CHEETAH SURVIVAL ON NAMIBIAN FARMLANDS

L. Marker, D. Kraus, D. Barnett, and S. Hurlbut

ISBN: 99916-30-62-7

First Edition: 1996
Second Edition: 1999
Third Edition: 2003

Design and Typography: Paul van der Bijl

Production & Colour Separations: NexDigital, Windhoek

Printed by Solitaire Press, Windhoek

Publication sponsored by:
The Cotswold Foundation, Cincinnati, Ohio, USA

Dedication

To all Namibian farmers in whose hands lay the future of the cheetah.
Thank you for caring.

Laurie Marker: Co-Founder and Executive Director of the Cheetah Conservation Fund has a Bachelor of Science from Easter Oregon State University. She began her cheetah research in 1974 in Oregon where she developed one of the world s top three captive cheetah breeding programmes. Beginning as a veterinary assistant she soon became the Curator of Cheetahs, as well as the Marketing and Education Director. In 1977 she first came to Namibia to conduct cheetah research. In 1987 she developed the International Cheetah Studbook, registering and coordinating captive cheetah management. In 1988 she joined the Smithsonian s National Zoological Park as the Director of the Center for New Opportunities in Animal Health Sciences and remains a Research Fellow. Internationally, she is a vice-chair for The IUCN Cat Specialist Group. In 1990, Market Co-founded the Cheetah Conservation Fund and moved to Namibia where she still lives. Between 1991 and 1993 she traveled through the Namibian farmlands discussing cheetah problems with the farming community, which resulted in this publication.

Dan Kraus: Co-founder of the Cheetah Conservation Fund, majored in Wildlife Management at Montana State College and worked at two safari parks. Dan travelled extensively worldwide and worked on a variety of research projects. Before travelling to Namibia in 1991, he worked at the Smithsonian National Zoo s NOAHS Center. Dan co-directed CCF from 1990 to 1996, where between 1991 and 1993 he also conducted the farmland survey.

Sandra Hurlbutt: Was Assistant Director of the Cheetah Conservation Fund from 1994 to 1996. After obtaining a Veterinary Certificate and Master Degree from Texas A & M in Reproductive Physiology in 1987, she worked at the Smithsonian s National Zoological Park in Washington, D.C., and the White Oak Conservation Center in Florida until she joined CCF.

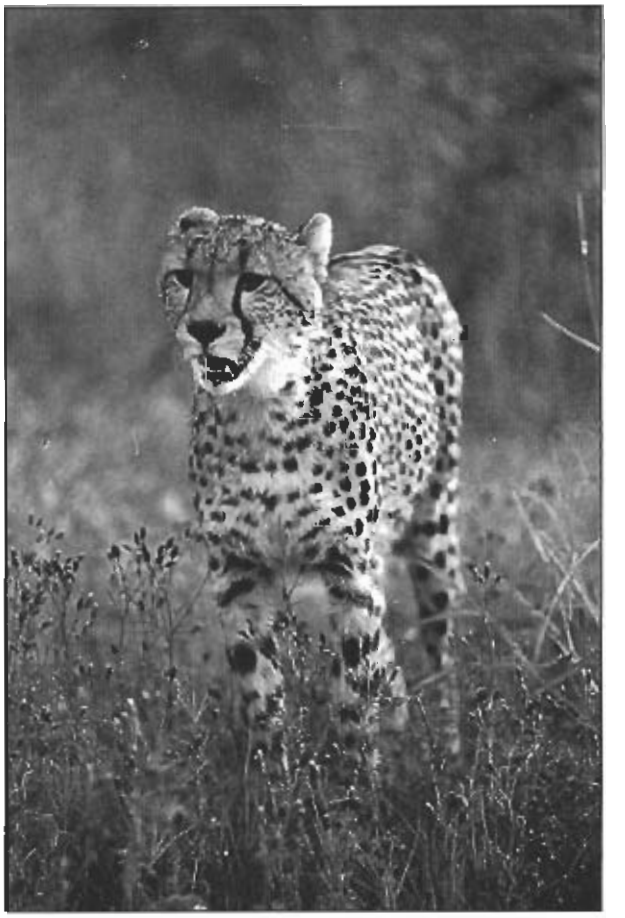
Debbie Barnett: Was a final year PhD, student in Reproductive Physiology from University of Wisconsin when she volunteered with Cheetah Conservation Fund in 1994. During her time in Namibia she not only worked on the survey, she was also involved with CCF s education programmes.

Contents

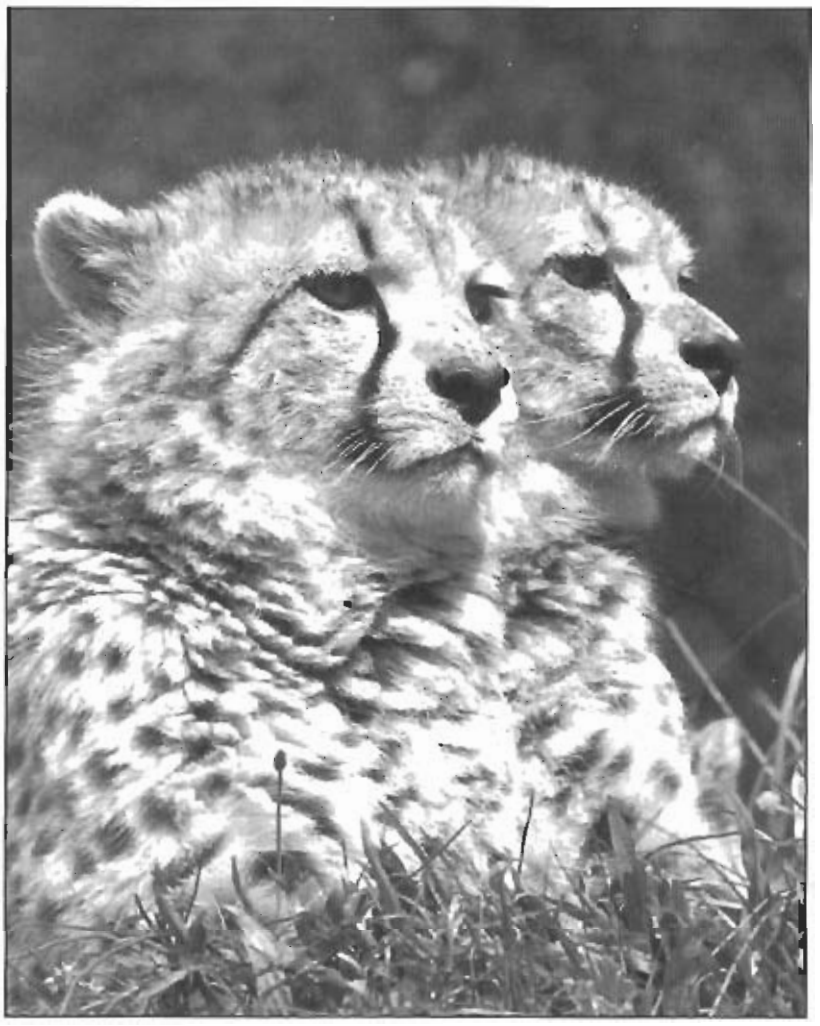
List of Tables & Figures

ACKNOWLEDGMENTS:

Funding and support for this project came from the WILD Foundation, Bay Foundation, Weeden Foundation, Namibian Nature Foundation, South Africa World Wildlife Fund, African Wildlife Foundation, Humane Society, Conservation Endowment Fund, Earthkind, Endangered Wildlife Trust, Mazda Wildlife Fund, and Total Petrol—South Africa. The survey could not have been done without the cooperation of the participating farmers who graciously took the time to talk with us and answer our questions. Enough thanks can not be given to Wes and Mary Kruger for their unending support and encouragement. We would like to thank all the Cheetah Conservation Fund volunteers that have helped in the formation of this report, especially Karin Bierbaum, Matt Carpenter, Ben Simon-Thomas, Wick Pancoast, Kris Sarri, Doug Amspaugh, and Stephen DeVincent. Thanks goes to Jorn Staby for helping with the development of the database program. Deep appreciation goes to the Fritz Hein Family, Volker Grelman and Anvo Safaris, and Birget and Hagen Eggert for housing during the survey. We would like to acknowledge Kim Hare and Dr. Roger Paskin from the Ministry of Agriculture, Water and Rural Development's Department of Vet Services (DVS) for compiling all of the DVS data used in this report. We are also grateful to Lynne Kruger-Vincent and Elisabeth Braun for translations of historical reports. Critical reviews were from Dr. Hu Berry, Dr. Linda Munson, Dr. Mary Sealy, Dr. Jock Orford, Dr. James Teer, Dr. Ben Oke, Peter Erb, and Kim Hare. Editorial comments were from Dr. Betsy Fox. Once again, we are grateful for the contributions and efforts of the farmers, and hope we have been able to help them with their predator management and understanding the uniqueness of the cheetah on their Namibian farmlands.



QUICK REFERENCE



Global estimates indicate that cheetah (*Acinonyx jubatus*) numbers have decreased from 100 000 in 1900 to as low as 12 000 in 1995. Due to loss of habitat to rising human populations, the wild cheetah populations are jeopardised by:

(1) a decline in the abundance of prey species,
(2) the conversion of land to agriculture and livestock farming, and
(3) conflict with livestock farming interests.

The largest population in the wild is found in Namibia, primarily on commercial livestock farmlands, and is estimated at 2 000 to 3 000 animals. Therefore, it is critical to establish the status of Namibia's cheetah population and determine the attitudes for its survival in the country.

From 1991-1993, the Cheetah Conservation Fund (CCF) conducted an in-depth survey of Namibia's north central commercial farmlands. The survey addressed physical features, livestock management techniques, predator problems, recommendations to reduce predator conflict, and observations of cheetah. Data collected was correlated with historical information and Namibia's Ministry of Agriculture, Water and Rural Development statistics. It was evident from the survey that the Namibian farmers play a critical role in the survival of the species. Indiscriminate removal of cheetah for livestock and game protection appeared to be one of the biggest threats to the species, as well as counterproductive for predator control. Adjustment of livestock and game management methods may be more effective in reducing predator conflict. CCF recommends management techniques to ensure maximum diversity of wildlife through non-lethal and preventative predator control methods. This will not only reduce conflict with the cheetah and other predators, but will work in harmony with the ecosystem.

The following outline, with page references to the text, serves as a quick reference for key information from the main text.

INTRODUCTION AND BACKGROUND

Introduction

Population Estimates: The stage has been reached where the world population of cheetah, estimated to be 100 000 in 1900, has been catastrophically reduced to between 12 000 and 15 000, of which 2 000 to 3 000 occur in Namibia. Namibia is home to between 20% and 30% of all living cheetah, making it the 'Cheetah Capital of the World.' (p1, 3)

Location of Namibian Cheetah: Ninety percent of Namibia's cheetah occur on commercial farms. Namibia's cheetah are an important genetic resource to ensure survival of the species, therefore the Namibian farmers play a key role in the cheetah's survival.(p1)

Jeopardising Factors: Due to loss of habitat to rising human populations, the wild cheetah (Acinonyx jubatus) populations throughout their range are jeopardised by:

(1) a decline in the abundance of prey species;
(2) the conversion of land to agriculture and livestock farming; and
(3) conflict with livestock farming interests.
(4) due to competition with larger predators, few reserves support viable populations to help ensure survival of the species. (p 1)

Long-term Survival: Maintaining habitat and developing strategies for maintaining free-ranging cheetah populations outside protected reserves are critical for long-term survival of the species. (p 4)

Captive Population: Ten percent of the world's cheetah population lives in captivity and is unable to sustain the survival of the species due to poor reproductive success and high infant mortality. The wild population supports the captive population through imports, but the wild population is declining. (p 4)

Removals: According to CITES (Convention on International Trade in Endangered Species) records, from 1980 through 1991, a total of 6 818 cheetah were removed from Namibia (for protection of livestock, trophy hunting or live export); however, this is believed to be an underestimate, as many removals are not reported. (p 4)

Background of the Namibian Farmland Ecosystem

Aridity: Namibia's harsh farming conditions are underscored by the fact that 16% of the country's total area is hyper-arid (true desert), where agriculture of any kind is excluded. Furthermore, of the remaining area, 49% is classified as arid, 32% as semi-arid and only 3% as sub-humid. (p 5)

Drought: Droughts are frequent and unpredictable in Namibia, and are believed to be normal aridity to many people. The recent drought phase has lasted over 15 years. (p 5)

Land Use: Fifty-one percent of Namibia's agricultural land is suitable for cattle farming and 33% is suitable for smallstock farming. There are nearly 6 000 commercial livestock farms utilizing 44% of Namibia's available agricultural land. (p 5)

Game Occurrence: As much as 70% of the game species and 90% of the cheetah occur on commercial farms. (p 6)

Effects on Cheetah: Europeans began farming livestock commercially in Namibia 1884, and during the past 100 years cheetah numbers have been affected by farming practices and natural events such as droughts and disease. (p 6)

Altered Biodiversity: Nature's diversity ('biodiversity') on these farms has been drastically altered. There has been over-grazing by livestock, extensive fencing, constant water availability, and natural events, which all have encouraged severe bush encroachment by excessive removal of game and predators. (p 6,7)

Bush Encroachment: The bush encroachment over the last 30 years has significantly decreased the productivity of nearly one-third of Namibia's livestock farmlands. (p 6)

Historical Status of the Cheetah on Commercial Farmlands in Namibia

Adaptions and Conflict: Namibia's cheetah have adapted well to living on farms because competitive predators like lion and spotted hyaena have been removed, natural prey is abundant, and drinking water is relatively easy to obtain at permanent water points for both the game and cheetah. However, the cheetah has been in constant conflict with farming interests. (p 6, 7)

Causes of Decline: The cheetah's conflict with man in Namibia has evolved over many years and has been affected by drought conditions, economic considerations, farming practices and environmental regulations. None of these is solely responsible for the cheetah's present status on the farmlands, but their combined and cumulative effects have altered the population, by causing a rapid decline in the recent past. (p 6-12)

Endangered Species: The world's cheetah population had declined so severely since the early 1900's that in 1975 the World Conservation Union (IUCN) placed cheetah on the list of Endangered Species (CITES Appendix I). This law prohibits the sale of live cheetahs and skins. (p 9)

Population Decrease: Namibia's cheetah population decreased from at the most 6 000 in the 1970's to the present 2 500. (p 1)

Protected Animal: In 1975 a SWA/Namibian Nature Conservation Ordinance classified the cheetah as a 'protected animal,' and allowed for its removal from the farmlands only in the case of specific livestock predation. Most of the removals though, have been indiscriminate and not related to livestock predation. (p 9)

Commercial Demand: Early records of removal of cheetah on farmlands indicate that commercial demand for cheetah encourages this indiscriminate capture without regard for law as stated in the 1975 ordinance. (p 11)

Natural Disasters: Two natural disasters occurred simultaneously in the early 1980's, negatively affecting the cheetah population: the 'drought of the century' and a rabies epidemic in kudu (a primary prey for the cheetah). Due to the denuded pastures from the drought, farmers reduced game populations by 60% by culling to save the pastures for livestock. With many game species being the cheetah's prey, the cheetah was affected by this reduction. (p 7, 8)

Livestock Loss: During this time, a large percentage of livestock loss was due to natural causes and farm management practices. However, the farmers' negative perception of the cheetah peaked then and approximately 800 cheetah were removed from the farmlands per year. (p 8)

Game Farms: Additional pressure on cheetah developed in the early 1980's with game farming, when game-proof fences were erected and valuable exotic wild herbivores were introduced, making the loss of any game a greater economic issue. (p 8, 9)

1983 Research: In 1983, due to the conflict between farmers and cheetahs, the Directorate of Nature Conservation and Tourism initiated an intensive research project to investigate the causes of conflict. This three-year project concluded the following:

(1) the farmers had strong opinions and attitudes about the cheetah;

(2) the cheetah was perceived by farmers as the worst problem animal, allegedly responsible for large financial losses;

(3) the sighting of cheetah or spoor (tracks) led to a natural reaction ascribing livestock loss to cheetah predation;

(4) a large percentage of calf loss was due to natural causes (i.e. disease, poor nutrition, stillbirths, etc.) and not cheetahs; and

(5) further research was necessary. (p 8)

Limited Trade: In 1992, CITES allowed limited trade in Namibian cheetah (annual quota of 150) in an attempt to reduce indiscriminate removal of cheetah. (p 10)

NAPHA: In 1994, the Namibian Professional Hunters Association (NAPHA) developed a special subcommittee called RASPECO (Rare Species Committee) to develop guidelines and programs to support the sustainable utilization of rare species such as the cheetah, to the enhancement of the species. (p 10)

MINISTRY OF AGRICULTURE, WATER AND RURAL DEVELOPMENT'S STATISTICS RELATING TO NAMIBIAN CHEETAH

The following information is published with the permission of the Ministry of Agriculture Water and Rural Development, Directorate of Veterinary Services (DVS). DVS Animal Health Inspectors collect information from farmers south of the Veterinary Cordon Fence on a biannual basis. An average of 80% of the commercial farms and stock inspection points in Namibia were inspected annually by DVS during a 8-year period (1986-94). No general survey of wildlife on farms is available from the Ministry of Environment and Tourism since 1983, therefore, DVS figures for 1986 - 1994 are the most current available from the government.

Livestock Loss: In this period 2% of the country's farms reported cattle loss and 11% reported smallstock loss to predators. Of the number of livestock lost due to predators, 29% of the cattle loss and 3% of the smallstock loss were attributed to cheetah by the farmers. (p 14)

Predators Destroyed: In comparison, 100 066 predators were destroyed on these farms (1986 - 1994), of which 1094 (1,1%) were cheetah. (p 15)

Cheetah Killed: However, the number of cheetah the farmers reported killing during this period decreased by 94% (390 killed in 1986 to 23 killed in 1994). (p 15)

Cheetah Removal Discrepancies: There are discrepancies in the official number of cheetah removals as reported by CITES and DVS. The number of cheetah killed according to DVS is 1 266 fewer than reported by CITES during the period (1986 - 1991). Because of these discrepancies, CCF encourages farmers to accurately report data, as it will aid in the development of management strategies. (p 16)

Protective Management: Between 1989 and 1993, and average of 9% of the cattle farmers and 7% of the smallstock farmers were questioned on their protective management techniques. Only 38% of the cattle farmers used calving camps, and only 19% corralled ('kraaled') their cattle. In the case of smallstock farmers, 49% used lambing camps, 69% used corrals, and 42% used a herder. (p 16)

Wildgame density: Using averages of wildgame density reported to DVS by farmers, 2 373 (33%) out of 7 251 farms provided the following estimates of wildlife numbers during 1989-93: 70 392 gemsbok, 58 054 springbok, 59 387 kudu. (p 17)

Extrapolated Wildgame Totals: Because the farms were surveyed throughout Namibia, it was possible to extrapolate total numbers for these species on commercial farms as follows: 213 000 gemsbok, 176 000 springbok, 180 000 kudu. These estimates are approximations only; however, they represent the best available data on these species. (p 17)

CHEETAH CONSERVATION FUND'S FARM SURVEY RESULTS

The following information was collected by CCF during its Farm Survey 1991-1993. Two-hundred-forty-one farmers in the north-central commercial farmland district were surveyed to gain an understanding of livestock/predator issues as they relate to cheetah in Namibia. The following points refer to the survey area only and are derived from the comments of survey participants.

Survey Area

Geographical Area: An area of 2 671 908 hectares representing 14,5% of Namibia's commercial cattle farms, was surveyed in the districts of Gobabis, Windhoek, Okahandja, Otjiwarongo and Grootfontein in the regions of Omaheke, Khomas, and Otjozondjupa. (p 19)

Livestock and Game Numbers: Livestock numbers (243 972) accounted for 66% and game numbers (132 534) accounted for 34% of animals on surveyed farms. Eighty-eight percent of all game was free-ranging (outside of game-fenced areas), and 20% of the game was in game-fenced areas, of which 15% was exotic (non-indigenous species). (p 23)

Cheetah Problems

Definition: It is difficult to define a 'cheetah problem,' because livestock loss specifically due to cheetah may be unknown and farmers' perceptions of predation may differ. Many farmers accept losing one or two calves a year, while others find any loss an economic hardship. (p 20)

Farm Size: Farms were classified as small (less that 7 000 ha), medium (7 000 to 15 000 ha) and large (more than 15 000 ha). Larger farms reported more cheetah problems, primarily due to less intensive farm practices. (p 22)

Game Farms: Nine percent of the area surveyed was game-fenced. These farms did not have more problems with cheetah, yet they removed high numbers of cheetah. (p 22)

No Cheetah Problems: Seventy-five percent of the 241 farmers in the survey were not having cheetah problems at the time of the survey. (p 30)

Ratio of Game to Cattle: Farms that reported problems with cheetah had a lower ratio of game to cattle than farms with no cheetah problems. (p 23)

Reported Losses

Cattle and Small Stock Loss: In the survey area, loss of cattle to cheetah comprised 33% of all predation, while loss of smallstock to cheetah comprised 22%. (p 28)

Age of Calves: The average age of the calves lost to cheetah was 4.4 months, with 51% of the total under three months of age. Few calves older than six months of age were killed by cheetah. (p 30)

Corralled Smallstock: Corralled smallstock, if not sufficiently protected, can suffer high losses, as once a predator approaches, their panicked movements stimulate the predator's killing instinct.

Other Predators: Farmers said they experienced more problems with black-backed jackal, caracal (rooikat), and leopard than with cheetah. However, cheetah were removed in higher numbers than leopard. (p 30, 31)

Additional Losses: Additional livestock losses were due to baboon, snake, aardvark burrows, poisonous plants, droughts, disease and stock theft. (p 32, 33)

Game Losses: Game losses to cheetah, especially loss of exotic wildlife on game-fenced farms, caused 49 game farmers to remove 1 280 cheetah, representing 45% of the total cheetah removals for the survey area during the two-year survey period. (p 33)

Exotic species: The majority of loss to cheetah in game-fenced areas is exotic species, because they are more vulnerable to predation than indigenous species. (p 33, 34)

Management Techniques

Calving Camps: Many methods of stock protection have been used by the farmers. The most prevalent technique used to prevent livestock loss was a calving camp. This technique was used by 43% of the farmers surveyed. (p 35)

Number of Camps: The number of camps a farm was divided into did not appear to influence predation pressure on livestock; however, farms with more camps tended to practice more intensive livestock management, thus reducing predator conflict. (p 25)

Calving Season: Calving seasons varied between farmers, but the peak calving months were November, December, and January. Heifers, which usually calve first, suffered greater calf loss than experienced cows, in particular when calving in the winter months. (p 27, 28)

Cattle Breed: Many farmers feel that Brahman, Brahman crosses and Afrikaner cattle are more protective of their calves and are better adapted to the Namibian environment. However, due to the differences in farm management practices and inaccurate reporting of livestock loss to predators, it was unclear whether farmers raising these particular breeds had lower rates of predator loss. (p 26)

Guard Animals: Donkeys were used successfully as guard animals accompanying a calving herd to deter predators. Likewise, the use of guard dogs, baboons and herders for smallstock was found to reduce loss. (p 37 - 39)

Electric Fences: Electric fencing was found to be worth the investment in the long-term to protect especially valuable game. (p 39, 40)

Cheetah Removals

Numbers Removed: During the past 20 years perhaps more than 10 000 cheetah may have been removed from farms. (p 44)

Removals vs Losses: Sixty-five percent (157) of the survey participants reported removing a total of 2 845 cheetah (1980 - 93) from the survey area. Yet, when removals were compared to specific livestock losses, there was an indication that removal of cheetah was not in response to specific loss of livestock. (p 43)

Removal reports: There was a large discrepancy between the reports to CCF in its farm survey and both the DVS and CITES figures on the number of cheetah removed from the farmlands. This indicates a vast variation in the number of cheetah removals reported, and questions the accuracy of official reports. (p 43, 44)

Removal vs Problem: CCF's survey found that a few farmers removed a large number of the cheetah. An interesting point was that those farmers who removed large numbers of cheetah did not observe cheetah more frequently on their farms, again representing a farmer's attitude versus an actual cheetah problem. (p 44, 45)

Male vs Female: More male than female cheetah were removed from the farmlands. (p 47)

Playtress: Farmers with cheetah 'playtrees' (specific trees that cheetah frequent) tended to remove more cheetah than farmers without playtrees, even though they had no higher incidence of problems with cheetah, possibly due to the fact that cheetah are easily caught at playtrees. (p 54)

Opening Territory: When cheetah are removed from an area, the territory is opened up, which encourages new cheetah to move into the area. Cheetah activity may increase on a farm until the territory is re-established. (p 45)

Short-term Solution: Removal of cheetah is a short-term solution. Without re-evaluation and restructuring of management techniques, cheetah problems can re-occur or increase. (p 45)

Cheetah Observations

Sighting Frequency: Almost half of the farmers sighted cheetah at least monthly, and nearly one-fifth saw cheetah or spoor on a weekly basis. (p 51)

Sighting vs Problem Perception: The more cheetah were observed on a farm, the more they were perceived as a problem, even though they were not necessarily connected to specific livestock loss. (p 52)

Group Size: Not previously considered social, up to 18 cheetah (adults and cubs) were seen together by the farmers. The average group size observed was 5. (p 55)

Litter Size: The average litter size observed by farmers was 3,4 (range of one to eight). (p 59)

Prey Species: The farmers who observed cheetah kills reported that the cheetah's wild prey consisted of the following 16 species, listed in order of frequency: kudu calves, springbok, warthog piglets, steenbok, gemsbok calves, hartebeest calves, duiker, eland calves, blesbok, ostrich, smaller game birds, guinea fowl, impala, hares, dik-dik, and kori bustard. (p 49)

Cheetah Behaviour and Habits

Home Ranges: Male and female cheetah home ranges may overlap, and individuals may move up to 26 km a day. Individual male cheetah occupy large ranges of more than 1 500 km^2, often moving through a number of farms in the process. Their ranges may vary according to mate selection, prey availability, etc. For these reasons, it may be easy for farmers to overestimate the number of cheetah on their farm. (p 50)

Play Trees: Male cheetah with overlapping ranges share 'playtrees,' which they scratch and scent-mark with urine and faeces. Female cheetah in heat may visit these playtrees to attract male attention. (p 53, 54)

Hunting: Cheetah hunt mostly by day and may go several days between kills. Cheetah eat rapidly to escape detection by other predators. When other predators are not around (as is the case on most Namibian farmlands), they take larger prey and may stay on their kill up to several days. (p 50)

Role in Ecosystem: The cheetah is a top predator, providing food to other inhabitants of the ecosystem. Carcases not consumed entirely by cheetah provide food to a variety of scavengers and smaller predators, therefore, carcases are not wasted. (p 50)

Opportunistic: Cheetah are opportunistic hunters. They prefer game over livestock, but will prey on unprotected and vulnerable livestock such as calves, goats or sheep. (p 49)

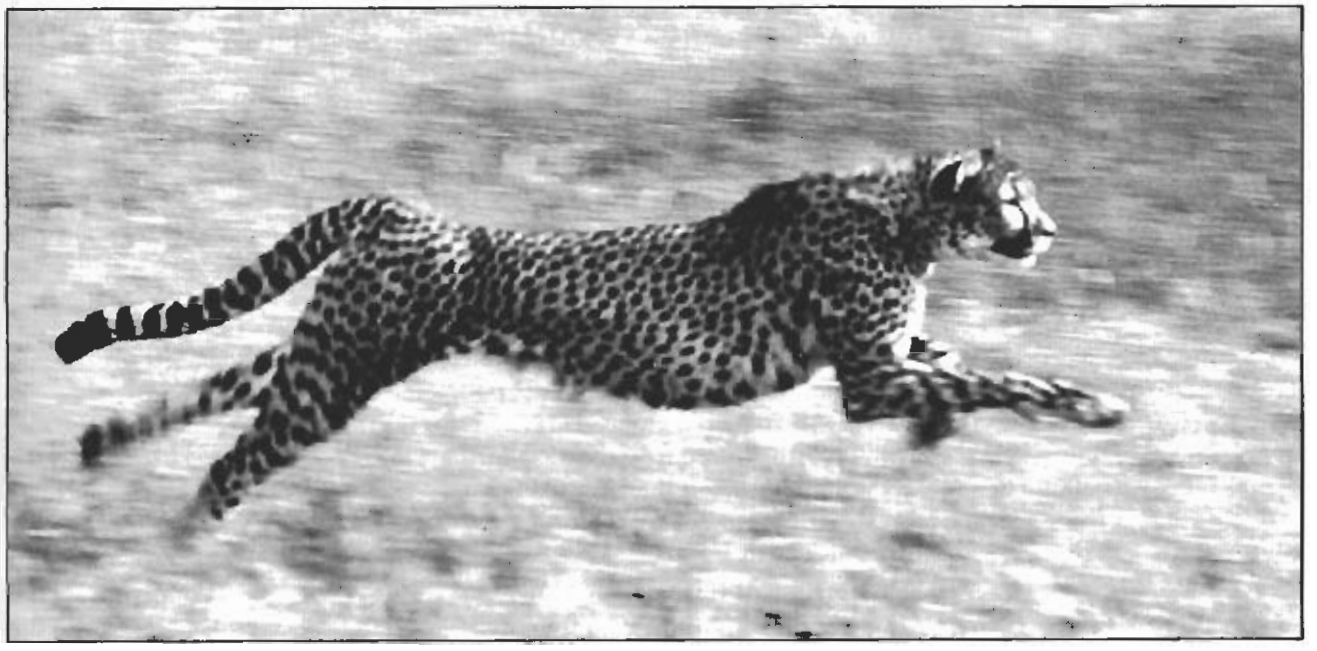
Competition: Leopards and baboons can be limiting factors for the cheetah population due to their more aggressive nature, as they can kill cheetah cubs and compete for the same prey and chase cheetah off kills. (p 52)

Reproduction: Female cheetah start breeding around two years of age, and have a gestation period of about 90 days, with a litter size ranging from one to eight (averaging three to four). In East Africa, fewer than 5% survive to adulthood. (p 57)

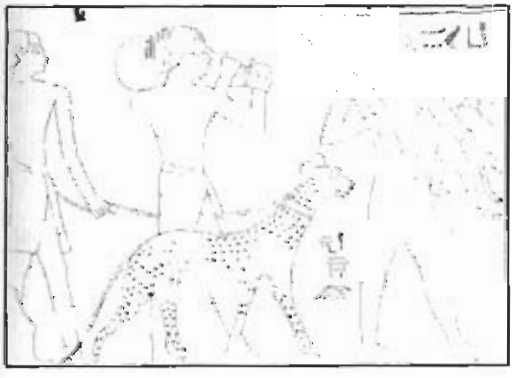
Cubs: Cubs are born throughout the year and leave the den to follow their mother at approximately 6 weeks old, when they begin eating meat. The cubs are weaned at three months, and become independent of the mother between 16 and 20 months old. Cubs from the same litter will stay together when they leave and males will stay together for life, forming coalitions (groups of brothers that hold a territory and hunt together). (p 57, 58)

Captive Cheetah: Captive born and/or hand-raised animals are not recommended for release into the wild. They have not learned survival skills from their mother and could potentially turn into problem animals. Without learned hunting skills, they may prey on livestock for survival and not have a natural fear of people.

I. INTRODUCTION



The world's fastest land mammal.



Cheetah were considered goddesses in early lower Egypt and kept by pharaohs as pets to protect the royal throne. From the tomb of Amunedjeh.

The cheetah *(Acinonyx jubatus)* is the most specialized of all the 37 species of cats. As the world's fastest land mammal, it can reach speeds up to 110 km/hour. The cheetah is built for speed versus power like other large cats. Its flexible light weight skeleton, lean body, small head and specialized organs are all designed for speed. With unique groved and hardened pads like tyre treads and semiretractable claws, the cheetah is able to grip the ground during high speed acceleration and pursuit. Its powerful tail acts like a rudder, keeping it balanced during the chase. It is further set apart from other large cats by its nonaggressive, shy nature. When challenged by other predators, the cheetah is the one that backs away. The cheetah's nature and hunting skills are so unique that it has been kept extensively by royalty for pets and hunting sports for nearly 5 000 years. This beautiful unique cat has inspired and intrigued people for centuries. However, today the cheetah's survival is in jeopardy.

Due to loss of habitat to rising human populations, the wild cheetah populations are jeopardised by:

(1) a decline in the abundance of prey species;
(2) the conversion of land to agriculture and livestock farming;
(3) conflict with livestock farming interests; and
(4) poaching and illegal trade [71, 107, 42, 84, 36, 106, 89]

Rapidly declining cheetah populations result in a smaller, less diverse gene pool. Consequently, viable breeding populations are found in fewer than half of the countries where cheetah still live. Neither protected reserves nor captive management can be relied on to support the survival of viable populations of the species.

Namibia has the largest remaining population of free-ranging cheetah [70, 45] This population of 2 000 to 3 000 cheetah (half of the estimated 1980's population[42]) is found in a contiguous area across more than 275 000 km^2 of Namibia's commercial livestock farmland. Approximately 1 000 farmers control the cheetah's fate in this area because the cheetah is in direct conflict with livestock farm practices. The majority of farmers perceive the cheetah as a threat to their livestock and game, and

therefore do not have a positive attitude towards its existence. If the cheetah is to survive on the farmlands in Namibia, these attitudes must change [68, 69].

Efforts have been underway by Namibia's Ministry of Environment and Tourism (Formarly the Directorate of Nature Conservation and Tourism of the South West African Administration - SWAA), Ministry of Agriculture,Water and Rural Development, Ministry of Education and Culture, as well as non-governmental organizations, including the Cheetah Conservation Fund (CCF, see Appendix I), to influence the farming community in managing and conserving a healthy ecosystem for wildlife. CCF is a nonprofit organization established in 1990. CCF's mission is to develop and implement long-term monitoring, multidisciplinary research, and conservation efforts for the survival of the free-ranging cheetah and its ecosystem in remaining habitats in Namibia and other appropriate areas of Africa. A main focus of CCF is aiding the farm community in predator management. CCF serves as a resource for farmers and actively promotes awareness of conservation issues.

Before recommending management for the cheetah, CCF deemed it necessary to establish a database on the farmlands that included farmers' attitudes and recommendations. CCF collected current information on the Namibian farmland ecosystem and the livestock/predator conflict during their Farm Survey. Historical information was obtained from the Namibian Ministry of Agriculture, Water and Rural Development's Department of Veterinary Services (DVS) records (of Animal Health Inspectors' Farm Visit Forms).

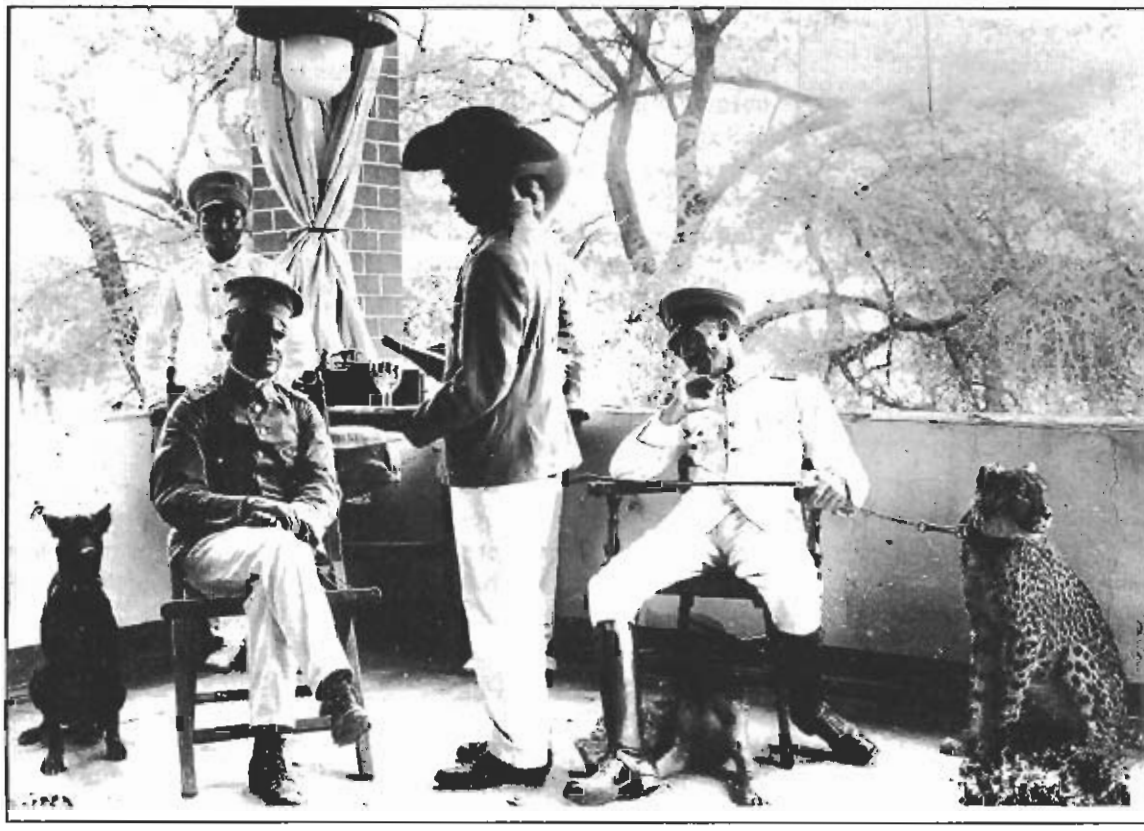
The objectives of this CCF document are:

(1) to identify the important components of farmland ecosystems necessary to sustain a healthy cheetah population;

(2) to identify farm management practices that reduce livestock loss from predators; and

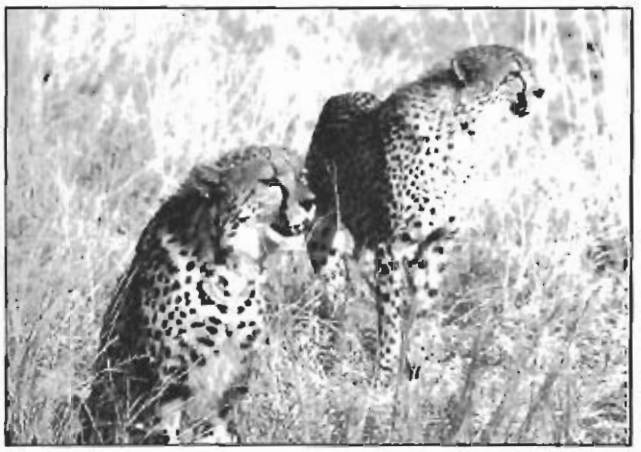
(3) to suggest conservation management strategies which are beneficial to both the cheetah and farmers, thereby ensuring the species' survival on livestock farms while maintaining the livelihood of the farmers.

Major Franke at the turn of century in South West Africa with a pet cheetah.



II. BACKGROUND

A. International and National Status of the Cheetah



During the past century the cheetah has become extinct in at least 17 countries.

In 1900, it was estimated that at least 100 000 cheetah lived in 44 countries throughout Africa and Asia[71]. The species has been extirpated from many areas since then. It is estimated today that at most 12 000 to 15 000 cheetah remain in 26 African countries, and around 200 more are in Iran (Figure 1). However, the majority of these populations are extremely small, consisting of widely scattered remnant groups with little or no access to each other for genetic exchange. Taking a census of such an elusive species, such as the cheetah, is very difficult particularly since it is widely scattered and highly secretive. Five subspecies of cheetah are currently recognized[92], each listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix I, and classified as Vulnerable or Endangered by the World Conservation Union (IUCN) [9, 10].

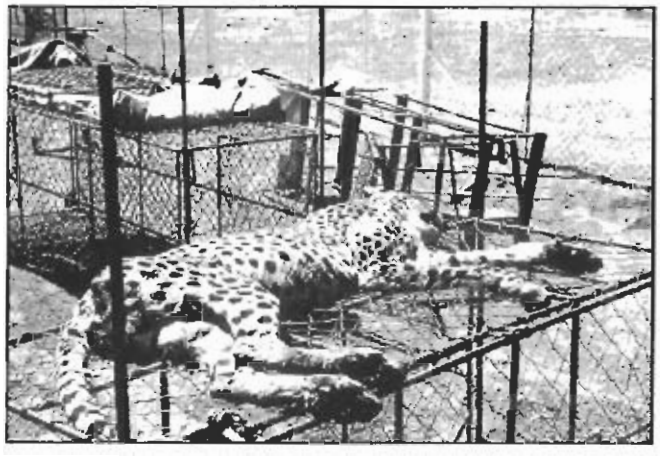
FIGURE 1. Current Worldwide Distribution of Cheetah. Thecountry distributions are based on the best knowledge and most accurate information currently available.

The cheetah species has little genetic variation (similar to 20 generation deliberately inbred livestock or mice), which is a disadvantage during ecological and environmental changes [76 - 79]. The southern African subspecies is more genetically compromised than the east African subspecies [79]. Researchers believe that inbreeding may be responsible for the 71% incidence of abnormal sperm, reproductive problems in captivity [103, 104, 105, 78], increased susceptibility to infectious disease [76, 78, 61, 58, 36], and high infant mortality in captivity [78, 61, 58]

Cheetah numbers are low in most protected reserves due to competition with other large predators, primarily lion and hyaena [107, 7, 8, 70, 104, 98, 47, 66, 50]. Therefore, a large percentage of free-ranging cheetah in Africa are outside of protected reserves. They are primarily on agricultural and livestock farmlands in southern Africa. To estimate the wild cheetah's survivability in Africa and its ability to adapt to a changing ecological system, adjustments to livestock farmlands must be considered [72].

Farming can jeopardise the natural ecosystem [46, 73], damaging natural environments and endangering species. Namibia is a classic case where farming domestic stock in arid and semi-arid regions has shown the effects of over-exploitation for short-term financial gain[2], such as the deterioration of the land and the decline in wildlife species like the cheetah.

The majority of the 6 818 cheetah trapped in Namibia between 1980 & 1991 were killed.



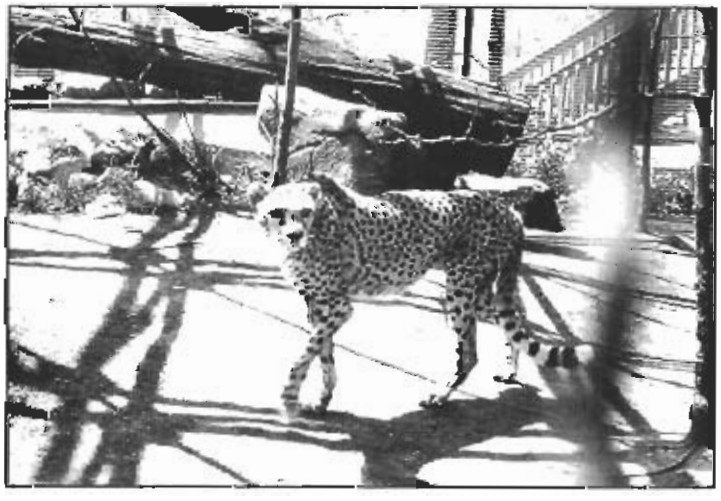
According to CITES [1992], Namibian farmers removed 6 818 free-ranging cheetah between 1980 and 1991 (5,670 killed in protection of livestock, 958 exported and 190 trophy hunted; see Table 1). This removal caused a decline in the Namibian cheetah population of approximately 50% [70]. Cheetah removals by farmers peaked in 1982 at a high of nearly 900 animals, and have since declined. This possibly reflects the decline of the cheetah population as a whole. Cheetahs were regularly removed indiscriminately and independent of livestock loss specifically due to cheetah. Not all removals are reported to the Ministry of Environment and Tourism or the local police, as the country's law stipulates. Therefore, it is believed that the CITES number of cheetah removed is an underestimate [69, 60]. Clearly then, maintaining habitat and developing strategies for maintaining free-ranging cheetah populations outside of protected areas are critical for the long-term survival of the species.

TABLE 1: National Utilisation of Cheetah in Namibia 1980 - 1991[10]

Method	1980	81	82	83	84	85	86	87	88	89	90	91	TOTAL
Shot[3]	623	669	850	721	646	537	318	317	272	271	301	145	5 670
Trophy Hunted	0	0	0	12	7	21	17	12	20	32	29	40	190
Live Exports	139	58	40	124	61	113	67	87	82	67	69	51	958
TOTAL	762	727	890	857	714	671	402	416	374	370	399	236	6 818

[3] For protection of livestock.

Ten percent of the world's population of cheetah lives in captivity (zoological facilities, other breeding facilities, and private individuals). Captive cheetah are unable to assist in the long-term survival of the species, because they tend to have low reproductive success and high infant mortality [52, 57]. Table 2 indicates how the population in captivity has increased from 19 facilities holding 33 cheetah in 1955, to over 212 facilities holding 1 214 animals at the end of 1994 [52, 57]. Although births in captivity increased during this period, the number of deaths exceeds the number of births. The captive population has increased mainly from imports of wild-caught animals, most of them from Namibia, since the 1970's.

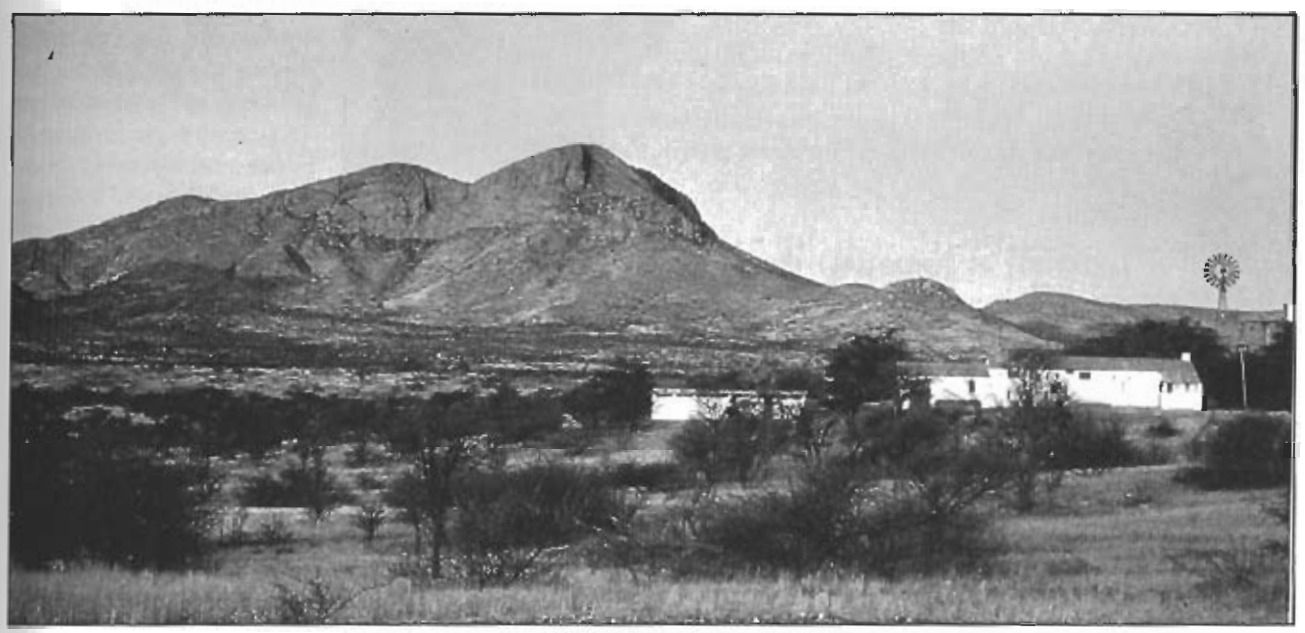


28% of captive cheetah in the world are wild caught. 98% of these are from Namibia.

TABLE 2: History of the World's Captive Cheetah Population[52-57]

	1955-64	1965-74	1975-84	1985-94	TOTAL
No. Imports	142	491	419	373	1 425
No. Births	16	178	967	1 353	2 514
No. Deaths	121	382	1 244	1 600	3 347
No. of facilities at beginning & end of period	19 - 92	92 - 80	80 - 150	150 - 212	19 - 212
No. of animals alive at beginning & end of period	33 - 206	206 - 401	401 - 848	848 - 1214	33 - 1214

B. An Historic Overview of the Namibian Farmland Ecosystem



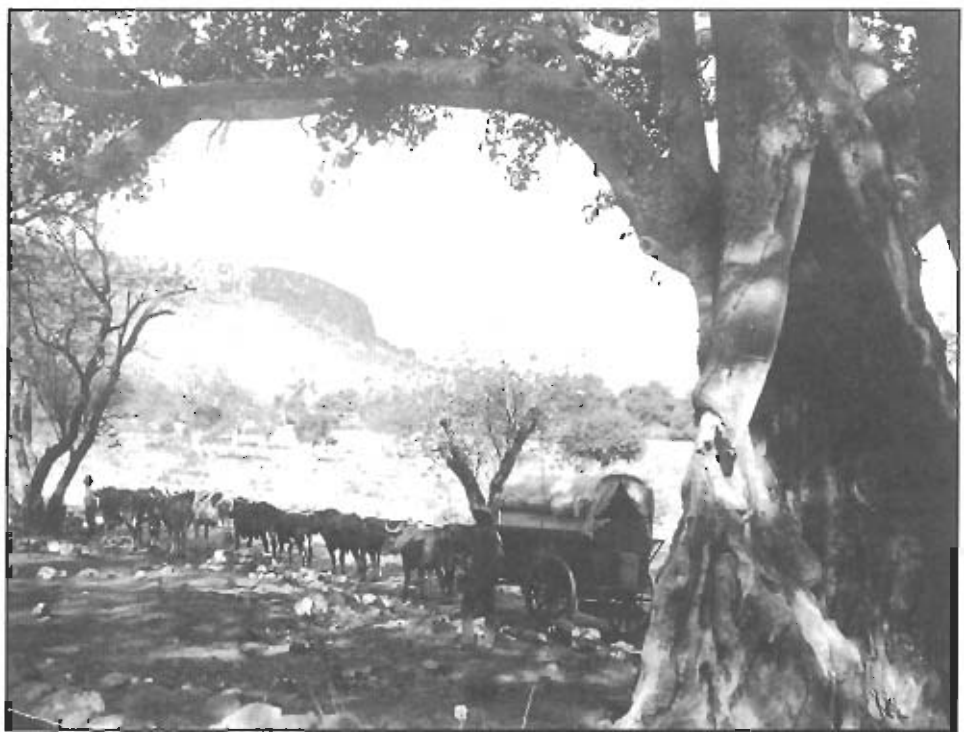
Namibia is known for its desert ecosystem. Called "a land between two deserts" [87], this arid country of 82,3 million hectares (2,7% of the African continent) has 12,65 million hectares unsuitable for agriculture. Sixteen percent of Namibia's total area is hyper-arid (true desert), where agriculture of any kind is excluded; 49% is classified as arid, 32% as semi-arid, and 3% as sub-humid [89, 4]. Land use for agriculture depends on rainfall distribution and water availability. Although rainfall is sporadic and unpredictable, records since the early 1900's show nine to 12-year cycles of wet and dry spells [2,3]. Periods of drought have been known to last four to nine years and are a regular occurrence [87]. However, the recent drought phase from 1979 - 1995 has lasted over 15 years. Namibia's flora (plant life) and fauna (animal life) are always affected in various ways by these drought phases.

Beef products are the backbone of Namibia's agriculture.

Seventy percent of Namibia's population is directly or indirectly dependent on agriculture as a livelihood [87, 99], and extensive livestock farming is considered the backbone of the country's agriculture. Beef products contribute 87% of the country's gross agricultural income. Fifty-one percent of the agricultural land is suitable for cattle farming and 33% is suitable for smallstock farming. There are nearly 6 000 commercial livestock farms utilizing 44% of Namibia's available

agricultural land [87, 99]. The majority of these commercial farms range in size from 5 000 to 20 000 hectares (average 8 000 ha) and are primarily bushveld with grasslands suitable for livestock or game. An estimated 70% of Namibia's huntable game species [41, 44] and 90% of the cheetah's habitat and range [70] are on privately-held commercial farms. Game farming contributes a large amount of foreign currency to Namibia, the majority from trophy hunting. Approximately $N6.4 million comes into Namibia annually due to trophy hunting [99].

1. Development of Namibia's Commercial Livestock Farming and its Effects on the Land



Early settlers at the base of the Waterberg Plateau.

The first European settlers colonised Namibia in 1884 and started extensive livestock farms which are still in production today [87]. An overview of Namibia's farming history includes the circumstances leading to the cheetah's success and subsequent recent decline on these farmlands. Farm management practices, wildlife and livestock numbers, and natural disasters (including disease epidemics and droughts) have affected cheetah populations over the last 100 years.

The biodiversity of these extensive farmlands has been drastically altered by three farm management practices:

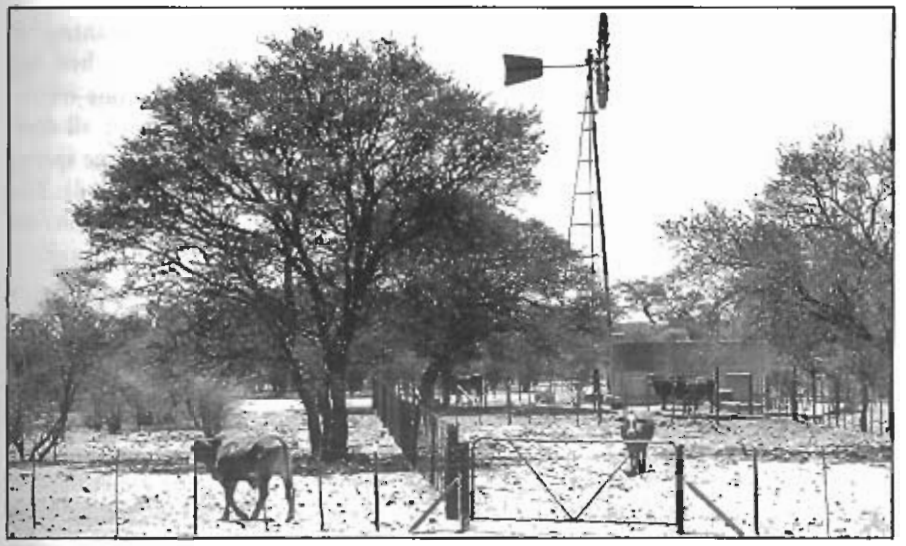
(1) extensive overgrazing resulting in bush encroachment [100];

(2) elimination of species deemed competitors to the livestock industry (herbivores competing for grazing, and predators killing srock); and

(3) over-utilization of wildlife for food and profit without regard for the ecosystem.

Over the 30-year period from 1960-1990, thick bush replaced the majority of the open grazing land in many areas. According to Namibia's Ministry of Agriculture, Water and Rural Developent information, bush has encroached 10 million hectares of good farmland, primarily since the 1980 drought. This encroachment has significantly decreased the productivity of nearly one-third of Namibia's livestock farmlands. A combination of environmental factors and human land use initiated this encroachment, resulting in a reduction in grazing lands. This in turn caused a 47% reduction in cattle numbers (2 077 511 to 1 107 082 cattle) on the commercial farmlands during this 30-year period [87].

Since the beginning of farming in Namibia, farmers' interests conflicted with the existence of large predators such as lion, hyaena, wild dog and leopard. Close monitoring or protection of livestock was impractical due to the extensive farming methods necessary (water was a limiting factor and large areas of land were required to sustain the livestock). Elimination of predators became the accepted practice. Lion, hyaena and wild dog were eradicated from the vast majority of the farmlands by 1950. Cheetah were a much rarer sight on farmlands prior to the 1950's [27, 28], possibly due in part to the presence of these larger predators. Sightings of cheetah on farmlands have increased since this time.



Boreholes concentrate animal numbers, which contributes to overgrazing.

Due to the atid climate and drought phases, the single most important change to the environment by the early farmers was providing water for livestock by sinking boreholes wherever water could be found. Prior to livestock farming and increased water availability in their habitat, wildlife migrated throughout the country in balance with the land, following water and good grazing. Much of the land (which is now heavily bushed) was open savanna with limited bush cover. With the development of waterholes, wildlife became resident on the farmlands. Because wildlife competed with livestock for water and food, they were killed off in high numbers to reduce competition. Increased fencing of farms into smaller 'camps' made game species easier to remove from farms. As a result, kudu, gemsbok and springbok populations decreased approximately 15% between 1955 and 1960 (Table 3). Farms were listed for sale in the 1960's as 'free of wildlife' [103].

TABLE 3: Population Estimates for Three Major Game Species in Namibia[43]

Species	1955	1960	1973	1980	1983
Kudu	72 500	60 800	111 900	200 000	83 700
Gemsbok	26 900	24 500	40 600	45 000	20 600
Springbok	45 700	37 300	141 900	250 000	91 700
TOTAL	**145 100**	**122 600**	**294 400**	**495 000**	**196 000**

Drought and disease in the 1960's increased the strain on the ecosystem already caused by the shift from diverse wildlife populations to high numbers of grazing livestock. In July 1961, a Foot and Mouth Disease (FMD) outbreak devastated livestock production. Cattle were quarantined, preventing the common practice of moving cattle to areas of better grazing during drought. This resulted in high cattle mortality, as well as further degradation of the farmland [87]. When the spread of FMD was directly linked to the migration of game, the first veterinary cordon fences (2,8 m high game fences) were erected in 1961 to prevent movement of wildlife and the spread of disease [87]. A national vaccination campaign halted the spread of FMD, but the 1961 outbreak and animal compoundment left grasses denuded and wildlife migrations disrupted. Due to declining wildlife numbers, a 1967 Nature Conservation Ordinance transferred ownership of huntable game species to the landowners, an economical method of encouraging landowners to conserve wildlife. Kudu, gemsbok and springbok populations then increased by 60% from 1960 to 1973.

The wet cycle during the early 1970's produced good grasses. Farmers stocked heavily, with two to three times the recommended capacity of one large stock unit per 20 hectare [2]. The populations of three game species (kudu, gemsbok, springbok) increased 40% berween 1973 and 1980 (see Table 3). Cheetah numbers also increased during this time due to the favorable environment [43].

In 1979, the first indication of what was to become the country's worst drought of the century appeared, and the degenerative effects of livestock overstocking began to show on the land. Although farmers reduced livestock numbers on commercial farmlands during the 1980's, the decline was not rapid enough to prevent degradation of the entire farming system. Bush encroachment accelerated on the overgrazed savanna. Many farmers resorted to game culling and capture to protect pastures for

During the 1980's rabies epidemic, the kudu population declined by almost 60%.

domestic stock. Some farmers took advantage of migrating game and claimed more than their fair share [100], which caused disputes over game ownership and utilisation rights. As a result of all these factors, populations of the three major game species declined 60% during 1980-1983 (see Table 3). This reduction in available prey escalated the conflict between farmers and predators, especially cheetah.

A rabies epidemic in the kudu population, a primary food source for the cheetah [69], presented another major wildlife crisis. The epidemic began in 1977, accelerated until 1983, and decreased dramatically until it ended in 1986. The kudu population declined by 58% from 1980 to 1983 (see Table 3). Although it is difficult to estimate the exact number of kudu that died during the epidemic, a conservative estimate places the loss at 30 000 to 50 000 animals over the five-year period of 1977 to 1983 [35]. It was estimated that up to 75% of the total kudu population died in the central and northern farming districts [44].

During the early 1980s, the conflict between farmers and cheetah peaked. Due to the drastic reduction of kudu and a general reduction in other prey species, cheetah were more prone to livestock predation. At least 890 cheetahs were removed (killed or live exported) from the farmlands in 1982 (see Table 1).

In 1983, due to the conflict between farmers and cheetahs, the Directorate of Nature Conservation and Tourism initiated an intensive research project to investigate the causes of the conflict. This three-year project concluded the following:

(1) the farmers had strong opinions and attitudes about the cheetah;

(2) the cheetah was perceived by farmers as the worst problem animal allegedly responsible for large financial losses;

(3) the sighting of cheetah or spoor (tracks) led to a natural reaction ascribing livestock loss to cheetah predation;

(4) a large percentage of calf loss was due to natural causes (i.e. disease, poor nutrition, stillbirths, etc.) and not cheetahs; and

(5) further research was necessary [69].

Prior to Namibia's independence from South Africa in 1990, many farmers reduced the wildlife populations for profit (i.e. sale of meat, and trophy hunting). This removal further reduced the cheetah prey base, which still has not recovered.

2. Development of Game Farming in Namibia

Game fences increased problems for cheetah.

Extreme environmental conditions (lack of suitable grazing and lack of water), exacerbated by drought, prompted many livestock farmers to seek an alternative revenue source in the 1980's. Since farmers believed that game could thrive on any type of soil under most climate conditions, many farmers began confining game inside fences to propagate it for profit. In areas where game was abundant, farmers erected high fences (2,6 m high and 21 wires) on portions of their farms for wildlife utilization and trophy hunting. Most game farms were developed in the northern half of the country where diverse game populations were plentiful [103].

Although game farming was not new, the increase in game-fenced areas in the early 1980's created greater problems for the cheetah, because wildlife numbers were declining due to the degenerating environmental conditions. Furthermore, game farms were developed without strategies for discouraging

predators from entering farms (e.g. electrified fences). Many game farmers indicated that cheetahs became a problem in their game-fenced areas for one or more of the following reasons:

(1) high fences altered the ecology of the land by concentrating high numbers of game unable to migrate, thus attracting cheetah;

(2) exotic game, not adapted to the area, provided easy prey for cheetah;

(3) reduction of prey outside game-fenced areas encouraged cheetah onto game farms where prey species were concentrated;

(4) constant catching and removal of cheetah opened territories for other cheetah to move into; and

(5) investment in game farming was for economic gain, thus loss of wildlife to predation resulted in loss of income.

3. Farming Environment and Laws

It is illegal to sell cheetah skins internationally. Many are confiscated by wildlife authorities worldwide.

Records from the 1760's show that early explorers to Namibia/South West Africa were impressed with the abundance of game throughout the country. This natural resource was unregulated until German colonisation in 1884, when legislation was enacted and game became the property of the state, thus giving the government control over hunting on private farmlands. Despite this legislation, farmers continued to remove wildlife to provide more grazing land for livestock.

Due to declining wildlife numbers, the Nature Conservation Ordinance 31 in 1967 placed ownership of huntable game (excluding protected and specially protected species) under the care of the landowner on whose property the game was present. Thus, wildlife rights resided with the landowner. The rationale for this ordinance was that landowners would protect and manage wildlife if they owned it, because they would economically benefit from its existence on their land through wildlife utilization. With legalized ownership, it was surmised that owners would see game as an asset instead of a burden. However, some game species migrate and continually change ownership, thereby to an extent nullifying the concept that game is the property of a specific landowner or lessee. Although problems have arisen when individual farmers irresponsibly overutilised this mutual resource, it is evident that this ordinance is directly responsible for the increase of game [103] (see Table 3).

Due to the decline of cheetah populations internationally, the United States in 1970 placed the cheetah on its Endangered Species List. In 1975 international endangered species laws placed the cheetah on Appendix I of CITES, and on the vulnerable or endangered list of IUCN. This classified the cheetah as an endangered species and prohibited the sale of live cheetah or skins on the international market. Farmers were confused by this classification, as they thought cheetah an abundant commodity.

Furrhermore, in 1975 a Namibian Nature Conservation Ordinance (No. 4 of 75) classified the cheetah as a 'protected animal.' However, the same ordinance permitted shooting cheetah in the interest of protecting life or property. The ordinance specifies that cheetah removal through catching or shooting must be reported within 10 days to the state police or the present Ministry of Environment and Tourism. This ordinance appears to have been abused, as most of the removals apparently have been indiscriminate and not specifically targeted at livestock problem animals.

The 1990 Namibian Constitution, Section 95, includes clauses supporting both sustainable utilisation of wildlife and protection of the environment, and invites the private sector to cooperate, stating that it is the responsibility of every Namibian citizen. Sustainable utilisation is defined by IUCN as "... the use of a population or ecosystem at a rate within its capacity for renewal and in a manner compatible with conservation of the diversity and long-term viability of the resource and its supporting ecosystem." Sustainable utilisation can only be achieved through sound manage-

ment practices backed by research and vigorously upheld by the active participation of people utilising the resource. Currently, many farmers in Namibia have a livestock and game management strategy in which predators such as the cheetah are generally considered to be a threat to their livelihood, so they remove them in high numbers. This type of removal is not in accordance with sustainable utilisation.

Since 1992, CITES has allowed a limited trade in Namibian cheetah (150 animals/year) under a special exception in the Treaty. This limited trade includes legal trophy hunting as well as live export to internationally recognised zoological facilities. The quota was permitted in an attempt to reduce indiscriminate removal of cheetah. The total number of cheetah removed under this CITES quota was 53 in 1992 (14 live exports, 39 trophy hunted), 30 in 1993 (12 live exported, 18 trophy hunted) and 44 through August 1994 (28 live exported, 16 trophy hunted). These numbers, however, are not a complete measure of the number of cheetah killed during these years; additional cheetah were killed to protect livestock or indiscriminately removed, but these figures are not yet available from CITES (see Table 1 for 1980-91 figures).

In 1994, in an effort to support long-term conservation strategies for the cheetah, the Namibian Professional Hunters Association (NAPHA) developed a special committee called RASPECO (Rare Species Committee). The purpose of this committee was to develop guidelines and programs which support sustainable utilisation of a rare species (such as the cheetah) to the enhancement of the species. It is hoped that the development of this program will help end indiscriminate catching and secure a future for the cheetah in Namibia.

NAPHA proposed an increase in the trophy hunting fee with half of the fee going to the farmer on whose land the cheetah is living, thus providing an economic incentive for the existence of cheetah on their lands. As a part of this program, NAPHA members were asked to participate by signing a "COMPACT for the Management of Cheetah" on their farms. The committee believes it is important for all involved to activate the hunters and farmers towards long-term cheetah conservation, as they are the people responsible for ensuring that all trade in cheetah is sustainable and legal, and that hunting quotas are enforceable.

4. Removal of Cheetah From the Namibian Farmlands

In the past, many cheetah cubs were trapped, hand-raised and sold to zoos.

In the 1960's, the decline of cheetah in East Africa prompted laws prohibiting the export of wild cheetah from East Africa into captivity. Thus, Namibia became the primary exporter of wild-caught cheetah for zoological facilities and private individuals. Because cheetah breed very poorly in captivity (see Table 2 Births), zoos internationally seek Namibian cheetah [52, 57].

Due to deficiencies in captive breeding, zoos paid high prices to game dealers to coordinate the capture of wild animals in order to sustain the captive population (see Table 1 Exports). Farmers designed live-traps to catch cheetahs and sold them at relatively low prices to game dealers. Game dealers often outbid each other to purchase the animals from farmers. One game dealer reported selling between 200 and 300 live animals per year 20 to 30 years ago, with a total of over 5 000 animals since the 1960's. He currently sells 20 to 30 animals per year [13]. It is

not clear where these exported animals went, as records are not always available, but the majority did not go to zoological institutions [52].

Prices paid to game dealers increased from approximately US$1 300 in the 1960s to US$5 000 in the early 1970s. By the early 1980's, the international buying price for cheetah had risen to approximately US$6 000, and game dealers continued to get the majority of the profit. The following examples indicate prices paid to farmers by game dealers (US dollar prices for each year are approximated)[28]:

Year	Type	Rand	US$
1963	Cub	R40	US$29
1964	Male	R100	US$72
1968	Female	R180	US$130
1968	Male	R150	US$108
1972	Adult	R193	US$193
1972	Adult	R175	US$175
1974	Female	R300	US$300
1974	Male	R100	US$100
1964	Skin	R30	US$22
1993	Skin	R350	US$100

Commercial demand, which continues today, encourages indiscriminate capture not specifically in 'the interest of protection of one's life or property' as stipulated in the 1975 Nature Conservation Ordinance[74]. Newspaper ads for cheetah wanted by dealers encourage the opening of traps for financial gain versus livestock protection. Although dealers generally only need a few animals to satisfy their market, many other cheetah are caught and then usually shot when they cannot be sold.

Jan Gaerdes, a well-known Namibian farmer, reported in 1974 the first information on cheetah removals in Namibia. He gathered information from 126 farmers, and this data gives the best indication of cheetah distribution at that time. In his report, Geardes included cheetah capture and kill records from 1910 through 1973. The vast majority of the removals in all regions of the country occurred in the 1960's and 1970's, when more than 240 cheetah were killed and over 900 were captured, presumably for sale. The number of farms in each region reporting cheetah removals during this time period were as follows:

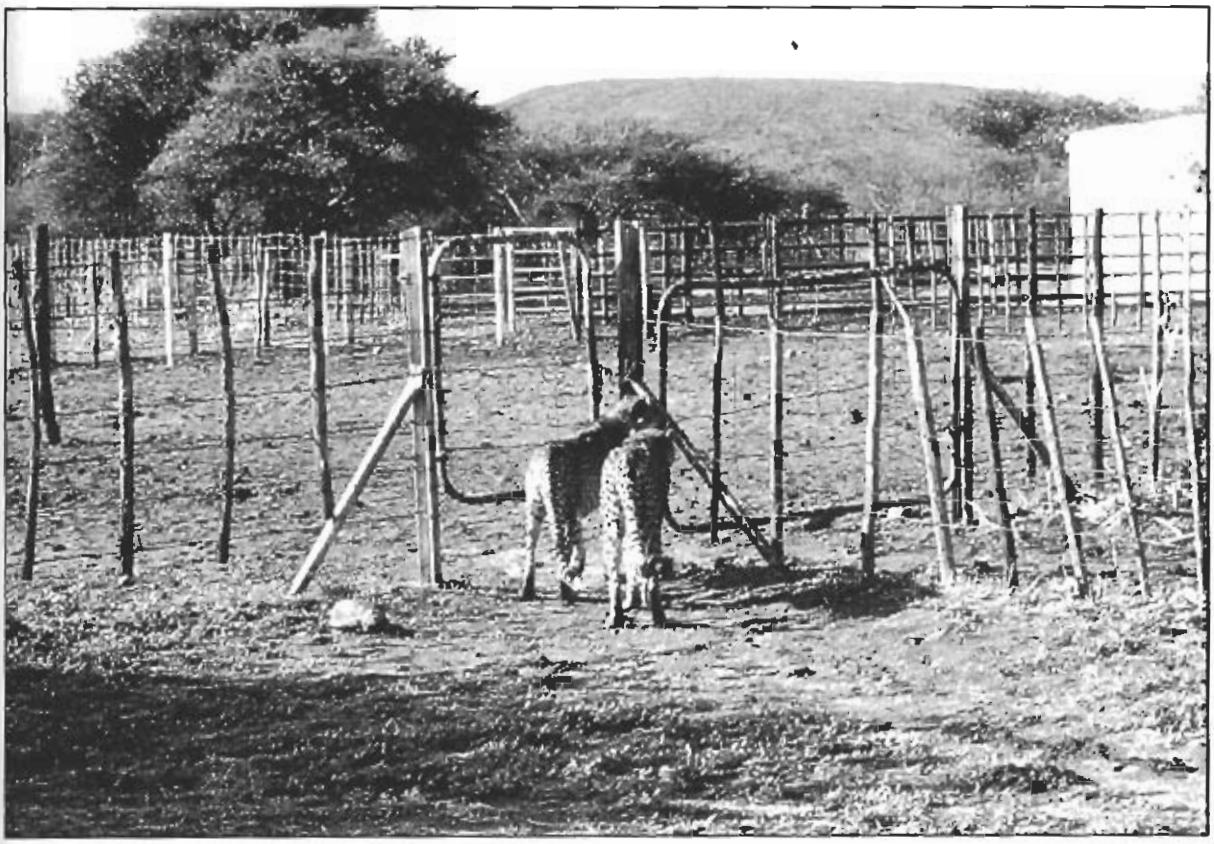
Okahandja	26 farms
Maltahohe	23 farms
Windhoek	22 farms
Grootfontein	17 farms
Otjiwarongo	14 farms
Outjo	12 farms
Omaruru	5 farms
Mariental	4 farms
Karibib	3 farms [28].

Farmers in Maltahohe nearly eliminated the species from that region during the 1940's through the 1960's. There are few reports of cheetah in Maltahohe since. Although only 5 farms reported removing cheetah in Omaruru, nearly 300 removals were reported by those farmers [28].

Relocation of problem cheetah has been attempted, usually without success. The first recorded releases of cheetah captured from the farmlands were into Etosha National Park in the late 1960's. In 1966 - 1967, an unspecified number was released into the park [17] Thirty more cheetah were released into Etosha in 1970[14]; and in 1971, an unspecified number was released into the park by a private individual[19]. The few relocations into Etosha that were monitored were not successful, as many cheetah moved southward out of the reserve in search of their old territories and were killed on farms [17, 18].

Unmonitored and indiscriminate relocations still occur today in Namibia[4]. Indiscriminate relocation may increase problems for the farmers, as well as disrupt the

III. MINISTRY OF AGRICULTURE, WATER AND RURAL DEVELOPMENT STATISTICS



90% of Namibia's wild cheetah live on commercial livestock farmlands.

Information for an historical overview of the livestock/predator conflict in the country was obtained from the Ministry of Agriculture, Water and Rural Development, Directorate of Veterinary Services (DVS). DVS Animal Health Inspectors collect information from commercial farms and communal area stock inspection points south of the Veterinary Cordon Fence on a biannual basis using Farm Visit Forms (FVF). This information has been computerised since 1986. At the request of CCF, DVS summarised its historical data on livestock/predator conflict in Namibia. DVS data presented in this document are published with the permission of the Ministry of Agriculture, Water and Rural Development.

Although not all farms were inspected annually by the Animal Health Inspectors, the 8-year average was 80% of the total commercial farms in the country. Several questions asked by the livestock inspectors are relevant to this report. The reliability of the information from DVS statistics depends on the accuracy of the information provided by the farmers to the Animal Health Inspectors. Although survey data is not precise or accurate, often it is the only information available, therefore it must always be considered in context.

A. Stock Losses and Predator Removal

Cattle and smallstock (goats and sheep) numbers from the DVS Inspectors FVF reports for both commercial and communal lands in Namibia are presented in Figure 2. Owamboland figures are not presented, as they were unreliable preceeding independence. However, DVS figures for 1994 are considered accurate for Owamboland (cattle - 334 169 and smallstock - 190 818). CCF chose to review the Animal Health Inspectors' findings about commercial farmlands only, because that is where 90% of the country's cheetah population is found. In 1994, livestock on commercial farmlands represented 49% of the cattle and 67% of the smallstock in the country.

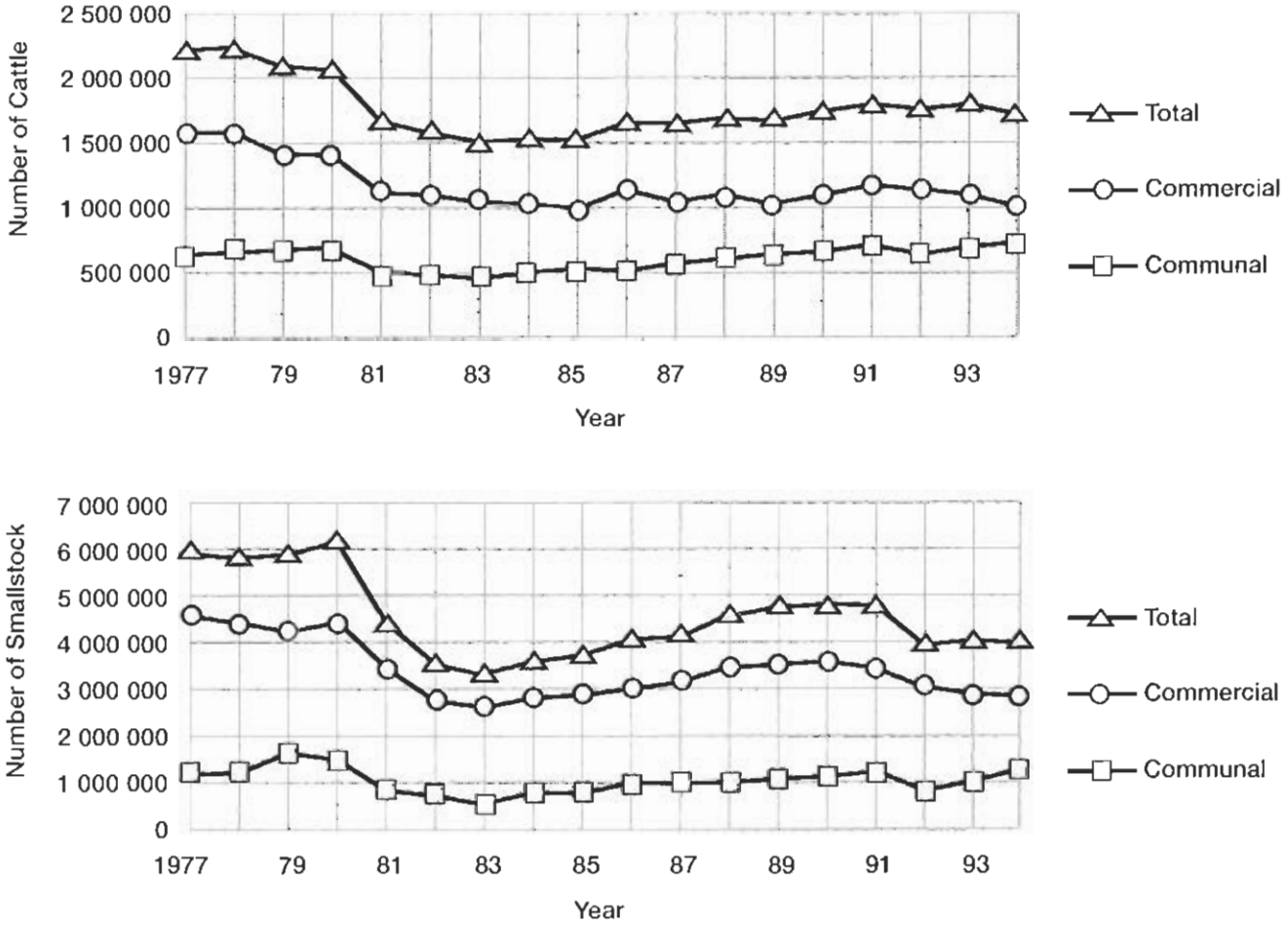


FIGURE 2. Cattle and Smallstock Numbers on Namibian Farmlands 1977- 1994. Shown are commercial and, communal land (excluding Owamboland) and the respective totals in Namibia.

As shown in Figure 2, cattle numbers for the country as a whole increased in the late 1970's to a high in 1980 on the communal lands. A subsequent rapid decrease in stock numbers on communal lands occurred between 1980 and 1982, primarily due to drought. On the commercial lands, cattle numbers declined steadily from 1978 until 1983, after which they stabilised; but they have not returned to the high numbers of 1978. There was a 38% reduction in the number of cattle on the commercial lands from 1978 to 1994. Smallstock numbers have shown a similar trend, decreasing drastically on borh commercial and communal lands between 1980 and 1983. On commercial farmland there was a 39% reduction of smallstock from 1977 to 1994.

During the period 1986 to 1991, an average of 2% of the country's commercial farms reported loss of cattle to predators, and an average of 11% of the farms reported smallstock loss to predators (Table 4). Of the total number of livestock lost due to predators, 29% of the cattle and 3% of the smallstock loss was attributed to cheetah. During this time period, both the number of farms reporting cattle loss to all predators and actual numbers of cattle lost decreased. A more pronounced trend occurred regarding cattle lost to cheetah only: the reported 1994 losses were only 7% of those in 1987. Farms reporting losses to cheetah dropped from 154 in 1987 to 15 in 1994. Even though smallsrock loss to all predators stayed high during this time, actual loss attributed to cheetah in 1994 was also only 8% of what it was in 1987.

TABLE 4: Total Cattle and Smallstock Loss Due to Predators and Cheetah 1986 - 1994

	1986	1987	1988	1989	1990	1991	1992	1993	1994	TOTAL
No. Cattle Killed by All Predator (No. Farms*)	1 053 (209)	1 347 (275)	892 (265)	718 (166)	563 (166)	532 (110)	908 (192)	712 (113)	832 (122)	7 557 ---
No. Cattle Killed by Cheetah (No. Farms*)	425 (96)	787 (154)	297 (110)	179 (58)	181 (33)	40 (13)	84 (32)	151 (36)	55 (15)	2 199 ---
% Cattle Loss Attributed to Cheetah	40	58	33	25	32	8	9	21	7	29
No. Smallstock Killed by All Predators (No. Farms*)	9 938 (718)	12 028 (797)	10 094 (637)	10 146 (452)	15 542 (605)	12 806 (518)	21 782 (755)	16 025 (685)	17 256 (710)	125 617 ---
No. Smallstock Killed by Cheetah (No. Farms*)	719 (70)	937 (99)	452 (47)	122 (16)	320 (15)	49 (10)	164 (17)	406 (38)	76 (12)	3 239 ---
% Smallstock Attributed to Cheetah	7	8	4	1	2	0,4	0,8	3	0,4	3

* Total commercial farms in Namibia = 5805 (1994)

Table 5 shows the numbers of livestock killed by cheetah and cheetah killed for protection of livestock per district between 1986 and 1994, according to DVS. The ratio of livestock loss to cheetah killed is not the same in every district, therefore these numbers should not be used to indicate the population of cheetah in each region.

TABLE 5: Livestock Loss Due to Cheetah and Cheetah Killed per District 1986 - 1994

Districts	No. Cattle Lost	No. Smallstock Lost	No. Cheetah Killed	Ratios*
Outjo	193	507	118	2 : 4 : 1
Otavi	3	5	63	1 : 2 : 21
Grootfontein	392	467	87	5 : 5 : 1
Otjiwarongo	249	83	251	3 : 1 : 3
Okahandja	661	608	176	4 : 3 : 1
Omaruru	124	193	85	1 : 2: 1
Windhoek	514	1004	146	4 : 7 : 1
Gobabis	41	53	94	1 : 1 : 2
Mariental	5	39	50	1 : 8 : 10
Keetmanshoop	17	280	24	1 : 16 : 1
TOTAL	2199	3239	1094	2 : 3 : 1

* Cattle Lost : Smallstock Lost : Cheetah Killed; ratios are rounded to the nearest whole number

According to DVS statistics, 100 066 predators were killed between 1986 and 1994, of which 1,1% (1094) were cheetah (Table 6). The number of cheetah killed on farms decreased 94% during this period (from 390 killed in 1986 to 23 killed in 1994). Furthermore, the number of farms killing cheetah in 1994 was 7% of 1986 numbers. The decrease in the number of cheetah removed could be due to fewer cheetah in the area, higher wildlife prey numbers, or farmers finding alternatives to killing cheetah.

TABLE 6: Number of Predators Killed 1986 - 1994

Predator Species	1986	1987	1988	1989	1990	1991	1992	1993	1994	TOTAL
Black-backed Jackal	10 004	6 177	5 397	4 070	6 726	6 073	8 706	5 467	3 827	56 447
African Wild Cat	2 074	957	1 570	1 480	1 099	2 702	2 677	1 948	2 177	16 684
Caracal	1 747	829	772	1 049	1 505	1 758	1 718	1 219	1 517	12 114
Silver Fox	1 234	1 444	1 429	397	475	970	1 050	924	886	8 809
Baboon	48	234	188	144	512	459	676	185	240	2 686
Cheetah	390	224	123	48	70	76	74	66	23	1 094
Other	301	150	90	81	147	116	184	78	88	1 235
Leopard	286	98	74	67	67	128	111	93	73	997
TOTAL	16 084	10 113	9 643	7 336	10 601	12 282	15 196	9 980	8 831	100 066
No. Farms Killing All Predators[a]	1 963	1 184	1 243	898	1 328	1 288	1 486	1 196	984	unk[b]
No. Farms Killing Cheetah[a]	152	89	72	27	43	35	48	35	10	unk[b]

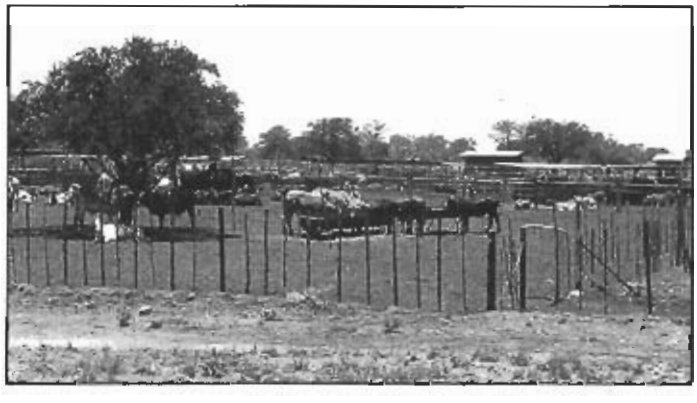
[a] Total number of commercial farms in Namibia = 5805 (1994)

[b] Total number of farms reporting for all years is unknown.

It is difficult to interpret DVS data, particularly for management purposes, because they do not correlate with other available information. The Ministry of Environment and Tourism also reported to CITES the number of cheetah killed for protection of livestock in Namibia (see Table 1). Its figures indicate that during the period of 1986 to 1991 (the only CITES figures available), 1 624 cheetah were shot for protection of livestock. The discrepancy of 693 animals between the DVS figure of 931 and the CITES figure of 1 624 on cheetah killed for protection of livestock further implies that any reports of cheetah killed may be incomplete and indicate mimimal removals at best.

While it is CCF's belief that these figures are incomplete, the DVS livestock inspectors' reports represent the only data available on stock loss in Namibia from 1986 to 1994. Improving data accuracy is extremely important to conservation and management strategies for an endangered species. Therefore, CCF encourages farmers to report data accurately to livestock inspectors.

B. Livestock Management



Proper livestock management is critical in reducing predator conflict.

Beginning in 1989, livestock inspectors included a question in their FVF survey on the use of farm management techniques to protect livestock from predators. Between 1989 and 1993, an average of 9% of the cattle farmers and 7% of the smallstock farmers per yer were questioned on their protective management, and this information has been compiled. The percentage of farms questioned is low, because this question was frequently forgotten by the inspectors. The data probably does not accurately represent all farms in the country due to the small sample size.

Of those questioned, only 38% used any form of calving camps and 19% corralled ('kraaled') their cattle. For smallstock, 49% used lambing camps, 69% used smallstock corrals, and 42% used a herder. All of these techniques help reduce livestock losses from predators.

C. Wildlife Numbers by District

From 1989 to 1993, the livestock inspectors' reports also included the number of game species on the farmlands by district. As this question was frequently forgotten by the inspectors, the total number of farms surveyed was small (an average of 11,5% of farms annually). For the five years, a total of 4 170 farm visits were conducted on 33% (2 373) of the 7 251 farms and stock inspection points. The data has been compiled for the five years, and duplications accounted for or removed. The estimated total wildlife numbers based on the percentages of farms visited per district are listed in Table 7.

CCF realizes the information presented in Table 7 may be inaccurate, due to the nature of the data in the reports from which it was extrapolated (species were listed as high, medium, or low densities only), but it is the only information for this time period and serves as a guideline. Since 1983, there has been no wildlife survey available from the Ministry of Environment and Tourism (see Table 3), thus the DVS livestock inspectors' figures are the only recent estimates of wildlife numbers available. Furthermore, reported wildlife numbers in surveys can be misleading, because farmers may be reluctant to report declining numbers, as it may affect their hunting quotas.

Estimating wildlife numbers for the whole country based on these figures (Table 7, 'EXT. TOTALS') indicates that wildlife populations have increased since the 1980's drought (compare to Table 3, 1983), although the gemsbok population figures may be an overestimate. As Joubert and Morsbach indicated in a 1982 unpublished report, the distribution of gemsbok on farmlands in five districts (Outjo, Otjiwarongo, Omaruru, Karibib and Okahandja) showed more than a 70% increase since the 1975 distribution [41]. Increase in wildlife numbers may be due to improved grazing and/or reduced culling of wildlife.

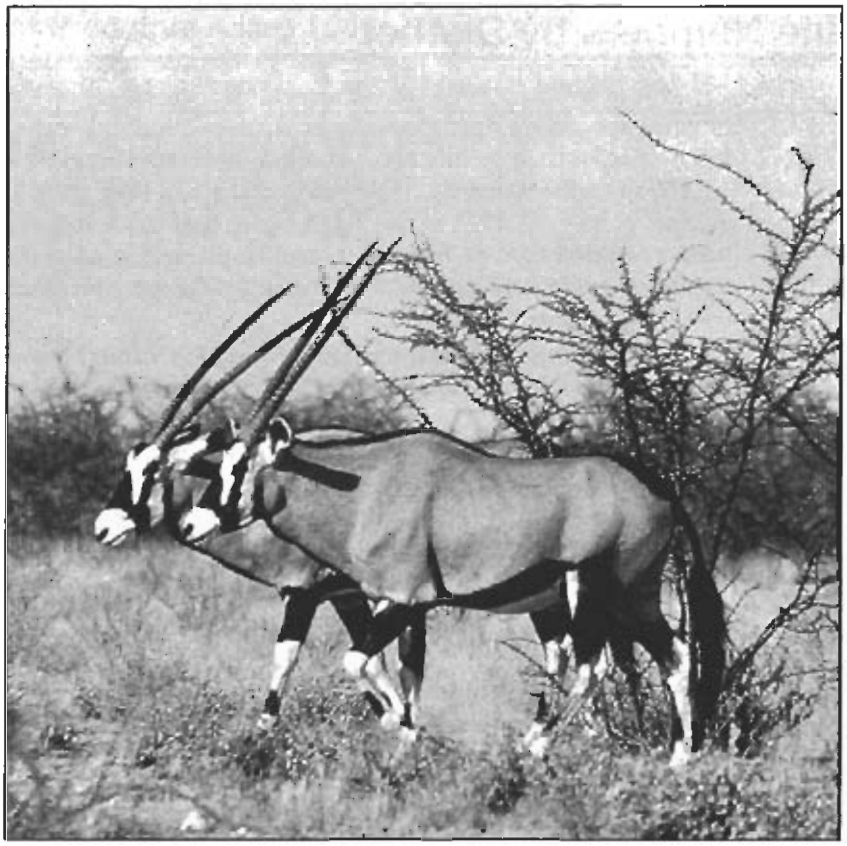
TABLE 7: Wildlife Numbers on Namibian Farms and Stock Inspection Points by District[a]

Districts	Total Number Farms	Number Farms Surveyed (%)	Estimated Number Kudu	Estimated Number Springbok	Estimated Number Gemsbok
Outjo	555	338 (61)	5 280	2 662	6 012
Otavi	351	13 (4)	545	0	25
Grootfontein	510	134 (26)	4 001	324	1 213
Otjiwarongo	543	101 (19)	3 787	587	5 922
Omaruru	482	133 (28)	5 384	4 395	8 727
Okahandja	446	296 (66)	10 070	2 268	15 400
Windhoek	1 160	590 (51)	15 808	17 468	18 446
Gobabis	1 005	335 (33)	9 809	6 683	6 487
Mariental	963	178 (19)	1 420	13 518	4 716
Keetmanshoop	1 236	255 (21)	3 283	10 149	3 444
TOTAL[b]	7 251	2 373 (33)	59 387	58 054	70 392
EXT. TOTAL[c]			180 000	176 000	213 000

[a] Information derived from DVS records, 1989 - 93. Annual Health Inspector Farm Visit Forms do not list specific numbers per species, but have catagories of high, medium, and low densities only. The density ranges for each species are as follows: kudu - low 1-10, medium 10-50, high >50; springbok - low 1-40, medium 40 - 100, high >100; and gemsbok - low 1-50, medium 50-100, high >100. The estimated numbers for each species listed in this table respresent the average of the high and low end of ranges for each species in the DVS records. CCF does not present this table as containing accurate and reliable information, but to serve as a guideline only.

[b] Total commercial farm and stock inspection points in country: 7 251

[c] Extrapolated Total: The 'Totals' were extrapolated to 100%, and the estimated population was rounded to the nearest 1 000.



Gemsbok are common on the commercial farmlands and are an important prey species for the cheetah.

D. Summary

The Ministry of Agriculture, Water and Rural Development statistics provide baseline information about issues affecting the cheetah population on the commercial farmlands. Research questions addressing the cheetah conflict and management issues can be formulated from this baseline data. Farmers can assist by reporting accurate numbers to the livestock inspectors.

An increased understanding of how disease, drought, and ecological changes influence the interactions between game, livestock and predators is necessary in order to sustainably utilize the ecosystem. There is a critical need to manage the ecosystem as a unit broader than individual farms. Predators, wildlife, livestock and their environment are interdependent, and if management of the farmland is inadequate, it will affect the balance between each component. A shift in balance between predator and prey has the potential to affect livestock and farmland economics. CCF feels that the degree of active management required to reduce predator conflicts will vary with individual circumstances, but it is important that farmers begin to think more critically about their part in the ecosystem.

IV. CHEETAH CONSERVATION FUND SURVEY

A. Purpose of the Survey

CCF discussed livestock management practices at farmers' association meetings.

An in-depth Farm Survey was conducted from 1991 to 1993 by the Cheetah Conservation Fund (CCF), as the first phase of CCF's research. The purpose of the Farm Survey was to obtain a basic understanding of the ecosystem on the Namibian farmlands which sustain cheetah populations and to research ways for humans and cheetah to co-exist. This included understanding how current livestock management practices impact cheetah and their prey populations. The survey serves as a basis for developing appropriate management plans and techniques that consider both land use needs and cheetah conservation.

The survey covered the north-central commercial livestock farmlands, which are considered prime cheetah habitat, and assessed the following:

(1) components of the farmland ecosystem that sustain the cheetah population;

(2) livestock and wildlife management practices, including local predator issues and management recommendations by the farming community; and

(3) behavioural observations of the Namibian cheetah.

Farm workers were a valuable source of information.

CCF believes this is the first report thar specifically includes predator control recommendations by the farming community. This information is essential to CCF's long-term conservation program and will be used as baseline information and a reference for further research.

CCF understands that conclusions based on questionnaires are debatable, but believes the survey provides useful information. CCF found that participants had a great interest in the survey and seemingly gave open and honest answers. Accurate responses by farmers to survey questions were essential, because inadequate or incorrect information will ultimately hinder livestock and predator management.

B. Survey Area

The survey covered 2 671 908 hectares in the north-central commercial farmlands, representing 7,3% of the total Namibian farmlands and 14,5% of the commercial cattle farmland. Interlinking farms selected for the survey span several districts, including western Gobabis, western and eastern Windhoek, eastern Okahandja, much of Otjiwarongo, and parts of the Grootfontein district, in the regions of Omaheke, Khomas, Otjozondjupa, respectively. The survey area lies between 19°30'S to 23°30'S and 16°E to 19°E (Figure 3). The area is predominately thornbush savanna, consisting of grassland with trees and shrubs in dense or open clumps [1].

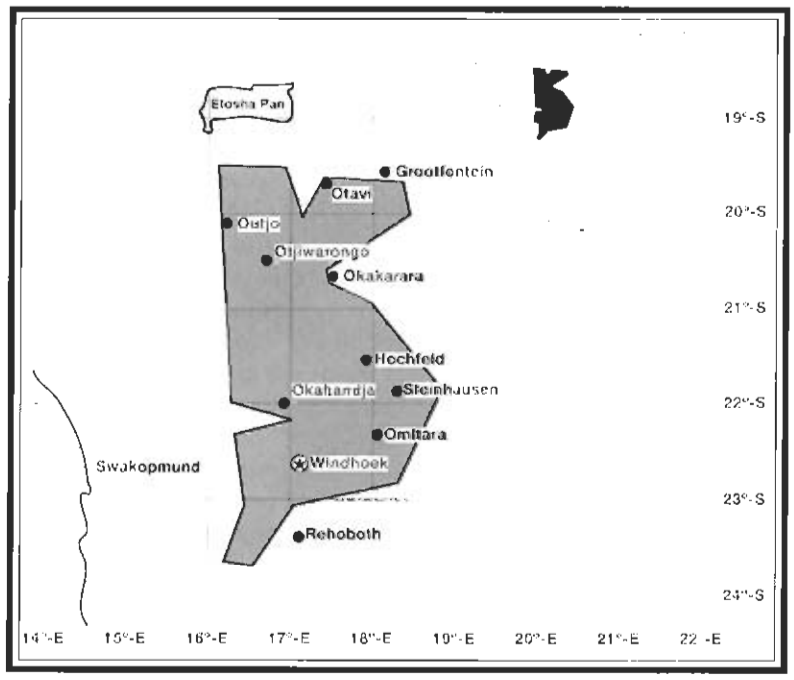


FIGURE 3. Map of the CCF Farm Survey Area. Survey covered the north-central commercial farmlands of Namibia. Insert shows survey area in respect to entire country.

C. Methods

Information was collected between June 1991 and August 1993 by the co-directors of CCF, using two types of questionnaire forms: (1) Form A, an in-depth personal interview with farmers, using topography maps at a scale of 1:50 000 for marking cheetah sightings and farm details; and (2) Form B, a shortened questionnaire presented for completion by farmers at local farmers' association meetings which CCF co-directors attended. Two hundred forty-one farmers who owned more than 385 farms were interviewed or completed questionnaires. One hundred twenty-nine farmers were interviewed (Form A) and 112 farmers completed questionnaires (Form B). During the Form A interviews, maps were marked with current and historic information about vegetation, water, wildlife distribution, wildlife movements, and other pertinent information. Information from both questionnaires (Forms A & B) was transferred to summary sheets and entered into a computer database (Q&A and EXCEL) for analysis.

The information was organised into the following categories:

(1) physical features of the farmland;
(2) livestock and wildlife densities;
(3) current livestock and wildlife management practices;
(4) livestock losses due to predators;
(5) interactions between cheetah and other wildlife;
(6) cheetah sightings and removals in the survey area;
(7) observations about cheetah behaviour; and
(8) farmers' attitudes and suggested solutions to reducing conflict with the cheetah.

The survey's main focus was cheetah/livestock conflict management. Therefore, information about the surveyed area and livestock management was correlated with cheetah problems whenever possible. It is difficult to define a "cheetah problem", because livestock loss specifically due to cheetah may be unknown and farmers' perceptions of predation may differ. Many farmers accept losing one or two calves a year, while others find any loss an economic hardship and consequently unacceptable. Throughout the survey, a "problem farm" refers to a farm in which cheetah are perceived as a problem; a "non-problem farm" refers to one where cheetah are not perceived as a problem. "Smallstock" refers to sheep and goats combined, and will be used throughout the report.

Statistical differences between paired means were determined with Student's t-test. The designation "p=" refers to the probability level that was used to judge the significance of the difference; a value less than p = 0,05 (p (0,05) shows that the numbers are significantly different. The designation "±" preceding a number indicates the standard deviation from the average (the first number). When a range of values was reported, the average value was used for analysis.

Not every participant responded to every question. Therefore, the number of responses will be denoted as "n=x," where x equals the number of farmers responding to a particular question. All farmers who participated in the survey are listed in Appendix II. When the text refers to individual farmers, allocated numbers follow in brackets, i.e. [no.] and are listed in the Farmers Reference section.

Wildlife population numbers reported by farmers are estimates only. Game population monitoring is routinely used in farm planning to calculate the carrying capacity for livestock. Furthermore, farmers are required to report game numbers on their property when applying for wildlife utilisation permits or participating in game reduction schemes [41]. Appendix III contains a list of wildlife species' referred to in the text, including Afrikaans, German and scientific names.

The results of the survey, as presented in this report, are divided into four sections:

1. Physical description of the survey area;
2. Farm management practices and predator issues in the survey area;
3. Historical information on cheetah in the survey area; and
4. Cheetah behaviour observed by survey participants.

Each section includes the objectives for asking the questions and a discussion of the responses.

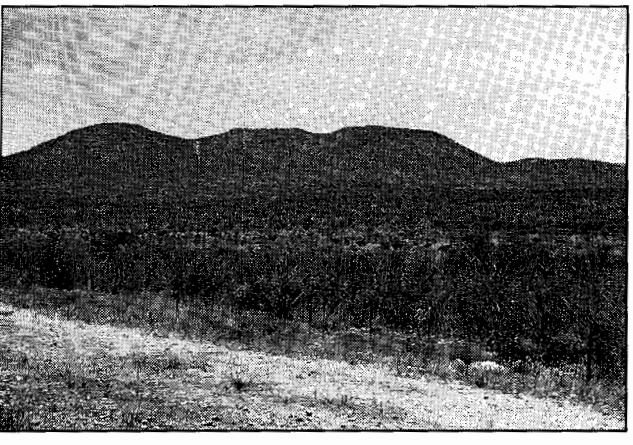
D. Description of the Farmlands in the Survey Area

The physical features of the farmlands vary widely and many have been altered or created within the last century by farmers. Therefore, it is critical to study how they influence game populations, livestock farming and cheetah behavior. The objectives of this section are to:

(1) define the physical features of the study area by assessing the general vegetation, size of farms, fencing, and number of water points; and

(2) identify the numbers and ratios of livestock and game in the study area, as they relate to available grazing and predator conflicts.

1. Physical Features of the Survey Area



The vegetation reported in Form A of the survey (n=121) contained 13% grassland, 26% sparse bush, 38% medium bush and 23% thick bush. Participants completing Form B were not asked about the vegetation on their farms, because those farms are situated in regions of the country where thick bush predominates, and therefore was a consistent factor.

Bush encroachment is a critical issue, as it reduces carrying capacity for livestock and wildlife [97]. Less land is suitable for grazing and larger tracts of land are required for farm units. There was little or no thick bush in the survey area before farms were established. Wildlife migrated to natural water points, thereby lessening the chance of overgrazing the land. Furthermore, high intensity natural fires often helped control the bush. Fires were prevented after the establishment of farms and fencing. Farmers stated that 30 to 40 years ago there was no bush encroachment in the northern section of the survey area [201; 63; 79; 72]. For example, one farmer stated that he has the same number of cattle as he did in the 1980's, but on twice as much land. These extensive farms prevent the farmer from monitoring his herds as closely, thereby increasing the opportunities for predation.

Note: Farmers referred to in the text are indicated by numbers in brackets "[ ]" and may be found in the Farmers Reference section.

Bush encroachment has claimed approximately 10 million hectares of good farmland over the past 20 years.

Farmers in the survey were categorised as owning small, medium, or large farms (Table 8) to help understand livestock and wildlife farm management systems. CCF wanted to determine if farm size influenced predator conflict. Eighty-seven percent of the farmers surveyed own farms smaller than 15 000 hectares, which represented approximately 69% of the land. Although not every farmer responded when asked about having a cheetah problem (n=225), of those who did, 34% of the owners of large farms (>15 000 ha) reported a cheetah problem, whereas 28% of the small farm owners and 19% of the medium farm owners reported a problem. This difference possibly may be due to less intensive farm practices on large farms.

TABLE 8: Farm Sizes in the Survey Area[a]

Total Farm Size (ha)[b]	No. Farmers	% Farmers	% Land
Small (<7 000)	91	39	20
Medium (7-15 000)	114	48	49
Large (>15 000)	30	13	31

[a] n = 235

[b] Total land holding in hectares by individual farmers. A "Total Farm" may be comprised of several small farms

There are primarily two types of fencing on the Namibian farmlands: livestock fencing and game fencing. Livestock fences have five strands of non-barbed galvanised wire to restrict cattle movements. Most farms are criss-crossed with these fences to create livestock "camps" enabling rotation of stock through the farm. Game fencing is constucted for non-jumping game (1,40 m with 11 wires) or high-jumping game (2,6 m, usually with 21 wires). Livestock fencing generally does not stop the migration of wildlife through farmlands, but game-fencing restricts wildlife movement both in and around fenced areas. The majority of the surveyed farmlands (91%; 2 425 147 ha) are fenced for livestock, and 9% (246 761) are game-fenced.

Game farms did not report more cheetah problems than farms exclusively raising livestock, yet many game farmers reported removing a large number of cheetah. Farmers stated several disadvantages of game fencing, including interruption in the migration of wildlife [68], overgrazing, fewer game calves, smaller animals [169; 2], and reduced natural selection [2].

On the left, a high-jumping game fence and on the right a standard livestock fence.

With the establishment of farms, constant water points were made available for livestock and wildlife. Overgrazing is more likely to occur when livestock and wildlife do not need to travel for water. Eighty-five percent of Form A participants were questioned about the location of their water points. There are 1 524 permanent water points on 1 075 343 ha in the survey area. It appeared that

water availability did not affect predator conflict, as the average number of water points was no higher on farms reporting a cheetah problem than on those without a problem (14,972 ± 1,81 and 12,99 ± 0,654, respectively; p=0,21).

Water availability is nonetheless a critical point, as drought drives wildlife to move in search of good grazing [91]. Droughts recalled in the survey area occurted in 1930 and 1934 [46; 91], 1945 [91] and 1960-64 [42]. During periods of dryness, cheetah are more visible to farmers [5] and predator conflict increases [100; 190]. Cheetah are more effective hunters of wildlife during periods of drought, when reduced vegetation increases wildlife loss through starvation, especially on game farms [8]. This may be due to a greater number of vulnerable malnourished wild prey as a result of the drought conditions.

2. The Number and Ratios of Livestock and Countable Game in the Survey Area

Kudu were reported as the most plentiful game species on the farmlands.

The livestock and countable wild game reported in the study area numbered 376 506 head (Tables 9 and 10). Sixty-six percent of the animals in the study area were livestock (cattle, goats, sheep) and the remaining 34% were game. The livestock numbers listed in Table 9 represent 15% of the cattle, 3% of the goats and 1% of the sheep (1,4% of total smallstock) on commercial Namibian farmlands compared to the Ministry of Agriculture, DVS, Annual Reports, 1986-1991; and 10% of the cattle and 1% of the smallstock recorded by DVS Animal Health Inspectors for 1993 [87].

TABLE 9: Livestock Numbers Reported in the Survey Area

Livestock	No. Reported	No. Farms Reporting
Cattle	165 443	233
Cattle Calves	33 086	157
Goats	16 527	117
Sheep	28 562	96
Unk. Smallstock[a]	354	4
Smallstock uncounted	—	6
TOTAL LIVESTOCK	243 972	233

[a] unknown if goats or sheep

As presented in Table 10, the majority of the reported game (88%) was free-ranging rather than in game-fenced areas. Fifteen percent of the reported species on game-fenced farms was exotic. In the survey area, the ratio of game to cattle varied greatly, from a low of 1:19 to a high of 99:1. The average ratio of game to livestock in the survey area was 1:2. Farms that reported problems with cheetah had a lower ratio of game to cattle than farms with no cheetah problem (p=0,02).

TABLE 10: Number of Wildlife Reported in the Survey Area

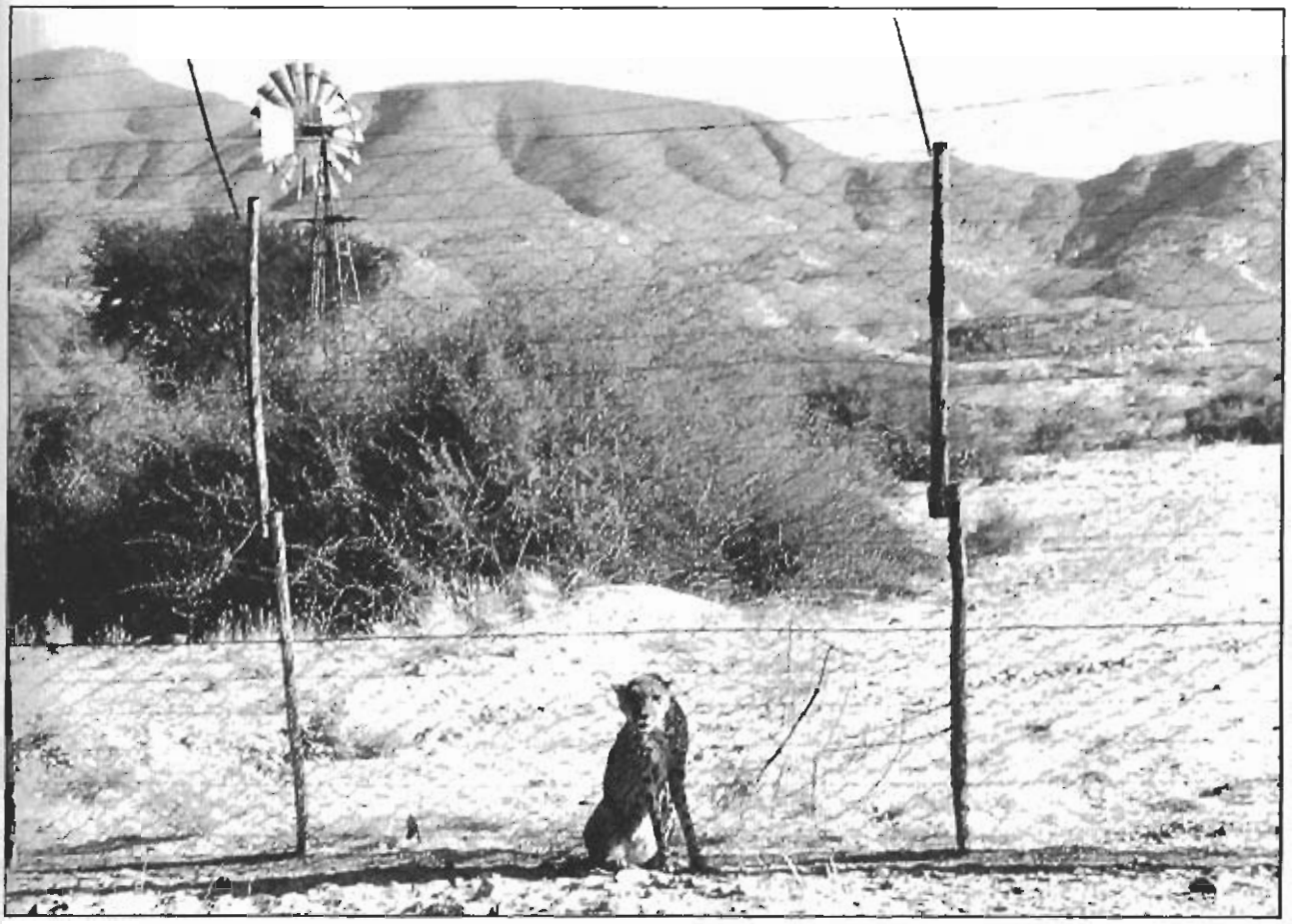
	Free-ranging	On Game Farms[a]	TOTAL
Kudu	31 664	1 764	33 428
Gemsbok	29 617	3 046	32 663
Springbok	13 423	1 243	14 666
Hartebeest	17 943	2 157	20 100
Eland	1 291	1 107	2 398
Blesbok[b]	383	809	1 192
Impala[b]	—	500	500
Plains Zebra	—	461	461
Hartmann's Mountain Zebra	1 699	226	1 925
Blue Wildebeest	—	1 151	1 151
Black Wildebeest[b]	—	645	645
Waterbuck[b]	—	320	320
Giraffe	—	340	340
Sable	—	52	52
Roan	—	63	63
Warthog	19 737	1 768	21 505
Ostrich	912	156	1 068
Tsessebe[b]	—	13	13
Nyala[b]	—	14	14
Water Buffalo[b]	—	16	16
White Rhino	—	4	4
Lechwe	—	10	10
TOTAL	116 669	15 865	132 534

[a] 55 Game Farms surveyed, encompassing 246 761 ha

[b] Exotic Species

The wild prey base available to the cheetah is critical in the issue of predator conflict. According to 38 farmers, a higher ratio of wildlife to cattle was the most significant feature in reducing livestock predation in the survey area. A plentiful wildlife population provides an abundance of prey, which in turn reduces the farmers' conflict with predators. Lack of wildlife can increase the risk that cheetah will prey on cattle, snggesting thar game levels should be kept high to protect cattle [94]. Farmers must realize that more abundant prey does not mean that the cheetah population will increase, as social behaviour limits a predator's maximum population density in an area [5]. Predators in turn assist the farmer by helping to keep wildlife populations healthy and at levels to reduce competition with livestock for grazing.

E. Farm Management and Predator Issues in the Survey Area



The objectives of this section are to:

(1) describe current livestock (cattle) management practices;
(2) quantify livestock loss in the study area and identify which stock is more susceptible to predation;
(3) describe current game farm management practices;
(4) describe game losses due to predators; and
(5) identify management practices that may reduce the conflict between livestock and predators.

1. Current Cattle Management Practices

1.1 Farm Camps

Farms are divided into camps for cattle rotation based on water points and grazing. The farm camp system indicates the level of management, because more camps generally involve a more intense farming system and more rapid rotation of livestock. Rapid rotation of livestock protects the land from overuse. Farmers also benefit from more contact with their cattle and closer observation, and livestock protection can be more easily integrated into the farm management plan. Farms that are managed less intensively have greater chances of stock loss from unknown causes.

Farms in the Form A survey were categorised based on the number of camps per total farm size (Table 11). The camp categories were defined by CCF based on the farmers' comments on the level of intensity of their farm management. Even though camp size varied from farm to farm, farms with more camps tended to practice more intensive livestock management. Thirty-nine of the farmers were classified as having few camps on their farms; 36% of these indicated they had a cheetah problem. Increasing the number of camps however, did not reduce the predation rate for all predators, including cheetah.

TABLE 11: Farm Camps Compared to Cheetah Problems in the Survey Area[a]

Camp Category	Total Farm Size[b] (No. of Camps)		No. Farmers	No. Farmers Reporting Cheetah Problems (% Camp Category)
Many	Small	(>35)	10	1 (10)
	Medium	(>50)	22	3 (14)
	Large	(>100)	2	1 (50)
Some	Small	(20-35)	18	6 (33)
	Medium	(30-50)	26	2 (8)
	Large	(60-100)	6	2 (33)
Few	Small	(<20)	12	4 (33)
	Medium	(<30)	19	6 (5)
	Large	(<60)	8	4 (50)

[a] Information obtained from Form A participants only, n = 123.

[b] Total Farm Size (hectares): Small (<7 000), Medium (7-15 000), Large (>15 000). Total Farm Size includes the total land holding by individual farmers, and may be composed of several smaller farms.

1.2 *Breeds of Cattle*

Because farm management is influenced by the breed of cattle (i.e. degree of maternal care and protection against predators), CCF asked the farmers questions concerning the particular breeds in the survey area. Of the 167 farmers reporting breed(s) of cattle on their farms, 109 (65%) raised Brahmans or Brahman-crosses, and 21 (13%) had Afrikaner breeds (Table 12). One hundred twenty farmers who raised only one cattle breed were evaluated, to see if particular breeds were more resistant to predator problems.

TABLE 12: Frequency of Cattle Breeds in Survey Area[a]

Breed of Cattle	No. Farmers	% Farmers	Breed of Cattle	No. Farmers	% Farmers
Brahman	49	30	Hereford	6	4
Simbrah	34	20	Charolais	4	2
Brahman X	26	16	Nguni	2	1
Simmentaler	26	16	Angus	2	1
Mixed Breed	24	14	Brown Swiss	1	< 1
Bonsmara	22	13	Pinzgauer	1	< 1
Afrikaner	21	13	North Devon	1	< 1
Santa Gertrudis	8	5	Jersey	1	< 1

[a] 167 farms responded to question, some farmers had more than one breed.

Due to the differences in farm management practices, it was unclear as to whether or not particular breeds had lower rates of calf loss. However, many farmers indicated that the Bos indicus (Brahman, Brahman crosses and Afrikaner) were hardier than the European breeds. The farmers believed that these cattle were less susceptible to predation because they were more protective of their calves and better adapted to the Namibian environment. Seventy-eight percent of the farmers responding to the cattle breed question raised Brahman, Brahman-crosses or Afrikaner breeds. Furthermore, CCF was told on a number of occasions about Bos indicus or indigenous breeds (primarily adult females) killing predators such as lion, leopard and cheetah. The influence of the cattle breed on predator conflict warrants closer examination.

Many farmers indicated that Brahman and Afrikaner breeds are more protective of their calves, better suited to the arid environment and less susceptible to predation than other breeds.

1.3 Calving Seasons

Many opinions exist in the study area about the optimal time of calving, but two primary calving seasons occur: summer and winter (Figure 4). Farmers reported having one of the following strategies: one calving season (94 farmers); two distinct calving seasons (81 farmers); or year-round calving (32 farmers). In all three of these methods, calving peaks during November, December and January, prior to and during Namibia's usual summer rainy season. Due to Namibia's semi-arid climate, the rain is a critical factor in the level of reproductive success and the timing of calving seasons. The average number of calving months in the study area is 5,59 ± 3,18 (n=203). Farms reporting a cheetah problem had the same length of calving period as farms without a problem (p=0,69).

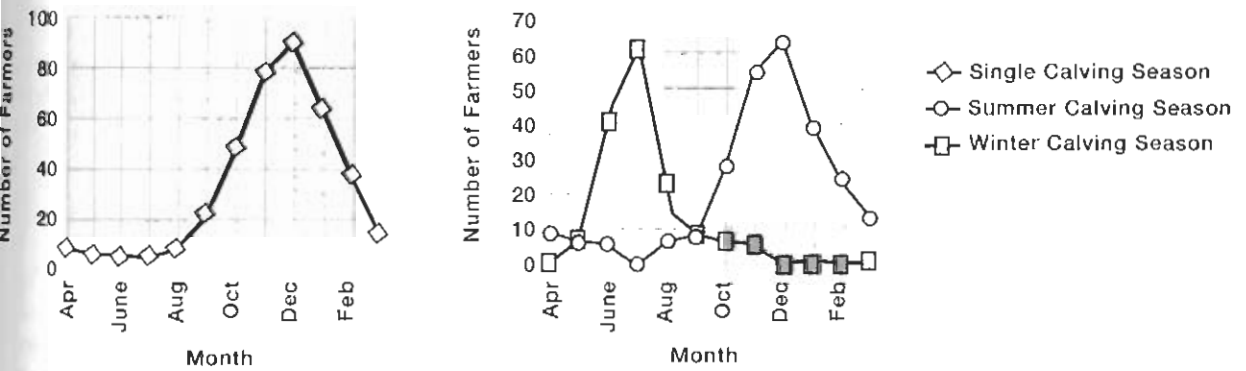


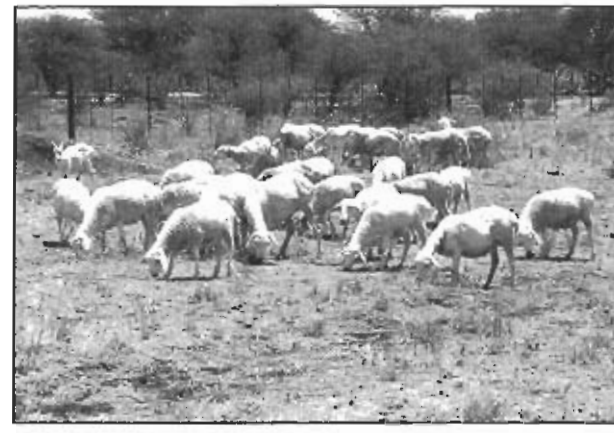
*FIGURE 4. **Calving in the Survey Area: One and Two Seasons.** Survey participants were asked how many calving seasons they used and in which months cows calved. Of the 207 responses, 126 had 1 season or year-roundcalving (left) and 81 had 2 seasons (right). The distribution of calving according to month is reported for both.*

The summer calving season extended from late August through early March. Heifers usually calved first, starting in late August, and suffered greater losses than experienced cows. Higher losses in heifers might have been due to a combination of factors, including inexperience with mothering; greater birthing problems; mating too young and calving early when predation pressures are reportedly highest. Dur-

ing the winter season, May through August, the animals that calved were primarily heifers or cows that failed to become pregnant in the preceding summer season. It was reported that heifers suffer greater losses when they calve during June, July and August [68]. This could have been due to fewer wildlife young available to predators at that time, low nutrition in the veld, and the calves being more susceptible to predation due to stress from the cold.

The fact that there is no correlation between the length of the calving season and predation in the study area may reflect the lack of synchronised calving within and among farms. Farmers observed that cheetah killed the first calves when calving started, but then returned to killing game [5; 13; 92]. The cheetah apparently preferred to hunt game once cattle calf numbers increased. Possibly this was due to an increase in the number of protective mothers and calves, i.e., the concept of safety in numbers. Predation on cattle calves might decline if farms synchronise calving both within their own herd and with other farms in the area.

2. Current Smallstock Management



Proper smallstock management can reduce predator conflict, eg. corralling for protection during night and lambing season versus continual free-ranging.

Farmers in the survey area raised smallstock more for personal consumption than for profit, and many herds of smallstock belonged to farm workers. For this reason, many practiced minimal management. However, smallstock loss to predators was not acceptable on most farms, and cheetah were removed as a consequence. Smallstock usually were free-ranging during the day (either alone, with a dog, with a herder, or with both a dog and a herder) and were confined to corrals at night. The most common species of sheep were Dorper and Damara fat-tailed sheep, and the most common species of goat was Boerbok.

3. Livestock Loss

Livestock losses in Namibia are due to a variety of factors, including: predation, drought conditions, diseases, reproductive failure, birth defects, injury, poisonous plants, natural causes, and stock theft. Between 1989 and 1993, predation was responsible for 10 to 15% of cattle losses and 30 to 40% of smallstock losses [DVS 1993 Annual Report]. However, in cases where livestock was found missing or when the cause of death could not be determined, most often predation was assumed. These assumptions could skew data and conclusions drawn about the livestock/predator conflict. Incorrect assumptions also can negatively influence the attitude of farmers towards the cheetah, thereby hindering proper management techniques for predator control.

With the goal of trying to understand the relationship between perceived predator problems and actual livestock losses, the survey investigated predation by all predators, with emphasis on the cheetah. As presented in Table 13, loss of cattle to cheetah comprised 33% of all cattle predation, while loss of smallstock to cheetah comprised 22% of all smallstock predation.

TABLE 13: Predation Rates Reported in the Survey Area

No. Farmers Reporting Calf Loss			No. Farmers Reporting Smallstock Loss	
No. animals lost/yr.	To All Predators (%)	To Only Cheetah (%)	To All Predators (%)	To Only Cheetah (%)
Over 20	2 (1)	2 (2)	24 (22)	1 (3)
11-20	32 (17)	7 (8)	16 (15)	4 (14)
5-10	52 (27)	19 (23)	23 (21)	7 (24)
1-4	77 (40)	26 (31)	33 (30)	9 (31)
None	29 (15)	30 (36)	14 (13)	8 (28)
TOTAL	192	84	110	29

Cattle losses to all predators ranged from 0-50 animals per farmer per year, while losses attributed to cheetah ranged from 0-25 animals per farmer per year, although only two farmers reported loss of over 20 animals. Eighty-five percent (163) of the 192 farmers responding to the question reported that predators took more than one calf per year. However, when specifically asked about calf losses to cheetah, farmers were reluctant to respond to the question (n=84), and fewer losses were reported. Sixty-four percent of the farmers reported calf loss to cheetah; however, only ten percent had losses greater than 10 animals.

Similarly, loss of smallstock to predators also varied, ranging from 0 to 100 animals per year. Eighty-seven percent (96) of the 110 farmers responding to the question reported that predators took more than one smallstock animal per year. However, when specifically asked about smallstock losses to cheetah, farmers again were reluctant to respond to the question (n=29). Nineteen percent reported smallstock loss due to cheetah. When reporting smallstock losses, farmers generally reported losing higher numbers than cattle (58% of the survey participants who lost smallstock to predators lost more than five animals, and 37% lost more than 10).

3.1 *Livestock Loss Due to Cheetah*

Farmers' attitudes towards cheetah did not necessarily correlate to actual livestock loss due to cheetah.

Livestock losses due to cheetah were not as high as CCF expected. According to research by the Directorate of Nature Conservation and Tourism [68,69] attitudes towards the cheetah did not necessarily reflect actual loss of livestock to cheetah. Farmers in the survey were asked if they had a problem with cheetah, in order to see if there was any correlation between loss (Table 13) and attitude (Table 14). As shown in Table 14, of those responding, 75% did not consider the cheetah a problem (1991-1993). Of the 56 participants who reported a "cheetah problem," only 18 indicated how many cattle or smallstock they lost to cheetah (their losses are included in Table 13). This makes it difficult to understand the relationship between livestock loss and cheetah predation.

As shown in Table 13, only 28 farmers (33%) reported losing more than five cattle per year to cheetah and 12 (41%) reported losing more than five smallstock to

cheetah, but as shown in Table 14, 56 farmers (25%) considered the cheetah to be a problem. Although the farmers reporting a cheetah problem and those reporting losses exceeding five animals to cheetah are not necessarily the same individuals, the figures illustrate that at least 25% of the farmers are affected by the cheetah, either by actual loss or by their attitude.

TABLE 14: Number of Farmers Reporting Problems with Cheetah in the Survey Area

	Presently (%)	1980's
Yes	56 (25)	54 (43)
No	170 (75)	69 (57)
TOTAL Responding	226	123

In the 1980's there were more reports of both livestock predation by cheetahs (Table 4) and removal of cheetah for livestock protection (Tables 1 & 6) than during the time of this survey. During the 1980's, drought decreased wildlife numbers in general and a rabies epidemic severely reduced the numbers of kudu, a primary food source for the cheetah. Farmers were asked whether they suffered high losses of kudu during this epidemic. Of the 47 farmers responding, 74% (35) reported high losses. Furthermore, when asked if their cheetah problems increased during this time, 54 (43%) of 126 responding answered yes, further suggesting that game numbers affect cheetah conflicts with livestock.

Because there is a greater economic loss associated with predation on calves than on smallstock, more specific information was collected regarding cheetah predation in calving herds, in order to identify when calves are most vulnerable. As shown in Figure 5, the average age of the calves lost to cheetah was 4,4 months. More than half (51%) of the losses were calves under three months of age, and 57% of these were less than eight weeks old, suggesting that close monitoring during the first three months shows greatest benefit to the calf's survival. After the age of six months, calves are markedly less vulnerable to cheetah (Figure 5). Although the majority of calves killed by cheetah are less than six months old, seven farmers reported losing calves up to 24 months of age. It is questionable whether a cheetah could kill livestock of this size. Additionally, many farmers reported that predator bite wounds in calves of all ages may lead to further problems of infection, sickness and even death.

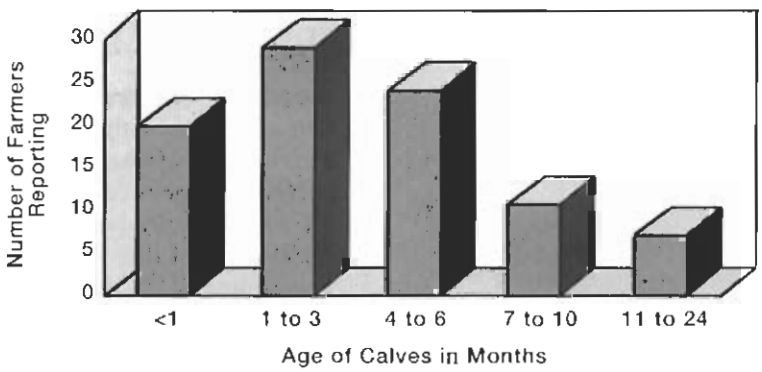


FIGURE 5. Age of Cattle Killed by Cheetah in the Survey Area. Responses, collected from 90 participants, ranged from birth to 24 months. The average was 4,4 months.

3.2 Livestock Loss Due to Other Problem Predators

In addition to cheetah, livestock farmers had to contend with predation by leopard, caracal (rooikat), and black-backed jackal (Table 6 & 15). More farmers in the survey area had problems with these three predators than had problems with the cheetah. Lion and spotted hyaena are rare in the study area (they are only occassionally seen in the northeast and northwest regions); therefore, these species are not discussed.

TABLE 15: Farmers Having Problems with Other Predators in the Survey Area

	Yes (%)	No (%)	Some (%)	No. Responding
Black-backed Jackal	134 (65)	66 (32)	7 (3)	206
Leopard	66 (33)	128 (64)	6 (3)	200
Caracal	71 (37)	98 (52)	20 (11)	190

Farmers indicated greater predator problems due to black-backed jackal than cheetah.

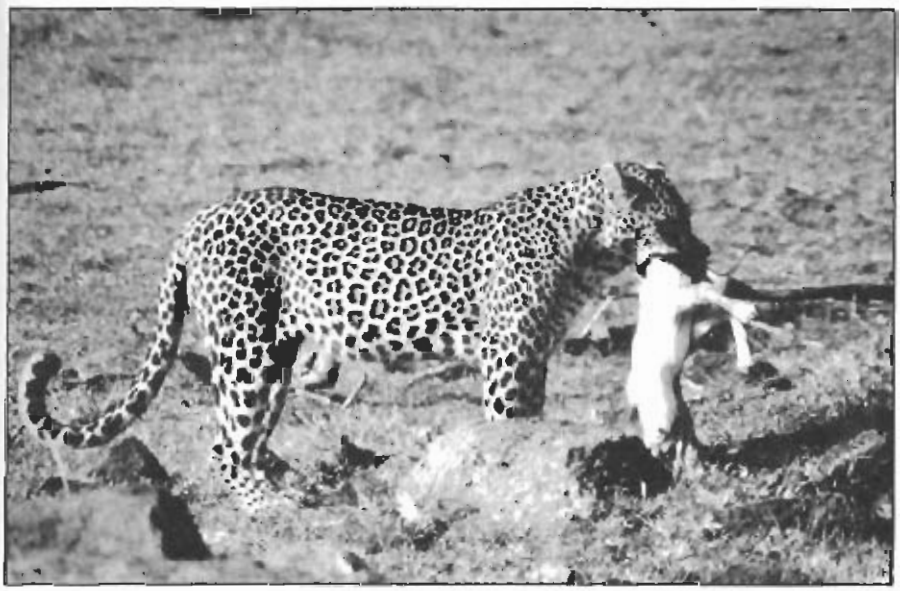
Black-backed jackal were the most prevalent problem predator in the study area. Sixty-five percent of the participants indicated a problem with black-backed jackal. Black-backed jackal primarily prey on smallstock, but were reported by farmers also to prey on livestock calves [43, 12, 188] and large game calves (nyala, [5]; springbok & blesbok, [78]). Farmers perceived increased problems during the calving season when black-backed jackal appeared to kill greater numbers of calves [8]. Black-backed jackal were seen eating the nose and tongue of the newborn [14, 188] and attacking the rear of the cow while waiting for the afterbirth [75, 188]. The transmission of rabies from black-backed jackal to livestock was also a concern [43].

The caracal was a problem for 37% of the survey participants. Many farmers indicated that caracal cause more livestock predation problems than cheetah [2; 8; 53; 85]. The caracal is known to prey on kudu calves, adult springbok, ostrich, blesbok, kori bustards, goats, and cattle calves up to three months [8, 18, 7, 85, 50, 193, 78]. The caracal has been seen defending kills against black-backed jackal [34].

Several farmers reported that predators such as black-backed jackal and caracal seemed to proliferate during drought, when other populations tended to drop. This might be attributed to their adaptability in the ecosystem. These species are more opportunistic than cheetah and readily take advantage of drought-stricken victims.

Although farmers reported more problems with leopard than cheetah, cheetah are removed in greater numbers.

The survey found that 33% of the farmers had problems with leopard, compared to only 25% reporting problems with cheetah. CCF found this result of interest, as cheetah were removed from the farmlands in greater numbers than leopard (see Table 6). The higher cheetah removal rate probably can be attributed to the behavioural differences between the two species, i.e., cheetah are more easily caught than the highly secretive and cautious leopard. It has been reported in the past that leopard and cheetah ranges rarely overlap in Namibia [65]. In the study area, however, 22 participants reported both a cheetah and a leopard problem, defi-



nitely indicating an overlap in the ranges. These discrepancies may be due to the fact that McVittie's study was limited and/or that there have been a various factors change in the past 16 years, including leopard densities.

Over the past three years, leopard densities appear to be increasing in various regions of the country, as more farmers are reporting increasing leopard problems [unpublished biannual CCF Farmers Reports, 1992-1994]. If true, the increasing leopard population may become a limiting factor to cheetah on Namibian farmlands. Leopard are territorial competitors and a threat to cheetah cubs. Unlike cheetah, leopard are extremely adaptable and are found in a variety of habitats throughout Africa. Many farmers were surprised to learn that the leopard is not an endangered species. The population of leopard in the whole of Africa is estimated at over 500 000 [62], yet the population of leopard in Namibia is unknown.

Although Namibian leopard home ranges have not been researched extensively, studies indicate that they are much smaller than Namibian cheetah home ranges which can be up to 1500 km^2 (as shown by CCF ongoing research and Morsbach[70]). One leopard was tracked in the Waterberg Plateau Park for a few months with an estimated range of 5 by 10 km [20]. Another ongoing study on several leopards in Bushmanland indicates an estimated home range of approximately 25 km^2 [94]. In a study in Kenya, four male leopards had an average home range of 52,8 km^2 and four females had an average home range of 18,2 km^2 [67].

It is necessary to note that the mere presence of predator tracks is not sufficient evidence that predation has taken place. Accurately determining the cause of death in livestock is sometimes difficult, but it is important for implementing appropriate actions to minimise loss. Evidence must be gathered, pieced together and evaluated according to predators found in the area, time of day, season, and other variables. Farmers can sometimes determine the cause of death of livestock by examining carcases and the area around the death site. Occasionally, expert assistance from a veterinarian is necessary to assess the situation accurately.

3.3 Additional Causes of Livestock Loss

Calves and foals which slip into aardvark holes often are not found and die. Cheetah are frequently blamed for these losses.

In order to put predation into perspective, other factors reducing livestock numbers must be discussed. Animals other than predators can cause livestock loss. For example, baboon are known to kill cattle calves and smallstock lambs to eat the milk stomach (abomasum) [188]; they also have been known to chase larger stock into fences, sometimes causing death [41]. Bites from several species of snakes kill livestock [85]. Calves may starve to death when they get separated from their mothers by fences [85]. Furthermore, a major cause of death in calves is slipping into aardvark holes [86; 12; 68]. Some farmers reported up to 15 calves per year died in holes; horse foals also have been reported falling into holes [48; 12]. Livestock are known to break legs in the aardvark holes as well. One farmer estimated there were about 360 holes per 60 ha in one of his camps [86].

Poisonings, mostly plant, are an important component of livestock losses (10% for smallstock and 15% for cattle, DVS Annual Report, 1993). The most common poisonous plants of the area include "slangkop" (Urginea sanguinea and Ornithoglossum sp.) and "gifblaar" (Dichapetalum cymosum). Gifblaar flowers in September and is poisonous in January (a high calving month), when it can cause huge losses due to heart failure and paralysis if cattle eat it and then drink water. Slangkop also affects the heart. Extraordinary losses, of up to 130 cattle in one year due to plant poisonings, were reported by farmers in the survey area [4, 8, 7, 11, 14].

Metabolic problems caused by drought and malnutrition have always caused high stock losses. For example, in

1992, 25% of cattle and 39% of smallstock losses were attributed to drought and malnutrition. During critical drought conditions in 1993, deaths from metabolic problems increased dramatically, to 61% of the cattle and 65% of the smallstock losses [DVS Annual Report, 1993].

Infectious causes of death are a constant component of total losses for cattle and smallstock (just under 10% of the total in normal years; DVS Annual Report 1993). Isolated cases of rabies on farms are continuously reported, and brucellosis also has been reported [89]. Isolated outbreaks of anthrax continue to be a problem for livestock [8; 44; 5] and wildlife, including the cheetah[87,40]. Farmers reported cheetah dying of anthrax: five in 1988 [5] and 12 in 1989 [44]. Furthermore, anthrax appears to be a limiting factor for the cheetah in Etosha [51].

Poor fertility (heifer calving rate is sometimes only 55%)[1] also negatively impacts cattle herds through low conception rates, early abortions, etc. (five to 15% of total loss from 1989 to 1993; DVS Annual Report 1993). A veterinarian can assist farmers greatly with increasing herd fertility and improving overall reproductive management. Many farmers recommend culling a cow that loses its calf, thus removing weakness in the herd. This technique is a Breed Standard for the Bonsmara Herd Registry.

A growing problem which has increased in the last few years is stock theft. Often cheetah are blamed for these missing stock animals. It is also worth mentioning that feral and stray dogs as well as farmers' pet dogs, especially when in packs, may be responsible for game and stock loss [5,6].

4. Current Game Farm Management Practices

Although questions regarding game farm management practices were not specifically asked in the survey, information was gathered on current techniques. The majority of game farms in the survey area did not appear to have a formal game management plan; therefore, there exists a great necessity to create management practices which specifically protect valuable game on game farms.

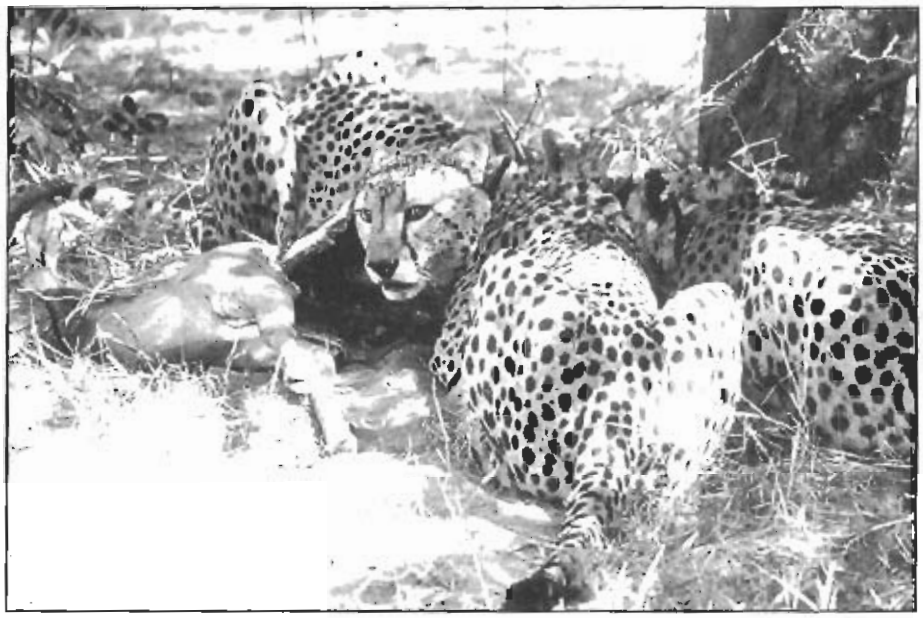
Game is primarily used for trophy hunting, utilising indigenous species as well as exotic species which have been introduced (i.e. blesbok and impala). With the exception of only a few farmers, no predator control (i.e. electric fences) had been instituted on the game farms. The primary cheetah control was live capture and removal, thus encouraging continual predator problems.

5. Game Loss Due to Cheetah

To become familiar with the attitudes towards game losses, CCF enquired about the loss of game ro cheetah on both livestock and game farms. Most livestock farmers accepted cheetah preying on the game, because when there was enough wild prey, livestock predation decreased. However, many game farmers indicated that the loss of game to predators in game-fenced areas was an economic problem. When game farms were started in Namibia, they created a situation that is ideal for the cheetah, thus encouraging conflict. In fact, game farms have often been referred to as "candy stores" for predators.

Although numerical data were not collected on game losses, a great deal of information was gathered. Forty-nine game farmers in the survey reported removing 1 280 cheetah (1980 through August 1993) because of game losses. This represents 45% of the total cheetah removals reported in the survey. As stated before, removing cheetah from an area encourages new cheetah to move into the vacated territory. Often, the number of cheetah increases in a recently-vacated area before a new animal takes over the territory. Predation problems may increase during this time.

Predator problems likewise increase in the unnatural setting created by introducing exotic species into game-fenced areas. As presented in Table 10, many game farms have imported exotic species from another country (e.g. blesbok or impala from South Africa) or have translocated animals from another area of Namibia where the habitat and bush cover are different (e.g. springbok from the deserts of southern Namibia brought north to thicker bushed areas in Otjiwarongo). Although perfectly



Exotic species introduced into game farms are more vulnerable to predation than native species.

healthy, these animals can become easy prey—more vulnerable, often unable to escape—due to the unfamiliar habitat and strange circumstances of their new environment. Some possibly have never before encountered a predator, so they fail to react appropriately. Additional factors, such as restrictions on natural migration imposed by game fencing and greater bush cover, further increase the risk of predation. The disruption of wildlife movement patterns caused by game-fenced areas potentially can change the ecology of the entire ecosystem, depending on the type and numbers of game utilising the land. Game fencing stops natural migration, confining animals to a habitat selected for them by farmers. This unnatural situation contributes to higher predation rates.

Furthermore, CCF believes it is important for the game farmers to understand the predator's role in the ecosystem. Predators help to maintain a healthy ecosystem by culling the old, injured, or sick, leaving healthy animals to survive and breed. These strong breeding animals have been naturally selected to pass on their genes to their offspring, thus helping to establish healthier game populations. Predators also may help slow the spread of disease. For these reasons, some game farmers referred to the cheetah as "nature's doctor."

6. Wildlife Management Incorporating Sustainable Utilization

Namibia is the first country in the world to include sustainable utilization of wildlife and protection of its environment in its constitution. The IUCN defines "use" as an activity by which humans derive benefit from a population or ecosystem. Uses are either consumptive or non-consumptive, active or passive. "Sustainable use" is the use of a population or ecosystem at a rate within its capacity for renewal and in a manner compatible with conservation of the diversity and long-term viability of the resource (i.e. wildlife) and its supporting ecosystem [8].

Sustainable use can only be achieved today through sound management practices which are supported by research and active participation by those people who are utilizing the wildlife. There are four parts of a sound management program. First, management must be holistic and incorporate the entire ecosystem. The wildlife that is being managed should be viewed in consideration of its impact on other resources and the environment. Furthermore, several species may be utilised at the same time, and their interactions on each other need to be considered. Secondly, management plans must be flexible and incorporate adjustments when needed. Populations being utilized must be constantly monitored (i.e. health, sex and age structure, number of births and deaths, densities, etc.) to determine when management schemes need to be modified. Thirdly, wildlife should be managed by the people (i.e. farmers) owning and utilizing it, and not solely by the government or international organizations. This can only be achieved through social and economic incentives for the landowners. Fourthly, any utilization must be carried out in an ethical manner.

7. Management Practices to Reduce Predator Conflict

Correct identification of the cause of livestock loss is essential. It is quite common for farmers throughout the world to blame predators first for the majority of livestock losses before investigating the cause of loss thoroughly. If it is determined that predation is the cause, the appropriate species culprit must be identified for effective management strategies. Tracks are not necessarily sufficient evidence, as more than one species may feed on or investigate a carcase. Farmers must familiarise themselves with predator behaviours and clues for proper identification of the predator. An excellent reference to aid the farmer in identification as well as predator control techniques is "Predators and Farmers" [6], by the Endangered Wildlife Trust.

When the specific predator causing livestock loss has been accurately determined, it is necessary to identify livestock management strategies to help prevent further losses. All information and management practices must be evaluated carefully since every situation is unique, and different methods may be required for reducing predation in each case.

Some farmers indicated that implementing new livestock protection methods was too much work, as their management was already extensive. This attitude is unfortunate, as the lack of any predator control or the presence of vulnerable livestock or game may encourage opportunities for predators. Farmers must realize their methods of farming can create losses. Conversely, proper management can prevent or remedy many problems.

As presented in Table 14, 75% (170) of the farmers questioned did not have cheetah problems at the time of the survey. These farmers offered a variety of useful livestock management techniques which they felt reduced predator problems. Each strategy described on the following pages has advantages. Some practices may work for an individual farmer, whereas others may not be practical.

7.1 Management of Calving Herds for Predator Control

Listed in Table 16 are the techniques used at calving time to control predation (73% of the farmers responded to the question). Two techniques, random monitoring and no protection, represented 45% of the responses; CCF considers these ineffective management strategies in preventing livestock loss to predators. The most prevalent technique, used by 43% of the farmers, was calving camps. Twelve percent of the farmers monitored their calving herds daily. Fifteen percent used other methods, including increased stock densities, donkeys with calving herds, bulls in the calving herd, cows with horns, and older cows in with heifers. Nineteen percent of the farmers used more than one technique, usually combining calving camps with other methods.

TABLE 16: Protection Techniques at Calving Time Used by Farmers in the Survey Area

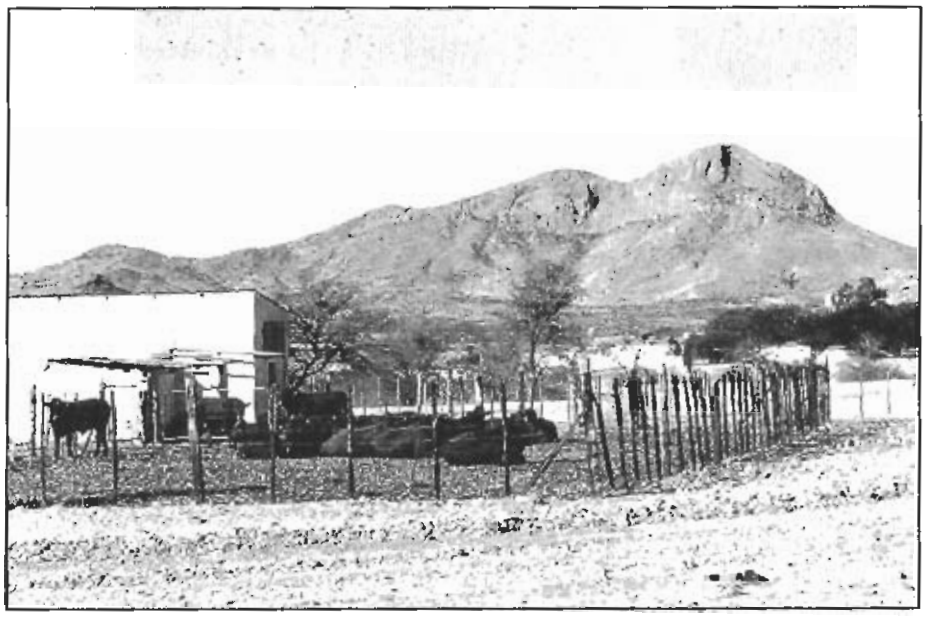
Technique	No. Farmers[a]	%
Calving Camps	77	43
Daily Monitoring	21	12
Other Techniques	27	15
Random Monitoring	39	22
No Protection	40	23

[a] 177 farmers responding; some farmers used a combination of techniques

Calving camps that are watched closely have benefits in addition to deterring predation, including:

(1) increasing delivery success, by assisting cows and heifers having problems (pulling big calves if a cow is small);
(2) detecting and treating sickness;
(3) 36-hour weaning for re-breeding of females;
(4) feeding calves during a drought; and
(5) taming calves [45; 111; 41; 7].

Additional suggestions to reduce calf loss included grazing and calving in different areas, and locating calving areas away from habitat with high cheetah populations [198]. Calving camp locations should also avoid areas with cheetah playtrees (see Section 4) and high numbers of aardvark holes. Several farmers significantly increased survival rates by keeping calves in a calving camp next to the house until they are six weeks old. One farmer stated his only losses were cows and calves he did not find in time to put in the camp. He as well as another farmer [111] mentioned an added benefit of tamer cows and calves due to daily handling.



Calving bomas close to homesteads offer greater protection from predators and the advantage of closer monitoring of cows and calves.

Young calves (less than three months old) are the most vulnerable to predation; therefore, both the timing and duration of the calving season are critical (see Figure 5). Wild species usually have a short, highly synchronised calving season, which supposedly decreases predation rates on calves. Several farmers stated that the optimum calving times coincides with wildlife calving times, as cheetah then concentrate their efforts on the young of game. Coordination of cattle calving with game calving is a natural strategy for reducing predator conflict.

One of the current Namibian farm management practises is Holistic Resource Management (HRM). One aspect of this system utilises fast rotation of high densities of livestock through smaller camps. The theory behind this technique is that it simulates the land use patterns of large herds of migrating game and is better suited for sustainably utilising the land [84]. Several farmers keeping large herds (70 to 100 cows) which rotate between camps advocate such a method. Since cheetah are shy and tend to stay away from big herds, this system can help reduce predation, as there is safety in numbers. Concentrating herds and keeping as many camps empty as possible are also good for vegetation. The vegetation can rest, resulting in a higher quality and quantity of plants [38; 7; 35].

Other methods not in wide use also warrant mentioning:

(1) clearing the bush in and around calving camps to reduce cover for predators and decrease their chances of ambushing the calves;
(2) keeping herds with calves out with a herder during the day, but corralled at night for protection [25];
(3) keeping calves up to four months old in a corral with a roof at night [111]; and
(4) culling cows that fail to successfully raise offspring.

Many farmers sell heifers that lose their calves [105; 28; 240] and suggest using a smaller bull to breed heifers to avoid calving difficulties due to large calves [14; 66]. For crossbred calves, it has been suggested that farmers use bulls from smaller breeds (i.e. Afrikaner) to breed heifers.

7.2 Calving Herd Guard Animals

A donkey with a foal is an effective guarding animal, as she will guard the calves as she guards her foal. The birth of the foal should be one month prior to calving.

Many farmers successfully use donkeys to ward off cheetah [14; 16; 84; 68; 18]. Donkeys are generally docile, but seem to have an inherent dislike for intruders such as cheetah, black-backed jackal, caracal and even domestic dogs. Livestock farmers in other parts of the world also use donkeys to protect livestock from predators[98]. Additionally, donkeys are useful for stopping fights in a bull herd [41]. One farmer has been using donkeys systematically since 1986 and has subsequently lost only one calf to predators. Before using the donkey, he reported losing 32 calves in one year to predators. His system includes a breeding schedule for the donkeys and cattle so that each calving herd is accompanied by a donkey mare and her month-old foal. He cites low cost, easy management, and a high success rate as his reasons for using donkeys.

However, reports of success using donkeys to reduce predation vary. Improper husbandry or rearing practices and unrealistic expectations probably account for many failures. Some key guidelines in using a donkey for predation control include:

(1) using only a mare or gelding (donkey stallions can be aggressive to livestock);

(2) allowing the donkey to bond with the herd it is to protect (allow 4-6 weeks);

(3) using only one donkey for each herd, except for a jenny with a foal;

(4) testing a new donkey's response to predators by challenging it with a dog in a pen or small pasture (do not use donkeys that react passively during this test); and

(5) using donkeys in small open pastures with a moderate-size herd [98].

Mules also have been used for protection because they are more aggressive than donkeys. One farmer reported seeing a leopard trampled to death by a mule. Although mules are aggressive guard animals, they have been known to "steal" calves for their own, since they cannot reproduce [188].

Zebras [220; 13], horse stallions [159] and horned oxen [31] have been used successfully to deter predators. The early settlers commonly kept horned oxen with their calving herds [79; 12]. Some survey participants expressed the belief that cattle, especially females, should never be dehorned [12; 75]; and that mature cattle are more successful against predators than heifers [12].

7.3 Smallstock Management for Predator Control

Information on smallstock management was collected from 95 (60%) of the 158 smallstock farmers (Table 17). Individual participants reported that dogs, herders and corrals have all been used to protect smallstock. Of the farmers interviewed, 16% used only dogs and 15% used only a herder with their flocks. Nineteen percent used both dogs and herders, while 10% used no form of smallstock protection. Overall

Baboons are used to protect smallstock, but may become unreliable and aggressive.

Several farmers mentioned the use of baboons as smallstock guard animals [96; 125; 60]. The baboon must grow up with the herd in order to bond with it. Even though baboons can be good protectors, they may become dangerous. Due to their aggressive nature, they can be hostile not only to predators and intruders, but also to the owners themselves. Such problems may increase as the baboons mature. Furthermore, one farmer stated that his baboon was not consistently reliable, as when it got bored with the stock, it would come to the farmhouse [125].

Herders staying with a herd all day can discourage or chase away most predators. The herder may also be able to chase predators such as the cheetah away. Properly trained herders can further assist farmers by recognising sick or injured animals, weak young, inattentive mothers, etc. The early recognition of animals with problems can increase overall survival rates as well as decrease susceptibiliry to predation.

Many farmers reported high losses in corrals: 26 of 75 animals and 32 of 79 animals killed by cheetah [104], and 27 goats killed in one night by five cheetah [7]. Corralled smallstock cannot escape predators, but their panicked movements repeatedly stimulate the predator's killing instincts, so that it kills more than it can eat. It has been found that using lighted corrals and better fencing will reduce these incidents. One farmer had success in hanging a light in the middle of the corral approximately one metre above the heads of the sheep. Corrals surrounded by a thornbush barrier also have proven successful. However the thornbush must be continually maintained as well as thick and high enough to discourage predators. Locating corrals close to human acrivity also is helpful.

7.4 Other Forms of Livestock Predator Control

In the survey area, the practise of using poison to eliminate predators also was investigated. Of those responding, 65 farmers used poison while 179 did not. Poison can disrupt the farmland ecosystem; it is very non-selective, often killing non-targeted animals. Poisoning is a method of fighting nature, rather than working with it. The use of poisons is discouraged, as there can be severe long-term negative consequences for the ecosystem.

Other forms of predator control included poison collars on stock to selectively eliminate the specific livestock-killing animal; and both sight and sound repellents, which can be effective remporary aids to protect livestock, but predators soon become accustomed to the repellents. Anorher method gaining wide acceptance is taste aversion, which causes the predaror physical illness after eating treated bait [33]. This method has proved very effective, as it selects the specific problem animal. Electric shock collars temporarily placed on predators are currently being promoted in Namibia as a form of predator control. Significant research data currently available negates the effectiveness of this technique. Predators quickly learn that once the collar has been removed, the shocks no longer occur [25, 26, 32, 11, 38, 22].

7.5 Game Farm Management for Predator Control

In some ways it is more difficult to protect wild game from predators than it is to protect livestock. Wildlife is the predator's natural prey, and exotic species can be more vulnerable than native species. The farmers' best option may lie in game-fencing design and maintenance. Although cheetah cannot jump, they easily gain access into game-fenced areas through warthog holes under the fences.

There are several ways farmers can restrict the cheetah's access to their game farms. Warthog holes can be eliminated by checking the fence line regularly. The bottom strand of the fence can be replaced with strong barbed wire, although this is at best a minor deterrent. Electric fencing (see Appendix V) is widely used throughout South Africa to both contain or exclude predators. Some Namibian farmers also

An electric fence that is properly installed and maintained will more than pay for itself by reducing loss of valuable game.

are utilising electric fencing with success [65]. As cheetah are very sensitive to the electric shock produced by the fence, it is a strong deterrent. However, electric fences must work continually and be well maintained to be effective. Over the long-term, farmers have indicated that electric fences are worth the investment to protect valuable wild game.

Wildlife management, both inside and outside of game-fenced areas, is a critical component in helping reduce wildlife losses to predators. The Cheetah Conservation Fund's ongoing radio telemetry research on the movement patterns of cheetah indicates that cheetah do not reside permanently inside game-fenced areas, as many farmers believe. If cheetah are deterred from entering game farms and have adequate prey populations outside of game-fenced areas, losses wirhin game-fenced areas will be reduced.

7.6 Conservancies

Conservancies are an important new development in the promotion of effective farmland ecosystem management.

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. By definition, a conservancy is "an area where conservation is actively being practised, where conservation means the management of human use of organisms or ecosystems to ensure that such use is sustainable. Besides sustainable use, conservation includes protection, maintenance, rehabilitation, restoration, and enhancement of populations of ecosystems" [81].

Five conservancies exist in Namibia (Ngarangombe, Waterberg, Khomas Hochland and Steinhausen on commercial farmland; and Damaraland on communal farmland), and two more are being formed at the time of this writing. Each of these conservancies has developed a constitution which serves as a set of guidelines among the participating farmers. The constitution outlines conservation and management strategies, including cooperative management and sustainable utilization, of the natural resources in conjunction with agricultural aims. The constitution may include utilisation of game for trophy hunting, rations, eco-tourism, etc. Constitution guidelines assist farmers in coordinating the management and utilisation of game on the farms. CCF supports and encourages the formation of conservancies.

F. Historical Distribution and Removal of Cheetah in the Survey Area

The Namibian cheetah population numbers have varied in the past. The objectives of this section are to give an overview of:

(1) sightings of cheetah by farmers in the survey and by farmers in other reports;

(2) the number of cheetah reportedly removed; and

(3) the sex and age structure of cheetah removed.

1. Historical Review of Cheetah Sightings by Farmers in the Survey Area

As stated earlier, most farmers agree that the cheetah population has declined noticeably in the last few years. Information listed below on the cheetah population in the past was obtained from the farmers in the survey:

- From 1920 to 1932, there were cheetah throughout the Okahandja area [62].
- In Okahandja during the 1950's to 1960's, there were more cheetah than between 1960 to 1968 [79; 40; 86].

- In 1924, as well in 1944 to 1945 there were no cheetah in the Hochfeld area [79]. The first few came in during the 50's and even more in the 60's following the wildlife during the drought [29].
- In the survey area, a number of farmers felt that there were more cheetahs in the 60's and 70's than there are today [40; 74; 97], and that the cheetah problem was much worse 30 years ago [59].
- Another farmer stated that after 1968, the numbers increased until the 80's after which the numbers have continued to decline [62].

The following summary of excerpts from a Gaerdes report [27] provides further information and an overview of the distribution of the Namibian cheetah in the early 1900's. Gaerdes' information was obtained from previous written reports and from individuals (original source is underlined).

- 1910 - Streitwolf and Muller - no cheetahs observed in the Caprivi.
- 1913 - publication: Jagd and Wildschutz in den Deutschen Kolonien - no cheetahs were found in areas of Luderitz and Windhoek. In Gobabis cheetahs were plentiful, as well as in Grootfontein and Outjo through the whole district. They were found in Maltahohe, and Keetmanshoop in the southern area of the Karasa mountains, as well as Okahandja and Karibib. Cheetahs were not particularly mentioned in the Omaruru and Waterberg areas.
- 1914 - 1919 - Steinhardt - No cheetahs were seen in Koakoveld, but this was "probably just an accident" because they are killed in the southern part.
- 1931 - Wilhelm - reported only sporadic sighting from 1910 - 1924 in the Caprivi region.

According to another Gaerdes' report [28], cheetah killed a high number of cattle in the Grootfontein area in 1901. From 1910 to the early 1930's, there were reportedly a lot of cheetah in the south of the country. They were rare in Seeis in the early 30's. One female was seen with nine cubs in Maltahohe and Gibeon during 1955.

An excerpt from additional historical information in a 1934 publication by G.C. Shortridge[91] is quoted below to indicate cheetah distribution at that time. It is worthy to note that this cheetah distribution appears to correlate with his reported game distribution at that time for eland, kudu, blue wildebeest, gemsbok, hartebeest, and springbok (southern range).

> *The cheetah has a widely scattered range through South-West Africa and it was considered to be quite plentiful in the eastern sand-veld regions. It appears to be somewhat scarce in the Kaokoveld... all though he saw skins in the possession of natives and also observed the spoor. In Ovamboland cheetah skins were seen in native villages... are not uncommon in the Namutoni Game Reserve. In Grootfontein District they are well-known to the Kung Bushmen around Karakuwisa. ...I did not hear of their occurrence in the coastal desert strip... scarce in the neighbourhood of the Orange River, the western and southwestern parts of Great Namaqualand, and the highlands of western Damaraland. Farther east, in Gobabis District and elsewhere in the sand-plain country adjoining Bechuanaland, cheetah increase in number...Considerable numbers of cheetah skins are brought into Windhoek and Keetmanshoop annually by natives from the eastern portions of South-West Africa and Bechuanaland.'*

Number of Cheetah Reportedly Removed From the Farmlands

Over the years many cheetah have been removed by farmers from the free-ranging population (see Tables 1, 6 and 7). The most pressing question is, can the cheetah population sustain the level of removal that has occurred? If more cheetahs are being removed than are being born, then the obvious answer is "no." Population size on farmlands cannot be determined precisely without extensive cooperation of the farming community to conduct a capture-tag and release program. More critical is assessing the subset of the population that is being removed. In order to gather information on removals, historical records were reviewed and farmers were surveyed about cheetah they have removed.

Farmers in the survey were questioned about their experiences and methods of trapping cheetah.

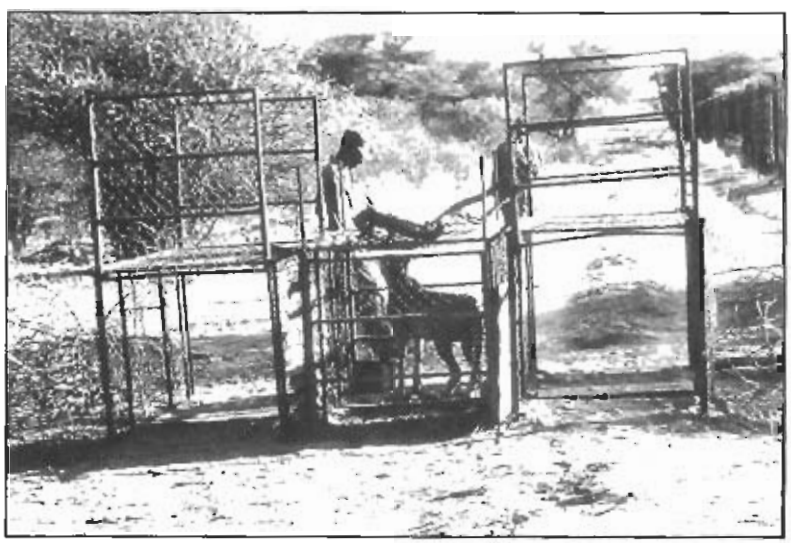
Historical information on removals by district is available from two sources: Gaerdes, covering 1960 - 1973 [28], and DVS records from 1986 - 1994. The information, presented in Table 18, shows the distribution of removals according to districts of the country. These figures can be used as a general indication of the cheetah distribution at the time. Yet, due to variables such as the number of farms, management practises, the effects of natural disasters, attitude of the farmers, etc., they cannot be used as a definitive measure of the cheetah population per district.

TABLE 18: Historic Records of Number of Cheetah Removed Per District

District	Gaerdes[a] 1960 - 1973	DVS[b] 1986 - 1994
Windhoek	296	146
Otjiwarongo	102	251
Okahandja	109	176
Outjo	45	118
Omaruru/Karibib	211	85
Grootfontein	54	87
Otavi	—	63
Keetmanshoop	—	24
Mariental/Maltahohe	98	50
Gobabis	—	94
TOTAL	915	1094

[a] from [28]; total of 126 farms.

[b] from DVS records.



When one cheetah is caught out of a group, adjacent traps stay open and it is matter of days before the rest of the group is caught.

To better understand the causes of removal, as well as all pertinent information about the animals removed (e.g. sex, age, group structure, etc.), farmers were asked for specific details about cheetah removed from their farms. Since cheetah are shy animals and usually avoid humans, they are difficult to see on the farmlands. Therefore, they were usually live-trapped in capture cages instead of being shot on sight. Cheetah traps primarily were set at playtrees, and secondarily along fence lines and roads which cheetah were known to frequent or travel. Farms with playtrees tended to remove more cheetah (p=0,12) than those that did not have playtrees, even though the frequency of cheetah on the farms was nearly the same (p=0,90) and there was no greater incidence of

problems. This suggests that farmers with playtrees took advantage of the opportunity playtrees provided them for removal of cheetah. A captured cheetah's vocalisations (calls) attract other cheetah [39], and a second trap can usually be filled if it is placed next to the first one with the captured cheetah. Farmers indicated that once one cheetah in a social group is captured, it is easy to capture the rest of the group, as it tends to stay in the area.

Many farmers agreed that the removal of cheetah (hunting and catching) created a vacancy in the area which attracted in other cheetah [24; 142; 63; 65]. This has also been seen with other cat species [90-12]. After a cheetah or group of cheetah is caught, it is only a matter of time, from a few days to three to four weeks [29], before others can be caught, because new cheetah come into the vacated territory. This is called a "vacuum effect" [90].

Sixty-five percent (157) of the survey participants reported removing a toral of 2 845 cheetah (1980 - 93) from the survey area. Yet, when removals were compared to specific losses, it appeared that removal of cheetah was not in response to specific loss of livestock (see Table 13). In addition, it was hard to correlate farmer's attitudes with numbers of cheetah removed. When 226 farmers in the survey responded if they had a cheetah problem, only 25% (56) said "yes" (see Table 14). Fifty-two farmers having cheetah problems removed on average more cheetah (23,57 ± 6,51) than the 141 farmers who did not think they had cheetah problems (10,1 ± 1,98; p=0,007). As previously mentioned, the accepted amount of livestock loss varied among individual farmers.

According to the survey, the game farmers removed a significantly disproportionate amount of the total cheetah in the area. Of the total 2 845 cheetah removed, 1 280 (45%) were removed by 49 game farmers, representing only 31% of the total farmers.

Figure 6 compares the cheetah removal numbers reported in CCF's survey with CITES and DVS records. CITES records are the official records from the Ministry of Environment and Tourism and supposedly represent all removals in the country; however, these records are solely dependent on farmer's reports to CITES. DVS records are from an average of 5 771 farmers surveyed a year (1986 - 1991), covering 80% of Namibia's commercial farmlands. The 241 farmers that CCF surveyed covered only 14,5% of Namibia's commercial farmlands. Based on these differences, Figure 6 illustrates the vast variation in numbers of cheetah removals reported.

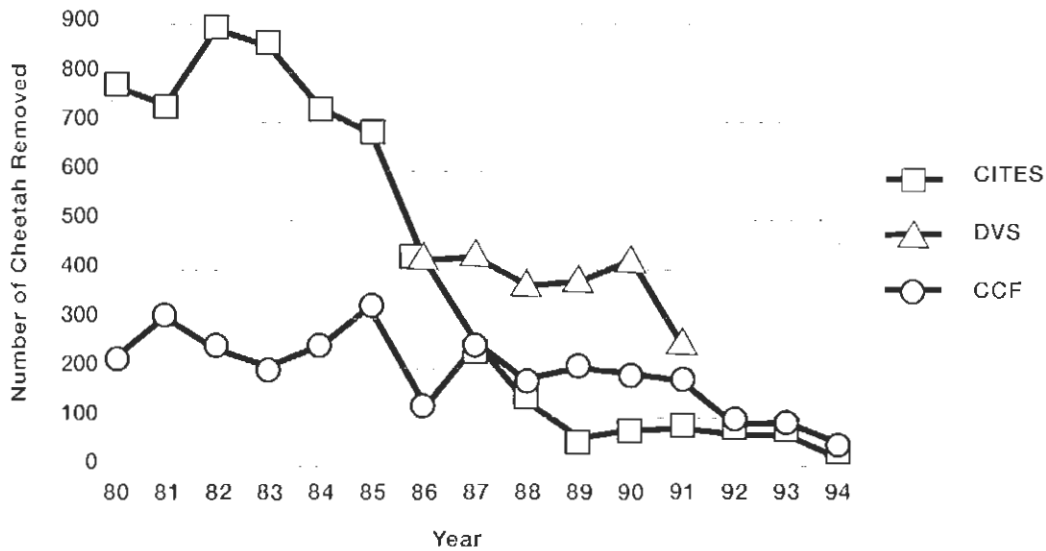


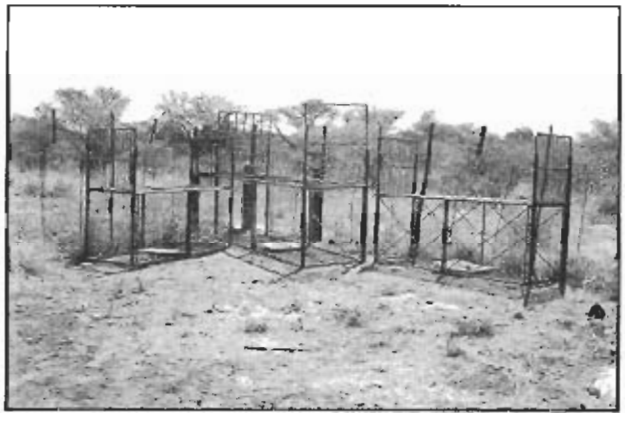
FIGURE 6. Comparison of CCF Farm Survey, CITES, CCF and DVS Records on the Number of Cheetah Removed from Namibian Farmlands 1980 - 1994. The CCF survey only includes 14,5% of Namibia's commercial farmland, indicating CITES (official Namibian international wildlife records) and DVS (representing 80% of farmlands) figures are underestimates. This discrepancy between sources indicates cheetah removals are not being consistently and accurately reported.

Many cheetah are killed, buried and not reported to officials.

More significantly, the 157 farmers responding in the CCF survey reported removing 42% of the total number of cheetah reported by CITES as legally removed from the entire country from 1980 to 1991. The official CITES number for this period is 6 818 (see Table 1). Yet, the information obtained in the CCF survey indicates that probably more than 10 000 cheetah were removed in Namibia from 1980 to 1991. CCF believes that CITES numbers are low, as many animals or skins are kept or buried in the fields and not reported. In 1985, Morsbach [68] found a similar discrepancy, reporting that official CITES numbers were approximately 50% lower than actual removals by farmers. Furthermore, the number of farmers that CCF surveyed is only 4% of DVS's annual average of 5 771 farmers surveyed (1986 to 1991). Yet, when CCF's removal figures are compared to DVS totals, CCF figures represent 115% of the animals reported to DVS. These discrepancies show the vast variation of numbers of animals reported to have been removed.

Consequently, CCF strongly recommends that farmers keep accurate records to report to officials. Inaccurate numbers potentially can hamper effective management techniques for livestock protection and predator control. It is only from accurate record-keeping that management strategies can be developed to assist the farmers and cheetah.

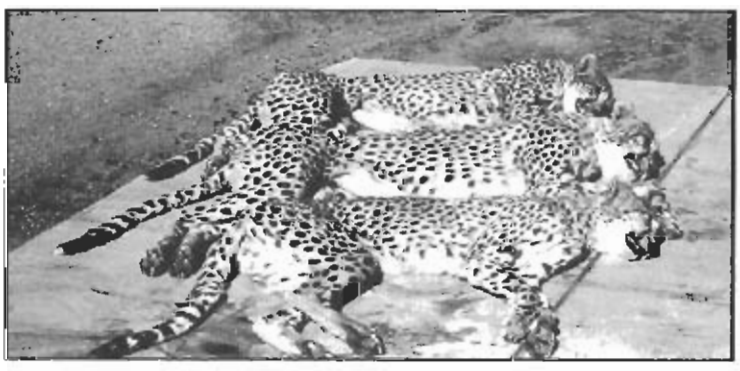
In each region there appears to be a main cheetah catcher who keeps traps open all the time. Several farmers who caught a high number of cheetah reported catching more during May, June and July [15; 29; 99; 116; 29]. It is not yet clear why more cheetah were caught during these months than others. During these same months, many cubs also were reported to have been caught, with one farmer reporting that the cubs were mostly females . From November 1991 to October 1994, 121 cheetah live-caught by farmers for removal were examined by CCF. A higher percentage was caught in the months of January, May, June, and October. May and June begin the winter calving season, while October is the beginning of the summer calving season. Early in the calving season the first of the newborn animals are most vulnerable, possibly increasing both cheetah activity on farms and farmers' awareness of cheetah.



Some farmers keep multiple traps open all the time, even if they are not having problems.

CCF's survey found that a few farmers removed a large number of cheetah. Interestingly, the farmers removing large numbers of cheetah (>50 total reported to CCF) did not observe cheetah more frequently on their farms (p=0,55). Again, this shows an attitude versus an actual problem.

Only two farmers (anonymous) surveyed by CCF kept accurate records of the months, numbers and sexes of cheetah caught. Figure 7 presents the number of cheetah removed during each month by both farmers, one is a commercial cattle farmer and the other a game farmer. The high months of removal (greater than 15 removed) for the cattle farmer were January, May, June, July, August, November and December, which are all peak cattle calving times. The game farmer caught the most cheetah in April, with declining numbers caught during the following months. The months of high numbers of cheetah captured on the game farm do not appear to correlate with any relevant parameters.



A high number of cheetah are killed during the calving season as a preventative measure.

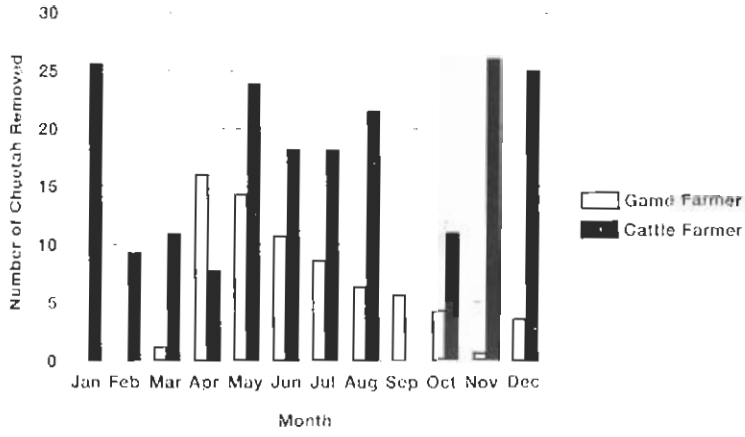


FIGURE 7. Removal of Cheetahs By Month On Two Farms. Number of cheetah removed each month by two farmers in the survey group.

In Figure 8, cheetah removed by these two farmers are compared to the total cheetah removals reported to CCF. Between 1980 and 1993, these two farmers (1% of the farmers surveyed) reported 10% of the cheetah removals in the survey area.

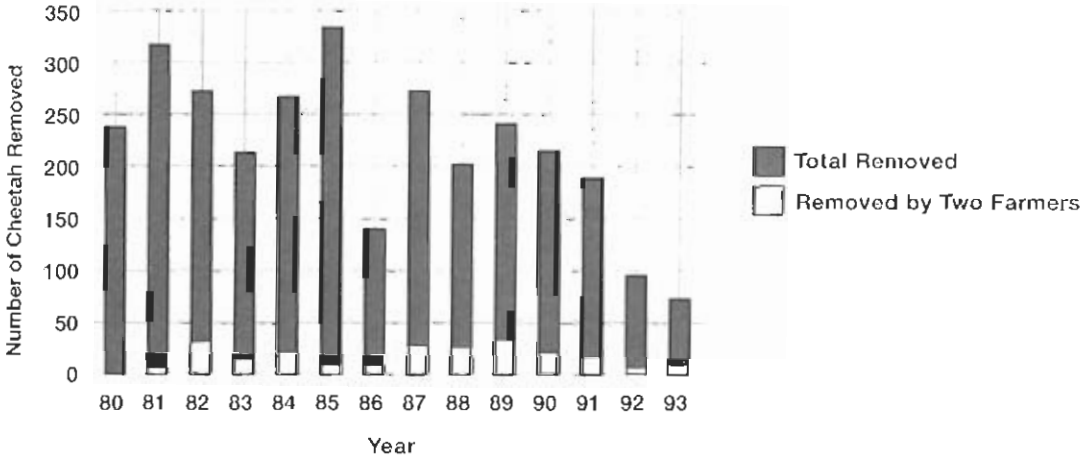


FIGURE 8. Proportion of Cheetah Removals by Two Farmers in the Survey Area. Combined number of cheetah removed annually by a game farmer and a commercial cattle farmer compared to the total number of cheetah removed from the survey area, 1980 to 1993.

Indiscriminate removal is not an effective strategy for protecting livestock or managing the cheetah population, and it can be extremely detrimental to both. In fact, it appears to be one of the biggest threats to the cheetah (Figure 9). As reported by the farmers, the majority of the 2 845 cheetah removed in the survey area were not removed due to livestock losses, but as a preventative measure. For example, out of 170 cheetah examined by CCF which were live captured by farmers for removal, fewer than 10 were actual problem animals caught killing livestock. Removing a healthy cheetah capable of subsisting on wild game can open that territory to a problem animal. Evidence suggests that removing a predator from its territory creates a vacuum encouraging other individuals to compete for that territory, potentially increasing livestock loss [93, 21, 75]. Furthermore, because males live in coalitions in Namibia, if only one male is captured and removed, the remaining individual(s) may become problem animals. The hunting capabilities of the remaining male(s) may be reduced, and they may travel into unfamiliar areas trying to re-establish themselves; in both situations the male(s) may be more prone to livestock predation. However, in cases where a "problem" livestock-killing predator is accurately identified, its removal may be warranted [75]. However, adjusting livestock management practices may be a more permanent solution to livestock predation.

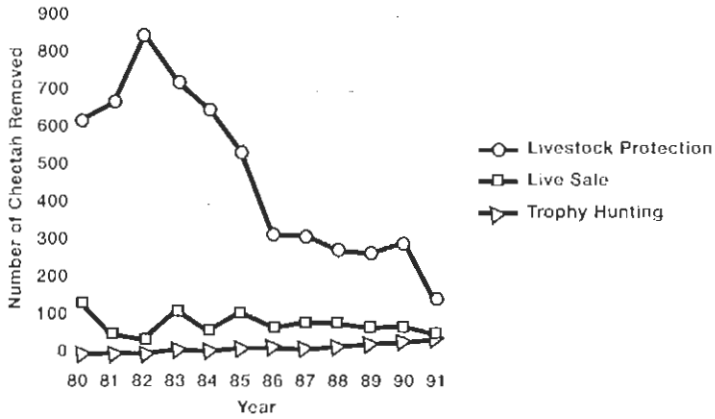


FIGURE 9. Purpose for Removal of Cheetah from Namibian Farmlands 1980 - 1991. Indiscriminate removal for livestock protection is the largest portion, followed by live export and trophy hunting. Information derived from CITES, 1992.

Twenty-five percent of the farmers surveyed suggested possible solutions to indiscriminate removal of cheetah, such as:

(1) carefully identify and remove only the problem animals;

(2) relocate or keep problem cheetah in captivity;

(3) receive compensation for loss;

(4) increase trophy hunting by placing a value on cheetah; and

(5) protect cheetah by eliminating its market value.

In response to these suggestions, CCF has the following comments:

(1) Proper identification of specific problem animals is essential before removal.

(2) CCF does not recommend the release of proven livestock predators back onto livestock farms. Follow-up research on released non-problem cheetah shows there is a high death rate associated with relocation due to vulnerability in unfamiliar territory. They can also become problem animals, as they may take stock on farms as they move through areas trying to re-establish themselves, or traveling back to their original territory. Furthermore, captivity is not a solution to the problem. Cheetah generally do not live long in captivity and have low reproductive success.

(3) Compensation would work only if paid to those farmers implementing proper non-lethal predator control methods. Farmers would have to be self-policing and honest in order for the system to work.

(4) Trophy hunting should only be done in a legal and ethical manner.

(5) Market value can be a vicious cycle, as removals due to demand can increase problems, further increasing removals, etc. Therefore, a market value can encourage additional removals and escalate problems and negative attitudes. It is hoped that farmers will critically review their motives for removals of cheetah.

The following comments on cheetah removals made by farmers are interesting:

- *'People did things in the past, because my father did it and my grandfather did it, but maybe it does not have to be that way anymore."*
- *'Several people say that young farmers will help older farmers, who are set in their ways and want to kill cheetah, to understand."*
- *'It is a fever to kill/shoot cheetah."*
- *'People live with blinders on and keep killing."*
- *'High prices paid by dealers, plus playtrees, could mean a threat to the cheetah's future."*
- *'Man's ignorance equals cheetah's enemy."*

3. Sex and Age Structure of Cheetah Removed

The sex and age structure of cheetah removed from the study area was not well documented, but the information gathered from the 157 farmers who removed 2 845 cheetah is presented in Figure 10. The number of cheetah removed per year is subdivided into males, females, cubs and unknown, as remembered by the farmers and reported to CCF.

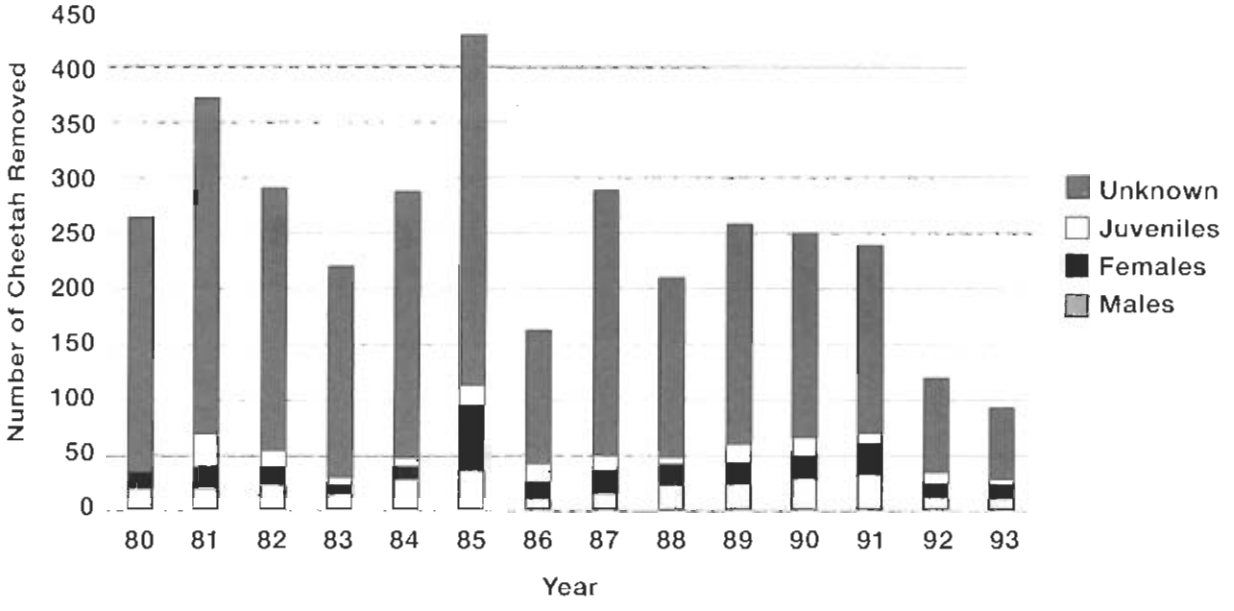


*FIGURE 10. **Demographics of Cheetah Removed From the Study Area.** The proportion of cheetah of known sex, as well as young and unknown removed. Of the animals of known sex, males comprised the largest portion.*

Most farmers reported catching more males than females. Examples of ratios of more males to females were: 50 to 3 [4]; 91 to 46 [99]; 21 to 1 [63]; 56 to 1. Furthermore, of 121 cheetah live captured by farmers and examined by CCF (November 1991 - October 1994), 80 were male and 41 were female. A disproportionate number of males to females (44 to 3) also was reported by Gaerdes in 1974 [28]. Some studies have shown that stock-raiding cats are more often male than female [96, 82] and generally subadult animals [82]. This is not conclusive, as other studies yield different conclusions. This question has not been investigated for the Namibian cheetah.

G. Behaviourial Observations on Cheetah in the Survey Area

The objectives of this section are:

(1) to define the prey base and hunting habits of the Namibian cheetah;

(2) to explore the cheetah's movements on the farmland;

(3) to define cheetah playtrees;

(4) to present preliminary information about the demographics of the Namibian cheetah population; and

(5) to describe cheetah behaviours, including those unique to the Namibian population

In this ection, reponses by farmers will be correlated with information already known about the cheetah in general.

Why ask These Questions About the Namibian Cheetah?

The survey questions discussed in this section provide a greater understanding of the Namibian cheetah's behaviour, which will aid in the development of conservation and management strategies. As an endangered species, the cheetah must be managed if it is to survive in the future. Endangered species need management in order to avoid extinction, because the are much more vulnerable to environmental and ecological changes. Managing a species includes the management of the animal itself, its habitat, its food, and its interaction with other organisms and the non=living environment - in other words, the entire ecosystem.

As stated earlier, Namibia has the last remaining large free-ranging population of cheetah in the world (2 000 - 3 000 animals). Due to the recognized genetic problems of the species [77,78], stabilising this population is important for long-term viability. Namibian cheetah have adapted to the farmlands, exhibiting behaviour unlike cheetah in other parts of Africa. Yet, very little information is available on the free-ranging cheetah in Namibia, and no significant research papers have been published on the subject to date. The majority of the studies and data available are on the East African subspecies.

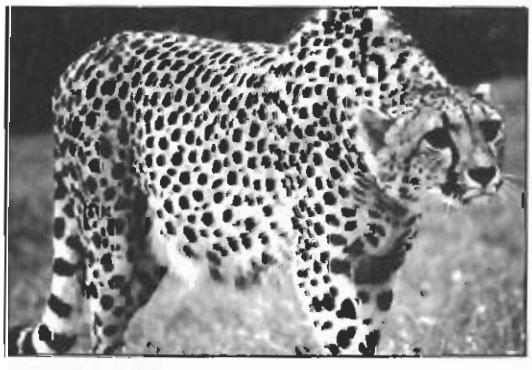
Many Namibian farmers asked for more information about the cheetah to understand its behaviour and assist in its long-term management on their farmlands. Over 90% of all the farmers in the survey had limited knowledge about problems facing the cheetah and their role in its long-term survival. It was evident from the survey that conservation education and awareness would help the survival of the cheetah, as was mentioned by 29% of the farmers.

There were many misconceptions about the cheetah. For example, many farmers believed that the cheetah is a dog, but it actually has its own genus (*Acinonyx*) within the cat family (Felidae). Another misconception is that they suck blood out of a carcase then leave it. Cheetah kill by strangulation. If they are scared off a carcase, holes left in the neck by their teeth may lead to this incorrect assumption.

CCF encourages farmers to utilise the information compiled from this survey plus other resources to understand the cheetah and develop management strategies. The wealth of valuable information collected from the farmers has provided a significant darabase to add to what is already known about the cheetah.

1. The Cheetah's Prey Base in Namibia

To better understand livestock predation, it is important to review the dynamic interplay between the predator and its prey. As the fastest land animal, reaching speeds up to 110 km/hr, cheetah have a highly specialised method of hunting. The prey animal must flee in a stereotypical way for the cheetah to kill successfully. The cheetah must go through a sequence of "predatory motor patterns" as follows: eye-stalk-chase-trip-bite-consume. Each predatory behaviour must occur before the next can happen.



The way in which the cheetah kills and consumes its prey is important for identification of actual cheetah kills.

Kudu calves were reported by the farmers to be the main prey of the cheetah.

Most predators are opportunistic. Even though predators prefer wildlife (because they naturally stimulate the predatory response), accessible livestock is vulnerable to predation. It has been suggested that livestock domestication through selective breeding has led to a progressive loss of danger perception and a lessening of the reaction to stress [37]. Livestock are compromised not only genetically, but also behaviourally. The instinctive "flee" reaction to predators has been lost through domestication. With respect to the cheetah, this may be advantageous for livestock, as cheetah need the inducement to chase brought on by their prey's "flee" reaction. For this reason, cheetah seem to prefer preying upon game, tending to take livestock only in exceptional or opportunistic cases, i.e. inaccessible wild species or very accessible and unprotected livestock (i.e. calves outside a proteted boma). Easy access to livestock may encourage predators to become problem animals. Therefore, farmers play a key role in the development of problem animals when their livestock is unprotected.

Observing cheetah kills on the Namibian farmlands is very difficult due to the shy nature of the species and the thick bush, but many farmers said that they had observed cheetah kills. Table 19 shows the prey known to be killed by cheetah on the farmlands, according to the survey participants. This list does not intend to represent the average cheetah diet; it simply tabulates what farmers have observed. Eighty-one of 138 farmers reported that kudu calves were killed by cheetah; this supports the assumption by farmers that the kudu is the cheetah's main prey on the commercial farmlands. Springbok (where available), warthog and steenbok were a main part of the cheetah's diet. Gemsbok and hartebeest calves also were common prey followed by a variety of other animals killed in fewer numbers. Observations by farmers confirmed previous assumptions that small prey, including rabbits and game birds, comprised a portion of the cheetah's diet [69].

TABLE 19: Cheetah Prey Composition Reported in the Survey Area[a]

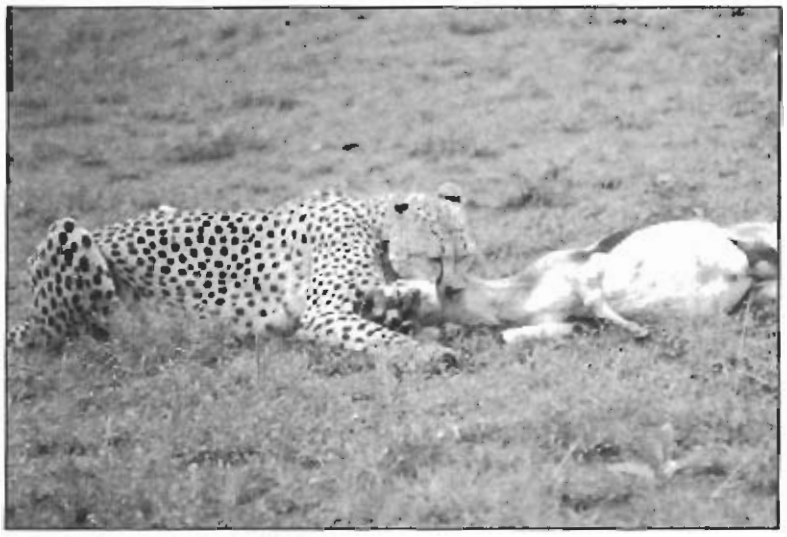
Prey Species	No. Reports	Prey Species	No. Reports
Kudu Calves	81	Blesbok	8
Springbok	39	Ostrich	6
Warthog Piglets	37	Smaller Game Birds	5
Steenbok	26	Guinea Fowl	4
Gemsbok Calves	25	Impala	3
Hartebeest Calves	20	Rabbits/Hares	2
Duiker	12	Dik-Dik	1
Eland Calves	8	Kori Bustard	1

[a] Reported by 138 farmers

The composition of the cheetah's diet reported by the farmers varied from previous data [69] in which approximately 77% of the cheetah's diet included hartebeest, kudu and gemsbok calves (in that order of frequency). The difference in the order of frequency between the two reports may be due to the fact that Morsbach surveyed an area in Namibia where the hartebeest population was higher during a time of low kudu numbers following the rabies epidemic (early 1980's).

Prior to Namibia's independence from South Africa in 1990, many farmers reduced wildlife populations for profit. This removal further reduced the cheetah's prey base, and farmers feel that the game populations still have not recovered [21,72,71].

2. Cheetah Hunting Behaviour



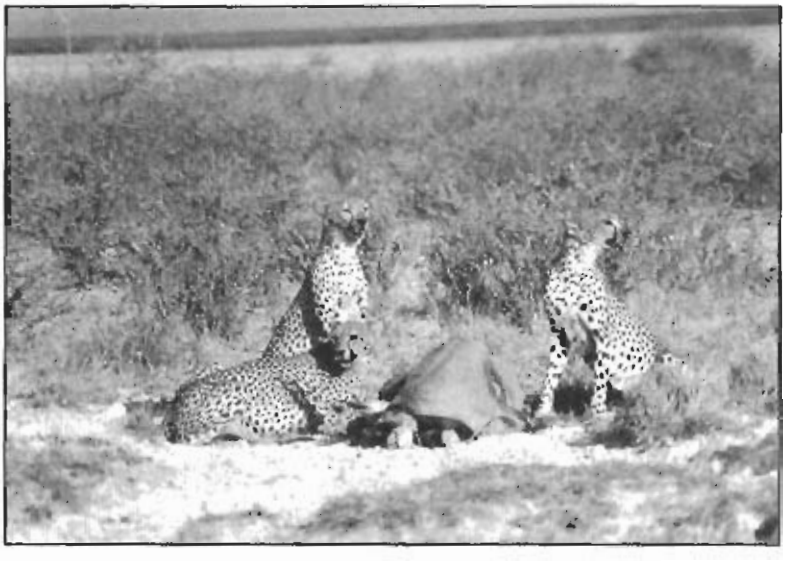
Cheetah kill very specifically, tripping their prey during a short high speed chase and killing with a fatal strangulation hold.

Cheetah are diurnal animals which hunt during the day. Morshach[69] found that cheetah in Namibia moved mainly in the daytime during the summer, from up to one hour before sunrise until abour 10 a.m.; then they laid in the thick bush until approximately four to five p.m., at which time they moved for up to an hour after sunset. During the winter they laid in the sun until warm (approximately 8 a.m.) and then hunted until up to 1 p.m., when they again rested. Two to three hours later they began hunting which continued until just before dark. Before, during and after a full moon they moved long distances at night, especially during the summer. Cheetah stayed a day or two in an area with prey, lying and sleeping before moving on.

In East Africa the cheetah kill rate is 50% of their hunting attempts [85], yet they may go for up to three days without success. Cheetah have been observed working in groups to catch prey including adult gemsbok and young warthogs [69]. Once a cheetah has made a kill, it begins by eating the hindquarters which have the largest amount of meat. A cheetah can consume over 10 kg of meat in less than two hours [85, 80]. Rapid consumption is important for the cheetah, as its prey is often taken by other predators. Often with smaller antelope, the abdomen is opened and the soft organs (liver, kidneys, heart, and lungs) are consumed first [80]. Cheetah do not eat the intestines and stomach [85].

It has been suggested that cheetahs may abandon carcases after one to two hours (after consuming a sufficient amount of food) because defending their prey from competitors would be counterproductive [85]. Many farmers said that they do not like the fact that cheetah may leave a kill without eating the entire carcase, as they believe it is wasteful. However the absence of competitive predators such as lion and hyaena on Namibian commercial farms may allow cheetah to eat more of their prey. This theory is supported by several farmer's reports [98; 181; 99] and CCF's observations of cheetah staying with a carcase for a few days, thereby reducing the number of kills they need to survive. One farmer mentioned obseving a cheetah feeding on a kudu carcase that had been killed two days earlier by another cheetah [48]. Morsbach[69] also reported cheetah returning to their kill after four and eight days, to consume the carrion. Previously, cheetah were not considered to be scavengers.

Male coalitions can overcome larger prey than a single cheetah and may have an advantage in defending their prey against competitors.



Additionally, the reduced competition from other predators, coupled with group hunting, also may allow Namibian cheetah to take larger prey species. While Thompson gazelle are the main prey base in the Serengeti plains [86], and springbok are the principal prey in Etosha National Park in Namibia [24], kudu calves appear to be the primary prey on the Namibian farmlands. Furthermore, it is important to understand the cheetah's role in the ecosystem in order to understand this aspect of the cheetah's behaviour. The cheetah is a top predator which provides food to other inhabitants of the ecosystem; therefore, the carcase is never wasted.

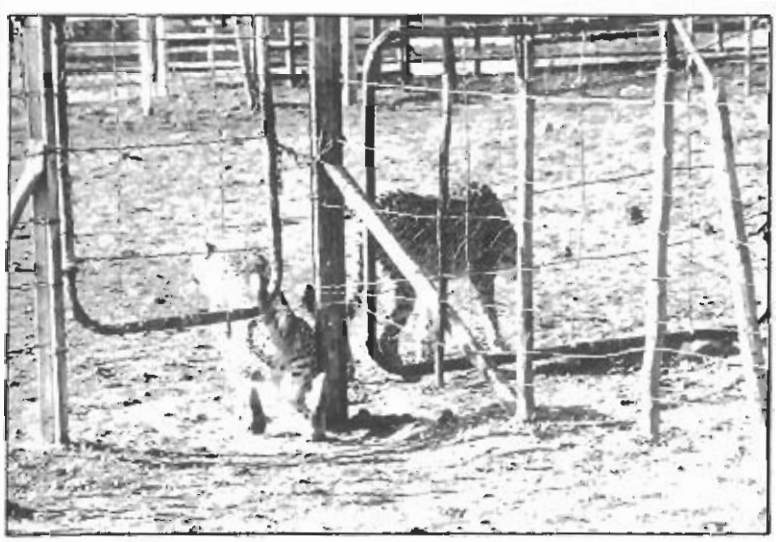
Farm fences can work to the cheetah's advantage. Farmers sometimes noted cheetah using fences to assist with a kill, especially when hunting ostrich and adult kudu [165]. Furthermore, a cheetah was observed eating a kudu that had died after being caught in a fence. One farmer believes that the cheetah's pursuit of game drives wildlife off the farms [31], while others believe cheetah follow game moving through the farms [2; 65; 1].

One farmer reported seeing cheetah kill a kudu approximately 500 m from a herd of cattle. At the time of the kill, the cattle got excited and left the area. The cheetah could have taken advantage of the frenzy in the herd; however, it preferred the game and was not stimulated to kill a calf [6]. As stated earlier, maintaining high numbers of game is a significant deterrent to livestock predation. A depleted wildlife prey base may cause the cheetah to take advantage of an opportunity to prey on available livestock.

The impact that cheetah and game populations have on each other is not yet fully understood. In studies of other cat species, it has been shown that the presence of cats alone has not prevented prey species from increasing in number [90]. Furthermore, an increase in the kudu population in the survey area has not resulted in a corresponding increase in the cheetah population. In fact, 21 farmers agreed that the cheetah population has declined noticeably in the last few years, even though kudu numbers have recently increased.

Farmers made several interesting comments about cheetah being killed by prey. Cheetah were observed killed by gemsbok [4, 26], blue wildebeest [53,65], warthog [68], and cattle [38]. Fights were seen between cheetah and warthog [127] as well as cheetah and baboons [5, 44]. These comments are not surprising due to the non-threatening nature of the cheetah and the fact that it is not a large, powerful predator.

3. Cheetah Movements on Farmlands



A cheetah's home range can include 10 - 12 farms.

According to CCF's radio telemetry research, cheetah occupy home ranges in Namibia of larger than 1 500 km² which can overlap, and individuals move 13,8 to 26 km per day [67]. Competition for territories can be fatal, and vacated territories are quickly filled. Activity and movement possibly are determined to a large extent by both prey availability and avoidance of other cheetah.

In order to better understand the cheetah's movements through livestock farmlands, farmers were asked to estimate where and how often they sighted cheetah and spoor (tracks) on their farms. Two hundred and sixteen farmers answered this question, and Figure 11 shows the frequency of cheetah sightings reported in the study area. Forty-eight percent (103) of the farmers sighted cheetah at least monthly. Nearly one-fifth of these saw cheetah or spoor weekly. CCF realises sightings are subjective, depending on the attentiveness of the farmer and his workers, so these reports serve as a guideline only.

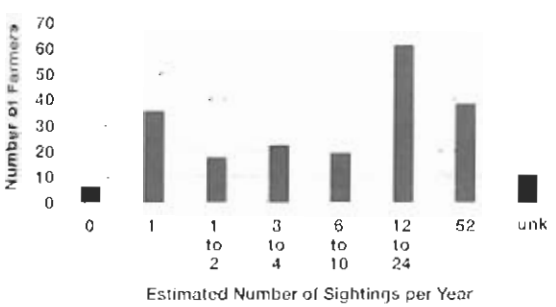


FIGURE 11. Frequency of Cheetah Sightings in the Survey Area. Survey participants were asked about the frequency of cheetah sightings or spoor on their farm(s). Responses, collected from 216 participants, ranged from 0 (none) to 52 (weekly observation) times per year. The average frequency of sightings was 17 times per year (approximately every 3 weeks).

It is interesting to compare the frequency of cheetah seen by the farmers to the number of farmers reporting problems with cheetah (see Table 14). Cheetah were more frequently observed on problem farms (20.75 ± 2.99 times/year; 44 out of 56 farms with problems) than on non-problem farms (15,51 ± 1,64; 121 out of 170 that did not report a problem). This warrants further investigation with a larger number of farms.

Farmers were asked specifically if cheetah movements varied during the year. Seventy-five farmers reported that the cheetah's degree of activity changed during different seasons, specifically at the beginning of calving time and during the rainy season. This may also correlate to times of the year when wildlife are moving to take advantage of fresh grasses. Farmers feel that cheetah are nervous animals that move a lot [39] and are influenced by game movements [48; 39; 99]. They feel that cheetah prefer thick bush [92], which provides them with an advantage when stalking prey. Farmers also believe that cheetah demonstrated a preference for following trails and sandy riverbeds [49;72;68].

Thirty-six percent (88) of the farmers reported that cheetah move through farms from hill to hill (Figure 12). These hills (mostly over 500 m high) appear to be focal points in the cheetah's movements on the farmlands. It is likely they use the hills to survey the area for prey and/or other cheetah in their territory. However, farms where cheetah were seen on hills did not report more frequent sightings of cheetah (p= 0,57).

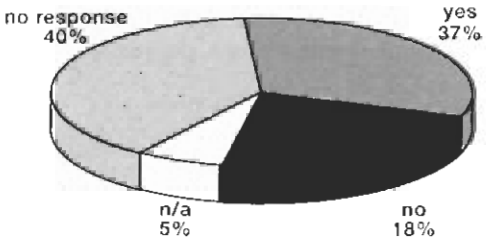
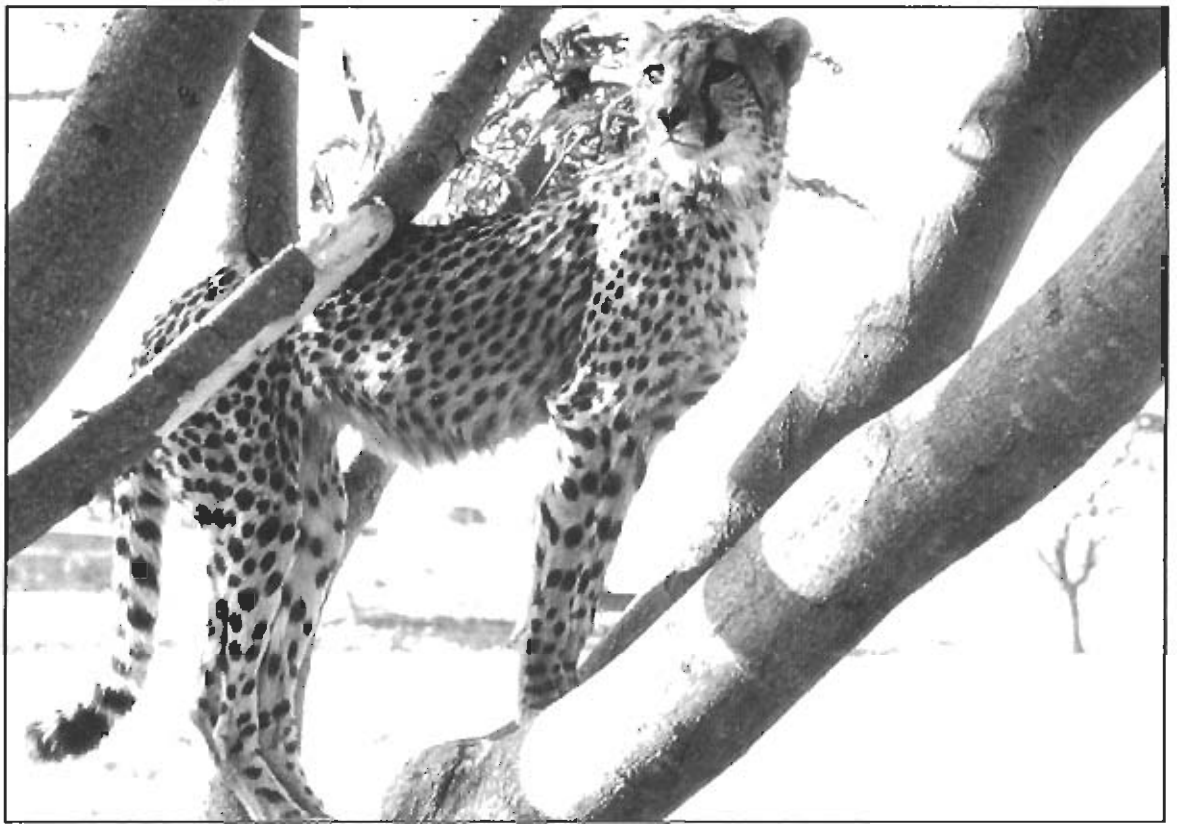


*FIGURE 12. **Percentage of Farmers Reporting Cheetah on Hills and Rises.** Survey participants were asked if they had seen cheetah on hills and rises. Of the 88 farmers responding, the majority said yes.*

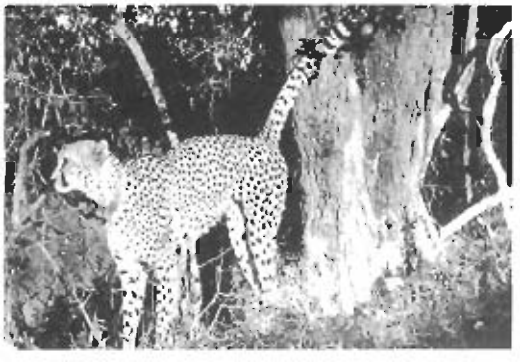
Typically, leopard are associated with hills and rises over 500 m high. Leopard offer a competitive threat to cheetah and a risk to cheetah litters. Previous results from a limited study indicated that cheetah rarely lived in the same areas as leopard [65]. This hypothesis is not supported in the survey, as a significant portion of the farmers reported seeing cheetah in areas with hills and rises of 500 m to 2 000 m, where leopard typically are sighted. Additionally, there was overlap between farms reporting cheetah and leopard problems. Baboon also are found on farms with hills. Baboon have been reported to kill cheetah cubs and attack adult cheetah [4; 44]. Both leopard and baboon can be limiting factors for cheetah populations in the farmlands.

Cheetah are often seen on hills and rises such as these.

4. Cheetah Playtrees



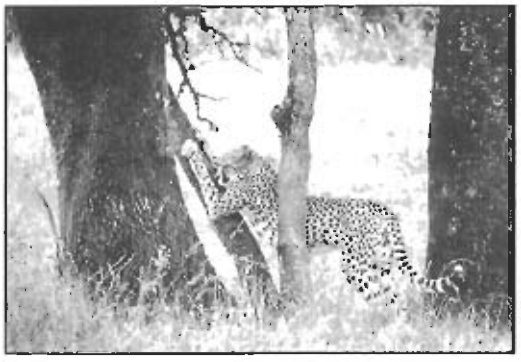
Playtrees have sloping trunks cheetah climb onto.



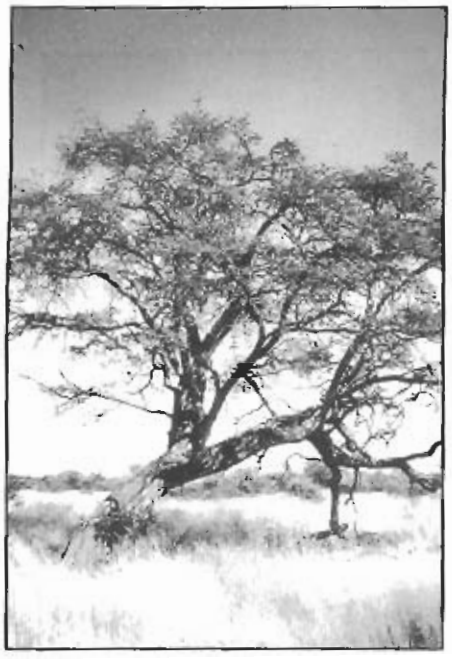
Cheetahs communicate by marking playtrees with urine and scratches.

The term "playtree" refers to certain trees which are considered to be an integral part of the cheetah's behaviour in Namibia, as reported by farmers over the past 50 years. The playtree (or "marktree"), an omiparpara tree (*Peltophorum africanum*), was first noted by E. Haerlen in 1939 and was "recognizable at its scraped crust" [27]. These trees serve as a marking post and are believed to be important for both males and females in defining home ranges and communicating reproductive status. The trees may also serve as a viewing point. One farmer believes that when females are in heat they will go to playrrees to find males [99].

These trees are thought to be a focal point for Namibian cheetah in their large home ranges. There have been only limited reports of trees being used for marking in East Africa [16]. Although there have been several published photographs of cheetah on trees in East Africa, the trees have not been collectively referred to as "playtrees", nor as being frequented on a regular circuit. The use of these trees may be greater in Namibia due to the differences in social behaviour and/or terrain. Visibility is high in East African savanna plains and trees are not as abundant for marking or viewing posts. In Namibia, trees may aid visibility over the bush and are abundant for marking.



Only specific trees are used as playtrees, and some tress are continually used for many years, even after they have fallen over. In some cases, playtrees are used by more than one set of cheetah, and may be used in social avoidance or attraction. In many areas it appears that a cheetah may go from playtree to playtree in a circuit through its home range. According to CCF research and Morsbach [20] some playtrees are located where sev-



The camelthorn tree is most frequently used as a playtree.

eral different cheetah ranges overlap. Sex ratios of cheetah live trapped at playtrees by farmers indicate that males frequent the trees more than females. This needs further investigation, but may be due to the fact that females possibly are less prone to social communication when they have cubs to protect.

Cheetah apparently exhibit very strong drives to get to playtrees and appear to move from playtree to playtree, marking them with urine, faeces and scratching. Based on current radio telemetry research conducted by CCF, cheetah appear to frequent playtrees during their movements through their ranges. The use of playtrees may change throughout the year depending on the cheetah's movements, which are based on breeding potential, prey availability or home range competition.

Playtrees have been reported mainly in the northern and central areas of Namibia [29]. Many farmers reported that the tree species commonly used as playtrees include: camelthorn tree (Acacia erioloba), bastard umbrella-thorn tree (*Acacia luederitzii*), weeping wattle tree or omiparpara (*Peltophorum africanum*), and shepherd's tree (*Boscia albitrunca*). These playtrees are usually tall with sloping trunks onto which cheetah can jump.

Survey participants were asked about the number of playtrees on their farm(s). Responses collected from 185 participants ranged from zero to six trees, with an average of two per farm. Not all farms have playtrees. As shown in Figure 13, an equal number of farmers reported playtrees as did not. CCF has termed farms without playtrees as "pass-through" farms, although, some of these farms may contain undiscovered playtrees.

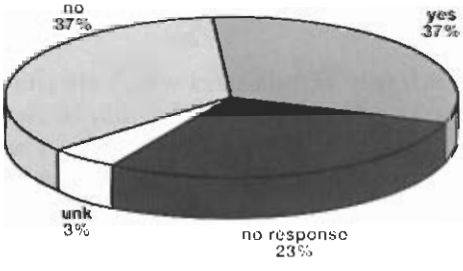


FIGURE 13. Percentage of Farmers Reporting Playtrees. *Survey participants were asked if they were aware of cheetah playtrees on their farms. Approximately 37% of the farmers said 'yes', equal to the number of farmers saying 'no" (unaware of playtrees and/or without knowledge of their existence).*

Cheetah are regularly caught at playtrees by the use of a thornbush boma with a trap for an entrance.

Namibian cheetah are regularly live-trapped at playtrees. The fact that cheetah are easily caught at playtrees could be a threat to their existence [29]. Farmers with playtrees tended to remove more cheetah than farmers without playtrees (16,84 ± 4,54 to 9,38 ± 1,53, respectively), although cheetah movements on playtree farms were no higher than on pass-through farms. There was no difference between the average number of playtrees on non-problem farms and on problem farms (0,789 ± 0,18 and 1,119 ± 0,2, respectively; p=0,321).

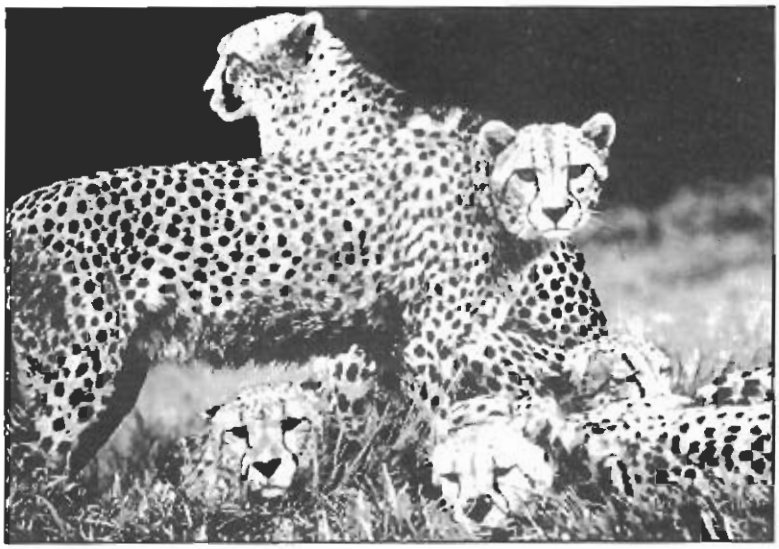
In addition to playtrees, some farmers witnessed cheetah on play rocks and using stones as scratching rocks [55; 12]. Faeces have been observed on termite mounds as well. All of these may be additional marking posts for the cheetah. Similar behaviours have been noted in East Africa. In the open areas of East Africa, marking posts appeared to be plants or objects that stood out in the environment, such as dirt mounds or concrete road embankments[18].

5. Preliminary Information on Cheetah Demographics In Survey Area

In order to begin managing any wildlife population, it is critical to understand its demographics, including the size, sex and age structure of the population, as well as births and deaths. Additionally, understanding the social structure and over-all health of the population is important in the analysis of the genetic composition of the population for long-term viability.

Because basic information about the Namibian cheetah population is needed for the development of a cheetah management plan, farmers were asked to share information from observations on their farms about behaviour, litter sizes, and sex as well as any additional information about the cheetah they removed. This information was marked on 1:50 000 topographical maps of the farmlands for analysis.

5.1 *Social Grouping of Cheetah*



Namibian cheetah may be more social than East African cheetah.

Social structure among cheetah seems to vary from country to country. Most research has been conducted on cheetah living in East Africa, which has provided a great deal of insight into the cheetah's social behaviour [30, 15, 48, 8]. The uniqueness of the Namibian cheetah is evident when compared to the East African subspecies.

Namibian cheetah appear to be more social than the East African subspecies, although limited group sightings have been reported in East Africa [30, 15]. Large groups of cheetah have been frequently reported in Namibia. CCF asked farmers about the largest groups of cheetah seen (Figure 14). The largest group reported was 18 cheetah [78], comprised of adults and cubs, but the average group was 5,5. Large groups were most often seen near water-holes and dams. The role of large groups is unclear, but they may contain related animals that come together for short periods. There are no reports or indications that these groups travel together.

In East Africa, groups are usually composed of a female with cubs (grown cubs easily can be mistaken for adults) or brothers in a coalirion. Other groupings may be males temporarily joining single females, or females with cubs, for mating; or orphaned cubs not old enough to be on their own associating with other groups for hunting advantages[8]. A social group may have advantages in regards to hunting success, the ability to take larger prey, rearing of offspring, and defense of territories [16, 65]. Caro [8] stated that in East Africa, cooperative hunting alone is not a reason for the formation of cheetah groupings. Groupings in Namibia may be due primarily to social reasons, with other advantages being a consequence of these groupings.

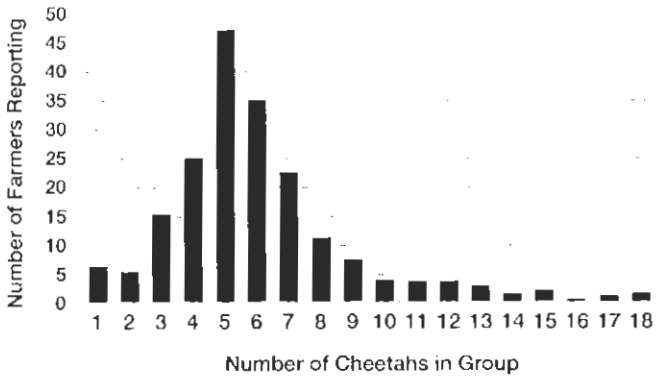


FIGURE 14. Group Sizes of Cheetah Seen in The Survey Area. Survey participants were asked about the largest group of cheetah they had observed in the survey area. Responses were collected from 199 participants. The largest group observed was 18 cheetah, with the average being 5,5 cheetah. Nearly 25% of the farmers responding reported seeing group sizes larger than eight cheetah.

The farmers also were asked about the structure of the cheetah groupings they most frequently see. Because most sightings are from a distance, grown cubs may have been mistaken for adults. Of 199 reports about cheetah social groups, 31% (61) mentioned multiple adults and cubs, although this was not a specific question (Table 20). Continual reports from farmers indicate that cubs are often seen accompanied by two or more adults. This social structure of the Namibian farmland cheetah was previously noted by McVittie [65], who reported 14 cases in which an unsexed adult accompanied a female with a litter of cubs. There have been limited reports in East Africa of litters accompanied by more than one adult [31, 15]. Further investigation hopefully will give insight into this social behaviour and the specific make-up of the groups.

TABLE 20: Structure of Cheetah Social Groupings in the Survey Area

Social Group	# of Farmers	Percentage[a]
Lone Individuals	49	25
Multiple Adults	91	46
Lone Adult and Cubs	83	42
Multiple Adults and Cubs	61	31
— 2 Adults and Cubs	35	18
— 3 Adults and Cubs	9	5
— 4 Adults and Cubs	6	3
— 5 Adults and Cubs	3	2
— 7 Adults and Cubs	2	1
— Non-specific Adults and Cubs	6	3

[a] 199 farmers responded to question. Most farmers had seen more than one social grouping.

In East Africa, both male and female cheetah are territorial in nature. Prime cheetah territories include areas that provide both abundant prey and sufficient cover for successful hunting. In East Africa females live a solitary life except when rearing cubs [49]. As already mentioned, multiple adults are often seen with a litter of cubs in Namibia. Female cheetah in Namibia have enormous home ranges up to 1 500 km^2 which sometimes overlap with ranges of other females [70]. The average home range of East African female cheetah is 800 km^2 [8].

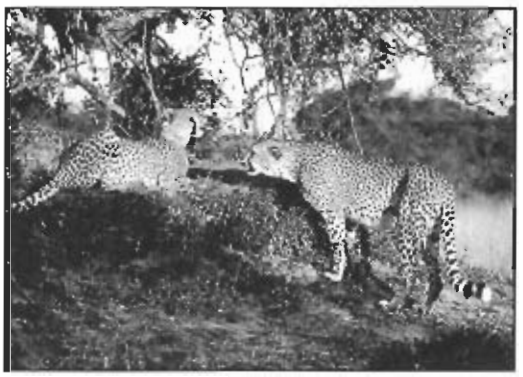
Male coalitions appear to be stable units of two or more adults, usually brothers.

Male cheetah most often live in groups of up to four animals called "coalitions." The majority consists of brothers, but lone males have been known to join a coalition [8]. In Namibia, these coalitions will occupy home ranges of between 800 km^2 [70] and 1 500 km^2 (CCF radio telemetry research). Male ranges in East Africa are significantly smaller, ranging from 37 - 48 km^2 [8], probably due to territoriality. According to CCF's research, solitary males in Namibia appear to maintain home ranges for long periods, however, research has shown that males in East Africa do not hold territories for extended periods [5]. The same difference in home ranges has been seen with lions in Etosha and East Africa [5]. In East Africa, groups of males compete for territories. Often the battles are fatal. In CCF's survey, there was only one report of male aggression where two males were seen fighting [86]. One killed the other and then mated with a female. Injuries on male cheetah (on live-captured animals) have been observed by the authors, who believe these injuries possibly are a result of territorial disputes. Male aggression in cat

species has been reported to be more common in areas where there is a high removal rate of individual cats and where newly-arrived animals are vying for the recently emptied territory [90].

Marking behavior is important for both males and females in defining their territory and communicating reproductive status. In Namibia, the "playtree" appears to be an important marking post. One farmer believes that when females are in heat they will go to playtrees to find males [99].

5.2 Reproductive Behaviour



Males cautiously approach females to check their reproductive status.

Most information on the reproductive behaviour of cheetah has come from either studies on captive animals or field studies conducted on reserves in East Africa. Female cheetah become sexually mature at 1,5 to two years of age [52 - 57, 103]. They have been described as "seasonally polyestrous" (several heats a year) [88], with an estrus (heat) cycle lasting seven to 14 days [102]. When a female cheetah comes into heat, she scent marks areas in her territory, including trees, with hormone-laden urine [63] which communicates her reproductive condition to the males [15, 49]. The phase of actual courtship begins during proestrus (the period immediately preceding heat). Vocalisations (calls) play an important part in the courting ritual. Males must approach the female close enough to test her estrus status by smelling her vulva region. Sometimes they may mock charge her. The breeding animals remain in close contact for two to three days and copulate infrequently [15]. Males leave after the courting period and do not take part in cub-rearing.

Cheetah cubs are born blind and helpless.

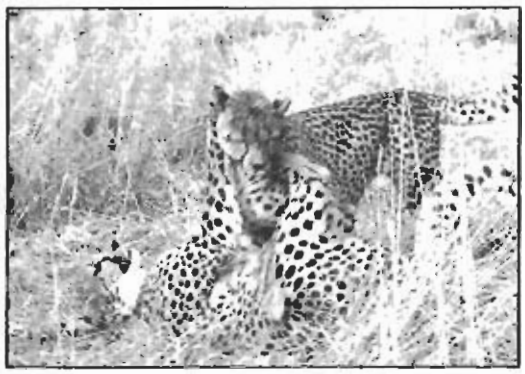
Cheetah gestation is 90 - 95 days. Births can occur throughout the year, and if a female loses her litter she will recycle readily. When ready to give birth, the female cheetah will select a well-hidden den to hide the cubs. In East Africa, the female moves the cubs every few days to a new den site to reduce the risk of being discovered by a larger predator [23].

In Namibia, newly-born litters have been found primary in thick bush [42;65;99], also in aardvark [4] and warthog holes [5], and high in the mountains [171; 4]. Cub mortality is very high in East Africa: up to 72% may die before leaving the den, and fewer than 5% survive to adulthood [49]. The two main causes of cub death in East Africa are predation by larger predators and abandonment by the mother if she has to travel long distances to hunt.

A think layer of hair, a "mantle", grows along cubs' back during the first few weeks. It begins to disappear around the time they are weaned.

The cubs' eyes open at five to 11 days, and at five to eight weeks they begin following their mother, at which time they begin to eat meat. Cubs are weaned at two to three months of age and reach half of their adult size by six months. They lose the last of their deciduous (baby) teeth at eight months of age. One year-old cubs may initiate some of their own hunts, even though they are not yet able to hunt successfully without their mother's aid. Hunting skills are acquired through play and participation. A mother will present live prey to cubs and they may assist her in the kill during a hunt [16].

A mother will leave her cubs when they are 16-20 months old. At this point cubs are physically and sexually mature, although not skillful hunters. Adolescent cheetah of both sexes remain together as stable units for several months after separation from their mother. The units of adolescents are more effective hunters. Females will live with their male siblings until their first heat. Dominant males then chase male siblings out of a territory and breed with a female. Male siblings stay to-



Play is an important part of the cubs' development, helping them acquire survival skills.

gether for life, forming coalitions, but usually are expelled from their mother's range by territorial males [8].

As stated, the first two years of a cheetah's life are important for learning hunting behaviour and survival skills. During this time cubs learn types of prey, locations of water points, and potential dangers (i.e. baboon, snake, leopard). For this reason, cubs that have been removed from the wild cannot be re-released, because they have not yet acquired these skills. Therefore, CCF does not recommend hand-rearing cheetahs and subsequently releasing them.

There were several interesting comments by farmers about cheetah cubs. There were four sightings of very thin or weak cubs in poor condition [17, 14, 6, 2]. It was assumed by these farmers that something had happened to the mother, i.e. she had been killed or trapped, and the cubs were left unattended to fend for themselves. All of these cubs eventually died. Another farmer [86] reported on a group of cubs (approximately five to six weeks old) which were found after the mother was shot 11 days earlier. The cubs were starved, and one died three days after they were found. A second cub had many ticks, continual seizures and died after one month. The third lived. It is amazing how long cubs may survive without maternal care.

5.3 Seasonal Birth Peaks

Seasonal birth peaks have been observed in East Africa, with a greater number of births occurring during the wet season (March - May). Two hundred twenty litters were observed during a ten-year study in East Africa. It was reported that litters conceived in the hotter dry season were smaller than those conceived in the wet season, and that females which lost their litters in the dry season took longer to conceive again [9]. This may be due to decreased male fertility caused by high environmental temperatures. Cheetah sperm is compromised due to limited genetic variation within the species, and therefore may be more heat-sensitive [101].

For comparison, Figure 15 presents by month 53 litters wild-born in Namibia, as reliably reported to or observed by CCF from 1989 through 1994, and information obtained from 654 captive-born litters world-wide [52-57]. Although a small sample size, the wild-born litters show four birth peaks, one during the early wet season (October - November) and another during the primary wet season (February - March). These peaks may correlate with the primary calving seasons of the majority of the game species. Furthermore, the peaks may reflect the female's reproductive cycles. Even though the cubs varied in age, overall this data shows no increase or decrease in the number of litters conceived during the wet or dry season, respectively, as in East Africa. A larger sample size and further investigation is needed to fully understand timing of conception and births in the wild Namibian population. CCF will continue to collect data with the cooperation of the farmers. Due to management variables in captivity, it is not possible to directly correlate captive and wild birth peaks. The captive population's reproductive cycle is currently being studied.

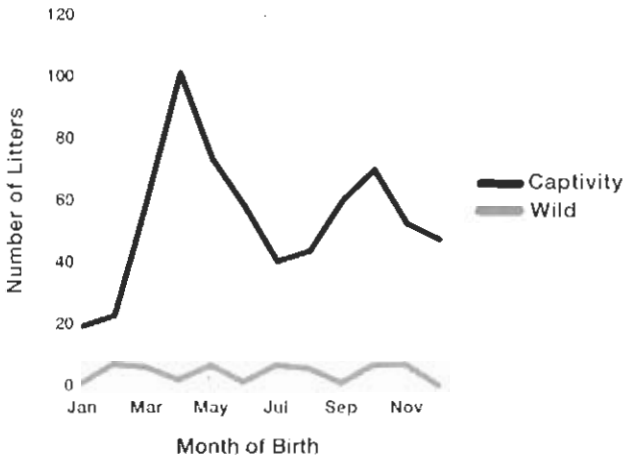


FIGURE 15. Seasonal Birth Peaks in Both Captive and Wild Populations. *Comparison by month of litters born in captivity and in the free-ranging Namibian population. Captive information is from 654 (of 691) litters world-wide [52-57], while the Namibian information is from 53 litters wild born in Namibia.*

5.4 Cheetah Litter Sizes

Newborn wild cheetah are rarely seen, therefore most information on litter sizes at birth is from the captive population.

Most field studies are plagued by the inaccessibility of new-born cubs. Determining the actual number of cubs born in cheetah litters is difficult, because observations are limited. The average litter size observed in East Africa was 3,5 (average 15 days old) [50]. Captive information has been collected since the first captive birth in 1956; the average litter size has been 3,4 cubs[52, 57] (Figure 16). Up to now, the only available information reporting litter size in Namibia was by McVittie in 1979[63]. Although the sample size was small, she reported 4,2 as the average number of cubs one to three months of age (five litters); and a litter size of 4,0 cubs at 10 months of age (nine litters). This larger litter size in Namibia may be due to decreased competition from larger predators, promoting healthier, better nourished cubs and increasing survivorship at the same time [63].

CCF wanted to investigate litter sizes observed by farmers in the survey area. The average size of a litter (after the cubs were out of the den) reported by 130 farmers was 3,4 (Figure 17). Furthermore, from CCF's records of 53 wild litters (162 cubs) in Namibia, the average litter size was 3,1 cubs (Figure 17). Even though the cubs' ages varied, these reports can be used for a general comparison to McVittie's findings. If McVittie's 1979 averages of 4,2 and 4,0 cubs per litter are accurate, the decrease to 3,1 and 3,4 averages may be related to the high number of cheetah removed in Namibia from 1980 to 1991 (6 818 animals removed; see Table 1). This substantial reduction might have caused more genetic problems by increasing the potential for inbreeding, as infant mortality has been reported to be an indicator of genetic inbreeding [53, 78, 61].

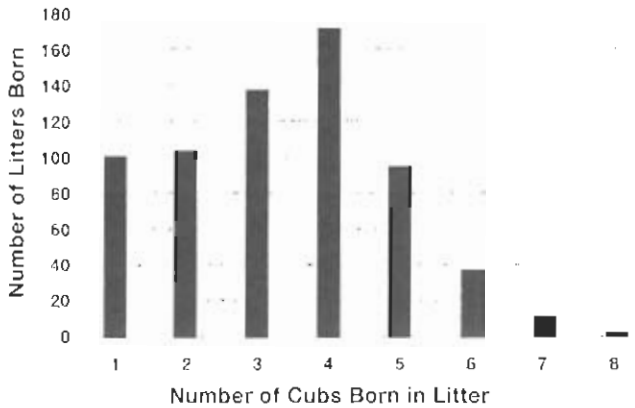


FIGURE 16. Cheetah Litter Sizes in the Captive Population. Cheetah litter sizes in captivity reported from 654 litters. Litters ranged from one to eight cubs, averaging 3,4.

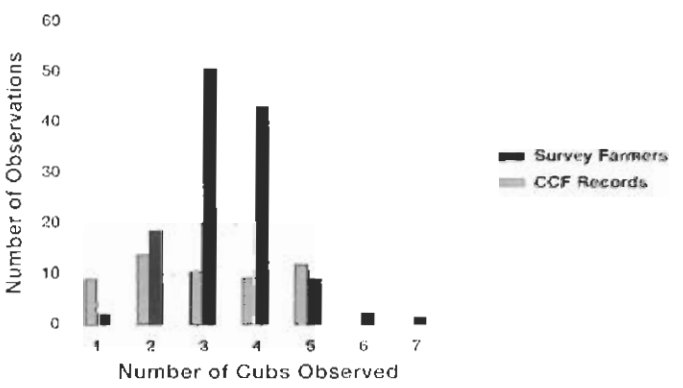
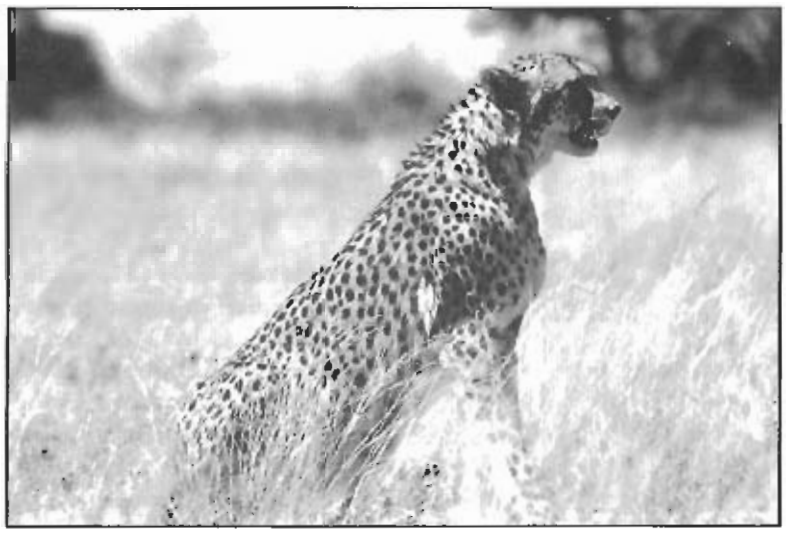


FIGURE 17. Cheetah Litter Sizes Observed in the Wild Population. Comparison of litter sizes of free-ranging Namibian cheetah as reported by farmers surveyed. Fifty-three litters reported by 130 farmers in CCF survey (n=130) ranged from one to seven cubs, averaging 3,4. Fifty-three litters from CCF records ranged in size from one to five cubs, averaging 3,1.

V. THE FUTURE OF THE NAMIBIAN CHEETAH



Will the cheetah survive?

It is critical to manage Namibia's cheetah population in order to ensure its survival for the future. Management of the cheetah requires an understanding of how to reduce short-term immediate threats to the population, as well as how to plan for its long-term survival and improve its genetic health. The problems posed by indiscriminate removal reach beyond severely reducing their numbers. These include the risks of removing healthy individuals, thereby escalating problems with inbreeding, and contributing to or avoiding the actual cause of livestock depredation.

The most pressing question is, what level of removal can the Namibian cheetah population sustain? If removals and deaths exceed births, then the level of removal is too high. Furrhermore, will the level of removal further compromise its genetic viability? The population's health, density and distribution on the farmlands cannot be precisely determined without extensive cooperation from the farming community in a research program.

It is critical that wildlife research of an endangered species is directly and immediately applicable to conservation and not just pure science. Furthermore, wildlife conservation efforts too often concentrate on single species without sufficient consideration of the environment or the human factor. Management of the entire ecosystem is essential. CCF realizes the key to the cheetah's survival is in the farmers' hands, therefore conservation measures must apply to farmers' needs and resources. Balanced management practices in harmony with nature will promote more profits for farmers in the long-term.

With proper management of the farmland ecosystem, the cheetah will continue to exist on Namibian farmlands, but the high level of indiscriminate removal must stop. With proper planning and foresight, the cheetah can become a natural resource and source of pride for the country. The awe that this big cat inspires in people throughout the world is a national treasure for all Namibians.

"The extinction of species of wild cats would be an inestimable loss to the world, not least because of their role as predators is essential to natural ecology. It behooves us to make every effort to prevent it, because human activities are largely responsible for their deteriorating status."[59] *(Appendix VI)*

SUGGESTED APPROACHES FOR MANAGEMENT OF THE CHEETAH ON NAMIBIAN FARMLANDS

The recommended approach is one whereby farming is done holistically and in harmony with the natural environment. Consequently, it is necessary to ensure that the maximum diversity of wildlife, including predators like cheetah, are properly managed in the long-term. Predation in any natural system is healthy, and even necessary, in order to eliminate sick or weak animals, and to prevent an increase in the numbers of animals which can become a problem if they are not controlled by predation.

What appears to be the most practical solution for the success of both the Namibian livestock farmer and the cheetah may be a coexistence where farmers know the cheetah that have home ranges on their farm, and understand what combination of livestock protection strategies are effective deterrents for them. Implementation of an effective livestock management program could reduce loss not only due to cheetah, but to other predators and causes as well. It is important the farmers realize that they play an important role in controlling losses due to predation. Farmers need to accept responsibility for predation control and management.

Seventy-five percent (180) of the survey participants proposed solutions to the cheetah conflict. Of those responding with solutions for reducing livestock and predator conflict, 40% of the farmers commented that either game or livestock management could reduce conflict and 6% suggested both. Specifically, 16% of the farmers advocated maintaining higher concentrations of free-ranging game for cheetah prey, and 30% suggested that more intensive livestock management would reduce livestock loss to the cheetah. The following management approaches have proven successful to farmers in the survey.

Cattle Management Techniques

Calving Camps and Guard Animals: Calving camps, corralling ("kraaling") calving herds and utilising guard animals such as donkeys can reduce loss to predation.

Calving Camp Location: Farmers should consider the possible presence of predators when planning the location of their calving camps. Farmers should avoid locating calving camps in areas of cheetah activity or where playtrees are located, as well as areas with high numbers of aardvark holes.

Corraling Calves: Calves are most vulnerable up to the age of three months and should be adequately protected against cheetah and other predators. Corralling calves close to homesteads or worker's camps at night has proved successful.

Synchronising Calving: Predation on cattle calves may decline if farms synchronise calving both within their herd and with other farms in the area, as well as with wildlife calving times.

Concentration and Rotation: High concentrations of cattle during calving has helped, as there is protection in numbers. This, combined with a fast rotation schedule through smaller camps, has helped several farmers.

Cattle Breed: Farmers that breed Brahman, Brahman crosses and Afrikaner cattle have low losses to predators. The farmers believe that these breeds are more protective of their calves.

Heifers: Inexperienced heifers calving for the first time should be given additional protection, such as putting them with older cows or in closely observed calving camps. Calving seasons are critical, especially for heifers. It is best for them to calve in mid-summer when there are more wild young, as well as more cows and calves for protection, as the first calves born during the start of a calving season are the most vulnerable to predation.

Culling: A cow that fails to reproduce or loses its calf to predation should be culled from the herd.

Camp Monitoring: Calving camps that are watched closely have additional benefits besides deterring predation, including:

(1) increasing delivery success rates, because cows and heifers can be assisted if they have problems, i.e., big calves can be pulled if the cow is small;
(2) detecting sickness;
(3) 36-hour weaning for re-breeding of females;
(4) feeding calves during a drought;
(5) taming calves; and
(6) rescuing calves that have fallen into holes.

Veterinarians: Farmers are encouraged to consult veterinarians to help increase herd fertility and improve overall reproductive management.

Smallstock Management Techniques

Camps, Corraling Herds: Lambing camps, corralling ("kraaling") herds or employing herders or guard animals such as specialised livestock guarding dogs can reduce loss. The use of both a herder and a dog together is most effective.

Involving Personnel: Personnel and herders could be trained to assist with herd management. Additionally, a bonus system could be implemented to reward employees for well-attended stock. This would raise the level of respect for the herder and improve protection of the flock by giving the herder a stake in its protection.

Corrals: Corralled smallstock need to be well-managed and protected to prevent loss: well-maintained thornbush barriers, lighted corrals, and locations near human habitation or settlement are helpful.

Game Management Techniques

Conservancies: Conservancies encourage farmers to manage the game on their farms cooperatively and with conservation ethics.

Exotic Species: Introduction of exotic game species like blesbok and impala, as well as native springbok into heavily bushed areas, may attract cheetah and cause predator conflicts to increase, so these animals require additional protection.

Electric Fencing: Electric game-fencing has proven to be an effective, long-term investment, but it requires sound management and maintenance, such as continually checking voltage, covering warthog holes, etc.

Barbed Wire: The use of barbed wire as the bottom wire on game fencing is an effective deterrent for warthogs, especially if it is electrified.

Game Fencing: Game fencing is not encouraged by CCF, as it stops the natural movement of animals, may cause overgrazing, and may increase predator problems.

General Management Concepts

Balance: A healthy balance of wildlife on farmland includes both prey species and their attendant predators. The greater the natural diversity ("biodiversity") of wild plants and wild animals on a farm, the better the farmer will be able to cope with unfavourable conditions such as drought, disease and bush encroachment.

Protection: Predators such as the cheetah are opportunistic, therefore, farmers should protect vulnerable livestock to discourage predation.

Prey: Cheetah have been observed by farmers to prey on at least 16 species of wild animals and birds. Therefore, the greater the variety of natural prey available on the farmlands, the less likely it is that cheetah will kill livestock.

Four Wire Fences: Wildlife-friendly farmers suggested four wires for interior livestock fencing and passageways for highly travelled game paths (allowing game to travel more easily inside farms, thereby reducing fence breakage).

Indiscriminate Removals: Indiscriminate removal of cheetah is not an effective predator control strategy.

Vacant Territories: When individual cheetah are removed, farmers should understand that this creates vacant territories which attract other cheetah. These "immigrants" may cause more problems than the cheetah which has been removed.

Vacuum: Additionally, more male than female cheetah are removed, primarily because they are easier to trap at playtrees. This "vacuum" will soon be filled by incoming males which are trying to establish territories. Consequently, trapping and removal of male cheetah may cause greater problems.

Investigate Losses: Farmers must thoroughly investigate stock loss to determine the actual cause of loss. The presence of predator tracks is not sufficient evidence.

Conservancies: CCF encourages farmers to join conservancies to help integrate sound management practices sensitive to the environment and wildlife.

Compensation: Compensation for loss specifically due to cheetah could be incorporated into conservancy programs. However, compensation would work only if farmers employed non-lethal predator control methods within conservation-oriented livestock and wildlife management plans.

Sustainable Use: Sustainable use of the cheetah can only be achieved through sound management practices which are supported by research on the entire ecosystem by all those involved.

Trophy Hunting: In order for trophy hunting to have a positive effect, it must be done ethically. Farmers and professional hunters are encouraged to sign the NAPHA COMPACT for management of cheetah on their farms.

Integrated Management: CCF recommends that farmers use a variety of integrated management techniques and strategies for predator control and overall farm management.

Poison: CCF does not support the use of poison for predator control, as it is nonspecific and damaging to the ecosystem.

Individual Situations: Farm sizes, features and issues differ among farmers. Therefore, farmers should evaluate their individual situation in order to develop specific strategies most effective for their farm.

Flexibility: Farmers should realize that the farmlands are a dynamic, constantly changing system. They as farmers must be flexible in their management approaches in accordance with changing farm and environmental needs, as well as predator issues.

Valuable Participation: The farming community overall is a valuable resource, and CCF encourages farmer participation in both governmental and non-governmental programs aimed at reducing predation and predator conflict through non-lethal management strategies.

Accurate records: CCF strongly recommends that farmers keep and report accurate records to officials. Inaccurate numbers potentially hamper effective management techniques for livestock protection and predator control. It is only from accurate record-keeping that management strategies can be developed to assist both the farmer and the cheetah.

Appendix I

THE CHEETAH CONSERVATION FUND

Farmers often assist CCF researchers in collecting data and samples from anaesthetized cheetah.

The purpose of the Cheetah Conservation Fund (CCF) is to secure habitats for the long-term survival of cheetah and their ecosystems through multi-disciplined and integrated research, conservation and education programs. Established in 1990, CCF is headquartered in Namibia and is the only international organization created to support on-site conservation research programs for one of the world's most unique and endangered big cats. CCF's primary focus is in areas outside of protected reserves, working with the local livestock farming communities in developing ways to reduce conflict between humans and cheetah. CCF conducts independent and collaborative research, disseminates information and recommends conservation management techniques.

The Cheetah Conservation Fund is a duly registered Namibian Trust. The members of the local board represent the private, government, education and business communities of Namibia, and help facilitate CCF's outreach into those sectors. Additionally, CCF has an International Research Advisory Board which includes internationally recognized specialists in cheetah, predator, livestock and wildlife research.

CCF co-directors, Laurie Marker-Kraus and Daniel Kraus, are internationally recognized cheetah specialists. CCF's approach to cheetah conservation is innovative and based on years of experience and research in Namibia and over 25 years of research on the cheetah.

Farm workers are encouraged to enquire and participate in on-going research efforts.

Blood samples help determine the health and genetic structure of the Namibian cheetah population.

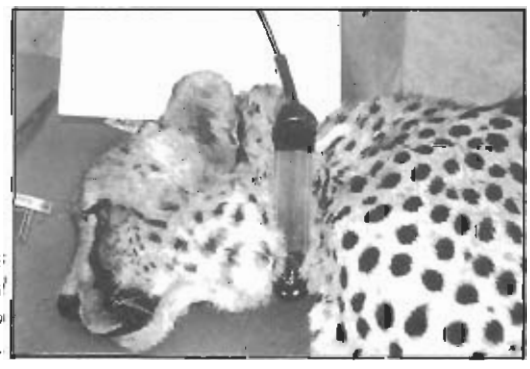
Farmers participate in research by allowing CCF to radio collar cheetah and release them back into the wild.

CCF's OBJECTIVES:

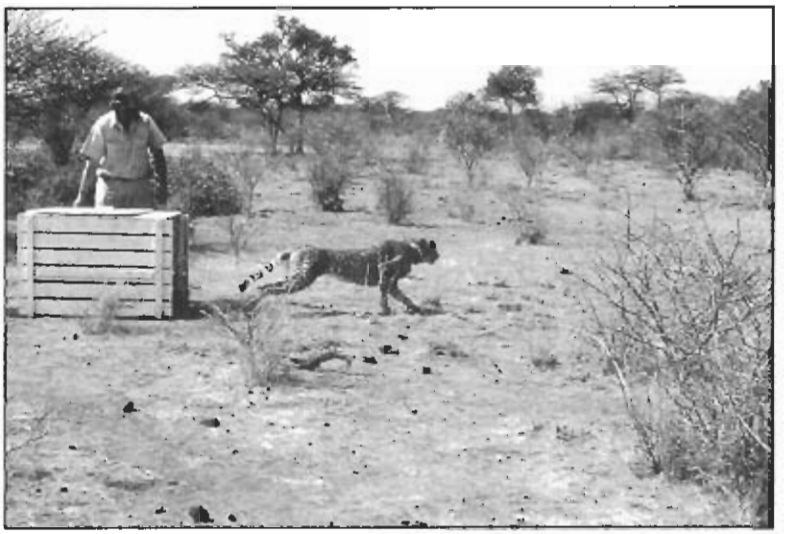
Objectives integrate the needs of both the cheetah and the Namibian farmer.

- Conduct long-term conservation research and education programs on the cheetah throughout its range to ensure its survival.
- Identify and research components of farmland ecosystems that are necessary to sustain healthy cheetah populations.
- Develop conservation management plans which are beneficial to both the cheetah and farmers.
- Promote livestock management techniques which incorporate non-lethal predator control methods for reducing livestock loss from predators.
- Collect biological samples from the wild cheetah population to build an extensive and comprehensive database on the species.
- Monitor the movements of cheetah through the farmlands by the use of radio-telemetry.
- Research and develop relocation techniques for cheetah in Namibia and other areas of southern Africa.
- Conduct behavioural research to study the uniqueness of the Namibian cheetah and its specific needs.
- Support multiple use of the farmlands, i.e. wildlife conservation, livestock farming, trophy hunting, and ecotourism.
- Build awareness among farmers, educators, students, and the general public about the role of cheetah in healthy ecosystems and the need to preserve Namibia's rich biodiversity.
- Collaborate with other research institutions and individuals internationally to help ensure survival of the species.

All cheetah handeled by CCF are ear tagged for permanent identification.



Radio collars are sturdy and transmit up to three years.



Once the data is gathered, and the cheetah are tagged and radio collared, they are released back into their home range with the co-operation of the farmer.

The movements of radio collared cheetah are tracked by airplane or car.

Many of the farmers in the survey indicated the need for education about the plight and natural history of the cheetah. CCF has an extensive environmental education programme.

His Excellency, President Sam Nujoma, the International Patron of the Cheetah Conservation Fund with the co-directors Laurie Marker & Daniel Kraus.

Appendix II

FARMERS PARTICIPATING IN THE SURVEY

Note

1. In cases where farmers own more than one farm, their first farm is listed under Farm Name, whereas all their Farm Numbers are listed.
2. The symbol "~" indicates a portion of the farm is owned by the farmer.

Owner Surname	Farm Name	Farm Numbers
Ahrens, W.H. (Mrs.)	Asroje	182, 181
Altman, K.W.	Okahennessiva	277, 278
Austermuhle, R.	Rustig	210, 208, 128
Baas, G.F.	Quabis	2
Baas, H.	Ombuerendende	183
Baas, J.	Ombujohapera	175, 185
Baas, S.	Otsihua	180
Bergman, C.	Okatumba Suid	197, 130, 131, 132, 127
Binding, H.W.H.	Kataneno	106 2
Binding, U.K.	Mazeppa	198
Bockmuhl, F.	Osombahe	112, 127, 1/2 ~108
Bohm, H.H.	Otjikuoko West	82, 83
Bohmeker, P.C.H.	Bergweiher	19
Botha, D.J.	Cunningham	331
Botha, T.L.	Okatjuojo	244
Bruckner	Namib Rand Game Ranch	
Coetzee, C	Stalingrad	397
Coetzee, H.	Omungondo	390
Coetzee, J.	Beatrys	399, 368
Coetzee, L.J.	Hieroutent	231,230
Cordes, C.H.	Bodenhausen	191
Cramer, G.	Petersfarm	169, 196
Cranz, J.C.	Isabis	19, 20
Cranz, S.	Gallschau	20
Dall, C.	Hopewell	240, 176, 185
Dau, J.	Vandetta	202
De Toit, F.R.	Grensplass	473
Delport, M.R.	Saskatschewan	232
Denhler, C.	Randveld	186
Denhler, R.	Okatumba Ost	195, 196
Denk, H.H.	Randjies	187, 188
Diechoff, V.	La Paloma	438
Diekmann, G.	Otjekongo	267, 265
Diekmann, H.W.	Donkerwater	439
Dressel, E.G.	Hairabib I	163, 173
Drum, W.	TEW	84
Du Plessis, T.	Hodges	326
Duval, C.W.	Paloma	227

Duval, U.	Omambonde-Tal	1261
Eggert, B.H.	Askewold	316, 525, 511
Engelhard, H.G.	Georg Ferdinand-Shake	86
Enslin, G.N.	Omupanda	130, 229
Erpf, H.	Okaputa	334, 107, 108, 105, 109, ~99
Fischer, U.(Mrs.)	Okawatuta Nord	110, 111
Foertsch, H.	Siegerland	268
Frey, H.E.	Okaramba West	193, 194
Friedend, G.R.	Tsufsab	293
Fritzsche, A.	Hilton-Vaagras	38
Frowerk, M.L.	Aris	29
Gaerdes, F.E.C.	Kalidona	277, 276
Garbade, G.W.	Kheman	334
Garbade, T.	Onduno	436
Gerhardt, C.D.	Bosvlakte	321,354
Goldbeck, H.K.	Orumbo	198
Goldbeck, T.	Astra	205
Grobbelaar, S.	Morgan	188,189,139,145,192,82
Groenewald, W.	Franklin	351
Groenewald, W.J.	Pierre	345
Halenke, W.	Hohewarte	76
Halenke, H.	Hohenau	81
Hamman, E.C.	Onganja	190,148,71,161
Hanssen, W.	Okonjima	128
Haussmann, B.L.	Lichtenstein	495,500
Hein, F.W.	Okatjuru	146,102
Held, D.	Fulma	204
Held, E.	Otjivero North	200
Held, H.	Omitara West	203, 110
Hieser, W.O.	Hartebeestteich Sud	132
Hoch (manager)	Losberg	105
Hoff, E.	Neu Heusis	332
Hoffman, W.	Tolene	200
Hoffman, J.H.A.	Oros	98,97,96
Honiball, W.J.	Daipapel	435
Horsthemke, W.E.	Pomona	214,570
Horsthemke, W.G.	Okajura	144,139
Horsthemke, G.	Eahero	129
Jacobs, G.G	Otjere	164
Jochen, Mrs. M.	Otjombali	189
Joubert, C.	Erindi Ranch	58
Joubert, P.	Aloegrove	360,359,362
Kahler, J.	Chipururu	1274
Kasch, H.	Goedemoed	99,97
Kebbel, H. + E.	Okawitumbika	237
Kellner, P.	Frischgewagt	289,209
Klose, A.H.W.	Okowiruru	105

Kock, C.	Localm	211
Kock, H.	Godeis	419
Kolver, A.	Moragora	150,226,225,230
Kopf, E.W.	Riverside	202,198,201
Kreiner, G.	Westende	10
Kreiner, K.	Kaross	237
Kriel, C.J.	"Bertram" Fingerclip	
Krone, F.	Wesselton	
Kronsbien,K.K.	Apex	327
Kruger, W.	Ganams	316
Kubisch, G.	Okapaue	190
La Born, E.	Okandivi	322,356,357
Lacheiner-Kuhn, A.	Marburg	94
Leuschner, I.L.	Lausitz	220
Lichtenberg, K.	Nue Otjisororindi	210
Ling, R.	Cowadray	195
Lintrelt, T.	Nausgomab	373
List, V.	Otjiwa	143,130
Lohmann, I.	Blohmthal	17
Lombard, H.J.J.	Weissenfels	22
Lung and Haagen	Ozondjache	152,316,315,155
Maateis, J.	Olympia Oos	499
Malan, N.M.	Waghog	384
Malan, S.F.	Hornkranz	21
Malherbe, A.	Aurora	159
Maree, L.M.	Mareewil	84
Marggraff, A.J.W.	Gelduld	300
Marggraff, H.	Ondunduwazirapi	299
Maritz, O.C.	Groot Korasieplaats	440
Marquardt, F.U.	Heatherbelle	197,276,138,136
Mcloud, M.A.C.	Rugby	207
Meissner, C.	Osire Nord, Pensona	216,478,243
Metzger, D.	Otjisona Nord	157,~91
Metzger, F.	Otjosondvombo	116,117
Metzger, H.P.F.	Omantumba	134
Middendorff, H.A.	Okonjete	127
Middendorff, I.U.	Otjihavera	62
Milz, F.	List Farm	347,368,353,360,362,175,357
Minnaar (manager)	Okandukaseibe	27
Mostert, J.F.G.	Langdon	95
Mudge, D.F.	Ovigere	105,170
Neethling, T.J.	Florence	249,244,149,186
Neubrecht, J.G.	Etemba Sud.	125,126
Neuhaus, L.	Omieve	179,178
Oberhalusfer, J.W.	Ententeich	128,138
Oberprieler, F.R.	Otjirukaku	42
Oosthuizen, P.S.	Brabamt	403

Opperman, J.C.	Welgeluk	386
Pack, W.	Grunental	1031,1084
Pienaar, N.J.	Nauams	177
Pretorius	Okaharui	81,247,88
Prinslo, C.	Swartkroon	137,272
Rabie, J.J.	Nauibgrens	154,899
Rapmund,O.W.	Rodenbeck	120
Redecker, H.	Natalia	202
Reiff, P.	Neudorf	155,154
Reimer, T.	Otjimbuku	136,251
Rensburg, J.	Osonjiva	387
Rich, W.	Okangono	112
Richter	Sovis	50
Ritter, K.D.W.	Woltemade	254,249,256
Rooken-Smith (manager)	Kambingama	204,203,328
Rosenthal, K.A.W.	Ongoanjomui	143,85
Rothkegel, H.	Twilight	113
Rumpf, E.	Combumb	238,576,218
Rusch, E.A.	Lichtenstein Sud	446
Rusch, E.U.	Lichtenstein North	433
Rusch, George	Haigamas	447
Rusch, Gerhard	Lichtenstern Ost	366/2
Rusch, H.	Hochland	37
Rust, A.	Sonnleiten	78
Rust, B.	Otukarru	43
Sadlowski, M.	Okawikenga	206,205
Schleicker, B.A.	Ondahaka	184
Schleyer, H.E.	Etendero	95,97
Schlosser, G.H.	Steinhausen	212,106
Schmidt, C.	Okambara	219,220
Schneider, S.	Okamutombe	186
Schneider-Waterberg, H.	Okosongomingo	149
Schullenbach, W.	Okarusewa	114,121
Schulz, H.	Naos	46
Schunamann, W.	Okowiruru Nord	107
Schwerdtfeger, H.	Okapura West	92
Seck, P.V.	Davetsaub	29
Seefeld, B.W.	Silversand	198
Seivers, V.	Warlencourt	99
Sibold, E, (Mrs.)	Hummelshain	154,153,73
Simpson, J.	Dei Gratia	389
Slabbert, B.	Oviumbo Ost	188,196
Smit, T.	Monty	329
Sohrada, P.H.	Okawaka	150,351,382
Stechman, H.J.	Ombarahewa	22
Steenkamp, M.	Lazy Spade	359
Steenkamp, B.	Prospect (Hoffnlingfelde)	19

Stier, J.F.C.	Omakune Nord	54,36
Stock, K.	Frauenstein	62
Stoermer, B.	Oruhungu	55
Straube, J.W.	Hohenheim	24,902
Stuhrenberg (manager)	Okatjuru	146,147,151
Swanapoel, D.	Neu Bremen	115
Swanepoel, B.	Ekuja Sud.	167,177,162
Swanepoel, S.F. (Mrs.)	Hartebeestteich Nord	133
Swanepoel, D.	Uitkyk	80
Teubner, W.A.	Otjompane Sud	40
Trasbah (Previous Owner)	Bildah	220
Trossbah, K.F.U.	Ombukombapa	135
Utz, W.	Swytzerland	92,90
Uys, J.	Orumbo Nord	199
Uys, C.J.	Calanoord	577,229
Vaatz, J.	Disternbrook	60
van der Merwe, R.	Omuramba	228
van der Merwe, C.R.	Equtivley	231
van der Merwe, J.M.	Okamatangara	398
van der Merwe, B.	Spaatzhu	761
van der Merwe, D.	Plaas Ike	346
van Hacht, F.W.	Okatjosohjiva	223
van Hase, R.	Jena	117,
van Heerden, A.J.	Rainhof	123,124
van Niekerk, H.	Olympia	651,279,400
van Staden, S.M.	Bergview	317
van Vuuren, L.M.	Alknaar	228
van Whelly, J.A.J.	Kamig Maord Ramsay	341,332
Vasagie	Yakondonga	42,29
Visser, H.	Burgkeller	234,243
Voights, H.	Voightland	135
Voights, R.W.	Voightskirch	135,136,139
Voights, U.D.	Krumhuk	30
Vollmert (manager)	Okamapu	104
von Alten, V.H.J.	Amperdaar	196
von Freier, B.	Haris	367
von Hase, R.	Kiripotib	262
von Leipzig, H.A.	Achalm	583,584,206
von Seydlitz, H.S.	Omarane	92,94
Wiechmann, M.	Otjihangwe Sud	171
Wilkens, S.	Okowiruru	107,113,126,135
Wiss, J.A.	Otjiseva	420,47
Woest, B	Suskes	172
Zander	Monteith	98,~97
Zensi, P.	Hamburg	504,508
Zimney, G.	Hockfeld	326,131,~329
Zwar, D.	Onbeameiata	122,~233,133

Appendix III

LIST OF SPECIES' NAMES REFERRED TO IN TEXT

Name in Text	Scientific Name	Afrikaans Name	German Name
Cheetah	Acinonyx jubatus	Jagluiperd	Gepard
Leopard	Panthera pardus	Luiperd	Leopard
Lion	Panthera leo	Leeu	Loewe
Spotted Hyaena	Crocuta crocuta	Gevlekte Hiena	Flecken Hyaene
Black-Backed Jackal	Canis mesomelas	Rooijakkals	Schabraekenschackal
Kudu	Tragelaphus strepsiceros	Koedoe	Grosskudu , Kudu
Gemsbok	Oryx gazella		GemsbokOryx , Gemsbock
Springbok	Antidorcas marsupialis	Springbok	Springbock
Steenbok	Raphicerus campestris	Steenbok	Steinbock
Common Duiker	Sylvicapra grimmia	Duikerbok	Kronenducker
Damara Dik Dik	Madoqua kirkii	Damaralandse Blouboklie	Damara Kirkdikdik
Red Hartebeest	Alcelaphus buselaphus	Rooihartebees	Kuhantilope
Eland	Taurotragus oryx	Eland	Elenantilope , Eland
Bontebok , Blesbok	Damaliscus dorcas sp.	Bontebok , Blesbok	Bontebock , Blessbock
Impala	Aepyceros melampus sp.	Rooibok	Impala
Plain's Zebra	Equus burchelli	Bontsebra	Steppenzebra
Hartmann's Mountain Zebra	Equus zebra hartmannae	Hartmann se Bergsebra	Hartmanns Bergzebra
Blue Wildebeest	Connochaetes taurinus	Blouwildebees	Streifengnu
Black Wildebeest	Connochaetes gnou	Swartwildebees	Weiss-Schwanzgnu
Waterbuck	Kobus ellipsiprymnus	Waterbok , Kringgat	Wasserbock, Ellipsen - Wasserbock
Giraffe	Giraffa camelopardalis	Kameelperd	Giraffe
Sable	Hippotragus niger	Swartwitpens	Rappenantilope
Roan	Hippotragus equinus	Bastergemsbok	Pferdeantilope
Tsessebe	Damaliscus lunatus	Tsessebe	Leierantilope
Nyala	Tragelaphus angasii	Njala , Njalabosbok	Tiefland-Nyala , Nyala
Water Buffalo	Bubalus bubalis	Waterbuffel	Wasserbueffel
White Rhino	Ceratotherium simum	Witrenoster	Breitmaulnashorn
Warthog	Phacochoerus aethiopicus	Vlakvark	Warzenschwein
Ostrich	Struthio camelus	Volstruis	Strauss
Guinea Fowl	Numida meleagris	Gewone Tarentaal	Perlhuhn
Kori Bustard	Ardeotis kori	Gompou	Riesentrappe

Three important cheetah prey species: kudu, hartebeest and gemsbok.

Appendix IV

LIVESTOCK GUARDING DOGS

Protecting livestock from wild animals is one of the most ancient uses man has had for domestic dogs. However, not every breed of dog can fill the role of livestock protector. Specific breeds of livestock guarding dogs are more instinctively adapted for effective protection than other breeds such as herding dogs. Livestock guarding dogs bond with the herd and instinctively protect and guard against any threats; whereas the herding dog's instinctive behaviour involves moving the herd and keeping it together. One dog can not fill the role of both herder and protector. Ideally, a farmer should have a separate dog for each role.

Livestock guarding dogs are used throughout the world for preventing livestock loss to predators. These specialised breeds are proven to effectively guard sheep, goats, llamas, cows, pigs and turkeys, against bears, wolves, coyotes, lynx, jackal, cheetah, caracal and baboons.

Basic Guarding Dog Behaviour

Livestock guarding dogs are calm and confident dogs that continually stay with the herd. They are raised with the herd from a young age and instinctively bond with the sheep or goats they are kept with. The dogs have superior senses of hearing, sight and smell, and are very sensitive to changes in normal herd behaviour or routine. They will investigate and aggressively confront any intruders or threats to the herd. Livestock guarding dogs are not dependent on their masters for affection or direction, and are capable of making independent decisions. There are three main behaviours that an effective livestock guarding dog must have: trustworthiness, attentiveness and protectiveness.

1. **Trustworthiness:** The basis of trustworthiness with the herd, and the main characteristic which sets livestock guarding dogs apart form other breeds, is the lack of predatory behaviour. There are two main behaviours in a trustworthy dog: submissiveness and investigatory. Submissive behaviour involves the dog's approaching the livestock with its ears back, tail down, and in a crouched position. Investigatory behaviours involve sniffing heads and anal areas and cleaning young lambs or kids. Both of these indicate strong bonding with the herd.

2. **Attentiveness:** Livestock guarding dogs are naturally willing to stay with the herd and in familiar territory. They will follow the herd, as well as sleep and rest among it. The more attentive the dog is to the stock, the more he will protect it.

3. **Protectiveness:** A dog that is both trustworthy and attentive will instinctively be protective. The dog will be sensitive to any changes or threats and will react appropriately in the interest of the herd's safety. Often this will involve a threatening "approach-withdraw behaviour". The dog rushes out towards a predator with a formidable bark, and then retreats back in to the herd. Predators are easily deterred in this manner. A guarding dog does not protect by chasing; because if he leaves the herd he is not proteting it.

Raising a Livestock Guarding Dog

The bonding process with the herd is critical to the success of a livestock guarding dog, and must begin at an early age. Training and raising a puppy should emphasize the formation of social bonds between the pup and the herd. The pup should attach to the herd and the herd animals must accept the pup as one of their own. Livestock guarding dogs mature slowly, but by the end of the first year, the dog must have learned to be trustworthy, attentive and protective of its herd.

It is important that owners realize that they play a vital role in raising an effective guardian, and that the process is different from raising herding dogs or companion pets. There are specific stages of development and training that an owner must be aware of in order to raise a reliable livestock guarding dog:

Early Juvenile—8 to 16 weeks of age: This is the most important stage of social bonding. Puppies are removed from their litter mates and placed with new owners when they are 6 to 8 weeks old. The puppy should be placed in a well-fenced area with the smallstock continually for 24 hours a day. It is best if at least 6-10 sheep or goats can be kept with the pup at all times. To make it easier, it is acceptable to rotate the stock; this allows all members of the herd to meet the pup. Ideally, the stock should be at least twice the age of the puppy, i.e. a two month old puppy in with four month old goats. This prevents accidental injury if the puppy plays too rough with the smallstock.

The pup and stock must bond with each other and share social behaviours with each other, i.e. dominance, submission, grooming, etc. Signs of bonding are easy to see. Pups exhibit behaviour to the stock that they would normally show to their litter mates, other dogs or people. One of the first behaviours noticed is care-soliciting and this is usually in a typical food begging manner—the pup approaches a sheep/goat with ears flattened, tail down, slightly crouched, head lifted to touch or lick noses. Another normal social behaviour that develops at this stage is dominance, i.e. the puppy dominating its food pan and growling at stock that may try to push in. This is a positive behaviour that reinforces the bond between the dog and stock.

It is critical to keep the puppy with the herd animals and to avoid contact with people, houses, vehicles and other dogs. Feeding and occasional reassurance are the only human contact the puppy needs—he must bond and obtain security from the herd, not the owner—this is extremely important. However, contact to correct bad behaviours is sometimes necessary. Puppies usually readily respond to correction and scolding. Verbal correction involving a sharp "no" is usually all that is needed. Puppies normally do not require physical correction; however there are a few insrances where verbal commands may not be enough. In the case of chasing stock, the pup can be held while firmly saying "no". In the more serious case of rough play with the stock, the pup's cheeks can be gently grabbed and shaken lightly while saying "no".

It is important that undesirable or negative behaviours are stopped immediately before they become a habit. Once a problem is noticed, it must be corrected. Pups must be reprimanded immediately following the behaviour so that it connects the correction with the behaviour. Owners must keep a close eye on the pups in order to foresee or correct any problems. Any undesirable behaviours allowed to develop during this stage will interfere with the effectiveness and trustworthiness of the dog as an adult. Two critical problems that can appear during this stage, if the pup is not properly bonded with the herd, is wandering and becoming a pet (caused by too much human interaction).

Late Juvenile—4 to 6 months of age: It is important to reinforce the puppies positive social behaviours that are emerging. The pups should be exhibiting ATTENTIVENESS by this stage. Pups should be spending time with the stock, lying with them during the day, and bedding with them at night. It is good to praise this attentive behaviour with a simple pat on the head when the pup is with the herd. Once the puppy is attentive it can go out with the herd, but only if it is supervised. It must not be left unattended, as it is still young and does not have confidence.

Pups at this stage should not have any negative experiences on their own or be allowed to develop bad habits. Puppies at this age are not old enough to provide protection and are vulnerable to potential predators, either by being frightened or hurt. A pup must be allowed to grow and gain experience slowly. If a predator scares a puppy at this stage it can be very hard to rebuild its confidence. It is best to pair the pup with a herder that goes out with the stock. A leash should be taken along and used if the pup shows bad behaviour or is in potential danger. The leash can be used as correction as well as protection and security. Once a puppy has learned behaviours other than full-time stock guarding, it is hard to make it into a reliable guardian. Chasing, running

off, and rough play are examples of common problems. It is important that these problems be reprimanded immediately.

Sub Adult—6 to 12 Months: By this stage, adult behaviours start to emerge and the owner must be aware of the differences in the development of the pup. Up to this point, social interactions with the stock were reinforced; and now potentially dangerous new behaviours must be suppressed in order for it to become TRUSTWORTHY. With the onset of puberty, the pups play behaviour with the stock may become rough and must be discouraged before it develops to any degree.

Chasing is the most frequently seen behaviour and it is sometimes paired with grab-bite or ear-chew. These dogs often will end up with a leg in their mouth, not knowing what to do, because they have not inherited the full predatory behaviour. If the dog is not severely reprimanded at this stage, then it may develop into a serious problem with the stock's being injured or killed. It is mandatory to correct this behaviour (firmly yelling "no", and throwing a stick to divert its attention, or spanking). If negative behaviours are observed or suspected it is best not to leave the pup unattended. If bad behaviours are corrected and not allowed to continue, then they will disappear.

Heat cycles start in the females, at which time they may wander or start chewing on sheep. Males may stray if attracted to other female dogs which are in heat in the area. Once again it is best to keep the pups separated from other dogs. Males may also attempt to mount the stock.

As the pup approaches a year old (between 8 and 12 months) it should be able to be let out with the herd with less supervision. The level of supervision is strictly dependent on the behaviour of the dog. The point at which the dog is able to do its job on its own is a very individual decision, and good judgment is invaluable.

Adult—12 months+: Dogs should be attentive and trustworthy by this stage and therefore PROTECTIVE. By the time the dog is 18 months old, he has reached physical, sexual and mental maturity. It should be confident and completely familiar with its social and physical space, boundaries, and routine. Owners should already start to see protectiveness against predators and other threats.

Housing

A newly weaned pup needs a secure area in its new home. The puppy should be provided with a shelter to protect it from sun, wind, rain and cold. An old blanket or hay helps it feel secure. This "house" will serve as a secure place for the puppy. The shelter should be located inside the pen or corral with the stock. Locating it near the waterpoint, bedding area or salt lick encourages interaction and closeness with the herd. The shelter will also serve as a safe haven for the pup if it feels threatened by an overly protective doe or ewe.

Diet

There are a few important points to remember when feeding a livestock guarding dog. From early on, they should eat a low protien diet. A typical diet consists of mielipop with the addition of dog nuggets (puppy nuggets up to 6 months old preferably) or cooked meat (no raw meat!) or raw eggs and milk. They should be fed twice a day until they are 5 to 6 months old, at which time they are starting to go out with the flock.

The livestock guarding dog, unlike other breeds, does not require large amounts of protein. The extra protein can affect the behaviour of the dog. It gives them more energy which can lead to chasing and other untrustworthy behaviours. It is also good if the dog eats the afterbirth or dropping of the stock, as it helps the bonding process.

Health Care

The livestock guarding dog puppy should receive all normal vaccines recommended by a veterinarian for dogs, and should be regularly dewormed. It is also important that the dogs are regularly checked for ticks, as ticks can transmit disease. Herders that will be attending the dogs should be trained to watch the dogs for signs of injury or illness.

Appendix V

ELECTRIC FENCING

Electric fencing is a viable, economic and effective solution to predator control. This proven non-lethal predator deterrent has been used successfully world-wide. For example, in Australia, electric fencing is a solution to problems on the farmlands caused by kangaroo, wild pig, dingo, wombat, wild dog, emu and rabbit. In North America, electric fencing successfully controls coyote and feral dog predation of sheep and prevents bear nuisances. The entire fence around the Umfalozi game reserve in South Africa is electrified to protect subsistence farmlands outside the borders from baboon, lion, hyeana and elephant. Research at the University of Natal proved the effectiveness of electrifying fences against black-backed jackal, domestic dogs and caracal. In Namibia, research in the Etosha game reserve demonstrated the effectiveness of electric fencing against invasions of elephant, kudu, giraffe, rhinoceros, wildebeest, lion, leopard and hyena. Several game farmers in Namibia also are realizing the benefits and cost effectiveness of electrifying their game fences.

Electric fences must be designed, installed and maintained properly in order to be successful. Ideally, electric fencing should be used in conjunction with game fencing. If a farmer already has game fencing in place, the cost effectiveness of electrifying the fence must take into consideration the loss of valuable exotic species that will be saved over the long-term. The following are suggestions for an effective electric fence:

Design

One strand 15 cm off the ground and 15 cm out from either side of the fence will help deter black-backed jackal, warthog, and aardvark.

A second strand placed 30 cm from the ground will shock predators such as cheetah and leopard when they approach the fence.

An optional third wire placed higher will stop a predator that climbs the fence and does not touch the lower wires.

Predators are actually easy to control an deter with electric fencing, as they are very sensitive to electric shock. However, passageways under the fence lines left by warthog cause farmers problems. Warthog can endure intense pain if their drive is strong enough. Therefore, the main concern for the farmer in electric fence design is the warthog's digging holes under fence lines. These holes can become predator passageways. An electric strand of barbed wire as the bottom strand of the fence will strongly deter any digging. Furthermore, the selection of the energiser should consider the higher shock needed for warthogs.

Installation

High powered low impedence energisers should be used. Farmers should investigate the differences in power output of the various energisers available and choose the best model for their needs. It is not recommended to cut costs and reduce the power of the energiser.

More powerful energisers lose charge rapidly, therefore it is recommended that solar charges are used to maintain the batteries.

Offset electrified wires should be mounted on the fence and not on posts, as rigid wires are more easily broken.

The earth or soil type affects the electrical conductivity. Drought greatly reduces electrical conductivity, therefore alternating live and earth return wires should be seriously considered.

Only galvanized component should he used to reduce corrosion.

Best quality materials and porcelain insulators should be used. Cost cutting on fence materials will only make a cheap ineffective fence.

Maintenance

Proper and continual maintenance of electric fences is essential for optimizing the system's effectiveness. Maintenance should include inspection for shorts in the system at least twice a week and the filling of any warthog holes.

The vegetation at the base of the fence should be controlled. Strong energisers are capable of burning away young green leaves, but bushes or trees need to be regularly cleared. Long-term (5 to 10 year) herbicides can be used to deter vegetation. Fence lines can also be burned every autumn.

Appendix VI

SAVING THE WILD CATS

International Union for the Conservation of Nature

Species Survival Commission

Cat Specialist Group

Cats have been part of the environment culture and mythology of human beings for thousands of years. The lion in particular, has been widely used as a symbol of royalty and state to the present day. in pre-Columbian civilisations in Mexico and central America, the jaguar had high ritual significance. The tiger has figured in the art and culture of the great civilisations of Asia. Domestic cats were revered in ancient Egypt, and in many countries today they rival the dog as a beloved companion of man.

Nevertheless, almost all species of wild cats are declining seriously in numbers because of human impact; some subspecies are already extinct; and others are on the brink of extinction.

Wild cats inhabit various parts of African the Americas and Eurasia. Lion, jaguar, leopard, tiger and snow leopard are known as the beg cats. Clouded leopard, cheetah and puma are also large in size, while the rest are smaller: African golden cat, Bornean bay cat, leopard cat, Chinese desert eat, caracal, jungle cat, pampas eat, Geoffroyís cat, kodkok, Iroimote cat, Andean cat, lynx, Pallasís eat, sand cat, marbled cat, black-footed cat, ocelot,, flat-headed cat, rusty-spotted cat, bobcat, serval, wildcat(Progenitor of the domestic cat), Asiatic golden cat, oncilla, fishing cat, margay and juguarundi.

The extinction of species of wild cats would be an inestimable loss to the world, not least because of their role as predators is essential to natural ecology. It behooves us to make every effort to prevent it, because human activities are largely responsible for their deteriorating status.

Why Cats Should be Conserved

Human beings have no right to eliminate other species. Indeed, in view of the extent of human domination of the natural environment, we have a responsibility and obligation to all species and to our descendants to perpetuate their existence. Extinction is forever.

The decline of a carnivore generally alter the ecological balance of its biological community. Cats are linked through predation to herbivores, which are, in turn, linked to each other through competition and to plant communities by their foraging. They are particularly sensitive to environmental disturbance, and the decline or disappearance of these vulnerable cat species serves as an indicator of changes in their ecosystem, which may the result of natural phenomenon or, as is increasingly the case in present times. of the impact of human activities. These changes frequently involve a deterioration in the human environment, such as the loss of forests and grasslands and their valuable animal and pant products, or impairment of water supplies essential to human life and agriculture. Furthermore, large cats, being at the pinnacle of the food chain, need considerable space, and are, therefore, key species in determining the area required to define an appropriate ecosystem.

In addition to the ecological consequences of the disappearance of these carnivores, many people feel a sense of inner loss when such magnificent and mysterious animals are gone from the wild.

Problems Faced by the Cats

Accelerating loss of habitat has now reached a critical stage as the human population continues to soar. In many cat ranges, remaining habitat represents but a small percentage of what existed in the past, and what remains could be wiped out in the near future.

Cats have long been hunted. They are killed because they have been viewed as competitors for prey. They are killed because they have taken livestock. They are killed for sport, and their body parts are used in some places as medicine. Young cats are captured for pets. And some, especially spotted cats, are killed for the fashion trade, which has often led to over-exploitation.

At the same time, the disappearance of natural prey has frequently deprived cats of their normal sustenance and contributed to conflict with humans and their livestock, leading inevitably to reprisal killing of cats, often including those not actually involved.

Where cat populations have been reduced to mall numbers they are increasingly vulnerable to extinction due to fortuitous local events, such as epidemics, fires and floods. Some scientists also fear the possibility of deterioration through inbreeding depression and loss of genetic diversity in ht long-term, which might reduce the ability of small populations to adapt to changes in their environment.

The Decline of the Cats

Cat populations have long been in decline and today every indicator suggests that declines are accelerating and have reached, in some cases, a critical stage.

The Asiatic lion is a classic example of decline because of human impact. Ranging 2,000 years ago from Asia Minor to Central India it was hunted and exterminated, so that by the beginning of this century only a few survived in Indiaís Gir forest. Fortunately, conservation efforts have succeeded in maintaining a lion population in the Gir, but it is confined to this single habitat, and thus is still dangerously vulnerable.

In 1947, the last recorded Asiatic cheetahs in the Indian sub-continent were shot. The sub-species still survives in Iran, but only in small numbers in fragmented habitat.

The Bali tiger is thought to have already become extinct before 1940, and during this present decade of the 1980is its neighbour, the Javan tiger appears to have passed into oblivion. No trace of the Caspian tiger has been found for several decades, and reports suggest that the Amoy tiger, which is endemic to China, is on the verge of extinction, and that other subspecies of tiger may have vanished from the wild there by tbe end of the century.

The Indian or Bengal tiger had declined to dangerously low numbers by 1970, but has recovered as a result of dedicated, internationally-supported conservation programmes implemented by the Indian and Nepalese governments. Nevertheless, it will remain vulnerable unless these programmes continue.

Among the small species, the Iriomote cat, endemic to a Japanese island east of Taiwan, is nearly extinct because of destruction of its habitat and human over-exploitation of its natural prey.

These examples of the decline of the cats and of suitable habitat are representative of the general situation throughout their world range.

Problems of Cat Conservation

There is still only limited knowledge of the distribution, numbers, biology and behaviour of almost all species of cat. Research to increase understanding of these factors is essential to the planning and implementation of effective conservation measures.

Economic planners and decision-makers often fail to recognize the importance for human welfare of wild lands, including ecosystems of which cats are part. Consequently, development programmes are carried out with little or no consideration of the longer-term impact, which may result in the decline and extinction of many species, including cats, as well as impoverishing the human environment.

As a result of increasing fragmentation of habitat and the pressure of human activities in their vicinity, large cats may become problem animals, particularly through livestock predation, and in rare cases taking human life.

Demands may then arise for elimination, not only of the offending animals, but of all the large cats in the area.

Insufficient resources are made available to pursue necessary research, and to implement protective measure and conservation management of natural habitats of cats, often because of failure to recognize their ecological significance and through lack of political will.

How Cats Can Be Conserved

Protected habitats of sufficient size and productivity to support viable populations of cats must be preserved, and linking corridors maintained wherever possible.

The distribution of each species and the habitat available to it needs to be established in detail down to the level of discrete populations.

Legislation to ensure long-term conservation of cat species and their prey, including controls on trade, national and international, must be passed and enforced.

Conservation of cats has to be reconciled with the needs of humans. Some conflict may be inevitable in areas where agriculture or livestock farming impinges on cat habitats, but it should be minimized by appropriate management measures. For many cats, and particularly large cats, parks and reserves may not be adequate. Land-use patterns in adjacent areas need to be designed so that they are compatible with use by both humans and cats.

Local people musty feel that efforts are being made to protect their interests. Information about the role of cats and ways to conserve them should be part of conservation education at all ages and levels of the community, including the politicians, officials, industrialists and businessmen who are the decision-makers.

Captive propagation programmes should be considered as an important precaution to serve as a genetic and demographic reservoir, which could, in appropriate circumstances, be used to reinforce wild populations.

All these measure should be included in an overall conservation strategy for each species to ensure its survival.

Conclusions

Species need not be lost provided action is taken to conserve them. Experience has shown that seemingly desperate situations can be reversed, if protection is given to species and their ecosystems.

The Cat Specialist Group is pledged to do all in its power to achieve the conservation of all cat species, and appeals for the cooperation of all people to ensure that these magnificent animals continue to coexist with humans.

Peter Jackson - Chairman, Cat Specialist Group

BIBLIOGRAPHY

1. Bagot-Smith, A. (1993, pers. comm.) Veterinarian, P.O. Box 165, Otjiwarongo, Namibia.
2. Berry, H. (1990) Large-scale Commercial wildlife utilization: Hunting, tourism and animal production in Namibia. In: WILDLIFE RESEARCH FOR SUSTAINABLE DEVELOPMENT, 45-49. Ed. J.G. Brooutenhuis, S.G. Njuguna and P.W. Kat. Proceedings of an International Conference held in Nairobi, April 22-26, 1990.
3. Berry, H. and Siegfried, W.R. (1991) Mosaic-like events in arid and semi-arid Namibia. In: THE MOSAIC-CYCLE CONCEPT OF ECOSYSTEMS: 147-160. Ed. H. Remmert. Springer-Verlag, Berlin Heidelberg New York.
4. Berry, H. (1995, pers. comm.) Head, Namib Research Institute, Ministry of Environment and Tourism, P.O. Box 1204, Walvis Bay, Namibia.
5. Bothma, J. du P., ed. (1989) GAME RANCH MANAGEMENT. Hatfield: J.L. van Schaik (Pty) Ltd.
6. Bowland, A.E.; Mills, M.G.L.; Lawson, D. (1994) PREDATORS AND FARMERS. Johannesburg: The Penrose Press.
7. Caro, T.M. (1987) Cheetah's mothers' vigilance looking out for prey or for predators. BEHAVIOUR ECOLOGY SOCIOBIOLOGY, 20(5):351-62.
8. Caro, T.M. (1994) CHEETAHS OF THE SERENGETI PLAINS. Chicago: University of Chicago Press.
9. CITES (1984) Convention on International Trade in Endangered Species of Wild Flora and Fauna. Part of the Endangered Species Act. CODE FEDERAL REGISTER, Part 23.
10. CITES (1992) Quotas for trade in specimens of cheetah. Eighth meeting of the Convention of International Trade in Endangered Species of Wild Fauna and Flora. DOCUMENT 8.22 (Rev.):1-5.
11. Conover, M.R. (1982) Evalution of behavioral techniques to reduce wildlife damage. In: WILDLIFE-LIVESTOCK RELATIONSHIPS SYMPOSIUM. J.M. Peek & P.D. Dalke (eds.) Moscow, ID: University of Idaho, pp. 332-334.
12. Creekmore, C. (1991) The paradox. NATIONAL WILDLIFE FEDERATION MAGAZINE. May pp. 22-25.
13. Delis, W. (1992, pers. comm.) Game Dealer, P.O. Box 51, Windhoek, Namibia.
14. du Preez, J. (1970, unpublished) Report on the feeding and release of 30 cheetah in Etosha. Namibian Nature Conservation Report N 50/7/3.
15. Eaton, R.L. (1970) Hunting behaviour of the cheetah. J. WILD. MGMT. 34:56-67.
16. Eaton, R.L. (1974) THE CHEETAH: THE BIOLOGY, ECOLOGY, AND BEHAVIOUR OF AN ENDANGERED SPECIES. New York: Van Nostrand Reinhold.
17. Ebedes, H. (1968a, unpublished) Research: Release of predators in Etosha National Park. Report to the Director of Nature Conservation, Namibia. No 50/2.
18. Ebedes, H. (1968b, unpublished) The immobilization of carnivorous animals, Namibia Nature Conservation Annual Report.
19. Ebedes, H. (1971, unpublished) Release of cheetah and leopard in the Etosha National Park. Report to the Director of Nature Conservation, Namibia. No 50/5/3.
20. Erb, P. (1995, pers. comm.) Senior Conservation Scientist, Etosha Ecological Institute, Ministry of Environment and Tourism, P.O. Okaukuejo via Outjo, Namibia.
21. Evans, W. (1983) The cougar in New Mexico: biology, status, depredation of livestock, and management recommendations. UNPUBL. REPORT, NEW MEXICO DEPT. OF FISH AND GAME, Santa Fe.
22. Forthman, D.L.; Gustavson, C.R.; Rusniak, K.W. (1985) Coyote control and taste aversion. APPETITE 6, pp. 253-264.
23. Frame, G.W. (1984) Cheetah. in: THE ENCYCLOPAEDIA OF MAMMALS, VOL 1, MacDonald, D.W. (ed) London: Allen and Unwin, pp 40-43
24. Fox, B. (1994, pers. comm.) Research Technician, Etosha Ecological Institute, Ministry of Environment and Tourism, P.O. Okaukuejo via Outjo, Namibia.
25. Garcia, J; Hankins, W.G.; Rusiniak, K.W. (1974) Behavioural regulations of the milieu interne in man and rat. SCIENCE, 185: 824-831.
26. Garcia, J; Garcia, Y; Robertson, R. (1985) The evolution of learning mechanisms. AMERICAN PSYCHOLOGICAL ASSOCIATION: MASTER LECTURE SERIES, 4, 191-243.
27. Gaerdes, J. (1974a) Cheetah in Southwest Africa. SWA SCIENTIFIC SOCIETY 9-10, supplement a.
28. Gaerdes, J. (1974b) Cheetah in Southwest Africa. SWA SCIENTIFIC SOCIETY 11, supplement b.
29. Gaerdes, J. (1974c) Cheetah in Southwest Africa. SWA SCIENTIFIC SOCIETY 12, supplement c.
30. Graham, A.D.; Parker, I.S.C. (1965) East African Wildlife Society Cheetah Survey. REPORT BY WILDLIFE SERVICES. East African Wildlife Society, Nairobi. Typescript.
31. Graham, A.D. (1966) East African Wildlife Society cheetah survey: Extracts from the report by Wildlife Services. E. AFR. WILD. J. 4:50-55.
32. Griffiths, R.R. Jr.; Connolly, G.E.; Burns, R.J.; Sterner, R.T. (1978) Coyotes, sheep and lithium chloride. PROCEEDINGS OF THE VII VERTEBRATE PEST CONFERENCE. pp. 190-196.
33. Gustavson, C.R.; Kelly, D.J.; Sweeney, M.; Garcia, J. (1976) Prey-lithium aversions in coyotes and wolves. BEHAVIORAL BIOLOGY, 17:61-72.

34. Hamilton, P.H. (1986) Status of the cheetah in Kenya, with reference to Sub-Saharan Africa, In, CATS OF THE WORLD: BIOLOGY, CONSERVATION AND MANAGEMENT. Eds. S.D. Miller, D.D. Everr. Washington, DC, National Wildlife Federation.

35. Hassel, R.H. (1984) Rabies in kudu antelope (Tragelaphus strepsiceros) and cattle in South West Africa. PROCEEDINGS: 13th World Congress on Diseases on Cattle, Durban South Africa: 65-70.

36. Heeney, J.L.; Evermann, J.F.; McKeirnan, A.J.; Marker-Kraus, L.; Roelke, M.E.; Bush, M.; Wildt, D.E.; Meltzer, D.G; Colly, L.; Lucas, J.; Manton, V.J.; Caro, T.; O'Brien, S.J. (1990) Prevalence and implications of feline coronavirus infections of captive and free-ranging cheetahs (Acinonyx jubatus). J. VIROLOGY 64: 1964-1972.

37. Hemmer, H. (1990) DOMESTICATION: THE DECLINE OF ENVIRONMENTAL APPRECIATION, 2nd edition. Cambridge: Cambridge Univ. Press.

38. Horn, S.W. (1983) An evaluation of predatory suppression in coyotes using lithium chloride-induced illness. JOURNAL OF WILDLIFE MANAGEMENT 47 (4) 999-1009.

39. Jackson, P. (1992) Saving the wild cats. IUCN/SSC, Cat Specialist Group.

40. Jaeger, H.G.; Booker, H.H.; Hubschle, J.B. (1990) Anthrax in cheetahs (Acinonyx jubatus) in Namibia. JOURNAL OF WILDLIFE DISEASES 26(3), pp423-424.

41. Joubert, E. and Mostert, P.K.N. (1975) Distribution patterns and status of some mammals in South West Africa. MADOQUA, ser. 9, no.1.

42. Joubert, E. (1984) The cheetah—South West Africa's spotted enigma. SOUTHWEST AFRICA 1984, pp 13-18.

43. Joubert, E. (1985) Harvesting game at night in South West Africa. In: GAME HARVEST MANAGEMENT. Ed. S.L. Beason & S.E. Robertson, pp 289-297.

44. Joubert, E. & Morsbach, D. (1982, unpublished) The 1982 distribution patterns and status of some mammals in South West Africa. unpubl. Report to the Directorate of Nature Conservation and Tourism.

45. Kraus, D.; Marker-Kraus, L. (1991) The status of the cheetah (Acinonyx jubatus). REPORT TO THE IUCN/SSC CAT SPECIALIST GROUP.

46. Kux, M. (1985) US strategy on the conservation of biological diversity. An Inter-agency Task Force Report to Congress.

47. Laurenson, K. (1991) Cheetahs never win. BBC WILDLIFE MAGAZINE, Feb. pp 99-105.

48. Laurenson, M.K.; Caro, T.M.; Barner, M. (1992) Female cheetah reproduction. NATIONAL GEOGRAPHIC RESEARCH AND EXPLORATION, 8:64-75.

49. Laurenson, K. (1994) High juvenile mortality in cheetahs (Acinonyx jubatus) and its consequences for maternal care. J. ZOOL. LOND.,234.

50. Laurenson, M.K., Caro, T. and Borner, M. (1992) Female cheetah reproduction. Patterns of female reproduction in wild cheetahs: implication for conservation. NATIONAL GEOGRAPHIC RESEARCH AND EXPLORATION 1:64-75.

51. Lindeque, P. (1994, pers. comm.) Researcher, Ministry of Environment and Tourism, Private Bag 13306, Windhoek, Namibia.

52. Marker-Kraus, L. (1990a) 1988 INTERNATIONAL CHEETAH STUDBOOK. Washington, D.C., Smithsonian Institutions's National Zoo's NOAHS Center publ.

53. Marker-Kraus, L. (1990b) 1989 INTERNATIONAL CHEETAH STUDBOOK. Washington, D.C., Smithsonian Institution's National Zoo's NOAHS Center publ.

54. Marker-Kraus, L. (1991) 1990 INTERNATIONAL CHEETAH STUDBOOK. Washington, D.C., Smithsonian Institution's National Zoo's NOAHS Center publ.

55. Marker-Kraus, L. (1992) 1991 INTERNATIONAL CHEETAH STUDBOOK. Washington, D.C., Smithsonian Institution's National Zoo's NOAHS Center publ.

56. Marker-Kraus, L. (1993) 1992 INTERNATIONAL CHEETAH STUDBOOK. Washington, D.C., Smithsonian Institution's National Zoo's NOAHS Center publ.

57. Marker-Kraus, L. (1995) 1993 INTERNATIONAL CHEETAH STUDBOOK. Washington, D.C., Smithsonian Institution's National Zoo's NOAH Center publ.

58. Marker-Kraus, L. & Grisham, J. (1993) Captive breeding of cheetahs in North American zoos: 1987-1991. ZOOBIOLOGY 12: 5-18.

59. Marker-Kraus, L. & Kraus, D. (1990) Investigative trip to Zimbabwe and Namibia. CAT NEWS, Vol 12 (1):pp 16-17. Ed. P. Jackson. Gland, Switzerland, IUCN.

60. Marker-Kraus, L. & Kraus, D. (1993) The history of cheetahs in Namibia. SWARA 16(5):8-12.

61. Marker, L. & O'Brien, S.J. (1989) Captive breeding of the cheetah (Acinonyx jubatus) in North American zoos (1871-1986). ZOOBIOLOGY 8(1): 3-16.

62. Martin, R.B.; deMeulenaer, T. (1988) Survey of the status of the leopard, Panthera pardus, in Sub-Saharan Africa. CITES. Lausanne, Switz. 106 pp.

63. Mattie, J. (1993, unpublished) Conservancies in Namibia. Report to Namibia Professional Hunter Association Annual Board Meeting, typescript.

64. McLaughlin, L. (1970) Aspects of the biology of cheetahs (Acinonyx jubatus Schreber) in Nairobi National Park. MSC thesis, University of Nairobi, Nairobi.

65. McVittie, R. (1979) Changes in the social behaviour of South West African cheetah. MADOQUA 11:171-184.

66. Mills, G. (1991) Thick bush and stronger predators complicate hunt. CUSTOS 19(12): 16-18.

67. Mizutani, F. (1993) Home Range of leopards and their impact on livestock on Kenyan ranches. SYMP. ZOOL. SOC. LOND. 65: 425-440.

68. Morsbach, D. (1985, unpublished) The ecology, behaviour and movements of the cheetah on farm areas of South West Africa, Namibia. Annual Reports, Department of Agriculture and Nature Conservation, Directorate of Nature Conservation and Recreational Resourts.

69. Morsbach, D. (1986, unpublished) The ecology, behaviour and movements of the cheetah on farm areas of South West Africa, Namibia. Annual Reports, Department of Agriculture and Nature Conservation, Directorate of Nature Conservation and Recreational Resourts.

70. Morsbach, D. (1987) Cheetahs in Namibia. CAT NEWS. 6:26-26.

71. Myers, N. (1975) The cheetah, Acinonyx jubatus. IUCN MONOGRAPH 4. Morges, Switzerland, International Union for Conservation of Natnre and Natural Resources.

72. Myers, N. (1986) Conservation of Africa's cats: problems and opportunities. In: CATS OF THE WORLD: BIOLOGY CONSERVATION AND MANAGEMENT. S.D. Miller; D.D. Everett, eds.

73. Myers, N., ed. (1990) THE WILD SUPERMARKET, THE IMPORTANCE OF BIODIVERSITY TO FOOD SECURITY. Gland, Switerland: WWF International.

74. Nature Conservation Ordinance. (1975) No 4 of 75; Schedule 4; OFFICIAL GAZETTE EXTRAORDINARY, 20 June 1975, no. 3469.

75. Nowell, K. and Jackson, P. eds (1995) Wild cats status survey and conservation action plan. IUCN/SSC Cat Specialist Group, Gland.

76. O'Brien, S.J. (1994) The cheetah's conservation controversy. CONSERVATION BIOLOGY 8 (4):1153-1155.

77. O'Brien, S.J.; Wildt, D.E.; Goldman, D.; Merril, C.R.; Bush, M. (1983) The cheetah is depauperate in biochemical genetic variation. SCIENCE 221: 459-462.

78. O'Brien, S.J.; Roelke, M.E.; Marker, L.; Newman, A.; Winkler, C.A.; Meltzer, D.; Colly L.; Evermann, J.F.; Bush, M.; Wildt, D.E. (1985) Genetic basis for species vulnerability in the cheetah. SCIENCE 277: 1428-1434.

79. O'Brien, S.J.; Wildt, D.E.; Bush, M.; Caro, T.; Fitzgibbon, C.; Leakey, R. (1987) East African cheetahs: Evidence for two bottlenecks? PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA 84: 508-511.

80. Phillips, J.A.; Worley, M.B.; Morsbach, D.; Williams, T.M. (1993) Relationship among diet, growth and occurrence of focal palatine erosion in wild-caught captive cheetahs. MADOQUA 18(2): 79-83.

81. Prescott-Allen, P. & Prescott-Allen, C. (1992) Sustainable use of wild species specialist group. SPECIES 18: 76-77.

82. Rabinowitz, A. (1986) JAGUAR. New York: Arbor House.

83. Ralls, K. & Ballou, J. (1982) Effects of inbreeding on infant mortality in some small mammals species. JOURNAL OF LABORTAORY ANIMALS. 16:159-166.

84. Savory, A. (1988) HOLISTIC RESOURCE MANAGEMENT. Island Press, Washington D.C.

85. Schaller, G.B. (1968) Hunting behaviour of the cheetah in the Serengeti National Park, Tanzania. E. AFR. WILD. J. 6: 95-100.

86. Schaller, G.B. (1973) THE SERENGETI: THE KINGDOM OF PREDATORS. London: Collins.

87. Schneider, H.P. (1994) ANIMAL HEALTH AND VETERINARY MEDICINE IN NAMIBIA. Windhoek: AGRIVET.

88. Seager, S.W.J.; Demorest, C.N. (1986) Reproduction in captive wild carnivores. In: Fowler, M.S. (Ed.) ZOO AND WILD ANIMAL MEDICINE. W.B. Saunders Co., Philadelphia, London: 852-881.

89. Seely, M., Kambatuku, J., Shanyengana, E. (1994) The Namibian environment and desertification. In PROCEEDINGS OF NAMIBIA'S NATIONAL WORKSHOP TO COMBAT DESERTIFICATION. Desert Research Foundation of Namibia.

90. Shaw, H. (1989) SOUL AMONG LIONS, THE COUGAR AS A PEACEFUL ADVERSARY. Boulder: Johnson Pnblishing Company.

91. Shortridge, G.C. (1934) THE MAMMALS OF SOUTH WEST AFRICA. VOL. II. London: William Heinemann Ltd.

92. Smithers, R.H.N. (1975) Family Felidae. In: THE MAMMALS OF AFRICA: AN IDENTIFICATION MANUAL, ed. J. Meester and H.W. Setzer 1-10. Washington D.C., Smithsonian Institution.

93. Smuts, G.L.; Wyte,, I.J.; Dearlove, T.W. (1977) A mass capture technique for lions. EAST AFRICAN WILDLIFE JOURNAL 15: 81-87.

94. Standard, P. (1994, pers. comm.) Researcher, Ministry of Environment and Tourism, P.O. Box 17, Grootfontein, Namibia.

95. Stuart, C. aud Wilson, V. (1988) THE CATS OF SOUTHERN AFRICA. IUCN Cat Specialist Group, African Carnivore Survey, Chipangali wildlife Trust, Bulawayo.

96. Suminski, H.P. (1982) Mountain lion predation on domestic livestock in Nevada PROCEEDINGS OF VERTEBRATE PEST CONFERENCE 10:52-66.

97. Teer, J.G.; Drawe, L. (1992) The Welder Wildlife Foundation, Working for the Cattleman. THE CATTLEMAN, December: 186-198.

98. United States Department of Agriculture (1992) A producers guide to preventing predation of livestock. Agriculture Bulletin No. 650

99. van Schalkwyk, P., ed. (1994) NAMIBIAN TRADE DIRECTORY: AN OVERVIEW OF NAMIBIAN TRADE AND INDUSTRY 1994-1995.

100. von Wietersheim, A. (1988) Game Farming. AFRICAN WILDLIFE, 42(2): 69-75.

101 Wildt, D.E. (1994, pers. comm.) Reproductive Physiologist, National Zoological Park, Smitsonian Institution, Washington D.C., 20007, U.S.A.

102. Wildt, D.E.; Platz, C.C.; Seager, S.W.J.; Bush, M. (1981) Induction of ovarian activity in the cheetah (Acinonyx jubatus). BIOLOGY OF REPRODUCTION 24: 217-22.

103. Wildt, D.E.; Bush, M.; Howard, J.G.; O'Brien, S.J.; Meltzer, D.J. (1983) Unique seminal quality in the South African cheetah and a comparative evaluation in the domestic cat. BIOLOGY OF REPRODUCTION 29: 1019-1025.

104. Wildt, D.E.; O'Brien, S.J.; Howard, J.G.; Caro, T.M.; Roelke, M.E.; Brown, J.L.; Bush, M. (1987) Similarity in ejaculate-endocrine characteristics in captive versus free-ranging cheetahs of two subspecies. BIOLOGY OF REPRODUCTION 36: 351-360.

105. Wildt, D.E.; Brown, J.L.; Bush, M.; Barone, M.A.; Cooper, K.A.; Grisham, J.; Howard, J.G. (1993) Reproductive status of cheetahs (Acinonyx jubatus) in North American zoos: the benefits of physiological surveys for strategic planning. ZOO BIOLOGY 12:45-80.

106. Wilson, V.J. (1987) Distribution and status of cheetah in Zimbabwe. Report of the Chipangali Wildlife Trust, Zimbabwe.

107. Wrogemann, N. (1975) CHEETAH UNDER THE SUN. New York, McGraw-Hill.

PHOTO CREDITS

All Photos, including the front and back covers, were taken by

L. Marker

except for the following photo credits:

A. Coetzee: p 10

L. Grubb: p 44 (top), 42

D. Heinrich: p 65 (top & bottom right)

S. Hurlbut: p 43 (lower)

R. Kimball: p 55

D. Kraus: p 34; p 53 (middle)

D. Morsbach: p 44 (bottom)

L. Munson: p 65 (lower left)

J. Rogers: p 57 (middle)

Courtesy of Cheetah Conservation Fund: p 67 (lower right); p 67 (middle right)

Courtesy of Windhoek Photo Nink: p 6

Courtesy of U. Winter (from Journal of Archaeology, vol 28): p 2 (lower)

FARMERS REFERENCES

Notes

1. Numbers assigned to farmers are CCF database numbers used in the Farm Survey.
2. Because not all farmers are directly referred to in the text, not all numbers are listed.
3. Farmer's names may be cross referenced with Appendix II.

No.	Farmer Surname
1	Hoch (manager)
2	Goldbeck, T.
4	Von Leipzig, H.A.
5	Wilkens, S.
6	Bockmühl, F.
7	Held, D.
8	Austermühle, R.
11	Held, E.
12	Uys, C.J.
13	Goldbeck, H.K.
14	Ahrens, W.H. (Mrs.)
15	Baas, S.
16	Neuhaus, L.
17	Schleicher, B.A.
18	Baas, H.
21	Rooken-Smith (manager)
24	Marquardt, F.U.
25	Cramer, G.
26	Altmann, K.W.
28	Leuschner, I.L.
29	Kubisch, G.
31	Rumpf, E.
35	Lichtenberg, K.
38	Rust, A.
39	Kronsbein, K.K.
40	Sibold, E. (Mrs.)
41	Metzer, D.
42	Hamman, E.C.
43	Wiechmann, M.
44	Malherbe, A.
45	Swanepoel, B.
46	Dennler, C.
48	Cordes, C.H.
49	Frey, H.E.
50	Seefeld, B.W.
53	Bergmann, C.
55	Baas, J.
59	Zinny, G.O.
60	Swanepoel, S.F. (Mrs.)
62	Horsthemke, G.
63	Horsthemke, W.G.
65	Hein, F.
66	Marggraff, A.J.W.
68	Mostert, J.E.G.
71	Rosenthal, K.A.W.
72	Stührenberg (manager)
74	Schünemann, W.
75	Schüllenbach, W.
78	Zwar, D.
79	Metzger, F.
84	van Heerden, A.J.
85	Neubrecht, J.G.
86	Gaerdes, F.E.C.
89	van der Merwe, R.
91	Enslin, G.N.
92	Duval, C.W.
94	Maree, L.M.
96	Utz, W.
97	Swanepoel, D.
98	Bohm, H.H.
99	Slabbert, B.
100	Middendorff, H.A.
104	Theissen, R.
105	Diekmann, G.
111	Trossbach, K.F.U.
116	Lung and Hagen
125	Reiff, P.
127	Erpf, H.
142	Lacheiner-Kuhn, A.
155	Voigts, U.D.
159	von Alten, V.H.J.
165	Hoffmann, J.H.A.
169	Hanssen, W.
171	Coetzee, J.
181	Dall, C.
188	Kruger, W.
190	Lohmann, I.
193	von Seydlitz, H.S.
198	Schwerdtfeger, H.
201	Eggert, B.H.
220	Garbade, G.W.
240	Gerhardt, C.D.

Namibia has the largest remaining population of free-ranging cheetah in the world, estimated at 2 500. Ninety percent of Namibia's cheetah live outside of protected reserves, primarily on commercial livestock farmlands. Approximately 1 000 farmers control the fate of the cheetah due to the cat's conflict with livestock farming interests. Most farmers perceive the cheetah as a threat to their livestock and game, and often kill or remove cheetah from their land, whether there is a loss of livestock or not due to the cheetah.

An in-depth farm survey was conducted from 1991 to 1993 by the Cheetah Conservation Fund (CCF) in order to investigate the conflict between the farmers and the cheetah. The purpose of CCF's survey was to obtain a basic understanding of the ecosystem on the Namibian farmlands which sustain cheetah populations, and to research ways for humans and cheetah to co-exist. This included understanding how current livestock management practices impact cheetah and their prey, and how the cheetah was affecting the farmers and their livestock. The survey served as a basis for developing appropriate management plans and techniques that consider both land use needs and cheetah conservation.

Cheetah Survival on Namibian Farmlands summarizes the results from CCF's farm survey, presents historical records of the Namibian cheetah, and offers management suggestions to reduce the conflict between farmers and cheetah. The book includes a *Quick Reference* section that summarizes key information from the text, and another summary section entitled *Suggested Approaches for Management of the Cheetah on Namibian Farmlands.*

The fate of the Namibian cheetah is in the hands of the farmers and they are responsible for controlling and reducing their losses due to predation. The most practical solution for both the farmers and the cheetah is for the farmers to understand the cheetah and its behaviour and to implement livestock management strategies that will effectively deter predation.

The Cheetah Conservation Fund (CCF) is a nonprofit organization established in 1990. CCF's mission is to develop and implement long-term monitoring, multidisciplinary research, and conservation efforts for the survival of the free-ranging cheetah and its ecosystem in remaining habitats in Namibia and other appropriate areas of Africa. A main focus of CCF is aiding the farm community in predator management. CCF serves as a resource for farmers and actively promotes awareness of conservation issues.

CCF International Cheetah Research and Education Center is located near Otjiwarango, Namibia. The Center contains research and education facilities available to researchers, students and the public. CCF collaborates with scientists around the world to learn more about the cheetah, its habitat and how to ensure the species survival.

ISBN N°: 99916-30-62-7