INTRODUCTION

The springbok (Antidorcas marsupialis) is the only representative of the gazelle group of antelope in southern Africa, and like the gazelles its preferred habitat is the open plains. Recent work has shown territoriality to be a common behavioural feature among ungulates (Estes 1969). Walther (1964, 1965, 1967) have described territoriality in Thomson's gazelle (Gazella thomsonii) and Grant's gazelle (Gazella granti), and Leuthold (1971) thought that male gerenuk (Litocranius walleri) in the Tsavo National Park, Kenya, were territorial. Mills (pers. comm.)* considers that the spacing of solitary adult male springbok at intervals of about 1.2 kilometres along the lower Nossob River in the Kalahari Gemsbok National Park is evidence that these animals occupy territories. Bigalke (1966, 1970) believes that the solitary male springbok commonly seen from the onset of the rut he observed in about April until the start of the rains, are probably territorial. The present study was carried out to test this thesis.

STUDY AREA

The Jack Scott Nature Reserve, comprising approximately 3100 hectares of privately owned land, lies at about 25°55' S, 27°45' E in the Krugersdorp district, Transvaal, Republic of South Africa, with the Magaliesberg range about 15 kilometres north of the reserve's northern boundary. The study area forms part of a transitional zone between bushveld and highveld grassland, and the Magaliesberg range may demarcate the approximate northern and southern distribution limits of certain game species in this region (du Plessis 1969). Altitude varies from about 1300 to 1600 m above sea level. The terrain is predominantly hilly or gently rolling, and surface rocks are often widespread. Soils are generally shallow except in localised bottomland sites, and are mostly of a sandy loam or clay loam type. Perennial surface water is restricted to streams in the northern part of the reserve. The climatic regime is typical of the Transvaal Highveld with its dry, severe winters and summer rainfall averaging 700 mm. Lowest temperatures occur in June and July, when rainfall is lowest.

Following Acocks' (1975) classification of veld types, the reserve is situated in the central variation of the Bankenveld, just south of the sourish mixed bushveld. Using the physiognomic classification of Tinley (1969), the following plant communities may be distinguished in the reserve: Acacia treeveld and scrubveld, Protea caffra treeveld, Protea roupellia treeveld, grassland, thicket and forest. These communities can be easily recognised in the field, are relevant in terms of the distribution of game, and can be utilised for management purposes. Springbok were distributed almost exclusively on the open grassland, which covers approximately 1730 hectares of the reserve. In many areas, particularly overlying chert and dolomite, a large variety of forbs occur among the grasses; trees and shrubs are absent or occasional. The grass species comprising the grassland vary in their frequency of occurrence and contribution to basal cover and form intricate distributional patterns.

Eighteen species of ungulates occur in the reserve. The springbok were introduced and numbered 55 animals at the end of March, 1972. However, they probably occurred in the study area in historical times as Holub (1881) records them from the Krugersdorp district.

METHODS

The observations on sociality of springbok were made during a survey of ungulate population structure and dynamics and habitat utilisation on the Jack Scott Nature Reserve. Between 18 March 1971 and 27 March 1972 the entire reserve was traversed each month by motor vehicle and foot and sightings of springbok and other animals were recorded on a grid map. Although size of grid squares in the field was rather large (200 x 200 metres), the distribution patterns obtained, together with recording of sex and age and other details of the springbok, provided an indication of social organisation. Particular animals or groups were observed in more detail to gain information on social behaviour. Three adult male springbok were recognisable by individual characteristics. Records were kept of the extent and date of all burning within the study area because of its influence on ungulate distribution.

The age classes used for springbok follow those proposed for other ungulates by Ansell (1966), whose scheme uses height classes relative to the adult female, and were supplemented by the ageing

* M G L Mills, Kalahari Gemsbok National Park, P O Gemsbokpark 8815
criteria, based on horn development, described for springbok by Rautenbach (1971). Following Ansell (op. cit.) the age categories used were "infant", "juvenile", "subadult" and "adult", in addition to the class "young", comprising the juvenile and infant categories. Other criteria used included behaviour and general physical appearance. Springbok grow rapidly and distinguishing between infants and juveniles and between juveniles and young subadults in the field is often arbitrary using only size and horn development as ageing criteria. Since horn growth in male springbok commences at birth whereas in females horns begin to appear at about three and a half months of age (Rautenbach 1971), determination of age class is difficult if the animals cannot be sexed. Springbok ewes are physiologically capable of conceiving a lamb in the first autumn of life when about seven months of age (Bigalke 1966, Skinner and van Zyl 1970a). Considering tooth development and the age at which the female reaches sexual maturity, the subadult age class should include animals between seven and 22 months old (Rautenbach, op. cit.). In the field Rautenbach's diagrams of horn development for animals nine months old were used as a guide for separating subadults from juveniles. During the present study ageing was greatly facilitated by knowledge of birth periods and by the small size of the springbok population in a relatively limited area.

RESULTS AND DISCUSSION

Population structure

By recording time, locality, and sex and age composition for all springbok sightings, it was eventually possible to accurately assess population structure of the small population in the study area. When observations started in March 1971, the population comprised 21 reproductively adult ewes (although some were subadult according to horn development), two juvenile rams, four juvenile ewes, and 13 adult rams. Five lambs were born during the winter (July) of which two disappeared, probably due to jackal predation. The remains of one very old male, probably killed by a leopard, were found among cover on a boulder outcrop. A further 15 lambs were born during the main spring and summer lambing season (Fig. 1) and were still surviving at the end of March 1972, when observations terminated. Based on a census conducted on 14 November 1971, and continuing observations, population structure at the end of the study was: 10 adult males, two subadult males, 21 adult females, four subadult females, three juveniles (born in July 1971) and 15 lambs from the spring and summer lamb crop. Total population size was thus 55 animals.

The number of lambs born during the summer 1970/71 lambing season is unknown but must have been at least six, as evidenced by the classification of six juveniles in March 1971.

The main lambing peak in springbok probably varies in different parts of the species' range and may also vary slightly in the same area from year to year. In the Jack Scott Nature Reserve observations were insufficient to determine limits or any peaks in rutting behaviour. Moulting was observed once during a subsequent visit to the study area on 31 May 1972. With a gestation period of about five and a half months (van Zyl and Skinner 1970), the lambs born in January 1972 could have been conceived in July/August 1971; back-dating in respect of the lambs born in July 1971 would indicate mating about January 1971 (late summer). The peak breeding season occurs in autumn (Bigalke 1963, Brand 1963, Skinner and van Zyl 1970b), although springbok in the western Transvaal have been known to lamb throughout the year (Skinner and van Zyl 1970a). Bigalke (1970) considers that autumn lambing is largely dependent on the condition of the veld in spring.

SOCIAL ORGANISATION

Social groupings

A total of 366 sightings of springbok was recorded where the animals involved were classified according to sex and age classes (Table 1). Three basic social groupings were recognised:

(a) the female herd, consisting of adult and younger females together with their most recent lambs;

(b) the male herd, consisting of adult and subadult males;

(c) lambs and juveniles.


<table>
<thead>
<tr>
<th>King of group</th>
<th>Number of sightings</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single $\delta$</td>
<td>178</td>
<td>48.6</td>
</tr>
<tr>
<td>$\delta + \delta'$</td>
<td>25</td>
<td>6.8</td>
</tr>
<tr>
<td>$\delta + \varphi$</td>
<td>39</td>
<td>10.7</td>
</tr>
<tr>
<td>$\delta + \varphi + y$</td>
<td>63</td>
<td>18.0</td>
</tr>
<tr>
<td>$\delta + 12 + 1$ infant</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>Single $\varphi$</td>
<td>7</td>
<td>1.9</td>
</tr>
<tr>
<td>$\varphi + y$</td>
<td>12</td>
<td>3.8</td>
</tr>
<tr>
<td>$\varphi + 1$ infant</td>
<td>14</td>
<td>3.8</td>
</tr>
<tr>
<td>$\Omega$</td>
<td>11</td>
<td>3.0</td>
</tr>
<tr>
<td>$\Omega + 2$</td>
<td>9</td>
<td>2.5</td>
</tr>
<tr>
<td>$\Omega + 2\delta$</td>
<td>12</td>
<td>3.3</td>
</tr>
<tr>
<td>$\Omega + 2\delta + 1$</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>$\Omega + 1\delta + 1\delta$ juv.</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>$\Omega + 2\delta$</td>
<td>4</td>
<td>1.1</td>
</tr>
<tr>
<td>$\Omega + 1$</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>$\Omega + 1\delta + 2\delta$</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>$\Omega + 1\delta + 3\delta$</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>$\Omega + 1\delta + 3\delta + y$</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>$\Omega + 1\delta + 3\delta + y$</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>$\Omega + 1\delta + 3\delta + 1$</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>$\Omega + 1$</td>
<td>2</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Total

366 100.0

$^*$ $\delta$ = adult male
$\delta$ = adult and subadult females
$\delta$ = subadult male
$\delta$ = juvenile male

*y $=$ young (infants and juveniles)

Table 2. Frequencies of size classes of female springbok herds (adults and subadults only) in the Jack Scott Nature Reserve, for the period March 1971 to March 1972.

<table>
<thead>
<tr>
<th>Herds with one adult male</th>
<th>Herds without adult male</th>
<th>No. of groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-5</td>
<td>6-15</td>
</tr>
<tr>
<td>No. of sightings</td>
<td>81</td>
<td>37</td>
</tr>
<tr>
<td>Per cent</td>
<td>48.8</td>
<td>22.3</td>
</tr>
</tbody>
</table>

(b) the bachelor herd, consisting of males ranging in age from juvenile to adult;
(c) solitary adult males.

Most of the female herds in the study area were small (Table 2), numbering one to five adult and subadult females. The mean number of subadult and adult females in a female herd was 5.3 animals with a maximum of 21, including juveniles and infants, the maximum recorded herd size was 32 animals.

A bachelor herd of five young adult males was sighted four times over the period 20 March to 24 April, 1971, but was not recorded subsequently, indicating that they either established territories or wandered about singly. A bachelor herd of three adult males, sighted four times over the brief period 15 to 26 August, 1971, was also not seen again. Only on 9 November, 1971, did a bachelor element again appear in the population, when two subadult males (probably born in the summer of 1970/71) were seen, and these same two individuals were last seen together on 21 January, 1972. The small size of the female herds and poor representation of bachelor males are probably related to the small population size in the study area.

Territorial behaviour

Nearly all definitions of territoriality include the defence of an area or intolerance towards conspecifics within an area. However, Leuthold (1970) states that “in many animals it is difficult to observe actual defensive behaviour, as this may be ‘diluted’ into inconspicuous displays between males that apparently know each other”. He suggests these additional criteria for territoriality:

1. Frequent occurrence of single adult males;
2. Repeated observations of a known single adult male in the same location, with — and more important — without females;
3. Observations of the same adult male in the same area but with different females on different occasions;
4. Observations of the same females with different adult males in different locations;
5. Observations of a new adult male in an area where a known adult male had been seen repeatedly; at the same time, the original adult male should be seen elsewhere, without females, possibly with a bachelor herd. (This would amount to a change in ownership of a specific territory).

Fulfilment of not one but several or all of these criteria would indicate that territoriality was likely to exist. The indirect evidence for territoriality in the study population is based largely on criteria 1, 2, 3 and 5 and will be discussed in this order.

1. Single adult males comprised 48.6 per cent of total sightings (Table 1), and 91.3 per cent of all sightings of pure male groups. The high value of the latter figure must be attributed to the small population size. Also the number of sightings of single adult males with females or females and young is significantly high (35.5 per cent of total sightings).

2. Observations of six adult males are summarised in Table 3, and their approximate locations are shown in Figure 2. “Bent Tail” was unmistakable due to the unusual shape and movement of his tail. Sightings of this animal were plotted on photo enlargements with an accuracy of ± 50 aerial metres, while the 200 m grid was used to record the distribution of the other males, two of which could be positively recognised by natural features. Although the remaining males lacked any distinctive characteristics, repeated sightings of males in the same localities and in more or less the same spatial relationship to one another, strongly suggest that the same males were being observed on each occasion. The observations indicate that some adult males are attached to a definite locality, where they are usually seen either alone or with a female or nursery herd. The sightings of particular adult males apparently occupying particular locations were made over periods ranging from 15 weeks in the case of “Bent Tail” to 47 weeks in the case of male “B”.

3. Variable numbers of females were seen on different occasions with certain single adult males in particular locations (Tables 4 and 5) suggesting that the females moved about from area to area, and that composition of herds of females changed quite frequently.

Table 3. Observations of the associations of six adult (territorial) male springbok in the Jack Scott Nature Reserve, for the period March 1971 to March 1972.

<table>
<thead>
<tr>
<th>Identification</th>
<th>No. of observations of various associations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With female herd¹</td>
</tr>
<tr>
<td>&quot;Bent Tail&quot;</td>
<td>14</td>
</tr>
<tr>
<td>A³</td>
<td>12</td>
</tr>
<tr>
<td>B⁴</td>
<td>41</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>6</td>
</tr>
<tr>
<td>E</td>
<td>5</td>
</tr>
</tbody>
</table>

¹Female herd is here taken to include adult and subadult females, with or without juveniles and infants of both sexes.
²Other observations included interactions between a territorial male and other males, and one sighting of male A with an infant.
³Male A was the third owner of "Bent Tail's" territory, replacing the second owner after a short period.
⁴Male B occupied an area bordering that of "Bent Tail".
4. Although it was possible to recognise some females by their horns, their locations were unfortunately not plotted. However, several observations were made of the same females with different adult males in different locations. It appears that female springbok move around over a much larger area than the solitary males listed in Table 3, although the same female or group of females sometimes stayed for at least several days in a particular location.

5. The evidence for exchange of males on a territory is based on the case history of the area originally occupied by "bent Tail". This male was sighted 44 times in a limited area over a period of 104 days (1 April to 13 July, 1971), 29 times alone and 14 times with females or females and young. A further two sightings were located near a mineral lick a short distance east of the shallow, dry drainage line that appeared to be the boundary between his area and that of adult male "B", his only neighbour. The other boundaries were natural features — rocky ridges and slopes along a drainage line to the west, some rock outcrops to the south, and just across the road to the north, an area of tall, mature grass.

On 17 July 1971, a new adult male, recognisable by a small marking, was seen feeding alone within "Bent Tail's" area. "Bent Tail" was found alone over one kilometre away, and appeared nervous, running away with a greatly increased flight distance when approached, and continuing to run for a considerable distance. This contrasted with his previous behaviour on his area where he was much more bold and allowed a much closer approach. Neither male showed any sign of injury from fighting. The new male was subsequently sighted another five times on "Bent Tail's" former area, the last sighting being made on 27 July, 1971. Once during this period (on 25 July), "Bent Tail" was seen standing within the western fringe and looking towards the new owner feeding about 400 metres away. There were 27 subsequent sightings of "Bent Tail", two near or within his former territory, and the remainder widely dispersed (Fig. 2); in only four was he in the company of females.

A third adult male (male "A") was seen on "Bent Tail's" former territory on 13 August, 1971, and was

### Table 4: Observations of the adult (territorial) male springbok "Bent Tail" with female springbok herds in the Jack Scott Nature Reserve during 1971.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Herd Composition*</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 May</td>
<td>1036</td>
<td>2♀♀, 3 juv.</td>
</tr>
<tr>
<td>16 May</td>
<td>0945</td>
<td>2♀♀, 1 juv.</td>
</tr>
<tr>
<td>17 May</td>
<td>1100</td>
<td>2♀♀, 1 juv.</td>
</tr>
<tr>
<td>28 May</td>
<td>1630</td>
<td>5♀♀, 1 juv.</td>
</tr>
<tr>
<td>29 May</td>
<td>0815</td>
<td>14♀♀, 1 juv.</td>
</tr>
<tr>
<td>10 June</td>
<td>1605</td>
<td>5♀♀, 1 juv.</td>
</tr>
<tr>
<td>11 June</td>
<td>1100</td>
<td>6♀♀, 3 juv.</td>
</tr>
<tr>
<td>12 June</td>
<td>1708</td>
<td>6♀♀, 3 juv.</td>
</tr>
<tr>
<td>19 June</td>
<td>1600</td>
<td>1♀♀</td>
</tr>
<tr>
<td>25 June</td>
<td>1540</td>
<td>1♀♀, 3 juv.</td>
</tr>
<tr>
<td>30 June</td>
<td>1650</td>
<td>2♀♀, 3 juv.</td>
</tr>
<tr>
<td>3 July</td>
<td>1700</td>
<td>1♀♀</td>
</tr>
<tr>
<td>10 July</td>
<td>1152</td>
<td>3♀♀</td>
</tr>
<tr>
<td>13 July</td>
<td>1055</td>
<td>6♀♀</td>
</tr>
</tbody>
</table>

* Juv. = juvenile  
♀♀ = adult and subadult females

### Table 5: Observations of the adult (territorial) male springbok "A" with female springbok herds in the Jack Scott Nature Reserve during 1971 and 1972.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Herd Composition*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 August</td>
<td>1635</td>
<td>4♀♀, 3 juv.</td>
</tr>
<tr>
<td>20 August</td>
<td>1042</td>
<td>5♀♀, 1 juv., 2 infants</td>
</tr>
<tr>
<td>30 August</td>
<td>1805</td>
<td>1♀♀</td>
</tr>
<tr>
<td>7 October</td>
<td>0925</td>
<td>3♀♀</td>
</tr>
<tr>
<td>10 October</td>
<td>1417</td>
<td>3♀♀</td>
</tr>
<tr>
<td>7 November</td>
<td>1703</td>
<td>5♀♀</td>
</tr>
<tr>
<td>8 November</td>
<td>1750</td>
<td>5♀♀</td>
</tr>
<tr>
<td>21 December</td>
<td>1735</td>
<td>6♀♀</td>
</tr>
<tr>
<td>30 December</td>
<td>1745</td>
<td>4♀♀, 1 juv.</td>
</tr>
<tr>
<td>1972</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 February</td>
<td>1705</td>
<td>16♀♀, 9 infants</td>
</tr>
<tr>
<td>11 February</td>
<td>1450</td>
<td>5♀♀</td>
</tr>
<tr>
<td>20 February</td>
<td>1810</td>
<td>5♀♀, 1 juv., 1 infant</td>
</tr>
</tbody>
</table>

* Juv. = juvenile  
♀♀ = adult and subadult females
resighted a further 44 times until 20 February, 1972.
The second male that had briefly occupied the terri-
tory was not seen again or, if seen elsewhere, was not recognised from the small marking that
distinguished him. Male “A”s” centre of activity was
noticed to have shifted more to the north towards the Skeerpoort River (Fig. 2), compared with that of
“Bent Tail”. This was attributed to the burning of
the block between the road and the Skeerpoort Ri-
ver. Prior to burning, the grass growth here was
dominated by tall, coarse Trachypogon spicatus, and
appeared to be largely avoided by springbok and
blesbok.

Defensive or intolerant behaviour

No fights but some intolerance on the part of
single adult male springbok towards male conspec-
ifics was observed. On 27 April 1971, a bachelor herd of five adult males grazed their way on to the
area where an adult male had been sighted re-
peatedly. He started walking towards them from a
distance of about 300 metres and finally ran at them,
chasing one bachelor for some distance and causing
the remainder to scatter. The male then turned
round and walked back towards his original loca-
tion. The bachelor herd moved away, feeding, to-
wards an area occupied by a second lone male. On
seeing the bachelors this male chased them back in
the direction from which they had come. The bache-
lor herd then avoided the first male, which ap-
proached causing their pursuer to stop and turn
back towards his area. A brief chase ensued before
the first male returned to his original position. Mean-
while the bachelors had hardly stopped running
when another territorial male ran towards them and
scattered all five.

On 25 June 1971, an adult male springbok was
seen feeding within the area normally occupied by a
lone adult male. Shortly afterwards another adult
male, probably the territory owner, was seen run-
ning towards the first male, which fled and was
hotly pursued for a short distance, before the pur-
suer suddenly stopped, horned a small shrub, and
walked back the way he had come. The first male
had slowed down to a walk when suddenly a
neighbouring territorial male appeared and vigo-
rously chased him again for about 300 metres, stop-
ning by a road. The male that had already been
chased twice was then chased for the third time by
yet another lone adult male.

It is noteworthy that in both the above instances
of chasing of a bachelor herd and a single adult
male, no females were observed in the vicinity. The
only other observation of chasing of a bachelor herd
was made on 9 November 1971, when male “D” was
observed chasing two subadult males. All the above
observations taken together suggest the existence of
territorial behaviour in male springbok in the study
population.

Territory size and duration of occupation

Only two of the springbok territories were
reasonably well mapped, but it was apparent that
they were equivalent in size to several blesbok terri-
ories. For instance, within the territory of “Bent Tail” there were seven known blesbok territories at
one time. The spacing between the approximate
centres of activity of the territory of “Bent Tail” and
that of his neighbour, male “B”, was subjectively
determined to be about 650 metres. The approxi-
mate minimum territory size of “Bent Tail”, calcu-
lated by linking all the outermost points of obser-
vation (except for the two east of the drainage line
boundary) and determining the area thus enclosed,
was 0,27 square kilometres. Male “A”, who subse-
quently occupied “Bent Tail’s” territory, expanded
his activity northwards on to the burnt area so that
his territory size was probably at least 0,5 square
kilometres. Using the distribution of sightings on
both the burnt and unburnt areas, the territory size
of male “B” was estimated to be about 0,7 square
kilometres. Prior to the burning, male “B”s” territory
was probably just over 0,2 square kilometres in size.

Observations (Table 6) suggest that some adult
male springbok in the study area restrict their activi-
ty to definite localities (territories) for four to 12
months, or possibly even longer. During a brief sub-
sequent visit to the reserve on 31 May 1972, male
“B” was sighted still within his territorial area,
mounting a female from a female herd.

Advertising the territory

Many territorial mammals mark their territories
with scent, either from special scent glands or
through faeces and/or urine. Both Thomson’s and
Grant’s gazelles use linked urination-defecation at
particular spots as a means of territorial demar-
cation (Walther 1964, 1965; Estes 1967). The de-
fecation stance is rather exaggerated and Walther
emphasises the possible territorial display function
by calling it “demonstrative defecation”.

Territorial male springbok were also seen to adopt
a distinctive urination and defection stance, but
the use of dung heaps was not observed, although one
lone springbok ram was occasionally seen lying
down near or on the edge of blesbok dung heaps.
However, Parris (pers. comm.)* reports the occur-
rence of springbok dung heaps in the Kalahari re-
region of Botswana.

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**TABLE 6. Number of observations per month of four adult male springbok on their territories in the Jack Scott Nature Reserve.**

<table>
<thead>
<tr>
<th>Adult male</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>1971</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Total sightings on territory</th>
<th>Length of stay (weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Bent Tail”</td>
<td>9</td>
<td>21</td>
<td>11</td>
<td>3</td>
<td></td>
<td></td>
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* Occupied former territory of “Bent Tail”
Thomson's and Grant's gazelles possess preorbital glands, but the male Grant's gazelles, unlike Thomson's males, do not mark with them (Walther 1964, 1965). Territorial male Thomson's gazelles mark by carefully pursing the orifices of the preorbital glands around decapitated grass stems, twigs etc., leaving a pitchlike substance (Estes 1967). Springbok also have preorbital glands, but this form of marking was not observed. Walther (1964, 1965) had described "weaving" with the horns and forehead in the grass or small bushes in Thomson's and Grant's gazelles. In the study area, adult male springbok have been observed weaving in small shrubs with their horns and foreheads, both when alone and after chasing another male. Weaving is conspicuous and probably functions as a visual display. In an agonistic encounter between males, weaving may signify threat. Apart from visual advertisement of territory, it is not known whether any secretion from the preorbital glands is transferred on to the vegetation by the act of weaving. Thus the possible scent marking function of weaving when performed by territorial males is uncertain.

The mere presence of a territorial male continually in a particular area constitutes static-optic advertising; this might be important in territorial springbok which were sometimes seen lying down or standing for quite long periods.

Reproductive behaviour

On 19 May 1971, an adult male approached an adult female from behind with head and neck held out in a near horizontal position (similar to the extended neck posture described in Thomson's gazelles by Walther 1964), and making an "urr-urr-urr" noise. The female crouched slightly to urinate and then walked on, and the male nosed the ground where she had urinated. It was not possible to see whether the male then performed "Flehmen".

On 18 August 1971, an adult male springbok was seen to approach several females in turn from behind, with his head and neck extended as though sniffing, and at times emitting an "urr-urr-urr" sound, possibly serving as a "driving" call, described in Grant's gazelle by Walther (1965). However, whenever his nose came to about 30 cm from her tail, the female walked forward. One female stopped momentarily and he approached, with his head and neck extended, until quite close behind her. He then raised his left foreleg straight outwards and tapped the ground three times in a movement very similar to that described for Grant's gazelle by Walther (1965), who interpreted this as a relic or precursor of the mating kick ("Laufschlag"). The male did not touch the female with his foreleg when he performed this abbreviated Laufschlag, which has also been observed in springbok by Bigalke (1963). "Flehmen" was not observed.

Mother-young relationships

On 23 October 1971, an infant springbok (the second recorded that spring) was seen with an individually recognisable ewe and one adult male in the southeastern sector of the reserve. On 21 October, this ewe had been seen about 600 metres further north without an infant. Then, on 26 October the same ewe was seen on a firebreak burn, still in the company of the same adult male, about 600 metres to the south, but no infant could be seen anywhere in her vicinity. On 30 October the same ewe and adult male were again seen with the infant, very close to the site where they had been seen on 23 October. It seems possible that the infant had been left lying hidden in this location while the mother foraged at a distance.

Lying-out behaviour occurs in both Thomson's and Grant's gazelles, i.e. the lamb lies hidden in the grass for a period after birth but is visited at intervals by the mother for suckling (Estes 1967). According to Bigalke (1966), springbok lambs lie hidden for the first few days after birth and usually move only when the mothers visit them for suckling. Estes (op. cit.) records that the females of both Thomson's and Grant's gazelles withdraw from their herds a short distance and drop their lambs in medium to long grass, but may give birth on bare ground for lack of anything better.

At 09h40 on 12 January 1972, a nursery herd of 23 springbok (12 females, 11 young) accompanied by one adult male was disturbed on an area of very short open grassland that had been burnt on 20 September, 1971. The agitated behaviour of one adult female who repeatedly looked in a particular direction as she moved off, attracted my attention. An infant springbok, judged to be only hours old, was found lying down on the open ground. No sign of afterbirth could be found, but the infant was still wet and appeared unable to get to its feet yet, although it tried once when I approached and stood next to it. Walther (1965) described how a newly born Grant's gazelle lamb, after it had gained its feet and sucked, moved, with its mother's help, away from its place of birth to lie out in a patch of tall grass.

CONCLUSION

Records of the distribution of breeding and lambing of springbok in the Jack Scott Nature Reserve are not available for previous years, and the 1971/72 pattern may have been atypical. Thus the possible seasonal variation in territoriality related to seasonality of breeding (and also food availability) is not known. Population density and dispersion of food items may influence sizes of male springbok territories and of female springbok herds and home ranges. Detailed information on such aspects as the spatial distribution of bachelor males relative to herds of females and territorial males, variation in the proportion of adult males occupying territories, and the process of acquisition and loss of territories, was not obtained.

The criteria of Leuthold (1970) for territoriality in antelope, provided the basis for indirect evidence of territoriality in springbok; direct evidence in the form of aggressive behaviour towards conspecific males was also recorded. All the observations strongly suggest that springbok in the Jack Scott Nature Reserve are territorial. However, the study population was small, and social organisation in springbok populations in other environments may differ in many particulars.

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