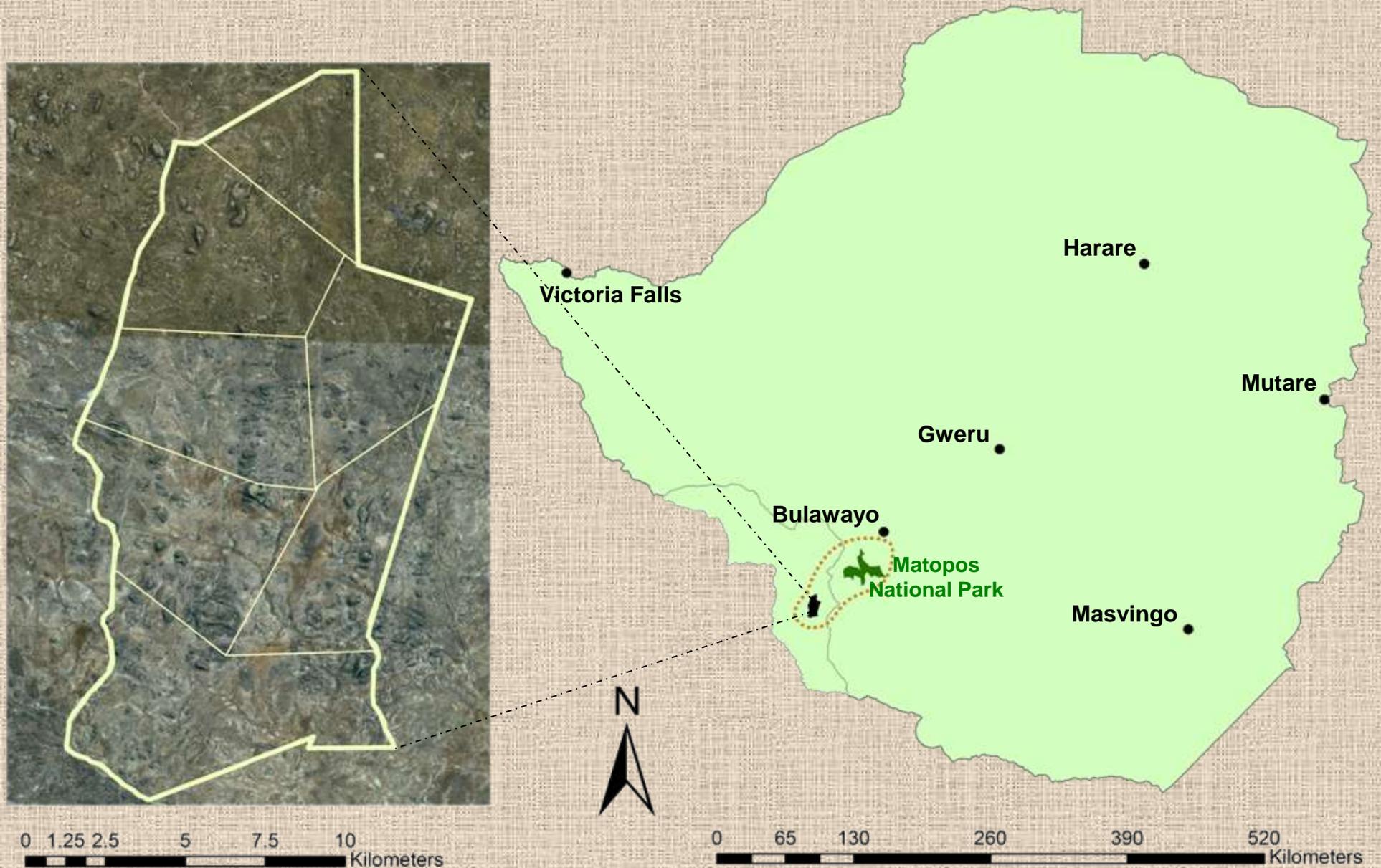


Leopard population density and home range size in the Mangwe District of Zimbabwe



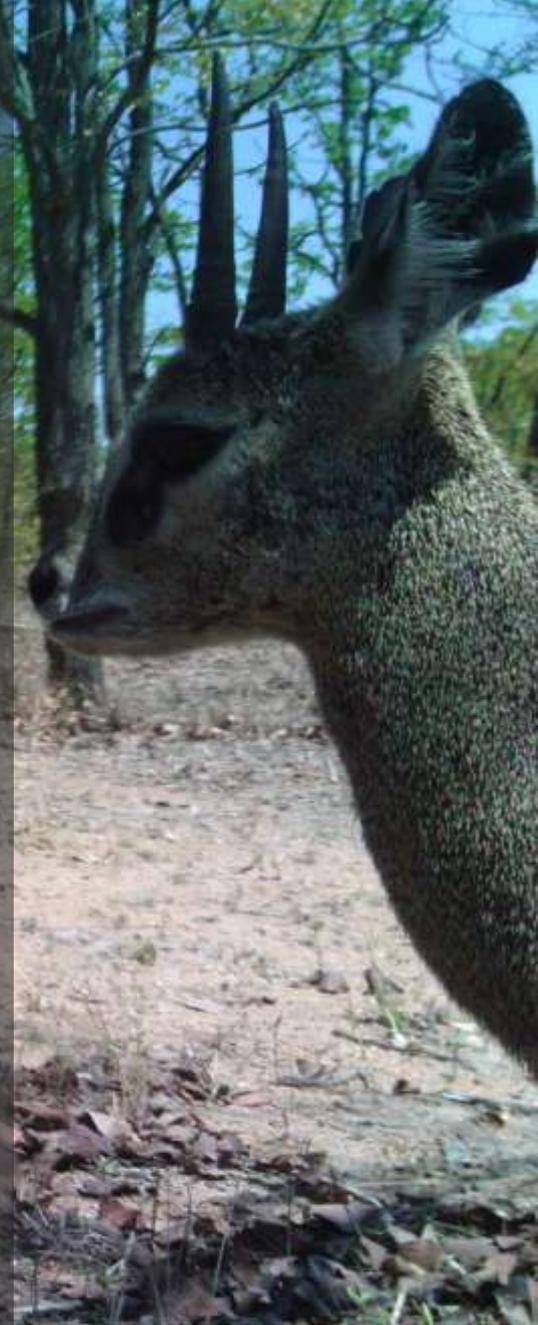
RHODES UNIVERSITY
Where leaders learn

Study Area: The Ingwezi Game Management Project



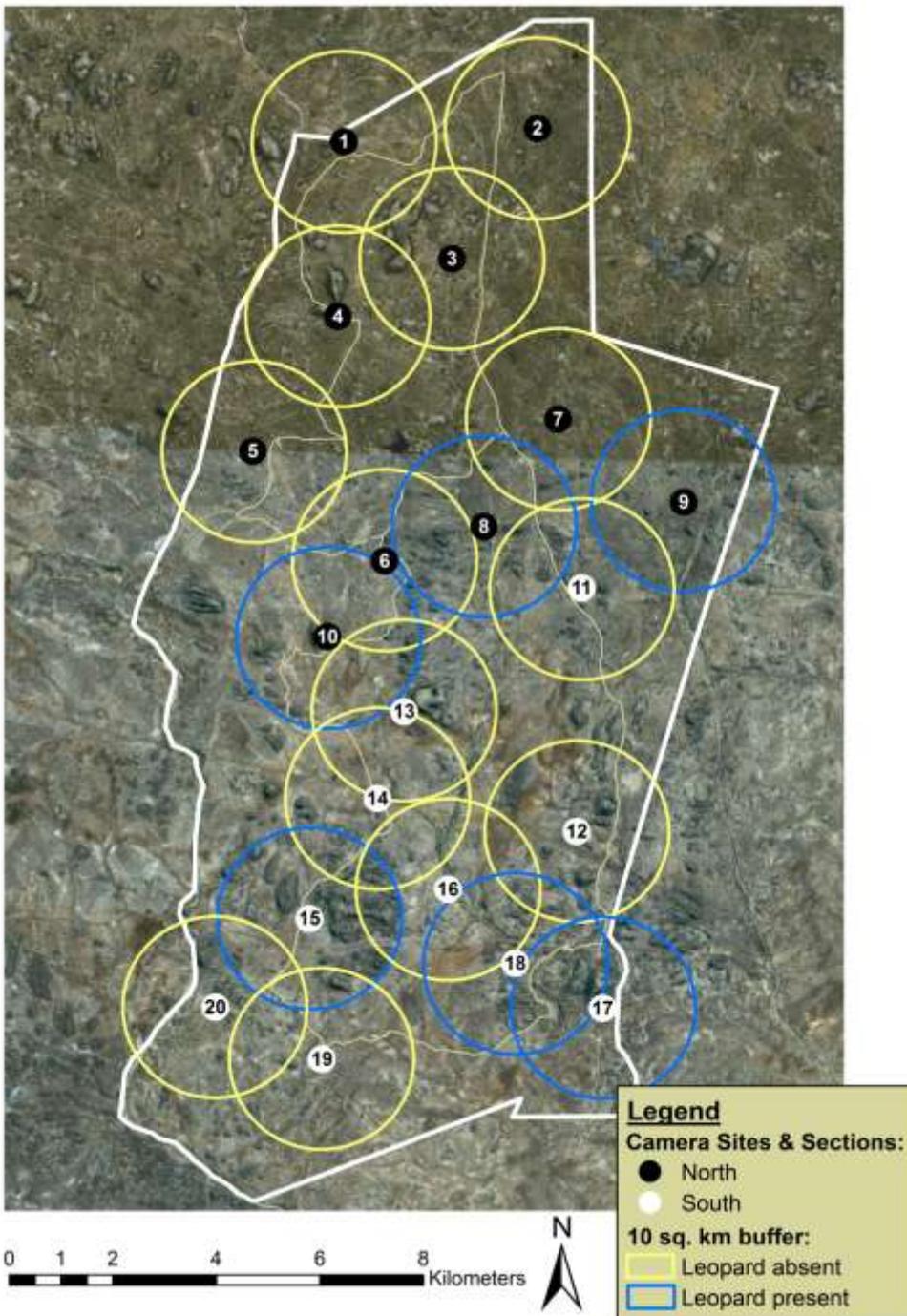
Estimating Leopard Density

- ❖ In order to set sustainable quotas robust density estimates needed
- ❖ Secretive, nocturnal, dangerous
- ❖ Camera trapping surveys using capture-recapture sampling & models
- ❖ Trap sites chosen to maximise chance of leopard capture, whilst satisfying assumption that no leopard has zero probability of being photographed
- ❖ Use minimum recorded home range size, for this terrain – 10km² (female from Matopos NP)



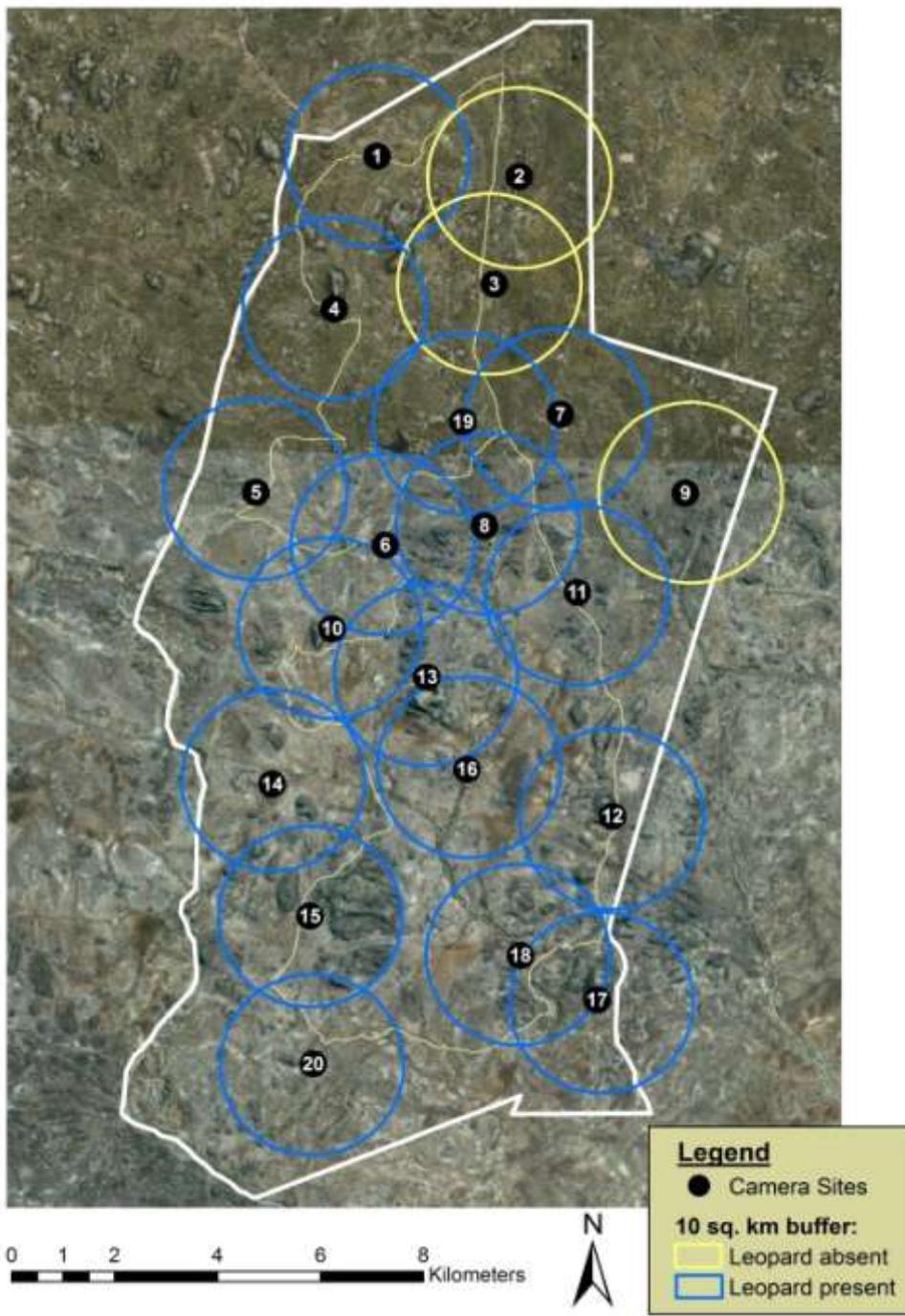
Non-baited Camera Trapping Survey:

- ❃ Pair of cameras/10km²
- ❃ Two contiguous subsections
- ❃ 20 sites in total
- ❃ 40 days (20 each)
- ❃ Wildview: burst mode, 5 mins. delay, flash, 24 hrs
- ❃ Consecutive photos of UnID species considered independent events if >30min apart
- ❃ Resulted in only 6 leopard photos



Baited Camera Trapping Survey:

- ❃ Baited with cattle foetuses
- ❃ Single camera/10km²
- ❃ 20 sites in total, all deployed simultaneously
- ❃ 65 days
- ❃ Wildview: burst mode, 5 mins. delay, flash, 24 hrs
- ❃ Consecutive photos considered independent events if >30min apart
- ❃ Resulted in 292 leopard photos



Data analysis: Non-baited

- Effectiveness and completeness as an inventory of mammals in the area:
 - only photos of medium & large mammals (>1kg)
 - compared to available checklists for adjacent areas
- Counted the total number of photos taken per species (n), their percentage contribution (Spp. %) to total photos, capture frequency (CF) - number of photographs (n)/100 camera days
- Sampling effort required to obtain at least one photo of all species with 95% CI:
 - evaluated relationship between CF& the number of days to register each species for the first time
 - Tobler *et al.*'s (2008) binomial model



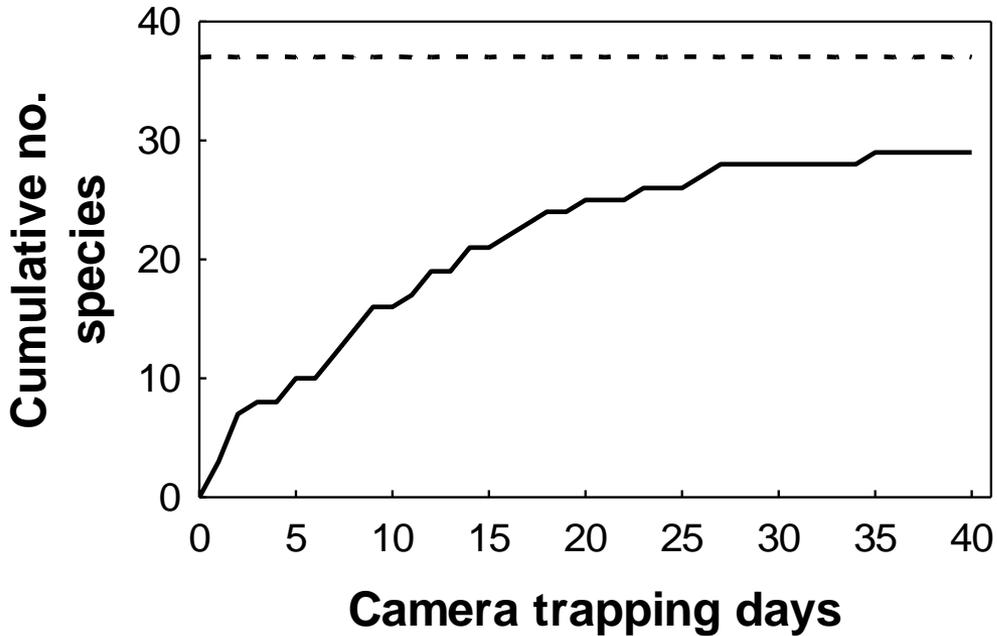
Data analysis: Baited

- ❖ ID individuals from rosette patterns
 - created a matrix for all captures and non-captures, number of trapping occasions & site ID
- ❖ Capture-recapture analyses:
 - Lincoln index
 - CAPTURE
 - SPACECAP which is a Spatially-Explicit Capture-Recapture (SECR) programme



RESULTS:	Non-baited	Baited
Camera trapping days	800	1320
Total no. of photographs	507	1713
% Anthropogenic	53%	14.5%
Total mammals	30	23
Small mammals	4	2
Total medium – large mammals out of a possible 37 ‘known’	26 (70%)	21 (57%)
Total birds	11	13
Total reptiles	1	0
Most common ungulates	Impala Common duiker Klipspringer	Bushpig Common duiker Kudu
Most common carnivores	Brown hyena African wildcat Black-backed jackal	Rusty-spotted genet Honey badger Brown hyena
Less common species photographed	Warthog Caracal Spotted hyena	Serval Caracal Spotted hyena

Results: Non-baited

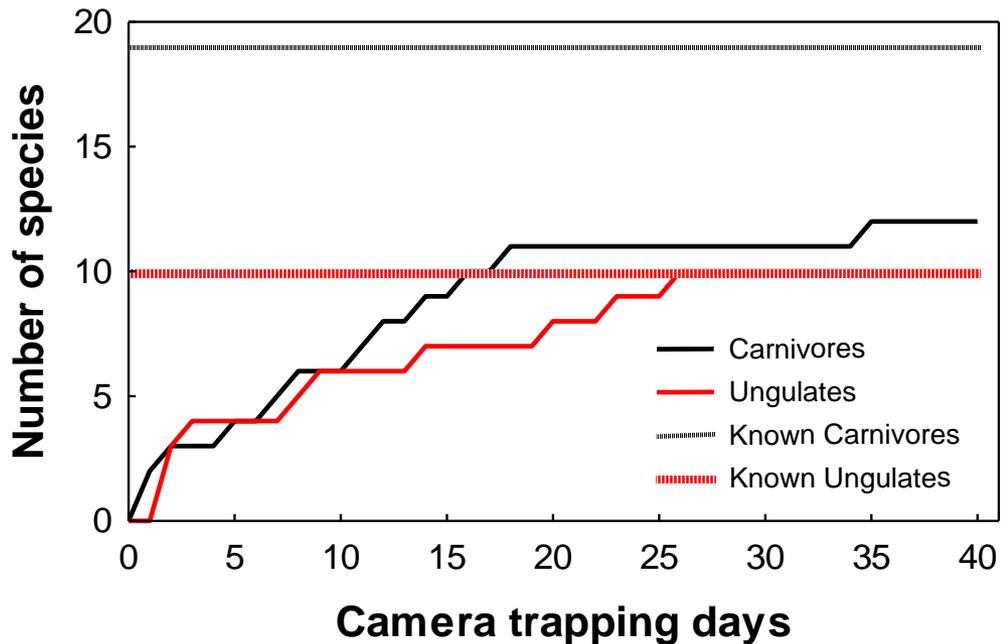


→ Effectiveness & completeness:

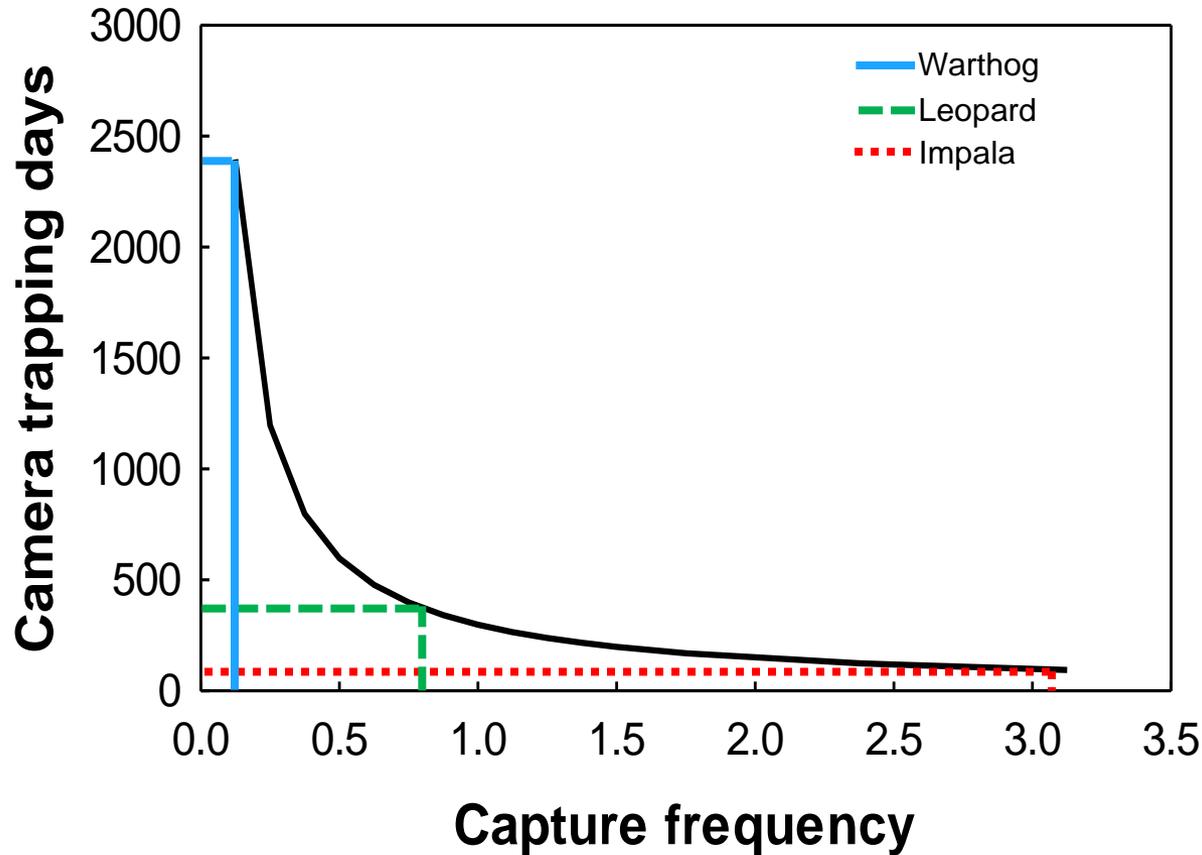
- * Known mammals $n=37$
- * Not complete after 40 days
- * Increased effort (trap days or cameras, or both)

* All ungulate species present were photographed after only 26 survey days

* The most elusive, nocturnal and perhaps less common carnivore species were not recorded by the end of the survey



Results: Non-baited

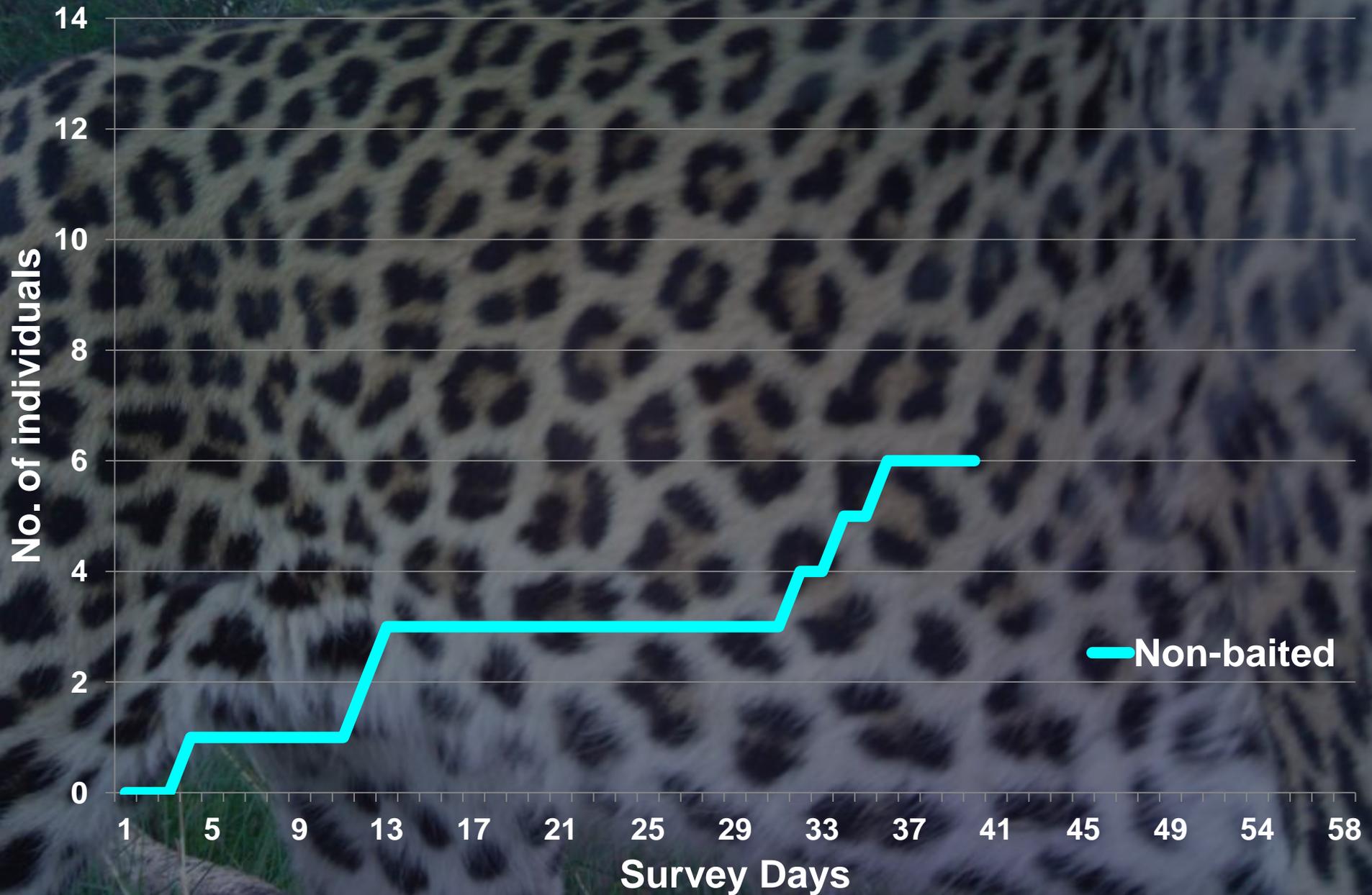


Sampling effort required

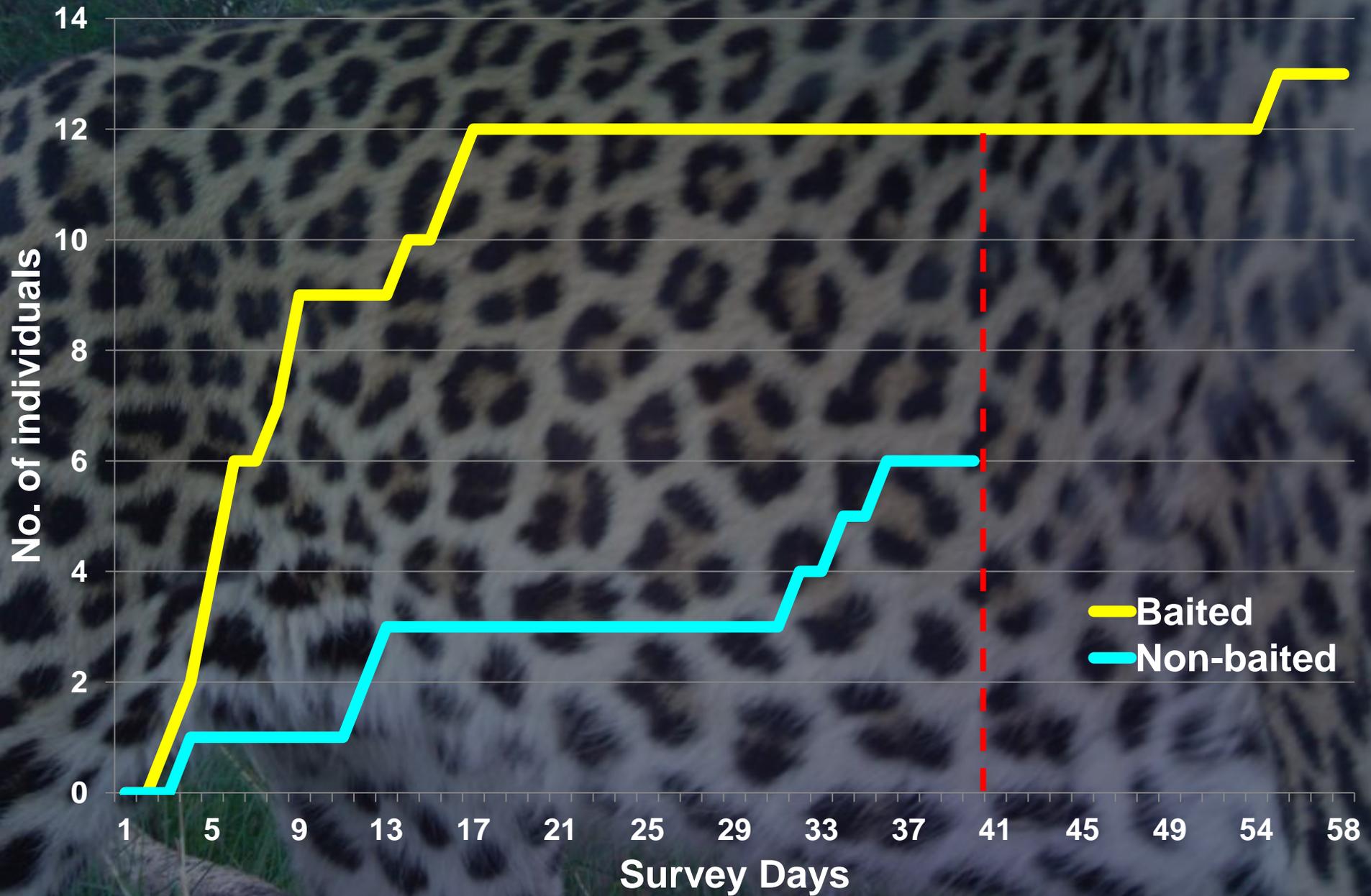
- * Based on CF:
 - More common species with CF of >2.0
 - Less common species CF of $0.6 - 1.8$
 - Rare or elusive species CF of <0.6

- * Effort required to register the more common species (impala) was 150 camera trapping days
- * Less common species (leopard) would require an effort of between 170 to 480 trapping days
- * 2400 trapping days required to register at least one photo of the rarer or more elusive species with 95% confidence

Results: Cumulative number of leopard captures



Results: Cumulative number of leopard captures

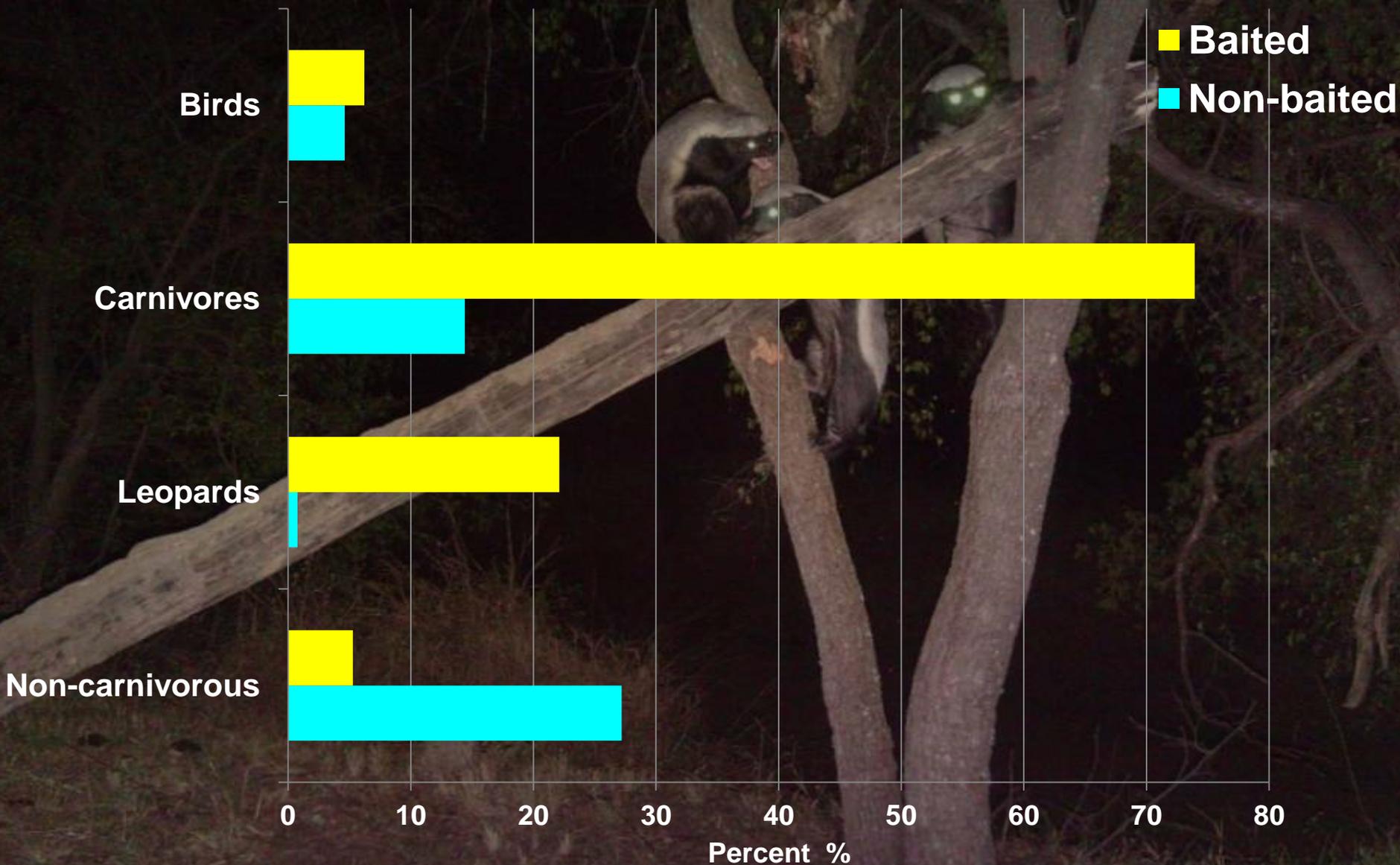


Results: Leopard densities

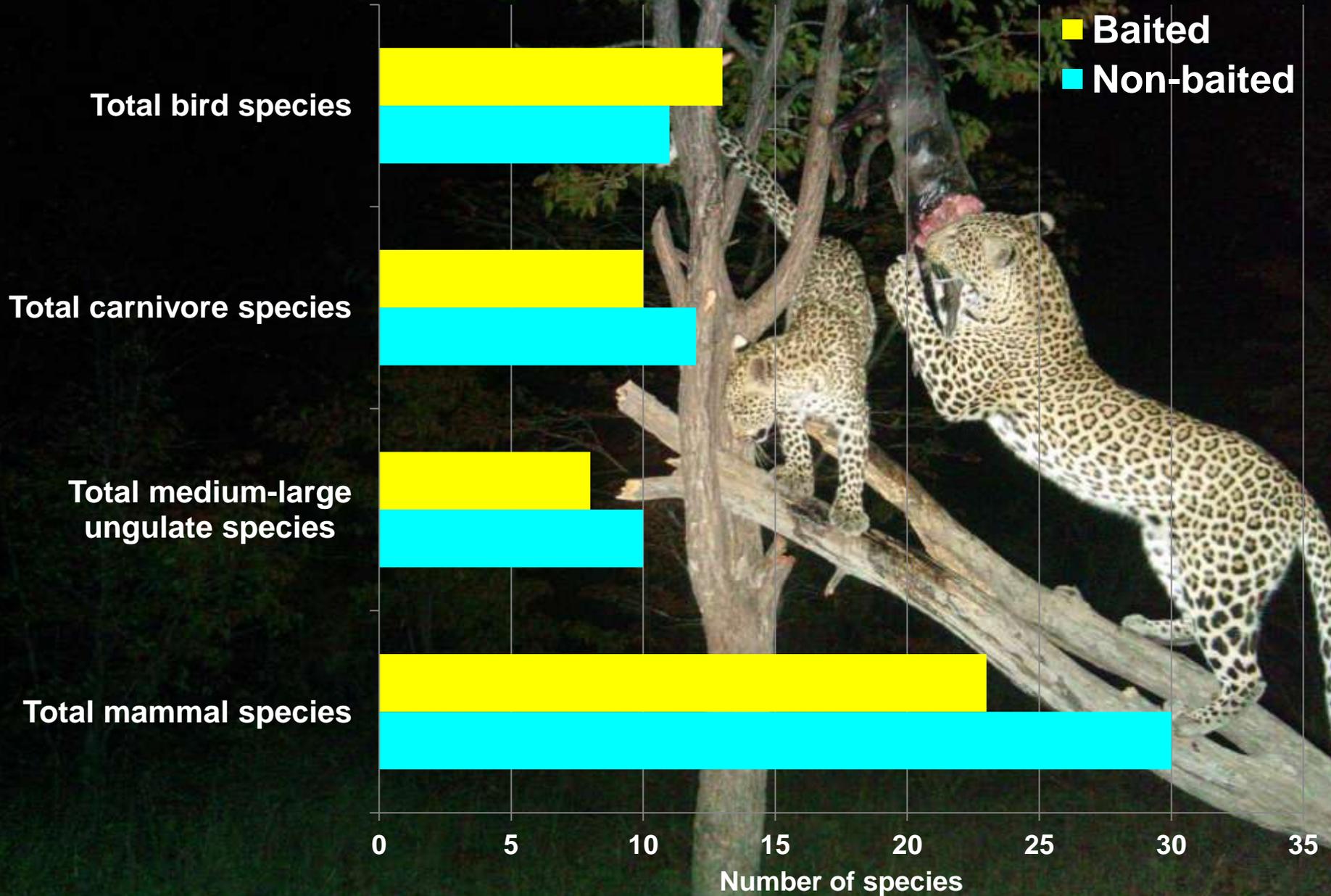
- ❃ Identified 13 individuals for analysis:
 - 8 females (1: >7yrs, 4: 4-7yrs, 3: 2-4yrs)
 - 5 males (2: 4-7yrs, 2: 2-4yrs, 1: 0-2yrs)
- ❃ Lincoln index:
 - $n = 12.3$ leopards
 - Density estimate of 6.1 leopards/100km²
- ❃ CAPTURE:
 - $n = 14 \pm 3.4$ leopards
 - Density estimate of 6.5/100km²
- ❃ SPACECAP:
 - $n = 15.2 \pm 1.8$ leopards
 - Density estimate 5.12 \pm 0.6 leopards/100km²



Percentage contribution to total photos



Total no. of species recorded



Telemetry

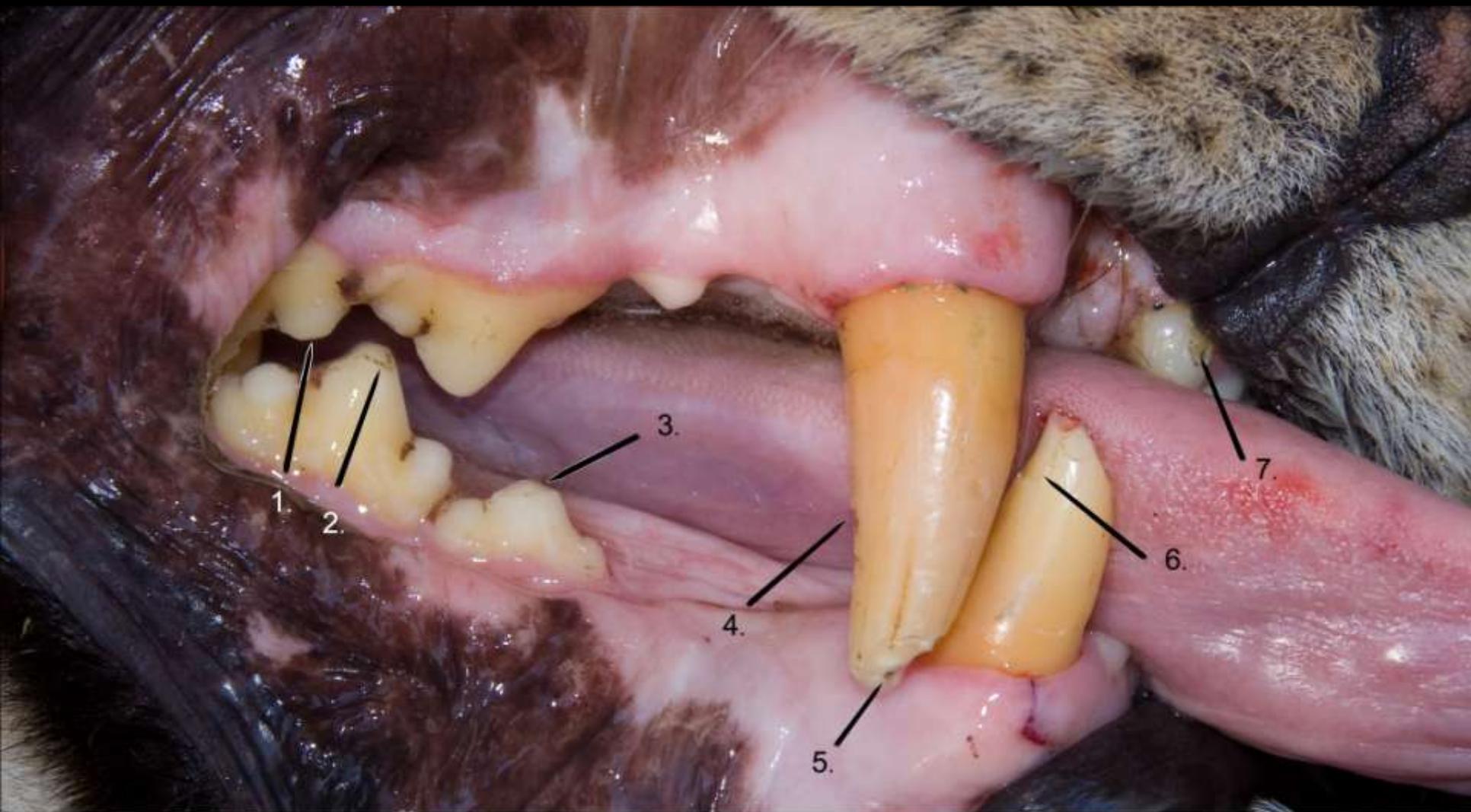
“the process of recording readings or measurements, at or from a distance”

- Home range size
- Density
- Movement patterns





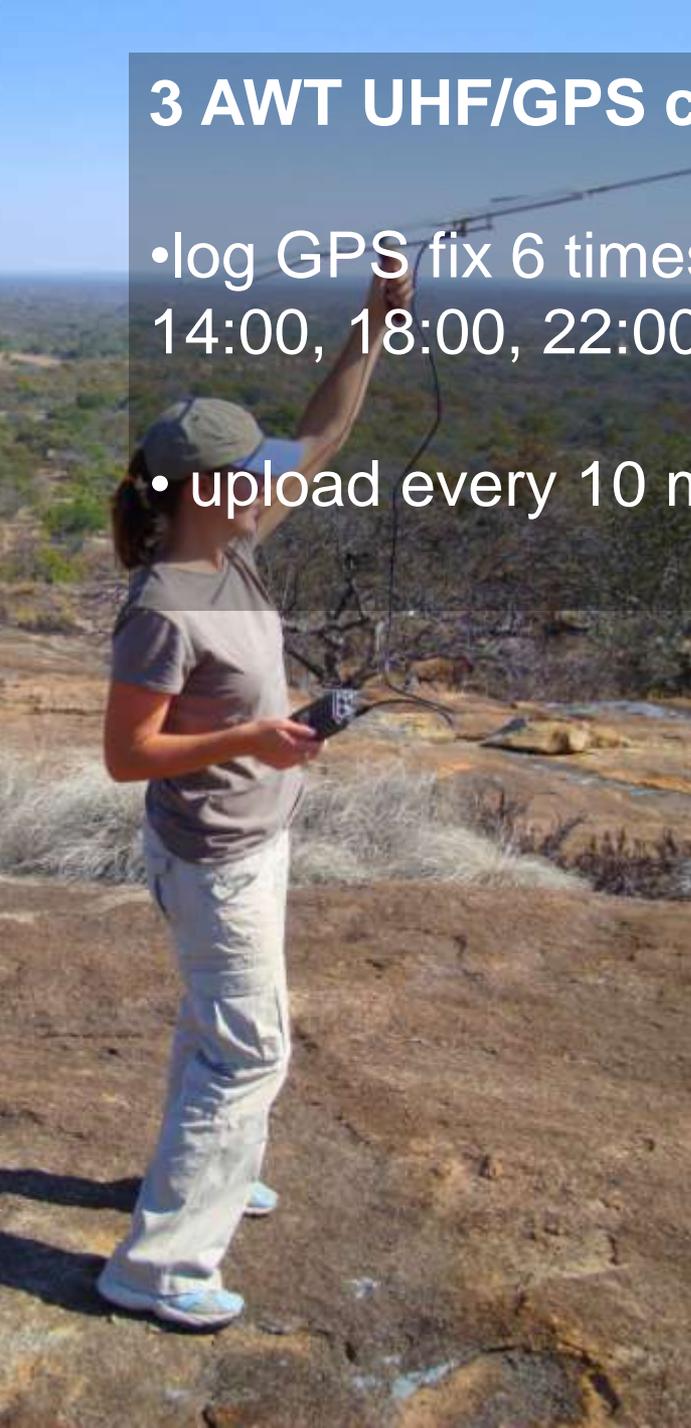




Leopard Female AU 410. 05/08/10. Image MG_2883b. Tooth wear and old damage prior to capture, suggest that this Leopard was well into adult phase (over 6 yrs), even though small in body size. Wear can be seen on upper P4 (1); lower P3 (3) and lower P4 (2); wear of the posterior surface ('serrated edge') of left upper canine C1(4) and tip of the same tooth (5); the older damage to lower C1 tip (6); and older wear of upper I3 (7) support this theory.

3 AWT UHF/GPS collars:

- log GPS fix 6 times/day, every 4 hours (06:00, 10:00, 14:00, 18:00, 22:00, 02:00)
- upload every 10 minutes for 24 hours



M1: collared for 8 weeks



F1: collared for 15½ weeks

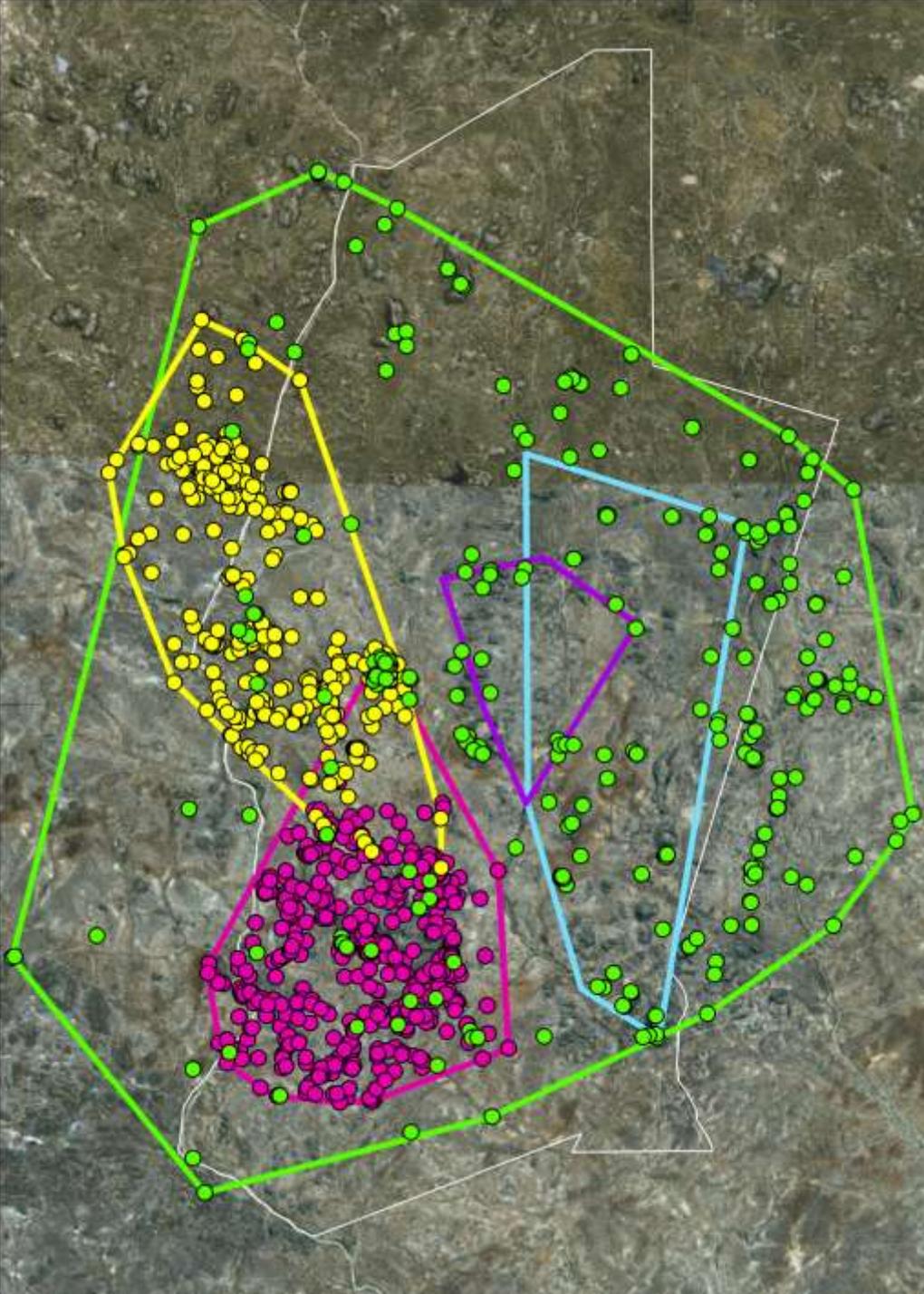


F2: collared for 11 weeks



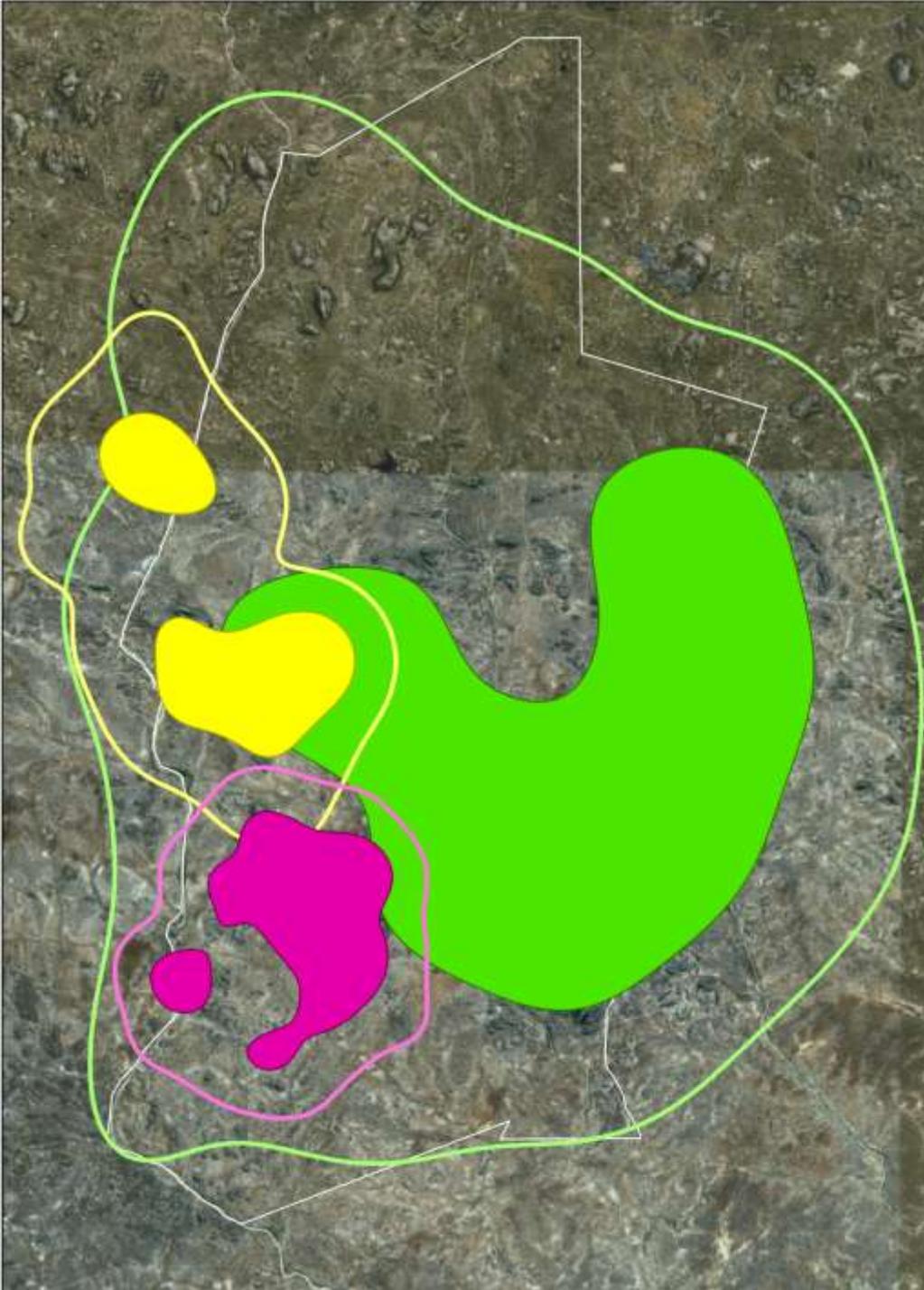
Minimum Convex Polygons (MCP) – 100%

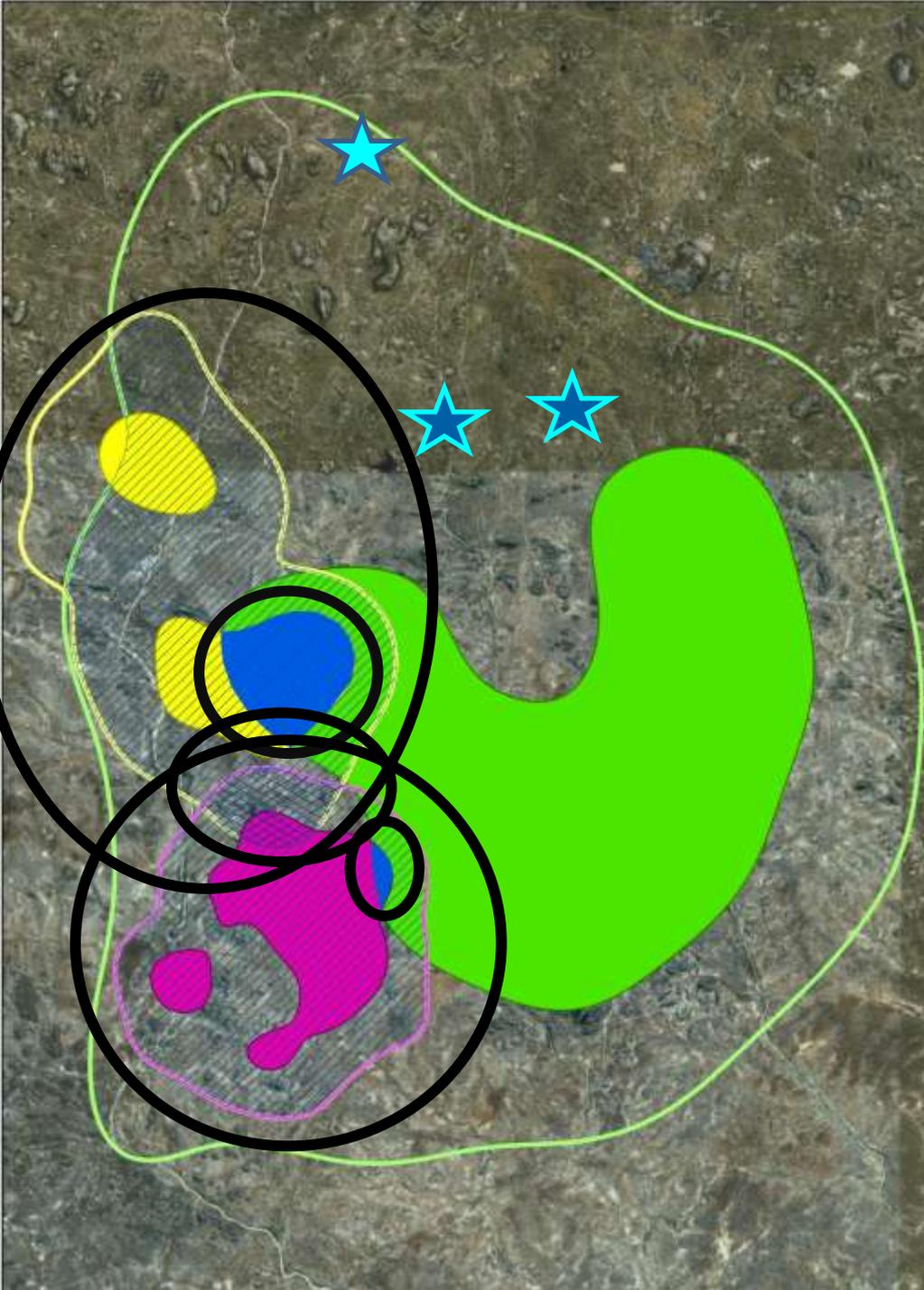
- Male = 231km²
- Female 1 = 32km²
- Female2 = 37km²
- *Female 3 = 33km²
- *Female 4 = 9km²



Kernel Utilisation Distribution 50% & 95%

- Male = 50%: 72 km²
95%: 263 km²
- Female1 = 50%: 11 km²
95%: 31 km²
- Female2 = 50%: 11 km²
95%: 45 km²





Range overlap

Male/Female2: 4.6 km²
41% of Female2 **core** &
6% of Male **core**

Male/Female1: 0.3 km²
3% of Female1 **core** &
0.4% of Male **core**

Female2: entire range within
Male's

Female1: 86% of entire range
overlaps Male

Female1/Female2: 2.8 km²
9% of Female1 range &
6% of Female2

**Estimated number of mature
males in the Marula area:**

**Based on core Home Range
of 72 km²**

= 40 males

