

Annual Report on the 2005/2006 Field Season:
The Ecology of the Cape ground squirrel (*Xerus inauris*) in the Namib Desert.

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Two closely related species of diurnal ground squirrels inhabit southern Africa. Although the morphological similarity of these species makes them difficult to distinguish in the field, evidence suggests that their social systems are extremely different. The Cape ground squirrel (*Xerus inauris*) is a highly social species inhabiting open areas in arid regions across southern Africa (Waterman 1995). This high degree of sociality appears to be the result of predation pressure (Waterman 1995, 1997). Although predation appears to be the primary selective force leading to sociality in this species, differential resource abundance may influence the type of sociality and life-history exhibited. In areas with low resources, competition for food resources may limit the sizes of groups (Waterman 2002). In areas of high resources, Cape ground squirrels may live in large groups composed of several female social groups (Herzig-Straschil 1978). These observations suggest that the social system in this species may be fairly plastic, varying with abundance of available resources, yet this hypothesis has not been examined. Specifically, very little is known about the biology of Cape ground squirrels in the South West Arid region in Namibia, where resources are especially limiting or in central South Africa, where resources are more abundant.

The main objective of this research is examine the biology of Cape ground squirrels to assess the hypotheses that resources or predation are the main constraints on grouping in this species. The specific research goals for this past year included 1) continue general trapping and monitoring of the populations, and 2) collection of morphometric data on removed animals.

Methodology:

Study sites:

The overall project includes three study sites, one of which is in the NamibRand.:

Site 1 (a moderate resource site) is a 3500 ha ranch in the Kalahari-bushveld region of Namibia (23°25'S, 18°00'E) where squirrels have been studied since 1989. Annual precipitation averages 201 mm per year.

Site 2 (a low resource site) is Farm Aandster (25°20'S, 16°02'E), which is part of the Namibrand Nature Reserve. Annual precipitation is 81 mm of rain per year.

Site 3 (a high resource site) is in central South Africa in an area with annual precipitation of 501 mm.

Trapping and Marking:

All squirrels were captured using mesh wire live traps (Tomahawk 15x15x60), baited with peanut butter and chicken feed (Waterman 1995, 1996). Traps were checked

regularly every hour. To avoid heat stress traps were covered with cardboard to increase shade. Individuals were marked for permanent identification with implantable passive microchips (Avid Co., 2mm x 13 mm) and all other sites individuals were marked with freeze branding (Quick Freeze; Rood and Nellis 1980). For identification at a distance dye marks were placed on the body (Rodel D dye). Individuals were weighed and examined for species, sex, age, reproductive condition and external parasites. In areas where the two species overlap, we distinguished species by examination of the squirrel's incisors and tail hairs and measured tail length. As small amount of skin was removed from the tip of the tail of each animal to use for DNA verification of species identity and for studies of paternity. Animals were then released at site of capture.

Observations:

Ground squirrels are strictly diurnal, and the open habitat and sparse cover in the areas where they live make visual observations quite easy (except this year where rainfall has allowed the grass to grow). Squirrels were observed from a vehicle to determine the size and composition of social groups.

Preliminary Results:

Population monitoring and comparisons of the three sites:

In the first year of the study we established 3 study sites in areas of differing rainfall, in order to examine the effects of resources on the social system of the Cape ground squirrel, *Xerus inauris*. General trapping and monitoring has continued at all three sites.

Ymke Warren, Corris Kaapehi and Mary Beth Manjerovic trapped at Aandster from 7 to 11 July 2005, 3 to 7 October 2005, and 28 March to 1 April 2006 for a total of 15 days trapping. At last trapping 100% of the original burrow clusters surveyed were still occupied by squirrels. We have now trapped and marked nearly 100 animals over the past 3 years. Currently we have 75 animals marked in 10 burrow clusters, including subadults and juveniles (Table 1). These were the first young animals trapped since 2002 at the Aandster and this was most likely a response to approximately 100mm of rain that fell during the summer of 2005 and 2006. As more rainfall has fallen in the 2006 year, we predict high numbers of juveniles in trapping this winter than in previous winters, as Christian (1980) found with other species of small mammal in the neighbouring farm of Gorrasis.

	Adult	Subadult	Juvenile	Total
Male	27	12	6	45
Female	18	5	7	30

Table 1. Sex and age categories of squirrels trapped July 2005- April 2006.

Male sperm competition:

All animals trapped had tissue collected for nuclear DNA analysis. This project, lead by Mary Beth Manjerovic (Ph.D. student, University of Central Florida) will

evaluate the paternity of offspring and the overall population genetics of the Cape ground squirrel.

In addition to the genetic analysis, Ms. Manjerovic is also exploring the morphological aspects of sperm competition in this species. Animals under intense sperm competition are predicted to have morphological adaptations to this form of sexual selection, especially enlarged testes size, longer penises and long vaginas. Ms. Manjerovic will examine the degree of sperm competition in Cape ground squirrels by examining these morphological characteristics. She collected 10 animals (5 males and 5 females) from the airstrip at the NamibRand Nature Reserve. Body size, mass and the dimensions of all reproductive organs were collected, as well as the collection of testicles and vaginas in Bouin's solution. All animals were vouchered to the National Museum of Namibia.

Alloparental Care in Cape ground squirrels.

A review of cooperative breeding in mammals (Solomon & French 1997) established three criteria for labeling animals as cooperative breeders: 1) delayed dispersal of offspring, 2) reproductive suppression, and 3) alloparental care. Using these criteria, female Cape ground squirrels can be described as cooperative breeders. First, as with many social species of ground squirrels, subadult females exhibit natal philopatry and usually do not disperse unless reproductive positions are unavailable (Waterman 2002). Furthermore, although young males typically disperse at 8-10 months, 29% of young males remain in their natal group long after they have obtained reproductive maturity (up to 3 years). Thus, females and some males exhibit delayed dispersal (Waterman 1995). Second, in larger groups of adult females, the sexual maturation of young females is delayed due to reproductive suppression (Waterman 2002). Third, all members of the group (adult females and subadult females and males) provide care of juveniles through allogrooming, play, and possibly predator detection and deterrence (Waterman 1995, unpubl.). Knight (1991) even reported seeing communal nursing. We are investigating this last criteria in more detail. Ymke Warren is using focal animal and all-occurrence data collection in the Kalahari to examine which individuals in a social group provide alloparental care and how that could be influenced by sex, age and relationship with the mother. Comparison of the social structure of Aandster with the Kalahari site will allow us to examine whether more animals remain to provide alloparental care in a harsher environment (the Arid Environment Hypothesis).

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