CHAPTER 3

METHODS

Introduction

To answer the questions posed, a study was done during two years of fieldwork in the Kgalagadi Transfrontier Park, from June 2000 to July 2002. Caracals were captured and radio transmitters were fitted to research animals. These animals were then radio-tracked to gather range use data. The spoor tracking technique (Eloff 1984, Bothma & Le Riche 1984, Stander et al. 1997) was used to gather behavioural, habitat selection and prey selection data relating to caracals in the Kgalagadi Transfrontier Park. Faecal samples were collected and analysed to determine what prey caracals selected and whether caracals utilised sheep as prey. Spoor counts (Stander 1998, Funston *et al.* 2001) were conducted to investigate the relative caracal densities in the interior of the park and along the Namibian border.

The results of this study were prepared as a set of independent journal articles, and each article contains a description of the methods that were used for that investigation. Therefore, the general methods that were used during the present study are discussed briefly here. In most instances the data were analysed on a seasonal basis with a hot season from October to March, and a cool to cold season from April to September (Bothma & Bothma 2004). It was not viable to conduct seasonal analyses of the prey selection of caracals due to the small sample size available for the hot season.

Capture, collaring, care and release of caracal.

To fit caracals *Caracal caracal* with radio collars, it was necessary to capture a number of animals and immobilise them. Box traps were used to capture caracals in the Kgalagadi Transfrontier Park. The macro and micro positioning of the box traps were important to optimise the chances of capturing caracals (Boddicker 1988). Various combinations of different lures and baits were used to attract caracals into the cages. These worked with varying degrees of success. The trap line was patrolled on a daily basis to ensure that non-target animals could be released and that the caracals were immobilised before being subjected to unnecessary heat stress (Brand 1993). Modifications were made to the standard box trap design to allow for the introduction of a crush into the trap. When a caracal was caught, the crush was placed into the box trap. An assistant would then use the crush to physically restrain the caracal inside the box trap. It was then possible to administer the immobilising drug, Zoletil [Virbac RSA (Pty) Ltd. 1996], to the captive animal by using a hand-held syringe. Once immobilised, the caracals were removed from the box traps, to be checked for any injuries and external parasites, weighed, measured and fitted with Telonics radio-collars. In high ambient temperatures, immobilised caracals were doused with water to prevent overheating. Because there is no reversing agent for Zoletil the immobilised caracals were placed back inside the box traps and the trapdoor was closed once they had been fitted with radio collars. The trap with the caracal inside was left in a cool area to allow the immobilising agent to wear off (Stander & Morkel 1991). Once the caracals had fully recovered from the immobilising agent, they were released.

Range use

Caracals were fitted with 250 g Telonics radio-collars, transmitting on individual frequencies within the 148.80 to 148.89 MHz. frequency range. After release the collared caracals were radio-tracked on a weekly basis. This interval of at least a week between consecutive locations avoided underestimation of range size due to auto-correlation of the locations (Swihart & Slade 1985, Reynolds & Laundre 1990). Radio tracking was done from the ground by using high vantage points to locate the radio signals. Occasionally aerial tracking was used to supplement the ground tracking. To avoid the errors inherent in basing locations on triangulation, the individual caracals were physically located to get a visual confirmation of their positions (Macdonald & Amlaner 1980, Nams & Boutin 1991). The positional fixes for each individual were recorded with GPS equipment and were then used to calculate the range sizes for the caracals. Two range estimation programs, Ranges V (Kenward & Hodder 1996) and Animal Movement (Hooge 1999), were used to calculate the minimum convex polygon, the kernel and the harmonic mean range for caracals that generated sufficient data points to ensure meaningful results from statistical analysis (Mizutani & Jewell 1998, Broomhall 2001). Two alternative analysis programs were used to give a less biased reflection of the range sizes of caracals and to improve the flexibility of the results for comparison with future studies.

Habitat selection

To facilitate the study of habitat selection by caracals in the Kgalagadi Transfrontier Park it was necessary to redefine certain terms that are usually associated with habitat selection so that their application in relation to the present study was relevant. Habitat selection was based on dividing the shrubby Kalahari dune bushveld into a number of subdivisions including habitat components (dune crests, dune slopes and dune streets), dune slope aspects, and plant association (Van der Walt 1999, Van Rooyen 2001). To stratify the shrubby Kalahari dune bushveld into habitat components, the non-mapping method (Marcum & Loftsgaarden 1980) was preferred to the traditional mapping method because of its ability to stratify vegetation on a fine scale.

Caracal spoor were followed according to the method of Eloff (1984), Bothma &Le Riche (1984) and Stander *et al.* (1997) to gain an insight into the behaviour of these animals. This method involved patrolling the roads within the study area at 10 km per hour with the tracker scanning the road from a tracking chair that was bolted to the front bumper of the research vehicle. On detecting fresh caracal spoor, the tracker started to walk, following the spoor, describing the behaviours that could be identified from the spoor. The behavioural observations were recorded on field forms. In addition to behavioural observations, habitat utilisation observations were recorded and linked to GPS locations, to facilitate habitat selection analysis. The behaviours were categorised as either involving movement or being stationary. Many of the stationary behaviours could be related to specific plant species within each habitat component.

Baseline vegetation frequency data were collected by using 100 m step-point transects in each of the habitat components (Mentis 1981). The data were converted to reflect the plant frequencies in each habitat component. These frequencies could then be compared with the plant utilisation that caracals displayed while performing various stationary behaviours. This reflected the microhabitat selection that caracals displayed.

Chi-squared tests were used to establish whether caracals selected or avoided various habitat components and plant species within the defined habitat components. Where significant levels of selection were indicated, the Bonferroni approach was used to establish whether specific plant species or habitat components were selected or avoided

(Marcum & Loftsgaarden 1980, Moolman 1986, Caley 1994, Alvarez-Cardenas *et al.* 2001).

Hunting behaviour

The spoor tracking method of Eloff (1984), Bothma & Le Riche (1984) and Stander *et al.* (1997) was used to collect data related to the hunting behaviour of caracals. From the spoor, a Kalahari San tracker could distinguish six individual component behaviours related to hunting; stalk, crouch, take-off, chase, pounce and kill. Although Schaller (1972) defined minimum distances for component behaviours of hunts as they related to lions *Panthera leo,* it was necessary to redefine these distances as they relate to caracals because the distances that relate to lions are too great to apply directly to caracals.

For analysis purposes, the prey were separated into two distinct categories with large adult prey having a mean body mass of > 1 kg and small prey one of 1 kg or less. Prey that left visually faint or undetectable spoor were assumed to be small prey because the spoor of larger prey would be clearly visible and identifiable. Correspondence analysis (SAS 1999) was used to model the sequence of hunting behaviours most likely to result in a kill.

Prey selection

Two methods were used to analyse the prey selection by caracals in the Kgalagadi Transfrontier Park. Traditional scat (faecal) analysis was used as the primary method, and records of known and attempted kills detected from spoor tracking were used to supplement these data as was done by Bothma & Le Riche (1984) for leopards *Panthera pardus*.

Caracal scats were identified by their association with caracal spoor (Bothma & Le Riche 1984, Emmons 1986, Oli *et al.* 1993) and their typical segmented appearance (Norton *et al.* 1986, Stuart & Hickman 1991). On collection, scats were placed in labelled paper bags and air-dried (MacDonald & Nel 1986). On completion of the fieldwork the contents of the scats were analysed in a laboratory. The scats were washed to remove all water-soluble components. Only the macroscopic particles of the scat then remained, including; tooth fragments, hair, bones, plant material, hoofs and insect carapaces. These remnants were used to determine what prey the caracals had been utilising.

Gelatine imprints of the hair cuticle patterns were made and compared with the cuticle patterns on reference slides made from hair samples from known species. Additionally the cuticle patterns were compared with existing keys (Dreyer 1966, Perrin & Campbell 1979, Keogh 1983, Keogh 1985). Cross sections of the hairs in the scats were made (Douglas 1989) and compared with cross-sections of the hairs of known species, and with a photographic record held at the Centre for Wildlife Management.

While spoor tracking, all hunting attempts were recorded. Where possible the intended prey was also identified from spoor. In many instances, however, the prey animal could not be identified and was recorded as unknown for prey selection analysis.

Possible optimal foraging for Brant's whistling rats

To determine whether caracals were employing an optimal foraging approach when searching for Brant's whistling rats *Parotomys brantsii*, it was necessary to compare the incidence of Brant's whistling rat colonies along a random path with their incidence along caracal movement paths. A vehicle was used to conduct 20 straight line transects of 10 km each. Observations on the presence or absence of Brant's whistling rat colonies were made at 0.5 km intervals along the length of each transect. This gave a base line (expected) frequency of the occurrence of Brant's whistling rat colonies within the study area. Whilst spoor tracking caracal according to the method of Eloff (1984), Bothma & Le Riche (1984) and Stander *et al*. (1997) observations on the occurrence or absence of Brant's whistling rat colonies were made every 0.5 km along each set of caracal tracks. The base line frequency of Brant's whistling rat colonies was then compared with the frequency observed along the caracal tracks to determine whether caracals selected paths with a relatively high incidence of Brant's whistling rat colonies using the CATMOD procedure (SAS 1999).

The effect of small stock farming in Namibia on caracal density in the neighbouring Kgalagadi Transfrontier Park.

Spoor density is directly related to the density of that species in an area (Tyson 1959, van Dyke, Stander 1998, Funston *et al*. 2001). Spoor counts were conducted along management tracks in the study area to determine whether there was a higher caracal spoor density along the border than in the interior of the Kgalagadi Transfrontier Park. Two long-distance transects were used, one along the Namibian border and one in the interior of the Park. The interior transect was conducted along a route that diverged away from the Namibian border. At its furthest point, this route lay 30 km away from the Namibian border. Both routes were completed on consecutive days of each month. A tracker sat on a tracking chair mounted to the front bumper of the research vehicle and indicated every incidence of caracal spoor. These incidences were noted, in conjunction with their position, distance for which they were visible on the track, and their orientation (transverse or longitudinal) relative to the track. Only fresh spoor, as indicated by the tracker, were included in the data set. Because the aim was to try to detect a cline of caracal activity between the interior of the Park and the areas along the border, the interior transect was divided into three strips, 0 – 10 km, >10 - 20 km and >20 - 30 km, relative to their perpendicular distance from the Namibian border. The density, length and orientation of the spoor recorded along the strips in the interior were compared with those recorded along the border.

Questionnaire survey

To investigate the perceptions by the Namibian farmers of the extent of the impact of predators on small stock production, questionnaires were distributed to farmers at various farmers union meetings. Due to the low number of respondents, these data are too sparse to warrant further analysis. Where the opinion of the Namibian farmers is referred to in the text, it is based on the responses of 15 farmers to the questionnaires, five of whom own land that borders directly on the Kgalagadi Transfrontier Park.

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