

Eaton RL. 1976. A possible case of mimicry in larger mammals. *Evolution* 30(4):853-6.

Keywords: 1Afr/*Acinonyx jubatus*/cheetah/coloration/countershading/Honey Badger/identification/kitten/*Mellivora capensis*/mimicry

Abstract: Cheetah infants appear to mimic the honey badger or ratel (*Mellivora capensis*). The coloration of both ratels and cheetah kittens is the opposite of counter-shading, which is typical of the vast majority of mammals. While counter-shading disrupts three dimensional vision, patterns of light above, dark below actually increase conspicuousness. The ratel exemplifies warning coloration; the cheetah kitten appears to mimic the ratel. For mimicry of ratels by cheetahs to evolve it must be true that larger predators are less inclined to approach and attack a ratel than another small animals of comparable size, cheetah kitten must be preyed upon primarily by visual predators, and cheetah kittens must be situated in places where predators are likely to see them far enough away to make errors in identification.

## A POSSIBLE CASE OF MIMICRY IN LARGER MAMMALS

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Received October 7, 1975. Revised March 11, 1976

Gingerich (1975) postulated mimicry of the striped hyena (*Hyaena hyaena*) by the aardwolf (*Proteles*). I discovered a second possible case of mimicry in larger mammals. Cheetah (*Acinonyx jubatus*) infants appear to mimic the honey badger or ratel (*Mellivora capensis*). The coloration of both ratels and cheetah kittens is the opposite of counter-shading, which is typical of the vast majority of mammals. While counter-shading disrupts three dimensional vision, patterns of light above, dark below actually increase conspicuousness. The ratel exemplifies warning coloration; the cheetah kitten appears to mimic the ratel.

For mimicry of ratels by cheetahs to evolve,

it must be true that: a) larger predators are less inclined to approach and attack a ratel than another small animal of comparable size (a potential predator seeing a cheetah kitten at a distance and mistaking it for a ratel should be less likely to attack the kitten); b) cheetah kittens must be preyed upon primarily by visual predators; and, c) cheetah kittens must be situated in places where predators are likely to see them far enough away to make errors in identification.

### RESULTS

Until about 2.5 months old, cheetahs have a peculiar silvery-gray to nearly white mantle and



FIG. 1. The honey badger or ratel (above) is highly aggressive to larger predators, while the cheetah infant is defenseless and preyed upon heavily. The ratel and cheetah are sympatric. The conspicuous appearance of ratels appears to be warning coloration; infant cheetahs may mimic the ratel and thus reduce predation or aggression of sympatric predators including the ratel. Drawings from photos, prepared by Arnold Slettebak.

dark lower parts described as black (Eaton, 1974; Schaller, 1972). Close visual inspection reveals a regular black-spotted pattern that is indistinct at a distance of 30 feet (Fig. 1). Later, the normal adult pelage of pale brown or tan background with numerous small black spots, replaces the natal pelage. No other felid has such a conspicuous infant appearance.

An adult ratel is about three feet long, 10 inches high and 25 pounds in weight. The back is silvery gray or white and the underparts and legs are dark brown or black (Fig. 1), thus resembling an infant cheetah in size, color and coat pattern. The ratel is sympatric with the cheetah throughout most of its African range (Dorst and Dandelot, 1970; Pienaar, 1969; Smithers, 1966, 1968; Sweeney, 1959), and was sympatric until recently in Arabia and India where the cheetah has become greatly reduced and extinct, respectively (Eaton, 1974).

Schaller (1972) noted the kitten's resemblance to the ratel and suggested that the coloration is camouflage for protection from avian predators. But eagles should easily detect infant cheetahs away from cover as their pale dorsally silver-gray or whitish coloration is far more conspicuous than

the black-spotted tan camouflage of older kittens and adult cheetahs during the dry season when grass is tan. Infants are even more conspicuous against green vegetation in the rainy season. In East Africa, the peak of cheetah births occurs in the major wet season and infants are most common during the late wet and early dry seasons, before vegetation has dried and paled (Eaton and Craig, 1973). Moreover, there have been no reports of predatory birds attacking cheetahs although similar-sized carnivores such as juvenile jackals (*Mesomelas*) are attacked (Schaller, 1972; van Lawick-Goodall and van Lawick-Goodall, 1971).

Particularly when very young, cheetahs incur the highest predation known for larger felids (Eaton, 1974; Schaller, 1972; Adamson, 1972). The major predators are the lion (*Panthera leo*) and spotted hyena (*Crocuta crocuta*), a lesser predator is the leopard (*Panthera pardus*). It appears that interspecific aggression and predation control cheetah numbers (Eaton, 1976). Evidently, predation by mammals accounts for nearly all known mortality of offspring during their first 5-6 months. It seems probable, therefore, that the conspicuous appearance of kittens has evolved to decrease predation. The probability that mimicry of ratels reduces predation on cheetahs is shown by observation of the interactions of ratels with the predators of cheetah kittens.

Several observers have noted the reaction of the ratel to larger predators and man as pugnacious, aggressive and fierce, fearless and tough, courageous and tenacious (Dorst and Dandelot, 1970; Pienaar, 1969; Smithers, 1966, 1968; Sweeney, 1959; J. Gaerdes, pers. comm.), much as described for its counterparts, the badgers (*Meles meles* and *Taxidea taxus*) of Europe and North America. Ratels attack and fend off potential predators. Kruuk (1972) noted that two ratels trotted over the Serengeti plain and met a pack of spotted hyenas, which ignored them. One ratel ran to the hyenas and snapped at them. The hyenas, each weighing at least 100 pounds ran away. A similar encounter was observed between a single ratel and striped hyena (Cullen, 1969). Ratels have attacked adult Cape buffalo, inflicting lethal wounds (Dorst and Dandelot, 1970), and packs of dogs without being seriously injured themselves (Smithers, 1966). When attacked by larger carnivores, ratels are notorious for successful defense and putting attackers to flight.

Morphological features protect ratels and are conducive to winning encounters with larger species; they possess exceptionally thick and tough skin that is loose so that the ratel can twist enough to bite an attacker wherever it may grip (Smithers, 1966). Ratels also possess powerful teeth and legs, stout sharp claws (adapted for



digging), and the capacity to eject offensive anal gland secretions (Dorst and Dandelot, 1970; Smithers, 1966, 1968).

Though ratsels are considered common throughout their range (Dorst and Dandelot, 1970; Pienaar, 1969; Smithers, 1966, 1968; Sweeney, 1959) and associate with several larger predators that regularly prey on smaller ones (Pienaar, 1969), there are only three records of ratsels being killed by larger predators. There were 2 ratsels of 25,846 kills by lions and 1 in 4,133 kills by hunting dogs (*Lycan pictus*) in Kruger Park, South Africa (Pienaar, 1969).

The major predators of cheetah kittens hunt by sight (Eaton, 1974; Kruuk, 1972). Young cheetahs are most active and most vulnerable to attack by day, when the mother is often away hunting (Eaton, 1974). If cheetahs mimic ratsels, then the cheetah's predators have to be deceived some of the time by visual information—confusing cheetahs with ratsels. As ratsels are common and prefer habitats where cheetah kittens and their predators occur (Schaller, 1972; Dorst and Dandelot, 1970; Pienaar, 1969; Smithers, 1966, 1968; Sweeney, 1959), and are sufficiently aggressive or successfully defensive to the cheetah's predators, the latter should tend to avoid ratsels and presumably the ratel's mimic, the infant cheetah.

To qualify as Batesian mimicry the model need only to be dangerous to predators of the mimic. The striking appearance of the ratel is probably warning coloration as in skunks. As cheetah kittens are essentially harmless, the ratel appears to be the cheetah's model. The mimic gains fitness by its coloration, a warning to predators that have been worsted by ratsels.

Since the only other possible case of mimicry postulated for larger mammals (*Proteles* and *Hyaena*) is dependent on the inability of predators to discriminate size differences between the model and the mimic (Gingerich, 1975) it is puzzling why the appearance of cheetahs changes from conspicuousness to camouflage just when they become larger than adult ratsels. Cheetah kittens do not begin to hunt or accompany their mother on hunts until they are at least 5 months old (Eaton, 1974; Schaller, 1972) at which time a conspicuous appearance would reduce hunting efficiency and be disfavored. Yet, the mimic appearance is lost at about 2.5 months of age, which suggests the possibility that predators detect size differences between the model and the mimic.

I suspect that at the age the cheetah's appearance changes the kittens are mobile and swift enough to flee or take cover from predatory attacks. Others have recorded (Myers, 1974; T. Abbot and S. Fuller, pers. comm.) successful evasions of predators by cheetahs 3.0-6.0 months of age. Cheetahs are preyed upon less while they are smaller by resembling ratsels but they

probably incur less predation when they are older and more mobile by being camouflaged. The change in the cheetah's appearance as it grows larger than the ratel (and before its appearance could adversely affect the mother's hunting) does not necessarily counter the argument that mimicry exists because predators are presumably unable to discriminate size differences at a distance.

Judged by their behavior, prey and selection of habitat (also used by mother cheetahs to hide younger litters) ratsels may be serious enemies or predators of cheetah kittens while they are very small, more stationary and less mobile. If ratsels rely partly on vision to communicate and avoid encounters, then cheetahs may mimic ratsels to avoid attack by ratsels. Several factors are likely to interact: mimicry of ratsels could reduce attacks by ratsels as well as those predators that avoid ratsels.

The methods of comparative psychology are suitable for testing size discrimination in captivity, and "models" used in the field would provide additional information on the kinds of interactions between the proposed model and mimic. It should be considered that mimic species receive protection from attack by the model.

#### ACKNOWLEDGMENTS

I thank Arnold Slettebak for the drawings, and Gordon Orians, Carl Koford, David Barash, Dennis Paulson, and Nancy Buenger for commenting on the manuscript.

#### LITERATURE CITED

- ADAMSON, J. 1972. *Pippa's Challenge*. Ballantine Books, New York.
- CULLEN, A. 1969. *Window into Wilderness*. East African Publ. House, Nairobi.
- DORST, J., AND P. DANDELLOT. 1970. *The Larger Mammals of Africa*. Collins, London.
- EATON, R. L. 1974. *The Cheetah*. Van Nostrand Reinhold Co., New York.
- . 1976. Evolution of sociality in the Felidae. In: *The World's Cats III* (2). Burke Mus., Univ. Washington, Seattle pp. 95-142.
- EATON, R. L., AND S. J. CRAIG. 1973. Captive management and mating behavior of the cheetah. Pp. 217-254, In: R. L. Eaton (Ed.) *The World's Cats*, I. World Wildlife Safari, Winston, Oregon.
- GINGERICH, P. D. 1975. Is the aardwolf a mimic of the hyaena? *Nature* 253(5488): 191-192.
- KRUKK, H. 1972. *The Spotted Hyena*. University of Chicago Press.
- MYERS, N. 1974. A day in the life of a cheetah family. Unpubl. ms.
- PIENAAR, U. V. de. 1969. Predator-prey rela-

- tionships amongst the larger mammals of the Kruger National Park, *Koedoe* 12:108-176.
- SCHALLER, G. B. 1972. *The Serengeti Lion*. University of Chicago Press.
- SMITHERS, R. H. N. 1966. *The Mammals of Rhodesia, Zambia and Malawi*. Collins, London.
- . 1968. *A Check List and Atlas of the Mammals of Botswana*. Trustees of the National Museums of Rhodesia, Salisbury.
- SWEENEY, R. H. C. 1959. *Check List of the Mammals of Nyasaland*. The Nyasaland Society.
- VAN LAWICK-GOODALL, H., AND J. VAN LAWICK-GOODALL. 1971. *Innocent Killers*. Houghton Mifflin Co., Boston.