UNIVERSITY OF PRETORIA
CENTRE FOR WILDLIFE MANAGEMENT
WELGEVONDEN PRIVATE GAME RESERVE

Report 6

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Centre for Wildlife Management

Sixth Progress Report:

1. Introduction
2. Preliminary leopard capture
3. Testing of GPS collars
4. Leopard conservation initiative
5. Brown hyaena research
6. Meso-carnivore and civet research

Inside this issue:

1) Introduction

Our leopard research at Welgevonden has been making steady progress since the research commenced during the latter part of 2008. Since then I have collected over 120 leopard scats during my field visits, washed and prepared these scat for analysis, identified over 100 suitable camera trapping sites, ran two camera trapping surveys, which captured over 15 000 pictures and led to the positive identification of 23 different leopards. During these field work stints I also collected over 180 brown hyaena scats, GPS logged over 100 brown hyaena latrine sites and collected some scats for other carnivores.
Currently we are aiming to fit six leopards with GPS collars. Our attempts started in November 2009 but we gave up in January 2010 when we had no success. Based on previous experience in leopard capture in the Waterberg we found that the wet seasons are not particularly a good time to catch leopards (Section 2). We therefore scheduled our next attempt to coincide with dry season (May-August).
In the mean time we ordered and received the GPS collars, which we tested in the field (Section 3). We initiated a leopard conservation project around Welgevonden to assist livestock ranchers in the prevention of livestock losses due to carnivores. We will report on this project, although this is only in its infancy (Section 4).

We are fortunate that additional research is sprouting from the leopard camera trapping and field work, these include brown hyaena research (Section 5) and meso-carnivore research (Section 6).

Janelle Bashant, is using the brown hyaena data from the camera trapping to estimate brown hyena densities. She is also analyzing scats collected to investigate brown hyena diets. We will report on some of her results.
Liza Isaacs is going to look at the Civets and other meso-carnivores on Welgevonden, again from the camera trapping database. Liza enrolled this year and only some preliminary results will be discussed here.

Leopard Research:
Progress report is prepared by Lourens Swanepoel. Lourens is a PhD student from the University of Pretoria.

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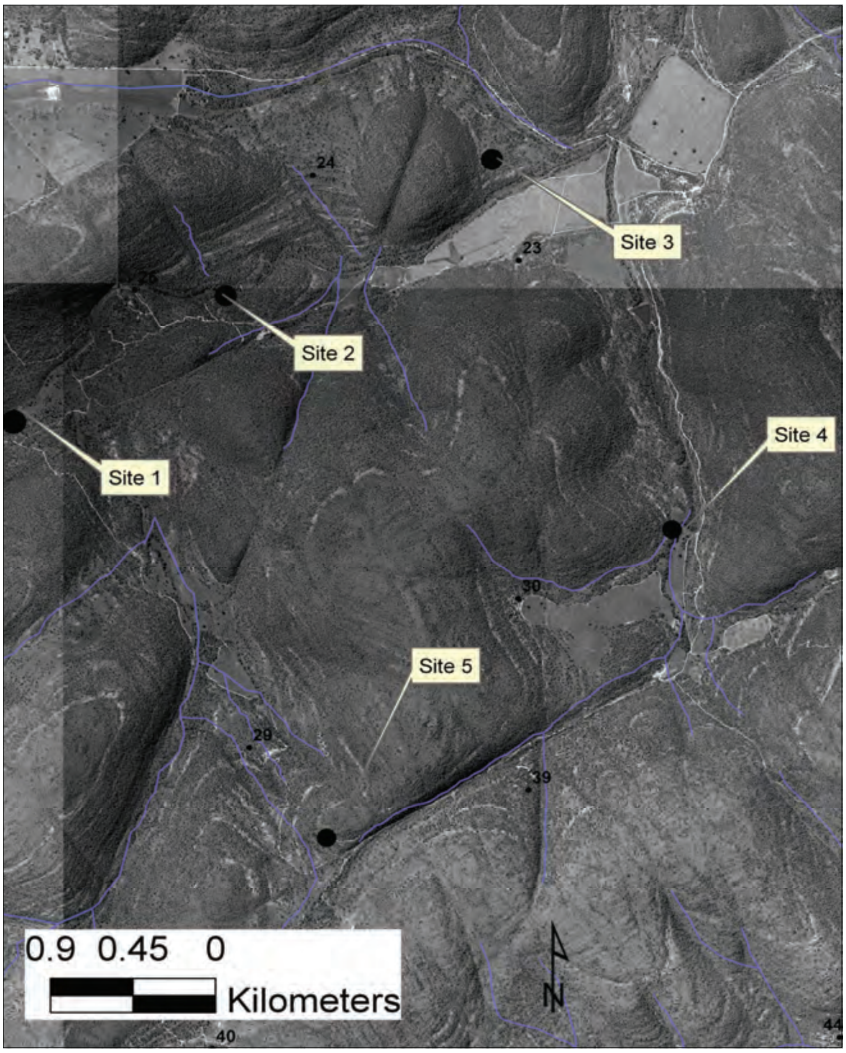
2) Methods: Leopard capture

During the period November 2009 to January 2010 we set 5 baits in the centre of Welgevonden with aim of capturing leopards. At site 4 and 2 we also set capture cages. At each site we place a impala carcass in the tree to attract leopard to site. The capture cage will be set once we knew a leopard took the bait. In this way we reduce the changes of capturing non target species.

Transporting capture cages to the sites

Setting the capture cage and bait



Map showing the different capture and bait locations

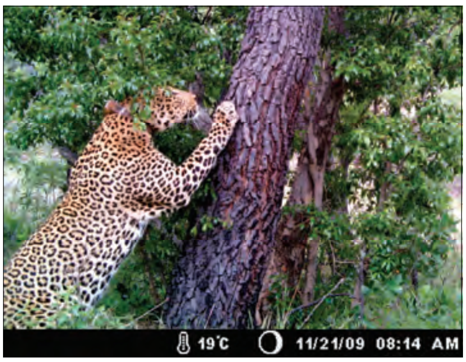
2.1) Results: Leopard capture

The only leopard that responded to the baits was the Shambala male. He investigated the bait at site 1 on several occasions, but we were unable to keep him long enough at the bait to set the cage. We did not have any success at the other sites. We believe that our low success rate could be ascribed to the following conditions:

1) That our capture sites were not good enough. However, this area (Fig tree plains) is believed to have the highest leopard density on the reserve. Leopards were also photographed close to the baited sites during the camera trap surveys, so we were confident that leopards use this area.

2) Completion from other carnivores. We did not observe any other carnivores on site, excepts brown hyenas. We believe that browns will not chase a leopard away, and baits were all fixed in trees.

3) Too much prey in the veld. We believe that this is possibly our biggest constraint in summer, leopards are spoilt for choice. This can also affect the movement patterns of leopards that could affect our trap placements. Our results here are similar to our experience on previous leopard capture operations in the Waterberg, where the best time to capture leopards was the dry season. We will therefore focus our trapping effort more in this winter (May-July). We are also fortunate to get the help of Dairen Simpson and Will Fox who are experts in leopard capture.

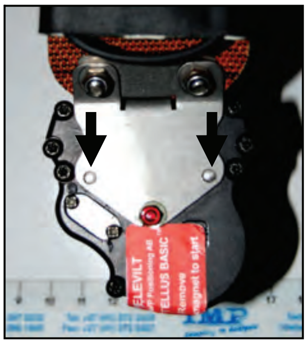


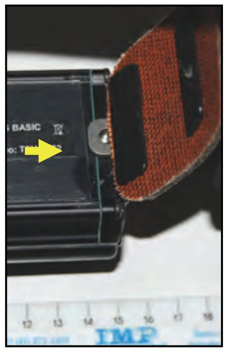
3) Televilt GPS/GSM collars (www.followit.se)

The GPS/GSM collars arrived in September 2009 from Sweden. These collars have the following characteristics:

1. GPS
2. GSM download
3. UHF download
4. Remote drop-off system (see arrows)
5. Mortality, activity & temperature sensors

These collars will therefore download data via a GSM network, or, we can download them via a remote download option (UHF download) if no network is available. Mortality will be activated after a set amount of time of no movement (e.g. when leopard dies). The collars will drop off after a set number of days, or it can be dropped by activation via a remote control. Collars weigh around 550 g for males and 500 g for females.



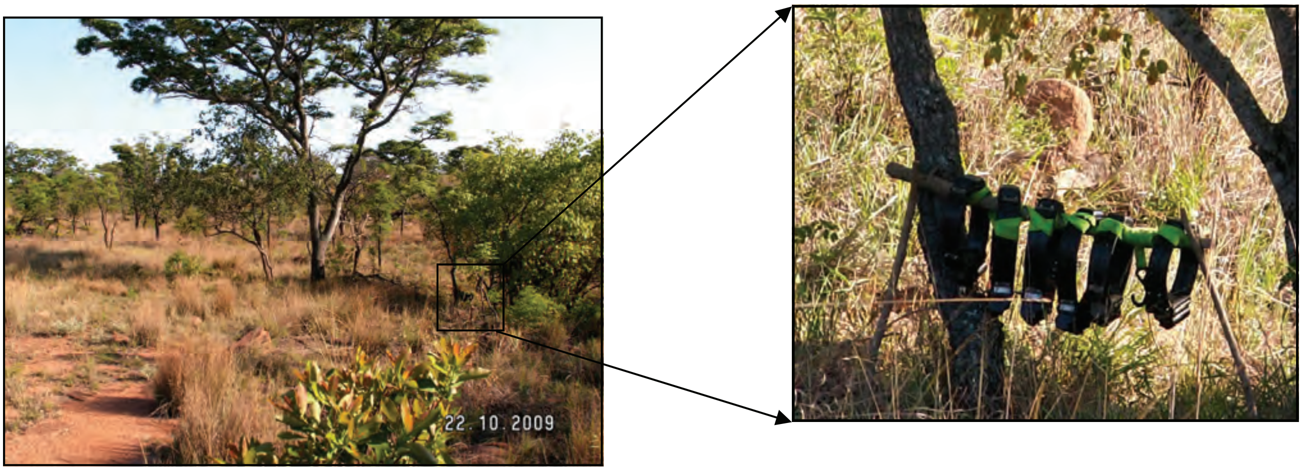


3.1) Methods: Testing of collars

We tested the performance of the collars by assessing how quickly a collar can take a GPS fix (Time To Fix: TTF), how accurate the location was (in relation to a known GPS point), how many satellites were received and at what distance locations could be download via the remote control unit (UHF unit).

To test this we placed all 6 collars about 30 cm of the ground under a bush imitating leopard habitat. At each test location we took a GPS location with a Garmin Etrex (12 channel) handheld receiver. We noted down the GPS location, location error, TTF, number of satellites received, habitat and topography. At 4 test location we only collected one GPS location, at one site 4 GPS location and one 2 GPS locations. This allowed us to assess how accurate each collar established a GPS location under static conditions.

For the remote download test we downloaded data from the collar on set distance increments, starting at 0 m, and increasing distance with a 100 m. We downloaded data in 3 different topographies, nl. flat, valley (standing on top) and mountain (standing at foot of mountain). We recorded the time it took the remote to establish contact with the collar (Time To Handshake: TTH), time it start to download data, time until it finished, number of points downloaded and habitat.



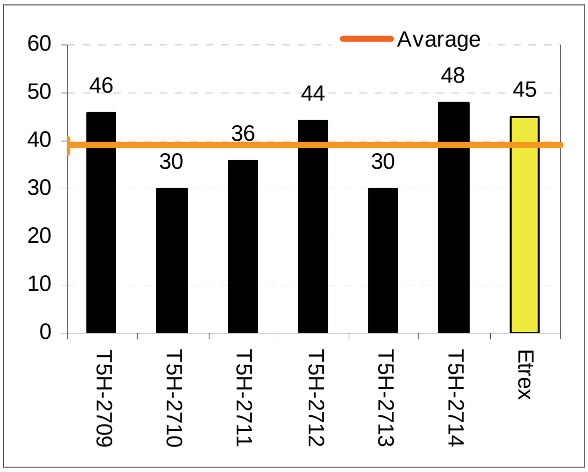
3.2) Results: Collar performance

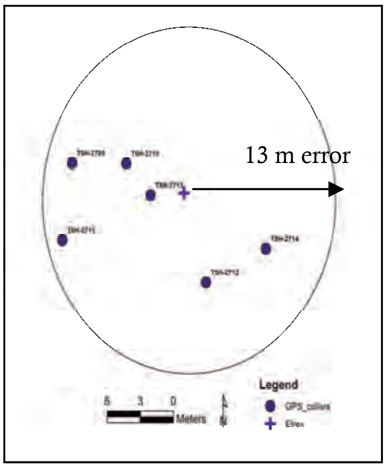
It took the collars an average of 35.32 sec to fix a GPS location. This, however, varied between topography and vegetation types. All collars had fixed between 4-5 satellites when they took a GPS location. I tested 7 different sites, 3 sites on steep areas and 4 on flat areas. The results below show the results for each site, graphic (circle) show how accurate the locations were against a known GPS location with its error (this was estimated with a Garmin Etrex). I buffered each Etrex location with a radius equal to the error at that site.

Site 1:

Topography:	Steep
Vegetation:	Short closed
Collars TTF:	39 sec agv
Etrex TTF:	45 sec
Etrex Error:	13 meters

All collar GPS locations were within the error radius

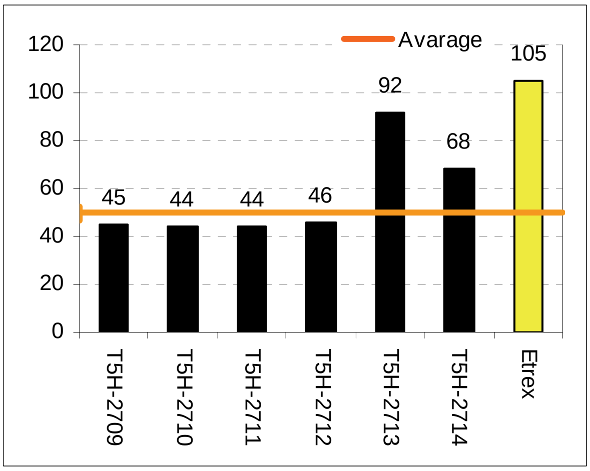


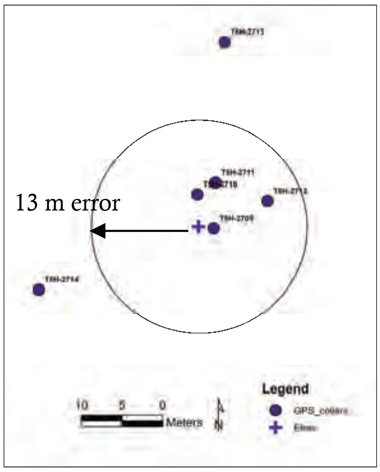


Site 2:

Topography:	Steep
Vegetation:	Short closed
Collars TTF:	56.6 sec agv
Etrex TTF:	105 sec
Etrex Error:	13 meters

Two of the GPS collar readings were outside the error radius of the Etrex GPS location. They were however within a 20 m radius of the Etrex location. These two collars (T..13/14) also had the longest search time (see graph).

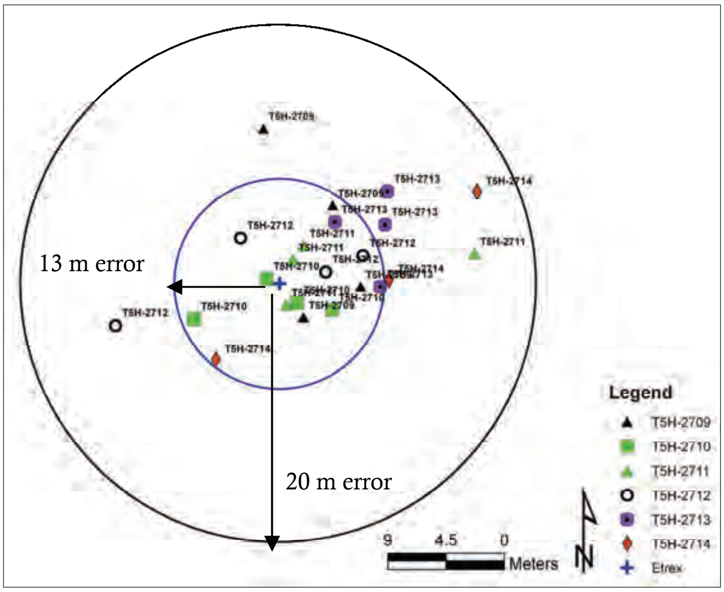




Site 7:

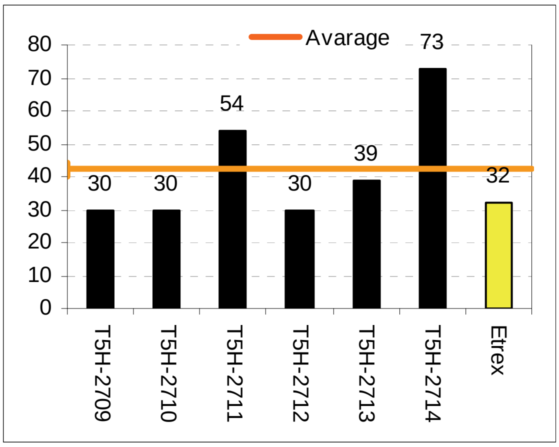
Topography:	Steep
Vegetation:	Short closed
Collars TTF:	30.6 sec agv
Etrex TTF:	32 sec
Etrex Error:	9 meters

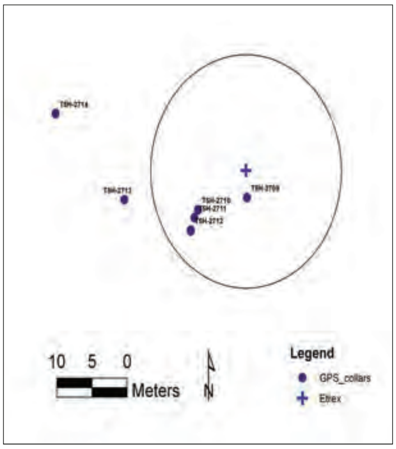
At this site I let the collars download 4 GPS locations over a 2 hour period. Most of the static GPS location fell inside the Etrex error of 13 m. Six locations fell outside this 13 m error, but still within 20 m of the Etrex GPS location. This suggests that even though the collars are not changing location, the GPS location fixes change. This is probably a result of the GPS satellite orientation changing in the sky, and/or due to individual variation in each GPS collar. Even with this error, most GPS readings were within an average of 8 m from previous GPS reading.



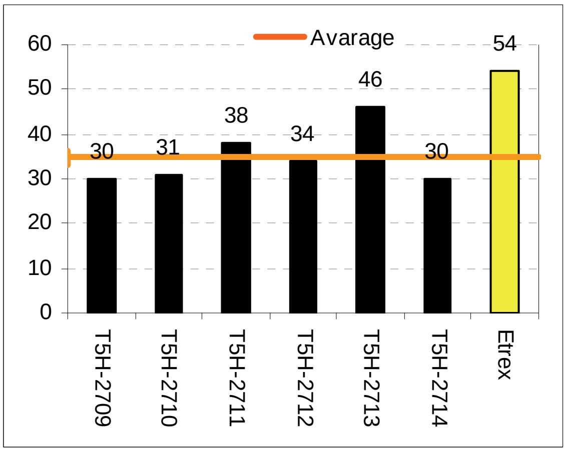
3.2) Results: Collar performance..........

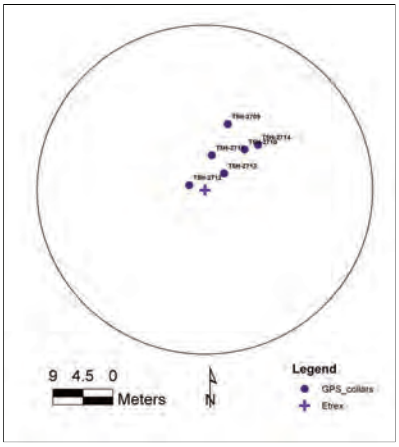
Site 3:
Topography: Flat
Vegetation: Short closed
Collars TTF*: 42.6 sec agv
Etrex TTF: 32 sec
Etrex Error: 13 meters
GPS locations of two collars (T..13/14) were outside the error radius of 13 m. T5H-2714 had the highest search time of all collars.



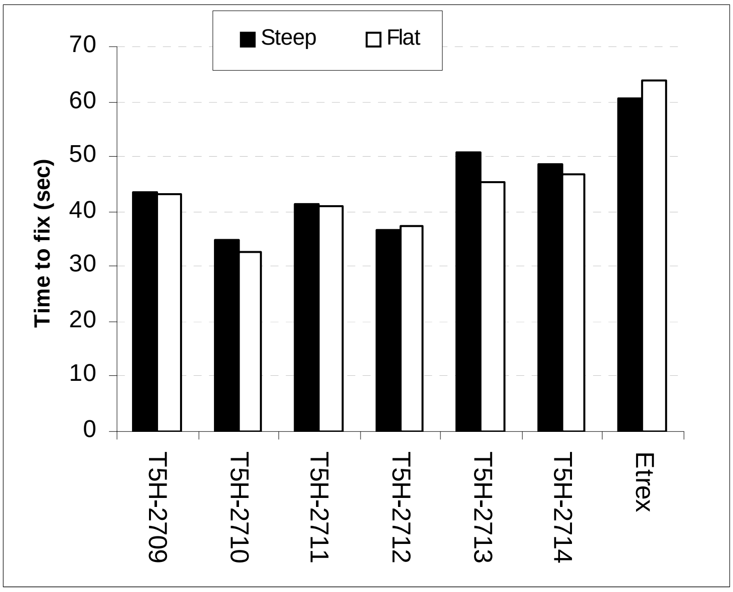


Site 4:
Topography: Flat
Vegetation: Short closed
Collars TTF: 34.8 sec agv
Etrex TTF: 54 sec
Etrex Error: 24 meters
All locations were within the error radius of the Etrex GPS location.





Results for all the collars on the different topography sites (steep *vs* flat) indicated that collars took a similar amount of time to get a GPS location fix. Two collars (T...13/14) took marginally longer on steep slopes to get a GPS fix, while search time for the Etrex were overall longer than for the GPS collars. This shows how powerful the GPS units of each collar is. This is also good news for battery life, as the shorter a collar took to fix a location, the less battery it drains. This however is also a function of GPS location interval, and for short intervals, search time is overall shorter. We have to balance between short search time (short GPS location interval) and long battery life. Experience has shown that anything under a 4 hour interval will decrease search time, while maximising collar longevity.



Flat area

Steep area

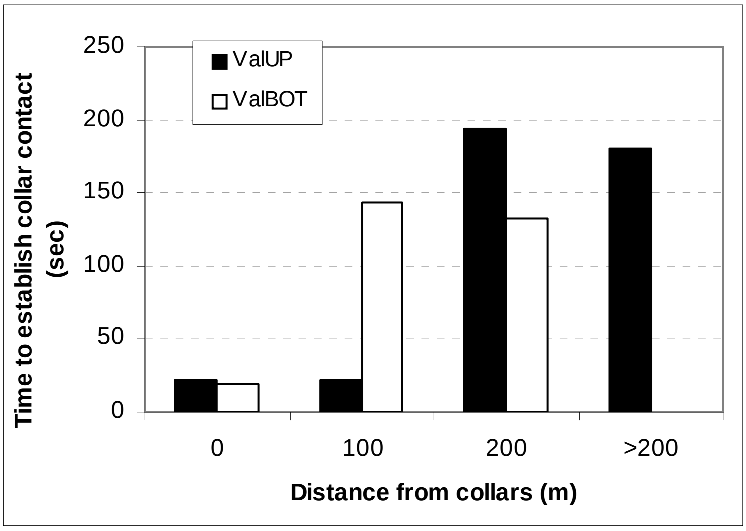
*TTF = Time to fix a GPS location

3.2) Results: Remote download

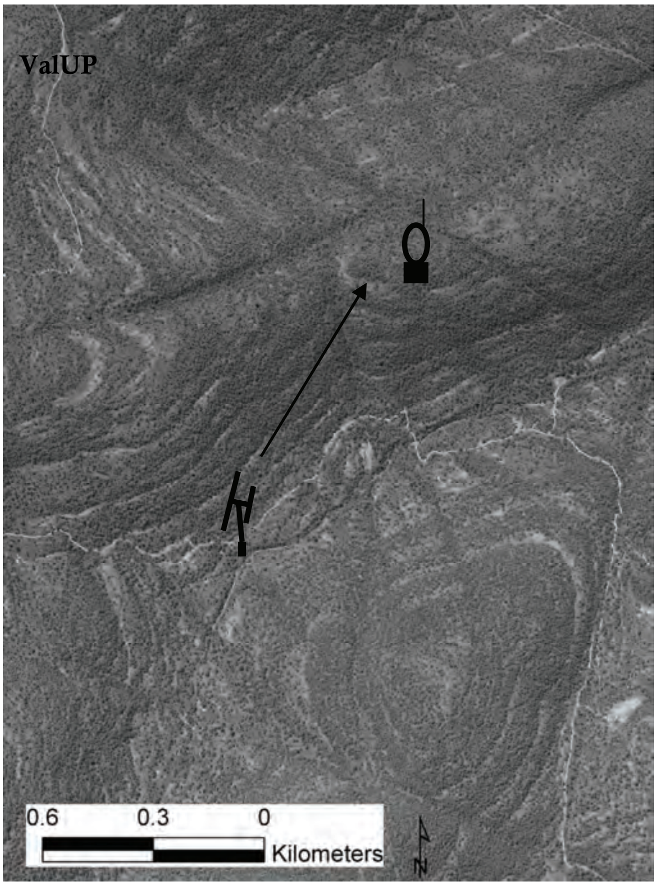
The dense vegetation and topography interferes quite heavily on the feasibly of remote data download. We found that after 100 m it become increasingly difficult to make contact with the collars with the remote unit (see graph). We also found that if you stand at the bottom of a mountain (ValUP), the remote download option functions better, than standing above a valley (ValBOT) and download data from a collar in the valley.

Once contact is established the collars download data quite quickly, on average it took 23 sec to download 100 GPS locations. However, downloads were erratic whenever the distance between remote and collar reached 200 m.

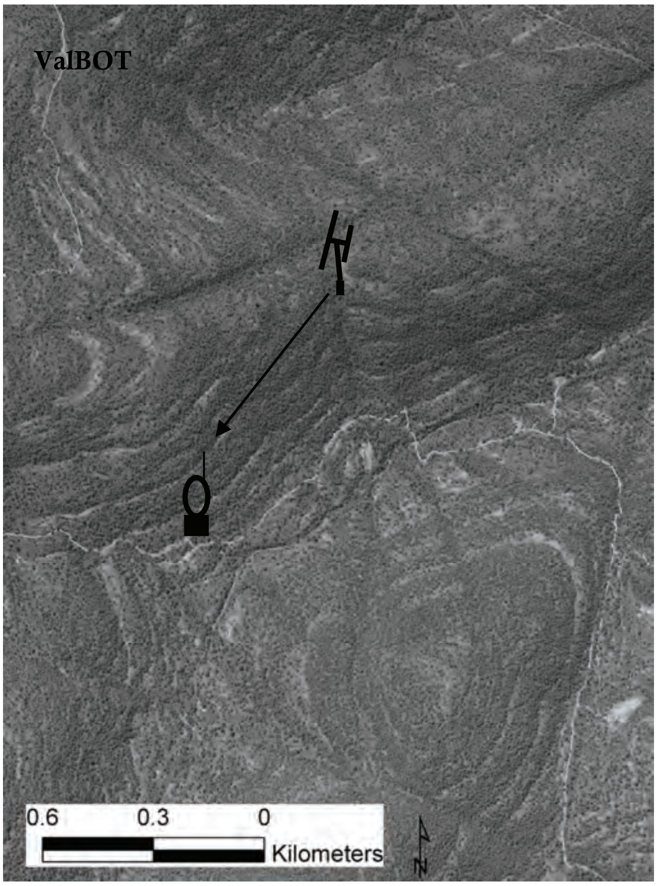
We could not test aerial download, but remote download by air will increase the download distance.



ValUP: The download option seems to work better if you stand at the bottom and the animal is somewhere in the steep sided area, that is the collar is somewhere above remote unit.



ValBOT: When the collar is down in the valley, that is below the remote control, this way of downloading seems to perform poorer.



4) Leopard conservation initiative

While Welgevonden is quite a large reserve, some of its leopards will not be contained on the reserve and will move out of the reserve onto private land. This is quite necessary as it prevents inbreeding and let youngsters the freedom to establish new territories. However, this trans-boundary movement can have negative effects on the whole population inside Welgevonden when mortality potential on the bordering properties is high . It can happen that the mortality rate outside Welgevonden is higher than the net reproduction potential inside Welgevonden, leading to the so called Edge Effect. This is quite a common problem of medium to small reserves and some recent research has shown that this happens in Phinda Game Reserve (Balme *et al.* 2009). Balme *et al.* (2009) also found decreasing leopard morality on the game ranches adjacent to Phinda led to a lower mortality inside Phinda. This result has serious implications for the conservation of carnivores on medium and small reserves, indicating that the neighbors can have serious negative effects on the population inside a reserve.

Welgevonden is quite lucky that it is bordered by a Natural Park (Marakele) and by some large (Shambala) and some smaller reserves. However, a large proportion is bordered by game and livestock ranches. It has also been shown that livestock and game ranchers do not tolerate carnivores impacting on their stock, and on occasions destroy such animals.

After some discussion with Deon Cilliers of the Wildlife Conflict Prevention group at the Endangered Wildlife Trust (EWT) we decided to initiate a leopard (carnivore) conservation project on some of Welgevondens' neighboring properties. Deon, through some donations by lodges and WLOA, will place some Anatolian Guard dogs on selected livestock farms bordering Welgevonden. Results from other areas have shown that these guard dogs can cause a dramatic reduction in livestock losses, which leads to increased tolerance towards the carnivore in question.

This project is in its infancy but we believe that this initiative will reduce conflict between livestock farmers and leopards (and other carnivores). This will allow for the establishment of a conservation buffer around Welgevonden, which is important for the conservation of leopards and other carnivores in the Waterberg Biosphere.

5) Brown hyaena research at Welgevonden

Background:

Brown hyenas are shy, nocturnal scavengers that live in clans, although they forage alone. They live on carrion, but will hunt on occasions and feed on vegetation. Little is known about brown hyenas not just in the Waterberg, but also the whole of SA. Brown hyenas are sensitive to other carnivores and it dominated by just about all other carnivores. Large carnivores, like lions, can therefore negatively impact on brown hyenas.

While collecting data during my leopard research I also collected data on brown hyenas on Welgevonden. When ever I was out looking for leopard scats, tracks, camera trap locations or busy with camera trap placement, I always collect brown hyena scats as well. During the camera trapping surveys a large number of brown hyenas were also photographed.

One of my supervisors, Prof M Somers, come to hear about my large collection of brown hyena scats and photographs. We discussed the merit of the data and what could be done with it. We decided to make this dataset available to a student from the USA, Janelle Bashant, who will be using this data to investigate the effect of lion presence on brown hyena diet and abundance. I have a similar dataset for Lapalala (without lions) which will be used to contrast Welgevonden (with lions) with. **The following results are taken from a preliminary report prepared by Janelle Bashant**

5.1) Brown hyaena research: Preliminary results, scat analysis

Scats were washed in a commercial washer. Clean, dried scats were quantified into 9 categories: **bone, hair, mammals, rodent, reptile, bird, invertebrates, edible plant matter (being seen as seed remains), and all plant matter (any plant item found).** Percentages were found in each group using the formula (V_{mp}) = sum of volumes of each category/total number of scats x 100. Once these percentages were found, a comparison was done based on the differences found for the 2 study sites (Table 1). A further comparison was also done, using 2 seasons (wet and dry) in order to determine whether or not time of year influenced brown hyena diet (Table 2, Figure 2). The main focus, however, will remain on the comparison of the 2 study sites, as lions are absent from Lapalala, and present on Welgevonden

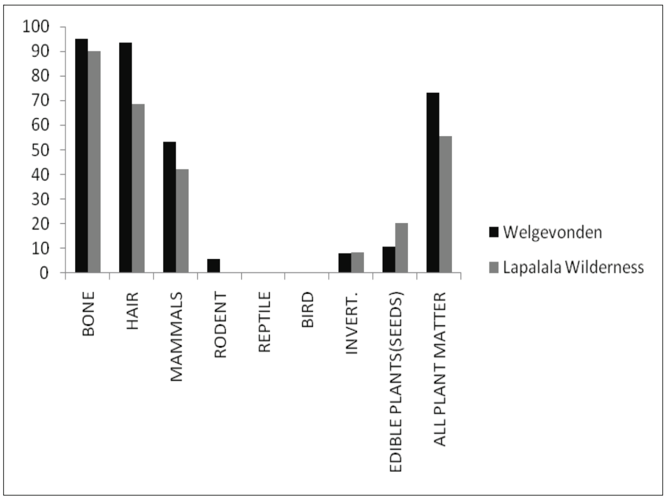


Fig.1 Percentage of feacal samples containing each quantified food group for all seasons in Lapalala (*n*= 213) and Welgevonden (*n* = 186).

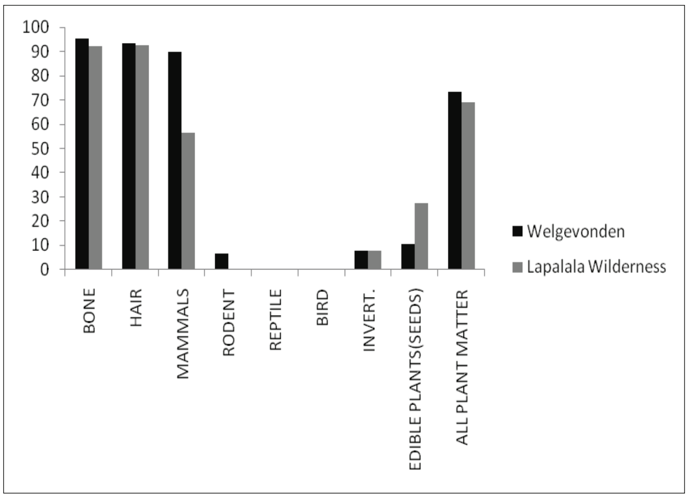


Fig.2 Percentage of feacal samples containing each quantified food group for the dry season in Lapalala (*n*=74) and Welgevonden (*n* =170).

5.1) Brown hyaena research: Preliminary results, scat analysis….

QUANTIFYED FOOD GROUPS	LAP	WELG
BONE	90.141	95.161
HAIR	68.545	93.548
MAMMALS	42.254	53.226
RODENT	0	5.914
REPTILE	0	0
BIRD	0	0
INVERT.	8.451	8.065
EDIBLE PLANTS(SEEDS)	20.188	10.753
ALL PLANT MATTER	55.399	73.118
n=	213	186

Table 1. Percentage of fecal samples containing each quantified food group for all seasons.

QUANTIFYED FOOD GROUPS	LAPALALA		WELGEVON-	
	Dry	Wet	Dry	Wet
BONE	92.029	86.48	95.294	-
HAIR	92.754	22.97	93.53	-
MAMMALS	56.522	14.86	90	-
RODENT	0	0	6.471	-
REPTILE	0	0	0	-
BIRD	0	0	0	-
INVERT.	7.971	8.108	7.647	-
EDIBLE PLANTS(SEEDS)	27.536	6.757	10.588	-
ALL PLANT MATTER	68.841	29.73	73.53	-
n=	138	74	170	0

Table 2. Percentage of fecal samples containing each quantified food group for 2 seasons.

Welgevonden brown hyena scats shows that a higher percentage of bone, hair, mammals, rodent, and plant matter being consumed than at Lapalala. Lapalala, instead, shows a higher percent of invertebrates and edible plant matter being consumed (Fig 1, previous page). This could possibly be due to the absence of lion, which kill large prey species, resulting in less scavenging success of larger food items on Lapalala. To better quantify the results, the 'mammals' category will be broken down into 'ungulates' and 'not ungulates' categories, to better reflect the prey items that lions kill and hyenas scavenge. This will give more accurate results as to what Lapalala and Welgevonden hyenas scavenge in relation to the presence or absence of lion. These are thus the preliminary results for this project, with others to follow

5.2) Brown hyaena research: Abundance

At the moment Janelle has identified over 36 individual brown hyenas for Welgevonden. We have not fitted any mark recapture models to the data yet as we are refining the observation data. It is also interesting to note that Welgevonden's brown hyenas were observed to carry food in their mouths more, then browns at Lapalala, and they were generally in a better condition (as observed from camera trapping pictures).

Various brown hyenas carrying food parcels in their mouths

6) Civet and other meso-carnivore research at Welgevonden

As a group the meso-carnivores are generally understudied in SA, especially on private land. The data collected by the camera trapping at Welgevonden is therefore a rich source of information that will contribute to the general body of knowledge regarding the meso-carnivores.

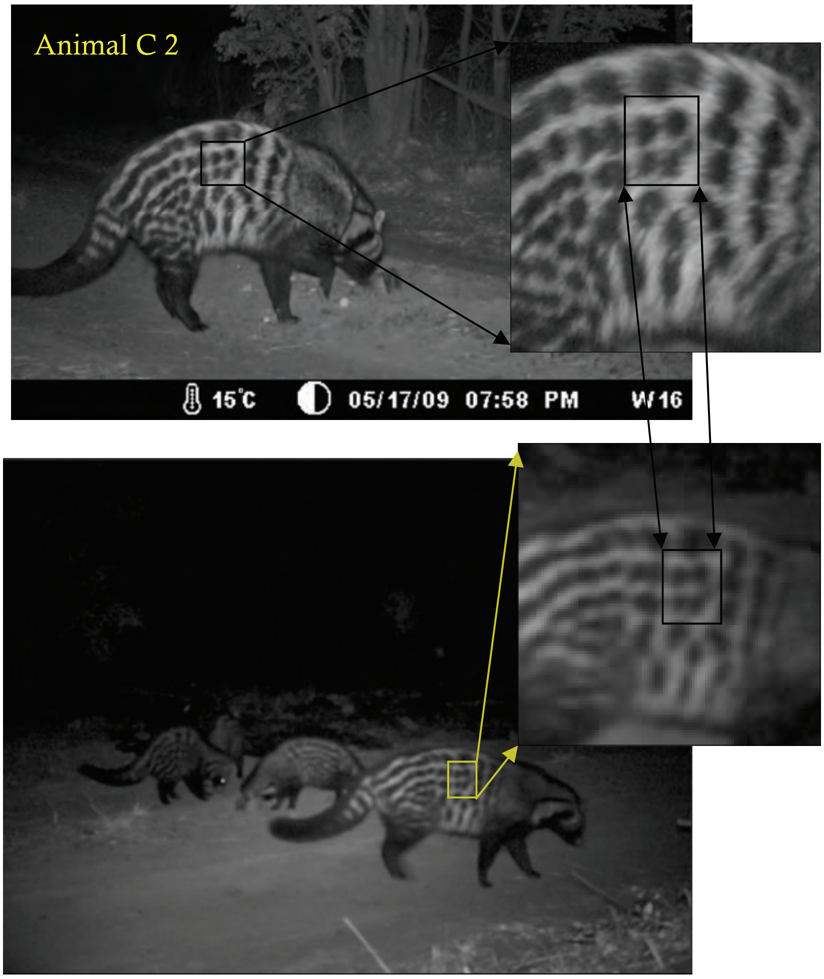
One member of this group, the African Civet, has a distinctive black and white spotted coat that allows for the identification of individuals. This is useful as we can use this trait to identify individuals over time which will allow us to estimate density.

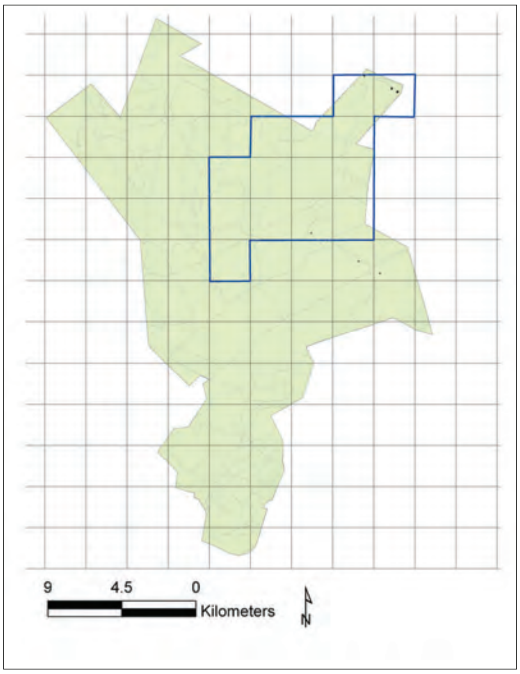
Prof M Somers and I discussed the feasibly of using the leopard camera trapping database to investigate the diversity of meso-carnivores in the presence and absence of lions, and then focus on the civets to establish densities and habitat association in areas with and without lions. Liza Isaacs, a student from SA, will be conducting this research. She only enrolled in March and therefore have not analyse any data yet. Nevertheless, I have done some preliminary analysis on civet pictures to investigate the feasibility of such a approach. The results here is thus a analysis of density of civets in one of the blocks surveyed at Welgevonden.

6.1) Civet research: Preliminary abundance estimate

The results here is only for Box 3 during the camera trapping season of 2009. During this survey a total of 72 civet pictures were taken, resulting in 32 left and right sided profile pictures.

A total of 7 individual civets could be identified, excluding 4 juveniles.





The mean maximum distances moved between camera traps by individual civets were 5.3 km. Four civets were photographed over 20 times, while the rest were photographed less then 10 times during the 20 days.

Using the Heterogeneity model of program CAPURE (Rexstad & Burnham 1991) an abundance of 9 (SE 2.97) were estimated with a confidence interval between 8 and 17.

These estimates resulted in a density of 0.9 adult civets/10km²

References:

Balme, G. A., R. Slotow, et al. (2009). "Impact of conservation interventions on the dynamics and persistence of a persecuted leopard (*Panthera pardus*) population." Biological Conservation **In Press, Corrected Proof**.

REXSTAD, E. & BURNHAM. K.P. 1991. *User's guide for the interactive program CAPTURE. Abundance estimation of closed animal populations.* Colorado State University, Fort Collins.

Acknowledgements

This project is made possible by funding from Trisha Wilson