

ISSN 1027-2992

CAT NEWS

Special Issue N° 3

2007



Status and Conservation Needs of Cheetahs in Southern Africa



IUCN
The World Conservation Union

SPECIES SURVIVAL COMMISSION



Cat Specialist Group

CAT News

is the newsletter of the Cat Specialist Group, a component of the Species Survival Commission of The World Conservation Union (IUCN).

Regular issues are published twice a year. Additionally, Special Issues on specific topics are published in between. Cat News is available to subscribers to Friends of the Cat Group.

The personal subscription for Friends is CHF 60 or US\$ 50 p.a.; CHF 30 or US\$ 25 for bona fide students.

The institutional subscription is CHF 120 or US\$ 100.

Cheques are payable to IUCN/SSC Cat Specialist Group, KORA, Thunstrasse 31, CH-3074 Muri b. Bern, Switzerland.

Bank transfer to UBS AG, CH-3000 Bern 77, Switzerland.

Account nos.

for CHF: 235-359825.41H

for US\$: 235-359825.60Y

Swift Code for wire transfer: UBSWCHZH30A.

CAT News Special Issue No 3 on the Status and Conservation of the Cheetah in Southern Africa has been supported by the Howard Buffet Foundation and Cheetah Conservation Fund, Namibia

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Stämpfli Publikationen AG,
Bern, Switzerland

ISSN 1027-2992

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Cover photo: Cheetah family on a mound (Photo S. Durant).

Foreword

In the past few decades, the cheetah along with its habitat and prey has experienced dramatic declines throughout Africa due to human encroachment resulting in land use changes. Cheetahs are known to have one of the largest individual ranges of any terrestrial carnivore and are found to be particularly susceptible to land fragmentation. Most protected park networks are too small to conserve viable populations and larger predators (ie. lions and hyenas) are known to displace them which results in higher numbers of cheetahs living outside protected areas, placing them in increased human/wildlife conflict situations.

Cheetah conservation activities outside of protected areas have mostly taken place in the southern African region where a network of researchers and conservationists has developed. In December 2005, the Cheetah Conservation Fund in Namibia hosted the first Southern African Regional Cheetah Workshop where the idea for this special issue of Cat News was developed. The workshop brought together 32 cheetah researchers and conservationists from six countries to develop strategies to ensure cheetah survival in the 21st century. The workshop was sponsored by the Cheetah Conservation Fund (CCF), the Wildlife Conservation Network (WCN) and Classic Escapes.

This special issue of Cat News highlights the accomplishments in cheetah conservation in the southern African region over the past few years and prioritizes research and conservation objectives for the future. The compilation of current knowledge shows the needs for conservation of cheetah outside and within protected areas, discusses problems facing the cheetah due to human-predator conflict issues and reveals extension and education initiatives that have been implemented. This special issue was supported in part by the Howard Buffet Foundation, the IUCN/SSC Cat Specialist Group and the Cheetah Conservation Fund.

Collaboration and co-operation between the regional cheetah conservation organizations continues to work towards developing methodologies for their long-term studies on cheetah populations. These studies are fundamental to understanding the dynamics of the cheetah population and how it will be affected by ongoing removals, habitat changes and conflict. Long-term data is also vital to help guide the development and implementation of management strategies aimed at ensuring the conservation of this species within and between countries in this region.

This special issue forms the basis of the Southern African Regional Conservation Strategy being compiled by regional cheetah specialists and governmental representatives in Botswana in December 2007. As with any regional strategy, the task will be to formulate conservation activities that will lead to the long-term survival of the cheetah. However, it will only be with the support of the governments and local communities that the strategy will be implemented so that the cheetah will continue to have a place under the southern African sun.

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Participants at the Southern African Regional Workshop in December 2005 at CCF, Namibia (Photo L. Marker).

The Namibian Cheetah: Status Report

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Over the past century, wild cheetahs *Acinonyx jubatus* have undergone a drastic reduction in global geographic range and population size, leaving Namibia as one of the remaining strongholds for the species. This report examines the distribution and population trends of cheetahs in Namibia and discusses their relative abundance on the commercial farmlands, which has led to intense conflict with humans: an issue that continues to threaten the long-term viability of the population. We provide a brief overview of the policy and legislation relevant to cheetahs in Namibia, and discuss the rates of, and reasons for cheetah removal from the farmlands, which tend to predominantly involve adult male cheetahs. Considerable research has been conducted on Namibian cheetahs, and has shown that they have extremely large home ranges, prefer habitat patches with grassy cover and high visibility, and show prey selection for native game species. In addition, extensive biomedical, reproductive and genetic research has been conducted on the Namibian cheetah providing valuable data from which conservation strategies are based. We also provide an overview of the current threats facing Namibian cheetahs, and discuss possible strategies for addressing these threats to ensure the long-term conservation of this valuable population.

Global cheetah population trends and the importance of Namibia

Cheetahs once had a broad geographic range, spanning the entire length of Africa, extending into the Middle East and even into the Indian subcontinent (Marker 2002, Wrogemann 1975). Nevertheless, it was clear that the 20th century was a time of dramatic decline for the cheetah: a variety of factors, including habitat loss, degradation and fragmentation, and conflict with humans, drove

numbers sharply downwards: by 1975 only 30,000 cheetahs were thought to remain worldwide, and probably fewer than 15,000 exist today (Bartels *et al.* 2001).

Currently thought to remain in only 29 countries, often in small, fragmented remnant populations, Namibia remains a stronghold for cheetahs, which is thought to currently support around 3,000 cheetahs – over 20% of the remaining global cheetah population

(Marker 1998), however trapping of cheetahs by livestock and game farmers continues to affect the long-term survival (Fig. 1). Effective management and maintenance of healthy cheetah populations in Namibia is therefore critical for cheetah conservation worldwide, and knowledge gained here could prove invaluable for cheetah conservation and management, both in other range countries. Namibia has a relatively low human population of 1.8 million, of which 31% of the population lives in urban centres, with large areas of Namibia having a population density of below one person per square kilometre (Erb 2004). This results in relatively low human disturbance over much of its range, a factor which no doubt contributes to cheetahs persisting in high numbers in this country (Marker *et al.* 1996).

Trends in the distribution and status of cheetahs in Namibia

In Namibia, as anywhere else, it is hard to get accurate data on the population status and trends of cheetah, but some distribution maps are available (Fig. 2a, b) and information has been derived from interviews, questionnaires and sighting reports that allow for density estimations (Marker-Kraus *et al.* 1996; Nowell & Jackson 1996; Marker 1998; 2002; Hunter & Hamman 2003; Standen & Hanssen 2004). Namibia has a vast network of protected areas, covering



Fig. 1. High numbers of cheetahs have been eliminated from Namibian farmlands through live trapping at known cheetah “playtrees” and marking areas in attempt to solve the perceived conflict between farmers and predators (Photo L. Marker).

over 14% of the country, most of which is desert with low prey density (Fig 3a, b). These protected areas harbour less than 100 cheetahs or 5% of the population due to asymmetric competition with larger carnivores in parks and endemic anthrax in Etosha (Lindeque *et al.* 1998).

However, cheetahs were recorded as being plentiful both in the north-central and southern areas of the country in the early 1900s (Marker-Kraus *et al.* 1996). Today these areas constitute important livestock farming areas, so this distribution has resulted in intense conflict between local landowners and cheetahs, particularly in the north-central region where the majority of the cheetah population occurs (Marker-Kraus *et al.* 1996; Marker *et al.* 2003a). The solution to human-predator conflict has been, and continues to be to a large extent, lethal control. Most of the large predators such as lions *Panthera leo* and spotted hyaenas *Crocuta crocuta* were eradicated from the farmlands by the 1950s (Marker 2002). This actually had some benefits for cheetahs, as larger carnivores frequently steal their kills and kill their cubs (Durant 2000, Laurenson 1994), so the farmlands provided an important refuge from these competitors. The threat from other carnivores was replaced with the threat from humans. From 1980 to 1991, 6,818 cheetahs were officially reported to have been removed from the Namibian population – usually by trapping (Fig. 1) – these were mostly killed or sold into captivity (CITES 1992. Marker-Kraus, *et al.* 1996).

The fate of cheetahs on the farmlands is closely linked to the periodic cycles of drought in Namibia: during droughts, wild prey numbers decline, and farmers are even less tolerant of predator presence as they cannot afford any livestock losses during periods of economic hardship (von Wietersheim 1988, Joubert 1985). Table 1 shows key game species trends from 1955 through 2006. During the drought of the 1960s game was systematically eradicated due to perceived competition with livestock for grazing and water. In 1967 the Nature Conservation Ordinance 31 transferred ownership of huntable game species to the landowners in an attempt to encourage landowners to conserve wildlife by giv-

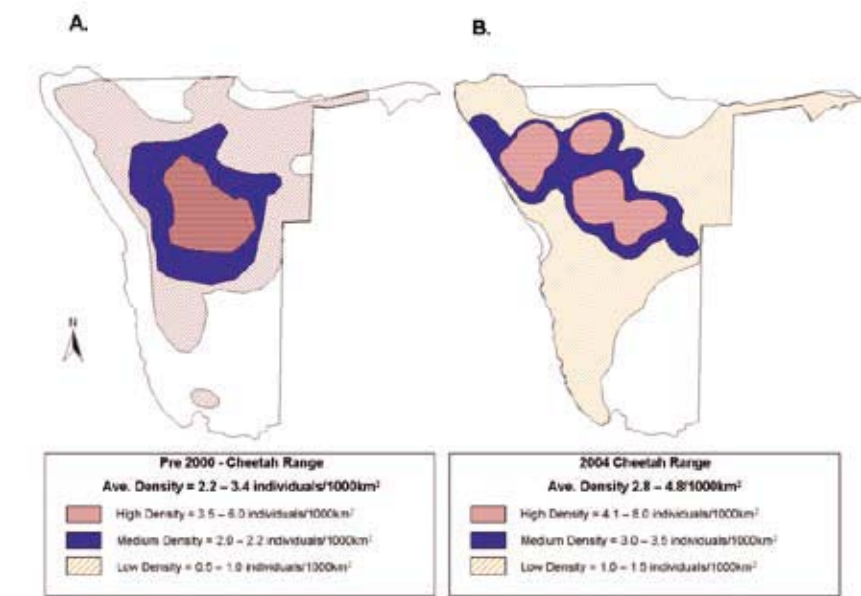


Fig. 2. (A) Distribution and density estimates of cheetah in Namibia 1990 – 2000 (MET, 2000), (B) Distribution and density of cheetah based on sightings plus observations (Hanssen & Stander 2004). Density estimates calculated from Marker (2000) and Marker *et al.* (in prep.).

ing it an economical value and the game numbers increased.

During the 1970s, above average rainfall resulted in an abundance of wild game and a parallel increase in cheetah numbers (Joubert 1985), but the 1980s saw the worst drought of the century. Wild game was culled to save pastures for livestock resulting in predator conflict and up to 900 cheetahs per year were reported removed and killed during this period (Marker-Kraus *et al.* 1996). In addition, a kudu rabies epidemic reduced this species by 58% (Joubert 1985). During the same time, farmers started diversifying their livestock farming operations to incorporate game farming on their commercial (free-hold) farms. The fact that the national commercial cattle herd has declined from 2.5 million in the late 1950s to 845 656 by the end of 2001, can be attributed to some extent to the fact that many farmers have diversified to game farming. Orford (2002) reported that 10% of livestock farms had been converted to game

fenced farms since the Marker-Kraus *et al.* survey in 1996. Namibia’s wildlife industry has grown from an estimate N\$ 25.3 million contribution in 1993 to N\$ 154 million in 2000, representing a real growth of 20.7% per annum (Erb 2003). The increase in the utilising of wildlife as a form of income has brought with it a new dimension to the human-carnivore conflict, namely that of conflict over wildlife predation. This conflict has resulted in high removals of cheetahs as they are seldom tolerated in these game rich areas due to the relatively high value of this game (Marker *et al.* 2003a).

Despite the intensity of conflict, the north-central farmlands remain an important habitat for cheetahs in Namibia (Fig. 2a, b), due to an abundance of prey – 70% of the country’s game populations occur primarily on free-hold farms (Marker-Kraus 1996), and the low human density. In contrast, few cheetahs occurred in the eastern or western communal farming areas pre 2000 (Fig. 2a).

Table 1. Population estimates for game species in Namibia (1955-2006).

Species	1955 ^a	1960 ^a	1973 ^a	1980 ^a	1983 ^a	1996 ^b	2006 ^c
Kudu	72,500	60,800	111,900	200,000	83,700	59,387	164,571
Gemsbok	26,900	24,500	40,600	45,000	20,600	70,392	161,821
Springbok	45,700	37,300	141,900	250,000	91,700	58,054	181,161
TOTAL	145,100	122,600	294,400	495,000	196,000	187,833	507,553

^aJoubert, 1985, ^bMarker-Kraus *et al.*, 1996, ^cErb, 2006.

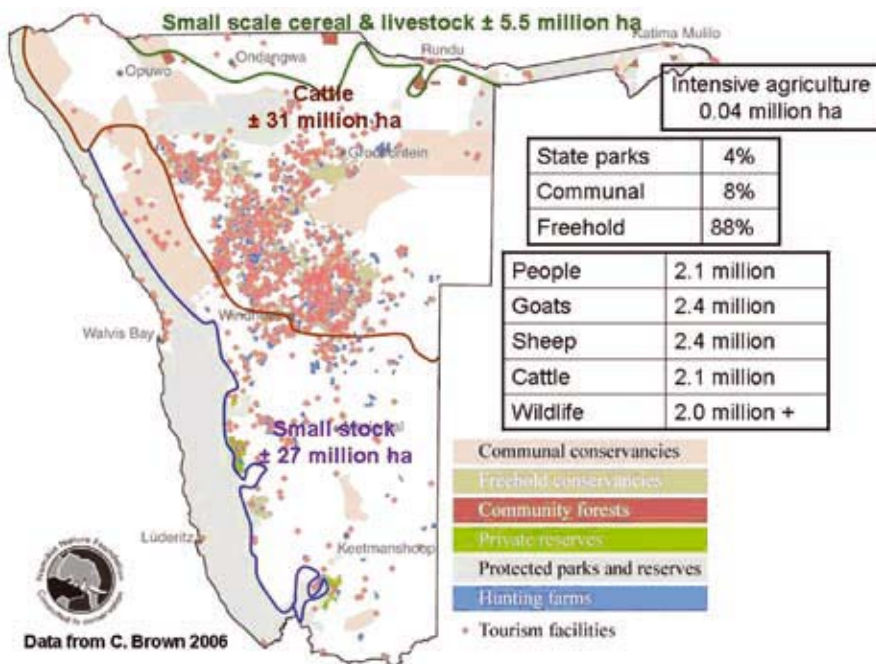
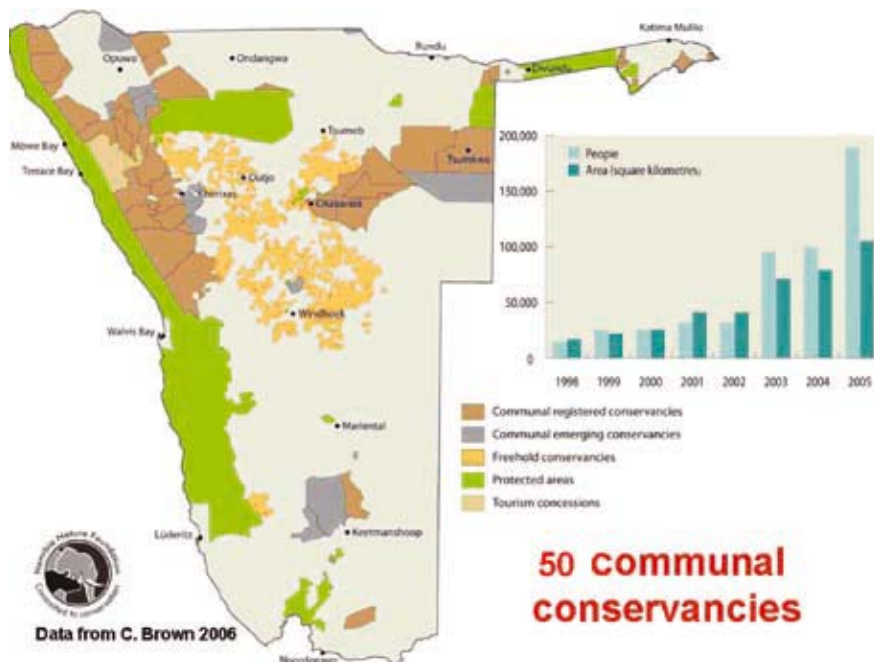


Fig. 3. (A) Land use within Namibia including numbers of people, livestock and wildlife, how much land is used for cattle and small stock as well as where wildlife is found by percent (Brown 2006). Namibia's commercial cattle herd is found in the north central part of the country.



(B) Map of Namibia showing communal/free-hold conservancies, protected areas and tourism concessions and number of people and square kilometers of land (Brown 2006).

The spread of small stock farming in the south, with its attendant predator-proof fencing and systemic eradication of carnivores has resulted in relatively few cheetahs persisting in the southern part of the country (Marker-Kraus *et al.* 1996).

The first free-hold conservancies were registered in 1996 and in 1998 the first four communal conservancies were gazetted. Where free-hold farmers already had utilization rights over their game, this act gave communal conservancy members limited utilization

rights over the game on conservancy land (NACSO 2004). Today over 50 communal conservancies and 20 free-hold farmers are registered (Fig. 3a, b). This economic incentive, together with the implementation of sound management strategies of existing game and the addition of new populations, has resulted in an increase in game numbers in communal areas (Erb 2003). Currently Namibia has a large and stable population of wildlife, both within protected areas and on free-hold and communal farmland (Erb 2003, 2006). This has led to an increase of cheetah numbers in the north-western areas of the country (Fig. 2b; Stander & Hanssen 2004).

It is hard to reliably monitor population trends across the country and to derive accurate estimates of population size. However, the general consensus is that the minimum number of cheetahs nationwide is 2000, with an upper boundary in the region of 5000 animals (Stander & Hanssen 2004). Communication with farmers suggests that cheetah populations in Namibia could be increasing, although there is no current data to substantiate this and could be a result of current land use change.

Removals

As mentioned above, it is hard to gather accurate data regarding the true levels of cheetah removals from Namibian farmlands, as much of it relies upon self-reporting without any incentive to do so. Cheetahs in Namibia frequent certain trees, known locally as 'play-trees', as part of their communications and territorial behaviour. This behaviour results in high numbers of cheetahs being trapped by farmers in traps cages at these so called play trees (Marker-Kraus & Kraus 1995). There is some information on numbers of cheetahs reported removed through trophy hunting, export, or due to being perceived as a 'problem cheetah' (Fig. 4, 5).

Two organisations in Namibia, the Cheetah Conservation Fund (CCF) and the Africat Foundation, have been independently monitoring cheetah removals for over fifteen years, providing valuable information on rates of removals and the reasons given for them. Since the early 1990s, these organisations have handled over 1260 cheetahs (both live and dead) trapped across ten re-

gions of Namibia (Fig. 4; C. Conradie, pers. comm., Marker *et al.* 2003, Marker Annual Report 2005 and 2006). The majority of the animals were captured as they were perceived to pose a threat to livestock ($n = 513$ cheetahs) or game ($n = 428$), while 27 were caught for tag-and-release, 17 were trophy hunted and 18 died from other causes (Fig. 4).

MET (Ministry of Environment and Tourism) figures that were reported to CITES were added for the period 1997 to 2005 and are shown in Figure 5. These numbers include dead or captured cheetahs handled by CCF and AfriCat, as well as cheetahs trophy hunted or killed due to conflict. They do not represent all removals as research has shown that some go unreported (Morsbach 1987, Marker *et al.* 1996).

Today, indiscriminate removals of cheetah still occur on both livestock and game farms, with data suggesting that game fenced farms pose more of a problem in terms of cheetah removals than livestock farms (Marker *et al.* 2003a). However, a recent survey indicates that although cheetah are still seen as a problem on Namibian farmlands, farmers' tolerance levels have increased and cheetah removals are now more closely linked with actual losses, rather than as preventative measures or indiscriminately (Marker *et al.* 2003b). Nevertheless, much work remains to be done to resolve human-carnivore conflict to further reduce removals and effectively conserve cheetahs on Namibian farmlands.

Research on the Namibian cheetah

Gathering reliable, long-term data on the Namibian cheetah population is fundamental to understanding the dynamics of the population and how it is likely to be affected by ongoing removals, habitat changes and conflict. Long term data is also vital to help guide the development and implementation of management strategies aimed at ensuring the conservation of this species. Research by CCF on cheetahs in Namibia for over 15 years, has provided a wealth of data on their ecology, the main results of which are summarised below.

Spatial ecology

A long-term radio-telemetry study (1993 to 2003) revealed that cheetahs

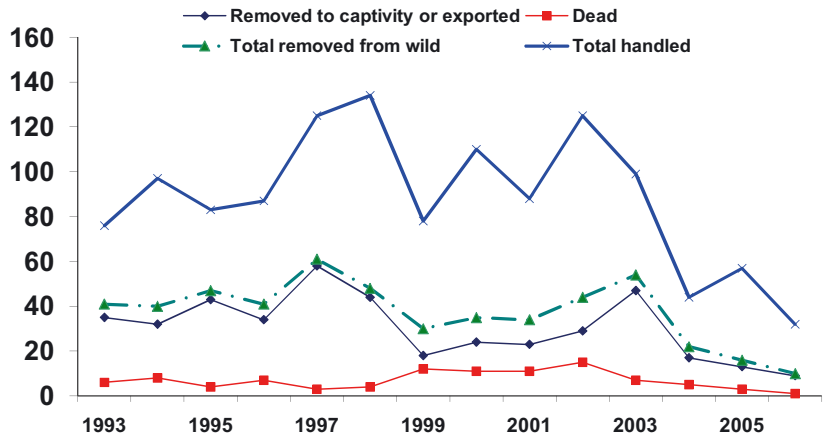


Fig. 4. Total number of cheetahs handled by CCF and Africat between 1991 and 2006, including those that were examined when dead and those that were placed in captivity or exported.

on the Namibian farmlands ranged over large areas, with an average home range size of 1,651 km² ($\pm 1,594$ km²), far greater than that described for cheetahs elsewhere, with no detectable effect of sex, social grouping, or seasonality (Marker 2002, Marker *et al.* 2007). Home range sizes in this study averaged 1,490 km² for single males, 1,344 km² for coalitions of males and 2,160 km² for females. The only other long-term dataset, from the Serengeti National Park, reveals ranges of 777 km² for non territorial males, and 833 km² for females (Caro 1994). Despite such large ranges in Namibia, cheetahs tended to utilise intensively only a small fraction of that area: 50% of fixes were located within an average of 13.9 \pm 5.3% of the home range (Marker *et al.* 2007). These

ranges were not exclusive, overlapping on average by 15.8 \pm 17.0%, with male cheetahs showing more intra-sexual range overlap than did females (Marker *et al.* 2007).

This extensive range size has some important implications for cheetah management and conservation on the farmlands. Firstly, an individual or a group of cheetahs ranges across 21 farms on average in a given year. Multiple sightings of cheetahs reported from different farms may thus be repeat sightings of the same individuals, and this should be borne in mind when sightings are used to estimate population size. More importantly, if only one farmer of those 21 is hostile towards cheetahs and habitually removes them, it could create a sink effect where other cheetahs

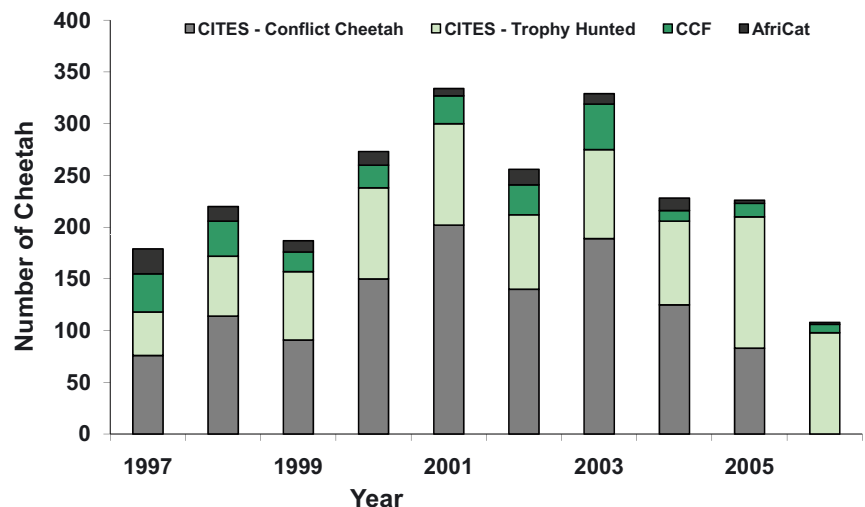


Fig. 5. Total cheetah removals reported by CCF, Africat and CITES by MET from 1997 to 2005.



Fig. 6. Cheetah family on a kill, adult hartebeest. Namibian cheetahs are reported to kill adults and calves of larger antelopes. Smaller antelopes, however, form an important part of a cheetah family diet (Photo L. Marker).

are drawn in to the newly vacant area from over a wide area and are then removed. This effect has been observed with other predators: in Kenya, a study by Woodroffe & Frank (2005) showed that removals of lions on one 180 km² ranch had direct effects on lions over an area of more than 2,000 km². This highlights the importance of involving as many farmers as possible in efforts to reduce conflict and therefore minimize the scale and impact of cheetah removals on the farmlands.

A variety of methods have been used on the farmlands to estimate cheetah population density, producing a range of estimates from 2.5 (+/- 0.73) cheetahs/1000 km² using radio telemetry (Marker 2002) to 4.1 (+/- 0.4) chee-

tahs/1,000 km² using camera trapping (Marker *et al.* in prep.). This variation highlights the problem of using different methods to estimate density, but so far no single, effective, repeatable technique has been identified which could be used across the wide range of habitats that cheetahs occupy in Namibia, and this remains a problem for effective cheetah monitoring and conservation.

Demography

The Namibian Cheetah is an example of a threatened population which has been subject to a high level of removal, and whose vital rates require more accurate determination in order to assess and manage the impact of such removals. The large numbers of cheetahs trapped

on the farmlands has allowed substantial data to be collected on Namibian cheetah demography. These data revealed that 51% of males trapped were in coalitions, with an average coalition size of 2.3, and there was a strong bias towards farmers capturing males: three males were trapped for every female caught (Marker *et al.* 2003c). The age of breeding females ranged from 19 months to 12 years with a mean of 5.3. Litter size obtained through trapping ranged from 1-6 with a mean of 3.1 (Marker *et al.* 2003c). Litters observed during radio-telemetry alone ranged in size from 2 to 5 with mean of 3 (Marker *et al.* 2003c). Reproductive information was gathered on 19 litters from 10 radio-collared dams showing interbirth intervals following litters that were raised to independence ranged from 21 to 28 months (Marker *et al.* 2003c).

There was evidence to suggest some degree of seasonal breeding, with peaks of births in March and June/July, and relatively low juvenile mortality but high adolescent and adult mortality, with most cheetahs studied dying at around 5-6 years of age (Marker *et al.* 2003a, Marker *et al.* 2003c). Human caused mortality accounted for 79.4% (n=50) of these recorded deaths. Ten were accidental, while the remaining 40 were deliberate killings. The main cause of deliberate killings, accounting for 25 cheetahs, was being shot due to being a perceived threat. Overall, therefore, shooting as a protective measure accounted for 47.6% (n=30) of the total reported mortality in the wild. Trophy hunting, by comparison, accounted for only 11% of overall deaths (Marker *et al.* 2003a, Marker *et al.* 2003c). This is not dissimilar to what was found in the only other long-term study of cheetah demography in the Serengeti (Caro 1994, Laurenson 1994). However, cub mortality was lower than the Serengeti and adolescent higher. The high adolescent and adult mortality is very worrying for long-term cheetah conservation in Namibia, as the removal of adults is likely to be far more damaging to population viability than the loss of juveniles (Crooks *et al.* 1998).

Diet and prey selection

In comparison to cheetah found elsewhere in Africa, the diet of cheetah on

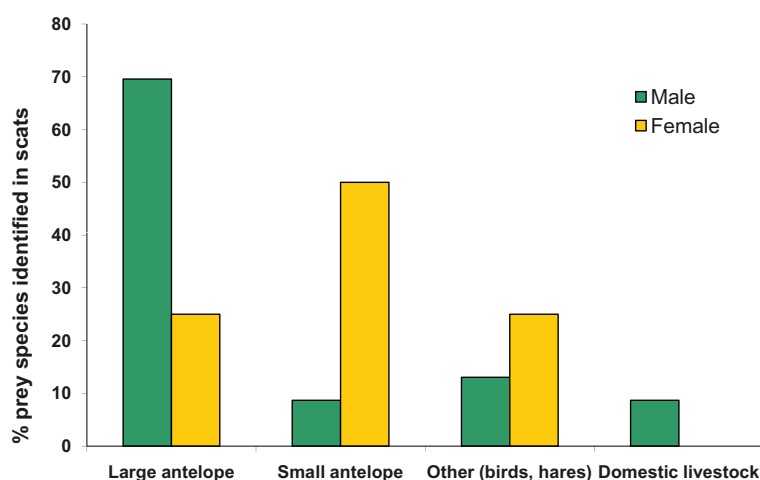


Fig. 7. Percentage of prey species identified in scats of both male and female cheetah (Marker *et al.* 2002).

Namibian farmlands is interesting for two reasons. First, the cheetah in this habitat occur in extensive integrated wildlife and livestock farmland systems, where kleptoparasites such as spotted hyenas and lions have been eliminated. Farmers reported up to 17 species of prey species ranging from large adult kudu *Tragelaphus strepsiceros* (approx. 250 kg) to kori bustards *Ardeotis kori*, with Morsbach (1985) reporting approximately 77% of the cheetah's diet included hartebeest *Alcelaphus buselaphus* (Fig. 6), kudu and gemsbok *Oryx gazelle* calves. Marker *et al.* (1996) farmer survey showed that 59% of farmers reported kudu calves as the primary prey of cheetahs. Scat analysis and prey transects on the farmlands provided information regarding the relative abundance of locally available prey species, as well as the frequency of those species in cheetah scats, therefore providing valuable data on prey selection in this area. These data confirmed that farmland cheetahs preyed on a wide range of species (Fig. 6) as reported by farmers' observations showing a strong selection towards native game species (Marker *et al.* 2003d, Wachter *et al.* 2006). Despite farmers' perceptions that cheetahs pose a serious threat to livestock, domestic stock remains were found in only 6.4% of scats, although livestock comprises around two-thirds of the available prey base on the farmlands (Marker-Kraus *et al.* 1996, Marker *et al.* 2003d; Fig. 7).

Minimum livestock depredation rates due to cheetahs were tentatively estimated at 0.01 calves and 0.004 sheep per km² on the farmlands, and may be substantially more depending on cheetah density (Marker *et al.* 2003d). Although these estimated depredation levels seem low, they could still impose significant economic costs on individual farmers, which highlights the need to develop ways to assist farmers in protecting their stock and therefore reducing human-cheetah conflict.

Habitat use

The long-term radio-telemetry study provided information on cheetah habitat selection (Fig. 8), by examining the habitats that cheetahs were located in during radio-tracking flights, compared to the overall habitat of the study area. Interestingly, cheetahs did not seem

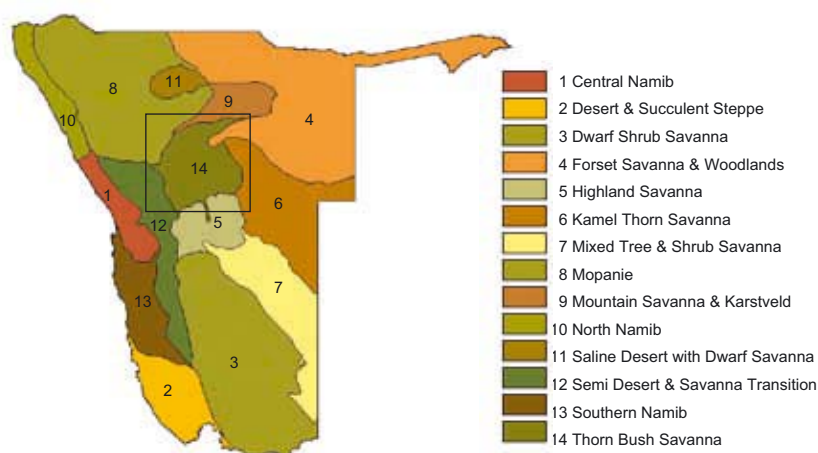


Fig. 8. Broad vegetation types (e.g. grassland, shrubland and woodland; Atlas of Namibia Project 2003). The boxed area indicates the area of highest density of cheetah.

to be selecting areas with higher prey density, but they did intensively utilise areas with good grass cover and better sighting visibility, which are likely to be advantageous for hunting (Muntiferling *et al.* 2006). Over the past few decades, the Namibian farmland has undergone substantial 'bush encroachment' (Fig. 9), where wooded savannah is replaced by dense *Acacia* thickets due to a combination of factors such as fire suppression, overgrazing and the extirpation of mega-herbivores (Bester 1996). This process reduces the productivity of the farmlands, increasing economic hardship for farmers, and affecting the availability and abundance of wild prey (Marker *et al.* 2002, Quan *et al.* 1994).

Health and genetics

Opportunistic bio-medical collection on wild-caught cheetahs provides very valuable insight into the health of free-ranging populations and allows for ongoing monitoring of the health and genetic status of Namibia's cheetahs. In addition, information on the health status of wild cheetah contributes to solving some of the questions surrounding the health problems captive cheetah experience (Munson *et al.* 2004)

Reproductive fitness of male cheetahs is assessed through the opportunistic collection of semen from wild males captured on farmland. The semen is assessed and, where possible, banked in the CCF Genome Resource Bank



Fig. 9. The Namibian farmland has experienced severe bush encroachment. This reduces the productivity of the land and affects the abundance of wild prey (Photo L. Marker).

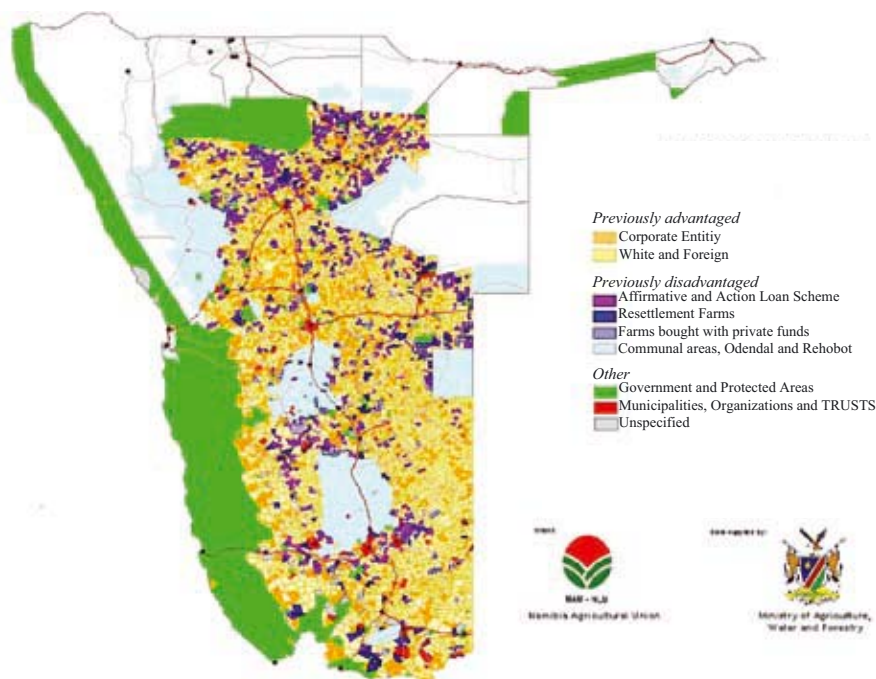


Fig. 10. Land Ownership in Namibia including resettled farmers, white free-hold farmers and communal areas. (Namibian Agricultural Union 2006).

(GRB; Crosier *et al.* 2006). This research includes evaluating and developing improved methodologies for sperm cryopreservation, analysis on the influence of age, season and where applicable captivity on ejaculate quality (Crosier *et al.* 2006; Crosier *et al.* 2007).

To assess the extent to which free-ranging cheetahs are exposed to feline and canine viruses, sera from 81 free-ranging cheetahs sampled between 1992 and 1998 were evaluated for antibodies against canine distemper virus (CDV), feline coronavirus (feline infectious peritonitis virus; FCoV/FIPV, feline herpesvirus 1 (FHV1), feline panleukopenia virus (FPV), Feline immunodeficiency virus (FIV), and feline calicivirus (FCV and for feline leukemia virus (FeLV) antigens. Antibodies against CDV, FCoV/FIPV, FHV1, FPV, and FCV were detected in 24, 29, 12, 48, and 65% of the free-ranging population, respectively, although no evidence of viral disease was present in any animal at the time of sample collection. Neither FIV antibodies nor FeLV antigens were present in any free-ranging cheetah tested (Munson 2004). These results showed that Namibian cheetahs had commonly been exposed to and survived several viruses known to cause serious clinical disease in captive cheetahs. Long-term studies on gastritis

have indicated that although wild cheetahs harbour the helicobacter, they do not show signs of disease (Terio *et al.* 2007).

Genetic sampling of wild caught Namibian cheetahs showed similar levels of genetic variation to East African cheetahs, as well as limited genetic differentiation between regions (Marker 2002; Marker *et al.* in press). These results support the notion of a genetically panmictic population and imply that cheetahs can be translocated within Namibia without significantly altering historic patterns of gene flow. Most groups of cheetahs in Namibia, whether they were family groups, sibling groups, or male coalitions, consisted of related animals (Marker *et al.* in press). Female cheetah within the CCF study area were more closely related than were males, and home range overlap was greater among related versus unrelated cheetahs (Marker 2002; Marker *et al.* in press).

Morphological research showed that a high proportion of the wild cheetahs examined (40% of 208 cheetahs), had deep focal palatine erosion (FPE), a condition where the first lower molar erodes and sometimes penetrates the upper palate (Marker & Dickman 2004). This was the first time FPE had been reported in free-ranging cheetahs, and demonstrates that it is not

an artefact of a 'soft' diet in captivity as originally thought. Other dental abnormalities were also observed in wild cheetahs – over 20% of animals examined were missing at least one premolar, while around a third (31%) showed crowding of the lower incisors (Marker & Dickman 2004). The cause of these dental abnormalities is not yet known, and more research will be valuable, as FPE in particular was linked to a poorer physical condition (Marker & Dickman 2004).

Current threats to Namibian cheetah

The Namibian cheetah population currently faces a range of threats, with the main ones being changes in habitat and land use and ongoing conflict with humans. The Namibian farmlands are currently undergoing considerable changes, as land tenure rights change and previously large tracts of land are subdivided into new plots for resettled farmers (Fig. 10). The ongoing spread of bush encroachment continues to alter the habitat and impact cheetahs through reduced prey availability and a reduction in preferred habitat patches, and it may also contribute towards continued conflict with landowners. Although attitudes appear to be changing slowly (Marker *et al.* 2003c), this human-cheetah conflict, particularly the indiscriminate removal of animals not actually causing problems, is still a significant conservation issue for cheetahs on the Namibian farmlands and must be addressed urgently.

Understanding population status and trends is also an issue of great importance, especially as land use changes continue to occur; as such information is vital for assessing the need for, and efficacy of conservation action. The main problem is that there is currently no single low-technology, low-cost technique that can be used to provide repeatable estimates of cheetah abundance across the range of habitats that they occur in. Identifying or developing such a method is a high priority and will be a very valuable tool for effective cheetah conservation in the future.

Possible conservation solutions

Many Namibians live in poverty and are therefore concerned more about immediately pressing issues than de-

clining cheetah populations, so any effective conservation strategy must be multi-disciplined, relevant and appropriate to the local situation. Firstly, education is of paramount importance, to train Namibians in effective range and resource management, highlighting the economic and cultural values of local resources, as well as raising awareness of ecological issues (Wildt *et al.* 2002). The potential value of wildlife, through both consumptive and non-consumptive utilisation, should be highlighted, and stakeholders trained so that they can make the most effective decisions in terms of land management, and a range of educational programmes are now being implemented to try to achieve this (Marker *et al.* 2002, Wildt *et al.* 2002).

However, the value of such education will be limited if people are still suffering losses from predators, so working with farmers to try to reduce depredation rates will be very important for reducing the problem of human-cheetah conflict. Various steps have been taken towards this end, including the placement of livestock guarding dogs (Fig. 11; Marker *et al.* 2005), and the provision of training courses and outreach materials to educate stakeholders about livestock and predator management (Schumann 2003), and local people now seem more tolerant of cheetahs on their land than was previously the case (Marker *et al.* 2003c). Encouraging farmers to join together in conservancies is also an important step of this process, as it allows larger-scale management where the costs and benefits of predator presence are shared between many landowners, with benefits for both farmers and wildlife (USAID 2005).

Truly effective, long-term conservation, however, will hinge upon the presence of cheetahs on private land being seen as a benefit rather than as a slightly mitigated cost. There are a number of ways that this can be achieved: through ecotourism, trophy hunting, or by exploiting current market trends which are showing a tendency for environmentally friendly products. This approach is currently being examined by Namibian beef farmers, who, if they follow certain guidelines for conservation-minded land management, can sell their meat at a premium internationally and market the



Fig. 11. Anatolian Shepherd Livestock Guarding Dogs help protect livestock from predators' attacks and reduce human-wildlife conflicts (Photo L. Marker).

product as "cheetah friendly" (Marker 2002). Another scheme involves the selective harvesting of encroaching bush, which is sold internationally as fuel logs, and marketed as helping the cheetah by restoring habitat, and feeding profits back into the local community (Marker 2002). Such innovative schemes are critical, as they link much-needed income generation and capacity-building to conservation, and raise the profile, both locally and internationally, of cheetah conservation in Namibia.

Policy and Legislation

Due to the decline of cheetah populations internationally, the United States placed the cheetah on its Endangered Species List in 1970. In 1975, the cheetah was classified as 'Vulnerable' by the World Conservation Union (IUCN), and was listed on Appendix I of CITES, prohibiting the sale of live cheetahs or skins on the international market. Furthermore, in 1975 a Namibian Nature Conservation Ordinance classified the cheetah as a 'protected animal' - although it may be shot in order to protect life or property - while currently the Namibian Red Data Book lists the cheetah as Vulnerable.

Despite its CITES listing, Namibia has been allowed a quota of 150 cheetahs annually since 1992, which includes legal trophy hunting as well as live export to internationally recognised zoological facilities (CITES 1992). The quota of 150 animals was based on a

population estimate of 2,500 cheetahs made by Morsbach (1987). This quota was permitted in an attempt to reduce indiscriminate cheetah removal. Due to national legislation, some countries such as the United States do not allow the import of cheetah products. Trade of live cheetah has been minimal since 1998 as Ministry of Environment and Tourism (MET) has discouraged the export of live cheetahs from Namibia to reduce indiscriminate trapping.

However, despite the legal protection measures afforded to cheetahs and other predators, the laws are not well implemented or effectively enforced. Ultimately the onus rests on the farmers as to whether or not they will remove cheetah, lethally or otherwise from their land. Moreover, the government relies on farmers volunteering information with regards to cheetahs they have captured and/or killed as many farms are situated in remote areas and it is virtually impossible to monitor predator removals other than through a voluntary reporting system. Despite the existence of a legal trade, illegal trade may also still pose a threat to the cheetah - there is organized trade from Namibia and Botswana into South Africa, and cheetahs have been moved from South Africa to Namibia for trophy hunting purposes (Dickman *et al.* 2006).

Cheetahs in Captivity

In addition to the wild population, the International Cheetah Studbook records

90 male and 92 female cheetahs being held in captivity in 21 private facilities across Namibia, as of December 2005 (Marker 2007). These facilities do not breed cheetahs, in accordance with current MET policy, which stipulates that captive breeding is not allowed in Namibia. There are also an unknown number of animals in private facilities that are not registered with the Studbook. Cheetahs can be held in private captive facilities in Namibia, but in 2005, MET revised the minimum standards for keeping large carnivores in captivity, in an attempt to improve current standards and ultimately reduce the number of large predators held in captivity.

The way forward

Much still needs to be done in Namibia for cheetah conservation to move forward effectively.

- Developing efficient techniques for estimating cheetah numbers will be important for assessing population size in Namibia, and therefore examining whether the current CITES quota is still sustainable.
- Changing land tenure and management is also an issue – the impact of newly resettled farms on cheetah distribution and conservation is currently unknown, so more studies should be initiated to examine the impact of such land use changes, and therefore learn how to best incorporate them into conservation strategies.
- There has also been an increase in game farms in Namibia, with possible negative consequences for predators, so working with game farmers to minimise depredation, as well as helping regulate the fencing and management of such farms through government policies, will be important for cheetah conservation. Encouraging policies that promote the concept of conservancies vs. game fenced farms is also imperative.
- Various policies already exist for land-use and conservation, however, at regional, national and international levels, and such policies are frequently hard to integrate and enforce. Working with all relevant agencies to encourage the streamlining of effective, appropriate land-use policies, as well as their enforcement, will be a very important task for future conservation work.

The variety and scale of these tasks, and the multitude of different stakeholders that they necessarily depend on, highlight how complex the long-term conservation of cheetahs on private land really is. However, the work done so far in Namibia demonstrates that it can be done, and may provide a valuable model that can be modified for other places where people and large carnivores struggle to coexist.

Acknowledgements

We would like to thank the following individuals for supporting Cheetah Conservation in Namibia and providing information for this report. Carla Conradie (Africat), Dr. Bettina Wachter (IZW), Matti Nghikembua (CCF), Laura Linn (CCF), Harald Forster (Okatumba Wildlife Research), Josephine Henghali (Ministry of Environment and Tourism, Namibia).

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Appendix I. List of projects

Cheetah Conservation Fund is a not for profit organization founded in 1990 undertaking scientific research regarding cheetah ecology, biology and their habitat, publishing scientific papers and sharing findings internationally, assisting in the management of captive and free-ranging cheetah throughout the world, maintaining a major public conservation awareness and education program for local and international communities and school groups from primary through college education; and conducting community conservation and predator conflict resolution programs.

Africat Foundation was founded in 1991 and officially registered as a non-profit organisation in August 1993. *AfriCat* has grown significantly since then and what started out primarily as an animal welfare organisation has over the years, identified the need to include a focus on education and research as being essential to our mission – the long-term conservation of large carnivores in Namibia.

Leibniz Institute for Zoo and Wildlife Research (IZW) is a long term study of the ecology, health and reproduction of free-ranging cheetahs ranging on Namibian commercial farmland. The IZW is an interdisciplinary institute that combines the expertise of behavioural ecologists, reproductive physiologists, geneticists and those interested in wildlife diseases to tackle important conservation and wildlife management issues worldwide.

Okatumba Wildlife Research (OWR) is a non-profit company that conducts research projects (radio-telemetry on large predators, monitoring projects on various game species, behavioural studies, etc.) and is involved in wildlife management for conservancies (vegetation survey, monitoring of habitat conditions, game counts, compiling guidelines for sustainable utilisation of natural resources, etc.).

Appendix II. List of organizations involved

Cheetah Conservation Fund, P.O. Box 1755, Otjiwarongo, Namibia.
Email: cheeta@iafrica.com.na Website: www.cheetah.org

AfriCat Foundation, P.O. Box 1889 Otjiwarongo, Namibia
Email: africat@mweb.com.na Website: www.africat.org

Okatumba Wildlife Research, P.O. Box 90188 Klein Windhoek, Namibia
Email: okatumba@namibnet.com Website: www.okatumba.de

Leibniz Institute for Zoo and Wildlife Research (IZW), Alfred-Kowalke0Str. 17 10315 Berlin
Email: Watcher@izw-berlin.de

Harnas Wildlife Foundation, P.O. Box 548 Gobabis, Namibia
Email: harnas@iway.na

Large Carnivore Management Association (LCMAN), P.O. Box 86635 Windhoek, Eros, Namibia.

Appendix III. Responsible authorities

Ministry of Environment and Tourism, Private Bag 13306, Windhoek, Namibia.

Status Report for the Cheetah in Botswana

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Historically, cheetahs *Acinonyx jubatus* have been distributed throughout Botswana. With once pristine habitat, very low human populations and one of the largest concentrations of ungulates on the continent, space and prey were plentiful. However, the last 40 years have seen great changes in the natural habitat, with overstocking of livestock, range partitioning, the arrival of deep borehole technology and the erection of cordon fences causing dramatic reductions in wildlife populations and the overall integrity of the Kalahari ecosystems. This report assesses current national cheetah status and distribution, detailing the factors presently affecting these populations.

History

Little historical data is available on cheetahs' status nationally. In 1975, Myers, estimated Botswana's cheetah population at 1000-2000 (Myers 1975). The cheetah was considered to be sparsely distributed. Two-thirds of the country was considered to be suitable habitat, the semi arid Kalahari ecosystem in the South and West (700 cheetah), and the well watered savannah of the Okavango Delta in the North West, which supports higher prey populations (800 cheetah). The remaining third of the country in the East, being semi arid and over utilised was assumed to have lower cheetah densities (500 cheetah). There was great concern over the extensive habitat deterioration due to a lack of management of the national herd of 1.5million cattle. Habitat degradation was resulting in declines in perennial grassland, an increase in scrub savannah, lowered water tables and disappearance of wildlife (Myers 1975). These concerns remain today and the need for habitat conservation in Botswana has never been greater.

Distribution and population estimation

Background of current estimates

Very little focused research has been carried out on cheetah in Botswana. However, the Department of Wildlife and National Parks (DWNP) carried out predator spoor surveys in the Central Kalahari Game Reserve (CKGR) from 1998-1999. Data collected along defined road transects of known length was used to provide an index of abundance (Stander 1998). The analysis yielded the result of 112 cheetahs in the

CKGR at a density of 0.25-0.26 cheetah/100 km² (Winterbach 2003). Further predator spoor surveys were carried out by P. Funston in the Kgalagadi Transfrontier Park (KTP) from 1998-2001. It was estimated that 204 cheetahs inhabit the KTP at a density of 0.57 cheetah/100 km² (Funston 2001). Both CKGR and KTP have similar habitats. Attention must be given to substrates when using spoor surveys to compare different areas.

This data was then utilised for Botswana's draft predator management strategy. This was compiled in 2003 and provides the accepted estimates for cheetah based on the current knowledge.

The national density estimates were derived from calibration factors found in the CKGR and KGTP. The following assumptions were made to estimate the cheetah population size:

- Density in the Kgalagadi Wildlife Management Area is intermediate between the CKGR and KGTP estimates, i.e. between 0.26-0.56 cheetah/100 km².
- Density in other areas varies between 0.15-0.56 cheetah/100 km².
- Cheetahs only occur in 25% of the Central Agricultural Unit.

This study provided a total national population estimate of 1,768 cheetahs. It should be noted this is a tentative estimate gained through extrapolation and expert assumptions. More data is required to provide an estimate on which to base management options.

The assumption of 0.15-0.56 cheetah/100 km² in the agricultural zones is

likely to be very conservative, as cheetah distribution in Botswana includes large areas outside conservation zones.

Survey methods

The information used to represent the status of Botswana's cheetah has been derived from: Draft National Predator Management Strategy (Winterbach 2003); Botswana's Department of Wildlife and National Parks (DWNP) Problem Animal Control (PAC) records from 1998-2006; 2006 Status report questionnaires; Sighting reports from 2003-2006. Farming community interviews from 2003-2006; Literature reviews.

Current distribution

In 1992 it was considered that cheetahs were widespread throughout Botswana, being most common in the South West and North West (Vandepitte 1992). Today, although widespread, cheetah distribution will likely be concentrated in the southern part of the country where densities of competitors will be lower (ODMP 2006). It is considered that large part of the cheetahs' distribution occurs outside protected areas and there may be higher densities in agricultural zones, where wild prey is available, than in conservation zones (Winterbach 2003).

According to estimates (Table 1, Fig. 1), the Kgalagadi Transfrontier Park (KTP) and Kgalagadi Wildlife Management Area (WMA) have the highest densities of cheetah. The Central Kalahari Game Reserve (CKGR) has lower estimates than might be ex-

pected, although prey has decreased considerably in the last 40 years and lions may be a limiting factor in this area. The agricultural zones throughout Botswana are important areas for cheetah, in these areas competitors such as lions and spotted hyenas have been removed, although livestock conflict now limits these populations. The Central Agricultural Zone has the lowest densities. This region is the most populated and utilised region in the country and has the highest cattle biomass. The protected areas in the North, Okavango, Chobe and the Pans have the highest prey densities, but also the highest lion and spotted hyena populations. Therefore, cheetah numbers may be limited in these areas. From the current cheetah distribution estimates the importance of conservation management for the cheetah in agricultural zones is very clear.

From PAC reports, interviews and sightings it can also be seen that cheetahs are present throughout Botswana, with the exception of some areas of the Central Agricultural Unit, such as the Tati Farms in the North West of the area, where no reports for cheetahs have been made in last 10 years. Conversely, within the Central Agricultural Unit, the Tuli Block Farms in the South West have higher numbers of reports than the rest of the area. The Tuli region is an area of mixed land use, with a gradual increase in sustainable wildlife utilisation and ecotourism in the region. This may have led to a local recovery of cheetah numbers in the region.

Further studies carried out to assess cheetah numbers include: The Okavango Delta Management Plan carried out a baseline survey of cheetah and leopard numbers in the Ramsar Site in 2006. The cheetah population was estimated through spoor surveys at 243. Cheetah density was estimated at 0.7 cheetah/100 km². This is considerably higher than originally estimated in the National Predator Strategy (0.35 cheetah/100 km²). This suggests that this area holds a more significant population than previously considered (ODMP 2006).

Cheetah Conservation Botswana carried out a spoor survey in Jwana Game Park in the Kgalagadi Agricultural 2 zone. The cheetah population was estimated at approximately 150 cheetah within the study area which spans a

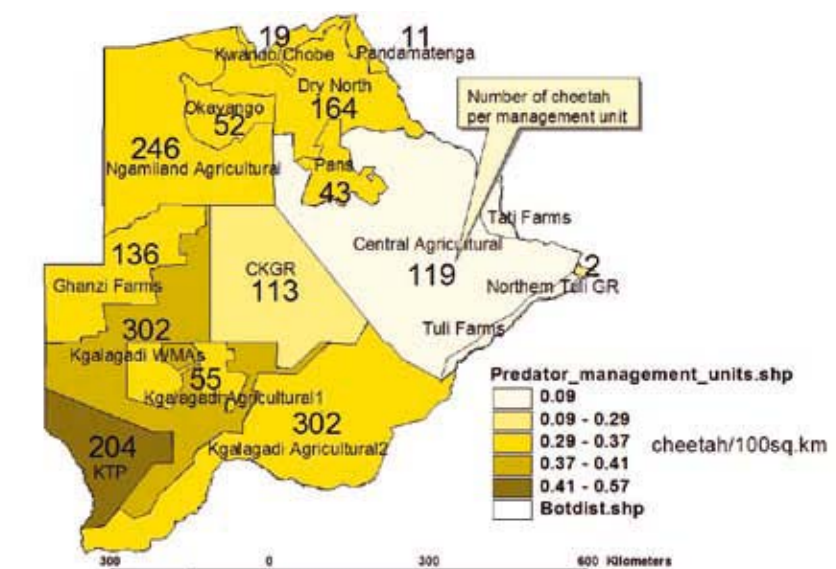


Fig 1. Current National Cheetah Estimates related to predator management zones.

quarter of the zone (A. Houser, unpubl. data). This is higher than the estimated 302 for the whole region. Although this supports the assumption that cheetah numbers are likely to be higher in the agricultural zones than the national estimates (Winterbach 2003).

Population trend

A general view is that cheetah numbers may be increasing in the agricultural zones. High predator populations in protected areas; removal of lion *Panthera leo* and spotted hyena *Crocuta crocuta* from farmlands and the effect on natural prey movements due to the expansion of artificial water points, may encourage cheetahs to utilise these areas. Of people (n=78) interviewed on trends over the last 5 years in the agricultural zones, 68% felt cheetah populations were increasing. 20% felt they had remained constant. While only 12% reported them to be decreasing (R. Klein, unpubl. data). However, high stocking rates and boreholes have made farmlands potential sinks for national predator populations, particularly cheetahs. Claims that cheetah numbers are increasing are just as likely to be attributed to an increase in livestock encounter rates due to expansion into areas

previously inaccessible to farming. This requires urgent further study.

Certain areas such as the Molopo Farm block in the South of the Kgalagadi Agricultural 2 Zone have seen decreasing cheetah populations. Sightings of cheetah were once a regular occurrence in this savannah habitat (M.Bing, pers. comm.). However, this region is affected by illegal trade in cheetah due to the proximity of the South African border, as well as livestock conflict. Reports of decreasing cheetah populations have also come from Orapa Game Park and Khama Rhino Sanctuary in the Central Agricultural Unit. Moremi Game Reserve and Chobe National Park both report decreasing cheetah populations.

Table 1. Cheetah estimates from Botswana's draft predator policy (Winterbach 2003).

Management unit	Estimate	Density Ind/100 km ²
Okavango	52	0.35
Dry North	164	0.36
Kwando/Chobe	19	0.35
Pandamatenga	11	0.37
Pans	43	0.35
Central Agricultural	119	0.09
Northern Tuli GR	2	0.29
Ngamiland Agricultural	246	0.35
Ghanzi Farms	136	0.35
Kgalagadi WMAs	302	0.41
CKGR	113	0.21
KTP	204	0.57
Kgalagadi Agricultural 1	55	0.35
Kgalagadi Agricultural 2	302	0.35



Fig. 3. One of a male coalition in Moremi Game Reserve. Cheetahs are rare in this reserve due to high hyena and lion populations. (Photo J. Mossymere).

Situation in protected areas (Fig. 2)

Fully protected areas are National Parks and Game Reserves and occupy 17% of Botswana. An additional 21% is designated as wildlife management areas (WMA's), where it is intended that the main form of land use will be sustainable wildlife utilization

Central Kalahari GR - 52,800 km²

The largest protected area in the country. It is made up of sandveld, acacia woodland and scrub. The CKGR changes dramatically through the seasons. During the rainy season seasonal game is found in large numbers, particularly springbok, gemsbok and wildebeest. The CKGR is an important refuge for Botswana's cheetahs and further studies are required to understand the population dynamics within the area.

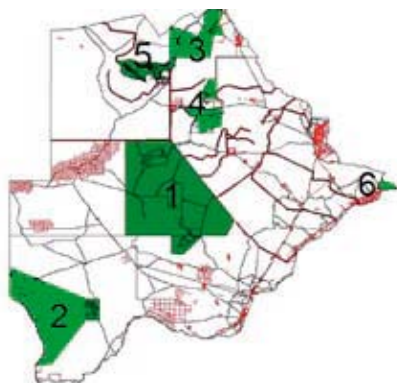


Fig 2. National Parks and Reserves in Botswana. 1 = Central Kalahari GR, 2 = Kalahari Gemsbok Transfrontier Park, 3 = Chobe NP, 4 = Makgadikgadi and Nxai Pan National Park, 5 = Moremi GR and 6 = Northern Tuli GR.

Kalahari Gemsbok Transfrontier Park - 28,400 km²

The KTP is made up of sandveld, acacia woodland and scrub, frequently interspersed with pans. The pans support nutritious grasses and with the provision of artificial waterpoints there are good populations of springbok, gemsbok and hartebeest. Cheetahs may exist at the highest densities in Botswana within this reserve. Spoor surveys must be repeated to determine trends.

Chobe NP - 10,698 km²

Habitats range from riverine, grassland, mopane woodland to acacia scrub. Cheetahs are rarely seen in this region, although they are occasionally seen in Savute and Nogatshaa. Cheetahs used to be found in the Northern part of the park but appear to have decreased in the region.

Makgadikgadi and Nxai Pan NP - 7,478 km²

The pans make up an area of approx. 12,000 km², although only 7,478 km² are protected. This area is characterised by numerous large pans and grassland. Large herds of springbok and zebra congregate during the rainy season as the clay soils yield rich grazing. For the rest of the year the game is highly dispersed. Cheetahs are present in the pans but not in high numbers and are a seasonal rather than permanent presence.

Moremi GR - 4,871 km²

The reserve incorporates a large part of the Okavango Delta. Moremi is a key

wildlife area with high populations of elephant, buffalo, lion, spotted hyena and large game. Cheetahs are present (Fig. 3) but not common. This is possibly due to inter-predator conflict with lion and hyena which may limit the cheetah population in the area.

Northern Tuli GR - 1,350 km²

This area is a combination of mopane forest, acacia bushveld, grassland and riverine habitats. Cheetahs are present (Fig. 4), but tend to be seasonal and not permanent, appearing to be more common during impala calving season at the onset of the rainy season. Since 2004, 19 cheetahs have been utilising the reserve (V. Stein, pers. comm). This implies the cheetah densities may be higher than earlier suggested by Botswana estimates.

Gaps in knowledge

Population size: Surveys need to be carried out in different habitats and land uses throughout the country to improve current estimates of cheetah populations.

Trends: Surveys need to be scheduled every 5 years in order to establish trends.

Conflict: It is known that the cheetah is considered a significant problem animal in many communities. The impact of such conflict on cheetah populations needs to be urgently assessed.

Habitat

Most of Botswana is semi-arid (Fig. 5). Mean annual rainfall ranges from 650 mm in the extreme northeast to less than 250 mm in the extreme southwest. Almost all rainfall occurs during the summer months, from October to April, and rainfall is highly variable temporally and spatially. The North-West, is dominated by the large inland delta and permanent wetland of the Okavango Delta, while the Central-North East consists of a large area of calcrete plains and salt pans. The East and South-East is hardveld and with around 450mm annual rainfall.

Most of the remaining areas of the country, about two-thirds, are covered by deep Kalahari sands and are sparsely populated (Jones 1999).

Regional differences

Cheetahs have been reported as present

in each major habitat type in Botswana. The cheetah density estimates are highest in the Kalahari sandveld and it is generally assumed that cheetah numbers are greater in this region.

Land Use Change

Since the 1970's cattle farmers in Botswana have benefited economically under the European Union Beef Protocol Agreement, which paid above world prices for Botswana's beef. Along with the development of deep borehole drilling technology and good rainfall years in the 1970s, this provided a strong incentive for the expansion of permanent livestock keeping into Kalahari pastures (Cooke 1985) and a move from low density usage by hunter-gatherer populations to borehole-centred livestock keeping. It is a change that has resulted in the substitution of domestic stock for formerly large herds of wild ungulates over large areas (Perkins 1996). The 1975 Tribal Grazing Land Policy (TGLP), promoted the expansion of commercial cattle ranches, in response to concerns of overgrazing and degradation due to the communal land system. Later, the 1991 National Policy on Agricultural Development facilitated further expansion. Hunter-gatherers and other non-cattle owners found their lands reclassified as cattle ranches. This has resulted in significant loss of wild lands.

Furthermore, the creation of veterinary fences, erected in order to control the spread of livestock disease, effectively blocked migration routes of vast numbers of migratory ungulates, with devastating effects on populations. The same restrictions arise from the increasing installation of ranch fences. Drought therefore will have a more severe impact on wildlife populations, due to the limitations on movement of migratory species to areas of surface water (Jones 1999).

The expansion of farming into the Kalahari, with considerable areas of new land for grazing, has continued for many decades and resulted in a significant increase in the national cattle herd, from 1.2 million in 1934 to about 3 million in 1998 (White 1998).

In response to these developments, Wildlife Management Areas (WMA's, Fig. 6) were established through the



Fig. 4. A coalition of three males in Northern Tuli Game Reserve. Cheetah may be recovering in this area due to the protected status and increased ecotourism in the region (Photo J. Klein).

Fauna Conservation Act, in 1986. These areas now make up 20% of land in Botswana, although many are still to be officially gazetted and managed for wildlife.

High rates of stocking and borehole densities eventually result in widespread thornbush encroachment (Verlinden 1997), sometimes generating woodland in as little as two decades (Abel *et al.* 1987). With current livestock distribution and densities, thornbush encroachment probably affects most of the unprotected land in Botswana (Bonifica 1992). Studies on grazing in the Kalahari show that as more boreholes are established more bush encroached zones appear, at the expense of grass covered grazing areas (Perkins 1999).

Prey

Interviews and sightings imply that impala and springbok (Fig. 7) are among the most common prey items for Botswana cheetahs, followed by small game such as steenbok and duiker. Calves of larger ungulates are also key prey items, such as eland, gemsbok, hartebeest and kudu. Alternative prey species can include smallstock and calves. There have not been studies to accurately assess this in Botswana

Livestock in diet of cheetahs

There have not been any studies to assess this in Botswana. Cheetahs are considered to be a regular problem animal, particularly in southern and western Botswana.

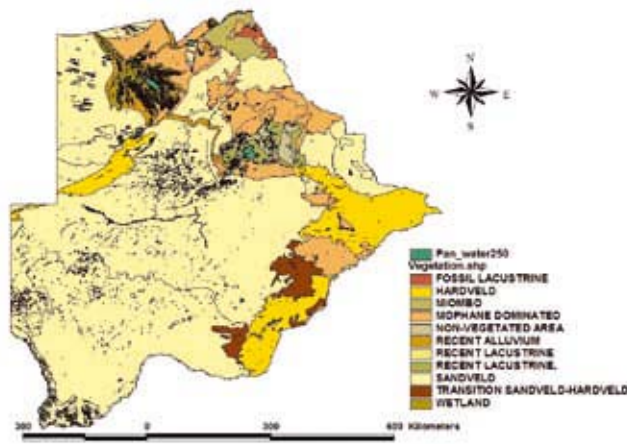


Fig. 5. Habitat classes throughout Botswana.

Evolution of prey species populations

Before the land use changes of the 1970's, Botswana had one of the largest surviving reservoirs of African plains game left on the continent' (White 1998). There have been drastic reductions in the wildlife population over the last 40 years. The decline is due to several reasons, including loss of habitat to growing human and livestock populations, installation of veterinary fences, drought, poaching and over hunting. As a result of these factors, wildlife is increasingly restricted to protected areas, which are insufficient in size and wealth of resources to support the current numbers of wildlife without seasonal movement.

Mass die offs occurred in the severe drought from 1982-1986, resulting in an 80% reduction in Kalahari ungulates (Verlinden 1997). This occurred as a result of dry season refuges being fenced off and increasingly encroached by humans and livestock. Subsequent game

counts in 1992 showed no significant recovery (Bonifica 1992).

Competition for grazing and water between wildlife and livestock may also be a factor, with studies showing 'a strong inverse relationship between cattle and wildlife densities, demonstrating that wildlife disappears from livestock invaded areas' (Arntzen 1998). Despite the low human densities and land devoted to conservation and wildlife utilization, the status of most mammal species declines.

Health and genetics

Cheetah Conservation Botswana has collected blood samples from 47 wild cheetahs in the Southern and Ghanzi Districts from 2004-2007. Samples were tested for IgG antibodies to feline herpesvirus (6% positive), feline calicivirus (15% positive), feline coronavirus (15% positive), canine distemper virus (4% positive) and for toxoplasmosis (55% positive) by immunofluores-

cence testing. They were also tested for puma lentivirus (0% positive) using an ELISA test. 22 samples were tested for feline leukemia virus antigen (0% positive) using an ELISA test produced for domestic cats (Dr K.Good, unpublished data). The results can only indicate that these cats have been exposed to and developed a titer to these viruses, further studies are required to give a better understanding of the prevalence of diseases nationwide.

Human population

The human population is approaching 1.6 million, and is growing at ca. 2.3% per year. The average population density is only 3 inhabitants per km², but more than 80% of the population is concentrated in the east on more fertile soils in the hardveld (covering ca. 20% of the country). More than 75% of the population lives in rural areas (CSO 2001), but population density is low suggesting there is potential for larger species of wildlife to coexist with people.

Small-scale farming is the primary economic activity for the majority of rural communities. Livestock have a strong cultural and economic value to most rural citizens of Botswana (Twyman 2001) and are widespread throughout the country.

Changes in distribution of population

Since the 1970's the human populations have expanded along with the expansion of the livestock industry into vast areas of the Kalahari previously inhospitable. This has been accompanied by the move away from low density usage by hunter-gatherer populations to borehole-centred livestock keeping.

Recently, there have been migrations away from cattleposts to villages and then larger urban centres, in search of employment, although on the whole the human impact on the landscape increase.

Threats and problems

Livestock conflict

One of the biggest threats to cheetah populations in Botswana is the conflict with livestock farming communities, who tend to view the cheetah as a threat to livestock and of no real value. Retaliatory killings are widespread but unreported or recorded. DWNP Prob-

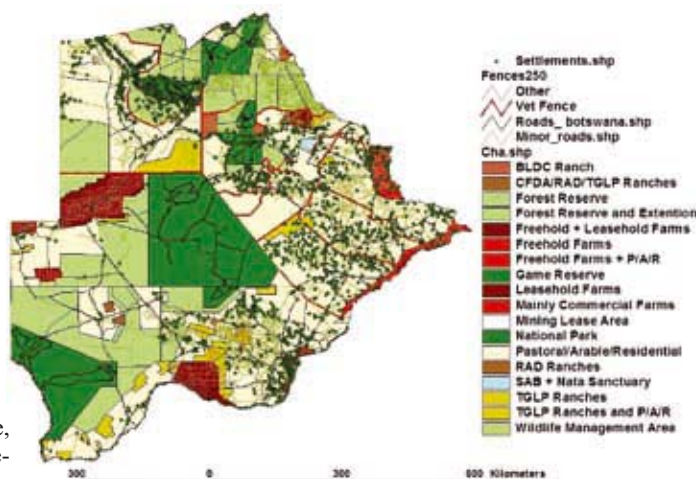


Fig. 6. Land use, roads and settlements in Botswana.

lem Animal Control (PAC) conflict incidence reports (2000-06) for cheetah (Fig. 8) are highest in the Southern district (32%), followed by Kweneng (26%), Central (20%), Ghanzi (11%), Kgalagadi (8%), Ngamiland (2%), and Chobe districts (1%). PAC reports can assist in identifying conflict hotspots and are a useful indicator of cheetah distribution.

Community surveys were carried out in Southern Botswana, assessing farm management and perceptions towards predators. 60% of interviewees (n=78) perceived they had a cheetah problem. 75% had a negative perception of cheetahs. Only 12% had a positive perception of cheetah (R. Klein, unpubl. data).

Currently, cheetahs are often killed on farmlands. While it is illegal to kill cheetah for any reason, the reality of enforcing this is immensely challenging.

Illegal trade

This occurs regularly and is one of the primary threats to Botswana's cheetah population. It is not possible to accurately assess how many cheetahs are leaving the country. However, it has been estimated to be approximately 50-60 individuals annually, mostly subadults and cubs (A. Houser, CCB; D. Cilliers, NCMP; pers. comm.). This is based on information from the Bray/Verda area, which is situated on the Botswana/South Africa border.

Conflict with other larger predators

Interspecific competition with lion and spotted hyena may influence cheetah distribution. Analysis of spoor surveys in the Okavango/Linyanti Ramsar site show that areas with higher cheetah densities had lower densities of lion and vice versa (ODMP 2006).

Solutions

The following actions are taken in response to the current threats towards predator populations.

DWNP Managed Compensation Scheme

The Department of Wildlife National Parks (DWNP) is responsible for the state funded compensation scheme for livestock depredation or crop destruction by wild animals. In 1997, the DWNP compensation scheme excluded



Fig. 7. Kalahari springbok in Southern Botswana, one of the main prey species of cheetahs in Botswana (Photo L. Boast).

livestock losses by cheetahs and other species that were not listed as dangerous in the Botswana Wildlife Conservation and National Parks Act no. 28 of 1992. The exclusion of cheetah depredation from compensation and the ban on killing of problem cheetahs may also have contributed to low tolerance by farmers (Selebatso 2006). In response to this, cheetah and wild dog were added to the list of compensated animals in April 2004. It is hoped that this will increase tolerance towards these predators. In practice, communities are not satisfied with the current compensation system. It is felt the reimbursements are insufficient and untimely. DWNP officers may have difficulties getting to claims in time and this can cause friction with local farmers.

DWNP Managed Problem Animal Control (PAC)

PAC is the responsibility of DWNP PAC officers. After an initial complaint, PAC officers advise the complainants of methods that can reduce the problem. Livestock owners are advised to herd stock during the day and kraal animals at night. PAC officers also address communities through traditional council meetings. The second stage in PAC is non-lethal control. PAC teams may chase the predator, shoot over the

animal's head and use non lethal explosives to move the animal away, normally towards a protected area. Translocations may also occur if the predator returns, which must be done in the presence of a licensed veterinarian. Occasionally, with persistent problem animals or when there is threat to human life, lethal control may be considered. There is no clear evidence that these methods are effective in decreasing conflict, although it is the hope that these measures will reduce the number of cheetahs killed by farmers.

Predator Conservation Organisations

Several organisations are involved with monitoring cheetah populations and working with communities to decrease conflict (See Appendix).

Policy and Legislation

Botswana law

The cheetah has always been classified as Royal game or conserved animals under the different game laws in Botswana and as such was protected from hunting since 1968. This was reinforced in 1992 with the Wildlife Conservation and National Parks Act, which states that the cheetah is a protected predator species in Botswana that may be hunted or captured only under and in accordance with the terms and conditions of a Director's

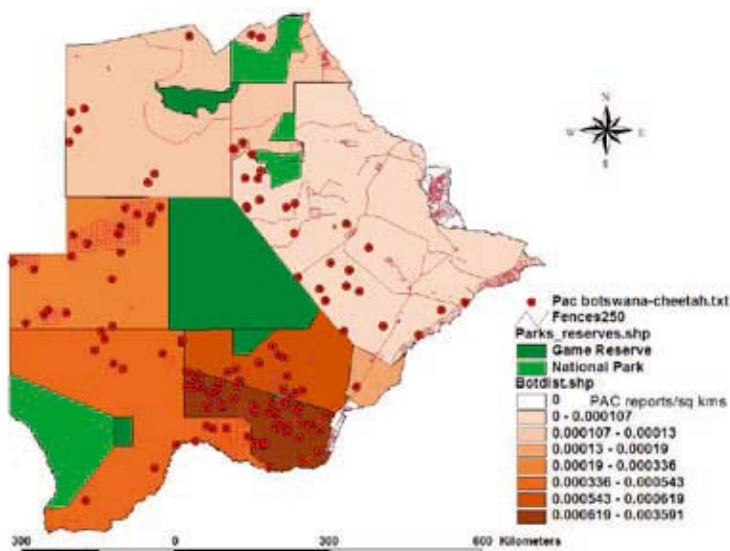


Fig. 8. Distribution of cheetah recorded by the Problem Animal Control.

permit. At this time cheetahs could be killed in defense of stock.

In 2000, a moratorium was passed banning the killing of cheetah and lion for any reason, including due to livestock conflict, after an alarming rate of retaliatory killing by farmers in protection of their livestock.

This law was added to in 2005, with the passing of a statutory instrument banning the killing of cheetah as problem animals and issuing offenders with P1000 (US\$200) fine or 1 year imprisonment.

Red listing

IUCN lists the cheetah as Vulnerable (VU), therefore it is considered to be facing a high risk of extinction in the wild.

Implementation of laws

Where possible the laws are implemented by the DWNP. However, due to large distances and limited manpower, laws are very difficult to enforce.

Extent and consequences of translocation of cheetahs

Translocation is a technique utilised by the PAC department in situations where a predator is considered to be a persistent problem. It is carried out as a last resort as an alternative to killing the individual. However, there are no mechanisms for guiding translocation exercises or proper monitoring of the consequences of translocated cats.

In certain regions, such as the Ghanzi farmlands, where farmers trap cheetah considered to be problematic, translocation is occurring regularly. There is an acknowledgement from the DWNP that translocation is not an ideal solution. However, it is seen as an option preferable to lethal control.

Sustainable use

There has been a ban on hunting cheetahs since 1968. Prior to this, in 1967, records for game trophies were compiled: 1964=54; 1965=55; 1966=37; 1967=54 (UNDP 1969). Since this time, legal hunting has not occurred. However, Botswana may consider sustainably utilising cheetah in the future.

Legal trade

CITES lists the cheetah as Appendix I. Botswana has a CITES quota of 5 cheetahs. However, this is not utilized as Botswana also has laws stating that the species can not be killed for any reason. There is no legal trade, whether trophies nor live animals.

Illegal trade

There is a regular illegal trade operating between Botswana and South Africa. Live animals and skins are smuggled across the long porous borders between the two countries.

Cheetahs in captivity

Seven cheetahs are currently being kept in two temporary holding facilities in

the Ghanzi farmlands. They are being kept for private concerns. Two cheetahs are kept at Mokolodi Nature Reserve, in South East Botswana, they were orphaned due to livestock conflict. Hand raised, they now act as ambassadors of the species. There are no other records of cheetahs in captivity in Botswana, and there are no zoos in the country. Breeding of cheetah is not encouraged and there are no breeding centres. Currently, there are no regulations for keeping cheetahs in captivity. DWNP is working on a captive predator policy and acknowledges this is urgently required.

Important next steps for conserving cheetahs

- Accurate information on the population size, distribution and trends. Baseline data for key habitats needs to be collected. Follow up surveys are required in CKGR and KTP. Studies need to assess the impact of predator/livestock conflict on cheetah populations.
- Maintenance of prey populations, including creation of corridors between protected areas to allow for natural wildlife movements.
- Awareness raising (Fig. 9) amongst communities on the status of cheetahs, the importance of predators and use of effective livestock management techniques to reduce conflict.
- Enforce the use of effective livestock management techniques in order to qualify for compensation.
- Investigate alternative livelihoods to enable communities to benefit from co-existence with cheetahs. i.e. ecotourism, predator friendly beef, veldt products, honey production.
- Investigations into illegal trade and strong penalties for offenders.
- Produce a captive predator policy, with standards for keeping large predators in captivity.

Conclusions

Botswana supports a significant number of the Southern African cheetah population. It is vital that wildlife policies incorporate the need for cheetah conservation nationally, particularly in agricultural zones. Further research and conservation management are essential to enable Botswana to conserve this three-

ated national resource and Africa's most endangered large cat.

Acknowledgements

Thanks to all of the individuals who completed status questionnaires and provided information for this report. Thanks to the Department of Wildlife and National Parks for permission to utilize DWNP PAC records and to their regional officers who sent in PAC Records for their regions. Thanks to the members of the farming community who took the time to be interviewed on predators and livestock management. Thanks to the government of Botswana for seeking to conserve their wildlife populations. (For list of contributors see the full report at www.cheetahbotswana.com)

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Fig. 9. Cheetah Conservation Botswana has a community outreach and education program to raise awareness for the importance of predators. Regular school talks take place, particularly in areas of high human/predator conflict (Photo W. Letubo).

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Appendix I

Projects

Cheetah Conservation Botswana (CCB) is a long term conservation project incorporating research, community outreach and public education. CCB has research camps in Jwaneng and Ghanzi farmlands, along with a national community education program to raise awareness and promote sustainable farm management.

Organizations involved

- Cheetah Conservation Botswana, Mokolodi Nature Reserve, Private Bag 0457, Gaborone, Botswana. info@cheetahbotswana.com; www.cheetahbotswana.com
- Botswana Predator Conservation Program, Private Bag 13, Maun, Botswana. lycaon@info.bw
- Centre for Conservation of African Resources: Animals, Communities and Land Use (CARACAL) Private Bag K60, Kasane, Botswana. caracal@botsnet.bw; www.caracal.com

Responsible authorities

Ministry of Environment, Wildlife and Tourism. Private Bag BO199, Gaborone. Tel: +267 3914955
Department of Wildlife & National Parks. Box 131, Gaborone. Tel: 3971405

The Status of the Cheetah in South Africa

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The distribution of cheetahs *Acinonyx jubatus* in South Africa appears to have increased over the past 25 years. This is due to a change in land use from cattle ranching to wildlife ranching. The largest part of the cheetah population occurs outside conservation areas on privately owned ranch land. The Kruger National Park and the Kgalagadi Transfron-teir Park are the two most important conservation areas for cheetahs due to their large size and pristine habitat. The main threats to cheetahs are focused outside conservation areas and are the illegal trade, unregulated captive breeding and persecution. International trade in cheetahs is regulated by CITES and there is no quota for hunting of cheetahs. However, hunting trophies originating from the wild and captivity have been exported with CITES permits. Several programmes are in place aiming at conserving cheetah. Research is done both inside National Parks and on ranch lands. The National Cheetah Conservation Forum of South Africa (NCCF-SA) is an active forum with members from various organisations involved in cheetahs from conservation organisations, government departments, captive breeders, biolo-gists, hunters and landowners. There is a relocation programme in place where cheetahs are relocated from ranch land to enclosed reserves to form a metapopulation. The most important steps to conserving cheetahs in South Africa have been identified as: metapopulation management, regulation and formalisation of the captive breeding industry, curbing the illegal trade, addressing persecution and conflict management and further research on cheetahs.

Historical Distribution

Early historical records of cheetah dis-tribution in South Africa are not com-prehensive. However, it has been sug-gested that cheetahs were widely dis-tributed through Africa in all suitable habitats from the Cape of Good Hope to the Mediterranean (Marker 1998).

More specifically, there have been several historical reports of cheetahs from the Beaufort West area in the Western Cape province. Jackson re-ported in 1919 that five cheetahs were killed in the Beaufort West district in the 1860's (Skinner & Smithers 1990). Additionally, the Zoological Society of London purchased a young live male aberrant cheetah that originated from the Beaufort West area and lived in the Zoological Gardens for many years (Sclater 1877).

Cheetahs were recorded at Good-house on the Orange river in the North-ern Cape province in 1840 (Backhouse 1844), where they were said to be locally common (Skead 1980). Cheetahs were also recorded in the Bushmanland and Kenhardt districts (Shortridge 1942).

Myers (1975) recorded a sighting of cheetahs near the Brak river in the Zout-pansberg region of the Limpopo prov-ince (formerly Northern Transvaal) in 1966. Several reports of skins and sight-ings of king cheetahs were also received from the Limpopo province (formerly Northern Transvaal) and Mpumalanga

(formerly eastern Transvaal) areas (Hills & Smithers 1980).

Cheetahs were reportedly extermi-nated from the Kwa-Zulu Natal pro-vince by the 1930's, but were reintro-duced from Namibia to several reserves in the province during the 1960's and 1970's (Skinner & Smithers 1990).

Current distribution and population trend

Distribution

The most recent and accurate published distribution map in the Red Data Book (Friedmann & Daly 2004) shows chee-tahs occurring throughout the northern part of South Africa from the North-ern Cape, North West province and into Limpopo (Fig. 1). Approximately 125,150 km² of land are suitable chee-tah habitat in South Africa (Boitani et al. 1999) of which approximately 55,654 km² are under formal conservation in-cluding the Kruger National Park and surrounding reserves, Pilanesberg Na-tional Park, Hluhluwe-Umfolozzi Park, Phinda Resource Reserve and Kgal-a-gadi Transfrontier Park (Friedmann & Daly 2004). Formal conservation areas account for 44.5% of the area that is suitable for cheetahs in South Africa.

Recent field studies by the De Wildt Wild Cheetah Project have been used to produce an updated distribution map for cheetahs (Fig. 1). These data were col-

lected by questionnaire surveys, com-plaint records and informal reports of cheetah sightings.

This distribution map only includes cheetahs which occur naturally and are free roaming and not confined in small reserves. There have been cheetah relo-cations into several reserves in various parts of South Africa where they were previously extinct. While many of these cheetahs have bred and can be regarded as being successful re-introductions, these cheetahs need to be managed in-tensively for genetic reasons by means of a metapopulation management plan in order to ensure their long term viability. The locations of these isolated relocated populations are shown in Figure 1.

Trends in cheetah population

The general feeling among wildlife ranchers and field workers is that there has been an increase in cheetah numbers in recent years which has been attribut-ed to a recovery of prey populations due to the increase in wildlife ranching. To-day, cheetah sightings are not uncom-mon in the Limpopo province (formerly Northern Transvaal), where in the 1960s and 1970s observations were rare.

The wildlife ranching industry ap-pears to have reached capacity and de-velopment of new ranches has slowed considerably over the past five years. Anecdotal information from the De

Wildt Wild Cheetah Project as well as the National Cheetah Conservation Forum of South Africa (NCCF-SA) suggests an increase in tolerance levels towards cheetahs on wildlife ranches and a subsequent decrease in complaints about cheetah predation.

Situation in conservation areas

Kruger National Park is South Africa's largest protected area covering approximately 20,000 km² of woodland savanna, with a further contiguous 2,000 km² of private reserve along its western border. Pienaar (1963) reported that cheetahs were never abundant in the Lowveld in historical times. His assessment of numbers was 219 (Southern District 81, Central District 93, Northern District 45). In a later publication (Pienaar 1969) he wrote "the latest estimates of numbers (1964) indicated that there were no more than 263 of these sleek and graceful carnivores in the whole Park." This estimate, and presumably the first one mentioned above as well, were reportedly made from a register system whereby accurate records were kept of all sightings by rangers of the species. A predator log was kept and the sight records pin-pointed on a special grid-map to indicate numbers and distribution patterns. It is however impossible to verify the accuracy of these early assessments.

The next attempt to count the number of cheetahs in the Kruger National Park was by Bowland & Mills (1994) using photographs taken by tourists to identify individuals. Between October 1990 and November 1991, 172 individuals were identified, made up of 82 in the Southern District, 60 in the Central District and 30 in the Northern District and giving an overall density of 0.88 cheetahs /100 km². Home range size for 18 cheetah groups varied between 104 and 1,848 km². In male coalitions there appeared to be an inverse relationship between group size and home range size while in female groups the relationship appeared to be direct. Some male ranges overlapped extensively whereas others were more exclusive.

In a similar study, but of shorter duration between October 2004 and April 2005 by Kemp & Mills (2005), only 103 cheetahs were identified, 34 in the Southern District, 54 in the Cen-

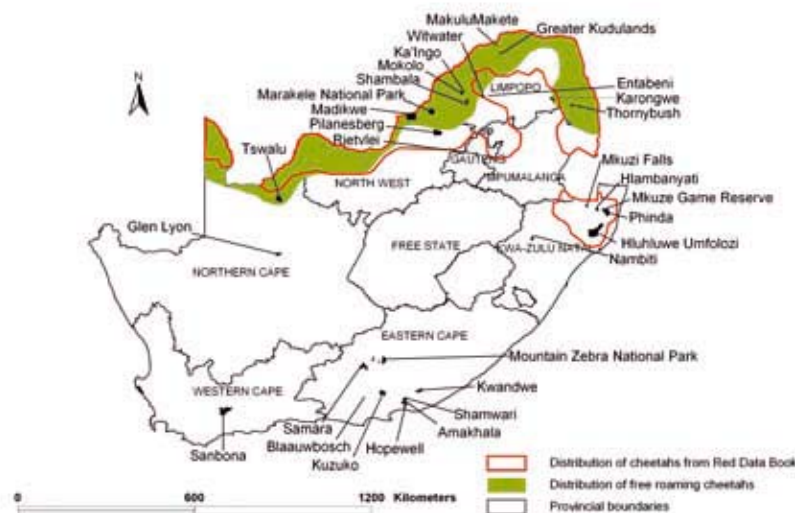


Fig. 1. The distribution of free roaming cheetahs in South Africa. Red polygons show the latest published distribution map from the Red Data Book while the green area shows the updated distribution map from the De Wildt Wild Cheetah Project field records. Locations of enclosed reserves that have re-introduced cheetahs are also shown.

tral District and 14 in the Northern District. Rarefaction analysis of these data showed that not enough animals were "captured" for a satisfactory population estimate and the figure given should be regarded as a minimum number. Evidently a longer study period is required in order to obtain a sufficient number of individuals to estimate population size.

Kgalagadi Transfrontier park covers an area of 36,000 km² in South Africa and Botswana, of which 9,600 km² are in South Africa. It is an arid savanna region. Mills (1990) thought that there were about 60 cheetahs on the South African side. A photographic survey similar to that in Kruger between June 1998 and July 1999 identified 80 individuals made up of 31 males, 19 females, 4 unknown and 26 cubs (Knight 1999). These animals were nearly all recorded along the two dry river-beds that run through the area and where tourist activity and springbok are concentrated. Both sexes range widely and appear to be attracted to the riverbeds. An intensive 5-year study has recently been initiated by Mills (2006) which will look at aspects of the behavioural ecology and conservation of the cheetah in the park. Because of its large size and pristine nature, the Kgalagadi Transfrontier park is also a very important cheetah area with a viable population living in a natural ecosystem.

Marakele National Park (502 km²) is in the Limpopo province near the

town of Thabazimbi. The size and structure of resident population is unknown but it was supplemented during 2003. Cheetahs are frequently sighted and it is thought that the cheetah population in the park is stable.

Mapungubwe National Park (53 km²) is not surrounded by predator proof fence. Cheetahs do occur naturally in that area, these free roaming cheetahs move freely in and out of the park, but little is known about the population.

Other Parks: Several national parks in the arid zone of South Africa, in particular Karoo (831 km²), Mountain Zebra (284 km²), Richtersveld (1,624 km²) and Addo Elephant (16,423 km²) are suitable areas for cheetah and are generally expanding in size. SANParks is considering reintroducing cheetahs into at least some of these parks, with the expanded Mountain Zebra Park receiving cheetahs late in 2007. A metapopulation management program whereby all sub-populations can be managed as a single population has to be developed for these parks and all other smaller reserves that have cheetahs.

Habitat

Cheetahs occur almost exclusively in the Savanna Biome (Low & Rebelo 1998). This biome is the largest in southern Africa and covers almost one third of the area of South Africa (Low & Rebelo 1998). A grassy ground layer and distinctive upper layer of

Table 1. The provincial distribution and extent of wildlife production units WPU in 2001. Source: Bothma (2005).

Province	No of fenced WPU	% of WPU	Size (km ²)	% of size	Mean size WPU (km ²)
Gauteng	72	1.42	821	0.8	11.40
Western Cape	82	1.62	2,652	2.6	32.34
Kwa Zulu-Natal	90	1.78	1,688	1.6	18.76
Free State	180	3.56	1,477	1.4	8.21
Mpumalanga	205	4.05	2,760	2.7	13.46
North West	340	6.72	3,649	3.5	10.73
Eastern Cape	624	12.33	8,816	8.5	14.13
Northern Cape	986	19.48	48,521	46.8	49.21
Limpopo	2,482	49.04	33,257	32.1	13.40
TOTAL	5,061	100%	103,642	100%	Nat mean 20.47

woody plants characterise the biome. Where the woody upper layer is near the ground, the vegetation is described as shrubveld (Fig. 2), where it is more dense it is referred to as woodland and the intermediate stage is locally referred to as bushveld.

Most vegetation types that make up this biome are utilized for cattle and wildlife ranching. Urbanisation is not a threat, probably because the hot climate and diseases historically hindered urban development (Low & Rebelo 1998). Due to the presence of the large Kruger National Park and Kgalagadi Trans-frontier Park, the biome is adequately conserved, however while this is a large

area, half the vegetation types in the Savanna biome are not adequately conserved with less than 5 % of their area in reserves (Low & Rebelo 1998).

However, most of this biome is utilised for wildlife ranching, and to a lesser extent for cattle ranching. Thus, if sustainable stocking levels are maintained on private ranches, this biome can be considered secure. This highlights the importance of the role of the private landowner in the long term conservation of the free roaming cheetah population in South Africa. It is estimated that currently over 17 million hectares of land in South Africa are used for wildlife production (Bothma 2005).



Fig. 2. The Thabazimbi district in the Limpopo province lies in the Savanna biome and the main vegetation type is mixed bushveld. The main land use is wildlife ranching. (Photo K. Marnewick).

Land use changes

Outside conservation areas, most of South Africa's free roaming cheetahs occur in the Limpopo province. Over the past 20 years, there has been a shift from cattle to wildlife ranching in this province. This is reflected in the number of new exemption permits issued annually by the provincial nature conservation authority these increased from 1983, when only four new permits were issued, to a peak of 207 permits in 1991 (Van der Waal & Dekker 2000). It is estimated that conversion from livestock to wildlife ranching takes place at a rate of 2 - 2.5% per annum (Bothma 2005). This shift in land-use practice is due to the ecological and economic advantages of multi-species wildlife production systems in this semi-arid savanna area (Bothma 2002, Van der Waal & Dekker 2000).

In 2001 there were 5,061 wildlife ranches in South Africa covering an area of 103,642 km² (Table 1, Bothma 2005). The Limpopo province contains 2,482 of these wildlife ranches covering an area of 33,257 km² (Bothma 2005). As a result of the change from cattle to wildlife ranching, most of the ranches have been surrounded with game fencing (Fig. 3) and are being stocked with wildlife for the main purpose of hunting and live sale. With the exception of cheetahs, brown hyaenas *Parahyaena brunnea* and leopards *Panthera pardus*, no free-roaming large carnivores occur on these ranches. This lack of intra-guild competition is perceived by some authors to be a situation that could benefit cheetah survival (McVittie 1979, Laurenson *et al.* 1995). However, these ranches are kept for economic gain from the wildlife. This means that cheetahs preying on the antelope represent an economic loss to the landowner and conflict occurs.

Generally, South Africa's National Parks have increased in size over the past 15 years and will probably increase in the future too. This is due to the formation of trans-boundary protected areas e.g. Kruger and Kgalagadi as well as the amalgamation of private reserves into National Parks. However, human populations on the borders of parks are increasing rapidly, this could put pressure on parks for resources and increase conflict with humans and wildlife on park boundaries.

Diet

In the Kruger National Park, Pienaar (1969) listed 2,527 cheetah kills recorded by park rangers between 1936 and 1946 and 1954 and 1966 of which 68% were impala *Aepyceros melampus*, but reedbuck *Redunca arundinum* were found to be taken preferentially taking into account overall abundance. In a more intensive study of radio collared individuals in the south east of the park, Mills et al. (2004) recorded impala as making up 45% of the kills with smaller species such as steenbok *Raphicerus campestris* being utilized by females and the young of larger species such as kudu *Tragelaphus strepsiceros* being taken by males.

In Kgalagadi, Mills (1990) recorded that 86.9% of 229 cheetah kills were springbok *Antidorcus marsupialis*, although these data were mainly from rangers' observations and were biased towards the river-beds. Labuschagne (1979) and more recently Mills (personal observations) covering more representative habitats have recorded a wider diet with gemsbok *Oryx gazella* calves, steenbok and springhares *Pedetes capensis* (hunted at night) making up a larger proportion of kills than recorded by Mills (1990).

Outside conservation areas, little information is available on cheetah diet. This is due to the elusive nature of cheetahs and the thick bush. Wilson (2005) did a small study on scat content collected on wildlife ranches in the Thabazimbi district and found that 49% (n=19) of the scats contained duiker *Silvicapra grimmia* hair and 24% (n=9) of the scats contained impala hair (Fig. 4).

Wildlife ranchers report high rates of predation on blesbok *Damaliscus dorcas phillipsi*, in the Limpopo province (De Wildt Wild Cheetah Project). Many wildlife ranches do not stock blesbok anymore as they report losing entire herds over a period of as little as two years. There is no hard evidence that cheetahs are solely responsible for this predation, and other predators and disease may also have an impact. In addition, blesbok do not occur naturally in this area and were introduced for the purpose of hunting, which may explain their poor survival. More recently ranchers are reporting losses to ostrich *Struthio camelus* populations.



Fig. 3. Cheetah photographed using a TrailMaster camera trap on the ranch Merriepean in the Thabazimbi district of the Limpopo province. The typical game fence, gates and dense vegetation are evident. (Photo K. Marnewick).

Predation on livestock does occur, but is not common. In the Thabazimbi district, one domestic calf has been confirmed as killed by cheetah and one cheetah was trapped at a goat kraal. In Lephalale, one landowner with a permit, shot a cheetah in a kraal and another in Alldays reported losing sheep in the kraal (De Wildt Wild Cheetah Project). Very few reports of predation on livestock have been positively confirmed since 2000.

Health

In the wild

As part of the De Wildt Wild Cheetah Project gastric biopsies have been taken from wild caught cheetahs kept in captivity briefly before being relocated to develop a database of health status of free-ranging cheetahs. Full necropsy examinations and disease evaluations of free-ranging cheetahs are done where possible and a database on disease in free-ranging cheetahs is maintained at the Zoological Pathology and Research program of the National Zoological Gardens, Pretoria.

In captivity

An annual evaluation is done of the health of adult cheetahs at De Wildt

Cheetah Centre and Cango Wildlife Ranch. This includes routine haematology and renal function biochemistry, as well as gastritis scoring using endoscopic biopsies. A comparison of disease prevalence between cheetahs housed at several different southern African institutions, including De Wildt Cheetah Centre, Cango Wildlife Ranch, Hoedspruit Centre for Endangered Species, assorted small cheetah breeding centres, and Cheetah Conservation Botswana is ongoing. A study using Polymerase Chain Reaction (PCR) for detection and sequencing of Coronavirus in cheetah faeces is conducted as part of a worldwide study of Corona virus in cheetahs.

Tremendous variation exists in the prevalence of gastritis and other diseases between institutions keeping captive cheetahs and between cheetahs housed in southern Africa and those in America and Europe. Individual susceptibility to gastritis, progression of gastritis and response to treatment for gastritis is also highly variable (Lane *et al.* 2004). Additionally, the incidence of clinical renal disease appears to reduce dramatically if severe (Grade 3) gastritis cases are treated annually with standard triple therapy combinations. The mean age of death



Fig. 4. Little is known about the diet of cheetahs outside conservation areas. It seems that the impala is one of the main prey species in the Thabazimbi district. (Photo L. Strugnell).

- Full pedigrees to assist with breeding strategies.
- National survey of cheetah numbers.

Samples have been obtained for 360 wild and captive bred animals. At present, microsatellite genotyping with 16 markers have been completed. Although the three genetic studies may each include additional markers, a panel of 12 microsatellite loci, originally described from the domestic cat genome, has been selected to ensure comparable data between the South African studies as well as between the local studies and ongoing international studies.

This research is being conducted at the National Zoological Gardens (NZG), Ms Karen Ehlers (UFS) and Prof Paul Grobler (University of Limpopo). The ARC (Genetics Division) will be responsible for the long-term maintenance of the database.

Scatology as a non-invasive conservation tool for the cheetah in South Africa
Non-invasive methods for gathering genetic information are vital for the study of species that are elusive, nocturnal, wide ranging or highly endangered because they can be implemented without having to capture or harm the animal or cause it any unnecessary stress (Creel *et al.* 2003, Gottelli *et al.* 2007). The aim of this project is to determine the accuracy and reliability of scatology as a non-invasive tool for the conservation of cheetah in South Africa by comparing blood and faeces obtained from corresponding animals. This will facilitate population management decisions by providing useful genetic information on the cheetah found at specific localities.

Onderstepoort Genetics Laboratory Cheetah Genetics Project

The main objective of the South African Cheetah Conservation Genetics Project is to share resources and expertise to address several priority questions for the conservation of cheetah in the country. The genetic information gained from these projects will be used as a tool for the establishment of active conservation management strategies for both wild and captive bred cheetah.

The human population

South Africa's human population is

due to gastritis and gastritis associated renal disease drops dramatically if severe (Grade 3) gastritis cases are treated.

Preliminary results of the nutritional trial at De Wildt Cheetah Centre indicate that cheetahs fed a horse and chicken meat diet supplemented with a vitamin and mineral mix develop gastritis sooner than those fed a commercial diet formulated for domestic cats with renal disease. Commercial feline diets for renal or intestinal disease improve clinical status of at least some cheetahs with renal disease and/or gastritis.

Genetics

A *National Genetic Database* for cheetah has been established at the Agricultural Research Council (ARC). In this central database all information on captive and wild cheetahs in South Africa (including Namibia, Botswana and other countries) is recorded. The success of this Database is fully dependent on

the co-operation of all breeders, keepers and conservationists of cheetah in South Africa. Information stored in the Database includes the following:

- Individual information such as unique animal identification numbers, birth date, sex, age, parents, place of birth, numbers born, population of origin, transponder number, etc.
- DNA profiles of captive and wild cheetah in South Africa using microsatellites and other genetic markers. This information will provide the following valuable outputs:
 - Overall statistics such as group DNA reports, genetic variation estimates for breeding populations (inbreeding values, homo- and heterozygosity values, genetic distances among breeding populations).
 - Information for cheetah from all breeders in one central genetic database will be important for assistance in breeding plans and strategies.

growing at a rate of 2.2% per year which is higher than the 1.3% per year for the rest of the world and above the 1.6% per year for other developing countries (Cincotta et al. 2000). There is a tendency for human population densities to be particularly high in areas surrounding current reserves, and hence pressure on reserves is expected to increase in the future (Harcourt, Parks and Woodroffe 2001), resulting in increased conflict between humans and wildlife. There have been some land claims on properties owned by white commercial farmers. Such land claims have occurred in specific isolated areas and have as yet had very little impact on any of the cheetah range areas. The main threat to cheetahs would come from a change in land use practices, either by fragmentation of habitat or loss of prey species.

Threats

The illegal trade in cheetahs

Current legislation in South Africa allows for the commercial breeding of predators including cheetahs. Several species of predator are bred by some landowners for sport hunting, this type of hunting is often referred to as 'canned' hunting. This practice can provide a substantial source of income. Currently large predators such as lion and leopard as well as some of the smaller cat species can legally be hunted in South Africa.

Most of the above mentioned captive breeders who breed predators for commercial purposes also breed cheetahs. These facilities often obtain their cheetah breeding stock from the wild free roaming population which occurs on ranchlands in the North West, Northern Cape and Limpopo Provinces. These cheetahs are generally illegally captured and sold by landowners. Additionally, cheetahs are not only captured in South Africa but also in Botswana and Namibia.

In Botswana, cheetahs are reportedly captured by locals and sold to ranchers in South Africa who in turn sell the cheetahs to captive facilities (Klein 2007). This takes place mostly in the Bray/McCarthy's rest area of the North West Province. Here the border between the two countries is a dry river bed with a cattle fence and gates, making it easy to smuggle cheetahs into South Africa without going through

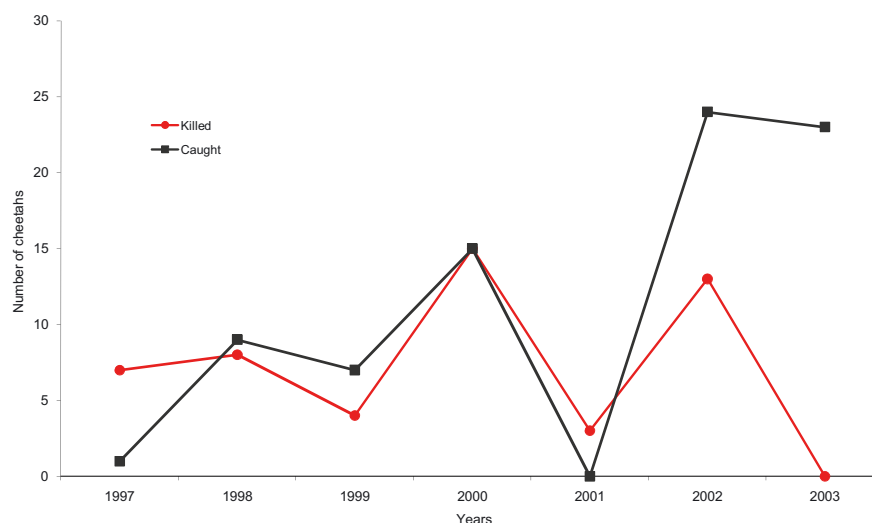


Fig. 5. Caught and killed cheetahs from properties in the Molopo area from 1997-2003.

any border post. It is reported by reliable sources that these cheetahs end up in captive facilities in the Eastern Cape, Western Cape and Free State Provinces. Generally, wild cheetahs do not make successful breeding animals, resulting in these wild cheetahs being exported as captive bred animals. This is done by microchipping the cheetah and claiming that it is captive bred. A CITES permit is then issued and the cheetah is able to leave the country legally. There are currently no laws that demand DNA certificates to prove parentage.

Cheetah cubs are also reported to be smuggled into South Africa from Namibia by animal traders who then export wild born cubs as captive born cheetahs to zoos and safari parks. The main culprits involved here are the larger animal and bird traders in South Africa. Cheetahs are also reportedly trapped in South Africa and smuggled into Namibia where they are 'canned hunted' on the Namibian CITES quota. Reliable sources estimate that approximately 60 cheetahs are traded illegally each year.

The current permitting system in South Africa simply requires that a cheetah has to be fitted with a microchip and this is the only proof required to export cheetahs as captive bred animals from South Africa. Captive breeding facilities in South Africa are not required to be members of ISIS (International Species Information System, www.isis.org) or any other recognized studbook.

The National Cheetah Conservation Forum of South Africa lobbying

for compulsory membership to an international studbook as well as a regional DNA database for captive facilities in South Africa. The NCCF-SA is also requesting that no cheetahs be exported from South Africa, or moved inside South Africa without genetic proof of its origin.

Persecution and retaliatory killings

Because most of South Africa's cheetah population occurs outside conservation areas on privately owned cattle and wildlife ranches, conflict is widespread. The most common method used is to shoot on sight, however reports of running over with vehicles, trapping then shooting, gin traps, snares and poisoning have been received (De Wildt Wild Cheetah Project, Wilson 2005). Quantifying the extent of these killings is difficult as it is illegal to kill cheetahs. In a survey in the Thabazimbi district of the Limpopo province, Wilson (2005) reported that 71% of respondents (n=199) perceived cheetahs to be a liability and reported of 19 male and seven female cheetahs being killed over a period of three years from 1999 to 2001.

In 2004, the De Wildt Wild Cheetah Project conducted a questionnaire survey of landowners in the north western part of the Limpopo province. Here, 161 landowners were interviewed, 72 in the Vhembe and 89 in the Lephalale district, supplying information for 299 different ranches. Of these respondents, 56.5% had seen cheetahs on their properties. In the Lephalale district 48.6% of the

landowners who had cheetahs on their property perceived cheetahs as a liability while 25.7% felt cheetahs were an asset, the remainder either had no strong feeling or would not comment. In the Vhembe district, 34.4% of the respondents felt that cheetahs were a liability while 28% felt they were an asset and the remaining respondents once again did not comment or had no strong opinion.

In a survey in the Bray area of the North West Province Wilson (report to DW), reported 88% of the respondents perceived cheetahs as a liability and that 50% had removed cheetahs from their property. With the help of the local farmers union, the following graph was produced showing the trends in cheetah removals from properties in the Molopo area from 1997-2003. The increase in the number of cheetahs removed live is a reflection of the increased demand for live cheetahs on the black market (Fig. 5).

In contrast, in the Bela-Bela (formerly Warmbaths) area of the Limpopo province, 57% of respondents felt that cheetahs were an asset to them. This reflects the fact that ecotourism is one of the main land uses in the area and hunting is less popular than in the other study areas.

Unregulated captive breeding

In South Africa more than 500 cheetahs are kept in captive breeding facilities (see captive breeding section and Sup-

porting Online Material SOM Table T1). Permits are required from the provincial conservation authority to hold cheetahs. However these permits are the only requirement and have very few conditions attached. There is at present no legislation enforcing membership of a stud book, accurate data bases, breeding records or a co-ordinated conservation plan. This means that most cheetahs in captivity are not contributing to a healthy, sustainable captive population. Additionally many facilities source their cheetahs from the wild, either legally or illegally, which impacts on the wild cheetah population. Some facilities even supplement their captive population with wild animals for genetic purposes. The captive breeding industry is often used as a cover for the black market trade. Hence current estimates of the number of cheetahs in captivity is not accurate.

Solutions

NCCF- advisory forum.

The De Wildt Wild Cheetah Project addresses conflict directly by responding to complaints from landowners. This involves visiting landowners on their properties, discussing their problems and possible solutions and showing the landowner how to correctly identify spoor and killing methods of the various predators. Capture is only used as a last resort where the landowner cannot

be convinced to either leave the cheetah on the property or to collar and release it for monitoring purposes.

Workshops are organised by the De Wildt Wild Cheetah Project in collaboration with other organisations where the attendees are given presentations not only on cheetahs, but also other predators, poison, birds, bush control, veld management, government policy and anything else pertinent to wildlife and cattle ranching. Updates are also given on research findings of cheetahs on ranch lands. These workshops are generally ended with an informal meal and some lucky draws.

'Cheetah Friendly' is an initiative developed by the NCCF-SA that promotes the formation of predator 'safe areas'. Landowners sign a pledge with very basic criteria to be Cheetah Friendly. In return the landowner gets a sign for his gate and a certificate for his lodge. This concept can be developed further to include marketing opportunities for the landowner as well as by educating consumers to use Cheetah Friendly areas for their hunting trips and holidays.

Research

In order to better conserve cheetah outside protected areas, information is needed on their status, range use and potential impact on wildlife ranching. The De Wildt Wild Cheetah Project is running an intensive study of cheetahs outside conservation areas with the core study area in the Thabazimbi district of the Limpopo province. Questionnaire surveys, capture-recapture sampling using camera traps and range use studies are being done.

NCCF- advisory forum

In 2000 the National Cheetah Management Programme (NCMP) was formed. This programme was initiated by a group of landowners who were concerned about the free roaming cheetah on cattle and wildlife ranches. They approached the De Wildt Cheetah and Wildlife Trust looking for solutions to the conflict in ranching areas. The landowners and De Wildt organised a meeting with conservation authorities, landowners, conservation organisations and any other party with an interest in cheetah conservation. This meeting



Fig. 6. Trap set to capture cheetahs. Cheetahs identified as problem animals on cattle and wildlife ranches are trapped and relocated. The landowner is compensated. (Photo K. Marnewick).

formed the NCMP and established the compensation – relocation programme. The NCMP evolved with time to become the National Cheetah Conservation Forum of South Africa (NCCF-SA) which is a consultative forum for all issues surrounding cheetah conservation. The NCCF-SA and its members are also actively involved in the guidance of government policy, development of best practice protocols and promotion of ethical practices.

Compensation Scheme

At the inaugural NCCF-SA meeting, it was decided that a compensation scheme was needed for damage causing cheetahs. This scheme was unique in that it was decided to compensate landowners for capturing live cheetahs (Fig. 6). These cheetahs would then be relocated into conservation areas where they are unable to escape and would be monitored. The financial aspect of the scheme was designed to be self-sustaining. The landowner is given R10 000 for the cheetah and the relocation venue gives a minimum donation of R15 000.00 for the cheetah. The R 5 000 balance covers the veterinary requirements of the cheetah in holding before relocation. The holding facility sources any other funds required for feeding, staff, transport, etc.

This scheme was well received by the landowners. South Africa is unique in that the wildlife industry is strongly driven by economics and therefore an economic incentive helped attract the attention and cooperation of landowners. However, this still remains a controversial programme both within and outside South Africa.

The De Wildt Cheetah and Wildlife Trust houses and administers this fund on behalf of the NCCF-SA. The compensation scheme has its own bank account and is managed independently. No cash payments are made for cheetahs, only electronic transfers are made and only after approval by the provincial conservation authority. Wild caught cheetahs are held in a dedicated holding facility which is separate and remote from any captive cheetahs.

Relocation Programme

Cheetahs that are received through the compensation scheme are kept in hold-



Fig. 7. Anatolian guard dogs are used to protect small livestock. Trials have now started using guard dogs to protect cattle (Photo L. Strugnell).

ing for a period of approximately three months. This allows the cheetah to have a veterinary check up, be fitted with a collar for subsequent monitoring and to become habituated to people and vehicles. This is necessary as relocation venues are usually eco tourism based and the cheetahs will need to be viewed by tourists.

Relocation venues are required to submit a management plan which must show that the reserve is ecologically able to hold cheetahs in a free-roaming situation for a minimum of two years without supplementing the prey population. A monitoring programme is compulsory.

From 2000 until the end of 2006, 136 cheetahs had been received of which 20 had to be placed in captivity as they were too young to be released (unweaned cubs), or were injured and deemed unfit for release (e.g. badly broken limbs, broken jaws, etc). Marnewick *et al.* (in prep.) have investigated the survival of relocated cheetahs onto 27 enclosed reserves in South Africa. Data for 186 cheetahs of which 92 were adults and 94 were cubs born on reserves were analysed using Kaplan-Meier estimator (product limit estimator) with staggered entry (Pollock *et al.* 1989). The mean annual survival of cheetahs was 77 % over a five year period. The main cause of death of relocated cheetahs was due to conflict with lions, leopards and other cheetahs. The challenge now

is to develop an effective metapopulation management plan for these cheetahs. Removing cheetahs from ranch lands cannot continue indefinitely and in the longer term other solutions need to be investigated to maintain cheetahs on ranch lands.

Education and Outreach

In South Africa ‘cheetah ambassadors’ have been used to educate and transform the opinions of young African learners. The cheetah is used as a learning tool in the natural science curriculum and the programme is in line with the Outcomes Based Education Curriculum. Well trained cheetahs are taken into classrooms and following a visit, teachers are presented with a Natural Science Resource kit. The kit includes posters and lessons for learners and incorporates themes such as water conservation, anti-litter campaigns, creation of vegetable gardens and protection of habitats. The De Wildt Cheetah and Wildlife Trust and Cheetah Outreach both deliver outreach programmes to local community schools and together reach approximately 36,000 learners annually.

Anatolian guard dogs (Adapted from Cheetah Outreach documentation)

As a result of the successful Anatolian guard dog initiative by CCF in Namibia (Fig. 7), a trial programme has been launched by Cheetah Outreach and

the De Wildt Wild Cheetah Project, to introduce the Anatolian to serve landowners of South Africa. To give this trial the best possible chance of success, landowners were carefully selected and given an information booklet, collated from CCF literature and experiences, outlining introduction and management strategies for their dogs, as well as veterinary protocols to ensure health. To promote a good working diet and veterinary care, costs are sponsored by the programme for the first year. There are currently nine dogs working successfully in cheetah range areas in South Africa. Due to the success of the Anatolian guard dog project in South Africa, Cheetah Outreach breeding the Anatolian for placement on ranch land. Trials have also begun on placing dogs with cattle.

National DNA database for captive cheetahs

A national DNA data base for captive cheetahs is managed by the Agricultural Research Council (ARC) Genetics Division. Each cheetah in captivity should be provided with a DNA certificate providing unambiguous and verifiable identification of individuals as well as proof of parentage. Ideally DNA certification should be legally required before any cheetah can be traded to prevent trading in wild under the umbrella of captive breeding. To date, however, it has not been possible yet to get this DNA certificate endorsed by government.

Policy and legislation

In South Africa, the nine provincial nature conservation ordinances and environmental management acts are relevant to cheetahs as well as the National Environmental Management: Biodiversity Act (NEMBA). The provinces can have stricter measures than NEMBA but may not be less restrictive. CITES is the only international treaty relevant to cheetahs in South Africa. New norms and standards for Threatened or Protected Species (TOPS) will be in place early in 2008.

The Red Data Book of the Mammals of South Africa (Friedmann & Daly 2004) classifies cheetahs as vulnerable due to an estimated population size of breeding individuals of just more than 250. However, it was noted that with

the available data, cheetahs were close to being classified as endangered. The main threats were identified as direct loss or exploitation, especially outside conservation areas.

Sustainable use

South Africa does not have a CITES or local quota for trophy hunting of cheetahs. However, the CITES records show one hunting trophy of wild origin exported to France in 1997, two cheetah trophies leaving South Africa destined for Norway in 2002 and two more for Peru in 2005. According to the CITES records these cheetahs were hunted in South Africa and they were captive bred. While the hunting of captive bred animals is generally frowned upon for ethical reasons, the CITES criteria for exportation of hunting trophies is a non-detriment finding to the population in the wild. Therefore, hunting a captive bred animal would not, except in extreme cases, have a negative effect on the survival of the wild population, thus such trophies can be permitted.

Legal trade

Legal international trade in cheetahs is done under the CITES convention. A total of 428 specimens have left South Africa from 1996-2005. 399 (93%) of the animals were listed as of captive origin. Most cheetahs were transferred to zoos or other captive facilities abroad. The trade has increased during the past decade and lately some 50 specimens have been traded annually (SOM Table T2).

Captive breeding

In 2004 the NCCF-SA established a Captive Breeding Committee in order to facilitate any issues pertinent to cheetahs in captivity within South Africa. One of the tasks assigned to this group was to establish how many facilities were holding cheetah in captivity and to define the estimated population size. Of the 44 recorded facilities holding cheetah in captivity only eight can be classified as zoological parks, the balance being private reserves, safari parks, rehabilitation centers or breeding operations, all of which maintain cheetah in a controlled captive environment. It was determined that at least 11 of the 44 facilities were actively breeding cheetahs. The total population of 524

cheetahs is regarded as the minimum known animals in captivity at the time of the survey. The extent of the captive breeding industry is difficult to determine accurately due to insufficient records and privacy policies. The lack of sufficient record keeping and regulation makes the captive breeding industry an ideal channel through which the black market trade is operated. Captive breeding facilities need to be well regulated and audited to ensure that they operating legally and ethically.

Important steps for conserving cheetahs in South Africa

1. Regulate the captive breeding of cheetahs in South Africa. This includes an audit of all facilities, a compulsory stud book and DNA data base, development of breeding plans and conservation objectives as well as more effective permitting and control. DNA certificates proving parentage should be compulsory for all cheetah sales and movements.
2. Develop and implement a metapopulation management plan for cheetahs in isolated reserves. Cheetahs in small confined reserves represent a valuable genetic pool, but need genetic management in order to maintain overall genetic diversity of the population.
3. Eliminate the black market trade of cheetahs. This, to a large extent, will be achieved if the captive breeding industry is correctly regulated.
4. Promotion of 'Cheetah Friendly' ranching practices. More than 10,000 km² of land are currently Cheetah Friendly, this concept has to be further developed into a marketing tool for the rancher.
5. Continued research on status, range patterns and survival of cheetahs outside conservation areas to obtain long term information on cheetah population trends to guide management and conflict issues. Results of this research must be disseminated to landowners, conservation bodies and government officials.
6. Education of children, landowners and the general public about the role of the cheetah in the ecosystem and the importance of wildlife. This must continue through the outreach programmes, media and workshops for landowners.

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Supporting Online Material SOM

www.catsg.org/03_specialissue/cheetah_southern_africa/content_cheetah_southern_africa.htm

Tables T1 and T2, Appendices AI to AIV

Status of the Cheetah in Zimbabwe

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The cheetah *Acinonyx jubatus* once occurred throughout Zimbabwe, but is now largely absent from the north and east of the country. Estimates of the cheetah population over the last 30 years range from 400 to 1,500, but many of these figures are not based on reliable data, and no current estimates are available. The cheetah population is thought to have been stable or decreasing in protected areas, and increasing on private land. The fast track land resettlement programme (FTLRP) initiated in 2000 may have affected the present status and distribution of the cheetah, but this has not yet been investigated. Cheetahs are legally hunted as problem animals and as trophies, but insufficient data are available to assess the impact of hunting on the population. Illegal removals may also have an important impact on the population. It is suggested that research is conducted to determine the current status and distribution of the cheetah population, and how this may have been affected by recent land use changes. In addition, it is recommended that trophy quality should be monitored, and information on non-lethal predator management techniques should be provided to farmers.

History of cheetahs in Zimbabwe

Historically the cheetah (Fig. 1) was thought to have been distributed throughout Zimbabwe (Kingdon 1997, Stuart & Wilson 1988). In the 1960s cheetahs had a patchy but wide distribution in Zimbabwe, and resident cheetah populations were recorded in each province (Child & Savory 1964, Smithers 1966). By the end of the 1970s cheetahs were virtually absent from much of the north east of the country where crop farming is the dominant land use, but cheetahs were more abundant in the south, west and centre of the county, where commercial wildlife and livestock production is common (du Toit 2004, Myers 1975, Smithers & Wilson 1979, White 1996). Subsequent studies reported a similar distribution (Fig. 2; Marker 1998, Stuart & Wilson 1988, White 1996, Wilson 1984, 1988).

There have been few surveys of cheetah abundance in Zimbabwe. Most population estimates were generated using questionnaire & interview surveys in which respondents were asked to estimate the number of cheetahs on their property. Estimates were then summed to give total population size. However, as home ranges of cheetahs are large and frequently include several properties, this method may lead to overestimation of total population size (Bashir *et al.* 2004, Wilson 1988).

Interview and questionnaire surveys were used to estimate the total cheetah population at 400 in 1973 (Myers 1975) and 470 in 1987 (Wilson 1988). Wilson (1988) accounted for overestimation by using educated guesswork to reduce his totals. White (1996) estimated that 728 cheetahs were present on commercial farmland alone in 1996 based on a postal questionnaire survey, but he did not reduce the sum of the respondents' estimates, so his findings are not directly comparable with those of Wilson (1988). In 1991 a national total of 1,391 cheetahs was calculated using a computer model by the Zimbabwe Department of Parks and Wildlife Management (DPWLM, the former name of Zimbabwe Parks and Wildlife Management Authority, PWMA), although the accuracy of this has been questioned (DPWLM 1991, cited in Davison 1999a, Zank 1995, cited in Marker 1998). Davison (1999a) used the figures given by White (1996) and DPWLM (1991, cited in Davison 1999a) to calculate the annual growth rate of the cheetah population during this period, which he used to extrapolate to a total of 1,500 cheetahs in 1999.

Several reports have suggested that before 2000 the cheetah population in protected areas was stable or decreasing (total 292 in 1999), but was increasing

on commercial farmland (total 728 in 1996) (Heath 1997, White 1996, Wilson 1988).

Current distribution and status

As the 1996 and 1999 population estimates (Davison 1999a, White 1996) are based on questionable data, and there have been no subsequent studies of status or distribution, the current distribution, status and trends of the cheetah population in Zimbabwe remain unclear.

Habitat

In Zimbabwe cheetahs occur in plains or open scrub or woodland, but avoid dense forest (Smithers 1966, Smithers & Wilson 1979). Purchase & du Toit (2000) found that in Matusadona National Park, cheetahs displayed a preference for the boundary between the foreshore of Lake Kariba (which was a grassland dominated by *Panicum repens*) and woodland (comprised mainly of *Colophospermum mopane* with a mixture of *Combretum* and *Terminalia* tree species and a thin herbaceous layer). The foreshore was characterised by a high density of prey species, while the woodland provided cover for hunting and from other predators, which may explain the cheetahs' habitat selection. In Hwange National Park cheetahs oc-

cur in open grassland, closed mopane woodland, and *Baikiea* woodland (Wilson 1975).

It has been estimated that 80% of the cheetahs in Zimbabwe occur on privately owned farmland (Stuart & Wilson 1988). Since independence in 1980 many large-scale farms were converted from cattle to wildlife ranches in Zimbabwe (du Toit 1998, cited in du Toit 2004). In 2000, at least 20% of the country's commercial farmland (5% of the total land area of Zimbabwe), in addition to the 12% managed by PWMA, was managed for wildlife production and tourism (du Toit 2004). This probably facilitated the expansion of the cheetah population on private land between 1986 and 1996 reported by White (1996). However, in 2000 the FTLRP was initiated in Zimbabwe, which resulted in the conversion of many large-scale commercial farms to small-scale subsistence farms (du Toit 2004, Wolmer 2005). This had a detrimental impact on several wildlife populations including cheetah prey species such as impala *Aepyceros melampus* (du Toit 2004). Although the impact of the FTLRP on cheetahs has not yet been thoroughly investigated, preliminary data collected by Marwell Zimbabwe Trust (MZT) suggest that cheetahs may occur in lower numbers in resettlement areas than commercial farms, and it seems likely that the population may have declined since the initiation of the FTLRP, as cheetahs depend on a sufficient prey base (Laurenson 1995).

Prey

Cheetahs in Zimbabwe have been reported to hunt a range of mammals, including warthog *Phacochoerus aethiopicus*, grey duiker *Sylvicapra grimmia*, steenbok *Raphicerus campestris*, impala, waterbuck *Kobus ellipsiprymnus*, bushbuck *Tragelaphus scriptus*, reedbuck *Redunca arundinum*, zebra *Equus burchelli*, tsessebe *Damaliscus lunatus*, kudu *Tragelaphus strepsiceros*, sable *Hippotragus niger*, and buffalo *Syncerus caffer* (Purchase & du Toit 2000, Smithers 1966, Smithers & Wilson 1979, Wilson 1975). In Hwange and Matusadona National Parks impala make up the majority of the cheetah kills (41% and 87% respectively; Purchase & du Toit 2000, Wilson 1975). Ground



Fig. 1. Cheetahs in Matusadona National Park (Photo Zambezi Society).

living birds such as guinea fowl *Numida meleagris*, francolin *Francolinus* spp, bustards *Otis* spp, and ostrich *Struthio camelus* are also hunted (Purchase & du Toit 2000, Smithers & Wilson 1979, Wilson 1975). Domestic stock, including sheep, goats, and calves may also be taken (MZT, unpubl. data, Smithers 1966).

Health and Genetics

The Wildlife Unit of the Zimbabwe Department of Veterinary Services has investigated the deaths of 22 cheetahs over the past 20 years. Of the five wild cheetah deaths investigated, one died during translocation as a result of multiple causes related to its poor condition, one was killed for hunting livestock, one was euthanased after a road traffic accident, and the causes of the remaining two deaths were unknown. Of the 17 investigated deaths that occurred in captive animals, six were killed by ingestion of anthrax infected meat, two by pneumonia, one by nephritis, one by asphyxiation, one by exsanguination as a result of flea infestation, one by accidental poisoning, one was euthanased due to fracture of the vertebral column, and four were due to unknown causes (Foggin, unpubl. data). No data are available on genetics.

Human Population

Data collected from the Zimbabwe Census Office indicates that between 1992 and 2002 the human population increased by an average of 1.1% per year to over 11.6 million. The four provinces in which cheetahs are thought to occur in greatest numbers (Matabeleland North and South, Midlands and Masvingo) are among the provinces with the lowest human population densities in Zimbabwe (9-30 people/km²). The number of people living in resettlement areas has grown by 87%, the largest increase of any land use type, while the population on large-scale commercial farmland has fallen by 16%.

Threats and Problems

Competition with large carnivores may limit the cheetah population size within protected areas (Durant 2000, Laurenson 1995). This may be why 80% of cheetahs in Zimbabwe are thought to occur on private farmland where lions *Panthera leo* and spotted hyenas *Crocutta crocutta* have been eliminated (Stuart & Wilson 1988). This brings cheetahs into conflict with humans in several ways. Farmers report that cheetahs prey on livestock, and although in Zimbabwe permits are issued to enable legal destruction of problem cheetahs,

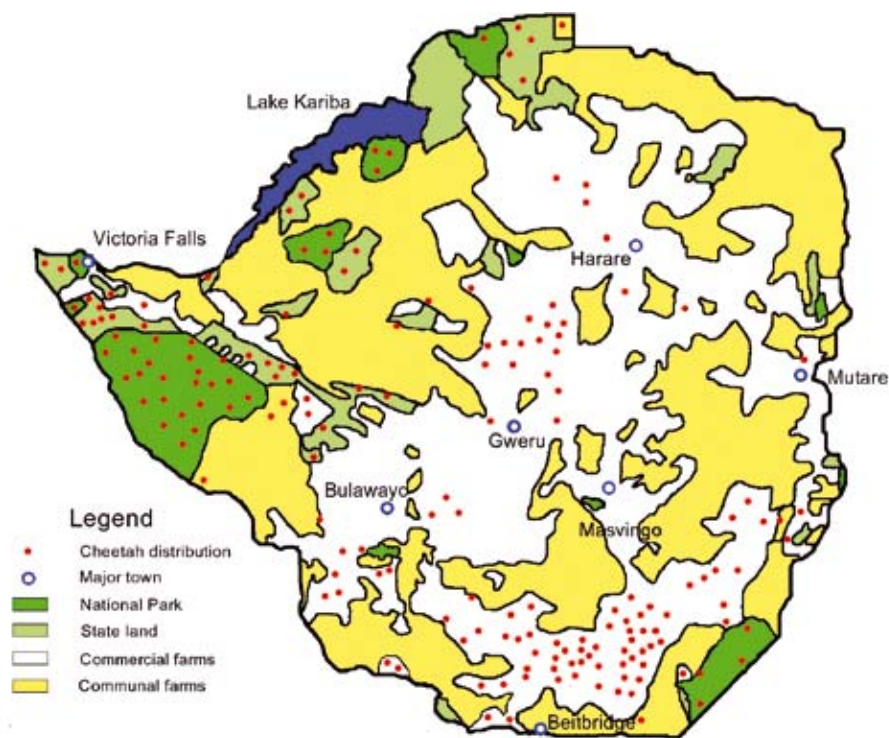


Fig. 2. Distribution of the cheetah in Zimbabwe in 1987. Subsequent studies have revealed similar distributions. Adapted from Wilson (1988).

the system is slow and cumbersome, and many farmers are thought to destroy cheetahs illegally (Purchase 2004, Wilson 1988). Myers (1975) reported that 28 of around 40 ranchers interviewed in Zimbabwe in 1972 removed cheetahs from their property illegally in the previous three years, and he estimated that 100 cheetahs per year were destroyed by livestock farmers in Zimbabwe's lowveld (low elevation southern areas) alone. Illegal removals of cheetahs on farm land is believed to have halved the cheetah population of Namibia during the 1980s (Morsbach 1987), and it may be a major threat to cheetahs in Zimbabwe, although as the number of commercial farmers operating in Zimbabwe is decreasing (Commercial Farmers Union, unpubl. data), this may become less important.

In an attempt to reduce illegal removals, the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) approved a quota of 50 cheetahs to be trophy hunted in Zimbabwe and exported annually since 1992 (CITES 1992). However, in order for an export quota to be approved, evidence must be supplied to demonstrate that the off take would not

be detrimental to the population. The quota was approved, despite the fact the no such evidence was ever submitted (Purchase 2004). There is currently no way of monitoring the effects of hunting on trophy quality, as trophy quality is not recorded by PWMA (Purchase 2004). Therefore it is not known if trophy hunting is a threat to the cheetah population.

The FTLRP could potentially be a very serious threat to cheetahs, due to increased habitat loss. Wildlife and livestock commercial farms thought to be most suitable for cheetahs are being converted to subsistence crop farms through the FTLRP, which may support lower cheetah densities (MZT, unpubl. data, Wolmer 2005). This threat has not been studied in detail, but it could be very important to the future of cheetahs in Zimbabwe.

Solutions

The CITES trophy hunting export quota system aims to encourage landowners to tolerate the presence of cheetahs by allowing them to gain income by selling cheetah hunts, although Purchase (2004) suggests that this has not improved tolerance.

Policy and Legislation

Cheetahs are specially protected in Zimbabwe under the 1996 revised Parks and Wildlife Act, and as such cannot be removed without permission from the Director General of PWMA (Anonymous 1996, Davison 1999b, Purchase 2004). A permit is required from PWMA in order to keep captive cheetahs. In order to breed cheetahs a breeder's permit is additionally required from PWMA. Cheetahs are also listed on Appendix 1 of CITES, prohibiting international trade of cheetahs or cheetah products in all but under certain circumstances, such as the export of privately owned trophies hunted under a quota granted by CITES to aid their conservation (CITES 1992). Cheetahs can be removed as problem animals or as trophies if permits are obtained from PWMA. There is no Red Data Book for Zimbabwe, although Sharp (1986) provided a Red Data Book inventory in 1986. He did not classify the cheetah into a Red Data Book category.

PWMA has used translocation of problem animals as a conservation tool. Between 1993 and 1994 fourteen adult cheetahs (eight males and six females) and three juvenile cheetahs were captured on private ranches as problem animals and translocated to Matusadona National Park (Zank 1995, cited in Purchase 1998). The translocated cheetahs appear to have become established in the park, and formed a breeding population (Purchase & Vhurumuku 2005). Chipangali Wildlife Trust captured a number of nuisance cheetahs, which it held in captivity, sometimes for several years, and subsequently released into National Parks. They released a pair of cheetahs into Matobo National Park in 2002, which still occur in the area (Wilson 2006). A group of four cheetahs were released into Hwange National Park in 2003, but three are now dead or missing and only one survived (Wilson 2006). A second group of cheetahs was reintroduced to the park (group size and release date not reported), and is thought to have become established (Wilson 2006). A pair of cheetahs were released into the park in 2005, and this release was also considered to be successful (Wilson 2006).

Sustainable Use

No direct data are available from PWMA on the number of cheetahs hunted as trophy animals, but the numbers of cheetah trophy export permits allocated is given in Table 1 as an indication of this.

Trade

Legal trade

Myers (1975) noted that 10 cheetah skins were legally exported between 1968 and 1972. Table 1 gives data on the number of CITES export tags issued since the trophy hunting export quota was introduced in 1992. Prior to 2005, export tags could be purchased at any time after the animal was hunted (often several years), meaning that a reasonable estimate of the number of export tags allocated for animals hunted in a given year cannot be calculated until several years later (G. Purchase, pers. comm.). The data provided in Table 1 should therefore be treated with caution. To address this problem the legislation was changed. From 2005 onwards if an export tag was required, the application must be made before the end of the year in which the cheetah was hunted (G. Purchase, pers. comm.).

The number of trophies exported has always been less than 50% of the maximum of 50 cheetah trophy exports permitted per year. Although no data are available from PWMA on the total number of cheetah on quota per year, the number of cheetahs for which trophy hunting quotas are applied is always greater than the maximum permitted (Masulani 1999). It is not clear if the low off take is attributable to failures of safari operators to sell sufficient hunts, failures of hunting clients to successfully hunt a cheetah, cheetahs being trophy hunted but not exported, or a combination of these factors (Purchase 2004). It is not known if the current off take is sustainable.

Illegal trade

There are little data available on current illegal trade in cheetahs in Zimbabwe. However, Myers (1975) came across 34 skins without documentation for sale from Zimbabwean fur dealers during his 3 month survey in 1972.

Cheetahs in Captivity

The current international cheetah stud-

Table 1. Numbers of metal CITES export tags allocated since cheetah trophy hunting was permitted in Zimbabwe by CITES in 1992. Data were collected from PWMA records at PWMA Head Office. Data collected in 2003 are from Purchase (2004). Data for 2006 were collected for this report. *These figures are likely to be lower than the actual values, as they were collected within 5 years of the hunting period being investigated.

Year cheetah was hunted	Metal export tags allocated	Year data collected
1992	7	2003
1993	8	2003
1994	5	2003
1995	24	2003
1996	12	2003
1997	4	2003
1998	5	2003
1999	10*	2003
2000	3*	2003
2001	7*	2003
2002	8*	2003
2003	11*	2006
2004	1*	2006
2005	2	2006
2006	1	2006
Mean 7.6, Total 68		

book lists only two cheetahs in one facility in Zimbabwe in 2005 (Marker 2007), but they have now left the country (V. Wilson, pers. comm.). There are currently three captive cheetahs in Zimbabwe kept at two private facilities: one facility is training two male cheetahs for outreach work, and one rancher has a single female cheetah. There are no known breeding centres in Zimbabwe.

Future Conservation Measures

An accurate assessment of the current cheetah population size and distribution is urgently needed to determine the status of the cheetah in Zimbabwe, and would help to assess the suitability of the trophy hunting quota. Trophy size should also be monitored in order to study the effects of hunting on the population. Research into the effect of the FTLRP on the status of the cheetah could help to guide future land use planning, management and development policies to minimise the impact on the cheetah, such as maintaining corridors between isolated cheetah populations. Research into non-lethal predator management techniques would allow the most efficient and cost effective techniques to be identified. This could be run in conjunction with an education programme, to show farmers how they can minimise

their livestock losses while reducing the impact on the cheetah population. An awareness programme aimed at children may also help to improve tolerance of cheetahs. Some of these issues are being addressed by MZT.

Acknowledgements

I gratefully acknowledge the assistance of Dr Gianetta Purchase, Justice Muvengwi, Dr Chris Foggin, Roxy Dankwerts, Kelly Marnewick, the Natural History Museum of Zimbabwe, the Commercial Farmers Union, Marwell Zimbabwe Trust, Dr Russell Hill, Vivian Wilson, and PWMA for the information or support they provided for this report.

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Appendix I - List of projects

Marwell Zimbabwe Trust is conducting research into the status and distribution of cheetahs in Zimbabwe, outside of Parks Estates and running an education project with the aim of minimising human-cheetah conflict.

Chipangali Wildlife Trust (Wildlife Research Unit) is also conducting a survey of cheetah status and distribution in Zimbabwe.

The Zambezi Society is conducting research within the Zambezi basin, including an investigation of the distribution of cheetahs.

Roxy Dankwerts is training two cheetahs for community outreach work.

Appendix II - Organisations involved

Marwell Zimbabwe Trust, PO Box 3863, Bulawayo, Zimbabwe
carnivore@dambari.com
+263 9 280029/30

Chipangali Wildlife Trust (Wildlife Research Unit), PO Box 105, Bulawayo, Zimbabwe, duiker@ecoweb.co.zw

The Zambezi Society, PO Box, HG744, Highlands, Harare, Zimbabwe
zambezi@mweb.co.zw
+263 4 747002/3/4/5

Roxy Dankwerts, Chedgelow Farm, Box AP 32, Harare Airport
roxy@mycheetah.org
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Appendix III - Responsible Authority

Zimbabwe Parks and Wildlife Management Authority, PO Box CY140, Causeway, Harare, Zimbabwe
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Mozambique: Preliminary Assessment of the Status and Distribution of Cheetah

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Historically cheetah were relatively widespread in Mozambique with records from the north, west and southern parts of the country. More recently significant populations were only known to exist in the north west corner of Tete Province, and within and on the periphery of the Limpopo Valley and Bauhine National Parks. Previous assessments of population concluded that hunting cheetahs for skins had reduced its ranged within the country, as well as a reduction in prey populations. This assessment indicates that the population of cheetahs appears to have further declined, with recent records only reported from the north west of Tete Province. However, given the historical distribution of cheetahs and the potential for the threats of poaching and reduction in prey to be alleviated there are areas where natural recolonisation may occur.

The distribution of cheetahs in Mozambique appears to have changed substantially during the last 30 years according to published literature. Smithers & Labao Tello (1976) reporting on field data collected up to 1970, that cheetahs had been seen in the Niassa and Cabo Delgado provinces (Fig. 1) with four confirmed visual records. The same paper reported that cheetahs were seen in the Zambezi delta area and in an almost continuous band from the north west part of Tete Province (south of the Zambezi river) down to the Limpopo Valley National Park (Fig. 1). Cheetahs were not reported from the north of the Zambezi river in Tete Province, but the authors felt that this was due to a lack of records rather than true absence. The distribution of cheetahs at this time correlated to the distribution of Eastern Miombo and ZambezianMopane woodlands (Fig. 2).

In a contemporary report by Myers (1975) based on more recent information, the author argued that cheetahs were only present in Mozambique in three areas: south of the Zambezi river extending westward towards Cabora Bassa (the central and southern areas of Tete Province); between the Gorongosa National Park and the headwaters of the Pungwe river, and in the Limpopo Valley National Park and peripheral areas (Fig. 1). The author goes onto argue that although cheetah may have been recorded in other areas of Mozambique, by 1975 they were no longer present. The total population for the country

was estimated to be around 200 at that time (Myers 1975). Myers argued that hunting for skins was a major factor in the decline of cheetah, with cheetah often being hunted to “console the disappointed hunter who fails to bag [a leopard]” (Myer 1975, p. 32).

In a more recent report, Skinner & Smithers (1990) included the area incorporating the Limpopo Valley and Bauhine National Parks in their distribution map for cheetahs, as well as parts of Tete Province. However, the most northern part of Tete province was excluded from the distribution, corresponding to the absence of cheetah reported in the Lower Zambezi valley in Zambia (Ansell 1978). More recent literature shows cheetahs in Mozambique as also being present in the north west corner of Tete Province on both sides of the Zambezi river (Nowell & Jackson 1996, Skinner & Chimimba 2005). All these sources of information reported that cheetah were only present in Mozambique in these two localities (Tete Province and in the area incorporating Limpopo Valley and Bauhine National Parks).

Cheetahs are now protected in Mozambique and cannot be hunted or exported. However, the effectiveness of this protection was limited until recently due to civil war. Anecdotal reports (C. Stockil, pers. comm.) indicate that poaching both of cheetah and their prey was intense during the civil war, possibly reducing populations. In addition, the large packs of domestic dogs

that were reported to have formed in many areas of Mozambique when villages were abandoned during the war years (Fuller 2006) could have had a large adverse effect on the cheetah population as dogs are known to tree and kill cheetahs on farmland in Zimbabwe

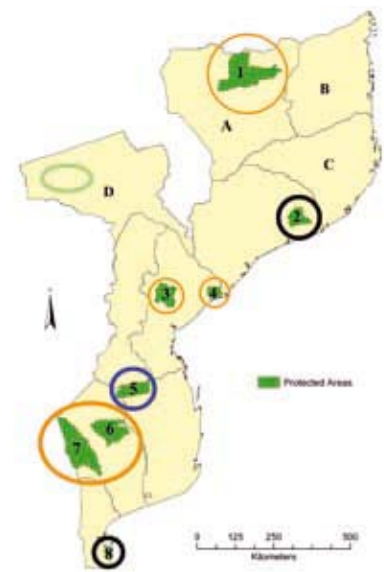


Fig. 1. Provinces and Protected areas of Mozambique (Source: WDPA Consortium, 2006). A = Niassa Province, B = Cabo Delgado, C = Nampula, D = Tete; 1 = Niassa Game Reserve, 2 = Gile Game Reserve, 3 = Gorongosa National Park, 4 = Marromeu Game Reserve, 5 =Zinave National Park, 6 = Bauhine National Park, 7 = Limpopo Valley National Park and 8 = Maputo Game Reserve. Green circle = currently present; blue circle = possibly currently present; orange circle = currently extirpated; black circle = no data.

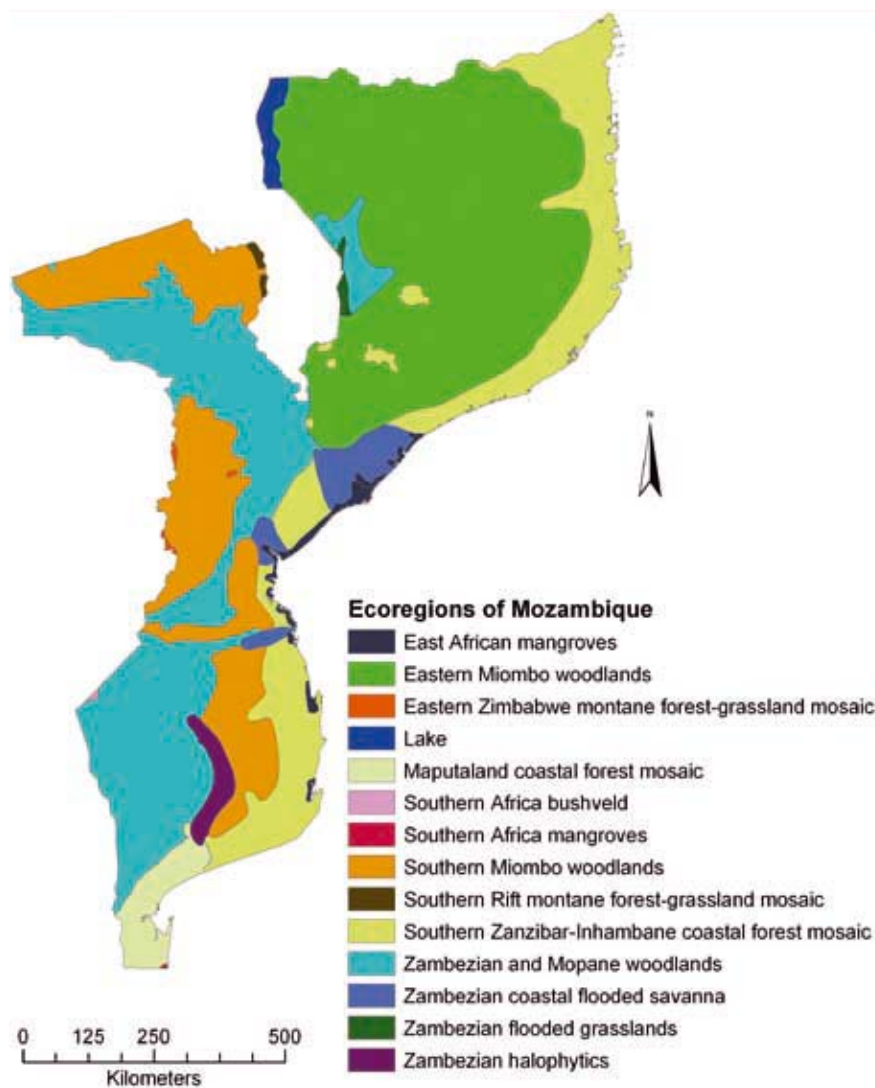


Fig. 2. Ecoregions of Mozambique.

(B. Leatham, pers. comm., R. Peek, pers. comm.). The effect of the civil war on prey populations, poaching of cheetahs and the potential impact of domestic dogs probably further depleted the population from the estimate reported by Myer (1975).

Review of available information

Here we present information regarding the current status of cheetahs within Mozambique. This information was obtained through open interviews with the Ministry of Tourism, and with individuals known to be currently working in the field, or who had worked in the field since the year 2000. In addition, a literature search was conducted to identify recent published data regarding the status of cheetahs since 2000.

Given the problems with differences in language, individuals were contacted in person and information gathered using a modification of the open interview approach.

Protected Areas

Niassa Game Reserve (No 1, Fig. 1)

An intensive survey to detect large carnivores and estimate numbers was carried out in a representative area of the reserve by C. Begg in 2003. During this survey no signs of cheetah were found, and the study concluded that cheetahs are absent from the Reserve. He feels that cheetahs were probably never found in this area, or at least, if they were, at low densities (C. Begg, pers. comm.). The other large species of carnivore were all detected during the sur-

vey, suggesting that protection has been sufficient. As cheetahs were reported as being present by Smithers & Tello (1976) in these northern provinces it appears that they may have become locally extinct or now occur at such low densities as to difficult to detect during surveys.

Gile Game Reserve (No 2, Fig. 1) and Maputo Game Reserve (No 8, Fig. 1)

No data was available from these areas, and the status of cheetah is still unknown. However, given that all these areas fall outside the distribution of cheetahs reported by Skinner & Chimimba (2005) it can be assumed that cheetahs are absent.

Marromeu Game Reserve (No 4, Fig. 1)

No cheetah have been observed recently in Marromeu Game Reserve (A. Marc, pers. comm.) or in the neighbouring hunting coutadas (areas).

Zinave National Park (No 5, Fig. 1)

There is a possibility that cheetahs exist in Zinave based on the confiscation of a skin that has yet to be confirmed to be cheetah (Fig. 3). The skin was confiscated early in 2007 from a villager living within the Park.

Gorongosa National Park (No 3, Fig. 1)

Six cheetah were introduced into an area north of this Park in 1973 (reasons for this introduction are not known) and as a result cheetahs were seen in Gorongosa during 1973 for a short period of time. However, in 2004 during an extensive survey for large mammal species no signs of cheetah were found and it is assumed that they have now become locally extinct (Anderson *et al.* 2006).

Bauhine National Park (No 6, Fig. 1)

It appears that although cheetahs were present in Bauhine National Park in the 1970's (Natural History Museum, Bulawayo; C. Stockil, pers. comm.), and later distribution maps of cheetah included the park (Skinner & Chimimba, 2005), there have been no sightings reported for a number of years. Excessive hunting of the prey base is assumed to be the reason for their disappearance (B. Soto, C. Lopez Pereira, both pers. comm.).

Limpopo valley National Park (No 7, Fig. 1)

It appears that although cheetah were present in this area in the 1970s there are no recent records of sightings or signs (B. Soto, pers. comm.; C. Lopez Perreira, pers. comm.). It is assumed that they have become locally extinct due to a combination of excessive hunting of their prey and poaching for their skins. However, this protected area has now become contiguous with Kruger National Park (KNP) as part of the Great Limpopo Transfrontier National Park. Cheetah are present in KNP in relatively high numbers and natural recolonisation may occur.

Outside protected areas

The Ministry of Tourism reported that cheetahs are rarely seen in Mozambique both within and outside of Protected Areas (B. Soto, pers. comm.; C. Lopez Perreira, pers. comm.). However, two confirmed reports from the communities living in the Zumbo district of Tete province indicate that cheetahs do still occur in the area around Caborra Bassa, but are seen sporadically and in very low numbers (Area A in Fig. 3; J. P. Valente Valente, pers. comm.). The presence of cheetah in this area was in question in the available literature with Ansell (1978) and Skinner & Smithers (1990) reporting that cheetah were not found in the Lower Zambezi valley, but Nowell & Jackson (1996) and Skinner & Chimimba (2005) include this area as part of the range of cheetahs. The two confirmed sightings reported during this study indicate that cheetah do persist in this part of Mozambique but the population is likely to be small and may depend on linkages to the population in the north-east of Zimbabwe, where reports of cheetah are infrequent.

Recommendations

There is still a lack of data regarding the status, distribution and threats to cheetah in Mozambique, with large areas of the country unsurveyed. The comparison between historical distribution and current suggests that there has been a significant reduction in range, and hence in population of cheetahs in Mozambique, such that their current range can be confirmed in only a single area within their historical range. This status



Fig. 3. Photograph of a partial skin confiscated in Zinave National Park in early 2007. It is not yet confirmed that the skin is from a cheetah (Photo C. Begg).

may change with more detailed information. Given that cheetahs occurred historically throughout much of the country, there is a need to identify potential corridors between the area where cheetahs are known to persist, and other potentially suitable habitat for cheetah to help guide planning for the conservation of the species in Mozambique.

With the Limpopo Valley National Park becoming contiguous with the Kruger National Park as a result of the removal of boundary fences, cheetah from Kruger may naturally recolonise this area of Mozambique. Cheetahs are also present in the Gona-re-Zhou National Park in Zimbabwe which is now part of this TFCA, and recolonisation may occur naturally from here as well, although human settlements may be a barrier to movement.

Acknowledgements

The Zambezi Society provided the financial support to carry out the preliminary assessment. I am very grateful for the feedback from Dr Colleen Begg (Niassa), Jorge Pedro Valente Valente (Tete Province), Bartolomeu Soto (Ministry of Tourism), Dr Carlos Lopez Perreira, Clive Stockil, Jean Andre Marc (Marromeu), Blondie Leatham, Richard Peek and Woody Cotterill (Natural History Museum, Bulawayo).

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Status and Distribution of Cheetah in Zambia: A Preliminary Assessment

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The historical and present day distribution of cheetah in Zambia appear to be similar, although the range has contracted. Liuwa Plains National Park, the northern section of the Kafue National Park and South Luangwa National Park still hold populations of cheetahs, although it was not possible to estimate population sizes. Cheetahs are reported from the Chimbwi plains area of the Bangwelu complex of protected areas, but sightings are infrequent. Cheetahs are also reported from the area between North and South Luangwa Parks, but appear to now be absent from the North Luangwa Park. It is not clear if cheetahs are still vagrant or extirpated in the Lower Zambezi National Park and surrounds. No data were available regarding the status of cheetahs in the remaining national parks, and in unprotected areas. The main threat to cheetahs appears to be a loss of suitable habitat and competition with humans, and a reduction in available prey. Given the reduction in range, there is an urgent need for a survey of Zambia to determine cheetah population sizes, and threats to their survival.

Historically the cheetah was recorded as a widespread but rare to uncommon species in Zambia (Myers 1975, Ansell 1978). Cheetahs were resident in most protected areas, the Lower Zambezi complex being the only exception, where cheetahs were recorded as either absent (Skinner & Smithers, 1990) or as vagrants (Ansell 1978, Nowell & Jackson 1996, Skinner & Chimimba, 2005; Fig. 1).

In a review of mammal fauna in the Four Corners area of Africa (centred around where Botswana, Namibia, Zambia and Zimbabwe meet), Cotterill (2004) reports that cheetahs are present in this part of Zambia, but the report does not include distribution. Benson (1969) record cheetahs as present in Sioma Ngwesi and Liuwa Plains National Parks (Western Zambezi complex, Fig. 1). I. Manning (pers. comm.) also confirmed that cheetahs were found in many protected areas of Zambia in low numbers, with the exception being the northern sector of Kafue National Park where cheetahs were seen frequently (Kafue Complex, Fig. 1). Carr (1986) reports that cheetah were present in South Luangwa National Park but restricted to the plains habitat of the Park (Luangwa complex, Fig. 1). Myers (1975) reports that cheetah were present in Kasanka and Isangano National Park (Bangwelu complex, Fig. 1).

Myers (1975) argued that the distribution and status of cheetahs in Zambia was a result of limited areas of suitable habitat (<40,000km², much of it outside of protected areas) and low densities of preferred prey, combined with persecution by humans sharing the same habitats. A large proportion of Zambia is covered with Miombo woodland, a relatively unproductive habitat, interspersed with areas of higher nutrient levels, such as floodplain grasslands and Mopane woodland (Fig. 2). The uncommon status of cheetahs in Zambia may simply be a result of the prevalence of miombo woodland. In addition, habitats favoured by prey and predators are also favoured by humans for agriculture, and Myers (1975) predicted that as the human population of Zambia increased, competition with cheetahs for habitat would also increase, resulting in a drastic decline in the national cheetah population. He reports that cheetahs were locally extirpated in the Kafue Flats area as a result of competition and persecution by humans (Kafue Complex, Fig. 1).

Cheetahs are specially protected in Zambia, but can be hunted as trophy animals and destroyed as problem animals with special permission from the government wildlife authority.

Review of available information

Much of the published information

regarding the status and distribution of cheetah in Zambia was found to be outdated. This assessment is based on reports from individuals known to be working in the field in Zambia. Information was collected on a one to one basis, and not through the use of a questionnaire as the number of respondents was limited. The Zambia Wildlife Authority was approached for information, but by the time of writing, the author had received no feedback.

Protected areas (including National Parks and Game Management Areas) *The Western complex including Sioma Ngwesi and Liuwa Plains National Parks, and surrounding game management areas (A in Fig. 1)*

Cheetahs appear to have persisted in Liuwa Plains National Park with regular sightings of individuals and groups (Personal observation, T. Turner and E. Farmer, both pers. comm.). At present there is not enough data to estimate population size, but with the ongoing monitoring and research in the Park, by the African Parks Foundation it is hoped that a population estimate can be made soon. Cheetahs have also been sighted in the Sioma Ngwesi National Park and surrounding game management area, although it was not possible to estimate population sizes (Purchase *et al.* 2007).

The Kafue complex including the Kafue, Kafue Flats, Lochinvar and Blue Lagoon National Parks, and the surrounding areas (B in Fig. 1)

The Kafue National Park has historically had the most sightings of cheetahs recorded and sightings are relatively common throughout the park (W. Cotteril, I. Manning, E. Farmer, and F. Dunn, all pers. comm.; Purchase *et al.* 2007). This cheetah population may be the most significant in Zambia but no population estimate is available. Myers (1975) reported that cheetah had become locally extinct in the Kafue Flats areas incorporating the Lochinvar and Blue Lagoon National Parks.

The Lower Zambezi Complex including the Lower Zambezi National Park and surrounding areas (C in Fig. 1)

There are no recent records of cheetah in this area of Zambia, although cheetahs are reported infrequently from the Zimbabwe side of the Zambezi river, and south of the Zambezi river across the border in Mozambique (Purchase *et al.* 2007; Purchase 2007). Historically this area was often excluded from distribution maps of cheetahs and cheetahs may still only be vagrants in this area.

Three cheetah were introduced into the Lower Zambezi National Park from Namibia in the late 1990's but none survived.

The Luangwa complex, including North and South Luangwa National Parks and the surrounding areas (D in Fig. 1)

The status of cheetahs in Luangwa appears to be in dispute. Cheetahs have always been recorded in South Luangwa but only infrequently (I. Manning and E. Farmer, both pers. comm.). Certainly there is an abundance of suitable prey with resident impala and puku. They are considered by people working in North Luangwa to be absent (Chomba, pers. comm.). They were hunted as trophy animals in the hunting block to the north of this Park in the 1970 and early 1980's, and may not have recovered from this persecution (P. White, pers. comm.). Cheetahs have been sighted in the Munyamadzi corridor between the North and South Parks (P. White, pers. comm.) in 2000,

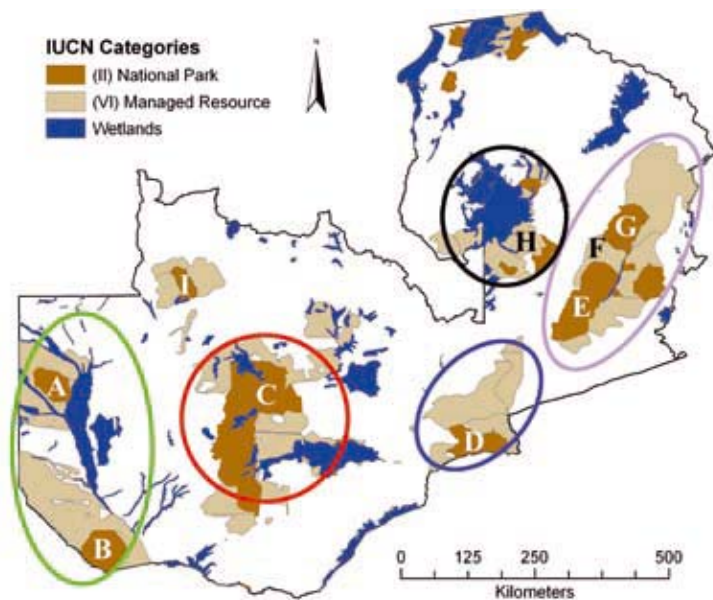


Fig. 1. Protected areas and seasonal wetlands of Zambia (Source: WDPA Consortium, 2006). Brown = National Park NP; Beige = Game Management Area; Blue = seasonal wetland; Green circle = Western Zambezi complex; Red circle = Kafue Complex; Blue circle = Lower Zambezi Complex; Purple circle = Luangwa complex and Black circle = Bangwelu complex. A = Liuwa Plains NP; B = Sioma Ngwezi NP; C= Kafue NP; D = Lower Zambezi NP; E = South Luangwa NP; F = Munyamadzi corridor; G = North Luangwa NP; H = Chimbwi plains; I = West Lunga NP.

and this is the most recent sighting recorded to date (Purchase *et al.* 2007). There is an urgent need to accurately assess the current population size of this area of Zambia, given that protection status is high and hence good potential for conservation of the species.

The Bangwelu complex including Kasanka, Isangano and Lavushi Manda National Parks, and surrounding areas (E in Fig. 1).

The Chimbwi plains appear to have been the centre of cheetah activity in this area, and one respondent reported



Cheetah in the Zambezi Basin (Photo Zambezi Society).

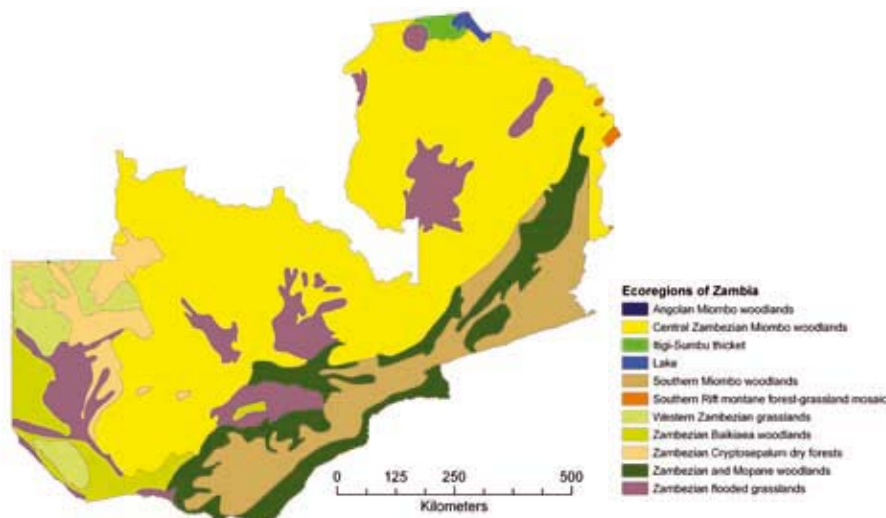


Fig. 2. Ecoregions of Zambia.

seeing cheetah there recently (I. Manning, pers. comm.). The Chimbwi plains are the main source of wildlife in the region, but are relatively unprotected, whilst the three national parks within the complex are unfortunately on the periphery of this area. No cheetah have been sighted in Kasanka National Park since 2000 (E. Farmer, pers. comm.), and historically cheetah numbers were thought to be low in the protected areas of this complex (Myers 1975). If cheetah are to survive in the region there is a need to increase the protection status of the Chimbwi plains (E. Farmer, pers. comm.).

Other protected areas of Zambia

Cheetahs are reported to have been extirpated from the West Lunga National Park and surrounding areas due to a loss of prey and high human populations within the protected areas. No recent information was available for the other protected areas of Zambia.

Outside Protected areas

All respondents contacted during this assessment could only provide infor-

mation regarding the status of cheetah within the protected area network of Zambia. However, all respondents felt that cheetahs were no longer present in areas outside of this network, and there were no reports of conflict between cheetahs and farmers.

Recommendations

Unfortunately the available information regarding the status and distribution of cheetahs in Zambia is still extremely limited. There are a number of potentially important populations of cheetahs in the country (in Liuwa Plains, Sioma Ngwezi, Kafue and possibly South Luangwa National Parks) but more information is required, especially with respect to population estimates and identification of threats. There are also a number of areas (such as the Bangwelu complex and the Kafue Flats) where there is potential to increase the small remaining populations of cheetahs, after improving the environment. The protected areas with resident cheetah populations are large in size (Table 1), and the priority is to improve management of prey and

protection of habitat, resulting in the protection of potentially large populations of cheetahs within the southern African region. Between these areas there are limited opportunities for dispersal, but as each protected area could hold viable populations independently, establishing corridors is unlikely to be a priority.

Acknowledgements

The Zambezi Society provided the financial support to carry out this preliminary assessment. I am very grateful for the feedback from the following people: Ian Manning, Fiona Dunn, Paula White, Edmund Farmer, Tom Turner, Andrew Chomba and Woody Cotterill. I am also grateful to the Natural History Museum, Bulawayo for allowing me to look through their records.

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Table 1. Summary of cheetah status and distribution in protected areas of Zambia

Protected area	Size (km ²)	Status	Most recent sighting
Liuwa plains	3600	Resident	2007
Sioma Ngwezi and surrounding areas	43300	Not known	2005
Kafue	22400	Resident	2007
Chimbwi plains	~8000	Not known	2006
South Luangwa and Munyamadzi corridor	12350	Not known	2000

The Status of Cheetah in Malawi

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Cheetah were reported as almost extinct from Malawi in 1996 and it appears that the species is now extirpated from this country mainly due to reduced habitat and prey as a result of an increased human population. Historically the cheetah was never widespread in this country due limited areas of suitable habitat and prey. Since 1980 cheetahs were only reported in three national parks along the western border with Zambia, the source of the cheetahs in Malawi. Given changes in Zambia as well as Malawi, it appears that there are no longer corridors for movement of cheetahs into Malawi, and the areas and prey base within the country cannot support viable populations.

Current status of cheetah in Malawi

Malawi is one of the most densely populated countries in southern Africa (Fig. 1), and falls within the moist miombo belt of Africa, an area thought to be generally unsuitable for cheetah given low prey densities (Myers 1975). In the late 1980's cheetahs were reported as absent from most of Malawi, and only resident in Kasungu National Park, and infrequent in Nyika and Vwaza Marsh protected areas (Ansell & Dowsett 1988, Gros 1996, Caro, unpubl. report; Fig. 1). In these previous reports it was mentioned that cheetahs were only present in these protected areas as a result of linkages into neighbouring Zambia, where a complex of protected areas exist in the Luangwa Valley, and it was stressed that linkages to these areas needed to be maintained.

By 2007, it was reported during a review of information regarding the status and distribution of carnivores in protected areas of the Zambezi Basin, an ecological area that almost completely encompasses Malawi, that cheetahs were no longer present in any of the protected area of Malawi (Purchase *et al.* 2007; P. Taylor, L. Labuschagne, S. Michael, all pers. comm.), with the possible exception of Kasungu National Park (Kamwend 2005), as there have been no confirmed sightings of cheetahs in the last 5 years. During the same review it was found that cheetahs had not been recorded in the North Luangwa National Park in Zambia since 1985, were infrequent and at low densities in South Luangwa National Park and their status was unknown in the other protected areas that comprise the Luangwa complex

(see Zambia Status report in this same volume for more details). Anecdotal evidence suggests that over hunting of the species may have been the cause of decline in Zambia, and this, coupled with a reduction in prey and habitat due to increasing human populations in the corridors connecting the protected areas in both countries, has resulted in local extinction in Malawi.

Recommendations

Nyika and Vwaza March protected areas are now part of a proposed transfrontier conservation area (TFCA) with the aim of linking wildlife (and tourist) populations in the Luangwa valley and the two Malawi areas. Such initiatives will improve corridors for wildlife movement, and is the only hope of seeing the return of cheetah to the Malawi protected areas in the long term.

Acknowledgements

The Zambezi Society provided the financial support to carry out this preliminary assessment. I am very grateful for the feedback from Paul Taylor (Malawi Wildlife and Environment Society) Lucille Labuschagne (Nyika TFCA) and Stewart Michael (Lower Shire protected areas).

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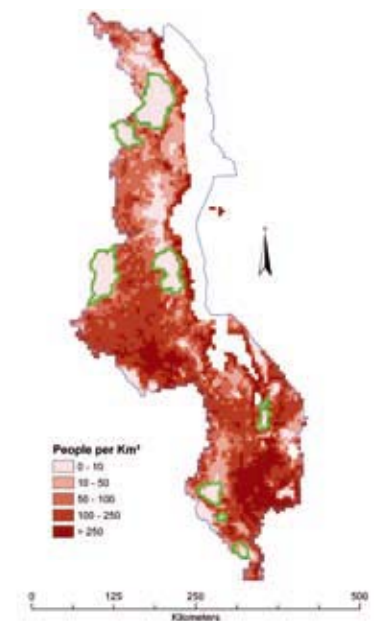


Fig. 1. Human Population Density in relation to protected areas of Malawi (Source: WDPA Consortium 2006, Center for International Earth Science Information Network 2007).

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Regional Assessment of the Status, Distribution and Conservation Needs of Cheetahs in Southern Africa

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A country by country assessment of the status, distribution and conservation needs for cheetah *Acinonyx jubatus* in the southern African region indicates that this area holds a significant proportion of the global population of cheetahs, at least 4 500 adults. The largest proportion of this regional population occurs in four range states, Namibia, Botswana, South Africa and Zimbabwe where it is under threat as a result of conflict with livestock and wildlife ranchers, removal of animals (both legally and illegally) for trade, loss of habitat and prey base due to an increasing human population and possible health and genetic problems. Although more information is required, it appears that cheetahs are present in the other range states, but in low numbers and disjointed populations. No information is currently available regarding threats to cheetahs in these countries.

The cheetah is the only species in a unique genus, and there is concern that it is declining over its range, both in terms of overall numbers and in terms of areas that it occurs. As a result of this concern, various initiatives have started to document where cheetahs still occur, their status in these areas and the threats to their survival. In December 2005 at a meeting of conservationists working in the Southern African region of the cheetah's range, it was agreed that the status, distribution and major threats to the cheetah would be documented for all range states within the region. The findings of these assessments are summarised in this paper, and full reports are included in this Special Issue of Cat News.

Status and distribution within the Southern African region

Overall. It was documented that cheetahs occurred within all the range states included in this assessment, with the possible exception of Malawi where only one protected area was reported to have cheetah, but this report is contested. From the information collected cheetahs occur predominantly in the central area of the southern African region, including the central and western districts of Namibia, Botswana, Zimbabwe (except for the populated north eastern districts, and the northern dis-

tricts of South Africa (Fig. 1). Cheetahs were also reported as present in one protected area in Angola, from protected areas in the west and central part of Zambia, and from a small area in the Tete province of Mozambique, and also the Limpopo National Park in Mozambique (Fig. 1). There were large areas of Angola and Zambia, for which no information was available, and information from Mozambique was limited, but the indications are that the species is absent from much of the country.

Population estimates for many of the range states were not available, and only rough estimates were given. The minimum population of adult cheetahs in the region can be tentatively estimated to be not more than 5000: Namibia – 2000; Botswana – 1800; Zimbabwe – 400; South Africa – 550; Angola – not known; Mozambique – <50; Zambia – 100; Malawi – <10.

Major range states within the region.

The major range states within the region are Namibia (with the largest documented population of cheetah ranging from 2000 to a possible 5000). The largest proportion of the population occurs on commercial farmland as these areas provided refuges from competition with other large predators. Numbers in protected areas are relatively low. Overall, it is felt that the population is

increasing. Botswana has the next highest documented population of cheetahs, distributed throughout the country. The highest densities are recorded from the south western part of the country, with the eastern, more populated districts, recording the lowest densities. South Africa's population is well studied and is confined to the northern part of the country. Approximately 250 cheetahs occur in protected areas, with a similar number occurring on commercial farmland. Cheetah in Zimbabwe are also documented to be more common on commercial farmland, especially in the southern lowveld area of the country. Estimates vary enormously depending on the method used, but it is acknowledged that at least 400 cheetahs occur in the country, and possible as many as 1500. Zimbabwe has undergone significant land use change in the last 7 years, with 90% of farmland being converted from large scale commercial farmland to small scale resettlement farmland. The impact on the cheetah population is not clear, but indications are that the population may be declining due to this increase of human activity and loss of prey.

Other range states within the region.

Cheetahs were reported as present in protected areas of Angola (Kameia National Park in the north eastern cor-

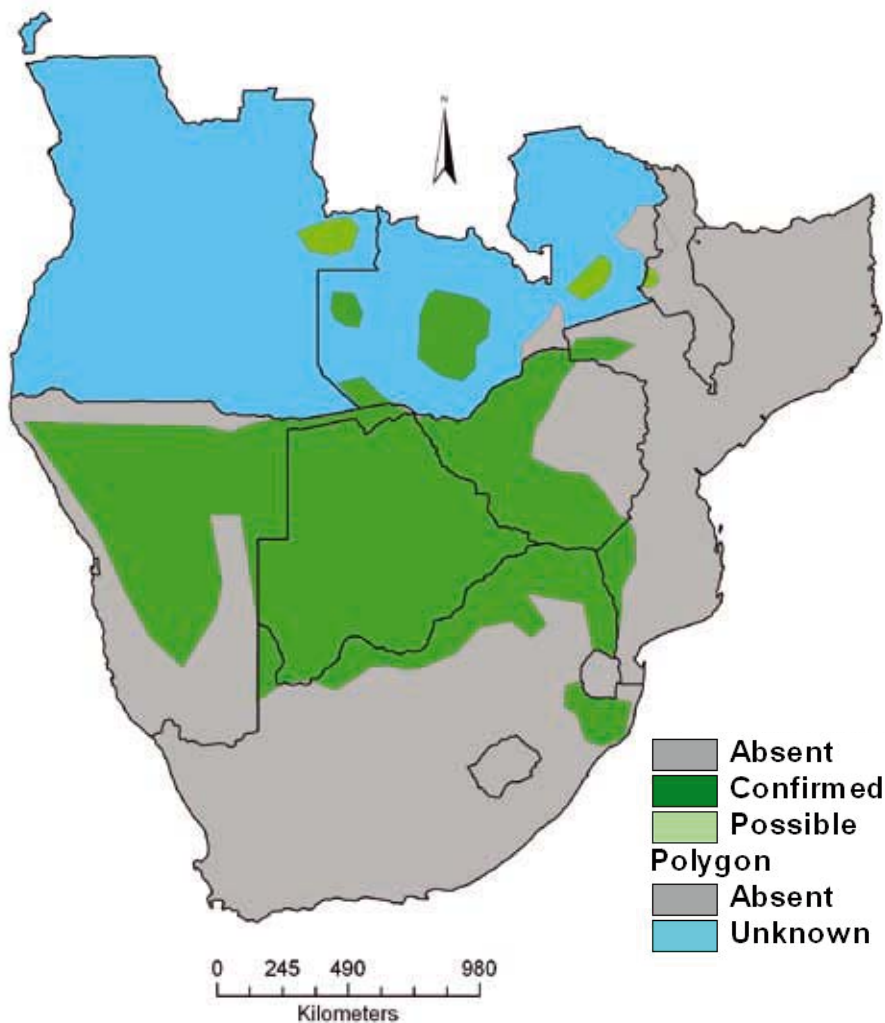


Fig. 1. Distribution of cheetahs in Southern Africa. The most important range countries in this region for the conservation of the species are Namibia, Botswana, Zimbabwe and South Africa. In the other countries, cheetahs have lost most of their ground.

ner of the country); Zambia (Liuwa Plains, Sioma Ngwezi and Kafue National Parks); Malawi (Kasungu national Park, although this record is contested) and Mozambique (Limpopo National Park). Cheetahs were also reported as present in the subsistence farming area around the Caborra Bassa area. However, overall these range states do not appear to have large populations of cheetahs, either reporting that cheetahs have never been common (Zambia) or that cheetahs have disappeared from large areas of the country (Malawi and Mozambique).

Major Threats identified

In all the major range states the main threat to the survival of the species is conflict with livestock and wildlife ranchers. In Namibia this has histori-

cally been a major cause of death and removal of cheetahs from the wild, although there is evidence that this threat is reducing. Retaliatory killing was also reported as a major problem both now and historically in South Africa and Zimbabwe. In the other range states no conflict was documented during this assessment, perhaps due to low numbers of cheetahs, and lower densities of livestock. Other threats reported included the following:

- Capture of wild cheetahs for live sales. This is especially a problem in Namibia, Botswana and South Africa.
- Decreasing wild prey base. This is a concern in Zimbabwe.
- Conflict with other large predators in protected areas, reducing the suitability of such areas for cheetah conservation.

- Bush encroachment as a result of historical over grazing. In Namibia this is documented as both a direct and indirect threat to cheetah as it reduces hunting success of the species, as well as reducing the overall productivity of ranches increasing intolerance to livestock depredation by cheetahs.
- Unregulated captive breeding. This is linked to the illegal trade in wild cheetahs as it is known that many of these cheetahs end up in captive breeding centres. This is especially a problem in South Africa.
- Due to the loss of range at the end of the last glacial period the few surviving cheetah experienced at least one severe demographic bottleneck that potentially significantly reduced levels of molecular genetic variation. The bottleneck and associated loss of genetic variation have been linked to several important life history characteristics of cheetah including relatively low levels of normal sperm in males, focal palatine erosion (FPE), kinked tails, and an increased susceptibility to infectious disease agents.

Overview of Policy and legislation

Policy and legislation varies across the range states:

- The cheetah is listed as a protected species in Zambia, Mozambique and Malawi where cheetahs cannot be destroyed.
- It is gazetted as protected species in Botswana and Zimbabwe but cheetahs can be destroyed with a permit from the Director of the relevant Wildlife Management Authority.
- It is gazetted as a protected species in Namibia, but can be destroyed to protect life and property without permission from a government authority.
- In South Africa legislation regarding the protection of cheetah is complex as each of the nine provinces has its own legislations, and there is separate legislation for protected areas as they fall under a different legal entity. However, within all the existing legislation there is some degree of protection afforded to the cheetah, and removal or destruction of animals requires a permit.

The cheetah is listed as an Appendix I species under the Convention in International Trade in Endangered Species

Table 1. Summary of the status, distribution and major threats to cheetahs in the Southern African region.

Country	Estimated minimum population	Trend	Occurrence (% of country)	Major threat	Legal status
Angola	Unknown but present	Unknown	Unknown	Unknown	
Botswana	1800	Increasing	100	Conflict with humans	Protected species
Malawi	< 25	Decreasing	5	Habitat loss	Protected species
Mozambique	<50	Unknown	5	Unknown	Protected species
Namibia	2000	Increasing	50	Conflict with humans	Partially protected species*
South Africa	550	Increasing	10	Conflict with humans	Protected species
Zambia	100	Unknown	Unknown	Unknown	Protected species
Zimbabwe	400	Decreasing	60	Habitat loss	Protected species

* Cheetahs can be destroyed without a permit if threatening life or property

(CITES). All the range states within the region are signatories to this convention and therefore cannot trade in live animals or products with, unless they have been granted a CITES quota. Namibia, Zimbabwe and Botswana all have annual CITES quotas to enable cheetahs to be traded to offset the costs borne by communities living with the species (150, 50 and 5 respectively). In all range states there does not appear to be clear legislation regarding the sale and movement of cheetahs bred in captivity and this of major concern, as it is a loophole for trade in wild cheetahs that are moved to captive centres.

Ongoing efforts to conserve the species and recommended solutions

In all the major range states efforts are ongoing to find solutions to the threats mentioned above. Current efforts include:

- Improving awareness of the importance of the cheetah especially within governments and management communities such as commercial and subsistence farmers.
- Improving livestock husbandry to reduce depredation by cheetah and improve tolerance of livestock and wildlife producers.
- Encouraging the formation of conservancies to allow for more effective management of wildlife and cheetahs.

- Relocation of problem cheetah to areas where they are tolerated.

Other solutions recommended by each country include

- Effective regulation of captive breeding centres as many of these are conduits for trade in cheetahs caught in the wild.
- Effective policing of borders to prevent the movement of illegally caught wild cheetahs, especially from Namibia and Botswana to South Africa.
- Increased research into the conservation needs of the species, especially the impact of increasing human populations and decreasing wild prey bases, and including an assessment of the minimum area required to sustain a viable population, as well as health and genetic threats.
- Increased education at all levels of society.
- Evaluation of alternative livelihoods for communities currently dependent on livestock to reduce conflict with all predators including the cheetah.

Conclusions

The Southern African region still holds a significant proportion of the overall global cheetah population (Table 1). However, this population is under threat from an increasing human (and subsequently livestock) population resulting in an increase in conflict that is detrimental

to the survival of the species (Table 1). Trade in live animals is also of concern as many of these animals originate in the wild. Disjointed and unclear policy and legislation in the region hampers efforts to control retaliatory killing and removal of cheetahs in each of the range states, and there is a need for policy and legislation to become more regional (Table 1).

In the four major range states conservation initiatives are ongoing to try and reverse these threats, but more support and resources are required. The region already has a history of working across boundaries to try and share experiences and conserve the species, but more transboundary initiatives are required, given that many cheetah populations in the region appear to exist across national borders (see Fig. 1). There is also a need to determine the status and distribution of the species in the poorly documented range states that could have viable populations of cheetahs present that are also under threat.



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