12 on the basis of its newfound "marginal"ness – a condition which their adjacent land use activities ensured would happen, intentional or not.
- One wonders: At what point will the eating away of the Kalahari frontier cease? and when will the livestock industry begin to "compromise" for Botswana's wildlife?

# Discussion

- Aerial surveys are becoming increasingly cost-limited and flown only during the late dry season in recent years.
- Rather than evaluating the worth of individual WMAs based on limited aerial surveys in single years and single seasons, greater insight might be gained by evaluating the remarkable 30-year aerial survey record holistically.

# Conclusion

- There is more wildlife inhabiting SO2-KW6 than is generally believed. The same is probable of other WMAs interlinking KTP and CKGR.
- An estimated **1,700 large antelopes plus 22 large carnivores** will be directly impacted by changing SO2-KW6 land use.
- The aerial survey results severely under-represented the number of large-bodied antelopes inhabiting SO2-KW6, and are utterly misleading for all smaller species such as steenbok and carnivores.
- Track-based wildlife surveys, employing the remarkable talents of local Kalahari expert trackers, are a more suitable method of collecting informative data for land use reallocation discussions than are visual surveys relying upon "direct-sightings" - whether that be from the ground, or airplane.

# Acknowledgements

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# References

Keeping, D. and Pelletier, R., 2014. Animal density and track counts: understanding the nature of observations based on animal movements. *PloS one*, 9(5), p.e96598. [AVAILABLE FOR FREE DOWNLOAD ONLINE](#)

Keeping, D., 2014. Rapid assessment of wildlife abundance: estimating animal density with track counts using body mass–day range scaling rules. *Animal conservation*, 17(5), pp.486-497. [AVAILABLE FOR FREE DOWNLOAD ONLINE](#)

