

# Mammals recorded in the QwaQwa National Park (1994-1995)

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Distribution, relative abundance, and habitat preferences of mammals were studied in the newly proclaimed QwaQwa National Park (QQNP) and compared with those of the adjacent 33 year-old Golden Gate Highlands National Park, a nearby protected area in the KwaZulu-Natal Drakensberg, Lesotho, and the rest of the Free State Province. In total, 53 mammal species were recorded inside the park and the probability of another 14 likely inhabitants, discussed. The fact that the QQNP contains ca. 70 % of mammalian fauna recorded in the Free State and between five and 10 Red Data species stresses the importance of this park and the necessity for correct management of this ca. 21 000 ha conservation area. The low small mammal numbers, variety, and mean diversity found on 17 transects in the QQNP is attributed to previous human habitation and activities—some of which are still present in the park.

Key words: distribution, diversity, mammal, QwaQwa National Park, species richness.

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## Introduction

The QwaQwa National Park (QQNP), established in 1991, is the newest national park in the Free State Province and falls under the jurisdiction of the Highlands Development Corporation. Before proclamation the park had been a cattle-farming area. Although much is known of the biota of the ca. 11 000 ha adjacent Golden Gate Highlands National Park (Golden Gate)—(mammals: Rautenbach 1976; vegetation: Potgieter 1982; geology: Groenewald 1986; birds: Earl, & Lawson 1988; Hutsebaut, Kok & Daneel 1992; Botha 1993; reptiles and amphibians: Bates 1991)—nothing besides the bird list by De Swart & Van Niekerk (1996) has been published on the fauna and flora of the QQNP.

This study was initiated to report on the mammals present in the QQNP, as well as to collect material for museum purposes; it reports on the distribution, relative abundance, and habitat preferences of small mammal species in the park, and forms part of a bigger, multi-disciplinary survey done in the

QQNP by the National Museum, Bloemfontein.

## Study area

The ca. 21 000 ha QQNP (centred at 28°29'S; 28°41'E) lies in the Wet Cold Highveld Grassland (41) and Altitude Mountain Grassland (46) of Low & Rebelo (1996) - mountain grassland with the typical cool, wet Drakensberg montane climate and severe frost, occasional snow, and highly erodible soils on slopes. It lies adjacent to the northern and eastern borders of Golden Gate. Altitudes range from 1700 m to 2380 m above sea level. The QQNP is characterised by deep, sheltered gorges with sandstone kranzes in the higher-lying areas, montane grassland in especially the higher-lying western section, drainage lines surrounded by short marshy grass, grassland, and marshy habitats on lower-lying areas, dry, north-facing slopes poor in plant species, and species-rich, dense thickets on the relatively moist, steep, cooler, south-facing slopes (De Swart & Van Niekerk 1996; Low & Rebelo 1996). The natural vegetation is similar to that of Golden Gate (Potgieter 1982; Earl, & Lawson 1988; Low & Rebelo 1996). In addition, before proclamation, several areas were planted with alien vegetation such as

*Acacia*, *Populus*, *Salix* and *Pinus* species, mainly along rivers and farm yards.

Mean annual rainfall in the park ranges from ca. 700 - 800 mm, with minimum and maximum monthly rainfall in July (7 mm) and January (> 117 mm), respectively (Low & Rebelo 1996; Weerbuuro 1986). Mean temperature varies from 3.9 °C in July to 19.2 °C in January; minimum and maximum temperatures from ca. -12.8 °C and 23.3 °C to 3.9 °C and 34.7 °C (July and January respectively) (Weerbuuro 1986).

## Materials & Methods

Small mammals were surveyed during four visits in 1994 and 1995 (each to a different quarter-degree square - Table 1) using conventional collecting techniques (i.e. live-trapping, snap-trapping, and mist-netting). In total, 17 trap lines were laid out between ca. 1 700 m and 2 200 m a.s.l. in different vegetation (habitat) types, covering all the major habitat types present in the QQNP, during the four visits (Table 1). Fifty ( $n = 2$ ), 100 ( $n = 4$ ) and 200 ( $n = 11$ ) snap traps, spaced 10 m apart, were put out on the various trap lines and left open for 4 days and 4 nights. Traps were checked and rebaited (with a mixture of peanut butter, rolled oats and marmite) at sunrise and just before sunset. The term "trap night" is used to describe one trap which was set for a 24 h-period (Rowe-Rowe & Meester 1982). Three measures of abundance were used, viz. trap success, variety (or species richness), and diversity. Trap success (or percentage success) is the number of small mammals captured/100 trap nights. Variety is the number of species collected, and diversity was calculated using the Shannon-Wiener information index (Nel 1975):

$$H = -\sum(p_i)(\log_e p_i)$$

where H = diversity index (a measure of both the number of species and equality of representation of the individuals of all species) and  $p_i$  = proportion of total sample belonging to the  $i$ 'th species.

Ten mole traps and 10 wire-mesh carnivore live traps were used during the total of 16 days and 16 nights for catching moles and carnivores in a variety of habitats. Bait used in carnivore traps was a mixture of cheese (roquefort) and lard. A .223 rifle fitted with telescopic sights and a 12 bore shotgun with spotlight were used, respectively during day and night, to collect mammals not easily trapped (such as *Lepus saxatilis*, *Pedetes capensis* and *Cynictis penicillata*).

Other large mammals were casually observed during the day when visiting traps, during walks in the veld, or on night drives. During walks, tracks were identified and scats collected. The latter were teased apart and both the carnivore and its mammal prey identified to species by comparing undigested remains with a reference collection in the National Museum, Bloemfontein, and with published results, e.g. scales on hair imprints (Keogh 1983a, 1983b) and tooth form (De Graaff 1981). Large, easily recognisable fragments of prey were macroscopically identified while hair and teeth were identified under a stereo microscope at 25x or 50x magnification.

Two mistnets (ca. 2 m x 12 m and ca. 6 m x 30 m) were used during each visit for catching bats. Nets were erected near open water (Table 1) and left in place for two to three hours every night, starting at or just before sunset.

All mammals not collected for museum purposes or handed over to the QQNP for educational purposes, were released at the point of capture.

## Results and Discussion

Forty-eight mammal species were recorded during this survey (Table 2). Specimens ( $n = 176$ ) from 17 species were collected while others (mostly larger mammals) were positively identified from sightings. Scats found belonged to *Galerella pulverulenta*, *Cynictis penicillata*, *Atilax paludinosus*, *Pronolagus rupestris*, *Procavia capensis*, *Pelea capreolus*, *Raphicercus campestris*, *Sylvicapra grimmia* and *Papio ursinus*. All hair and teeth in carnivore scats (*Rhodomys pumilio*, *Otomys irroratus*, and *Mastomys coucha*), tracks (*Hystrix africae australis*, *Aonyx capensis*, *Atilax paludinosus*, *Galerella pulverulenta*, *Pelea capreolus*, *Raphicercus campestris*, *Sylvicapra grimmia* and *Papio ursinus*), runways (*Otomys irroratus*), quills (*Hystrix africae australis*), soil heaps (*Cryptomys hottentotus*) and openings to nests (*Tatera brantsii* and *Cynictis penicillata*) found in the study area belonged to species which were also identified from trapping or sightings. Five additional species (*Myotis lesueuri*, *M. tricolor*, *Rhinolophus clivosus*, *Amblysomus hottentotus*, *Suncus*

*varilla*) previously collected in the four quarter degree grids by staff of the National Museum, Bloemfontein, were not found during this survey but are expected to occur in the park (Table 2). The domestic and alien mammals present in the park (such as dogs, cats, cattle, donkeys and the house rat *Rattus rattus*) were not listed in Table 2.

### Small mammals

In 10126 trap nights (Table 1) 165 small mammals from seven species were caught in the snap traps, i.e. 1.63 % trap success (mean

trap success of all transects =  $0.86 \pm 0.70$  %) (Table 3). Twenty-one (12.7 % of all captures) were shrews and the rest rodents (87.3 %). *Rhabdomys pumilio* was the rodent most often trapped (37.6 % of all captures), the species caught at the highest number of transects ( $n = 10$ ; 59 % of all transects), and dominated at all three transects above 2100 m a.s.l. (transect numbers 10, 11 & 12; Tables 1 & 3). *Aethomys namaquensis* was collected at nine transects (rocky slopes and outcrops covered with grass and shrubs, and open grasslands). The presence of both of these species in a wide range of habitats in

Table 1

*A description of the locality where mist nests were erected and the transects on which small mammals were caught during the 1994-1995 mammal survey of the QwaQwa National Park*

*One trap night = one trap set for a 24 hour period*

*'Altitudinal levels (a.s.l.) = 1700-1800 m; 1801-2200 m; 2201-2380 m*

Grid	Transect number	'Altitude	Date	Number of trap nights	Description
Snap-traps					
2828Bc	1	1700-1800	8/94	750	Open marshy grassland
	2	1801-2200	8/94	750	Slope of ridge: long grass & boulders
	3	1700-1800	8/94	750	Fallow lands: sandy soil
	4	1801-2200	8/94	750	Slope: long grass & large boulders
2828Da	5	1700-1800	9/94	750	Open grassland: sandy soil & long grass
	6	1801-2200	9/94	750	Rocky outcrop: shallow soil
	7	1801-2200	9/94	750	Rocky slope: long grass
2828Bd	8	1801-2200	10/94	750	Slope of ridge: trees, grass, boulders
	9	1700-1800	10/94	750	Open grassland: sandy soil & long grass
2828Db	10	2201-2380	3/95	375	Mountain summit: open grassland
	11	2201-2380	3/95	375	NE slope of mountain: Grass & rocks
	12	2201-2380	3/95	375	High plateau: grass under <i>Leucosidea sericea</i> trees
	13	1801-2200	3/95	375	Plateau: marshy grass around rock pools, exposed bedrock
	14	1700-1800	3/95	750	Open marshy grassland: foot of mountain
	15	1801-2200	3/95	750	Slope: Large boulders, grass
	16	1801-2200	3/95	188	Along stream on slope: large boulders, grass
17	1700-1800	3/95	188	Lower slope: trees, grass & boulders	
			Total	10126	
Mistnets					
2828Bc	< 1800	8/94	8		Along small stream in Avondrust area
2828Bd	< 1800	10/94	8		Along small stream above Skuinskop weir
2828Db	< 2200	9/94	8		Next to Honingkloof dam
2828Db	< 2200	3/95	8		Next to Honingkloof dam

Table 2

List of mammal species recorded in the QwaQwa National Park. The first column indicates those species caught and sighted during this survey, the second those species that could be identified from spoor, scats, and hair and teeth in scats, and the third those present in the mammal collection of the National Museum, Bloemfontein, coming from the four grid-areas and collected after 1970.

<sup>1</sup> - Species listed in the South African Red Data Book: terrestrial mammals (Smithers 1986): E = Endangered, V = Vulnerable, R = Rare, I = Indeterminate. X - indicates presence in the specific column

Species	Observed	Signs	NMB collection	Species	Observed	Signs	NMB collection
Order RODENTIA				Order PERISSODACTYLA			
<i>Aethomys namaquensis</i>	X		X	<i>Equus burchelli</i>	X		
<i>Cryptomys hottentotus</i>	X	X		Order CARNIVORA			
<i>Dendromus melanotis</i>	X		X	<i>Aonyx capensis</i>	X	X	
<i>Graphiurus murinus</i>	X		X	<i>Atilax paludinosus</i>	X	X	
<i>Hystrix africaeaustralis</i>	X	X		<i>Canis mesomelas</i>	X		
<i>Mastomys coucha</i>	X	X	X	<i>Cynictis penicillata</i>	X	X	
<i>Mus musculus</i>	X		X	<i>Felis caracal</i>	X		
<i>Otomys irroratus</i>	X	X	X	<i>Felis lybica</i> ( <sup>1</sup> V)	X		
<i>Pedetes capensis</i>	X			<i>Galerella pulverulenta</i>	X	X	X
<i>Rhodomys pumilio</i>	X	X	X	<i>Genetta genetta</i>	X		
<i>Tatera brantsii</i>	X	X		<i>Genetta tigrina</i>	X		
<i>Xerus inauris</i>	X			<i>Ichneumia albicauda</i>	X		X
Order INSECTIVORA				<i>Ictonyx striatus</i>	X		X
<i>Amblysomus hottentotus</i>			X	<i>Lutra maculicollis</i>	X		
<i>Atelerix frontalis</i> ( <sup>1</sup> R)	X			<i>Proteles cristatus</i> ( <sup>1</sup> R)	X		
<i>Crociodura cyanea</i>	X			<i>Suricata suricatta</i>	X		
<i>Myosorex varius</i>	X		X	<i>Vulpes chama</i>	X		
<i>Suncus varilla</i>			X	Order HYDRACOIDEA			
Order LAGOMORPHA				<i>Procavia capensis</i>	X	X	
<i>Lepus capensis</i>	X			Order PRIMATES			
<i>Lepus saxatilis</i>	X		X	<i>Papio ursinus</i>	X	X	
<i>Pronolagus rupestris</i>	X	X		Order TUBULIDENTATA			
Order ARTIODACTYLA				<i>Orycteropus afer</i> ( <sup>1</sup> V)	X		
<i>Alcelaphus buselaphus</i>	X			Order CHIROPTERA			
<i>Antidorcas marsupialis</i>	X			<i>Eptesicus capensis</i>	X		
<i>Connochaetes gnou</i>	X			<i>Myotis lesueuri</i> ( <sup>1</sup> I)			X
<i>Damaliscus dorcas phillipsi</i>	X			<i>Myotis tricolor</i>			X
<i>Pelea capreolus</i>	X	X		<i>Rhinolophus clivosus</i>			X
<i>Raphicerus campestris</i>	X	X		<i>Tadarida aegyptiaca</i>	X		
<i>Redunca fulvorufula</i>	X						
<i>Sylvicapra grimmia</i>	X	X					
<i>Taurotragus oryx</i>	X						

Table 3

Number of different small mammals trapped, total number of small mammals trapped, trapping success, variety, and diversity on 17 transects during the 1994-1995 mammal survey at QwaQwa National Park.

Trapping success =  $N/100$  trap nights

<sup>1</sup> - Transects number 2, 4, 6, 7, 8, 11, 13, 15, 16 & 17.

<sup>2</sup> - Transects number 1, 5, 9, 10 & 14

Transect number	<i>A. namaquensis</i>	<i>G. murinus</i>	<i>M. coucha</i>	<i>R. pumilio</i>	<i>T. brantsi</i>	<i>C. cyanea</i>	<i>M. varius</i>	Total	Trapping success	Variety	Diversity
1	-	-	1	14	-	1	7	23	3.06	4	0.937
2	-	-	-	9	-	2	3	14	1.86	3	0.892
3	-	-	-	-	8	-	1	9	1.20	2	0.349
4	7	-	-	-	-	-	-	7	0.94	1	0.000
5	-	-	18	16	4	1	1	40	5.34	5	1.141
6	1	-	-	2	-	-	-	3	0.40	2	0.637
7	8	-	3	6	-	-	-	17	2.26	3	1.028
8	8	1	-	-	1	-	-	10	1.34	3	0.639
9	1	-	1	3	1	-	-	6	0.80	4	1.242
10	-	-	-	6	-	-	-	6	1.60	1	0.000
11	1	-	-	1	-	-	-	2	0.54	2	0.693
12	-	-	1	4	-	-	-	5	1.34	2	0.500
13	-	-	-	-	1	-	-	1	0.26	1	0.000
14	-	-	1	-	-	-	2	3	0.40	2	0.637
15	5	1	-	-	-	-	-	6	0.80	2	0.451
16	1	1	1	1	-	1	1	6	3.20	6	1.792
17	2	4	-	-	-	1	-	7	3.74	3	0.956
All transects:											
	34	7	26	62	15	6	15	165	1.629	7	1.288
<sup>1</sup> Rocky habitat:											
	33	7	4	19	2	4	4	73	1.30	7	1.51
<sup>2</sup> Grassland habitat:											
	1		21	39	5	2	10	78	2.31	6	1.29

the Free State is described by Lynch (1983). Avenant (1996) reported on *Mastomys coucha*'s presence in a wide spectrum of vegetation types on virtually all substrates present in the Free State, Lesotho, and the northern parts of the Eastern Cape. The same was found in the QQNP where *M. coucha* was caught in virtually the whole spectrum of vegetation habitats sampled (Tables 1 & 3). *Graphiurus murinus* is reported to have a wide habitat tolerance within its distribution area (Smithers 1971; Rautenbach 1982). During this study, however, the species was found only on rocky slopes. *Tatera brantsii*

was, as expected, caught mostly on sandy soil of open grasslands and of old fallow land, but also at a grassy slope (transect number 8; substrate hard, clay and loam soil) and on an exposed bedrock plateau (transect number 13; ca. 2 000 m a.s.l. and 20 m from soft, loamy soil). Two species of shrews were collected: *Crocidura cyanea* and *Myosorex varius*. The wide habitat tolerance of *C. cyanea* in the relatively dry regions of southern Africa is described by Smithers (1971), Smithers & Wilson (1979), and Rautenbach (1982). In QQNP it was caught in vlei areas, open grasslands and slopes with grass cover.

It also occurred sympatric with *M. varius* on four out of the five transects on which it was trapped. *M. varius* was trapped on six transects in a variety of habitats often associated with vleis or surface water (Tables 1 & 3).

No strong seasonal effects in the presence or absence of species between the Spring samples (transects 1-9) and Autumn samples (transects 10-17) were observed (Table 3). The highest number of species (variety) on a transect was six. Four species were present in all four quarter degree areas, two species were present in three of the grid areas, and the remaining single species was present in two of the four grid areas. Total diversity was 1.288 (mean for all transects =  $0.700 \pm 0.478$ ). The big differences in variety and diversity on the different transects is attributed to differences in vegetation and substrate. Highest diversity was generally found on transects with highest variety and trapping success (Table 3). Two main habitat types were identified from 15 of the 17 transects, viz. a rocky habitat (outcrops, slopes and plateaus) and a grassland habitat (wet and dry grasslands)(Table 3). Seven and six species were caught in the two habitats respectively (Table 3) with overall diversity higher in the rocky habitat (1.51) than in the grassland habitat (1.29) despite a lower trap success (1.30 % vs. 2.31 % respectively). In the rocky habitat *Aethomys namaquensis* (45.2 % of total number of catches) and *Rhabdomys pumilio* (26 %) were most abundant, while *R. pumilio* (50.0 %) and *Mastomys coucha* (26.9 %) dominated in the grassland habitat.

Although the QQNP area is not mentioned as a mammal species richness, endemic species or Red Data Book species hotspot (Lombard 1995), five (9.4 %) of the 53 species listed in Table 2 are also listed in the South African Red Data Book (Smithers 1986) as "Vulnerable" ( $n = 2$ ), "Rare" ( $n = 2$ ) or "Indeterminate" ( $n = 1$ )(Table 2). Another 15

species (of which five are listed in the Red Data Book) occur in the adjacent Golden Gate and surroundings, and may occur in the park (following word of T. Hugo (warden) and literature: Rautenbach 1976; Lynch 1983; Skinner & Smithers 1990; Rowe-Rowe 1992 & 1994; Lynch 1994), viz. the rodents *Aethomys crysophilus*, *Dendromus mystacalis*, *Mus munitoides*, *Mystromys albicaudatus* ("Vulnerable"), and *Otomys sloggetti*, the insectivores *Chlorotalpa sclateri* ("Indeterminate") and *Crocidura flavescens*, the carnivore *Panthera pardus* ("Rare"), the antelopes *Oreotragus oreotragus* and *Ourebia ourebi*, and the bats *Eidolon helvum*, *Laephotis wintoni* ("Indeterminate"), *Miniopterus schreibersii*, *Nycteris thebaica*, and *Pipistrellus kuhli* ("Indeterminate"). Although Rautenbach (1976) listed *Malacothrix typica* as possibly present in Golden Gate, its presence is questioned as it has never been found in the area and is not listed in the Golden Gate mammal checklist (pamphlet of Golden Gate). Ice rat *Otomys sloggetti* was seen on the higher lying areas in the park (T. Hugo *pers.comm.*), while the chiropteran species *Pipistrellus kuhli* (Rautenbach 1976; Lynch 1983), *Eidolon helvum* (Lynch 1983), *Laephotis wintoni* (Lynch 1994), and *Miniopterus schreibersii* and *Nycteris thebaica* (Skinner & Smithers 1990) may at times (and in small numbers) occur in the QQNP. African buffalo *Syncerus caffer*, introduced to Golden Gate (Rautenbach 1976) but probably not present in this specific area before introduction (Rowe-Rowe *pers. comm.*), were not recorded in QQNP during the four field trips but may enter from time to time as the fences bordering the two parks are "virtually non-existent" (T. Hugo *pers. comm.*). Other big game also present at Golden Gate (eland *Taurotragus oryx*, red hartebeest *Alcelaphus buselaphus*, springbok *Antidorcas marsupialis*, blesbok *Damaliscus dorcas phillipsi* and zebra *Equus burchelli*) were introduced to the QQNP in 1992 and 1993. Of these, zebra

are probably alien; the zebra from this area referred to by Du Plessis (1969) are likely to have been the now extinct *Equus quagga* (Rowe-Rowe 1994; Rowe-Rowe pers. comm.) The warthog *Phacochoerus aethiopicus* (which likely never occurred here - Rowe-Rowe pers. comm.) and reed-buck *Redunca arundinum* were also introduced and re-introduced, respectively, to Golden Gate (Rautenbach 1976) but have not survived (Golden Gate checklist; T. Hugo pers. comm.).

The park is therefore expected to house 68 mammal species, ca. 70 % of the Free State's 97 species. In comparison with the QQNP's five (possibly 10) South African Red Data Book mammal species, the nearby, and much bigger, Lesotho (Afro Mountain and Alti Mountain Grassland - Low & Rebelo 1996) houses eight (possibly 14) Red Data Book mammal species (Lynch 1994).

Although none of the mammal species found during this project is confined to only one habitat type, some species which are expected in QQNP are more habitat-specific. Management should keep this in mind when burning. Humans (together with their domestic cattle, donkeys and dogs) that were allowed to remain in the park, as well as uncontrolled fires and people with dogs entering from the Phutaditjaba side of the park, may affect species composition. It also needs to be repeated (Lynch 1983; Rowe-Rowe & Lowry 1982; Rowe-Rowe 1995) that, with regard to wildlife management policies, small mammals should not be excluded or ignored when such policies are developed. They are an integral part of the ecosystem as they use an area for food consumption (a single species may occur at densities of > 200/ha - David 1979) and often constitute the first link in the food chains of many carnivores and raptors.

As in QQNP, two species (*Rhabdomys pumilio*, 44.1 %, and *Myosorex varius*,

38.7 %) dominated in numbers in the Alti Mountain Grassland of the Natal Drakensberg (Giant's Castle Game Reserve = Giant's Castle) (Rowe-Rowe & Meester 1982). In their study area two shrews and eight small rodents were collected in a total of 7560 trap nights. Although only three species were caught in both QQNP and Giant's Castle, 90 % of the species collected at Giant's Castle are expected to be present in QQNP. Overall trap success at Giant's Castle was 9.4 % (minimum = 2 %) and mean diversity 1.34 (minimum = 0.2). Rowe-Rowe (unpubl. 1977; in Rowe-Rowe & Meester 1982) recorded similar trap success (10.1 %), species richness ( $n = 10$ ) and mean diversity (1.39) at Cathedral Peak (also Alti Mountain Grassland - Low & Rebelo 1996). Overall trap successes at the two Natal Drakensberg sites were therefore more than 5.7 times higher, and mean diversity ca. twice as high as in the QQNP. The big differences in small mammal density, variety and diversity between the QQNP and the Natal Drakensberg may be due to the higher rainfall and herbage production in the latter area (see Rowe-Rowe & Scotcher 1986), but may also be indicative of the degree of disturbance in the relatively new QQNP. In comparison with studies done in natural Springbok Flats Turf Thornveld (Mendelsohn 1982: mean trap-success = 18.5 %, variety = 10) and natural West Coast Strandveld (Avery *et al.* 1990: overall trap success = 5.2 %) trap success and variety was very low. The fact that only eight out of the possible 13 small mammal species were caught is taken as a further indication of low species numbers and low overall diversity. Similar low species numbers and diversity were obtained in Lesotho (eight species trapped in 2785 trap nights; mean trapping success = 3.16 % - Nel & Avenant 1996). Lynch (1994) also reported low diversity and numbers after a four year intensive study in Lesotho, which he also attributed to the human habitation and activity (herd boys hunting with

dogs and farming malpractices such as overgrazing, uncontrolled veld burning, ploughing of fragile soils and monoculture which lead to soil erosion and habitat destruction).

In the Natal Drakensberg small mammal diversity appears to be related to succession, increasing from the pioneer stage, reaching an asymptote during an intermediate stage, then declining again in the climax stage (Rowe-Rowe & Meester 1982). It is therefore expected that small mammal diversity, together with variety and density, will increase with time on condition that the inhabitants, neighbours, and their dogs have a lesser influence on the park. High diversity, high variety, and high numbers usually go together (Rowe-Rowe & Meester 1982; this study). However, diversity alone is not an indication of the importance of the habitat in the ecology of the area as some habitats with low diversity but high densities may be more important as a source of prey to some predators despite the fact that low diversity plays a lesser role as a reservoir for a number of species (Rowe-Rowe & Lowry 1982).

The high percentage of *Mastomys coucha* caught in especially the grassland habitat (27 % of all captures) in the QQNP is a further indication of high disturbance in QQNP. Meester, Lloyd & Rowe-Rowe (1979) and Bronner, Rautenbach & Meester (1988) found *M. natalensis* to be the dominant rodent in grasslands soon after fire; their numbers later decreasing as other more specialised rodents increase. They attributed it to *Mastomys*'s high reproductive potential and ability to multiply very quickly (in advance of rodent species with more specialised requirements) after natural habitat destruction (Meester *et al.* 1979; Linn 1991). Rowe-Rowe & Meester (1982) mentioned that *M. natalensis* was only incidentally captured at two "unnatural" sites in the essentially pristine Giant's Castle, whereas on the Springbok Flats *Mastomys* sp. (caught in

13.4 % of traps) was the dominant small mammal in the pioneer communities on red clay (Mendelsohn 1982). Nel & Avenant (1996) reported a relatively high 5.5 % of all captures in Lesotho to be *Mastomys coucha*, all of them caught in badly disturbed areas or maize fields. Some of the conditions experienced in Lesotho previously occurred in the area of today's QQNP and some inhabitants still farm and hunt in the park with their cattle and dogs, respectively. The western and south western part of the QQNP especially (close to the urban areas of Phutaditjaba, Hlatseng and Monothsa), is still frequently visited by humans with dogs. The influence of accidental fires from this areas is addressed by De Swardt & Van Niekerk (1990). The situation is, however, expected to improve as the local inhabitants are expected to have a decreasing influence in the QQNP over time, neighbours excluded from the park, and if fire breaks are made to limit the destruction caused by fire. The adjacent 33 year-old Golden Gate may also play an accelerating role in the re-establishing of mammal species in the QQNP.

Protected areas cover only 8.6 % of South Africa. The small size and isolation of most of these areas are also criticised as this implies minimal movement and genetic exchange between reserves (Wynberg 1995). Although ca. 11 000 ha of the Wet Cold Highveld Grassland vegetation type is already conserved in the Golden Gate, the enlargement of the total conservation area to ca. 32 000 ha is of importance as it will increase the number and size of different sub-habitats under conservation, allow large herbivores to roam over larger distances, and more game may be re-introduced.

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