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SPOTTED HYENAS: MISUNDERSTOOD INDICATORS OF ECOSYSTEM HEALTH?

BY KAY E. HOLEKAMP

Fossil records reveal that more than 20 hyena species roamed the earth concurrently as recently as 10 million years ago, but most of these species are now extinct, and there are currently only four extant members of the carnivore family *Hyaenidae*. These are Spotted hyenas, Brown hyenas, Striped hyenas and Aardwolves. Brown hyenas are now quite rare, occurring exclusively in the drier regions of southern Africa. Unfortunately, we currently know very little about the conservation status of Striped hyenas or Aardwolves in eastern Africa because these animals are usually strictly nocturnal, they forage alone and tend to be very shy, so they are seldom seen. By contrast, Spotted hyenas (*Crocuta crocuta*), the largest and most gregarious of the extant hyenas, are

often abroad during daylight hours, and they live in social groups or 'clans' that may contain up to 90 individuals. Thus, compared to their closest relatives and other carnivores, most of which are rare and difficult to study, Spotted hyenas are very tractable subjects. My students and colleagues and I have been studying Spotted hyenas continuously in the Maasai Mara National Reserve since early 1988.

When residents of eastern Africa discover that hyenas are the specific focus of our research, they generally turn up their noses and ask why we would waste our time on "those awful creatures." I would argue that, far from being "awful," Spotted hyenas are by far the most interesting carnivores in Africa, and in fact can actually be quite lovable. I personally enjoy working with Spotted hyenas because they appear to violate many of the "rules" of mammalian biology. By studying these animals as apparent exceptions, I believe we will be more likely to discover what the "rules" really are.

THE SPOTTED HYENA IS THE MOST ABUNDANT LARGE CARNIVORE IN AFRICA, OCCURRING IN MOST AFRICAN ECOSYSTEMS SOUTH OF THE SAHARA, INCLUDING SWAMPS, MONTANE FORESTS, OPEN SAVANNA AND DRY DESERTS.

For example, in all but a tiny handful of the roughly 4,000 species of living mammals, males are larger than females, males are more aggressive than females, and males therefore enjoy higher priority of access to resources than females. Among Spotted hyenas, however, females are larger and more aggressive than males. They are also socially dominant to males, so they can easily displace males from food. Female Spotted hyenas also exhibit dramatically "masculinised" genitalia through which they urinate, copulate and give birth.

The societies of Spotted hyenas are nothing like Wild dog packs, lion prides, or mongoose packs. Instead the size and complexity of Spotted hyena clans match those of troops of baboons and Vervet monkeys. Spotted hyenas also appear to have more robust immune systems than other carnivores inhabiting the same areas as the hyenas, called sympatric carnivores. During the epidemics of canine distemper and rabies that killed so many lions and Wild dogs in eastern Africa during the 1990s, Spotted hyenas were almost entirely unaffected even though analysis of their blood revealed they had clearly been exposed to these diseases. All these apparent oddities make Spotted hyenas very appealing to me as research subjects.

But in recent years, research in my laboratory has also come to focus very explicitly on hyena conservation. All of us who serve on the International Union for Conservation of Nature (IUCN) specialist group for the family *Hyaenidae* are concerned that the misconceptions held by so many people about hyenas represent a huge threat to their long-term welfare. Naturally, people don't worry very much about protecting a species they don't care for. However, we now have reason to believe that Spotted

Top Left: *Mother and infant Spotted hyenas in the Mara Conservancy.*

Below: *Spotted hyenas hunting Zebras.*

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The unquie "masculinized" genitalia of the female Spotted hyena.

hyenas can play an important role in the conservation of lions, Cheetahs, Wild dogs, and many other forms of wildlife in African ecosystems.

As is also true for most other large African carnivores, the range of the Spotted hyena has shrunk considerably in recent decades due largely to more people on the land. Nevertheless, the Spotted hyena is currently listed by the IUCN as Lower Risk, and this species persists in relatively stable populations throughout much of its historic range, a fact attributed to its enormous behavioural and ecological adaptability. Our recent work suggests that this "plasticity" allows Spotted hyenas to survive in areas where other large carnivores have been wiped out. More importantly, it suggests that Spotted hyenas might prove useful as 'sentinel' or 'indicator' species for monitoring overall health of African ecosystems.

An indicator species is an organism whose characteristics reflect attributes too difficult, inconvenient, or expensive to measure in sympatric species. Current research on ecosystem health in Africa reveals declining populations of many species, signalling a pressing need for identification of an indicator species to permit conservation of these ecosystems before they become too damaged to recover. Indicator species have been recommended for monitoring other ecosystems, such as boreal forests, but none have yet been suggested for African ecosystems. An indicator species must be relatively easy to monitor and it must also be sensitive to environmental disturbances at many trophic (food-web) levels simultaneously. Spotted hyenas satisfy these conditions, and my colleagues and I therefore believe they may prove to be an effective indicator species in African ecosystems.

The Spotted hyena is the most abundant large carnivore in Africa, occurring in most African ecosystems south of the Sahara, including swamps, montane forests, open savanna and dry deserts. These animals are extremely adaptable carnivores, with only two natural predators - lions and humans. They can survive by scavenging on carrion, but they are also very efficient predators of large and medium-size herbivores. Unlike most other carnivores, the jaws of the Spotted hyena are specialised for cracking open large bones, granting them access to the nutrient- and fat-rich marrow that is inaccessible to other carnivores. Furthermore, although they prefer to eat antelope, hyenas thrive on a wide diversity of prey species ranging from termites to elephants. Spotted hyenas also breed year round, and can be active either day or night. In contrast, most other African carnivores occupy a much smaller range of ecosystems, have far more restricted dietary needs, have strict time constraints on breeding and daily activity, and their lives are more easily disrupted by human activity and other forms of environmental change.

Because the behavioural and ecological plasticity exhibited by Spotted hyenas far exceeds that of other large African carnivores, responses to environmental change observed in Spotted hyenas should theoretically represent conservative indicators of how sympatric mammal species can be expected to respond, including more specialised carnivores such as big cats or Wild dogs.

Because my students and I have been monitoring Spotted hyenas in the Mara for over 22 years, we are in the unique position of being able to use our archived data to inquire whether change in the hyenas' behaviour or physiology effectively predicts demographic change in our study animals, meaning change in population characteristics such as birth rates, mortality sources, or number of individuals per square kilometre.

For example, on a daily basis year-round we monitor use of space by the hyenas, and we also measure concentrations of stress hormones excreted in faecal material. Although clan size, birth rates and death rates in our Mara study clans have remained remarkably constant since 1988, in 2003 we observed that the sources of hyena

mortality had shifted significantly for the first time, and this trend continues today. Lions have historically been the hyenas' main killer but nowadays more hyenas are killed by people. Our recent research has shown that this demographic change in Mara hyenas is preceded by measurable change in their space-use behaviour by roughly five years, and by significant increases in concentrations of excreted stress hormones by roughly three years. Thus these animals emit early warning signals about their own welfare. Interestingly, whereas Spotted hyenas are affected by the presence of humans on foot, neither their behaviour nor their stress physiology is affected by tourists in vehicles.

We are currently testing the hypothesis that Spotted hyenas signal ecosystem health as effectively as they signal their own status. To do this, we continue to monitor behaviour, stress, physiology and demography in Mara hyenas, but we also now monitor populations of other animals living sympatrically with the hyenas to determine whether behavioural or physiological variables in hyenas accurately predict population trends in sympatric species. We are comparing hyenas and sympatric species living in the eastern Mara, where life is relatively stressful for the hyenas due to intensive livestock grazing and other human-related activity inside the Reserve, with those inhabiting the Mara Conservancy, where the relatively pristine conditions allow animals to lead a life virtually free from stressful human activity.

PHOTO BY: KAY E.HOLEKAMP

Hyena walks in front of large herds near Talek village in the eastern Mara.

Given the increasing fragmentation of wildlife habitat in eastern Africa, there is a critical need to develop methods for monitoring the health of those ecosystems in which wildlife remains. Wildlife represents one of Kenya's most important natural resources, as tourism is a primary source of foreign exchange. Thus the economic well-being of Kenyans is intimately linked with conservation, which depends critically on our ability to monitor the health of African ecosystems. Our current work will reveal whether Spotted hyenas can be used effectively as indicators of ecosystem health, not just in the Maasai Mara, but across sub-Saharan Africa.

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