Mammals of the Kammanassie Mountains, southern Cape Province

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The mammal fauna of the Kammanassie Mountain State Forest Reserve and Mountain Catchment Area was censused in the high-rainfall southeastern sector and low-rainfall northwestern sector from 2 – 12 February, 1979. Collecting yielded 287 specimens of 17 species of small mammals, while the presence of a further 16 species of larger mammals was confirmed. Mean trapping success was low (2,0%) which reflects the low density of most species. Of the 10 species of small mammals collected in the southeastern sector *Acomys subspinosus* and *Otomys irroratus* were abundant, while *Rhabdomys pumilio, Praomys verreauxi* and *Myosorex varius* were common; the other five species collected were rare. In the northwestern sector the species composition and relative density of each differed. Here *Aethomys namaquensis* was abundant, *R. pumilio* common, and five other species (including *A. subspinosus* and *O. irroratus*) rare. Few carnivores occur. Stomach samples of collected specimens yielded information on feeding habits; species vary considerably in their diet. Twenty-four species of both large and small mammals occur in the southeastern part, and 25 in the northwestern sector; 17 species are common to both.

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Die soogdierfauna van die Kammanassie Staatbosreservaat en Bergopvanggebied was op twee plekke, nl. die hoë reënval suidoostelike en die lae reënval noordwestelike dele gemonster vanaf 2 – 12 Februarie 1979. Versameling van kleiner soogdiere het 287 individue van 17 spesies opgelewer, terwyl die teenwoordigheid van 'n verdere 16 spesies van groter soogdiere bevestig is. Gemiddelde vangsukses was laag (2,0%) wat die lae digtheid van meeste spesies weerspieël. Van die 10 spesies kleinsoogdiere wat in die suidoostelike deel versamel is, was *Acomys subspinosus* en *Otomys irroratus* volop, terwyl *Rhabdomys pumilio, Praomys verreauxi* en *Myosorex varius* algemeen voorgekom het. Die ander vyf spesies versamel was skaars. In die noordwestelike deel was die spesiesamestelling sowel as elk se relatiewe digthede anders: hier was *Aethomys namaquensis* volop, *R. pumilio* algemeen en vyf ander spesies (insluitende *A. subspinosus* en *O. irroratus*) skaars. Min roofdiere kom voor. Maaginhoude van versamelde eksemplare het gegewens opgelewer oor voedingsgewoontes: die spesies het aansienlik verskil van mekaar in dieet. Vier en twintig spesies van klein en groot soogdiere kom voor in die suidoostelike deel, en 25 in die noordwestelike; 17 spesies kom in albei gebiede voor.

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The Kammanassie Mountains are one of a series of 'island' mountains in the Little Karoo, situated between the coastal Outeniqua-Tsitsikama ranges in the south and the Swartberg-Baviaanskloof ranges, fringing the Great Karoo, in the north. Apart from the intrinsic value of assaying the mammal fauna of a pristine montane Forest Reserve, comparison of its mammalian complement with those of the surrounding plains and mountains to the north and south affords valuable insight into the filtering effects of surrounding more xeric conditions, and powers of dispersal of species found on nearby montane areas.

Due probably to the paucity of large mammals and the rugged and inaccessible terrain, the montane mammal fauna of southern Africa, and of the South West Cape Biotic Zone in particular, is rather poorly known. This is regrettable as in the southern Cape, for example, the marked gradients in rainfall, temperature, altitude and floristic component, which are found from the coast inland, result in a wide variety of habitat-types and microhabitats. Thus, apart from ecological considerations, the distribution of many species of small mammals could prove surprising. Prior to the present study only a few montane areas in the southern Cape had been sampled namely, on the Rooiberg (David 1978 a, b), Swartberg (Bond, Ferguson & Forsyth 1980) and Swartberg, Outeniqua and Baviaanskloof (Breytenbach in prep.). The aims of the present study were twofold: to document the mammals occurring on the Kammanassie Mountain Forest Reserve and Catchment Area, and to gain some insight into their ecology such as habitat selection, community structure and trophic relations.

Methods

Two localities within the Kammanassie Mountain Catchment Area were each sampled for seven consecutive nights during February 1979. The first locality (including Trapping Sites A – Q as listed in Tables 1 and 3, and identified as Locality 1 as in Table 2) is defined as 'Kammanassie Mountain Catchment Area, 12 km WNW Uniondale', and is situated at the coordinates 33° 37′S; 22° 54′E. The second locality is at coordinates 33° 36′S; 22° 33′E, and is defined as 'Kammanassie Mountain Catchment Area, 8 km SE Dysselsdorp'. The seven Trapping Sites sampled at the latter are listed in Tables 1 and 3 as AA – GG, whereas this particular locality is identified as No. 2 in the species list given in Table 2.

Table 1 Characteristics of trapping localities in the Kammanassie Mountains, southern Cape Province.

Trapping site	Altitude (m)	Aspect	Landform	Rocks	Veld age (years)	Vegetation
A	1662	N & S	Steep mountain slopes and saddle.	S. 2 N. 4 Bottom 0	Variable 1 ± 6	Firebreak vegetation of 2 ages. S. slopes: very short ericoid restioid shrubland. N. slopes: short *Cullumia-Aspalathus* shrub/restio/grassveld. Saddle: *Merxmuellera* shrub/grassveld.
B	1585	SSW	Steep mountain slopes	Variable 3 – 4 with scree	± 20	Mosaic of short *Erica* spp. *Hypodiscus alboaristatus* and *Restio* sp. shrubrestioveld and tall *Protea punctata, Leucadendron rourkei* shrubrestioveld.
C	1463 – 1585	SSW	Steep slopes, very steep rocky gullies, and river banks.	Variable. W. aspects 5 with bedrock. S. aspects 2 with smaller stones.	3 20	Mosaic of short *Aspalathus/Cullumia/Pentameris* shrub restio, grassveld in young burn, short *Erica-Elegia Restio*-veld in moist gully, and medium *Erica* spp. *Hypolaena* shrub restioveld on better drained W. aspects.
D	1463	N	Steep and very steep slopes, Rock scarp and talus.	Bedrock outcrop 5. Rocks on talus smaller 3.	15	Medium to tall *Protea repens, Erica* spp., *Hypodiscus* spp., *Tetraria cuspidata*, shrub restioveld on talus slopes. Medium *Metalasia, Helichrysum paniculatum, Simocheilus, Tetraria ustulata*, grass/restio/shrubveld on boulders.
E	1418	—	River bank	Rare boulders 1.	20	Tall *Cliffortia/Berzelia/Scirpus* sp. Shrub grassveld.
F	1585	SSE	Steep mountain slopes		15?	Short *Erica* spp., *Hypodiscus alboaristatus, Restio* spp., shrub/restioveld. Similar to B.
G	1555	NE	Steep, rocky slopes.	Bedrock 4	15?	Medium *Erica, Aspalathus, Elegia paviflora, Hypodiscus* shrub restioveld.
H	1494	N	Moderately steep plateau scarp.	Bedrock and boulders, 4	12	Medium open *Protea repens* with *Elytropappus, Anthospermum, Simocheilus, Cannamois dregei* shrub/restio substratum.
I, J	1509	Level	Gently undulating plateau.	Rare surface rock outcrops, 1.	Not known	Mosaic of short *Muraltia-Merxmuellera* shrub/grassveld on heavier soils and short *Erica-Restio? filiformis* shrub restioveld on shallow stony soils. 1/3rd of W. trapline identical to H.
K	1509	± Level	Gently undulating plateau.	Rare surface rock outcrops 1.	< 1	Recently burnt firebreak. Very short *Helichrysum* sp., *Merxmuellera/Restio* spp. grass/restioveld.
L	1509	N	Gently sloping plateau.	Rare stones 1.	6?	Short to medium *Cyclopia? aurea/Merxmuellera? stricta, Restio* spp. Shrub restio grassveld.
M	1890	Mostly S	Steep slopes and mountain summit.	Rock outcrops, 5.	1 ± 6 20	Veld structure varies in different post burn areas. Mostly very short *Erica* spp., *Pentameris, Hypodiscus alboaristatus* shrub/restio/grassveld. In protected areas short *Protea venusta, P. rupicola, P. montana, Erica* spp., *Restio* spp. Shrub/restioveld.
N	= South slopes of A					
O	1159	S	Steep bedrock outcrops	Bedrock, 5.	18	Short *Leucadendron salignum, Agathosma, Erica* spp., *Hypodiscus striatus* Shrubrestioveld.
P	1082	SWW to WSW	Steep mid slopes	Small Stones 1.	16	Medium *Protea repens, Leucadendron salignum, Stoebe* sp., *Merxmuellera? stricta, Restio* spp. Shrub/grassveld.
Q	± 1585	SSW	Scree slopes.	Loose rocks 5.	± 20	Mostly bare or *Euryops virgineus, Psoralea* sp., *Erharta ramosa* shrub/grassveld at fringes.
AA	975	W, SW, NW	Steep valley slopes	Medium rocks 5. Some bed-rock outcrop.	Mostly ± 14 Some younger.	*Protea arborea* open woodland with short to medium *Elytropappus, Eroeda imbricata, Leucadendron salignum* shrub — *Hypodiscus striatus/Restio* sp. restio — *Themeda/Heteropogon* grassveld.
BB	945	—	Gently sloping valley bottom	Mostly small stones 1.	?	Renosterveld. Medium to tall *Elytropappus rhinocerotis* shrubland.
CC	640 – 670	E and level	Steep valley sides; level bottomlands.	Mostly small stones. Rock outcrop higher, 4. Bottomlands: mostly rocks and stones 1 – 2.	?	Renosterveld. Medium *Elytropappus rhinocerotis* shrubland. More mixed species composition than above. Bottomlands: *Acacia karroo, Rhus* spp. clump thicket in grassland.
DD	± 640	level	Stream sides and valley bottomlands	Bottomlands: rocks and stones 1 – 2.	?	Bracken; *Acacia karroo, Rhus.* spp.
EE and FF	975 – 1037	NE	Very steep valley slopes and ridges	Medium rocks and rare bedrock outcrops, 5.	18	Medium *Chrysanthemoides monilifera, Agathosma* sp., *Elytropappus — Themeda, Cymbopogon* shrub grassveld.
GG	± 640	level	As for DD	As for DD		As for DD.

Three trap types (Museum Special snap traps, Victor rat snap traps, and collapsible aluminium Sherman live traps) were set out in lines in different vegetation types, at different altitudes, and on different slopes to census small rodents and insectivores. Trap stations were 20 m apart, and each census line consisted of 30 or 50 stations, at which two or three traps of different types were set. Traps were baited with a mixture of peanut butter, rolled oats, golden syrup and sunflower oil, and checked, rebaited and reset in the early morning and late afternoon. Macabee gopher traps were set out where clear signs of rodent moles or golden moles were evident. Large wiremesh live traps were set in different habitats for carnivores. Lagomorphs were collected with a 12 bore shotgun. Personal sight records, and those from local officials, are incorporated in the list of species collected (see Table 2). Selected animals were prepared as regular museum study specimens, which were all deposited as voucher specimens in the Mammal Collection of the Transvaal Museum. For the number of specimens thus preserved per species from each of the two localities, see Table 2.

All small mammals collected were taken to base camps for identification, weighing, measuring, sexing and, in the case of kill-trapped specimens, analysis of stomach contents. Stomach contents were removed, mixed with water, well stirred, and subsamples analysed as to percentage white plant material (reflecting seeds and stems), green plant material (leaves) and insects, using a stereoscopic microscope with graticule eyepiece.

As the number of traps and duration of trapping differed in different habitats, captures were calculated as to no. of captures/100 trapnights (one trap set for one night = 1 trapnight). This allows comparison of relative densities of species in different habitats.

Species diversity was calculated using the Shannon-Wiener index

$$H^1 = -\Sigma p_i \log p_i$$

where H^1 = diversity and p_i = proportion of the ith species in the community (of a particular habitat or trap site). Evenness of representation of different species $E = H^1/H^1_{max}$

Scrotal and enlarged testes in males, and perforated vaginae, lactation, or the presence of embryos in females, were taken as indications of being in breeding condition.

Terms used in describing the various trapping areas are as follows:

Slope: 0 – 3% level, gently undulating; 8 – 16% sloping; 16 – 30% moderately steep; 30 – 55% steep; 55% + very steep.
(A 55% slope would mean a vertical drop of 55 m for 100 m moved horizontally.)

Rock Size: small stones, 13 cm diameter; medium rocks, 25 – 100 cm diameter; boulders, 200 cm + diameter.

Rock Cover: 1. 1 – 5%; 2. 6 – 25%; 3. 26 – 50%; 4. 51 – 75%; 5. 76 – 100%.

Vegetation height: dwarf, 25 cm; very short, 26 – 50 cm; short, 51 – 100 cm; medium, 101 – 150 cm; tall, 150 – 200 cm; high, 200 – 500 cm.

Physiognomy: Four elements are distinguished: Proteoid — Proteaceae forming an emergent layer; Shrub — small leaved shrub; Grass — graminoid plants including grasses and some Cyperaceae; Restioid — Restionaceae and some Cyperaceae and grasses with hard tubular stems and no, or non-photosynthetic, scale-like leaves.
If any of these elements has 20% cover it is included in the physiognomic description e.g. shrub - restio - grassveld = shrub >20%, restio >20%, grasses >20%.

Study Areas

The Kammanassie Mountains are part of the Table Mountain sandstone series and are comprised of sandstone, shale and tillites. They lie between 33° 33′ and 34° 41′S, and 22° 27′ and 23° 02′E. In altitude they vary from 671 m a.s.l. to the highest peaks at 1956 m a.s.l. Rainfall ranges from 815 mm on the plateau in the southeastern sector to 276 mm per annum on the northern slopes (e.g. the northwestern sector), depending on the altitude and aspect of particular slopes. An average of 614 mm was obtained from six weather stations on the mountain tops. Censusing of mammals was done from base camps in the southeastern and northwestern sectors of the mountains. Although the general veld type according to Acocks (1975) is false macchia, a great deal of local variation in vegetation occurs. For the various trapping sites this is given in Table 1, which also lists other characteristics.

Results and Discussion

Species richness and diversity

In total 33 species of mammals were recorded from the two localities sampled in the Kammanassie Catchment Area (Table 2). This relatively depauperate species composition is to be expected in the light of the declining trend in faunal richness with increasing latitudes (see e.g., Nel 1975, Rautenbach 1978). Another factor that possibly contributes to the low species density recorded, is ascribed to the fact that predominantly montane-associated habitats were sampled. Small areas of those habitats normally associated with plains, *viz.* woody vegetation on streambanks and grasslands, are present in the Kammanassie Catchment Area. These may, however, have not been fully occupied by species as a result of the isolation of the Kammanassie mountain complex from other mountain ranges or such habitats by the surrounding semi-arid Karoo.

The faunal composition of the area is a mixed assemblage of the typical faunas of three biotic zones, namely the South West Cape, the South West Arid and the Southern Savanna Grassland. *A. subspinosus* and *P. verreauxi*, for instance, are endemics of the South West Cape, whereas *E. edwardii, G. ocularis, O. megalotis, H. pulverulentus* and *E. zebra* are more typical of the faunal composition of the South West Arid biotic zone. Although *D. melanotis* and *O. laminatus* are known from other biotic zones, in a finer analysis they are grassland dependent species.

The majority of the species noted from the Kammanassie Mountain Catchment Area have a wide habitat tolerance and are consequently widely distributed and normally occur in high population densities, *viz. L. saxatilis, A. namaquensis, M. minutoides, R. pumilio, P. ursinus, C. hottentotus, H. africaeaustralis, C. mesomelas* and *S. grimmia*. Still others are relatively abundant but have a

Table 2(a) Species collected, with numbers of specimens prepared as voucher specimens per locality (for actual numbers collected, see Table 3)

		Locality[a] 1	2
Myosorex varius (Smuts, 1832)	Forest shrew	15	0
Crocidura flavescens (I. Geoffroy, 1827)	Giant musk shrew	1	0
Elephantulus edwardii (A. Smith, 1838)	Cape rock elephant shrew	6	7
Rhinolophus clivosus Cretzschmar, 1826	Geoffroy's horseshoe bat	0	1
Pronolagus rupestris (A. Smith, 1834)	Smith's red rock hare	1	0
Lepus saxatilis F. Cuvier, 1823	Scrub hare	0	2
Graphiurus ocularis (A. Smith, 1829)	Spectacled dormouse	1	0
Acomys subspinosus (Waterhouse, 1838)	Cape spiny mouse	24	3
Aethomys namaquensis (A. Smith, 1834)	Namaqua rock rat	2	11
Mus (Leggada) minutoides A. Smith, 1834	Pygmy mouse	0	1
Praomys verreauxii (A. Smith, 1834)	Verreaux's mouse	11	0
Rhabdomys pumilio (Sparrmann, 1784)	Striped mouse	6	6
Dendromus melanotis A. Smith, 1834	Grey pygmy climbing mouse	3	0
Otomys irroratus (Brants, 1827)	Vlei rat	16	1
Otomys laminatus Thomas and Schwann, 1905	Laminate vlei rat	2	0
Saccostomus campestris Peters, 1846	Pouched mouse	0	2
Herpestes pulverulentus Wagner, 1839	Cape grey mongoose	2	0

Table 2(b) Species sighted or known to occur according to local officials

		Locality[a] 1	2
Papio ursinus (Kerr, 1792)	Chacma baboon	–	√
Cryptomys hottentotus (Lesson, 1826)	Common molerat	√	√
Hystrix africaeaustralis Peters, 1852	Porcupine	√	√
Otocyon megalotis (Desmarest, 1822)	Bat-eared fox	√	√
Canis mesomelas Schreber, 1778	Black-backed jackal	√	√
Mellivora capensis (Schreber, 1776)	Honey badger	–	√
Genetta tigrina (Schreber, 1778)	Large-spotted genet	√	√
Panthera pardus (Linnaeus, 1758)	Leopard	√	√
Felis lybica Forster, 1780	Wild cat	√	√
Procavia capensis (Pallas, 1766)	Rock dassie	√	√
Equus zebra Linnaeus, 1758	Mountain zebra	–	√
Redunca fulvorufula (Afzelius, 1815)	Mountain reedbuck	√	√
Raphicerus campestris (Thunberg, 1811)	Steenbok	–	√
Sylvicapra grimmia (Linnaeus, 1758)	Common duiker	–	√
Oreotragus oreotragus (Zimmerman, 1783)	Klipspringer	√	√
Pelea capreolus (Forster, 1790)	Grey rhebok	√	√

[a]Locality 1: Kammanassie Mountain Catchment Area, 12 km WNW Uniondale: 33°37′S; 22°54′E
Locality 2: Kammanassie Mountain Catchment Area, 8 km SE Dysselsdorp: 33°36′S; 22°33′E.

more restricted range as a result of more narrowly specialized habitat requirements such as *M. varius, C. flavescens, R. clivosus, A. subspinosus, P. verreauxi, O. irroratus, H. pulverulentus, P. capensis* and *O. oreotragus. G. ocularis, O. laminatus* and *E. zebra* are regarded as rare, although their distributions are not very localized.

Table 3 details variation in species diversity encountered in the different trapping localities. The small mammal fauna in the southeastern, fynbos-covered (high-rainfall) sector shows a high species diversity H^1 as well as evenness of representation, pointing to a well-balanced and perhaps fairly complete small mammal community. In contrast, both diversity and evenness of representation in the northwestern, drier Karoid sector, is much lower. This could point to a rather more unstable community. This is partly due to the much stronger dominance of *Aethomys* in the northwest, than with *Acomys* and *Otomys* in the southeast, and also to the fact that the northwestern sector has three fewer species than the southeast. This points to less diversity in habitat occurring in the drier northwest.

In contrast to findings elsewhere in mountain fynbos (e.g. Cedarberg) (Rautenbach & Nel 1980) we found no clear relationship between altitude and species diversity (Table 3). However, it does seem that diversity, although not necessarily evenness of representation (*E*), is higher on north-facing slopes than elsewhere. Increase in altitude also did not affect occurrence of particular species — e.g. *Myosorex, Acomys* and *Otomys* occurred from 1 159 m a.s.l. to 1 662 m a.s.l. in the southeastern sector.

Table 3 Trapping results from various localities (= habitats) in the Kammanassie Mountains. For a description of localities, see Table 1. For calculation of H^1 and E, see Methods

Trapping sites	Aspect	Altitude (m)	No. trapnights	Trap success %	H^1	E	Genera species captured (no. caught in parenthesis)
A (and N)	N & S	1 662	543	1,1	1,25	0,79	*Myosorex* (1); *Acomys* (1); *Otomys irroratus* (4).
B	SSW	1 585	1 200	4,2	2,25	0,87	*Myosorex* (7); *Acomys* (7); *Praomys* (9); *Rhabdomys* (6); *O. irroratus* (20); *Graphiurus* (1).
C	SSW	1 463 – 1 585	1 250	0,96	1,56	0,98	*Myosorex* (3); *Acomys* (5); *O. irroratus* (4).
D	N	1 463	858	2,9	2,29	0,98	*Myosorex* (4); *Acomys* (6); *Praomys* (5); *Rhabdomys* (3); *O. irroratus* (5); *O. laminatus* (2).
E	level	1 418	1 000	2,4	1,64	0,71	*Myosorex* (1); *Acomys* (15); *Praomys* (4); *Rhabdomys* (2); *O. irroratus* (2).
F	SSE	1 585	360	3,1	1,57	0,99	*Myosorex* (4); *Rhabdomys* (3); *O. irroratus* (4).
G	NE	1 555	540	0,74	1,50	0,95	*Myosorex* (1); *Elephantulus* (1); *Acomys* (2).
H	N	1 494	675	1,2	2,16	0,93	*Myosorex* (1); *Elephantulus* (2); *Acomys* (3); *Aethomys* (1); *O. irroratus* (1).
I	level	1 509	750	0,27	–	–	*Acomys* (1); *Rhabdomys* (1).
J	level	1 509	750	0,53	1,92	1,00	*Elephantulus* (1); *Acomys* (1); *Rhabdomys* (1); *Aethomys* (1).
K	level	1 509	300	0,0	–	–	– –
L	N	1 509	450	0,67	–	–	*Rhabdomys* (3).
M	S	1 890	60	0,0	–	–	– –
O	S	1 159	180	6,67	1,95	0,84	*Myosorex* (1); *Acomys* (5); *Rhabdomys* (4); *Aethomys* (1); *O. irroratus* (1).
P	SSW	1 082	120	2,5	–	–	*Elephantulus* (3).
Q	SSW	1 585	32	25,0	1,75	0,88	*Crocidura* (1); *Acomys* (2); *Praomys* (4); *Rhabdomys* (1).
AA	W, SW, NW	975	750	2,9	1,71	0,74	*Elephantulus* (1); *Acomys* (2); *Rhabdomys* (6); *Aethomys* (12); *O. irroratus* (1).
BB	level	945	750	3,3	0,76	0,48	*Elephantulus* (3); *Rhabdomys* (21); *Mus* (1).
CC	E; level	640 – 670	1 680	1,4	1,06	0,53	*Elephantulus* (1); *Rhabdomys* (2); *Aethomys* (19); *Saccostomus* (2).
DD	level	640	800	1,5	1,28	0,81	*Rhabdomys* (7); *Aethomys* (4); *Saccostomus* (1).
EE	NE	975 – 1 037	540	3,5	1,23	0,62	*Elephantulus* (1); *Acomys* (2); *Rhabdomys* (2); *Aethomys* (14).
FF	NE	975 – 1 037	540	1,3	–	–	*Elephantulus* (1); *Aethomys* (6).
GG	level	640	600	1,3	1,06	0,67	*Rhabdomys* (1); *Acomys* (6); *O. irroratus* (1).

Trapping success and relative densities

At the southeastern part of the Kammanassie Mountain 9 068 trapnights between 2 – 8 February, 1979 yielded 170 specimens of 10 species, giving a mean trap success of 1,9%. In the northwestern part 5 660 trapnights, from 8 – 12 February 1979, yielded 117 specimens of 7 species, with a mean trap success of 2,1%. Table 3 shows that trapping success in the various habitats varied considerably even though some species were ubiquitous. In the southeastern sector of the massif (mostly mountain fynbos), trap success for a particular species ranged from 0,6% (*Crocidura* and *Graphiurus*) to 28% (*Acomys*), while in the drier, more Karoo-like northwestern sector both the species composition and trap success for species shared, differed for example, 0,85% trap success for *Mus*, to 52,14% success for *Aethomys*.

Differences in success between the three trap types used at one sector of the mountain range, or between sectors, were evident. Thus in the southeastern sector (localities A – Q) Shermans were 1,73% successful, Museum Specials 2,05%, and Victors 1,87%, while in the northwestern sector (localities AA – GG) comparative figures were Shermans 1,42%, Museum Specials 2,17%, with Victors 1,13% successful. In the southeastern sector there were no significant differences between the success (measured against number of trapnights for each trap type) of the traps, but in the northwestern sector a significant difference ($P<0,01$) did arise; here success with Museum Specials was significantly less ($P<0,05$) than expected, while success with the Victors was significantly higher ($P<0,05$) than expected.

In the predominantly fynbos-covered southeastern sector of the mountain Victors were the most effective in capturing *Otomys* spp., while Museum Specials were the most effective in trapping *Acomys*. For the other species captured the three trap types were more or less equally effective. The single *Crocidura* was trapped in a Sherman, and the single *Graphiurus* in a Victor. In the more Karoid

N W sector Shermans were most effective in capturing *Aethomys*, while Museum Specials were most effective for *Rhabdomys*. Apart from *Aethomys* only *Rhabdomys* were captured in Shermans, while for the other species captured, Victors and Museum Specials were more or less equally effective.

Overall trapping success was low in both major areas sampled. However, figures obtained agree with other results of trapping in fynbos, especially montane areas (Bigalke, *in press*, Rautenbach & Nel 1980), although Bond *et al* (1980) obtained much higher figures for the Swartberg, as did David (1978 a, b) during March for the Rooiberg, but not in late November, when the Rooiberg figures came closer (but were still higher) to our own. It should be pointed out, however, that differences in trapping techniques between Bond *et al* (1980) — non-removal trapping — and the present study, removal trapping — could explain some of the discrepancy in trapping success.

Table 4 details each species' contribution to the community, based on trap success in the two general areas sampled. It is obvious that apart from *Rhabdomys*, which is a common species in both major areas sampled, and *Elephantulus*, which is rare, the relative contribution of species varies considerably in the two areas, and this no doubt reflects major differences in climatological and vegetational aspects. Only four species are not common to both areas: *Myosorex* and *Otomys laminatus*, respectively common and rare in the fynbos, absent in the Karoo-like vegetation, and *Saccostomus* and *Mus*, sharing the reverse distributional pattern. Also the relative abundance of species varies greatly in diferent habitats (Table 3). Although every trap type was not employed in each trapping locality (= habitat), the number of habitats sampled should obviate against a species or species being selected against, and the results should therefore be a fair approximation of the situation prevailing. However, selective response to different trap types is known to occur in some species; how much this factor affected our present results is unknown.

Food preferences

Preferred food resources of the various species are given in Table 5. It is clear that species vary considerably in their diet, which would help in total niche separation, even if they occur in the same habitat. Apart from the two insectivores, few insects are taken. This is perhaps an artifact resulting from the census dates, as on the nearby Swartberg one of us (G.J.B.) has found that the insect component in the diet of e.g. *Myosorex* is also very low in summer, but increases dramatically in autumn. Kern (1977) found the same for *Crocidura hirta* in the Kruger National Park. Sweeps with insect nets on the Swartberg similarly yielded few specimens in summer, and many more in autumn. It could therefore be expected that a similar situation prevails as regards the relative percentages of white and green plant material taken — although greenery is always available, preferred portions may be scarcer in the warm, dry summer when less green material is available than in the wet season, and less taken, apart from *Otomys*. Rodent densities are probably too low to result in much damage to the vegetation.

Breeding

There was a difference between the percentage of individuals of given species in breeding condition in the southeastern and northwestern sectors of the Kammanassie mountains. For example, 100% of the male and 33% of the female *Rhabdomys* were in breeding condition in the southeastern sector, compared to 22 and 22% respectively for the northwestern sector; also no male *Aethomys*, and the single female caught were in breeding condition in the southeastern, compared to 31 and 7% respectively in the northwestern sector. Apart from a single male *Saccostomus*, no individuals of other species were in breeding condition in the northwestern sector. In the southeast, 9% male, and 17% female *Praomys*, 52% male and 59% female *Otomys irroratus*, 14% female *Aethomys* and the single male *Graphiurus* were in breeding condition.

Table 4 Contribution by individual genera/species to small mammal communities in two areas of the Kammanassie Mountains

	Southeastern sector (habitats A – Q)			Northwestern sector (habitats AA – GG)		
Status	Genus	% contri-bution	No. habitats occurring	Genus	% contri-bution	No. habitats occurring
Abundant	*Acomys*	28,0	11	*Aethomys*	52,1	6
	Otomys irroratus	24,0	8			
Common	*Rhabdomys*	14,1	9	*Rhabdomys*	33,3	6
	Myosorex	13,5	9			
	Praomys	12,9	4			
Rare	*Elephantulus*	4,1	4	*Elephantulus*	6,0	5
	Aethomys	1,8	3	*Acomys*	3,4	2
	O. laminatus	1,2	1	*Saccostomus*	2,6	2
	Crocidura	0,6	1	*Otomys irroratus*	1,7	2
	Graphiurus	0,6	1	*Mus*	0,9	1

Table 5 Food selection by various genera in the Kammanassie Mountains, given as mean percentage white plant (W), green plant material (G) and insects (I), taken in the fynbos zone (SE sector = locality 1) (A), and Karoid NW sector (= locality 2) (B)

Genus	n	W	G	I
(A)[a]				
Elephantulus	2	40,0	–	60,0
Myosorex	11[b]	70,7	–	29,3
Otomys	34	4,4	94,9	0,7
Acomys	31	92,9	4,7	2,4
Rhabdomys	13	71,5	23,3	5,2
Praomys	13	67,9	13,8	18,3
(B)[c]				
Acomys	3	90,0	–	10,0
Rhabdomys	14	41,4	43,9	14,6
Aethomys	16	68,4	17,4	14,2

[a] The single *Graphiurus* captured had a stomach 100% filled with flesh; the single *Aethomys* contained 50% white and 50% green plant material.

[b] An additional *Myosorex* stomach contained 95% flesh and 5% insects.

[c] The stomach of a single *Elephantulus* contained 30% white and 70% insects.

Embryos were found in *O. irroratus* (n = 5; all females had a single embryo in the left horn of the uterus); *Acomys* (n = 4; being 2L; 4L 3R; 2L 1R; and 3L 2R); and a single *Rhabdomys* (2L 2R).

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References

ACOCKS, J.P.H. 1975. Veldtypes of South Africa. *Mem. bot. Surv. S. Afr.* 40: 1—82.

BIGALKE, R.C. (in press). Aspects of vertebrate life in fynbos South Africa. In: Heathers and related shrubland, ed. R. Specht. Elsevier, Amsterdam.

BOND, W., FERGUSON, M. & FORSYTH, G. 1980. Small mammals and habitat structure along altitudinal gradients in the southern Cape Mountains. *S. Afr. J. Zool.* 15: 34—43.

DAVID, J.H.M. 1978a. Report on survey of vertebrate fauna on the Rooiberg, Ladismith, Cape, conducted by staff and students of the Zoology and Botany Departments, University of Cape Town, 23—27 March, 1978. Report to Dept. Forestry.

DAVID, J.H.M. 1978b. Report on second survey of small mammal fauna on the Rooiberg, Ladismith, Cape, conducted by staff and students of the Zoology Department, University of Cape Town, 24 – 28 November 1978. Report to Dept. Forestry.

KERN, N.G. 1977. The influence of fire on populations of small mammals of the Kruger National Park. M.Sc. thesis, University of Pretoria.

NEL, J.A.J. 1975. Species density and ecological diversity of South African mammal communities. *S. Afr. J. Sci.* 71: 168—170.

RAUTENBACH, I.L. 1978. A numerical re-appraisal of the southern African biotic zones. *Bull. Carnegie Mus. Nat. Hist.* 6: 175—187.

RAUTENBACH, I.L. & NEL, J.A.J. 1980. Mammal diversity and ecology in the Cedarberg Wilderness Area, Cape Province. *Ann. Transvaal Mus.* 32: 101—124.