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Abstract: The cheetah is suffering declining numbers throughout Africa, where suitable habitat is disappearing and prey is becoming scarce due to the consequences of human encroachment, as land is developed and converted to farmland for livestock production. Wildlife reserves and conservation areas in reality have had the opposite effect for the cheetah, due to forced competition with other large predators. The Namibian cheetah has adapted to the farmlands mainly because of its diminishing natural habitat and the elimination of other large predators. Today, the cheetah's survival is in humans hands.

HOW LONG WILL THE CHEETAH RUN?

(Laurie Marker-Kraus and Daniel Kraus)

Introduction: The fate of the failing cheetah populations lies with the conservation efforts by people like internationally-recognized cheetah experts Laurie Marker-Kraus and Daniel Kraus.

Description of the Cheetah

The world's fastest land animal, the cheetah, is the most unique and specialized member of the cat family. It is markedly different in both anatomy and behavior than the other 36 species of Felidae. Unlike most other cats, the cheetah has a comparatively larger chest, a leaner body, and longer legs, and it cannot fully retract its claws. As the most specialized member of the cat family, it is the only species in its own genus, Acinonyx. (See Box Topic: The Cheetah - Fastest Land Mammal on Earth)

The cheetah is more often than not always mistaken for a leopard. The distinguishing marks of a cheetah are the long tear-drop shaped lines on each side of the nose from the corner of its eyes to its mouth. The cheetah's coat is tan, or buff colored, with smaller, less distinct spots in-between larger spots measuring from 3/4 to 1 1/4 inches across. There are no spots on its belly, which is white, and on the tail, the spots merge to form four to six dark rings. The tail usually ends in a bushy white tuft.

Although male cheetahs are often slightly bigger than females, it is difficult to tell males and females apart by appearance alone; however, the males usually have a slightly larger head. Adult cheetahs weigh between 70 and 140 pounds and stand about 30 inches tall at the shoulder. The head and body are about 4 feet long and the tail is a little more than half as long as the total body length. (See Box Topic: The Life Cycle of the Cheetah)

The cheetah dates back to prehistoric times, 4 to 6 million years ago, well before the other big cats. It was one of the most widely distributed of all land animals and roamed the entire world. Based on fossil remains, it is thought that the cheetah actually originated in North America, and through the course of time, migrated over land bridges from North America into China, through Asia, India, Europe, and Africa. The cheetah of today evolved into its present form about 200,000 years ago, and lived in its entire worldwide range as recently as 20,000 years ago. After the Pleistocene era, about 10,000 years ago, the cheetah's range was restricted to Asia and Africa.

The cheetah's history with humans dates back almost five thousand years. Cheetahs have the longest hunting association with man of any animal, with the exception of the dog. In Hindu cheetahs have been called the "Spotted One" or "Chita," being known as the hunting leopard, the most easily tamed of the big cats and used as a hunting companion and for the sport of coursing. Cheetahs have been kept as pets by kings, emperors and princes and have been considered to be a prerequisite for royalty for almost as long as the possession of gold. Because of this continuous drain on the wild populations, the numbers of cheetahs declined throughout Asia. In Africa, the cheetah was important to many of the local ethnic groups: the San hunting communities of southern Africa ate cheetah meat for speed; traditional healers used cheetah feet bones for fleet-footedness; and kings wore cheetah skins for dignity. (See Box Topic: Cheetahs role as a Pet and Hunter in the Royal Households of the Middle East)

Losing the Race for Survival

Diminished Populations:

Prior to the 20th century, the cheetah was widely distributed throughout Africa and Asia. Cheetahs were originally found in all suitable habitats from the Cape of Good Hope to the Mediterranean, throughout the Arabian Peninsula and the Middle East, from Israel to India and Pakistan, and through the southern provinces of the Commonwealth of Independent States (formerly the USSR). In 1900, it was estimated that there were more that 100,000 cheetahs throughout Asia and Africa. The cheetah is now classified as an endangered species and listed in Appendix I (which includes species that are most threatened) of the Convention of International Trade in Endangered Species (CITES).

Today, the Asian cheetah is nearly extinct, as it has suffered a devastating decline of available habitat and prey. Cheetahs were rareties in Asia minor and Arabia by the end of the 19th century, the species was declared extinct in India in 1952, and the last reported cheetah was seen in Israel in 1956. The only confirmed reports of Asian cheetahs comes from Iran, where one to two hundred occur in small isolated populations. Some of these remaining animals are surviving on rabbits, due to the disappearance of larger prey species.

Free-ranging cheetahs still inhabit a broad section of Africa, including areas of North Africa, the Sahel, East Africa, and southern Africa. But, only half or fewer of the countries where cheetahs still exist may have viable cheetah populations. Fewer than 15,000 cheetahs remain throughout their range, (we conservatively estimate 9,000, and optimistically estimate 12,000 animals). These individual numbers, however, are not the important point; rather, the numbers of viable populations is the critical factor. Such dwindling populations means that those cheetah which do survive come from a smaller, less diverse gene pool. There are now only two remaining population strongholds, Kenya/Tanzania in East Africa, and Namibia/Botswana in southern Africa.

The cheetah's greatest hope for survival lies in the relatively pristine countrysides of Namibia, which is home to the world's largest remaining population of cheetah. But even here, the cheetah's numbers have drastically declined by half in the past ten years leaving an estimated population of less than 3,000 animals.

The cheetah's problems for survival are unique:

The cheetah is suffering declining numbers throughout Africa, where suitable habitat is disappearing and prey is becoming scarce due to the consequences of human encroachment, as land is developed and converted to farmland for livestock production. Since human and livestock populations prefer the grasslands, where cheetahs usually have been found, these new settlements and agricultural developments have wreaked havoc with the cheetah's habitat and have placed the species in direct conflict with livestock farmers.

Wildlife reserves and conservation areas are intended to be a safe haven for wild animals where they can roam freely and live naturally. Ironically for the cheetah, however, such parks and reserves in reality have had the opposite effect, due to forced competition with other large predators, notably the lion and hyena. Although cheetahs are the more successful hunters, they lose up to 50% of their prey to such larger predators which dominate the land. A viable population of cheetahs thus is therefore difficult to sustain. In addition, there is also a high percentage of cheetah cub mortality, often due to predation and abandonment by their dam because of insufficient prey. Thus, the largest percentage of free-ranging cheetahs, today, are found outside of protected areas, where they are also in trouble: to survive, the cheetah requires large tracts of wild land where there is a balance of prey and predator; such habitats, however, are becoming increasingly scarce.

Poaching poses an additional problem in much of the cheetah's remaining range. Poaching has greatly increased, especially during the last twenty years, due to the many civil wars which have

supplied guns to the general populace, which may then poach all forms of wildlife for human survival: food and income.

If these problems were not sufficient, molecular genetic studies on free-ranging and captive cheetahs have shown that the species lacks genetic variation, probably due to past inbreeding, as long as ten thousand years ago. The consequences of such genetic uniformity have led to reproductive abnormalities, high infant mortality, and greater susceptibility to disease, causing the species to be less adaptable and more vulnerable to ecological and environmental changes. (See Box Topic: Genetic Problem's Because of the cheetah's Limited Gene Pool)

Unfortunately, captive breeding efforts have not proven to be meaningful to the cheetah's hope for survival. The similar experiences of the world's zoos have reaffirmed the traditional difficulties of breeding cheetahs in captivity. Despite the capturing, rearing, and public display of cheetahs for thousands of years, the next reproductive success after Akbar the Great's recorded birth of one litter in the 16th century occurred only in 1956 at the Philadelphia Zoo. Unlike the other "big cats," which breed readily in captivity, the captive population of cheetahs is not self-sustaining and thus is being maintained through the import of wild-caught animals, a practice which goes against the goals of today's zoological institutions. Although reproduction has occurred at many facilities, only a very small percentage of cheetahs have ever reproduced, and cub mortality is very high. In the absence of further importations of wild-caught animals, the size of the captive population can be expected to decline further, a trend which, coupled with the continuing decline of the wild population, leaves the species extremely vulnerable.

The development of the International Cheetah Studbook (by Laurie Marker-Kraus) has assisted captive management efforts by creating a forum for international communication and creating the preconditions for selecting breeding animals. The Studbook is published annually and is a chronology of the captive population of cheetah. It consists of an inventory of births, deaths, and transfers in the captive population, as well as acquisitions of wild-caught animals into captivity. It is used as a tool to assist managers in establishing a genetically healthy captive population. Of the approximately 950 cheetahs living in 160 of the world's zoos in 36 countries, virtually all have come from Namibia. Yet, very little is known about the behavior and biology of the Namibian cheetah population. A better knowledge of the population in Namibia will greatly improve the understanding of the cheetah's captive problems and will help to formulate an effective plan to manage the species in captivity.

Long Term Conservation Efforts

We founded the Cheetah Conservation Fund in 1990 to directly confront the above issues and to implement techniques for cheetah conservation in their natural habitat. A permanent base for this long-term, on-site effort for the wild cheetah was established in 1991 in Namibia, Africa, home to the largest remaining, viable, population of cheetahs. Here, we are developing programs which can then be adapted for use in other African countries.

In Namibia, seventy percent of the wildlife lives on farmlands averaging in size from 10,000 to 40,000 acres. Ninety- five percent of the cheetah population lives on these private lands, due to the availability of prey and the elimination of other large predators. Private ownership of wildlife causes unique problems for conservation efforts, as each farmer has particular opinions about how to deal with "his" or "her" wildlife, even though the game moves from farm to farm; female cheetahs will cover over 1,200 sq. km. and males over 800 sq. km. Since the wildlife belongs to the landowners and has an economic value through live sale,

meat production, and trophy hunting, strategies to sustain populations of wildlife and the cheetah must be developed in conjunction with the farmers, along with livestock and pasture management practices. Our goal is to develop workable strategies for promoting sustainable cheetah populations, a goal which, in the end, largely is dependant on the willingness and the capacity of individuals and local
communities. The first step has been in conducting a comprehensive survey of all the districts in Namibia which still have cheetah. This survey has included, cheetah distribution patterns, availability of prey, attitudes of farmers towards the cheetah, and current livestock and wildlife management practices and how they impact on the cheetah.

Historically, the cheetah has been viewed as a pest and a
threat to the livelihood of especially livestock farmers. Since it is legal to shoot an animal deemed to interfere with one's property and livelihood, three generations of farmers have done their best to eliminate the species; and yet, by the late 1970's, a population of approximately 6,000 animals remained. Due to a variety of circumstances in the 1980's, including severe draught, mismanagement of wildlife populations, and the continued over-stocking of livestock on rangelands, cheetah populations came into even greater conflict with farmers. During this same period, eighty percent of one of the cheetah's main prey, the kudu, died off due to an outbreak of rabies. As a result of these events, the cheetah resorted to greater predation of domestic livestock, instigating an all-out war towards the species. By the latter part of the 1980's, the cheetah population had been reduced by more than half.

And, the conflict continues. The Namibian cheetah has adapted to the farmlands mainly because of its diminishing natural habitat and the elimination of other large predators.Conserving the biodiversity of the large ranges that cheetahs occupy is thus one of our main objectives for long term conservation efforts. The cheetah can only survive if its habitat is preserved and can support healthy, wild prey populations. Since, in general, the cheetah prefers wild game, the maintenance of wild prey reduces the conflict of cheetahs with livestock farmers. The cases where cheetahs do acquire a taste for livestock, can either be attributed to old-age or physical impairments, or to young cheetah that lose their mother before becoming good hunters themselves. Such individuals animals could be singled out and caught, and not the entire population as a whole.

Moreover, Namibian cheetahs exhibit social behavior unlike that of cheetahs in other parts of Africa. For example, a pressing problem for cheetahs is live trapping, after which a large percentage of them are then shot and killed. The live traps are set at `playtrees,' trees which have not been reported in any other area of Africa, and which are a focal point for cheetahs in their large home ranges. "Playtrees" have sloping trunks that branch into large horizontal limbs that can easily be climbed into by cheetahs. Cheetahs visit the `playtrees' on a regular basis and mark them with scat and urine. Although not all farms have `playtrees', on those that do, the farmer can catch all the cheetahs that visit the trees. In addition, farmers often report seeing cheetahs in large groups of 10 to 20 animals, and cubs are reportedly seen with more than one adult.

Developing a clear understanding of the farmers' problems with cheetah and learning what can be done to reach a compromise is critical to ensuring that the cheetah's habitat will be available for the future and that the cheetah has a chance to survive. Farm management practices used around the world to protect livestock from predators can help to reach such a compromise by reducing the need to eliminate large numbers of the species. Some of these practices include: reducing calf losses by moving calving herds out of the areas where `playtrees' are located; bringing cows closer to the homestead during calving time; keeping heifers (first time calving cows) in the same camps as older cows, as many losses are in heifer herds because they are inexperienced; keeping larger concentrations of stock in camps during calving to help to protect the calves; keeping a few cows or

steers with horns together with the calving herd; placing donkeys with calving herds, as donkeys are aggressive toward intruders and chase away cheetahs; rotating stock more rapidly through camps; and promoting more aggressive breeds of cattle, such as the Bos Indicus and indigenous breeds. Other solutions are being found for small stock, sheep and goats, including employing herders and large breeds of guard dogs; placing bells on several individuals in a herd, which seems to confuse and
scare cheetah; and raising baboons with the herds, since baboons then become furious protectors. Farms with more wildlife have less problems with cheetahs because cheetahs prefer wild game.

The Cheetah Conservation Fund aims to establish a permanent base of operations on a farm in one of the cheetah regions of Namibia from which to begin an outwardly growing area, specifically recognized as a cheetah conservation area; and to conduct a continuous process of grassroots education and training concerning the importance of biodiversity to sustaining the local ecosystem. For example, as a selective hunter, the cheetah plays a major role in the health of prey populations, seeking the oldest and weakest animals from a herd, allowing the strongest to survive and thereby helping to continue he evolutionary process, since these stronger animals can then pass on their genes to strengthen the species as a whole. Also, by leaving some remains of their kills, the cheetah helps to feed other animals which are important in the ecological cycle including jackals, porcupines, badgers, civet and genet cats, vultures and insects. Thus, predators are important to the overall ecology of a healthy world.

Most importantly, since the base is also an outreach center specifically recognized for cheetah conservation on farmland, farmers would know where to find information and help if they are having cheetah/livestock problems. To this end, the farmers' participation in conservation strategies for the cheetah will actively be encouraged. For example, we invite farmers to collect data about cheetahs by keeping track of cheetah sightings and tracks on their farms, so that patterns of movement between farms can be developed. Moreover, in conjunction with the farmers' observations, we are opportunistically collecting biological samples, blood and tissues, for analysis from cheetahs which are trapped on farms to assess the over-all health and genetic make-up of the free-ranging population. Since cheetahs continue to be killed each year, these condemned cats will at least supply information for the species that, in the end, will help to
provide solutions to the complex issues of their conservation.

As there will always be some problem cheetahs on farmlands, the development of reintroduction techniques also forms part of the future plans of the Cheetah Conservation Fund. Successful methodologies will need to take into account the social behavior of the cheetah, its large home ranges and strong homing instinct, conflict with resident cheetah populations and the impact that even a limited population of cheetahs have on the prey species. Reintroduction can only be successful in areas that can support adequate prey populations. Critical components of the over-all program will include land use planning and livestock management, as well as the population dynamics of the prey base.

The research and outreach program conducted by the Cheetah
Conservation Fund will assist the Namibian government with
policies towards the sustainable utilization of wildlife and the ecosystems in which it lives, having an immediate impact on the conservation of the cheetah in Namibia, and providing valuable information which will increase chances of survival for the cheetah throughout its existing range.

Box Topic: The Cheetah: Fastest Land Mammal on Earth.

The world's fastest land animal, the cheetah, is aerodynamically built for speed and unmatched in the animal or automotive world for its acceleration from zero to 40 mph in just three strides and full speed of 70 mph in a matter of seconds. The cheetah has the optimum body size

and stride length to reach these high speeds. As the cheetah runs, only one foot at a time touches the ground. There are two points, in its 20 to 25 foot stride when no feet touch the ground, as they are fully extended and then totally doubled up. Nearing full speed, the cheetah is running at about 3 1/2 strides per second.

During its high speed chase in pursuit of prey, the cheetah's respiratory rate climbs from 60 to 150 breaths per minute. Because of the increased rate, the cheetah can only run 400 to 600 yards before it is exhausted; at this time it is extremely vulnerable to other predators, which may not only steal its prey but attack it as well. The cheetah is not an aggressive animal, having a light and lanky body, short weak jaws, and small teeth, the price it paid for its speed.

The cheetah has specialized for this speed through many morphological and physiological adaptations. To facilitate such explosive use of energy, the cheetah is endowed with a powerful heart, an oversized liver, and large, strong arteries. For aerodynamics, it has a small head, a flat face, a reduced length of muzzle which allows the large eyes to be positioned for maximum binocular vision, enlarged nostrils, and extensive air filled sinuses. Its body is narrow and light-weight with long, slender feet and legs, and specialized muscles which act simultaneously for high acceleration, and allowing greater swing to the limbs. Its hip and shoulder girdles swivel on a flexible spine that curves up and down as the limbs are alternately bunched up and then extended when running, giving greater reach to the legs. The cheetah's long and muscular tail is acts as a stabilizer or rudder for balance to counter-act its body weight, so that it doesn't roll over and spin out in quick, fast turns during a high speed chase. The cheetah is the only cat with short, blunt claws that are semi non-retractable and help grip the ground like cleats for traction when running. Their paws are less rounded than the other cats, and their pads are like tire treads to help them in fast, sharp turns.

The Life Cycle of the Cheetah

Sexual maturity in female cheetahs usually occurs at 20 to 24 months. On average, the female's oestrus lasts about two weeks and is preceded and succeeded by periods of increasing and diminishing receptivity, during which time she leaves her scent through frequent urine squirts. The mating period lasts from one day up to a week; and when the male leaves it is over. The female's gestation period is 90 to 95 days, after which she will give birth to a litter of up to six cubs. Shortly before she is ready to give birth, she will find a quiet, hidden spot in the tall grass, under a low tree, in thick underbrush or in a clump of rocks. Newborn cubs average in weight between 9 to 15 ounces.

Although cheetah cubs are blind and completely helpless at birth, they develop rapidly. At 4 to 10 days of age, their eyes open, and they begin to crawl around the nest area; at three weeks their teeth break through their gums. Due to the possibilities of predation from a variety of predators including, lions, leopards, hyenas, baboons, and birds of prey, the female moves her cubs from den to den every few days, thus avoiding the possibility of their scent becoming too strong in any one area, and the den becoming obvious because of her comings and goings.

For the first six weeks, the female has to leave the cubs alone most of the time, in order to hunt. Also, she may have to travel fairly large distances in search of food. During this time, there is a very high occurrence of cub mortality due to predation. Moreover, if food is very scarce, females are known to abandon their cubs. If a female does lose her cubs, she will come back into estrus within days.

Unlike the fur of adult cheetahs, the fur of the newborn cubs is dark and the spots are blended together and barely visible. Then during the first few weeks of life, a thick yellowish-gray coat, called a mantle, grows along the cub's back. The dark color helps the cub to blend into the shadows, and the mantle is thought to have several purposes, including acting as a thermostatic umbrella against

rain and the sun, and as a camouflage imitating the dry dead grass. The mantle is also thought to be a mimicry defense, causing the cub to resemble a ratel, or honey badger, which is a very vicious small predator that is left alone by most other predators. Even still, cub predation is as high as 90 percent in the wild. The mantle begins to disappear at about three months old, but the last traces of it, in the form of a small mane, are still present at over two years of age.

The cubs begin to follow their mother at six weeks old, keeping very close to her, and beginning to eat meat from the prey of her kills. From this time onward, mother and cubs remain inseparable until weaning age. A female with cubs needs to kill one animal a day to have enough food for herself and her cubs. Since cheetahs rely on sight for hunting, they are diurnal, more active in the day than night. In warm weather, they move around most during the early morning and late in the afternoon when the temperatures are cooler.

Life Cycle of the Cheetah

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At about three months old, the female begins to bring live prey to the cubs, like newborn antelopes, which she releases in front of the cubs. The cubs run after the prey, which often escapes, whereby the female retrieves it again for the cubs. Thus the cubs learn from a very young age the techniques involved in hunting and killing.

Cheetahs are one of the best hunters. The technique used most often is by stalking, as close as possible to their prey, then bursting into full speed. They then trip the prey with one of their front paws and as the prey falls, they bite it by the throat in a strangulation hold. Their chase is short, as they usually catch the prey within the first 200 yards.

The cubs grow very rapidly and are half of their adult size at six months old; at eight months old, they have lost the last of their deciduous teeth. About this time, the cubs begin to make clumsy attempts at stalking and catching. Much of the learning process takes the form of play behavior. The cubs stalk, chase and wrestle with each other and even chase prey that they know they cannot catch, or prey that is too large. The cubs learn to hunt many different species, including guinea fowl, francolins, rabbits, and small antelope. They still are not very adept hunters at the time they separate from their mothers.

The female leaves her cubs when they are between 16 to 18 months old and will re-breed, starting the cycle over again. The cubs stay together for several more months, usually until the female cubs reach sexual maturity. At this time, the male cubs are chased away by dominate breeding males. Male cubs stay together for the rest of their lives, forming a coalition. This male coalition is beneficiary in helping to acquire and hold territories against rival male cheetahs. Males become sexually mature between 2 1/2 and 3 years of age.

Box Topic: Cheetahs role as a pet and hunter in the royal households of the Middle East.

The earliest record of the cheetah's long association with humans dates back to the Sumerians, about 3,000 BC, where a leashed cheetah, with possibly a hood on its head is depicted on an official seal. The cheetah was considered to be a goddess in early lower Egypt. It was known as the MAFDET cat-goddess, and was revered as a symbol of royalty and stature. Tame cheetahs were kept as close companions to pharaohs, as a symbolic protection to the throne, by the MAFDET, because of this symbols of cheetahs have been found on ritual and magic knives of the Middle Kingdom. Many statues and paintings of cheetahs have been found in royal tombs, as it was believed that the cheetah would quickly carry away the pharaoh's spirit to the after life. By the 18th and 19th dynasties, paintings indicated that the cheetah rivaled dogs in popularity as hunting companions.

In Italy, cheetahs were coursed during the fifth century. Russian princes hunted with cheetahs in the 11th and 12th centuries, and, at the same time, Crusaders saw cheetahs being used to hunt

gazelles in Syria and Palestine. Marco Polo brought back detailed accounts of the hundreds of cheetahs kept by Kublai Khan. There was practically no Italian Renaissance court without hunting leopards and many of the French courts also had cheetahs. The best records of cheetahs having been kept by royalty, from Europe to China, are from the 14th, 15th and 16th centuries. Hunting with cheetahs was not to obtain food, which royalty did not need, but for the challenge of sport. This sport is known as coursing.

Adult cheetahs were caught in the wild, as they already had well developed hunting skills. They were caught, tamed and trained within a few weeks. The cheetahs were equipped with a hood, so they could not see the game they were to hunt. They were taken near the prey either on a leash, on a cart, or on the back of a horse sitting on a pillow behind the rider. The hood was then removed and the cheetah dashed after the prey and caught it, after which the trainer would, reward it with a piece of meat, and take the cheetah back to the stable in which it was kept.

Many emperors kept hundreds of cheetahs in their stables at any one time. With this great number of cheetahs in captivity, it was recorded only once, by Emporer Jahangir, the son of Akbar the Great, an Indian Mogul in the 16th century, that a litter of cubs was ever born. During his 49 year reign, Akbar the Great had over 9,000 cheetahs in total, which were called Khasa or the Imperial Cheetahs, and he kept detailed records on them.

All of the cheetahs kept as hunting leopards were taken out of the wild from free-ranging populations. Because of this continuous drain on the wild populations, the numbers of cheetahs declined throughout Asia. In the early 1900's, India and Iran even began to import cheetahs from Africa for hunting purposes.

Box Topic: Genetic Problems of the Cheetah.

The fact that genetic uniformity poses a threat to the survival of a population or a species has been evident since Darwin formulated his theory of natural selection. Genetic variation is the raw material for evolution, and it is this variation on which natural selection operates in times of environmental or ecological change. Unfortunately, the cheetah is a species that lacks genetic variation and the consequences of this lack of plasticity is imperiling its future.

The difficulties in captive breeding of the cheetah prompted an extensive genetic and physiological analysis of both captive and free-ranging cheetahs during the 1980's. The results of this research shows that today's cheetah populations are descendants of but a few animals which remained after the Pleistocene era about 10,000 years ago. The cheetah somehow survived this time of mass extinction and the population increased through inbreeding and the worldwide range was restricted to Africa and parts of Asia.

Collaborative research conducted at the DeWildt Cheetah Breeding and Research Centre in South Africa, the Wildlife Safari in Oregon, and the Serengeti Plains in East Africa revealed startling results. First, a comparative analysis of cheetah ejaculates revealed a sperm count one-tenth of that observed in domestic cats and an extremely high frequency (71%) of sperm abnormalities. These reproductive abnormalities are congenital and result when close relatives interbreed. This was what first alerted the researchers that there was something very unusual going on with this species. Then, molecular genetic analysis of blood samples revealed that the cheetah appeared to be unique among felids and other mammals in having an extreme monomorphism of genetic variation.

From this discovery it was hypothesized that the cheetah as a species appears to have suffered a severe population bottleneck followed by inbreeding, approximately 10,000 years ago and several regional bottlenecks since, thus, reducing the variety of alleles in its gene pool. Therefore, today's population looks very similar to deliberately inbred laboratory mice of 20 generations between brothers and sisters. The consequences of this genetic uniformity has led to reproductive

problems, a high incidence of infant mortality, up to 30% in captivity, and a greater susceptibility of the entire population to infectious diseases.

Unfortunately this disease susceptibility has recently been seen when a series of out breaks of a near benign virus, known as feline infectious peritonitis, almost decimated several captive cheetah populations. The virus, which has a mortality rate of up to 5% in genetically healthy domestic cats, killed up to 60% of the cheetahs that the virus came into contact with during these recent outbreaks.

Another discovery from this research revealed that the two subspecies of cheetahs, the East African cheetah (Acinonyx jubatus raineyi) and the southern African cheetah (Acinonyx jubatus jubatus) show 10 to 100 times less genetic distance than due human racial groups. This finding questions the validity of existing subspecies classifications, and could be significant in management recommendation, as hybridization may help to improve the health of these free-ranging populations.

The vulnerability of this species due to its lack of genetic variation has alerted the conservation community to the vulnerability of small populations and has changed the way biologists and managers look at the conservation of many of today's endangered species. Although, this picture may appear bleak for the cheetah's future, the history of the cheetah is that of a survivor, as it has recovered from several population bottlenecks and has increased in numbers each time. And, now with proper conservation and management strategies, where habitats are protected and cheetah population numbers are sustained, the species can survive for the future. Today, the cheetah's survival is in humans hands.