On the sexual cycle of mature bachelor bontebok rams at the Bontebok National Park, Swellendam

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The bontebok *Damaliscus dorcas dorcas* is indigenous to the south western Cape grassveld where it is an endangered species. It is protected in the Bontebok National Park (BNP) and other nature reserves in the Cape Province. In BNP there was concern because the annual lambing percentage had, for 14 years prior to 1973, been of the order of 54% following a lambing season in August/February each year. De Graaff, Van der Walt and Van Zyl (1979) considered this a low reproductive rate and ascribed it to ram interference or protein deficiency. It was therefore decided to reduce the number of males and thereby interference by bachelors during the rut and to implement a long-term veld burning programme to improve the grass cover. Moreover, by post mortem examination of the culled males, it was possible to extend the studies on this species to obtain a better understanding of fertility levels in male bontebok. This paper reports the results of this preliminary study.

A total of 24 rams were culled in three batches of eight during early June, September and February 1975/76. Only 21 rams were compared as three individuals were not fully mature. Two of the rams were territorial so the present comparison is between groups of mature bachelors. Bachelors were selected and each individual shot through the neck with a 0,22 hornet rifle. Blood was collected from the jugular vein into heparinized glass tubes, the plasma separated by centrifugation. Plasma testosterone and luteinizing hormone were quantitated by radio-immunoassay (Millar & Kewly 1976; Millar & Aehnelt 1977).

After being shot the buck was taken immediately to a slaughtering area where it was weighed and dressed. The kidney fat index (KFI) was determined for each carcass following Riney (1955) and the percentage fat in the right buttock of each carcass dissected out (Butterfield 1962) in order to obtain an estimate of condition.

Testes and epididymes were weighed, one sample of epididymal fluid examined for spermatozoa under the microscope and a nigrosin eosin smear made with another. Slices of testes were fixed in Bouin's fluid and embedded in paraffin wax, sectioned at 5 μm, stained with Delafield's haematoxylin and chromotrope 2R and the state of spermatogenesis noted.

The results are summarized in Table 1 from which it can be noted that, although the lightest group in poorest condition were culled in June, there was little difference between the appearance of the three groups. Nor was there a great deal of difference between the mean body mass of the three groups but the rams were heavier during the first half of the breeding season in January to March. This is also indicated by mean KFI and percentage buttock fat values, reliable indices of condition in impala according to Monro and Skinner (1979), which indicated condition in the June group to be fair and in the other groups good.

Testosterone was not assayed in all rams (four in June and September and six in February) but clearly peaked at the onset of the mating season and reached its lowest point in June when three of the rams had levels < 1 nm/1. Testosterone values were also measured in three mature rams in April 1975 from De Hoop Nature Reserve where the mean value was 23,5 nm/1 in accordance with the February mating season levels for BNP. Plasma LH exhibited no significant seasonal variation. Mass of testes and epididymes was lowest in June when there was also a decline in number of mitoses resulting in a reduced output of spermatozoa and even a disruption of the spermatogenic cycle in four instances. However, by September spermatogenesis had apparently recovered. This trend is similar to that in the related blesbok *D. d. phillipsi* (Skinner & Huntley 1971) although it seems to be somewhat masked by the influence of rainfall and its effect on nutrition during winter in Swellendam. Motile spermatozoa were invariably present in the fluid extruded from the epididymis; the fluid was creamy in appearance which is consistent with a sperm density $>500 \times 10^6$ sperm/ml (Van Rensburg 1957) although the volume declined markedly in June. Between 75 and 85% of the spermatozoa had a morphological appearance which is assumed to be normal for this species (Dott & Skinner In prep.). Estimates of the proportion of live spermatozoa could not be made on nigrosin-eosin smears because all the spermatozoa appeared to be eosinophilic even when the undiluted semen exhibited wave motion and 50% of the spermatozoa were motile after the semen had been diluted. The same phenomenon was observed in blesbok and tsessebe (Dott & Skinner In prep.), and in the blesbok there was no question of infertiity, therefore this cannot be assumed to indicate infertility in the bontebok and there was no other evidence of infertility in the bontebok rams examined whether they were territorial rams or from a bachelor group.

Although the norm for territorial breeding rams has not been established, the evidence indicates that the males were in fair breeding condition. There are however known differences between the sexual capacity of territorial rams and bachelors which favour the former in blesbok (Fairall Unpub.). In contrast to the results obtained at Swellendam

Table 1 Carcass characteristics and sexual parameters (± S.D.) of bachelor bontebok rams culled at the Bontebok National Park, Swellendam during three seasons of the year

	June 1975	September 1975	February 1975
Body mass (kg)	59,6 ± 4,32	59,9 ± 6,19	63,6 ± 3,36
Carcass mass (kg)	29,1 ± 3,61	30,9 ± 3,41	32,2 ± 2,41
Dressing (%)	48,8 ± 4,72	51,5 ± 1,58	50,6 ± 2,30
Carcass length (cm)	72,7 ± 2,90	73,1 ± 2,73	74,3 ± 1,70
KFI + (Range)	15,1 (15,8 — 33,3)	49,6 (30,1 — 74,0)	41,6 (23,1 — 74,4)
Buttock fat percentage of wet mass	0,42 ± 0,21	0,75 ± 0,16	0,62 ± 0,29
Testes mass (g)	79,2 ± 30,52	118,6 ± 28,51	114,6 ± 17,48
Epididymes mass (g)	16,3 ± 6,32	24,4 ± 4,77	31,0 ± 12,0
Plasma testosterone (n Mol/L)	3,1 ± 4,25	11,8 ± 8,51	322,6 ± 6,68
n	7	7	7
Condition visual	Fair	Good	Good

the semen obtained by electroejaculation from a territorial ram (at De Hoop in April 1975) exhibited wave motion whereas no spermatozoa could be found in the ejaculate of a ram from a bachelor group on the De Hoop Provincial Nature Reserve in April 1975 (Dott & Skinner In prep.). A more extensive study would be required to clarify the situation, preferably on the live animal. If a detailed study of the male and female behaviour were conducted at the same time a good foundation would be established for formulating a management policy.

Table 2 actually represents the instantaneous lambing rate or net reproductive rate as reflected for the time at the end of the lambing season. This does not include mortality which may have occurred amongst the lambs during the rather extended lambing season of about 4–5 months as reported by De Graaff *et al.* (1976). An average post lambing net reproductive rate of 54% must therefore be considered quite reasonable, especially if compared with the reproductive performance of a healthy blesbok population (Du Plessis 1972). Du Plessis reported a gross pregnancy rate of 84,5% for blesbok at the Van Riebeeck Nature Reserve (VRNR) near Pretoria and a neonatal mortality rate at the end of the lambing season of 36,6%. It is not unreasonable to assume that similar early mortalities also occur in a bontebok population, which if applied at BNP would give a gross pregnancy rate of 85,2% which compares favourably with that for blesbok.

Table 2 Instantaneous lambing percentage and population growth of bontebok in the Bontebok National Park over a 19-year period (1960 — 1978)

Year	*Instantaneous lambing percentage	**Population total
1960	50	68
1961	68	80
1962	70	92
1963	82	121
1964	58	145
1965	56	158
1966	44	180
1967	61	208
1968	62,5	255
1969	51	294
1970	29	263
1971	33	280
1972	52	285
1973	41	***263
1974	—	***—
1975	—	***—
1976	56,8	***234
1977	61,5	239
1978	51	303
Average	54,5	

*Instantaneous lambing percentage presents the ratio of lambs to adult ewes expressed as a percentage.
**Population total denotes the total at the time of the count and therefore excludes natural mortality during the year.
***About 65 mles culled from the population.

Results from the present study indicated that the bontebok rams were all in fair to good body condition and breeding condition at the commencement of the burning programme. A macro-nutrient deficiency therefore does not seem to have been a limiting factor on the population at that stage.

It is therefore not surprising that in spite of the culling of males and apparent improvement of the habitat through burning and a reduction in the stocking rate, the lambing percentages for the ensuing years did not alter significantly (Table 2). This further corroborates the conclusion that a post-lambing seasonal lambing percentage of 54% must be considered the norm for bontebok in the BNP and permits a satisfactory population growth as indicated in Table 2.

An unknown factor is however the extent and causes of lamb mortality. If the prime objective is to improve the neonatal survival rate further studies are necessary to establish what these are.

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Early postnatal development, parental care and interaction in the banded mongoose *Mungos mungo*

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The banded mongoose *Mungos mungo*, has been reported on by Simpson (1964 & 1966), Neal (1970), Michaelis (1972) and Rood (1974 & 1975). However, no comprehensive records have been published of the early physical and behavioural development which is the object of this note. A litter of three (two males and one female) was born in captivity in February 1976. The pups were weighed and measured every day for the first 19 days, thereafter intermittently until Day 43 and once more on Day 86.

Physical and behavioural development

This is summarized in Tables 1 and 2. Increment in hindfoot (c.u.) and ear measurements had reached an asymptote by Day 86. The pups were born at 5,4% of adult mass which was calculated as 1,35 kg from Rood (1975) and Sadie (*pers. comm.*); by Day 86 they had reached 59,7% of adult mass. Mass discrepancies do occur e.g. Simpson (1966) quoted a three-day old mongoose to weigh much less than those in the present study, but it may have been abandoned by the parents particularly as Sadie (pers. comm.) found that wild young were heavier than those hand-reared. In the present study the captive litter, which suckled from the dam, had already reached a mass by Day 86 that Rood (1975) attributes to subadults of six months to a year.

Table 1 Physical development of the banded mongoose, *Mungo mungo*, after the first day (Day 0) (Figures in parenthesis indicate day that the particular development was first noticed).

Ears	(1)	Partly folded back.
Eyes	(4)	Dark line where eyelids part. (8) Eyes of one male open (sex distinguishable by Day 6). (9) All eyes open. (19) Marked improvement in eyesight.
Teeth	(0)	Incisors 1 mm long. (8) Canines break through. (14) First molars appear. (16) Premolars appear. (17) Second molars appear.
Feet	(0)	Well-developed with toes separate.
Hair	(0)	Sparse pelt except on ventral surface of tail; pigmentation bands of adult dorsum visible in skin; vibrissae well-developed. (1) First black band visible on individual hairs. (7) Body hair 11,4 mm long; genal vibrissae 10 mm long; (10) Ventral tail surface now also haired, except close to genitalia. (15) Ventrum well pigmented.
Mobility	(1)	Pups crawl in circles and climb out of a 9 cm scale pan. (9) Increased activity, they bounce around, even lifting the forequarters in forward movement. (10) When held upside down, the tail is circled continuously in righting movement, but circular crawling has disappeared. (12) Movement still awkward; yawn, self-groom, go through handstand climbing action of analmarking. (15) Leave nest at will, follow mother about. (16) Stand on hindlegs in alert posture. (19) Pronounced scratching at ground and at faeces. (21) Jump out of scale pan and bite handler, play vigorously. (28) Rush at one another, climb fence. (30) Tails so strong that it is almost impossible to straighten them for measurement. (33) Sideways component to play, i.e. backing away with body angled 90° at the middle. (35) Chasing component of play prominent. (36) Allo-grooming of parents. (49) Head-rolling.

Table 2 Behavioural development of a litter of three banded mongoose (Figures in parenthesis indicate day that the particular development was first noticed)

Contact	(15)	Continuously climb over adults and play-jump at one another, often followed by a mounting. (21) Play vigorously, wrestling, biting, shaking and often scratching the ground. (26) Allo-groom. (34) Much play consisting of biting, clasping or scratching-one another.
Alarm	(8)	First alarm reactions — growls and alarm chirrups (12) Jerk spit and urinate at sudden movements and adult alarm chirrup, bunch together in scale instead of trying to climb out. Bunching is an adult group alarm reaction (Rood 1975). (16) Take fright at greater distance.
Vocalization	(0)	Squeak incessantly when alone, presumably to call mother; contact 'kuks' when with mother. (6) Contact 'kuks' when hand-held, but whistle (audible from $\geq$100 m) when put down. (8) Chirrup-quality present in alarm whistle, growl, and low-intensity alarm gurgle; squeak in appeasement towards adults.
Elimination and Marking	(19)	Scratching at faeces followed by defaecation in latrine corner of cage, analdrag. (23) Anal gland secretion of males first seen. (40) Chin-wiping. (49) Head-roll follows chin-wipe.
Feeding	(19)	Scratch at objects and feed on solids. By this time pups accompany adults on short sorties, and scratching is probably as Rasa (1973b) describes for *Helogale*, helpful in turning leaves and debris in search of food. (40) Keep food to themselves, growl.