Range use of two coalitions of male cheetahs, *Acinonyx jubatus*, in the Thabazimbi district of the Limpopo Province, South Africa

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In the Thabazimbi district, conflict and confusion have existed surrounding the status and behaviour of cheetahs (*Acinonyx jubatus*) on wildlife ranches. A study of these cheetahs was undertaken to understand the ranging behaviour of cheetahs outside conservation areas. Five cheetahs were caught using double-door capture cages and fitted with radio collars; a coalition of two males, two out of a coalition of three males and a lone male. The coalition of two was tracked for 17 months, the three were tracked for eight months and the lone male’s radio collar failed days after being released. For the coalition of two the 100% minimum convex polygon (MCP) method produced a range size of 310 km$^2$ and the 100% MCP for the coalition of three was 190 km$^2$, neither of these ranges were asymptotic.

**Key words:** *Acinonyx jubatus*, cheetah, minimum convex polygon, radio telemetry, range use.

**INTRODUCTION**

The largest part of South Africa’s wild cheetah population occurs outside conservation areas on privately owned cattle and wildlife ranches. Over the past 20 years, there has been a shift from cattle to wildlife ranching in the Limpopo Province (Van der Waal & Dekker 2000). As a result of this change, most of the ranches have been surrounded with game fencing and are being stocked with wildlife for the main purpose of sport hunting.

Little is known about the cheetah populations occurring on ranch lands in South Africa. It has been suggested that cheetahs may fare better outside conservation areas due to the lack of intra-guild competition (Laurenson 1995). Additionally, the prey on wildlife ranches are maintained at high densities (Van der Waal & Dekker 2000) by means of supplementary feeding and water provisioning. However, while ecological conditions may favour cheetahs outside reserves, conflict with landowners frequently occurs (Marker 2002; Wilson 2006) which often results in the persecution of cheetahs by ranchers.

These factors mean that extrapolations of cheetah range use behaviour from studies in conservation areas may be inappropriate. In the Serengeti the patchiness of the prey accounted for the expanded ranges of cheetahs rather than low prey density (Caro 1994). On wildlife ranches, prey are non-migratory and are maintained at high densities, this could result in a reduced size in cheetah ranges. However, in the Phinda Resource Reserve, cheetahs sought out open areas in the woodland for hunting, thus the patchiness of the suitable hunting habitat affected the cheetah movement patterns (Hunter 1998). This may also be true on ranch lands, as the bush is often encroached and open areas constitute a small portion of the available habitat. It is thus expected that in a woodland habitat with non-migratory, high density prey that the cheetah ranges would be affected by the availability of suitable hunting habitat. Additionally, the absence of lions (*Panthera leo*) and spotted hyaenas (*Crocuta crocuta*) could positively influence the survival rate of cheetah cubs and if the threat of predation is removed then entire community structures may be altered (Durant 2000).

Range use by cheetahs on ranch lands was investigated as part of a larger study in an attempt to understand how cheetahs behave in this environment. Furthermore, an understanding of cheetah movements will allow for more effective conflict resolution with the ranchers by providing accurate information on the habits of cheetahs and correcting misconceptions.

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MATERIALS AND METHODS

The core study area was in the Thabazimbi district in the Limpopo Province of South Africa (Fig. 1). The district has an abundance of fenced commercial wildlife and cattle ranches, with a mean size of approximately 18 km$^2$ (Wilson 2006). The Thabazimbi district lies in the Savanna Biome of South Africa and the main vegetation type is Mixed Bushveld (Low & Rebelo 1996).

A cheetah scent-marking post was identified on the ranch Silent Valley (24°33'27.9"S; 26°39'52.1"E). In order to trap cheetahs, a thorn tree boma of approximately 5 m in diameter and 1.5 m in height was constructed around the scent-marking post. The only entrance to the boma was through a double-door capture cage.

A second capture cage was set on Atherstone Collaborative Nature Reserve (24°30'49.1"S; 26°47'28.2"E). The reserve is managed in a similar manner to most wildlife ranches with hunting and live capture of wildlife taking place and the reserve is not predator proofed. A goat (Capra hircus) placed in a holding cage next to the trap was used as live bait instead of the scent-marking post.

In August 2003 a single male was caught on Atherstone Collaborative Nature Reserve then in September 2003, a coalition of two male cheetahs was captured on Silent Valley. In June 2004, two members of a coalition of three males were captured on Atherstone Collaborative Nature Reserve.

The caught cheetahs were immobilized and fitted with standard VHF telemetry collars (Africa Wildlife Tracking, Model: AWT-RCH102, weight 200g). The cheetahs of each coalition were released simultaneously at the site of capture.

The cheetahs were monitored using an Aquila Trike microlight aircraft. The data presented here were collected from release until February 2005. Visuals of the cheetahs were nearly always obtained and their position recorded on a GPS fitted to the aircraft. The cheetahs appeared relaxed in the presence of the aircraft and were observed hunting, on kills, scent marking and resting up.

RESULTS AND DISCUSSION

The members of the coalitions were always sighted together except for the coalition of two, which split up for a period of approximately 100 days. It is not known what caused the split but Caro (1994) reported that males in the Serengeti only lost contact when pursuing a female in oestrus. This coalition reunited and has remained together since.

No data from the single male were obtained as his collar stopped working within days of being fitted. He was caught four months later in a capture cage at a goat kraal and shot by the farmer.

Data were analysed with the Animal Movements extension of ArcView (Hooge 1999) software package. For the coalition of two, 54 fixes were obtained and the 100% minimum convex polygon.
(MCP) method (Jenrich & Turner 1969) produced a range size of 310 km$^2$. For the coalition of three, 12 fixes were obtained and the 100% MCP was 190 km$^2$ (Fig. 2).

The software package Ranges 6 (Kenward et al. 2003) was used to determine if the cheetah ranges had reached asymptotes and to investigate the overlap of the ranges. Asymptotic ranges were not reached for either of the coalitions (Fig. 3) and these ranges are expected to increase in size with the addition of more fixes. The range of the coalition of three was overlapped by 73.8% by the range of the coalition of two, while the coalition of three overlapped the range of the coalition of two by 46.1%. This overlap did not appear to be temporal. The two coalitions were only sighted in close proximity to each other on one occasion.

Cheetahs have been studied intensively in several large conservation areas: the Serengeti ecosystem (e.g. Durant et al. 1988; Caro 1994; Durant 1998; Durant 2000), the Kruger National Park (e.g. Broomhall et al. 2003; Mills et al. 2004)
and Matusadona National Park (Purchase & Du Toit 2000). Intensive studies have also been done of cheetahs on Namibian farm lands (Marker 2002). Of these, the Kruger National Park is the habitat most comparable to that of the Thabazimbi district.

In the Kruger National Park, a coalition of two young, non-territorial males had a 100% MCP of 438 km² while a coalition of three territorial males had a 100% MCP of 170 km² (Broomhall et al. 2003) which is of the same order of magnitude as found in the present study.

Cheetah ranges vary widely in woodland savannahs from 24 km² in Matusadona National Park (Purchase & Du Toit 2000) to 320 km² in the Kgalagadi Transfrontier Park, although this figure is almost certainly an underestimate of the true range (Mills 1998). In Namibia, male cheetahs had a mean lifetime range of 1608.4 km² (Marker 2002). This may be due to the variation in habitat structure and distribution of prey in the different study areas (Broomhall et al. 2003). Marker (2002) found that cheetahs range size decreased as density of the bush decreased, indicating that range size was effected by the need to incorporate productive habitat. In Thabazimbi, the patchiness of available hunting habitat is probably the main determinant of range use. The 50% MCP for the coalition of two was 93.9 km² and for the collation of three the 50% MCP was 4.91 km². These core areas are centred around open areas, such areas are usually old agricultural lands that have been allowed to re-establish and provide the ideal open habitat required for cheetahs to hunt. Prey animals are maintained at high densities on wildlife ranches and prey is therefore not considered to be a determining factor. Water is provided for wildlife permanently and availability of water is also not considered to be important.

Capturing cheetahs in capture cages has proved to be difficult in this study. In approximately 1500 trap nights only five cheetahs were caught. No females have been caught and it appears that they are even more difficult to trap than males (National Cheetah Conservation Forum relocation records*). Marker (2002) also found that initially males were more frequently trapped than females on Namibian ranch lands. Darting of cheetahs from the ground is not possible in the study area as the bush is dense and the cheetahs are elusive and seldom seen. The authors have seen only one cheetah from the ground in three years of monitoring.

Several more cheetahs, both male and female, need to be collared and tracked to obtain a better understanding of the range size, habitat selection and range overlap of the cheetahs in the Thabazimbi area. Additionally, the collared cheetahs need to be followed to allow for enough fixes to be obtained making the range estimates accurate. Finally, it is important that this information then be passed back to landowners and conservation officials so that conflict between cheetahs and landowners can be more effectively resolved and sound management decisions made.

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