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).

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).

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 be 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; Stander & Hanssen 2004). Namibia has a vast network of protected areas, covering

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 giving it an economical value and the game numbers increased.

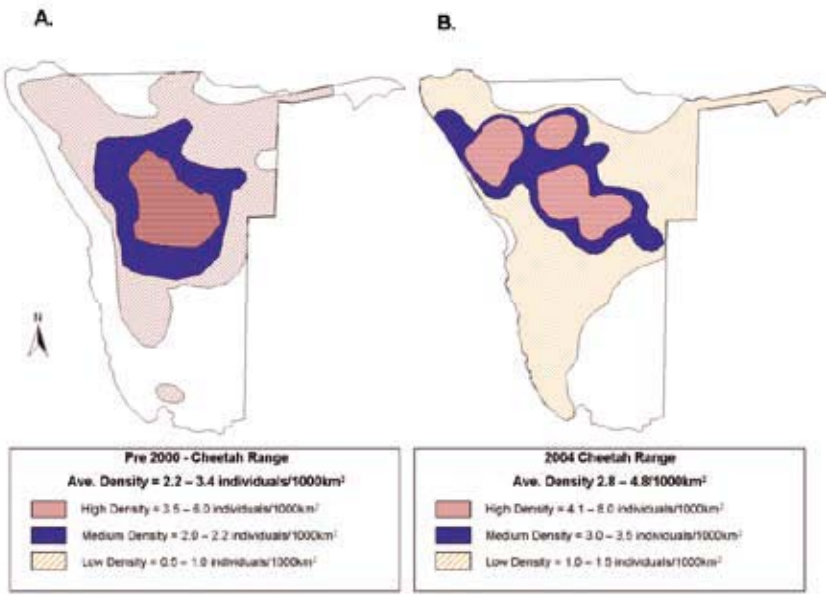


Fig. 2. (**A**) Distribution and density estimates of cheetah in Namibia 1990 – 2000 (MET, 2000), (**B**) Distribution and density of cheetah based on sightings plus observations (Hanssen & Stander 2004). Density estimates calculated from Marker (2000) and Marker *et al.* (in prep.).

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 occured 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

[a]Joubert, 1985, [b]Marker-Kraus et al., 1996, [c]Erb, 2006.

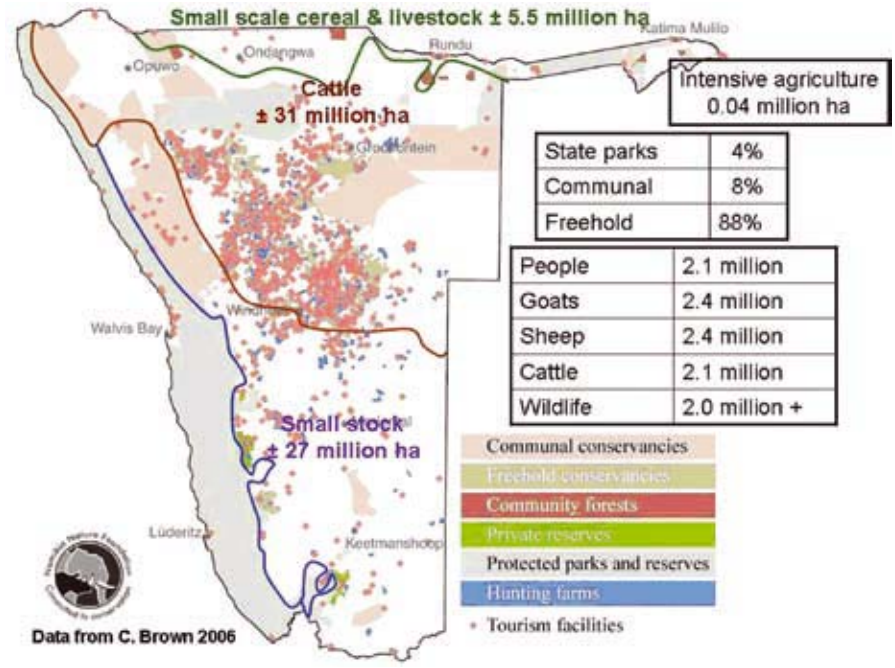
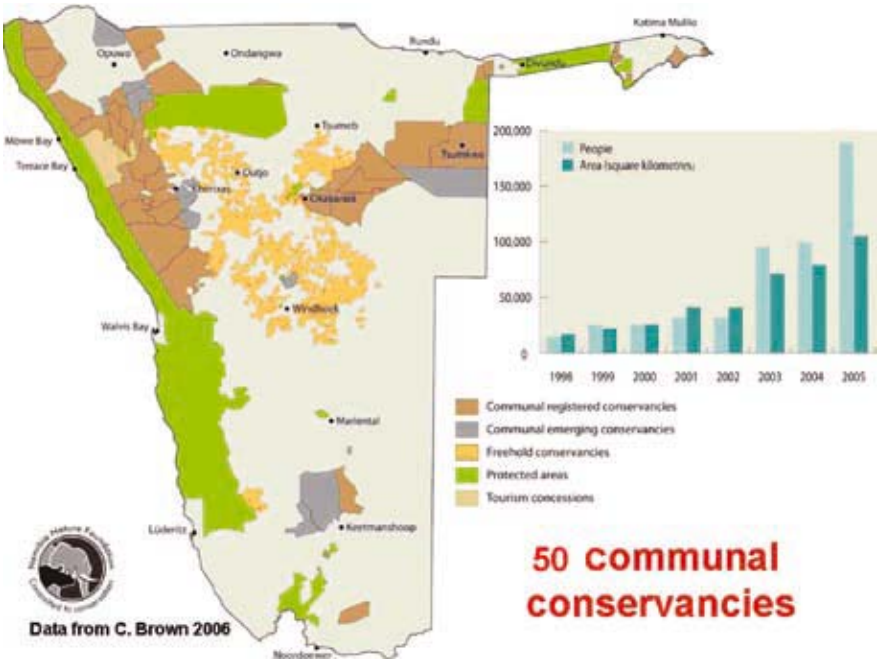


Fig. 3. (**A**) Land use within Namibia including numbers of people, livestock and wildlife, how much land is used for cattle and small stock as well as where wildlife is found by percent (Brown 2006). Namibia's commercial cattle herd is found in the north central part of the country.



(**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.

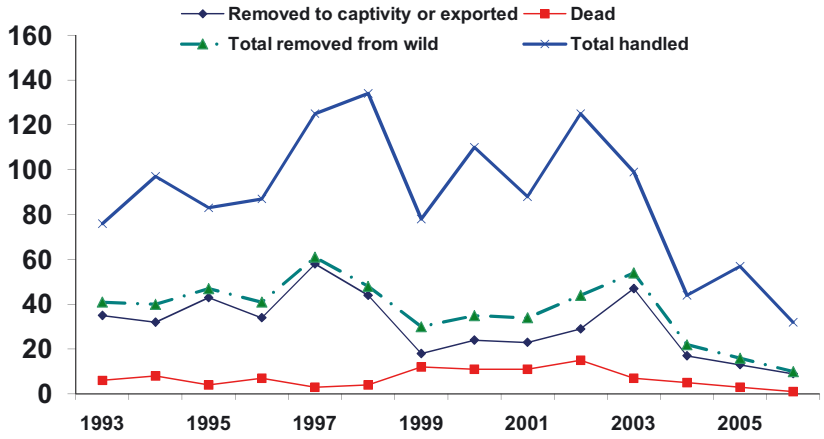


Fig. 4. Total number of cheetahs handled by CCF and Africat between 1991 and 2006, including those that were examined when dead and those that were placed in captivity or exported.

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 on the Namibian farmlands ranged over large areas, with an average home range size of 1,651 km^2 (± 1,594 km^2), 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 km^2 for single males, 1,344 km^2 for coalitions of males and 2,160 km^2 for females. The only other long-term dataset, from the Serengeti National Park, reveals ranges of 777 km^2 for non territorial males, and 833 km^2 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 ± 5.3% of the home range (Marker *et al*. 2007). These ranges were not exclusive, overlapping on average by 15.8 ± 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

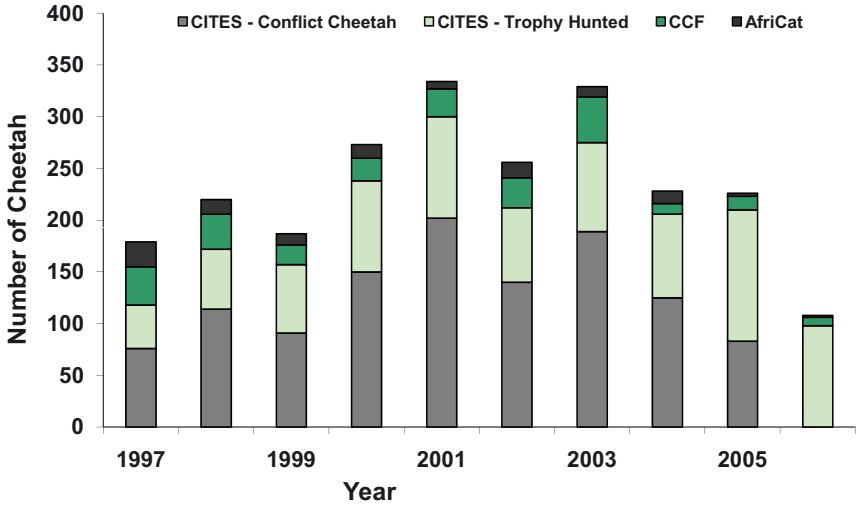


Fig. 5. Total cheetah removals reported by CCF, Africat and CITES by MET from 1997 to 2005.

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 km^2 ranch had direct effects on lions over an area of more than 2,000 km^2. 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 km^2 using radio telemetry (Marker 2002) to 4.1 (+/- 0.4) cheetahs/1,000 km^2 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).

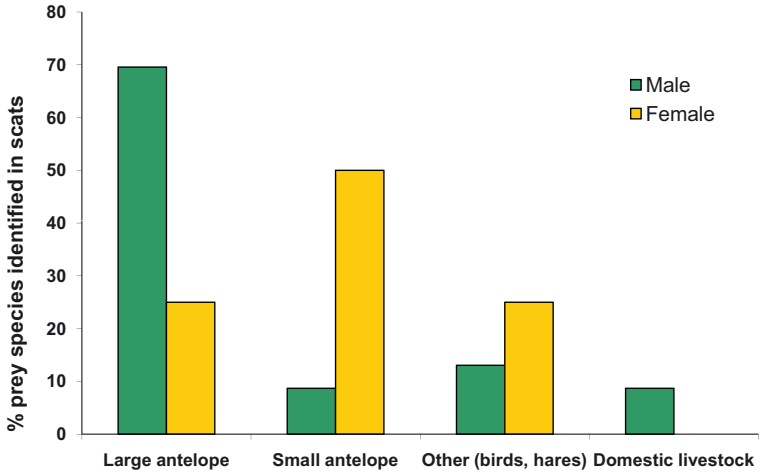


Fig. 7. Percentage of prey species identified in scats of both male and female cheetah (Marker *et al*. 2002).

Diet and prey selection

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

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 km^2 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 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 (Muntiering *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).

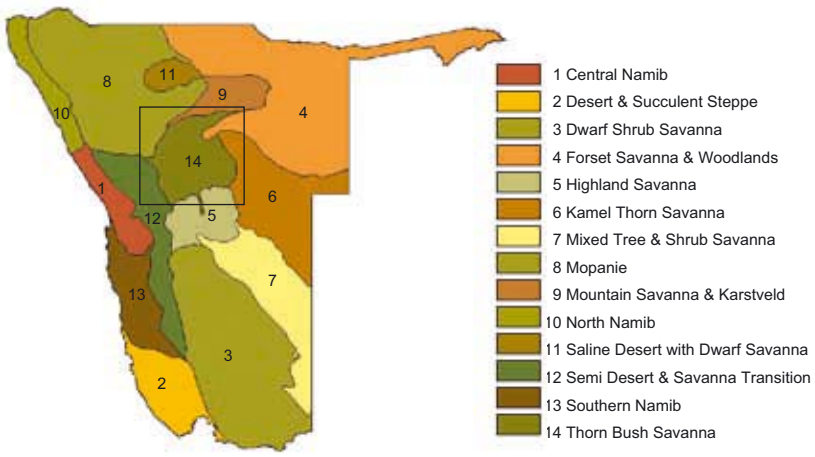


Fig. 8. Broad vegetation types (e.g. grassland, shrubland and woodland; Atlas of Namibia Project 2003). The boxed area indicates the area of highest density of cheetah.

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).

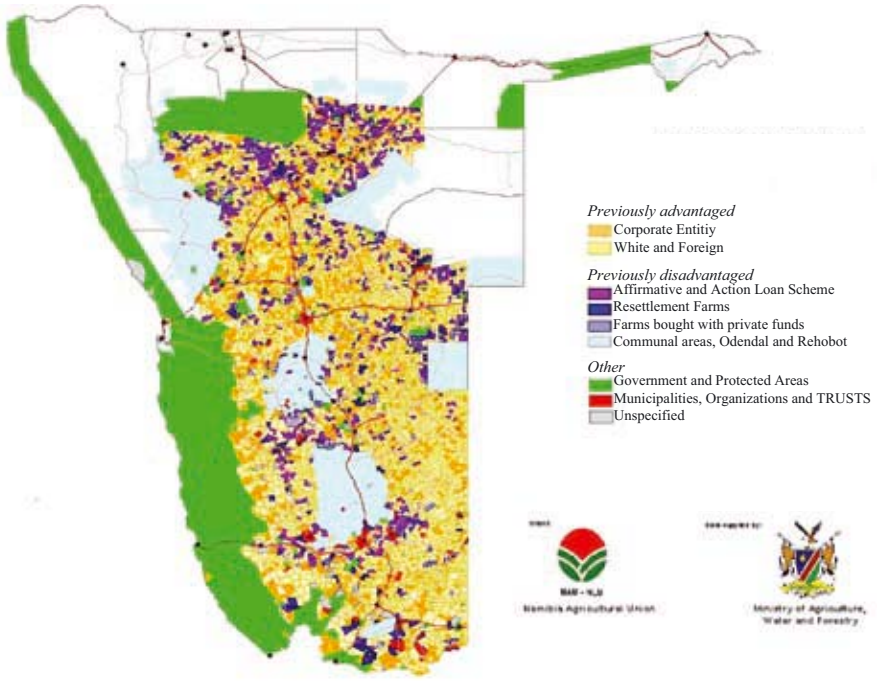


Fig. 10. Land Ownership in Namibia including resettled farmers, white free-hold farmers and communal areas. (Namibian Agricultural Union 2006).

(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 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.

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

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

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Appendix III. Responsible authorities

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