

# MEERKATS OF THE KALAHARI

## A COOPERATIVE COMMUNITY

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*Kuruman River Reserve, Kalahari Desert, South Africa* – It's another cold sunrise in the Kalahari, and as the nocturnal animals turn in from a long night of activity, others are springing to life. After shaking off the sleep, a meerkat (*Suricata suricatta*) props his tiny body upright on his tail and fluffs out his fur preparing for another typical day...of community service?

### MEERKATS, DARWIN, AND EVOLUTION

Darwin's theory of evolution by **natural selection** explains how species change over time, and is the scientific theory we use to explain the evolution of life on earth. The theory goes like this: a population of individuals has a certain genetic composition. In reproduction, there are some naturally-occurring mutations. Some of these mutations will affect an individual's traits. Those traits that increase an animal's reproductive success will show up more in the genetic pool of the next generation. Over time, the more adaptive traits will increase and the less adaptive traits will decrease in the population. The trend is for living creatures to continually adapt to their environment, with the most fit passing on their genes and the less fit dying out.

Darwin's theory explains many of traits we see in animals, such as the large, reflective eyes of nocturnal animals and the camouflage coloring of fawns, zebras, and many other creatures. But, scientists still debate how the rather uncommon trait of **altruism**, the deliberate sacrifice of an individual's reproduction to benefit another's and a trait displayed by meerkats, fits into Darwin's theory.

According to the theory of natural selection, an individual's **altruism**, or passing up the opportunity to pass its genes down to the next generation, should be a trait that eventually dies out from the breeding population – and yet it doesn't. Some meerkats spend part of all of their lives helping other meerkats raise their young rather than breeding. Only a few other mammals show this seemingly altruistic behavior, like mole rats, marmosets, wild dogs, and mongooses, but meerkats are unique in how coordinated their cooperative activities are.

### THE KALAHARI DESERT

The Kalahari Desert is part of the huge sand basin that reaches from the Orange River up to Angola, in the west to Namibia and in the east to Zimbabwe. The sand masses were created by the erosion of soft stone formations. The wind shaped the sand ridges, which are so typical of the landscape in the Kalahari. Only in recent geological history, 10,000-20,000 years ago, were the dunes stabilized through vegetation, so the area should actually be called a dry savannah. Unlike the dunes of the Namib Desert, those of the Kalahari are stable and not wandering.

The Kalahari is home to a wide range of savannah animals, including gemsbok, red hartebeest, springbok, eland, duiker, steenbok, bat-eared foxes, hyenas, jackals, lions, leopards, porcupines, and three kinds of mongooses (meerkats, slender mongoose, and yellow mongoose).



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## VOLUNTEER VIEW

*“The landscape of the Northern Cape is a stunning expanse of red sand dunes and scrubby thorn trees. The extreme weather of the Kalahari meant that we never quite knew what to expect the following day. Temperatures could vary between thirty and one hundred degrees Fahrenheit on any given day.”*

— **Mary Kate Zebracki**,  
Earthwatch volunteer



Evolutionary ecologist Dr. Tim Clutton-Brock says that meerkats' unusual system of rearing their young poses questions that go to the roots of our understanding of cooperative societies, including our own. The questions raised by cooperative societies include: Why do mature offspring remain in their parents' group instead of dispersing to breed? Why do they take risks and spend time and effort to help other members breed? How do group members divide their responsibilities and coordinate their contributions? And how do they ensure that all group members pull their weight?

Clutton-Brock notes that few of our closest relatives (like great apes or chimpanzees) cooperate with each other to the extent that meerkats cooperate. Like the behavior of other animals, human cooperation probably evolved over time as an adaptive trait. By studying meerkats, Clutton-Brock believes that we may gain some insight into how and why cooperatives societies evolve.

There are several theories as to how altruism may be an adaptive trait. These theories look at the different levels upon which natural selection may operate – such as the gene, the individual, the **kin**, the group, or even the whole population. Altruism, while perhaps not benefiting the individual, may be critical to the survival of the group. Or, maybe it does benefit the individual in ways we have not yet understood. Scientists are working to understand the rare trait of altruism in mammals.

## THE MEERKAT BABYSITTING CLUB

Meerkats, one of the three types of mongooses common in the Kalahari, live in large groups in the desert. Within each group (called a mob or a gang), an alpha male and female are the primary breeders, and the other members of the group, which includes several family groups, do not reproduce, but contribute to taking care of the young. This process of **cooperative breeding** is very similar to having a large community of nannies and relatives helping raise a child. In the meerkat world, researchers call them “helpers.”

It is clear that group caretaking helps ensure the survival of the young, but does it have any benefit for the helpers? If the behavior is purely altruistic, why has this behavior developed in only a few species and how is it being maintained?

Clutton-Brock, and his staff at the Kuruman River Reserve have been studying meerkats since 1993 to understand the costs and benefits of cooperative behavior in meerkats. Understanding the ecology of unusual social systems, like that of meerkats, is critical to conserving and managing the species.

## GATHERING DATA ON MEERKATS

To gather data on how meerkat societies work, the research team, led by Clutton-Brock, has identified ten study groups of meerkats in the Kuruman River Reserve. These groups are already habituated to humans, and are comfortable with the researchers who follow them daily, documenting their behavior. So habituated to humans are they that the meerkats will sometimes take advantage of a sitting person and climb atop for a better view.

### Gathering Biological Data

During the period when pups depend on helpers (1-3 months), researchers attempt to weigh all individuals in breeding groups (including pups) three times each day (dawn, midday, and before sleeping). This is actually easier than it might sound, though Clutton-Brock had to try several different incentives (chocolate, locusts, mealworms, raw eggs) before finding out accidentally on a hot day that meerkats really love cooked eggs! So, using bits of hard-boiled egg as an incentive, the researchers have trained them to hop onto the scale.

The weight of the meerkats helps researchers determine the health of the individuals, as well as how much a helper is giving to the group – **lactating** females may lose weight while they are nursing. Researchers also collect skin and hair samples for genetic analysis, to determine how related the animals are. They also collect urine and fecal samples, and examine these to get data on hormone levels and energy use. Hormone levels can tell scientists about the animals' reproductive condition, as well as about their anxiety and stress levels.

## Gathering Behavioral Data

From the day of birth, researchers identify the pup's babysitter every morning and afternoon. Researchers can identify each individual in the group, and, in many cases, know their complete life histories as well. Researchers are interested in documenting five main cooperative activities: **allolactation** (when a subordinate female produces milk and feeds another female's pups), babysitting, pup feeding, **sentinel duty**, and burrow renovation.

To examine these cooperative behavior patterns, researchers use three main techniques: ad lib samples, focal samples, and scan samples.

### Ad Lib Sampling

This research technique consists of recording everything that is going on. A researcher will sit and watch the entire mob and document instances of the five main cooperative activities as well as any additional activities or circumstances on a data sheet. While this kind of research is thorough in providing an overall view of the mob, it is highly subjective since only the activities that catch the researcher's eye will be documented. It's main purpose is to determine what activities or patterns should be studied in greater detail.

An example of ad lib sampling would be when, in the three to ten weeks after the pups are born, the researchers look for at least 300 pup feeds per litter by recording all pup-feeds by any group member and the identity of the recipient.

### Focal Sampling

Focal sampling aims to record all instances of one particular behavior of one specific individual in a predetermined time period (for example, 20 minutes). This method is best used to provide in-depth unbiased data, provided the subject remains in view. During the period of pup feeding, researchers conduct ten 20-minute focal watches on each group member. They watch for and record instances of food items being given to pups, and the identity of the recipient.

### Scan Sampling

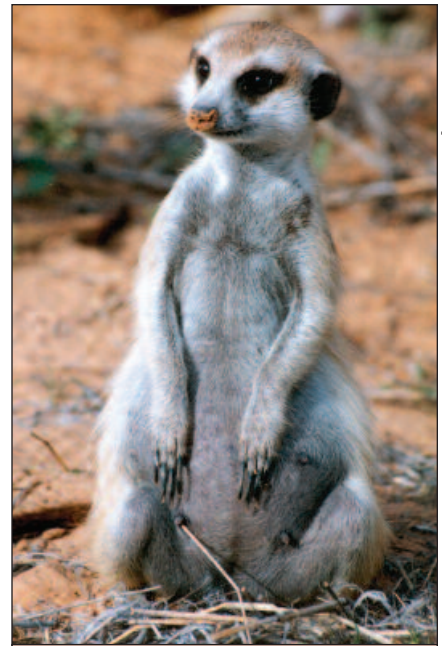
This technique involves recording the activities of the animals at pre-selected moments (e.g., every 30 seconds). The main purpose is to determine who is participating in which activity and how much time is spent doing it. Researchers conduct ten-minute scans on each group for at least ten hours per month, looking for which individuals are on guard duty and for how long. During breeding times, they also record the nearest neighbors of all group members at ten-minute intervals for at least 30 hours!

This method helps to show the distribution of behavioral states in a group and is best used for collecting a large amount of data on a certain mob.

In addition to recording the cooperative behaviors, the researchers may also see some interesting group activities. Meerkats are territorial creatures, and if one mob of meerkats encounters another mob, tempers flare. When an Intergroup Interaction (IGI) occurs it is not uncommon to witness what is known as a "war dance." An intimidation technique, the dancing consists of hopping from forelegs to hind legs repeatedly with the tail held high in the air. This is an attempt to make the mob appear larger than it is and thus thwart any outside threat to the group.

### Findings: The Social Lives of Meerkats

Clutton-Brock and the research teams have found that these meerkats live in groups of 3 to 40 individuals. The group contains a dominant female, who breeds two to four times per year, one or more males and a variable number of helpers of both sexes, that have either been born in the group or have joined the group as adults. In most groups, a single female reproduces, though the subordinate females are physiologically capable of breeding and often do so if the dominant female dies. Female helpers often remain in their birth groups throughout their lives and rarely leave unless they are forced to by the dominant female. Researchers have found that remaining in the group is a better strategy for subordinate females, because the survival rates of those that leave is relatively low. Life is different for males. Most leave their groups when they are 18 to 36 months old, and either join established groups or found new ones.



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### MEERKAT STATISTICS

**Average height:** 12 inches

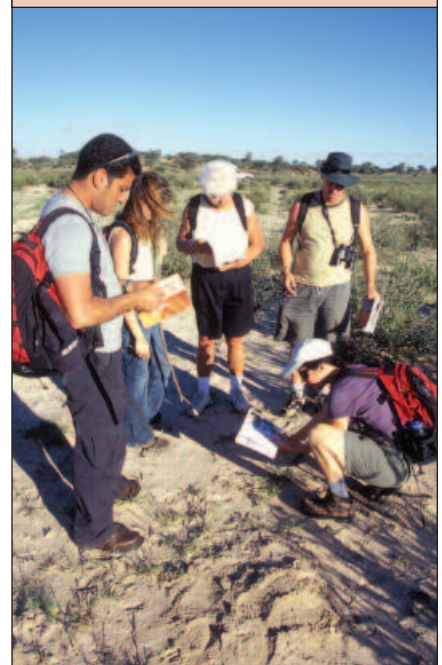
**Average weight:** 2 pounds

**Life span:** 12-14 years

**Predators:** Martial eagles and jackals

**Home:** Grass-lined burrows shared with rodents and other mongoose

**Food:** Scorpions, beetles, spiders, centipedes, millipedes, crickets, worms, small mammals, small reptiles, birds, eggs, tubers, and roots.



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Helpers of both sexes babysit and feed young, and also act as sentinels when the group is foraging. Meerkats eat insects including poisonous scorpions, grubs, geckos, small rodents, snakes, and some types of roots and fruits. Female helpers may also lactate to nurse the pups. Clutton-Brock's research has shown that high helper to pup ratios raise the daily weight gain, growth, and survival rates of juveniles, and that these high helper to pup ratios generally occur in larger groups. Larger group sizes also reduce how much energy a breeding female needs to expend, and increases her survival, probably because large groups have a more effective guarding system.

Clutton-Brock's research teams have found that some meerkat helpers contribute more than others, and that the more generous meerkats generally have higher weights than the others. The most generous meerkats seem to be the ones in their prime and those that have the highest body weights. But, Clutton-Brock has found, how cooperative a meerkat is does not relate to how closely related it is to the breeding female and the young it is caring for. In some cases, meerkats will cheat – they will bring in food for the pups, and then eat it themselves.

### DIRECTIONS FOR FUTURE RESEARCH

In examining the condition of the helpers, Clutton-Brock and his teams are looking into whether the cooperative behavior benefits the individual, which would be called **mutualism**, a situation where both are benefiting from the behavior. If a helper is more generous and less selfish, it may increase that individual's weight, fitness for subsequent mating, or position for staying within the group. The behavior we have called altruistic may perhaps have a little more in it for the individual than previously thought.

The researchers have also found that the heavier males do more guard duty, and that generous female helpers seem to show high levels of anxiety around pups. These are both areas that Clutton-Brock wants to study more fully.

Through continuing these lines of study, Clutton-Brock and other researchers hope to tease apart the factors that affect cooperative behavior and group survival. Understanding the ecology of cooperative breeders, like meerkats, will help us manage and conserve them, and may also give us insight into some evolutionary science questions.

### FIND OUT MORE

#### *Publications:*

Clutton-Brock, T. 2002. Meerkats Stand Tall. *National Geographic*, September 2002.

Clutton-Brock, T.H., O'Riain, M.J., Brotherton, P.N.M., Gaynor, D., Kinsky, R. and Manser, M. 1999. Selfish sentinels in cooperative mammals. *Science* 284:1640-1644.

Clutton-Brock, T.H., Russell, A.F. & Sharpe, L.L. 2004. Meerkat helpers do not specialise in particular activities. *Animal Behaviour*.

#### *Web Sites:*

Meerkats

<http://www.meerkats.com/about.html>.

Clutton-Brock's Research

<http://www.zoo.cam.ac.uk/zoostaff/larg/pages/Meerkats.html>

Cooperative Breeders

[http://www.stanfordalumni.org/birdsite/text/essays/Cooperative\\_Breeding.html](http://www.stanfordalumni.org/birdsite/text/essays/Cooperative_Breeding.html).

#### *Key Words:*

Meerkats, Kalahari, cooperative breeding, altruism, natural selection, evolution

### GLOSSARY

**allolactation** – a subordinate female lactates and is able to feed the young of another

**altruism** – behavior that benefits another individual at a cost to the actor, where cost and benefit are defined in terms of reproductive success

**cooperative breeding** – a system whereby several related and unrelated individuals help to raise the young

**kin** – genetically related, such as family groups

**lactate** – produce milk

**mutualism** – an interaction in which two individuals get some benefit

**natural selection** – the concept developed by Charles Darwin that genes that produce characteristics that are more favorable in a particular environment will be more abundant in the next generation

**sentinel duty** – guard duty; keeping watch while the others engage in normal activities.

Volunteers have joined this project through Earthwatch Institute. Read more about this study and other types of field research at [www.earthwatch.org](http://www.earthwatch.org)



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