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Abstract: The problem with the conservation of cheetahs in national parks is that lions live at high densities and play the greatest cause of mortality for cheetah cubs. Of a hundred cubs born, only five reach independence, which is an extraordinary high mortality for a large mammal. In addition to that, there is the problem of the lack of genetic diversity in cheetah populations. Programs of artificial reproduction and the creation of banks of semen were thus initiated. However, according to Tim Caro's opinion, the main threats to cheetah persistence into the next century came from habitat destruction, illegal hunting and the competition from lions and spotted hyenas.

Fast Cat in a Marathon

What we're learning about cheetahs may enable these troubled sprinters to compete in the long race for survival

By Mike Lipske
Photographs by Karl Ammann

TIME AND TIME AGAIN, the brutal scene plays out on eastern Africa's Serengeti Plains. An alert lion sees a small object scurrying around in the undergrowth. Rushing forth, the big cat easily overtakes an awkward cheetah cub. Ignoring a growling cheetah mother nearby, the lion catches the cub, killing it swiftly with one bite through the back of the head.

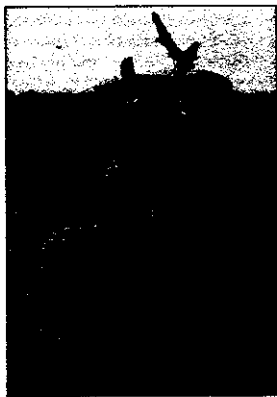
Such attacks on cheetah cubs are so common that enclaves like Serengeti National Park in Tanzania do not protect the species as well as one might think, says Tim Caro, a University of California-Davis biologist who has studied cheetahs since 1980. In fact, Caro and his colleague Karen Laurenson have found that lion attacks (reasons for which remain unknown) can wipe out entire cheetah litters.

"Cheetahs may fare better *outside* national parks," he says, where lions are at lower densities and cheetahs can rise from the bottom of the pecking order.

That startling view—that some protection is poison for cheetahs—is just one way researchers have labored to bring into focus a new picture of this endangered, beautiful and frankly rather strange felid. Probably at no other time have so many scientists struggled to understand both wild and captive cheetahs, conducting studies and pursuing conservation strategies that may save the troubled cat from extinction.

Once widespread throughout dry, open country in Africa as well as in the Middle East, Central Asia and even India, cheetahs have steadily lost ground over the last century. The rea-

sons are many. Farmers continue to destroy cheetahs in an effort to protect livestock. And, until an international ban on trade in spotted-cat furs took effect in 1975, hide hunters blasted away with impunity at the cats. Uncontrolled killing and habitat alteration in cheetah country also wiped out populations of several species of gazelles the cats depended on for food. Today, only 10,000 cheetahs exist in remnant populations in central and southern Africa, where conversion of bush to farmland still threatens their survival. Another 200 cheetahs may hang on in parts of Iran.



Mother's helper: A cheetah cub (above) perches high in a snag atop a termite mound as an adult searches for gazelles on the Masai Mara, Kenya. From such vantage points, cheetahs spot and chase down prey (previous pages) while cubs wait on the sidelines (right).

sons hunt with lighter weaponry. They have shorter canine teeth, weaker jaws and leaner bodies. But they come equipped with oversize nasal openings and lungs (and a large heart and arteries) to power sprints that double their respiratory rate to 150 breaths a minute. Those hot pursuits of game leave a cheetah so exhausted it can take up to half an hour to recover, and so vulnerable its kills are routinely stolen (one time in ten in the Serengeti) by hyenas and lions.

For centuries, fresh kills were also snatched from the relatively timid fe-

If cheetahs do become extinct, we will have lost the least catlike of the world's 37 species of felids. Consider the cheetah's famous sprinting ability. The greyhound-sized cats achieve velocities of up to 110 kilometers per hour (70 mph)—almost twice the top speed of a leopard or tiger. But cheetahs make those fast tracks on small, doglike paws that are equipped with blunt claws. Most other cats can fully retract their claws into sheaths in their paws (keeping their weapons sharp), but cheetah claw tips stay partly exposed, gripping the ground like cleats.

Compared to other cats working

the same turf, cheetahs hunt with lighter weaponry. They have shorter canine teeth, weaker jaws and leaner bodies. But they come equipped with oversize nasal openings and lungs (and a large heart and arteries) to power sprints that double their respiratory rate to 150 breaths a minute. Those hot pursuits of game leave a cheetah so exhausted it can take up to half an hour to recover, and so vulnerable its kills are routinely stolen (one time in ten in the Serengeti) by hyenas and lions.

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called coalitions—of two or three cats. Often composed of brothers, the coalitions defend small territories of about 40 square kilometers (15 sq.mi.).

Probing these peculiarities of cheetah existence, Caro has found that every year in the Serengeti wet season, the normally nomadic female cheetahs gather in areas where Thomson's gazelles have also concentrated. For the cheetah females, the areas provide food and cover. For cheetah males, in turn, the situation provides the bush equivalent of a singles scene—a chance to meet the opposite sex.

Competition to be near females, and so to mate, is fierce. Using teamwork,

male coalitions stand a better chance of establishing and holding on to territories near the females than do single males. "You may encounter more than twice as many females if you join up with another partner than if you were by yourself," Caro has learned. Unfortunately, half of all young male cheetahs die in battles that result when loners try to invade male coalition territories.

As Laurenson has discovered, though, it is lions—and spotted hyenas—that play the greatest havoc with cheetahs in East Africa's national parks. Lions alone outnumber cheetahs 2,800 to 500 in Serengeti National Park. For the cheetahs, the toll is chillingly clear:

"Of a hundred cubs born, only five reach independence, which is an extraordinarily high mortality for any mammal," says Laurenson.

That is why the scientists believe Africa's protected enclaves probably do not benefit cheetahs. "They're always going to suffer this reduction in reproductive rate," says Caro. "That's corroborated by the fact that in places like Namibia, on large farms where hyenas and lions have been shot out, you get very high cheetah densities and very large litter sizes."

The discoveries by Caro and Laurenson about wild cheetahs are accompanied by breakthroughs from other

Seeing but not seen, a cheetah spies on a group of gazelles through a stand of Masai Mara grasses. The cheetah's facial markings serve as camouflage enabling the sprinter to attack prey from up close.

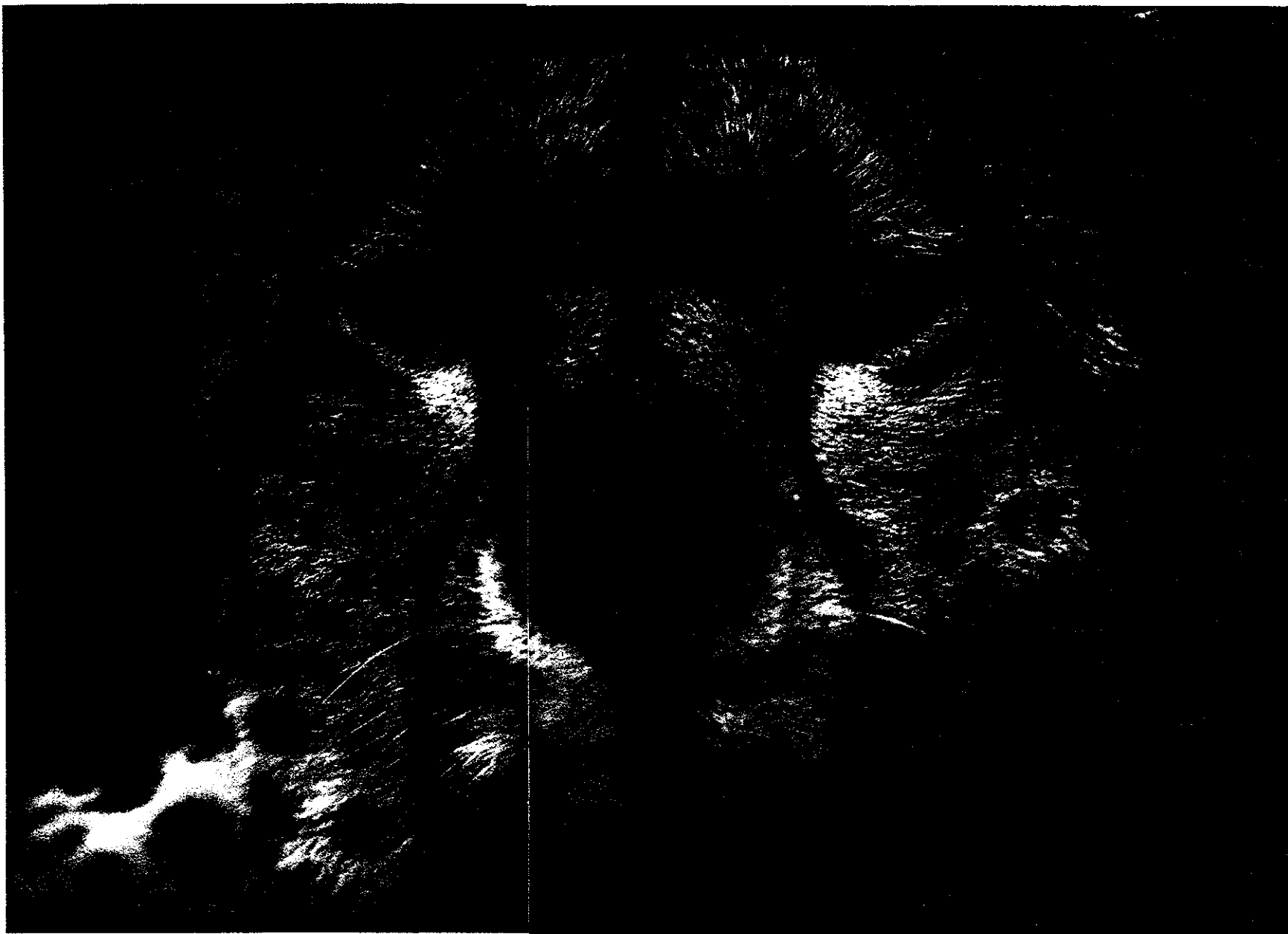
researchers—all working to keep the world's fastest land animal one step ahead of extinction. In zoos, geneticists and other experts have tackled a series of cheetah problems, including genetic frailty (cheetahs are remarkably inbred), zoo husbandry difficulties and diseases striking captive animals. At the same time, conservationists in southern Africa are trying to win friends among ranchers who consider cheetahs vermin.

In the opinion of some scientists, the troublesome problem of bad genes is the cheetah's most serious woe. Work done in the early 1980s by Stephen O'Brien, a geneticist with the U.S. National Cancer Institute, and researchers at Washington, D.C.'s National Zoo, revealed that cheetahs possess dramatically less genetic variation than any other species of cat.

O'Brien hypothesizes that a cheetah population crash some 10,000 years ago left only a handful of the cats alive, and that generations of inbreeding among survivors led to the species' loss of genetic diversity. This could account for abnormal sperm, high rates of juvenile mortality in zoos and a weakened immune system that would leave the entire inbred species highly susceptible to a deadly epidemic.

The problem of poor sperm quality in males has particularly severe impacts on captive breeding. "Cheetahs have a lot of sperm with coiled-up tails and bent tails," says JoGayle Howard, a research veterinarian at the National Zoo. "They have every type of [sperm] abnormality that's ever been reported in any species of mammal." Lab work by Howard and her colleagues proved that those abnormal sperm fail to fertilize eggs.

Determined to better the odds for cheetah reproduction, which had declined dramatically in most North American zoos by the mid-1980s, National Zoo researchers developed a technique known as laparoscopic intrauterine artificial insemination. To perform the high-tech matings, Howard inserts a fiber-optic cable through a tiny incision in the abdomen of an anesthetized female cheetah. The cable per-



mits the scientist to view the cat's reproductive tract. Howard then directs cheetah semen (taken from males in a process called electroejaculation) through a tiny catheter that feeds into the female's uterus. The technique paid off in 1992 with the birth of six cheetah cubs, in two separate litters, at a Texas wildlife center.

Next challenge, says Howard, is to collect semen from wild cheetahs in Namibia and use it to fertilize zoo females. "We could bank a lot of semen there and bring it back for artificial insemination of zoo cats," she says, "so at



An impala (above) suffocates under a cheetah's death grip. Herds of ungulates, such as Thomson's gazelles (right), serve as meat markets for single cheetahs searching for meals as well as mates.

least we can bring in some new genes from the wild."

Using new, more sophisticated measuring techniques than were originally available to O'Brien and his colleagues, scientists such as Howard can discern subtle differences in the genetic makeup of individual cheetahs. So, despite the similarities among cheetahs, some scientists believe they can enhance the species' genetic fitness by adding genes from wild cheetahs to the captive pool. Even so, cheetahs will never possess the level of genetic variation one finds in the average housecat. "We'll never get a normal cheetah again," says Howard.

Researchers may be finding ways around this genetic roadblock, however. In a recent issue of the journal *Zoo Biology*, scientists at the San Diego Zoo report on a study in which 10 of 12

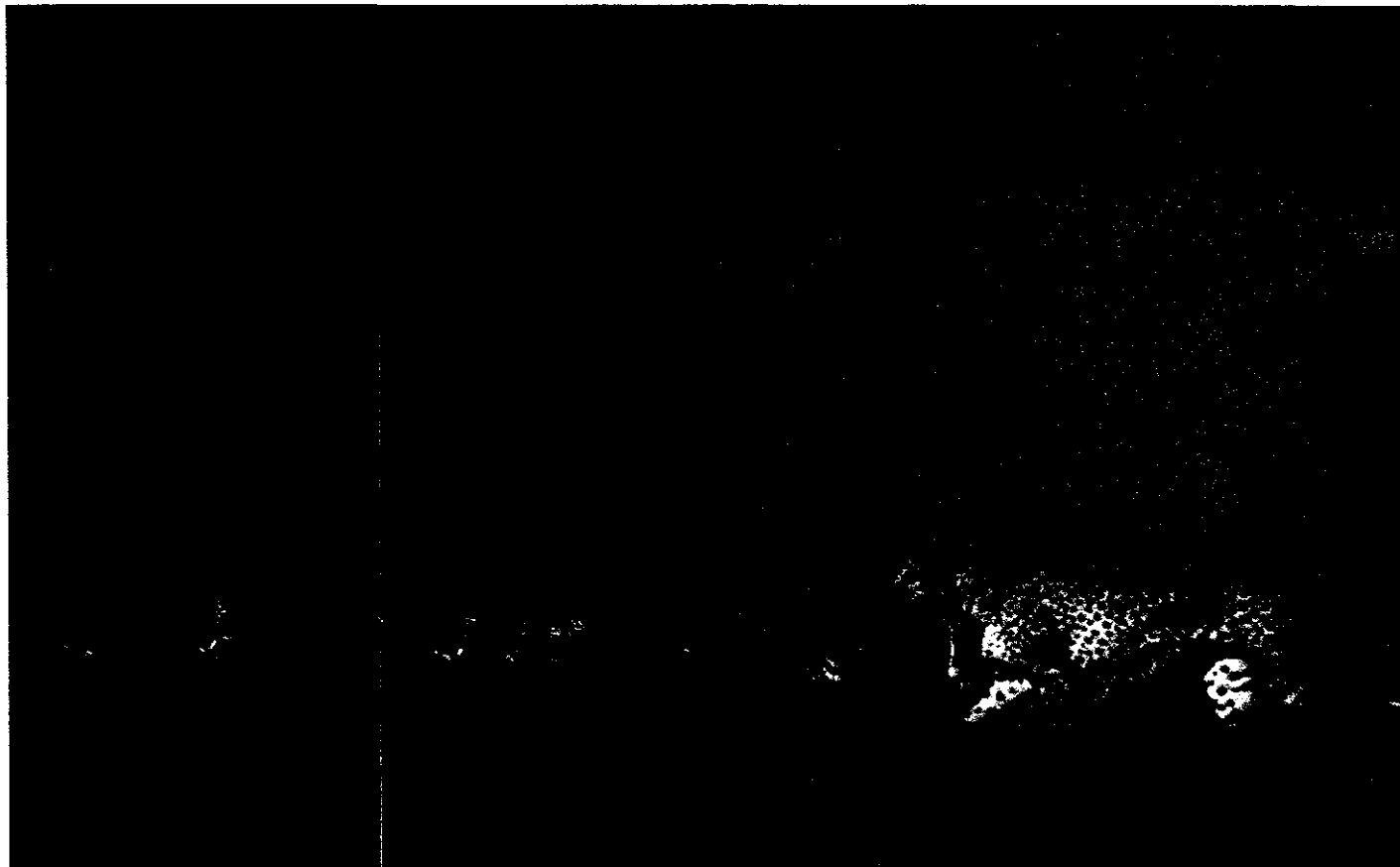
captive males produced pregnancies in zoo females.

"They do have lousy sperm quality," admits Donald Lindburg, a San Diego Zoo research behaviorist. San Diego scientists, like earlier researchers, found that about 70 percent of their male cheetahs' sperm was physically abnormal. But his zoo's success at making new cheetahs, Lindburg says, strongly suggests that the cats can still reproduce readily despite their less-than-stellar sperm. "What we're working on now is to look at the ways in which cheetahs are managed in captivity as a more likely explanation of their low reproductive rate in zoos," says Lindburg. "Zoos differ in terms of their know-how and their expertise," he says by way of explaining the success of San Diego and a handful of other zoos in breeding cheetahs.

One problem that is especially perplexing for zoos is liver and kidney diseases that are plaguing already troubled captive populations. "We're seeing 6-, 7- and 8-year-old cheetahs dying from these diseases, whereas a normal cheetah lifespan would be assumed to be somewhere between 15 to 17 years," says veterinarian Linda Munson, a cheetah-disease expert from the University of Tennessee in Knoxville.

To help counter the problem, Munson has enlisted help from Namibian ranchers, normally cheetah detractors. She's passed out necropsy kits to stockmen and encouraged them to harvest liver, kidney and stomach samples from cheetahs found dead in the wild. By examining the tissues, she hopes to learn if the diseases (very rare in other cat species) occur among natural populations of cheetahs, or instead, are caused by something cheetahs are exposed to in captivity.

Meanwhile, work by San Diego researchers suggests that cheetah immune systems may be more competent at resisting infection than earlier studies had implied. "We should not take the attitude that they have an evolutionary ax or guillotine being held over their neck and all is hopeless," says immunologist



Michael Worley of the San Diego Zoo.

Likewise, field biologist Tim Caro takes issue with the view that because of a lack of genetic fitness, cheetahs are doomed by high levels of juvenile mortality and infertility. "The main threats to cheetah persistence into the next century I see as stemming from rather old-fashioned factors like habitat destruction and hunting and, in addition, this competition from lions and spotted hyenas."

The illegal hunting Caro refers to is especially acute in Namibia, where cheetahs and people have long been at odds. Blaming the cheetah for attacking their goats, sheep and calves, Namibian stockmen have killed nearly

7,000 of the cats in just the last decade.

Laurie Marker-Kraus—an American who, with her husband, biologist Daniel Kraus, directs the Cheetah Conservation Fund in Namibia—has tried to find solutions. The biologists, who say the number of livestock kills by cheetahs is overstated, have convinced some ranchers to change their cattle to breeds that better defend their calves, for instance. And in a pilot project, a few ranchers have started running donkeys with their calves; the donkeys bond with young cattle and chase away predatory cheetahs.

What cheetahs need most, believes Caro, are effective reserves where cubs will not be wiped out by other preda-

tors, plus continued work to change ranchers' shoot-first attitudes. Add to that wise husbandry at zoos like San Diego and high-tech pregnancies of the sort perfected at the U.S. National Zoo, and this problem-plagued, inbred, breathtakingly beautiful ornament of nature just may sprint into the next century and even beyond. Moreover, by keeping a hard case like the cheetah alive, conservationists gain experience that may save other highly endangered critters such as Florida panthers and black-footed ferrets.

The most relevant fact about cheetahs? Maybe that these cats are still with us at all, coursing across the African plains long after a population

crash that wreaked havoc on their genetic diversity.

"In many ways, the cheetah is a bit of a success story," says Stephen O'Brien of the National Cancer Institute. "We're talking about a species that has survived a lot of generations. And population crashes are a bit like cancer patients in remission—the longer you survive afterwards, the better the prognosis." □

Mike Lipske, a former senior editor of this magazine, now contributes to a variety of publications, including Smithsonian, Swiss photographer Karl Ammann is currently coordinating the construction of a chimpanzee sanctuary in Kenya.