

The Brotherhood of Cheetahs

good article

On the Serengeti Plains, male cheetahs often form lifelong—and fruitful—partnerships

by Tim Caro



An hour after daybreak, the cold mists begin to evaporate from the shortgrass plains of Serengeti National Park. A mile away, I see three large cats begin to descend from a rocky outcrop where they have been resting during the last hours of the night. Even through binoculars I have trouble telling what species they are; they seem too small for lions but not chunky enough for leopards. I start the old Land-Rover and begin a slow zigzag approach toward them, knowing from experience that animals prefer not to face oncoming vehicles directly. At a hundred yards I stop and quickly grab the binoculars again as the three disappear into a riverbed. One glimpse from this distance, and I know that they are cheetahs and that all are males. Just what I had hoped for.

Most male cats live alone for all their adult lives. In only two out of thirty-seven species—lions and cheetahs—do males have the habit of keeping company with other males. When I first went to Africa, I was aware that male cheetahs sometimes live in small groups of two to four individuals, but neither I nor anyone else really knew why. In years past, many biologists thought groups of carnivores might have better hunting success; most researchers now discount this hypothesis. Forming coalitions would also seem not to make immediate reproductive sense: members often have to share fertile females, they come across, which is likely to lower the number of matings each male can garner for himself. But cheetahs and lions are not unique among mammals in their proclivity for group life; chimpanzees and bottlenosed dolphins also form all-male coalitions. A determination to understand what such males might gain from one another's company has kept me watching cheetahs for the past ten years. My base is at the Serengeti Wildlife Research Institute in Tanzania.

Finding the elusive cheetahs in my 1,200-square-mile study area means getting up very early or driving at night to a preselected spot and then sleeping in the back of the Land-Rover to be ready at sunrise. As dawn breaks, I drive to a series of rises and hilltops that dot the Serengeti's sweeping plains, turn the en-

A cheetah with a territory may spray-urinate, right, or defecate once an hour to alert all comers to his claim over the area. Nonterritorial males hardly ever scent mark.

gine off each time I stop, and from inside the car, slowly scan the surroundings with high-powered binoculars. In the early morning, cheetahs are relatively active and far easier to spot than later in the day, when they try to escape the midday heat by lying in the shade of tall herbs. Even at the start of the day, however, the cats are notoriously difficult to find. When I can't actually see a cheetah moving, the best indication of its presence is a light triangle against the dark background of vegetation (the outline of a cat sitting up) or a group of Thomson's gazelles all staring attentively in one direction.

Once I have spotted a cheetah, I drive close enough to take a series of black-and-white photographs, which I will use later to identify the animal with the help of a photographic file index I have compiled on more than 300 individuals. Every cheetah has a unique arrangement of black spots on a yellow background (easiest to see on the face, chest, and legs), and each has a distinctive pattern of black-and-white bands on its tail.

As my study got under way, I soon realized that although most males live in groups, not all do. Of the 110 males I came to know individually, about 20 percent lived in groups of three; 40 percent in pairs; and 40 percent alone. As I obtained more and more sightings, I could also see that the coalitions were not just temporary associations but rather long-term partnerships that may last a cheetah's lifetime, which can be as long as eight years.

Several kinds of observations persuaded me that about 80 percent of the coalitions were composed of brothers from the same litter. By carefully matching photographs taken at different stages of the cheetahs' lives, for example, my predecessor, George Frame of Utah State University, had established that littermates of both sexes remain together for some time after they leave their mother. But while sisters strike out on their own about the time of their first estrus, brothers stick together throughout their lives. In other coalitions, which we had not encountered and photographed as youngsters, members often had similar markings. Tail-banding patterns were par-

ticularly revealing. Using a sample of twenty-eight males, Sarah Durant, a colleague at the University of Cambridge, and I were able to show statistically that the tail patterns of males that lived together were much more similar to one another's than they were to those of other males in the population, a finding we had already made for known littermates. This suggests that these coalitions, too, were made up of brothers.

Most evolutionary biologists argue that if animals are going to live in groups—for whatever reason—they would do best to live with relatives, with whom they share genes, so perhaps it is not surprising that most cheetah coalitions consist of brothers. But what about the 20 percent in which the partners are not related? What keeps them together? I was sure that the answer was to be found in the cheetahs' behavior. The males I observed while driving out on the Serengeti's plains showed two very different sorts of activity. Some were territorial: regularly smelling prominent landmarks, such as fallen trees, termite mounds (and in some cases, the hood of my car), and then spray-urinating and defecating on them. The movements of these territorial individuals were predictable, and they usually remained within small, localized areas (sixty square miles) of the Park. Other males, which I called floaters, rarely scent marked (an average of once every two days as opposed to once an hour for residents) and ranged over huge areas of the park.

Significantly, the vast majority of the territorial males were members of a group. Fifty percent of both pairs and trios eventually settled on a territory. On average, pairs held on to their territories for eight months; trios for two years (one trio hung on for six years). In contrast, very few—about 4 percent—of the forty-five solitary males ever held a territory at all, and those that did generally lost control within four months. Most single males simply floated for their whole lives.

In retrospect it may seem obvious that smaller groups of males will be ousted by large ones, yet few fights between wild male cheetahs have ever been seen. In the course of my study, however, I have be-





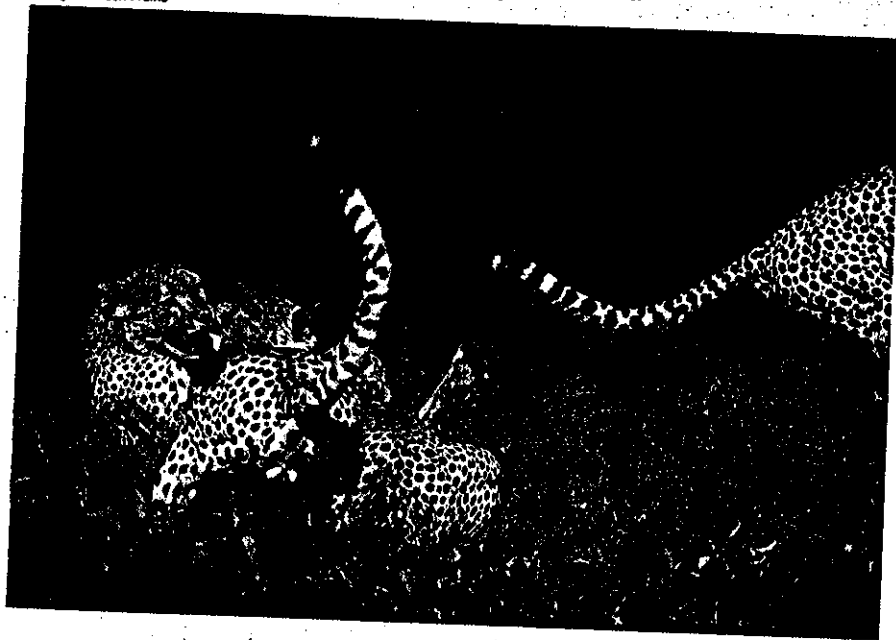
come convinced that fighting does occur and that it is a serious business. Many males carry some sort of injury—scars on their faces or open wounds on their flanks—presumably picked up while taking part in, and running away from, a skirmish. In one of the fights I was lucky enough to witness, a group of three trounced one exhausted male in a hail of blows that removed a pillow's worth of fur. Park rangers saw another territorial trio kill a solitary intruder at the entrance of the rangers' sleeping quarters. The rangers threw potatoes at the fighters to get them to move on, but the coalition persisted, eventually suffocating their victim, just as they would a gazelle.

Most evidence of fights is after the fact. I rarely come across dead cheetahs because they are quickly consumed by scavengers such as spotted hyenas, but our recent work occasionally enables us to locate the whereabouts of dead males. We have radio collared a small number of cheetahs in the park, and the radio transmitters are too tough to be devoured by predators. Even when badly chewed, they continue to emit signals. Of the eight radio collars that have been found (sometimes next to male cheetah carcasses), all were located inside territories. This would not appear to be just a matter of chance since neighboring territories are up to twelve miles apart and since the eleven territories on the plains cover only half my total study area. The fighting undoubtedly takes place within territories because it is *about* them.

But why are males killing one another in order to hold on to a territory? Since a male's reproductive goal in life is to mate with as many females as possible, I knew that to answer that question, I had to find out where the females were most likely to be found. Female cheetahs are solitary and have enormous home ranges. In the Serengeti, they hunt mainly migratory Thomson's gazelles and may cover as much as 300 square miles trekking after them. During the wet season (November to May), however, both hunter and hunted tend to concentrate in a number of specific areas on the plains. As Tony Collins, of Edinburgh University, and I discov-

Two members of a coalition of three males (one off to right) force a solitary male onto his back. Right: Lying down now, his ears back in extreme fear, the beleaguered cheetah has no chance against his attackers. These fights sometimes end in death for the victim.

George and Lori Frame



ered, the normally wide-ranging females are especially attracted to areas that provide both abundant prey and sufficient cover for successful hunting and shade during the heat of the day. Each year these same areas periodically become "hot spots," where the ranges of twenty to thirty female cheetahs may overlap at any one time.

A male cheetah could never defend the entire home range of even one female against other males, but he can attempt to carve out a small part of her range for himself. If this patch is within one of the hot spots where females concentrate, he stands an excellent chance of encountering many females there. This seems to be just what happens. By placing all sightings of females on a grid map, I discovered that in the wet season, which overlaps the time when the majority of females mate, females were more likely to be found inside established male territories than in the huge areas of no man's land between them. (Females range outside territories slightly more during the June-to-October dry season, a time when they are less likely to be ready to mate.)

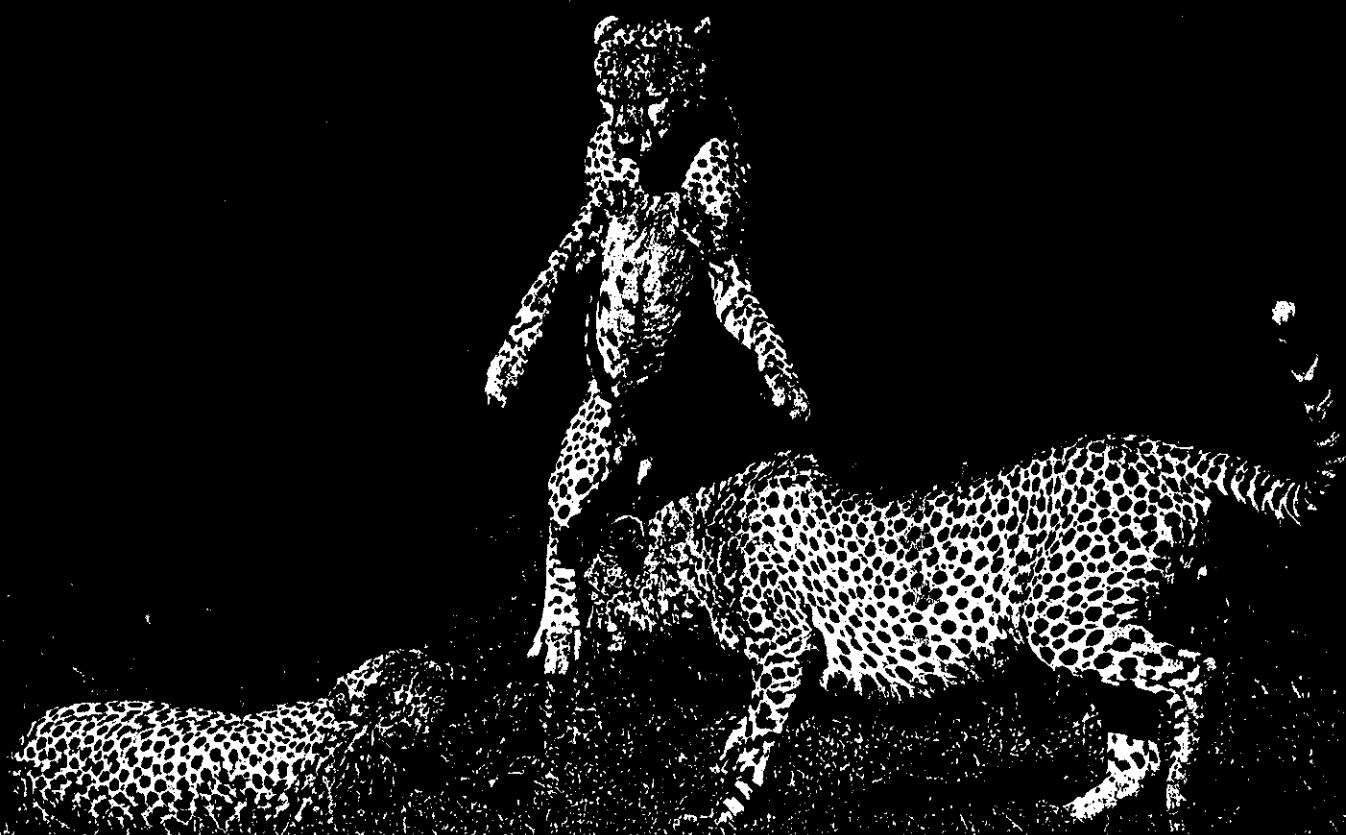
Unfortunately, for a male with such a strategically situated territory, competition with nonterritorial males for control over the hot spots is often intense. Males

with partners are in a much better position to defend their patch than is a single male, and the costs of sharing matings with a partner are outweighed by the advantage of encountering a large number of females. Coalition partners have been seen, in the wild and in captivity, to share the favors of a female approximately equally, mating with her in rapid succession. In terms of getting access to females, then, it pays the males to stick together.

The dice are loaded against solitary, nonterritorial males in other ways, too. Recently, in conjunction with colleagues Clare FitzGibbon and Mary Holt, of the University of Cambridge, I have found that territorial males, or residents, are in much better condition than nonresidents. In the course of radio collaring male cheetahs to determine their precise movements, we were struck by the contrast between floaters and residents. Most of the thirteen floating males were ill: some had sarcoptic mange on their ears and chest or suffered from hair loss, others had ulcerated mouths and gum infections, a few had dermatitis, and one had a foot abscess. None of the eight residents showed such symptoms. These external differences were reflected in the hematological measures we took: floaters had significantly higher white blood cell counts

and suffered from eosinophilia, a diagnostic feature of parasitic infections.

Floaters also had higher blood cortisol levels, a physiological indication of stress that was supported by the animals' behavior. Unlike residents, who often rested on rocky outcrops where they could see and be seen by other cheetahs, floaters usually skulked in tall vegetation. And floaters seemed less relaxed than residents during their midday rest period, rarely lying flat out in the heat of the day. They also ranged much farther than the resident males, perhaps to avoid confrontation with them. Whether stress results from a floating life style or vice versa is difficult to determine, but it is fair to say that animals in poor condition might be expected to rest while trying to recuperate. Therefore, the extensive ranging of floaters suggests that their life style is most



likely a cause rather than a consequence of ill health.

The floaters' problems may be compounded by the species' remarkable lack of genetic diversity. Steve O'Brien, of the National Cancer Institute, and David Wildt and Mitch Bush, of the National Zoological Park, have established that genetic variation in wild cheetahs is extremely low, comparable to highly inbred strains of laboratory mice. Exactly why cheetahs are so genetically uniform is still the subject of debate, but the consequences are less controversial (if other species are anything to go by) and include susceptibility to disease. It is tempting to speculate that the unusual genetic monomorphism of this species predisposes stressed nonresident males to a suite of infections. But before we can confidently link the peculiarities of the cheetah's ge-

nome to the floaters' poor condition, we will have to examine the health of individuals of different status (residents and non-residents) in other species of cats.

To a certain extent, the kind of life a cheetah male will lead is ordained at birth. Our ten-year records show that a male born into a litter with a brother will invariably be in a coalition for the rest of his life, providing his partner does not die. The chances of a single son ever becoming a member of a pair or a trio, and of reaping the associated reproductive benefits, are much slimmer. This being so, I wondered if cheetah mothers might favor litters with more than one male. Knowing that a number of insects and even a few mammals have recently been shown to manipulate the proportion of male and female offspring they produce (see "Daughters or Sons," *Natural History*, April 1988), I

have taken a preliminary look to see whether mothers might be producing litters with more sons than daughters. So far, no evidence of such a bias in sex ratio has shown up, in either the Serengeti birth records or the few litters of cubs born in captivity.

Testing this idea is difficult, however. Early findings in an ongoing study by Karen Laurenson of Cambridge University suggest that nearly three-quarters of all cheetah litters in the Serengeti fail to survive the first six weeks. This mortality—due to predation, disease, or a mother's losing contact with her cubs—also reduces the size of litters from a maximum of six cubs down to two or three.

We will need several more years of research to determine whether mothers skew the sex ratios of their litters, but our studies to date strongly suggest that moth-

In the Serengeti, two cheetahs pursue an adult male Thomson's gazelle.

Gregory G. Dimijian; Photo Researchers

ers may have the potential to influence their offspring's future in other ways. In the cat family, mothers help their young obtain food well past weaning, while the cubs are acquiring rudimentary hunting skills of their own. So, through differential provisioning of cubs, mothers might be able to increase the chances of pairs and trios of males reaching breeding age. To investigate this possibility, I recorded all the hunts and kills that cheetah mothers made during week-long periods of observation. Data from forty families of females and their dependent cubs showed that mothers with litters containing two or more sons hunted more often each day than mothers with only one son. (Any ef-

fect of litter size itself was ruled out statistically.) Such a mother did not rest after she had made a kill and her family had consumed it but set out to hunt again. This extra effort on her part translated into more meals per day.

Why would a mother with two or three dependent sons hunt more often than a mother with only one? Because, I believe, she's hungrier. To estimate levels of hunger, I scored mothers' belly sizes on a scale from one, essentially a starving cheetah, to fourteen, where the mother looked as if she had swallowed a basketball. During the course of a week, mothers with two or three sons were thinner, on average, than those with one son, even though they par-

took of more meals per day. At carcasses, all family members, but especially mothers, took time off from feeding to sit up and scan the surroundings for predators. I clocked the precise time spent feeding and found that mothers with several sons ate less at each carcass. This was not because predators were any more of a threat or because sons were any more aggressive than daughters at kills; in fact, feeding parties were fairly amicable affairs. These observations raise the possibility that mothers with two or three sons restrain themselves from feeding. Such restraint would, of course, leave the mother still hungry and inspire her to hunt again.

Whether this increased provisioning re-

sults in greater growth and survival of pairs and trios of sons is an open question since I cannot regularly weigh wild cheetah cubs. Nevertheless, the data we have on immobilized adult males provide tantalizing evidence that mothers' efforts are rewarded. We found that nine members of coalitions weighed significantly more than did eleven single males, an average of 100 pounds as opposed to 84 pounds. More importantly, their bodies, tails, and hind feet were longer, and their chest girth—the best indicator of overall size—was greater. Body weight can be affected by different feeding opportunities or hunting ability, but linear dimensions are often heavily influenced by the level of nutrition

during the developmental growth period. Thus mothers seem to be effective in promoting the number of "grandcubs" they will have by differentially helping pairs or trios of sons survive and grow large, which increases their chances of becoming territorial males with access to lots of females.

The more I come to understand the cheetahs, the more I see how—and why—they differ from other members of the cat family. Male cheetah social organization is driven by the movements and periodic concentrations of solitary females. In most other species—leopards, ocelots, and lynx, for example—females feed on resident prey and consequently can support themselves and their offspring in much smaller

A mother cheetah (center) and her three cubs engage in a peaceful grooming session. Cubs remain with their mother until sometime in their second year. When they leave, males will stay together for the rest of their lives.

Joe McDonald

areas. Each male's territory covers about three or four of these female territories. If a male leopard, for instance, were to join forces with another male, he would have to cover more than twice as many female territories to be recompensed for sharing matings. Assuming that three or four territories are about as many as any male (or any pair, for that matter) can defend, how a pair could possibly regularly patrol an area twice as big is hard to imagine. Thus a male leopard's best shot at maximizing his mating opportunities is to remain solitary and keep all other males away from "his" females.

Lions are perhaps superficially most like cheetahs because males, too, form coalitions, but the social organization of the females is quite different. Lionesses, unlike female cheetahs, are gregarious, living in prides of up to eighteen individuals. Males compete intensely for control of these prides, rather than for temporary aggregations of solitary females, as in cheetahs. Larger groups of male lions are more successful in taking over a pride, and sometimes they even control more than one pride at a time.

All the cats—big and small—are exciting, if difficult, to study. After ten years of fieldwork, I know of nothing to beat being out on the plains with only a group of cheetahs as companions. After a week spent following a cheetah family, I am always ready for the comfort of a warm bath and hot food, but my seven-day vigils are more than worthwhile. Whether sitting bolt upright at the nearby roar of a dangerous lion, scanning the horizon for approaching herds of prey, or trying to work out whether cheetahs on the horizon are a family that can be approached safely or a rival group of males to be avoided, I feel that I live and breathe the cheetah's every experience. Their worries, and their successes, become mine, at least for a week. Sometimes the days are long, and without doubt, the all-out sprint of the chase and drama of a kill add spice to my work. But to my mind, insights into the cheetah's complex social life will always provide the most unexpected and fascinating rewards of keeping company with this so-called solitary carnivore. □