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## **CHEETAHS AS PROBLEM ANIMALS: MANAGEMENT OF CHEETAHS ON PRIVATE LAND IN NAMIBIA**

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**Abstract-** The management of problem animals on private land is a complex, difficult issue. When an endangered species is involved, the necessity for crisis management can further complicate matters. Namibia is fortunate to be in a position where cheetah numbers are, at this stage, sufficient to sustain the population. However, with growing human population expansion and the demand for more land and increased pressure on resources, time is running out for the cheetah.

The extensive nature of farming practices in Namibia has inadvertently maintained habitat favourable for cheetah. The primary problem is conflict with livestock farming, to which there are solutions other than traditional lethal predator control. In order for agriculture practices to be compatible with the survival of wildlife, new methods and policies of farm management, wildlife management and predator control urgently need to be incorporated into land management.

### **INTRODUCTION**

The conflict between human development and wildlife species is widespread and well-documented in Africa. The cheetah is Africa's most endangered large cat. Loss of habitat, a declining prey base, competition with large predators and livestock interests are taking a heavy toll on wild cheetah populations.

Today, there are less than 15 000 cheetahs remaining world-wide<sup>6</sup>. The vast majority of cheetahs live in small, isolated groups outside protected game reserves where they are often in conflict with human interests and livestock, and most populations continue to decline. Consequently, viable breeding populations are found in fewer than half the countries where cheetah still live. This species, already genetically compromised, cannot afford further reduction to its gene pool. Neither protected reserves nor captive management can be relied on to support the survival of viable populations of the species. The long-term survival of the cheetah depends on the conservation of a healthy population in the wild and the vast farmlands of Namibia provide the last strong-hold for the cheetah.

Namibia is home to the largest free-ranging population of cheetahs in the world<sup>6</sup>. In Namibia, 90 % of the cheetahs are found on the commercial livestock farmlands, outside of protected game reserves, living in a contiguous area of over 275 000 km<sup>2</sup> in the north central region of the country<sup>6</sup>. Seventy percent of the country's wildlife species (the cheetah's prey-base) also live on these farmlands, which produce cattle, sheep, goats and wildlife.

Although the cheetah is protected under Appendix I of the Convention on International Trade of Endangered Species (CITES), Namibian farmers can legally remove cheetah under a provision that permits 'protection of property'<sup>6</sup>. Farmers have historically perceived cheetahs as having a severe negative economic impact on their livestock and wild game industries. Due to this attitude, from 1980 to date, well over 10 000 cheetahs have been legally removed from the wild population in Namibia<sup>6,7</sup>. Farmers continue to capture and remove large numbers of cheetahs as "pests" and "problem animals". These attitudes are the principal barrier to managing cheetah in Namibia. The survival of the Namibian cheetah is in the hands of approximately 1 200 commercial farmers and their willingness to integrate cheetah conservation efforts into farm management.

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## BACKGROUND ON CHEETAH CONSERVATION FUND (CCF)

In 1990, the Cheetah Conservation Fund (CCF) was established as a non-profit organisation, and set up base in Namibia to assist with the long-term management of the cheetah on Namibian farmlands. CCF's mission is to secure habitats for the long term survival of cheetah and their ecosystems through multi-disciplined and integrated programmes of conservation, research and education.

The first phase, within the context of CCF's long-term programme, involved an in-depth survey through extensive personal interviews with 240 commercial farmers, owning 385+ farms, in districts of the country where cheetahs still exist<sup>6</sup>. The purpose of the survey was to develop baseline data concerning components of the farmland ecosystems which sustain the cheetah population. These include the vegetation, numbers of livestock and availability of prey, current livestock and game management practices, farmers' interactions with cheetah and other wildlife, and recommendations by the farming community. The survey covered more than three million hectares and resulted in the publication of the book titled: *Cheetah Survival on Namibian Farmlands*<sup>6</sup>.

## FACTORS INFLUENCING CHEETAH POPULATIONS ON NAMIBIAN FARMLANDS

### Historical Ecological Changes

In order to understand the dynamics of the cheetah population on commercial farmlands, a historic understanding of the ecology of the farmlands is necessary. These commercial farmlands average 6000 ha and consist primarily of thorn bush savannah. Over the years, many ecological changes occurred in this arid country, and the biodiversity of these extensive farmlands was altered.

At the turn of the century the first settlers began developing the livestock farms that are in production today. The availability of water for livestock was the single most important development resulting in the establishment of permanent water points, allowing wildlife herds to become resident. Prior to this, wildlife migrated throughout the country following water and good grazing. Along with the farmland development came the conflict with predators. Protective measures for livestock were seldom employed due to the extensive farming methods<sup>6</sup>.

In the 1960's the vegetation in Namibia began to change due to over-grazing by livestock. Game did not belong to the landowner and was replaced with livestock, as it had little or no economic value to farmers. A wildlife conservation Ordinance in 1968 gave landowners game ownership, providing an economic incentive for the landowners to maintain game species, which resulted in an increase in game numbers<sup>6</sup>. Coinciding with this was the removal of other larger predators, particularly lion and spotted hyena, from most of the commercial farm areas. These combined factors resulted in an increase in cheetah numbers<sup>6</sup>.

Through the 1970's a wet cycle continued and farmers stocked heavily, two to three times the number of cattle recommended. In the late 1970's, the worst drought of the century to hit the country started and the degenerative effects of a single species, cattle, on the land began to show. Grasses were disappearing and bush was taking over, in many areas as much as 60 % to 90 % of the open grassland became heavy bush<sup>6</sup>. The drought continued and in the early 1980's the wildlife numbers were reduced by 50 % over a 3-year period, due to culling to save pastures for livestock and from natural deaths attributed to the drought<sup>6</sup>. The conflict with the cheetah increased to an all-time high.

Coinciding with these factors, the population of kudu, one of the cheetah's main prey, declined by nearly 80 % due to a rabies outbreak<sup>6</sup>. As the drought progressed its negative impact on livestock farming resulted in the value of wildlife increasing, as many farmers began utilising game as a source of income. Thus any loss of wild game to cheetahs was now an economic issue as well, at a time when predator pressure on livestock and game in game-fenced areas was at its highest. With this increased threat to livestock and the high value placed on game, farmers began a war on the cheetahs. During these years as many as 800 to 900 cheetahs per year were removed from the wild (CITES reports 6 782 free-ranging cheetahs having been removed between 1980-1991)<sup>2</sup>, effectively halving the cheetah population. These removals do not merely represent the loss of individual animals, but have contributed to greater genetic problems for the species.

## Game-fenced Farms

Since 1980, the advent of game-fenced farms has proven to be one of the most critical factors affecting cheetah survival. Portions of farms in areas where game is abundant are increasingly being set aside and high (2.5 m) game fences are erected which alter the ecology of the ecosystem. Many farmers continue to indicate that cheetahs are a big problem in their game-fenced areas. There are a number of factors contributing to these problems which includes the obstruction of natural game migration which negatively impacts free-ranging game numbers. Game is concentrated in high numbers in game camps which serves to attract cheetah to these areas. Game concentrations also result in overgrazing and reduction of natural selection, fewer game calves and smaller animals. Furthermore, the introduction of non-indigenous game which has an inflated value, results in higher economic loss to predators because they are not adapted to Namibian conditions and are easy prey for cheetahs.

Results from CCF's survey indicated that of the farmers interviewed, 19 % (49) were game farmers and they removed over 45 % of all cheetah reported removed in the survey<sup>6</sup>. This constant removal of cheetahs opens territories allowing more cheetahs access to the area, resulting in accelerated removals of cheetahs.

## Conservancies

A new land and wildlife management practice in Namibia is the formation of conservancies. Conservancies consist of adjacent farms joining together in broad units and developing management strategies sensitive to their farmland ecosystem as a whole. Conservancies provide an alternative to managing game on an individual farm basis. Conservancies promote conservation through sustainable utilisation. The advantage of conservancy areas over game farms is that this form of management promotes bio-diversity which includes predators. Besides sustainable use, conservation includes protection, maintenance, rehabilitation, restoration, and enhancement of ecosystems.

## HOW MUCH OF A PROBLEM ARE CHEETAHS?

### REMOVALS VS. LOSSES, A FARMERS PERCEPTION OF A PROBLEM ANIMAL

Deeply ingrained negative attitudes toward the cheetah persist among farmers. Although known to kill smallstock and calves up to six months of age, cheetahs have evolved and are adapted to catching wild game. However, many farmers have eliminated the cheetah whether or not livestock loss to cheetah has occurred, and in many cases, the cheetah is blamed for far more stock losses than they cause<sup>6</sup>.

Results from the CCF survey indicate that in many cases, where livestock was found missing or when the cause of death could not be determined, predation was often assumed<sup>6</sup>. These assumptions can skew data and conclusions drawn about the livestock predator conflict. Incorrect assumptions can also negatively influence the attitudes of farmers towards the cheetah, thereby hindering proper management techniques for predator control.

The primary problem for the cheetah is that most farmers practice preventative management - eliminating the cheetah indiscriminately either through shooting or trapping in live traps and gin traps. Thus problem animals are not targeted and localised removals occur, which can lead to problems as predator populations are disrupted with indiscriminate removals. Attitudes towards the cheetah do not reflect actual loss of livestock nor is there a correlation between actual cheetah problems and numbers of cheetahs removed<sup>6</sup>.

Results from a recent survey carried out by CCF, Namibian Farmers' Predator Questionnaire, out of 111 respondents, two farmers were responsible for removing 28 % (39 animals) of the total cheetah reportedly removed, even though their cheetah problem had decreased<sup>10</sup>. Twelve farmers removed 33 % of the cheetahs and reported increased cheetah problems<sup>10</sup>. Of the 111 farmers who responded to the survey, 40 % reported having no problems with cheetah; 29 % reported their cheetah problem being the same; 13 % reported having greater problems with cheetah and 8 % reported less of a cheetah problem than during previous years<sup>10</sup>.

Poor livestock management practices lead to increased losses to predators and a subsequent increase in "problem animals". Although some predators do become problem animals, the question of what a problem animal is and whether or not predators can be prevented from becoming so

called "problem animals" by sound farm management practices to reduce predator conflict, needs serious attention. Often removing the predator is a case of treating the symptom rather than the problem - which, in many cases, is caused by unsound livestock management techniques.

## LIVESTOCK MANAGEMENT TECHNIQUES TO REDUCE PREDATOR CONFLICT

The key to managing the cheetah on private farmland in Namibia is to reduce the occurrence of "problem cheetahs" in the first place and secondly, the managing actual "problem animals". This can only be done through applied integrated livestock management techniques aimed at reducing predator conflict. In order for agriculture practices to be compatible with the survival of wildlife, new methods and policies of farm management, wildlife management and predator control urgently need to be incorporated into land management.

CCF research has identified the following: 1) the numbers of livestock that have been killed by cheetahs are not as high as were originally thought; and 2) the farmers indicated that over 60 % interviewed do not use any form of livestock protection<sup>6</sup>. Seventy-five percent of the farmers put forth solutions aimed at reducing predator conflict. The solutions suggested by farmers fall into three main categories and include: 1) improving livestock management strategies to reduce conflict; 2) managing wild game to provide an adequate wild prey base for cheetahs on farmlands. Many farmers expressed concern that game numbers were being adversely affected by excessive hunting, resulting in higher livestock losses; and 3) increasing awareness about the cheetah and ways to live with the species, through conservation education programmes<sup>6</sup>.

Many farmers have developed methods to reduce predator problems<sup>6</sup>. A significant number of farmers bring cows nearer to the homestead when due to calf and keep calves in calving camps for added protection, as 60 % of all calf loss occurs under one month of age. Farmers also reported that keeping larger numbers of cattle together when calves were born helped provide additional protection - a case of "safety in numbers". Farmers reported keeping the adult cattle in mountainous areas, and in areas of high cheetah activity, while younger cattle are kept in the safer areas on the farm. A higher rotation of cows with calves through the camp system reportedly also helped reduce losses, as well as monitoring the heifer herds closer, as these first-year breeders have many calving problems and are not the most protective mothers. Raising a more aggressive breed of cattle like the Brahman, Afrikaner or Nguni, culling the cows that repeatedly lose calves and concentrating calving times into one or two seasons also combine to reduce losses. Placing donkeys with calving herds also reduces losses, as donkeys are aggressive and chase away jackals and cheetahs<sup>6, 10</sup>.

To reduce smallstock loss to predators, the use of herders and dogs is effective. In an effort to assist farmers with smallstock losses, CCF began a livestock guarding dog project, importing Anatolian Shepherds, a superior breed of livestock guarding dog, in order to promote the use of non-lethal predator control.

Electric fencing is a viable, economic and effective solution to predator control in game camps<sup>6</sup>. This proven non-lethal predator deterrent has been used successfully world-wide. Electric fences around game farms prevents warthogs digging holes which cheetah use. The use of secure fencing and electric fencing are the only ways to protect valuable exotic game in game camps. The responsibility rests on the landowner to keep predators out of the game camp. Destroying predators once they are in a camp due to poorly maintained fences, is symptomatic of poor farm management. Maintaining wildlife on farms can also help reduce livestock losses by ensuring that sufficient natural prey is available to predators.

None of the above examples of management techniques to reduce predator conflict is sufficient on its own, but should rather be integrated into the daily management of livestock in combination to provide the most satisfactory results. Only after these steps are taken can a realistic assessment be made of what exactly a problem predator is. Opportunistic taking of livestock that is not protected, such as new-born calves in the bush is indicative of poor livestock management and should not warrant the removal of the predator.

## UTILISATION OF CHEETAHS AS A MANAGEMENT PRACTICE

### Trophy Hunting

Namibia has a well developed trophy hunting industry. From 1983-1991, safari hunters took an

average of 21 cheetahs per year<sup>6,13</sup>. Most of these were shot on private land, mainly on game farms or hunting concessions rather than commercial cattle farms or communal land. In 1992, in an attempt to prevent indiscriminate removal, CITES allowed Namibia an annual quota of 150 cheetah to be taken legally as trophy animals or for live export<sup>2, 6, 13</sup>.

To support long-term conservation strategies for the cheetah, the Namibian Professional Hunting Association (NAPHA) established the Rare Species Committee (RASPECO) in 1994. The purpose of RASPECO is to develop guidelines and programmes which will support the sustainable utilisation of a rare species, such as the cheetah, to the enhancement of the species<sup>12</sup>. In this way hunters and farmers may be activated towards long-term cheetah conservation.

Furthermore, a COMPACT for the management of the cheetah, was drawn up by NAPHA's Rare Species Committee. Signatories agree that the cheetah is a valuable resource and that they will co-operate in efforts to ensure survival of the species, including responsible and monitored safari hunting. Farmers additionally agree to control indiscriminate killing of cheetah and manage their property as cheetah habitat. Half the trophy fee is given to the farmer on whose land the cheetah is hunted, thereby providing an economic incentive for the cheetah's existence on farmlands. The signatories of the COMPACT have agreed to donate N\$ 1,000 (of the trophy fee) to the Namibian Nature Foundation to support on-going research for cheetah conservation<sup>11, 12</sup>.

Good hunters are generally good conservationists and play an important role in conservation. Many actively support the management of the resources they utilise. In order for the cheetah to survive, its management must incorporate its habitat, natural prey and a holistic approach to management of the farmlands in which it lives.

The legalising of trophy hunting cheetah is, however, not without its problems. Although the drafting of the COMPACT by NAPHA represents a commendable effort by Namibian hunters to conserve the cheetah, hunters have shown a reluctance to sign the compact, the signing of which is not compulsory. Despite NAPHA's recommendation for their members to sign the COMPACT, agreeing to protect the cheetah as a valuable resource, as of December 1997 only 20 % of NAPHA members have signed. Furthermore, of those hunters trophy hunting cheetah, only a fraction have contributed the N\$1000 donation. Only N\$20 000 has been donated to date<sup>10</sup>. In 1997 alone, 89 cheetah were reported trophy hunted<sup>7</sup>. While the money spent by a trophy hunter during his stay in Namibia may be considerable, the trophy price for a cheetah is low, between N\$10 000 - 15 000. In contrast zoos sell live cheetahs for prices between N\$16 000 - 34 000.

The poor response to the COMPACT is of grave concern, as the COMPACT also represents an undertaking by hunters and farmers to hunt cheetah ethically, for "sustainability" of the species. Without the full commitment of the hunters utilising the species, the objectives of sustainable utilisation cannot be achieved, and added to indiscriminate removals, utilisation will further jeopardise the survival of the species. For this reason the conservation bodies concerned, NGO's, the farmers and the professional hunters need to take urgent steps to ensure that all participants comply with the management techniques.

Compliance with regulations laid down for trophy hunting is critical. The vast area covered by individual cheetahs and the thick bush in most parts of Namibia, combine to make it notoriously difficult to hunt cheetahs in this country. The social nature of cheetah further complicates the sustainable utilisation of this species. Cheetahs are most often found in groups consisting of either brothers which form a coalition, or females accompanied by young. The shooting of animals in these groups is not conducive to the principles of sustainable utilisation - the use of a wild population compatible with its long-term survival and its ecosystem. Shooting females with dependants creates problem animals by leaving animals too young to survive, which may resort to catching easy prey such as livestock. Furthermore, eliminating members of a coalition may leave solitary animals no longer able to hold their territory on their own, and which are used to hunting together, they too can resort to easy prey, such as livestock. Coalition males, due to their ability to hold territories and defend the right to breed, also form the active breeding segment of the male population<sup>6</sup>.

Only single males should be shot, greatly reducing the chances of finding a suitable trophy animal. Since its inception in 1992 the annual quota of 150 animals per year has not yet been met<sup>2</sup>, however, it is not merely the numbers of animals removed, but the impact of their removal on the remaining population that is of primary concern. Furthermore, in 1997, the number of cheetah hunting trophies exceeded Namibian Government expectations by 180 %, highlighting the

inadequacy of the Ministry of Environment and Tourism's previous years monitoring system. Unexpectedly, the indiscriminate removal of cheetah by farmers also increased<sup>7</sup>. American hunting associations are currently campaigning to 'down-list' the cheetah to facilitate the import of trophies into the USA. A less endangered 'listing' may lead to increased numbers of trophy hunted cheetahs. Indications are that the removal of as few as 70 females from the Namibian cheetah population annually will lead to imminent extinction<sup>1</sup>.

### Live trapping

Live trapping of cheetahs for export is permitted according to the annual quota instated in 1992. However, this method has the potential to be one of the most damaging practices hampering sustainable utilisation of cheetahs. Live trapping usually takes place to remove potential "problem animals" or on demand by animals dealers or zoos looking for cheetahs. In both cases trapping is usually indiscriminate, often inadvertently resulting in the removal of more animals than originally intended<sup>4</sup>.

The tourist industry in Namibia is growing, and many farmers compete to promote their "Guest Farms" for tourist accommodation. Increasingly, young wild cheetah are caught and exhibited as farmers try to create additional tourist attractions. Often these cubs die due to incorrect care and are replaced by additional wild-caught animals. In this way game farms can keep tame and semi-tame cheetahs without allowing free-ranging cheetahs on their farms, thus making no contribution to the survival of free-ranging cheetah.

Due to the fact that cheetahs in Namibia typically utilise so-called "playtrees", trapping is most successful at these playtrees. In many cases the problem animals is not targeted, but any cheetahs in the area are trapped at the playtree and removed. Due to the fact that male cheetahs use playtrees more frequently than females, excess males are often shot when females are sought for zoos<sup>5, 6</sup>. The trap is placed near the playtree, and a thorn bush boma makes the trap the only passage to the tree. These trees appear to be a powerful focal point in the cheetah's range, and the significance of these trees has been described by the farmers for over 30 years as the 'newspaper' tree<sup>6</sup>. Cheetahs observe their surroundings from this vantage point, leave their scat on the limbs and urine on the trunk as markers, and it appears that the cheetahs go from playtree to playtree in their circuitous range. Not all farms have playtrees, and these farms are termed as "pass-through farms", as the cheetahs move quickly through on their way to the next playtree<sup>6</sup>.

Once one cheetah in a family group is caught, it is usually held in a holding cage within the thorn bush boma. Its vocalisations will attract the other cheetahs which will then be caught. In this way entire family groups may be removed.

Trapping should be aimed at targeting only the animals responsible for livestock losses, so that cheetahs not causing a problem are not removed. Unfortunately this is an idealistic situation, and much education is needed to halt the indiscriminate removal of non-problem animals as preventative management. The global population of captive cheetah is not self-sustaining, and is largely maintained through the capture and export of wild Namibian cheetah<sup>2</sup>. Cheetahs not suitable for re-release should be made available to supply the demand for new bloodlines in captivity, taking the pressure of non-problem animals. Cheetahs causing livestock losses, but that are suitable for relocation back into the wild, can be considered for relocation to re-establish or supplement populations in protected areas such as National Parks where domestic livestock does not occur.

Currently the indiscriminate live removal and shooting of cheetahs cannot be ignored when considering quotas of legal utilisation practices such as trophy hunting. The annual figure for cheetah removed indiscriminately is unstable and may fluctuate drastically depending on factors such as drought, and serving to severely jeopardise attempts at sustainable utilisation through the implementation of established quotas.

### Large Carnivore Monitoring Programme

Current quotas for the utilisation of Namibian cheetahs are based on the population estimate of 2 500 animals, made in 1986<sup>6</sup>. In order to establish whether or not quotas allocated in 1992 are sustainable or not, accurate data on population dynamics, estimates on numbers and age structure are critical. A Population Habitat and Viability Assessment for Namibian Lion and Cheetah (PHVA) conducted in 1996 reiterated that at a census of the Namibian cheetah population was critical on the list of priorities for the conservation of this species<sup>1</sup>.



A Large Carnivore Management Forum initiated by the Ministry of Environment and Tourism, consisting of a broad selection of members concerned with carnivore conservation in Namibia was established in 1997, with one of its primary objectives being the formulation of a Large Carnivore Monitoring Programme. An intensive tag-and-release programme will be launched during September 1998. The results of this survey will serve as the foundation for reviewing quotas allocated for the utilisation of this population. This survey, which enlists the help of Namibian farmers to trap cheetahs so that they can be tagged and released, provides one of the first opportunities for farmers to become pro-actively involved in the conservation management of cheetah in Namibia.

## RESEARCH: PROVIDING A BASIS FOR SUSTAINABLE UTILISATION

No wild population can be managed effectively unless the management of the population is based on sound research. In order to understand the population dynamics and biology of the Namibian cheetah population CCF has been conducting in-depth research since its inception in 1990.

CCF research study areas include:

- Cheetah Population Biology,
- Cheetah Ecology,
- Cheetah Health and Reproduction
- Human Impacts on the Cheetah

The cheetahs' survival depends on the total ecological system of farmland management, prey species management and habitat stability. Since Namibia's wildlife is in the hands of the landowners, strategies to sustain populations of wildlife for the future must be developed in conjunction with livestock management. The development of effective strategies depends on the ability and the willingness of the local communities to participate in various aspects of wildlife and livestock conservation research programmes and their full understanding of all aspects of the ecosystem. CCF's focus is working with livestock farming communities developing ways to reduce conflict and make alternative management choices available to the landowners, while accommodating farmer's land use needs.

In order to gather information on home range requirements of cheetahs in Namibia, CCF started a radio-tracking programme in 1993. To date information has been gathered on 33 collared individuals, totalling 100 cheetahs. Farmers in the CCF research area (15 000 km<sup>2</sup> near the Waterberg Plateau) allow radio-collaring of captured cheetahs, and release them back into their original territories. Cheetahs are tracked weekly by fixed-wing aeroplane and have been found to have very large home ranges, from 800 km<sup>2</sup> up to 3 000 km<sup>2</sup>, and often cover over 30 km in 2 to 3 days. The ranges of several of the animals overlap, and they appear to avoid each other in the use of their ranges<sup>6</sup>.

Detailed information, including, body measurements, blood and tissue samples (over 300 to date) has added to the development of a comprehensive database and allows for on-going monitoring of the over-all health and genetic status of the population<sup>5, 8, 9</sup>, and screening for infectious viruses in different regions of the country<sup>6</sup>. Understanding the overall health and genetic make-up of the population is critical to the management of the population as it provides information on what underlying limiting factors may affect the long-term survival of this population. CCF recently presented several papers on these issues at the Annual Congress of the Veterinary Association of Namibia, 1997<sup>5, 8, 9</sup>.

Morphological abnormalities are also included in this data-base. Three distinct morphological abnormalities have been reported in free-ranging cheetah<sup>5</sup>. A distinct kink in the tails, as well as two dental abnormalities, focal palatine erosion (FPE) and crowded lower incisors. Since 1995, 19 % of the cheetah which CCF has handled have been recorded with a distinct kink in the posterior tail vertebrae<sup>5</sup>. This is the first documenting of this abnormality in the wild population. Prior to this, tail abnormalities such as a short tail and a curl in the tail were occasionally noted in the captive population. A distinct kink in the tail vertebrae has been reported in isolated populations of Florida panthers (*Felis concolor coryi*), a species of North American cougar that has less genetic variation than any other cougar subspecies or other feline species, and is nearly as low as the level of allozyme variation reported in the cheetah. This morphological characteristic has only rarely been seen, and occurs at low frequencies supporting the traits' genetic basis.

Overall 181 animals have been reported by CCF to have one or both of the two dental morphological abnormalities, focal palatine erosion and crowded lower incisors. A high incidence of Namibian cheetahs have been recorded by CCF with deep impressions in the upper palate, possibly a predisposition to focal palatine erosion, and several wild-caught cheetahs have had FPE<sup>5</sup>. FPE is a condition where the lower molars break through the upper palate.

The other abnormality seen in Namibian cheetahs includes a high incidence of cats with crowded, crooked and maloccluded lower incisors. The crowding varies from slight to severe where incisors are arranged in two parallel rows. The occurrence of crowded lower incisors was recorded after CCF began to notice this abnormality in many free-ranging cheetahs examined. Sixty-four percent of 123 animals were recorded as having crowded lower incisors<sup>5</sup>.

These preliminary observations may reveal a reduction in genetic diversity correlated with skeletal and congenital abnormalities that severely threaten the survival of the cheetah. Dental abnormalities may be significant due to the challenges cheetahs face in the wild. Severe problems have already been attributed to FPE in captive cheetah collections therefore it is important to establish whether these defects have a negative impact on their ecology in the wild. Since incisor teeth are used by cheetah to skin their prey, a malocclusion may theoretically make skinning more difficult thus allowing more time for other predators to steal their food.

The history of drastic reduction of this cheetah population over a relatively short period of time, along with the morphological features are consistent with the occurrence during the cheetah's recent history of one or more population bottlenecks, followed by period of inbreeding. These preliminary observations may reveal a reduction in genetic diversity correlated with skeletal and congenital abnormalities that severely threaten the survival of the cheetah<sup>5</sup>.

## EFFECTIVE MANAGEMENT THROUGH EDUCATION

Effective conservation action is best built upon examination of available biological information but is very much dependent upon the actions of human beings within the range of the threatened species. The survival of the cheetah population in Namibia will be determined primarily by the private commercial farmland landowners, consisting of some 1 200 farmers, as it is on their land that the remaining cheetah population lives. Namibia's cheetah population cannot be managed without the commitment and participation of these landowners. How they manage the population will depend on what kind of information they are provided with and how successful efforts are to change negative perceptions of this predator. Over 95 % of the farmers interviewed during CCF's initial survey indicated that they had no idea of the problems facing the cheetah's survival nor of how important they, as well as the Namibian cheetah population, are to this species' survival<sup>6</sup>. This statistic indicated a gross lack of information to the most important segment of the population concerned with the survival of the cheetah.

Since its inception, CCF is educating farmers, teachers and the general public about the need and ways to conserve Namibia's rich biodiversity, the role of predators such as the cheetah in healthy ecosystems and livestock management practices to reduce predator conflict. Education programmes consist of formal and informal education carried out throughout the country, as well as internationally. CCF works with students of all ages, students that will soon take on roles as teachers, wildlife managers or farmers. Since its inception, over 50 000 school children have been taught by CCF's travelling educational programmes.

CCF has been instrumental in the development of a 170 000 ha wildlife conservancy area together with neighbouring farmers. As a member of the Waterberg Conservancy, CCF is contributing to local economy through eco-tourism as several Conservancy farmers have recently developed guest houses which are increasingly being supported by visitors to CCF's Research and Education Centre. CCF's Education Centre has hosted over 2 000 students in the past three years.

CCF works extensively amongst the Namibian farming community, gathering and disseminating information and dealing with predator problems and related issues. The vast majority of cheetahs dealt with were not trapped because of livestock depredation but just because the farmers saw them. It is not a problem for these animals to go back into the wild. CCF works in co-operation with the farmers to find the best solution to each cheetah caught. Through research CCF has been able to show farmers that indiscriminate catching can cause greater problems for them, by opening up

territories, thus allowing other cheetahs access to the area. In certain cases, indiscriminate catching can actually create a problem animal, for example, through the separation (breaking up) of a family unit (i.e. female and sub-adult cubs). Therefore over 170 cheetah have been tagged and re-released back into their home-ranges.

## CONCLUSION

While both tourism and trophy hunting help conserve cheetahs on private land in Namibia, their contribution at present is of limited utility, and does not begin to compensate for the hundreds of cheetahs indiscriminately killed annually on cattle farms as "problem animals"<sup>12</sup>. If the contribution of economic use options for the conservation of cats outside protected areas is to be increased, specific co-operative effort on the part of conservationists and the tourism and trophy hunting industries is required.

Trophy hunting cannot be considered a replacement for problem animal control because livestock predation does not always necessarily occur at times when hunters are active. Also the dense bush and vast distances covered by cheetahs make them extremely difficult to track and hunt.

The management of problem animals on private land is a complex, difficult issue. When an endangered species is involved, the necessity for crisis management can further complicate matters. Namibia is fortunate to be in a position where cheetah numbers are, at this stage, sufficient to sustain the population. However, with growing human population expansion and the demand for more land and increased pressure on resources, time is running out for the cheetah. Research has shown that much of the genetic predicament the cheetah finds itself in today was caused by a historical bottleneck, followed by more recent regional bottlenecks, of the population<sup>13</sup>. If this same scenario were to happen again, could the cheetah, with its genetic limitations, withstand the environmental and ecological changes?

The extensive nature of farming practices in Namibia has inadvertently maintained habitat favourable for cheetah. The primary problem is conflict with livestock farming, to which there are solutions other than traditional lethal predator control. Sound management of predator populations has to include the judicious management of livestock and valuable game to reduce predator conflict, thereby reducing the number of problem animals that need to be managed.

The challenge lies in implementing these solutions timeously to ensure the continued survival of this population of cheetah, which could ultimately mean the difference between survival and extinction for this species.

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