



George Schaller on the Tibetan plateau at 17,000 feet.

Right: Tibetan antelopes.



Chang Tang—the name means northern plain in Tibetan—is high, austere, and largely unexplored. Rolling away to the horizon, its immensity is broken only by snowcapped ranges. Vegetation is scant, with neither shrubs nor trees to break the expanse. Just a few nomadic herdsmen inhabit the fringes.

Wolves still prowl the plains and snow leopards stalk their prey among the crags; wild yaks forage on the hillsides and herds of Tibetan antelopes migrate over unknown paths. This is a landscape untouched by civilization, virtually the same today as it was over a hundred years ago.

George Schaller, science director

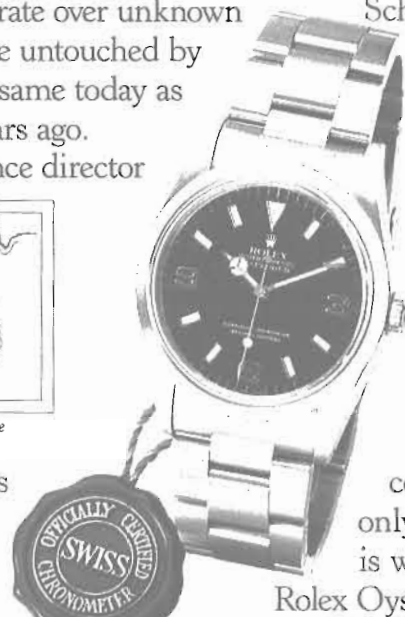


Site of the Chang Tang Reserve in the Tibet Autonomous Region.

of International Programs for the Wildlife Conservation Society, has spent four decades in wild and

**“We have the chance to save one of the last wild ecosystems on our**

rugged places, studying fighting for its survival. Schaller and his Chinese colleagues have established a huge refuge of Arizona in the mountains. There, Tibet’s wild animals can roam free and maintain their traditional ways. Schaller explains why we must protect the Chang Tang—the magnificent wilderness here could soon disappear. Under such harsh conditions, the right approach is only important, it’s important. This is why George Schaller is here. Rolex Oyster Perpetual timepiece.



Rolex Oyster Perpetual Explorer in stainless steel with matching Oyster bracelet.

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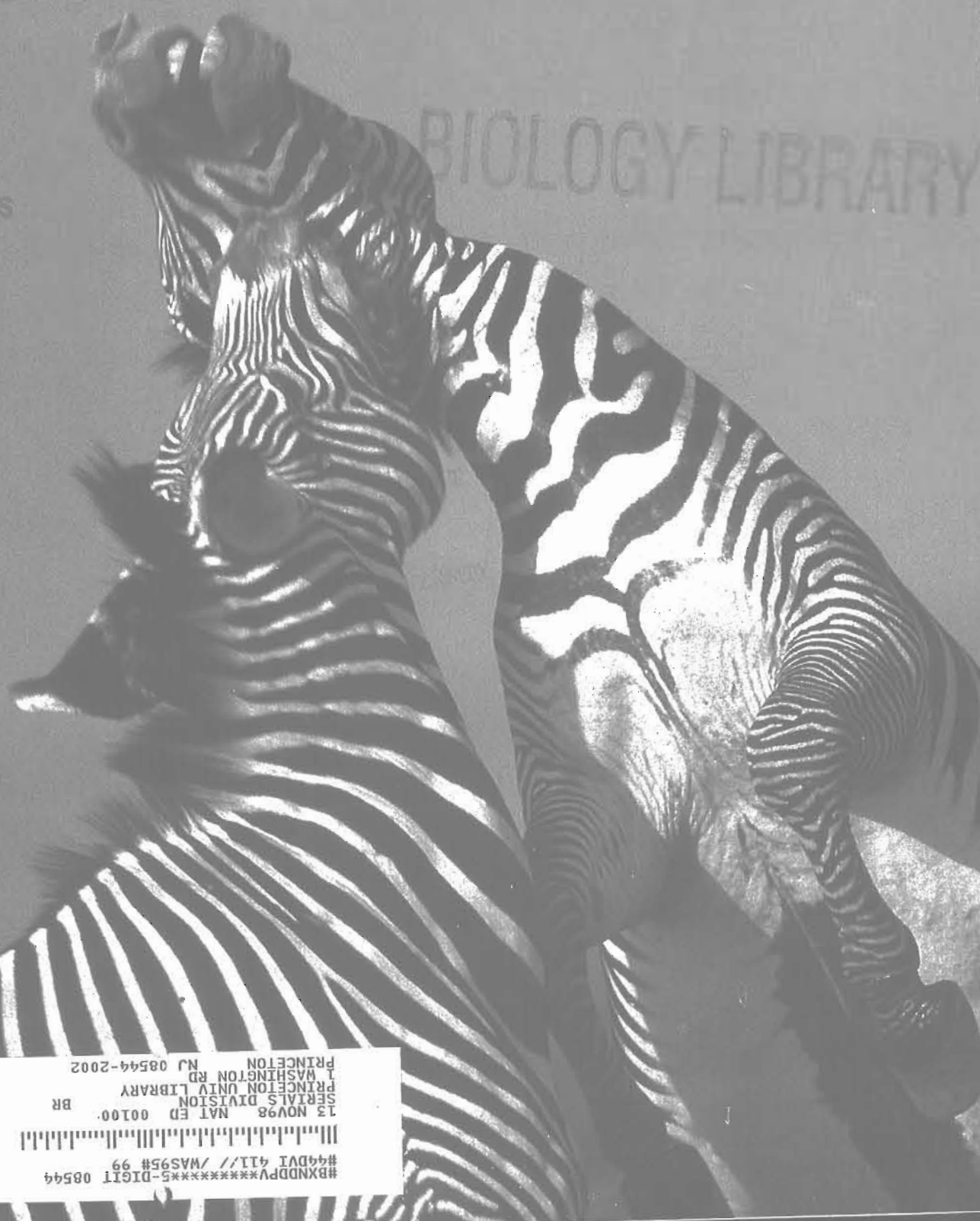
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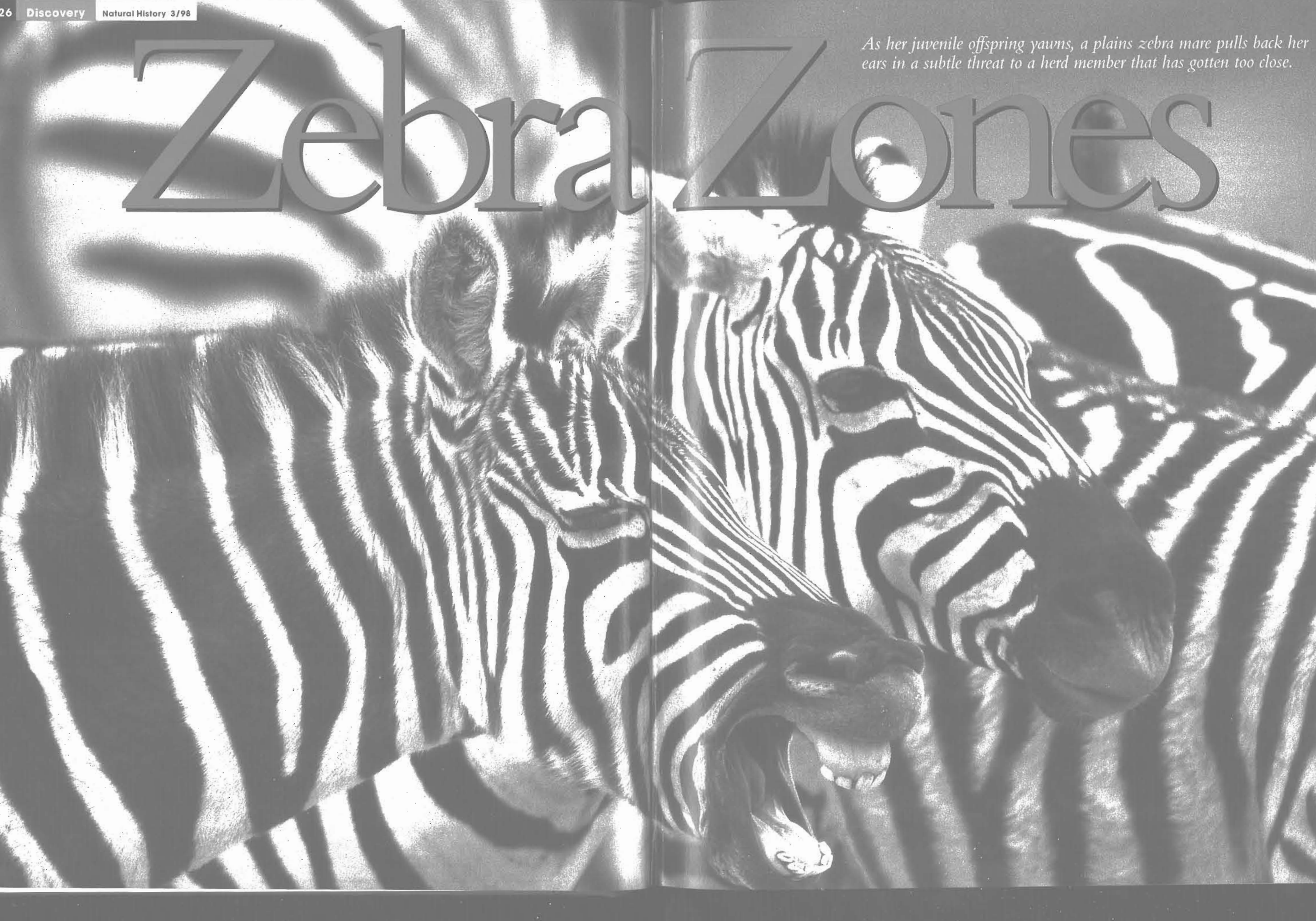
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# Zebra Zones

*As her juvenile offspring yawns, a plains zebra mare pulls back her ears in a subtle threat to a herd member that has gotten too close.*



Story by Mace A. Hack and Daniel I. Rubenstein

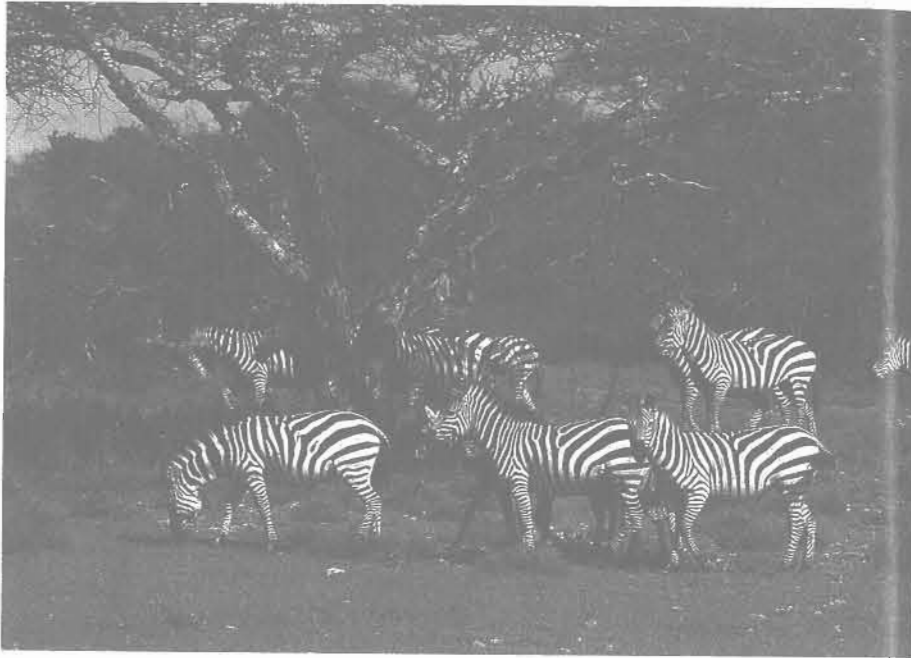
Photographs by Karl Ammann

Of the many species of equids (horses, asses, and zebras) that dominated the world's grasslands for much of the last eight million years, only seven are left, three of them zebras. All three zebra species live on the savannas of eastern and southern Africa, all feed exclusively on grass, and all have the stripes familiar to even the youngest child just learning that "Z is for zebra." Yet just as a closer look reveals differences in stripe patterns among the species, insights gained from years of fieldwork have uncovered two very different types of zebra society, one of which is unusual for mammals.

Of the three species, the plains zebra (*Equus burchelli*) is the most abundant and widespread, inhabiting tropical grasslands from the vast, acacia-dotted savannas of East Africa—where we have studied it for the past ten years—down through the scrubby woodlands of the Zambezi region to the rolling, treeless veld of South Africa. The mountain zebra (*E. zebra*), preferring a more temperate climate, lives in the broken, mountainous regions of Namibia and southernmost South Africa, while Grevy's zebra (*E. grevyi*) ranges over the stony, thin grasslands of Ethiopia and northern Kenya, where it sometimes overlaps with the plains zebra.

Both plains and mountain zebras live in year-round breeding groups of one to several adult mares, their recent offspring, and a single adult male—the stallion—that defends his exclusive mating rights to the females. These groups can be visualized as a wagon wheel, with the stallion at the wheel's hub and the mares occupying the rim. The spokes of the wheel are the strong bonds between each mare and the stallion. The females form long-lasting social bonds with one another as well, adding strength to the wheel's rim.

Females of many other social mammal species, such as lions and elephants, also form bonds, but they do so almost exclu-



*The plains zebra is the most abundant species, ranging from the acacia-dotted savannas of East Africa, through the woodlands of the Zambezi region, to the rolling, treeless veld of the south.*

sively with close kin. What makes plains and mountain zebra society unusual is that the bonds are between unrelated individuals. These zebras belong to a small set of species (which includes, among others, the mountain gorilla, the hamadryas baboon, and the greater spear-nose bat) in which not only male but also female offspring ultimately leave the group in which they were born; consequently, the adult females within a group are never closely related. (The evolutionary impetus for the dispersal of young females may be avoidance of inbreeding. Since a stallion may retain a harem for many years, any daughters that stayed at home would sooner or later wind up mating with their father. Our observations in Tanzania's Ngorongoro Crater lend support to this explanation: young females there move even farther away from the group of their birth than do young males.)

Grevy's zebras are less social, with mares and their most recent offspring the only stable social unit. Although one sometimes sees a number of mares and their young feeding together, such groupings

typically break apart within hours or days. Stallions live alone, defending territories near water or rich patches of grass and mating with any sexually receptive females that come to feed or drink. Mares with newborn foals must remain near water because of the physiological demands of milk production and the inability of young foals to travel long distances. Consequently, they may stay on a single stallion's territory for several months. Once her foal is old enough to travel, however, a mare leaves the stallion's territory, often joining up with other lactating mothers.

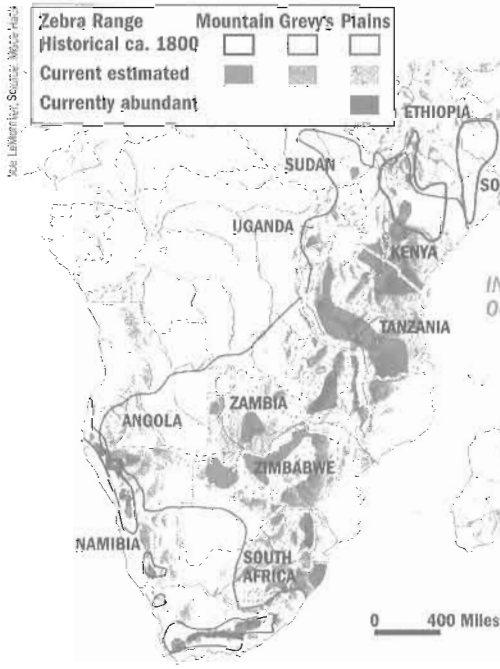
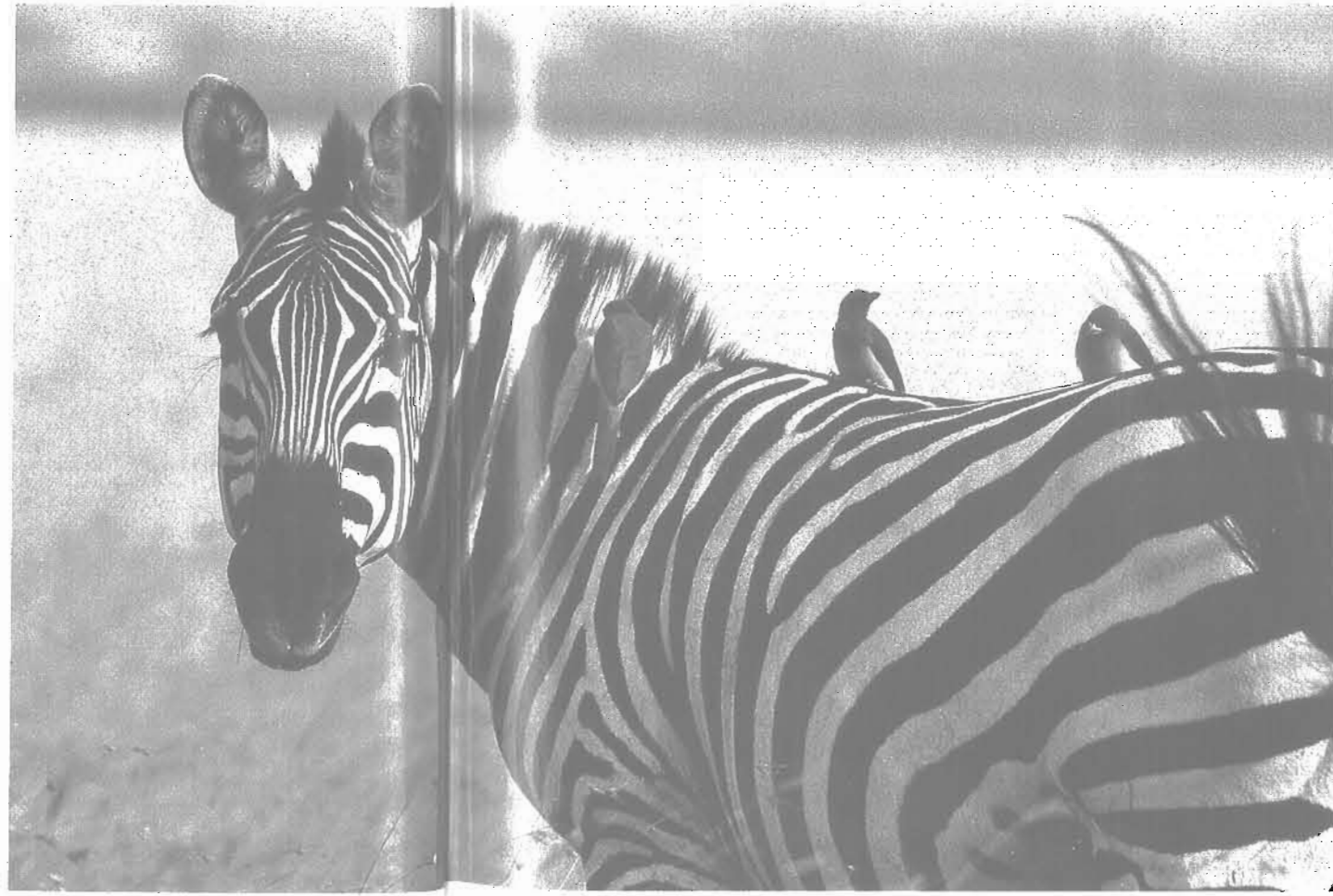
The differences in zebra society can be explained by a crucial tenet of behavioral ecology: the distribution of females is driven primarily by the distribution of the resources they need in order to repro-

duce. In the semiarid savannas of Kenya's Buffalo Springs and Samburu national reserves, where we and our colleagues have studied Grevy's zebras on and off for the past fifteen years, the best grass grows in widely scattered patches, forcing females to range over large areas to find sufficient food. Competition for grass, together with the differing ability of lactating and nonlactating females to travel long distances, works against the development of strong social bonds and stable groups. Plains and mountain zebras generally inhabit lush grasslands, where both food and safe places to drink are more abundant and more evenly distributed.

Male zebras, meanwhile, respond more to the distribution of females than to the distribution of resources. But this is seldom

*Travel Notes*

*The lush environment of Tanzania's Ngorongoro Crater supports zebras and a great variety of other animals year-round. Driving conditions are rough, so virtually all tourism is by safari. Most tours originate in Arusha, a five-hour bus ride from Nairobi or a short drive from Kilimanjaro International Airport. High season for tourism is from mid-June to August and at Christmastime. A less crowded time to go is the end of the wet season (late May and early June), when baby animals and breeding birds abound. Northern Kenya's semidesert offers an abundance of birds and an extensive mammal fauna dominated by the oryx, reticulated giraffe, gerenuk, and Grevy's zebra. Hotels in the Buffalo Springs and Samburu reserves can be reached by car from Nairobi.*



*Opposite page, top: Two stallion-and-mare groups of plains zebras graze together in typical East African acacia savanna. Group members maintain their cohesiveness, even in herds of several hundred. Left: On the alert for ticks or other parasites, oxpeckers ride on the back of a plains zebra.*

# Grave Times for Grevy's Zebras

By Stuart D. Williams and Joshua R. Ginsberg

Grevy's zebra has a distinguished lineage. It is the closest living relative of *Dinohippus*—the Miocene horse from which all modern horses, asses, and zebras evolved—and most closely resembles the first equid that wandered into Africa several million years ago. Eventually, the descendants of this equid came to range over much of the continent. At one time, Grevy's range may have included all of eastern Africa, but by modern times, it was restricted to the semideserts of Kenya, Ethiopia, and Somalia.

In recent years, the species has become endangered. It disappeared from Somalia in 1973. In Ethiopia and Eritrea, perhaps

only 500 Grevy's zebras survive, and those are found in and around a few protected areas. The species has also declined dramatically in Kenya, from an estimated 14,000 in the mid-1970s to approximately 4,000 today.

In Somalia, Grevy's was a victim of overhunting. Hunting was also a major threat in Kenya. By 1977, Kenya had banned both hunting and the export of skins, but the decline continued. Field studies that we and other researchers conducted in the 1980s suggested that competition with domestic animals might also be an important factor; and in 1992, we began a research project to investigate the complex interactions between Grevy's zebras and livestock.

In northern Kenya, Grevy's zebras compete directly with the pastoral people and their livestock for food and access to water. Kenya has one of the world's fastest growing human populations, and more people means more cows, goats, sheep, and camels. This has led to both intensified competition and, outside protected areas, a loss of habitat for the zebras. The importance of these findings cannot be

overestimated because protected areas account for less than one percent of the species' historic range.

Livestock do more than just eat grass that would otherwise be available to the zebras; their intense grazing can change vegetation, causing grass to be replaced by woody species unpalatable to zebras and domestic animals alike. A vicious cycle results: as less food is available, competition for it intensifies. Zebras are forced to travel farther and farther to find food. All this moving about burns up a lot of energy, an effect that shows itself in the poor survival rate of foals born to mares outside the parks and reserves. Making matters worse, these mares are often in poor condition themselves and bear fewer foals to begin with. Competition for water is also a problem. Zebras prefer to drink during the relative safety of daylight hours, but where Grevy's and livestock use the same water supplies, the zebras are forced to drink at night, when lions and hyenas are most active.

Many years may pass before the effect of this sort of competition becomes obvious. Although many young zebras die when competition is intense, the long-lived adults are little affected, and the population may decline as slowly as 2 or 3 percent a year. Over time, of course, even such a slow rate is devastating, as anyone who has ever lost the struggle to stay solvent knows: if the amount of money coming into a bank account is even slightly less than the amount going out, the account will eventually hit zero.

Conservationists usually focus their attention on critically endangered species. By that point, however, when only a handful of individuals remain, determining the processes that brought these species to the brink of extinction is difficult. We need to spend more time studying the slow, steady declines by which most species become endangered. Sadly, the Grevy's zebra is probably a good model for what is happening to many rare and threatened animals and plants.

as simple as it seems. A Grevy's stallion, for example, could follow mares around one at a time, waiting for an opportunity to mate. But such a strategy would be very time-consuming and inefficient, since females are sexually receptive for just a short time after giving birth, gestation lasts thirteen months, and foaling is not strongly seasonal. The stallion is more likely to encounter receptive females if he finds a place with the food and water females need and then stays put. If he can keep rival males away from the immediate area, he raises his chances of being the only male to copulate with receptive females.

Given these apparent advantages of territoriality, it may seem odd that the plains and mountain zebra males go to the trouble of defending whole groups of females

instead of simply staking out a claim to a water hole or rich sward of grass. But plains and mountain zebra females also travel widely to seek good grazing and cannot be depended on to return faithfully to the same spot. Plains zebras in the Serengeti, for example, migrate a few hundred miles every year, tracking the lush growth of grass that follows the rains. And while following a single mare might not make reproductive sense, following a harem is an altogether different proposition: any male that can defend a group of females as it travels stands a very good chance of mating with all of them as they come into estrus.

But why do females in the more social zebras form cohesive, long-lasting groups? Abundant food and water may

permit group formation, but they do not explain why it occurs. In many other animals, living in groups appears to lower the risk of predation for any one individual, but zebras probably do not form groups for this reason alone: a closely related equid, the wild horse, lives in groups identical in size and composition to those of the zebra, even in environments free of predators. Unless group living is a ghost of predators past, other factors must favor group formation in equid societies.

The answer can be found in the distribution and behavior of the surplus, non-breeding males known as "bachelors." Because zebras, like all equids, digest food relatively inefficiently, individuals spend as many as sixteen hours a day grazing. Pregnant and lactating mares especially

*In northern Kenya, Grevy's zebra competes directly with pastoral people and their livestock for food and water.*



*A male Grevy's zebra bites the neck of a female, a somewhat atypical prelude to mating.*



*A plains zebra scratches its head on a broken tree, a rare find in the grasslands.*



*After twenty minutes of fighting—which can get violent—stallions and bachelor males usually settle into an uneasy truce*

need lots of uninterrupted feeding time. If a female is disturbed often enough, her physical condition, and thus her ability to bear and raise a healthy foal, decreases significantly. In the plains zebras we study in Ngorongoro, as well as in a population of wild horses living on an island off the coast of North Carolina, we have found the main source of disruption to be contests between a group's stallion and other males—usually bachelors. As bachelor males approach a group, the mares move closer together while the stallion trots out to meet his challengers, which are usually familiar to him from similar encounters in the past. After touching noses with each one, he uses his considerable physical strength and agility to keep them away from his females. Occasionally, one of the bachelors manages to outflank a stallion that is busy sparring with other rivals. The intruder may get to the mares to investigate their reproductive status, or even attempt to copulate. Most of the time, however, the stallion—after a few tense minutes of rubbing necks, shoving, and snorting—succeeds in maintaining a buffer around his group, protecting his

mares from the disruptive sexual advances of other males. Thus, by choosing to associate with a dominant male, a female secures the peace she needs to graze for long periods. By intimidating other stallions and harems, a strong stallion can also ensure his mares' access to water and food. The influence of plains zebra bachelors on social organization may extend even further. In this species, bachelors congregate in large and cohesive groups, often containing twenty or more males. A single stallion set upon by such a large group has little chance of defending his females. As he barrels into the mob, taking on five or six of the marauders at a time, other bachelors just stream around him and head for the females. However, groups of plains zebra stallions and their mares often associate to form herds, which may sometimes contain as many as several hundred animals. When a bachelor group approaches such a herd, four or five stallions may leave their groups together and present a solid front against the interlopers, keeping them on the periphery of the herd. After twenty minutes of fighting—which can get violent but usually involves

*Books to Read*

*The Safari Companion*, by R. D. Estes (Chelsea Green Publishing, 1993)  
*African Mammals*, by Jonathan Kingdon (Academic Press, 1997)  
*Maasailand Ecology*, by K. M. Holmwood and W. A. Rodgers (Cambridge University Press, 1991)

*Plains zebras and blue wildebeests (dark animals in herd) often associate on the plains of East Africa, above. Two Grevy's stallions, opposite, battle over a mate. Prevailing in male-male combat is essential to reproductive success, and combat can be intense, as males punch with their forelegs and deliver bites to the head, neck, and legs.*

nothing more serious than an occasional lunge at the rump or hind legs of an opponent—the stallions and bachelors settle down to an uneasy truce of vigilant grazing and sporadic outbursts of tussling. Eventually, the bachelors wander off and the stallions return to their groups. Over the years, we have observed that the makeup of these herds is not random: certain stallion-and-mare groups tend to stay together, raising the tantalizing possibility that the herds represent an additional level of social organization. If so, zebras once again would be unusual among mammals, for only a few species, most of them primates, live in such complex societies. □

