Notes on two brief surveys of the small mammal fauna on the Rooiberg, Ladismith, southern Cape Province

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Two brief ($3\frac{1}{2}$ days each) trapping surveys of the small mammal fauna in fynbos vegetation on the Rooiberg mountains were conducted at the beginning and end of the rodent breeding season in 1978. Four study areas were selected at different altitudes and in different vegetation types. A total of six rodent, three shrew and one small carnivore species were captured. Estimates of density and biomass are given and were found to be relatively high for fynbos communities at the end of the breeding season (March). Differences were found between the fauna inhabiting north-facing and south-facing slopes.

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Twee kort ($3\frac{1}{2}$ dae elk) vangsopnames van die kleinsoogdierfauna in die fynbos op die Rooiberge is aan die begin en einde van die knaagdierteelseisoen in 1978 gedoen. Vier studiegebiede met verskillende hoogtes en verskillende tipes plantegroei is gekies. 'n Totaal van ses knaagdierspesies, drie skeerbekspesies en een klein roofdierspesie is gevang. Beramings van die digtheid en biomassa word gegee en hieruit blyk dit dat die digtheid en biomassa relatief hoog is vir fynbosgemeenskappe aan die einde van die teelseisoen (Maart). Verskille is gevind tussen die fauna wat voorgekom het aan die noordelike en suidelike hellings.

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The Rooiberg Forest Reserve, southern Cape Province, is situated in the Rooiberg Mountains at 33°40'S/21°30'E. These mountains run east-west and roughly parallel to the Langeberge to the south and the Klein Swartberge to the north. The Reserve lies in the triangle formed by Ladismith and Calitzdorp to the north and Vanwyksdorp to the south. It ranges in altitude from below 600 m to peaks just under 1 520 m and covers an area of approximately 300 km^2.

Two faunal surveys were conducted by members of the Zoology and Botany Departments and the Percy FitzPatrick Institute of the University of Cape Town, who were housed in a forestry hut at an altitude of 1 460 m. The small mammals taken are reported on here. The first survey (23 – 27 March 1978) commenced towards the end of the summer breeding season for small mammals in the south-western Cape. The second (24 – 28 November 1978) coincided with the expected beginning of the breeding season.

It is stressed that all the results should be regarded as preliminary and that it is quite impossible to carry out a comprehensive survey in $3\frac{1}{2}$ days of trapping. Publication of these results appears justified in view of the fact that the small mammal fauna of the south-western Cape mountains is in general poorly known and little or no trapping has ever been carried out in many areas.

Climate

Table 1 shows the mean monthly and annual rainfall on the Rooiberg from 1977 – 1982. It can be seen that the region received rain all year round, but with a minimum in the late summer months of January through March. Although precipitation occurs throughout the winter, it is less than in the spring and early summer and hence the region cannot be classed as a winter rainfall area.

Vegetation

The vegetation is unspoilt fynbos which stretches in unbroken stands of great beauty in all directions. Since the mountain range runs from east to west, major habitat differences exist between the south-facing and north-facing slopes. Taylor & Van der Meulen (1981) divide the vegetation into two principal communities, namely the *Erica – Restio* communities of the north-facing slopes and the *Protea* communities of the south-facing ones. If one selects almost any east-west valley on the Rooiberg and compares the vegetation on the two slopes the difference is very striking. The north-facing slope is very open and has small, low shrubs, whereas the south-facing slope is covered with a dense thicket of *Protea* shrubs up to 3 m

Table 1 Mean monthly and annual rainfall (mm) on the Rooiberg 1977 – 82. The figures are the averages of five stations ranging in altitude from 914 – 1 474 m

Jan	26,4	July	35,9
Feb	24,1	Aug	43,8
Mar	22,5	Sept	54,0
April	55,9	Oct	39,5
May	32,3	Nov	41,7
June	42,3	Dec	55,1
Annual mean 473,5			

in height. The major areas of north-facing slopes are designated by Taylor & Van der Meulen (1981) as 'N1' — upper ericoid/restioid above 1 060 m. The dominant species here are *Thamnochortus argenteus, Restio* sp., *Hypodiscus purpureus, Tetraria ustulata* and *Pantaschistis* sp. Taylor & Van der Meulen (1981) designate the major areas of the south-facing slopes as 'S1' — proteaceous slopes dominated by *Protea punctata, Leucadendron comosum, L. salignum, Erica hispidula* and *Hypodiscus albo-aristatus.*

Methods

Four live-trap grids for small mammals were established in different vegetation types. Grid 1 on both surveys was trapped on the first night only, after which the traps were moved to Grid 2. Trapping was then conducted simultaneously in Grids 2, 3 and 4 for a total of 2 200 (2 070) trapnights, using 330 (300) Sherman live-traps plus 70 (60) kill-traps per night (November figures in parentheses) for up to three days and four nights (maximum seven sessions). One trapnight is defined as one 12-h (roughly) trapping period; a 24-h daily cycle therefore consists of two trapnights. The traps were baited with a mixture consisting of peanut butter, oatmeal, beef fat and dried fruit. Traps were checked morning (from 08h30) and evening (from 17h00).

All small mammals caught were identified, weighed and sexed and external reproductive condition was noted. In Grids 2, 3 and 4 live-trapped mammals were marked by toe clipping and released (except in Grid 2 in March, where due to an oversight animals were not marked). Kill-trapped mammals were measured and dissected so as to ascertain the internal reproductive state. Stomach contents were kept and study skins and skulls were prepared.

Animals were classified into adult or juvenile age classes on the basis of body mass (Table 9). In this paper, adults are considered to be animals which are sexually, though not necessarily physically, mature. Although using body mass as the sole criterion may lead to some animals being wrongly classified, gross error is unlikely as is demonstrated by the results of five years of kill-trapping *Rhabdomys pumilio* on the Cape Flats (David 1980; Henschel, David & Jarvis 1982). These showed that female *R. pumilio* were sexually mature at 26 – 31 g and males at 35 – 40 g body mass. In this paper, *P. pumilio* were classified as adult if they weighed >34 g (males) or >30 g (females), otherwise as juvenile. The same criteria were applied to *P. verreauxi* and *A. namaquensis* since their body mass was comparable with *R. pumilio*. In the case of *A. subspinosus*, based on the information in Table 9, adults were considered to weigh 17 g or more and juveniles 13 g or less.

Details of each grid are given in Table 2.

Results and Discussion

The results of trapping in the four individual grids are shown in Tables 4 to 8. A summary of species captured and abundance for all the grids is shown in Table 3. In all, six species of rodents and three insectivores (two shrews and one elephant shrew) were captured. This compares with five rodent and two shrew species caught in the Swartberg and five rodent and one shrew species caught in the Baviaanskloof by Bond, Ferguson & Forsyth (1980); and with 10 rodent and three shrew species caught in the Kammanassie Mountains by Nel, Rautenbach & Breytenbach (1980).

The results indicate that considerable numbers of small mammals occur on both the more exposed north-facing and the more sheltered and densely vegetated south-facing slopes. However, in March, evidence from Grids 3 and 4 shows that considerably more mammals were caught on the south-facing slopes than on the north-facing ones (see Table 6, column showing corrected south-facing slope captures). This was due to the great abundance of *R. pumilio* at the end of the breeding season.

Two specimens of *P. verreauxi* were recaptured in Grid 3 in November (male 55 g; female 48 g) which had been originally marked in March (male 41 g; female 30 g).

Notes on some of the species captured

The ubiquitous striped fieldmouse, *R. pumilio*, was by far the most abundant rodent caught in all the grids in March, though it was relatively scarce in November. It occurred on both north and south-facing slopes. This diurnal mouse is very adaptable and is found in a wide variety of habitat types from semi-desert to tropical grassland. It normally prefers fairly thick cover and Bond *et al.* (1980) found that its abundance was strongly correlated with the amount of grass cover. Table 6 shows that 33 specimens were caught in Grids 3 and 4 on the exposed north-facing slopes where grass was scarce and cover sparse. However, its strong preference for the more densely vegetated south-facing slopes, where there was more grass as well as closely packed *Protea* bushes, is shown by the fact that an estimated 99 specimens would have been caught on south-facing slopes had equal numbers of traps been set on both slopes (Table 6 'corrected' columns). Even without a correction factor more *R. pumilio* were caught on the south-facing slopes.

Praomys (Myomyscus) verreauxi

This nocturnal species is endemic to the southern Cape Province (Davis 1962, 1974) and according to Misonne (1968) is found only between Klaver (280 km north of Cape Town) and Knysna. Specimens caught on the Rooiberg clearly belong to the subgenus *Myomyscus* as they had a tail length averaging over 125% of head and body length.

Our trapping results suggested a dependence on *Protea* flowers, as all specimens except three were caught on south- or northeast-facing slopes with *Protea* shrubs. Furthermore, chewed-off protea seed heads were common on the floor of the *Protea* stands. This supposition should be further investigated in view of the findings of Wiens & Rourke (1978) that some geoflorous species of *Protea* are specifically adapted for rodent pollination. They have demonstrated that *P. verreauxi* is one of the rodent pollinators. Pollination is effected while the mouse is foraging for nectar from the flower.

Aethomys namaquensis

This is the common rock rat found throughout Africa south of the Zambesi. It is nocturnal. We caught it only on the more exposed and rocky north-facing slopes. Bond *et al.* (1980) also caught it mainly on northern slopes in the Swartberg. They found that numbers of *Aethomys* were correlated with total ground cover of rocks and bare soil and also with succulent cover percentages. It was never found in areas with more than 75% total shrub cover.

Acomys subspinosus

This nocturnal mouse is endemic to the south-west Cape. It

Table 2 Details of the four trapping grids in March and November 1978 (figures for November appear in parentheses)

Grid	Vegetation	Location	Altitude	No. live-traps	No. kill-traps	Live-trap spacing	No. trap checks	Grid area m²*	Results
1	N4 (Taylor & Van der Meulen 1981). Arid fynbos. Shrubs 1 m high, 45% cover; with a sparse ground storey (0,5 m high 10% cover) of arrow-leaved shrubs and graminoids	North-facing at base of Rooiberg	900 m	120 (104)	24 (0)	6 rows; 18 m between rows and between traps	1, a.m. 0, p.m.	39 820	Table 4
2	Mixed proteoid – ericoid – restioid. Protea shrubs 1 – 2,5 m high, 10 – 30% cover. *Restio – Erica* 0,5 m high, 75 – 90% cover. Some areas dominated by *Passerina* sp. with grass	Northeast-facing facing slope, below and west of forestry hut	Approx. 1 280 m	120 (100)	24 (22)	4 rows, 30 traps per row, 9(18) m between rows and 18(1,35) m between traps	3, a.m. 1, p.m. (3, a.m. 2, p.m.)	25 474 (30 451)	Table 4 (7)
3	South-facing slope S1 (Taylor & Van der Meulen 1981): (1) 2 – 3 m high *Protea punctata*; 20 – 75% cover. (2) 0,2 – 0,75 m high closed (90% cover) ericoid – graminoid. Kloof bottom: 3 m high restioid – ericoid, 75 – 100% cover. North-facing slope N1 (Taylor & Van der Meulen 1981): (1) 0,75 – 1,25 m high Passerina, 20% cover. (2) 0,25 – 0,75 m high graminoid-ericoid, 60% cover.	North and south-facing slopes of kloof in front of forestry hut	Approx. 1 460 m	100 (100)	0 (0)	4 rows, 25 traps per row. 10(18)m between rows and 10(13,5) m between traps. 42(44) traps on N. slope and 58(56) traps on S. slope plus kloof bottom	4, a.m. 2, p.m. (4, a.m. 3, p.m.)	13 000 (25 456)	Tables 5 & 6 (8)
4	North-facing slope N1. (1) 0,25 – 0,5 m high restioid – ericoid 70% cover on ridge. (2) 0,25 – 1,0 m high restioid; 0,25 – 0,5 m high ericoids, 85% cover on slope. Kloof bottom: 1,5 – 2,5 m high ericoid – restioid, 95% cover. South-facing slope S1: (1), 2,5 m high *Protea punctata*, 30% cover; 0,25 – 1,0 m high ericoid – restioid. (2) 0,25 – 1,0 m high ericoid – restioid.	Steep north and south-facing slopes of kloof about 1 km east of forestry hut	Approx. 1 370 m	111 (101)	24 (24)	4 rows, 30(26), 30(25), 26(25), 25(25), traps per row. 45(22,5) m between rows and 13,5(13,5) m between traps. Every 5th live-trap had a kill-trap set nearby. 114(125) traps on N slope 21(0) traps and Kloof bottom and S-facing slope	3, a.m. 3, p.m. (3, a.m. 2, p.m.)	61 690 (30 100)	Tables 5 & 6 (8)

*Grid area includes 10 m wide perimeter

apparently prefers rocky areas since most specimens were taken on the more exposed and rocky north-facing slopes. However, two specimens were caught on a south-facing slope with dense *Protea* in Grid 4 in March (Table 6), and four out of 19 specimens were caught in the kloof bottom in November. As it was also caught on the north-east slope with proteas in Grid 2 (Table 4), it seems to be fairly tolerant in its habitat requirements. Bond *et al.* (1980) found that the numbers of this species were positively correlated with (a) increasing altitude; (b) medium size rocks, about 1,0 m diameter; and (c) dense phytomass below 60 cm high. They also caught it primarily on north slopes but some were caught on south slopes in the Baviaanskloof. We caught it at high altitude in the Rooiberg, but did not adequately sample lower altitudes. Nel *et al.* (1980) caught *Acomys* in a variety of habitats in the Kammanassie Mountains — mostly at altitudes of over 1 000 m, but once as low as 640 m.

Table 3 Summary of trapping results in all grids

		Total individuals caught	
		March	November
Rhabdomys pumilio	striped fieldmouse	129[a]	7
Praomys verreauxi	Cape mouse or Verreaux's mouse	34[a]	7
Aethomys namaquensis	rock rat	31[a]	3
Acomys subspinosus	spiny mouse	13[a]	22
Mus minutoides	pigmy mouse or dwarf mouse	1	0
Otomys irroratus	vlei rat	0	3
Myosorex varius	common shrew	11	30
Crocidura cyanea	musk shrew	2	0
Elephantulus edwardi	Cape elephant shrew	13	6
Herpestes pulverulentus[b]	Cape grey mongoose	2 or 3	3

[a]Includes recaptures for Grid 2 (live-trapped animals not marked in Grid 2 in March).
[b]Caught in carnivore traps set within the grids.

Table 4 Summary of trapping results in Grids 1 and 2 (March 1978). (Animals were not marked in these two grids.)

	Grid 1: 120 live-traps, 24 kill-traps, 144 trapnights			Grid 2: 120 live-traps, 24 kill-traps, 576 trapnights					
		SAA			SAA			TCIR	
Species	NIC	A	U	NIC*	A	J	U	am	pm
R. pumilio							7	30	13
P. verreauxi								11	
A. namaquensis	4	48,50 g 2♂	2					3	
A. subspinosus								2	
M. minutoides									
E. edwardi	2	2♂		6	1♂ 1♀		4	6	
M. varius									
C. cyanea									
Total	6							52	13
% Trap success	4,2								

NIC = Number of individuals caught. *Only available for *E. edwardi* in Grid 2. TCIR = Total captures including recaptures. SAA = Sex and age. (Age estimated on the basis of body mass; see text.) A = Adult; J = Juvenile; U = Unknown. am = Morning trap check, commencing about 08h30. pm = Evening trap check, commencing about 17h00.

Table 5 Summary of trapping results in Grids 3 and 4 (March 1978). (For abbreviations see footnotes to Table 4.)

	Grid 3 (area 1,3 ha): 100 live-traps, 0 kill-traps, 600 trapnights						Grid 4 (area 5,2 ha): 111 live-traps, 24 kill-traps, 810 trapnights					
		SAA						SAA				
Species	NIC	A	J	U	mean body mass (g)	biomass (g)	NIC	A	J	U	mean body mass (g)	biomass (g)
R. pumilio	41	17♂ 12♀	4♂ 6♀	2	40,4	1 656	43	3♂ 13♀	8♂ 15♀	4	33,4	1 503
P. verreauxi	16	9♂ 5♀	1♂	1	41,1	658	7	1♂	2♂ 4♀		25,9	181
A. namaquensis	3	2♂ 1♀			46,3	139	21	13♂ 6♀	1♂	1	43,4	912
A. subspinosus	4	2♂ 2♀			19,3	77	7	3♂ 3♀		1	22,6	158
M. minutoides	1	1♂			10	10	0					
E. edwardi	1	1♀			48	48	4	1		3	49	196
M. varius[a]	10	7		3	12,0	120	1	1			9	9
C. cyanea	0						2	1♀		1	10	20
Total	76	59	11	6	35,6	2 708	85	45	30	10	35,0	2 979
% Trap success	12,7						10,5					
Density[b] *N*/ha	58,5						13,7					
Biomass[b] g/ha						2 083						480,5

[a]Live shrews were not sexed in the hand. [b]Density and biomass estimates are minimum values based on animals actually caught. No correction has been made for animals present but not captured.

Table 6 Habitat preferences of animals captured in Grids 3 and 4 in March 1978

	Grid 3				Grid 4				
		Caught on				Caught on			
Species	Total individual mice caught	N-facing slope (42 traps)	S-facing slope + kloof bottom (58 traps)	Corrected S-facing slope[a]	Total individual mice caught	N-facing slope (114 traps)	S-facing slope + kloof bottom (21 traps)	Corrected S-facing slope[a]	Total animals caught (both grids)
Rhabdomys	41	3	38	28	43	30	13	71	84
Praomys	16	–	16	12	7	3	4	22	23
Aethomys	3	3	–	–	21	21	–	–	24
Acomys	4	4	–	–	7	5	2	11	11
Elephantulus	1	1	–	–	4	4	–	–	5
Myosorex	10	–	10	7	1	–	1		11
Crocidura	–				2	2	–		2
Mus minutoides	1	1	–	–	–				1
Total	76	12	64	47	85	65	22	104	161

[a]Corrected number of individual mice caught assuming the same number of traps set on both north and south-facing slopes (and trapping area reduced or increased proportionally).

Table 7 Summary of trapping results in Grids 1 and 2 (November 1978). (For abbreviations see footnotes to Table 4.)

	Grid 1: 104 live-traps, 0 kill-traps, 104 trapnights			Grid 2 (area 3,0 ha): 100 live-traps, 22 kill-traps, 610 trapnights				
		SAA			SAA			
Species	NIC	A	J	NIC	A	J	mean body mass (g)	biomass (g)
R. pumilio				4	2♂ 1♀	1♂	40,0	160
P. verreauxi				2	2♂		51,0	102
A. namaquensis	1	1♀						
A. subspinosus	2	2♂						
E. edwardi	2	1♀ 1?		2	2♂		43,5	87
M. varius				4	2? 2♀		11,0	44
O. irroratus				2	2♂		84,5	169
Total	5	5	0	14	13	1		562
% Trap success	4,8			2,3				
Density[a] *N*/ha				4,6				
Biomass g/ha								184,3

[a]See Table 5 footnote[b].

Myosorex varius

Nocturnal. This is the most common shrew found in the western and southern Cape. It occurs as far north as the Transvaal Highveld and prefers moist regions with dense cover (Meester 1968).

Elephantulus edwardi

According to Roberts (1951) this genus inhabits rocky areas and is diurnal. All 19 specimens were caught on the rocky north- or northeast-facing slopes. However, they were all caught in the morning trap check, none in the evening check. This may raise some doubt as to whether this species is diurnal, since it was caught with other typically nocturnal species such as *Aethomys, Praomys* and *Acomys*. Although it is conceded that, since the morning check did not commence till 08h30, they could have been caught after sunrise, it nevertheless seems strange that none was caught in the evening check, unless the activity pattern is in reality crepuscular.

Insufficient habitat data are available for comment on the other small mammals captured.

Diversity, population density and biomass of small mammals

It is necessary and useful to analyse faunal composition, but as Bigalke (1980) remarks: 'the abundance of various mammals is much more important for an understanding of ecosystem function'. Unfortunately, very little is known about population densities of mammals in fynbos and the results of no long-term studies have been published. Results of studies in the Western Cape quoted by Bigalke (1980) show that small mammal communities usually consist of 4 – 6 prominent species (one of them an insectivore), with 2 – 3 more abundant than the rest. This compares with 10 – 16 rodent species for tropical habitats (Fleming 1975). The small mammal community on the Rooiberg, therefore, is fairly diverse, by fynbos standards, since 10 species were captured (Table 3).

One way to assess the abundance of small mammals is from the percentage trap success — the number of new individuals caught per 100 trapnights. Bigalke (1980) quotes figures of trap success in fynbos of 1,6% – 3,3% in the Cedarberg and in the Jonkershoek valley, Stellenbosch. During the March survey in the Rooiberg, in Grid 3, 76 different individuals were caught in 600 trapnights and in Grid 4, 85 individuals were caught in 810 trapnights (Table 5). This represents a trap success rate of 10,5% – 12,7% or from three to eight times better than those quoted by Bigalke. To some extent this is a seasonal phenomenon, since this was at the end of the breeding season for most small mammals and numbers were therefore expected to be close to their peak. Trapping in the same areas at the end of November (start of breeding season) yielded a trap success of only from 2,3% – 5,0% (Table 7 and 8). For comparison, in the Kammanassie Mountains Nel *et al.* (1980) recorded trap success rates of only 1,9% – 2,1% during February, when numbers might have been expected to be

Table 8 Summary of trapping results in Grids 3 and 4 (November 1978). (For abbreviations see footnotes to Table 4.)

	Grid 3 (area 2,5 ha): 100 live-traps, 0 kill-traps, 700 trapnights						Grid 4 (area 3,0 ha): 101 live-traps, 24 kill-traps, 625 trapnights				
	NIC		SAA		mean body	biomass		SAA		mean body	biomass
Species	N[a]	S[a]	A	J	mass (g)	(g)	NIC	A	J	mass (g)	(g)
R. pumilio							3	1♂ 2♀		54,0	162
P. verreauxi	0	4	2♂ 2♀		48,5	194	1	1♂		47	47
A. namaquensis							2	2♂		55,0	110
A. subspinosus							19	6♂ 6♀	4♂ 3♀	18,3	347
E. edwardi							2	1♀ 1?		58	116
M. varius	3	20	23		9,5	218,5	3	1♀ 2?		10,7	32
O. irroratus							1	1♂		58	58
Total	3	24	27	0		412,5	31	24	7		872
% Trap success	3,9						5,0				
Density[b] *N*/ha	10,6						10,3				
Biomass[b] g/ha						161,8					289,7

[a]N = North-facing slopes, S = South-facing slopes. [b]= See Table 5 footnote[b].

Table 9 Mean body mass (g) of adults live-trapped in Grids 2, 3 and 4 in March and November 1978

		March			November		
Species	Sex	*n*	$\bar{x}$(g)	Range	*n*	$\bar{x}$(g)	Range
R. pumilio	M	20	47,8	38 – 64	3	50,7	48 – 52
	F	25	39,6	31 – 52	3	52,7	46 – 64
P. verreauxi	M	10	42,3	35 – 48	5	50,4	47 – 55
	F	5	40,8	33 – 48	2	45,5	43 – 48
A. namaquensis	M	15	46,0	38 – 55	2	55,0	54 – 56
	F	7	42,2	33 – 54	–		
A. subspinosus	M	5	19,8	18 – 21	6	20,7	17 – 24
	F	5	22,8	18 – 30	6	23,5	21 – 26
E. edwardi	M	–			2	43,5	43 – 44
	F	2	48,5	48 – 49	1	58,0	–
M. varius	?	8	11,6	9 – 16	27	9,8	6 – 13
O. irroratus					3	75,7	58 – 101

relatively high. If one considers only individuals caught (and not total captures) then Bond *et al.* (1980) obtained trap success rates of 6,5% and 8,9% in the Swartberg and Baviaanskloof respectively, between 24 November and 20 January, i.e. during the breeding season. Thus, the trap success rates for fynbos obtained by Nel *et al.* (1980) are in agreement with those given by Bigalke (1980), whereas those obtained by Bond *et al.* (1980) and in this study were considerably higher.

A more direct way to measure mammal abundance is by estimates of density derived from numbers of animals caught in a given area. Bigalke (1980) quotes a collective density of four rodent species in fynbos of from 17 – 34 animals/ha. Table 5, 7 and 8 give estimates of small mammal density and biomass for some of our grids. These estimates are minimum values based on animals actually caught. True values would be higher. Grid areas were calculated by adding a 10-m wide perimeter to each grid. In March, Grid 3 gave a rodent and shrew density of 56 animals/ha and Grid 4 a density of 14 animals/ha, which dropped to 10,6 and 10,3 animals/ha respectively in November. With regard to biomass, Bigalke gives a figure of about 527 g/ha. In March, Grid 3 gave the remarkably high biomass figure for fynbos of 2 083 g/ha, whereas Grid 4 gave a biomass of only 480 g/ha. These figures were reduced to 162 and 290 g/ha respectively in November. However, it should be pointed out that in March Grid 4 was too large, with trap lines too far apart (50 paces). This is probably greater than the home range diameter of most mice, so that the area between the trap lines was not adequately sampled. This statement is based on the finding of Johnson (1980) that the mean home range diameter of a sample of 12 adult male *R. pumilio* was only 26 m.

It should be stressed here that only long-term studies will yield really meaningful estimates of small mammal abundance in fynbos. Small mammal numbers vary considerably both seasonally and between years and this may well account for much of the variation shown in the estimates given above.

Reproduction

In areas of the Republic outside the winter rainfall regions small mammals generally have reproductive peaks during the summer rainfall period (October through March), Brooks (1974). However, David (1980) demonstrated that *R. pumilio* on the Cape Flats (a winter rainfall region) also has a summer breeding season extending from September to April, with October through March being the most important months. We therefore expected breeding on the Rooiberg also to occur in summer and that March would probably mark the end of the season, and that by November (or earlier) animals would once again be in breeding condition after the winter recess.

In March (Table 10), apart from one lactating shrew and one perforate *Praomys*, no other females were pregnant or lactating, nor perforate. It therefore appeared that no breeding was taking place and since juvenile *R. pumilio* and *P. verreauxi* were recorded amongst both the live-trap and kill-trap samples (Tables 5 and 10) it is evident that the breeding season

Table 10 Data from kill-trapped animals

Species	Number and sex	Reproductive data
March 1978 (n = 31)		
R. pumilio	6 M	1 TD sperm present; 3 TU no sperm; 2 no data
	8 F	All Imp; 3 parous with mean of 8,6 placental scars; 2 no data
P. verreauxi	3 M	All TD; 2 sperm present.
	3 F	2 Imp. non-parous; 1 perforate parous, 8 scars
A. namaquensis	3 M	2 TD no sperm; 1 no data
	1 F	Imp. parous, 9 scars.
A. subspinosus	1 M	No sperm
E. edwardi	3 M	1 sperm present; 2 no data
M. varius	1 M	No data
	1 F	No data
C. cyanea	1 F	Lactating
November 1978 (n = 14)		
R. pumilio	1 M	TD, sperm common
	2 F	Both pregnant, 7 embryos each, not lactating
A. namaquensis	2 M	TD, sperm common
A. subspinosus	2 M	1 adult no sperm; 1 immature
E. edwardi	2 F	1 pregnant, 2 embryos; 1 lactating
M. varius	2 M	Both with sperm
	3 F	2 pregnant, 2 embryos each; 1 non-breeding

TD = Testes descended, TU = Testes undescended, Imp. = Imperforate.

was recently over. Although the epididymes of some big males contained sperm, there were several that contained none. The condition of the males is in any case not a very reliable guide to the proximity of the breeding season since David (1980) showed that the epididymes of some large male *R. pumilio* may contain sperm throughout the year. Our finding that breeding appeared to have ceased by the end of March on the Rooiberg suggests that the breeding season in the Cape mountain areas ends earlier than in lowland areas.

In November, owing to the low density of animals, only a few mice were kill-trapped and hence not as much information on reproduction was gained as had been hoped. The results are shown in Table 10, from which it can be seen that no *Praomys, Otomys*, or female *Aethomys* were kill-trapped. No juveniles of these species were trapped. There was, however, evidence that the other four species were all in breeding condition. Two pregnant and one juvenile *R. pumilio* and one lactating and one pregnant female *Elephantulus* were captured. Although numbers of both these species were low, it was clear that breeding was starting. In the case of *Myosorex* and *Acomys*, numbers were high in Grids 3 and 4 respectively. No female *Acomys* were kill-trapped but several juveniles were live-trapped and two pregnant *Myosorex* were captured. It therefore appeared that recruitment had taken place and breeding was continuing in these two species.

The generally low numbers and scarcity of juveniles of all species seem to suggest that breeding had not started long before our survey. Though the data are somewhat scant, our evidence points to an acceptance of a summer breeding season for several species in this montane area. However, it appears not only to end earlier but also to start later and hence is considerably shorter than in lowland areas. Two species may be exceptions to this generalization, namely *Acomys* and *Myosorex*, whose relatively high numbers in November compared to March suggest that recruitment may have taken place during winter.

Conclusions

Only tentative conclusions can be reached after such a short field survey. First, it is doubtful whether all rodent species present were captured. No specimens of *Otomys* were captured in March, though three male *O. irroratus* were captured in November. It seems likely that other *Otomys* species, such as *O. laminatus, O. saundersiae* or *O. unisulcatus* may be present, since both Nel *et al.* (1980) and Bond *et al.* (1980) refer to *Otomys* spp. other than *O. irroratus* in other southern Cape mountains. Apart from the absence of these species, the species diversity found in those two studies is similar to that reported here. Additional sampling at lower altitudes may also yield other species such as *Saccostomus campestris*, caught at about 640-m altitude by Nel *et al.* (1980).

With two exceptions, the results of the March survey appeared to show the numbers of small mammals at a peak coinciding with the end of the breeding season, which contrasted sharply with the low numbers found in November. Rodent populations usually experience low numbers just before the start of the breeding season, due to natural losses during winter which have not been made good by recruitment. The two exceptions, *Myosorex* and *Acomys*, both showed clear evidence of winter breeding.

It is interesting that in March more species were captured on the north-facing slopes than on those of southern aspect, considering that the former have a more arid, exposed and barren nature than the latter. (In November, the south-facing slopes were sampled only in Grid 3 where only two species were caught.) In Grid 3 (Table 5) five species were captured on the north-facing slopes compared to three on the southern aspect slopes. In Grid 4 the figures were respectively six and four species. A similar trend was found by Bond *et al.* (1980) who caught five species on north-facing slopes and only four on south-facing slopes in both the Swartberg and Baviaanskloof mountains. The situation is probably influenced by seasonal change in population levels (as illustrated by our November survey) and more frequent surveys would be necessary to clarify the picture.

Little is known about the role of small mammals in fynbos community dynamics. Bigalke (1980) says that the apparently low mammal biomass suggests that these animals do not consume much of the primary production and do not therefore play a significant role in energy and nutrient cycling. However, the present study has demonstrated that at its peak the small mammal density and biomass may be relatively high. The findings of Rourke & Wiens (1977) and Wiens & Rourke (1978), for example, in relation to the pollination of geoflorous *Protea* spp. by rodents may serve to encourage others to undertake research into the role played by small mammals in fynbos communities, thus leading to a better understanding of the relationships involved.

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