



Kruger  
NATIONAL PARK

# A COMPARATIVE STUDY OF RODENT AND SHREW DIVERSITY AND ABUNDANCE IN AND OUTSIDE THE N'WASHITSHUMBE ENCLOSURE SITE IN THE KRUGER NATIONAL PARK

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South African  
NATIONAL PARKS



## **BROAD OBJECTIVES**

**To determine the species richness and diversity of rodents and shrews at the N'washitshumbe enclosure site**

- Three management activities i.e. fire & elephant impact
- Slopes of catena
- Representative species
- Movement of animals
- Rodents as indicators i.e. changes in habitat
- Effects of management i.e. fire
- Influence of woody species i.e. absence and presence
- Measurement and mass



## STUDY AREA

**The N'washitshumbe enclosure site occurs in the northern plains of the KNP**

- Lies on a flat basaltic landscape
- Up lying areas dominated by Mopane/Combretum
- Low lying areas grasses, seasonally inundated vlei
- Constructed in 1968/into vlei in 1986
- Site currently 306 ha
- Large browsers been excluded for 38 and 20 years respectively
- Fire also limited



The N'washitshumbe enclosure site fence line...

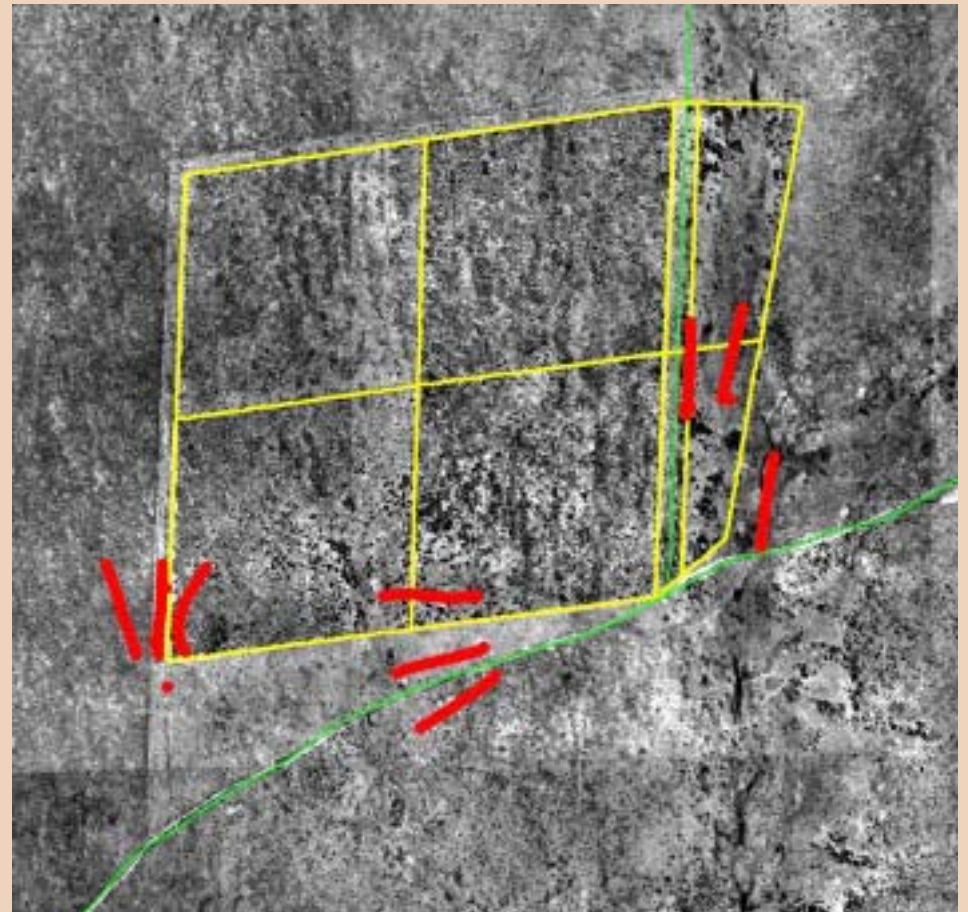


Stands of Zebra wood (*Dalbergia melanoxylon*) outside and inside the N'washitshumbe enclosure site



## CAPTURE METHODOLOGY

- Three grids (top, middle and bottom slope A, B, & C)
- Nine transects lines (in, fire break & around)
- 30 traps each (270)/300m



## CONTINUE...

- Traps were baited
- Traps were checked and re-baited daily



## CAPTURE...

- Animals were first sedated with ethyl acetate
- Measurement taken i.e. hind foot, ear, total & tail length and mass
- Animals sexed and aged



## MARKING...

- New specimens marked and recapture numbers recorded with recaptured specimens
- Samples were collected in 70% alcohol with corresponding information
- Ticks were also collected and sent to Veterinary Research Institute at Onderstepoort for identification



## VEGETATION SURVEYS

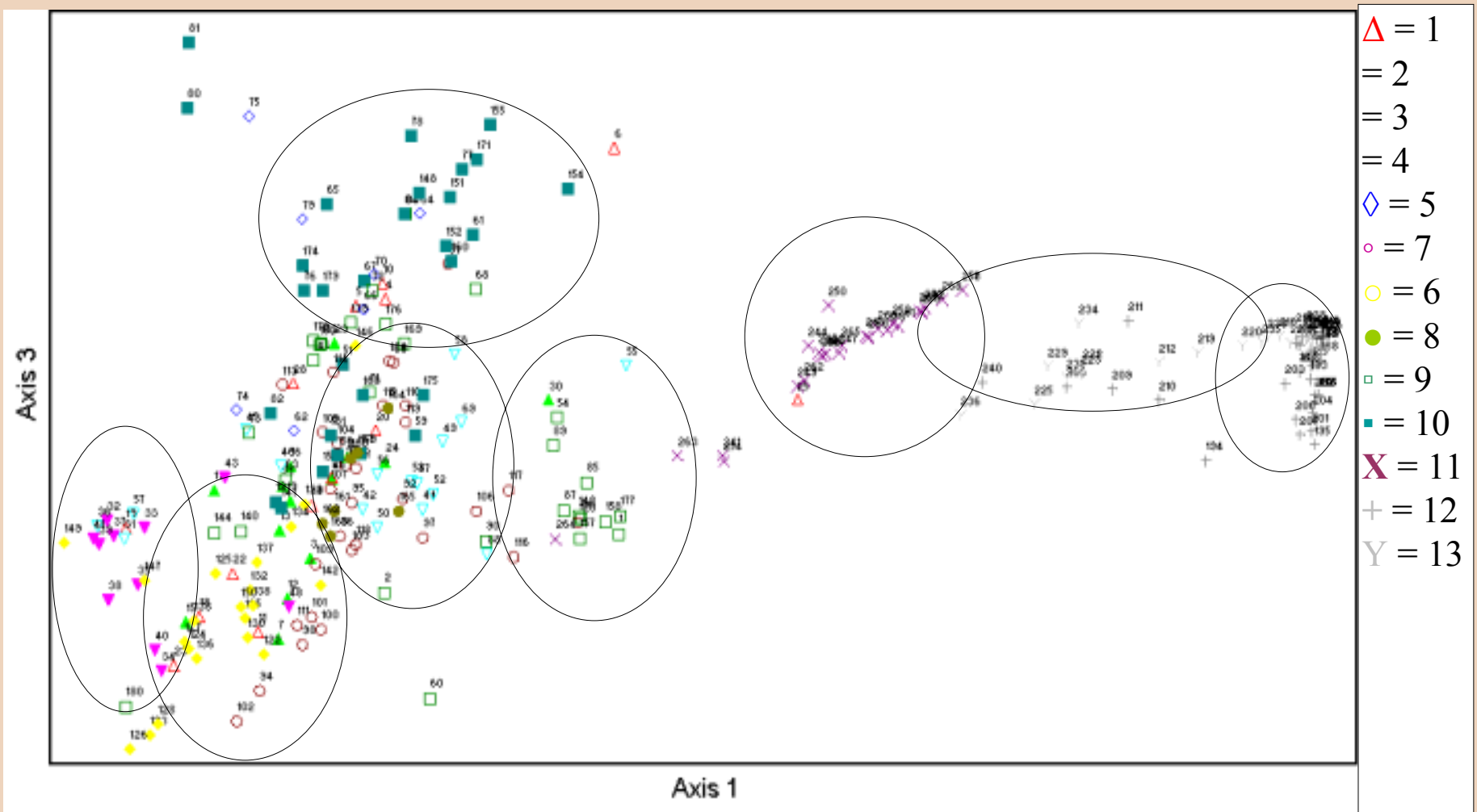
- Summer and Winter vegetation surveys conducted around each of the 270 traps
- 5m<sup>2</sup> grid placed over each trap
- Disc pasture = basal cover
- 1m<sup>2</sup> total count diagonal corners
- 10m radius trees recorded/height classes



## RESULTS

- The results recorded are from 270 traps per night/over 45 traps night (n = 2302). *Mastomys* (n = 1835), *Saccostomys* (n = 281) and *Tatera* (n = 99) dominant species
- These surveys were done over two years IN the enclosure site, in the fire break AROUND the site and OUTSIDE the site.
- One transect line placed in a SODIC area (n = 171)





Ordination of vegetation communities at the N'washitshumbe enclosure



**Thirteen plant communities composing fifteen species groups have been identified. These communities are:**

1. *Schmidtia pappophoroides* - *Heteropogon contortus* community
2. *Schmidtia pappophoroides* - *Setaria incrassata* community
3. *Panicum coloratum* - *Setaria incrassata* community
4. *Schmidtia pappophoroides* - *Urochloa mosambicensis* community
5. *Panicum maximum* - *Panicum coloratum* community
6. *Aristida bipartita* - *Colophospermum mopane* community
7. *Panicum coloratum* - *Colophospermum mopane* community
8. *Cenchrus ciliaris* - *Colophospermum mopane* community
9. *Setaria incrassata* – *Dalbergia melanoxylon* community
10. *Panicum maximum* - *Urochloa mosambicensis* community
11. *Sporobolus salsus* - *Sporobolus bechuanicus* community
12. *Cyperus textilis* - *Andropogon vlei* community
13. *Sporobolus welwitschii* - *Andropogon vlei* community





*Mastomys* spp.



*Saccostomys campestris*



*Tatera leucogaster*



*Mus minutoides*



**Eleven species were collected:** *Mastomys natalensis*, *Mastomys coucha*, *Saccostomy campestris*, *Tatera leucogaster*, *Lemniscomys rosalia*, *Aethomys chrysophilus*; *Mus minutoides*, *Graphiurus murinus*, *Steatomys pratensis*, *Crocidura hirta* and *Paraxerus cepapi*

The following plant communities indexes proved to be favoured to rodents:

5. *Panicum maximum* - *Panicum coloratum* community
3. *Panicum coloratum* - *Setaria incrassata* community
7. *Panicum coloratum* - *Colophospermum mopane* community

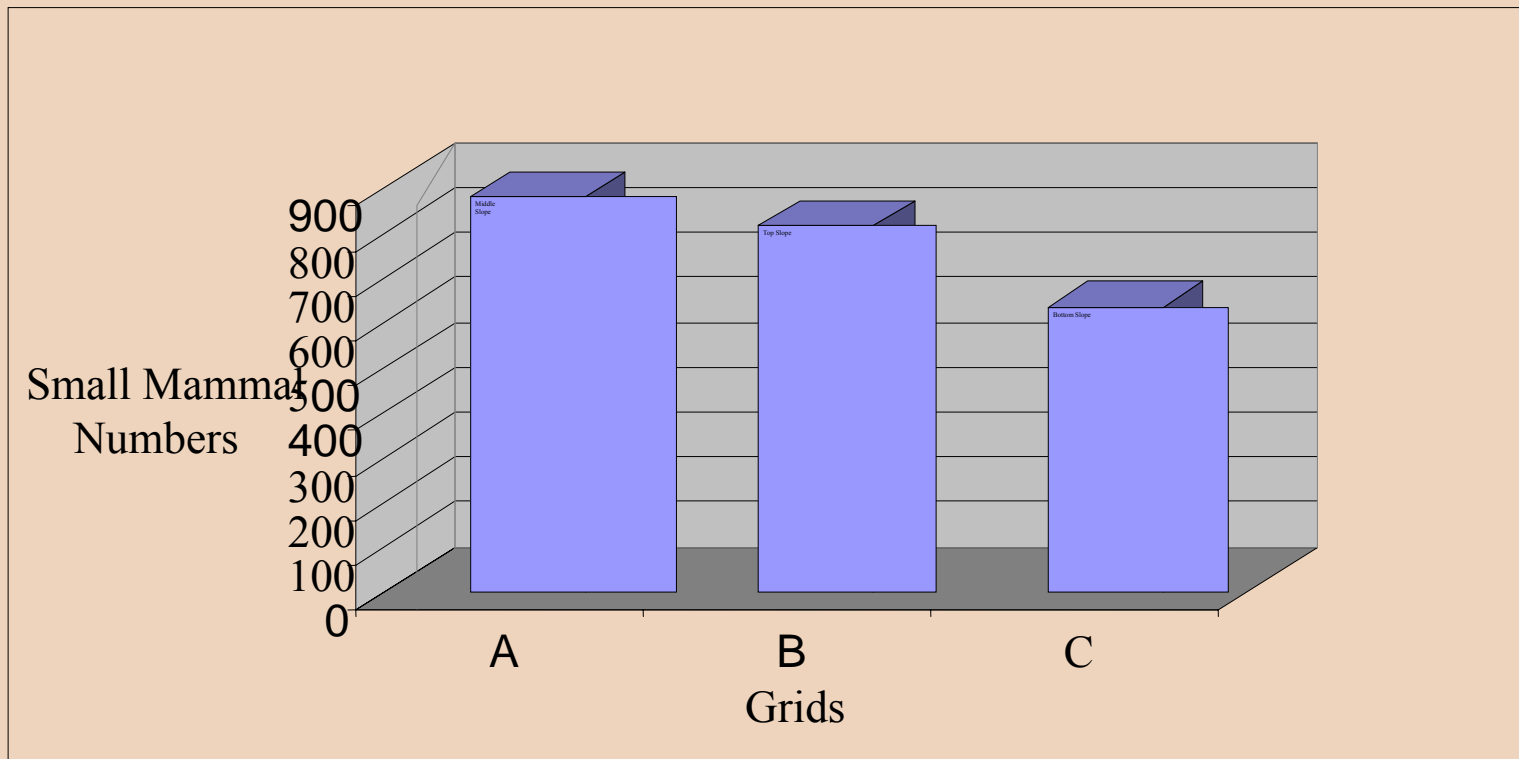
The following plant communities indexes proved unfavourable to rodents:

1. *Schmidtia pappophoroides* - *Heteropogon contortus* community
11. *Sporobolus salsus* - *Sporobolus bechuanicus* community



## SMALL MAMMAL RECORDS ON THE CATENA AT THE N'WASHITSHUMBE ENCLOSURE SITE

The catena was divided into three broad categories, top, middle and bottom slope



## **Small mammal records from the top slope of the catena at the N'washitshumbe enclosure site**

Data was recorded from the top slope referred to as grid B.

The top slope at the enclosure site was represented by relatively flat, dry ground, covered by low, stunted mopane (*Coloshoospermum mopane*) and zebrawood (*Dalbergia melanoxylon*). The area was sparsely covered by herbaceous material with a high percentage of bare ground.

The frequency of rodent captures differed significantly at grid B (n = 814).

The top slope was divided into three sampling transects based on management activity. The frequency of rodent captures differed significantly between outside 1B (n = 310), in the fire break surrounding the enclosure 2B (n = 298) and inside the enclosure site 3B (n = 206)



## Small mammal records from the mid slope of the catena at the N'washitshumbe enclosure site

- Data was recorded from the middle slope referred to as grid A.
- The middle slope at the enclosure site was represented by a slope, substantial grass cover, apple leaf (*Lonchocarpus capassa*) and marula (*Sclerocarya birrea*).
- The frequency of rodent captures differed significantly at grid A (n = 878).
- The middle slope was divided into three sampling transects based on management activity. The frequency of rodent captures differed significantly outside 1A (n = 342), in the fire break surrounding the enclosure 2A (n = 333) and inside the enclosure site 3A (n = 203)
- *S. pratensis* and *P. cepapi* were recorded exclusively on the middle slope.

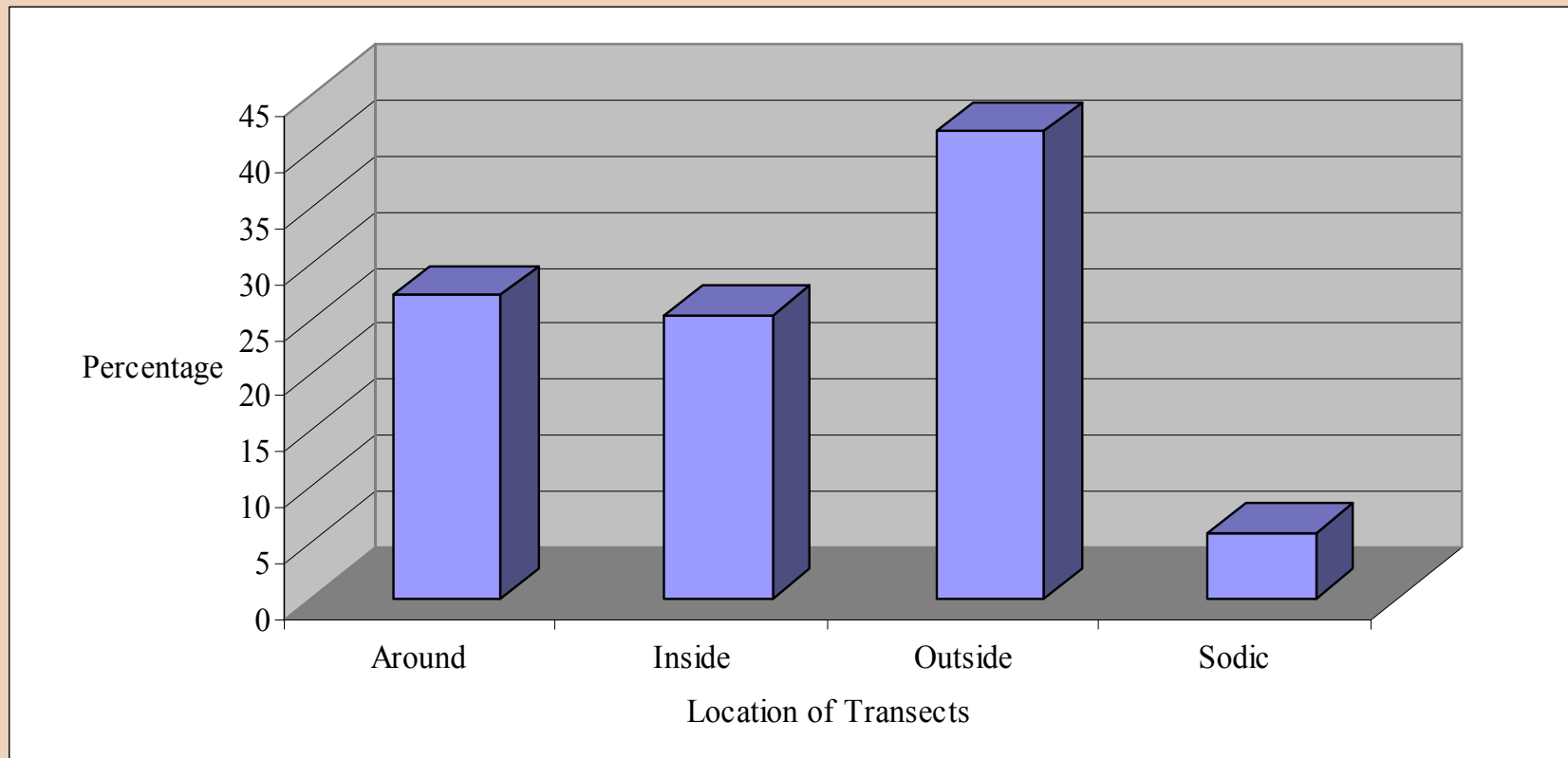


## Small mammal records from the bottom-slope of the catena at the N'washitshumbe enclosure site

- Data was recorded from the bottom slope and referred to as grid C.
- The bottom slope at the enclosure site was represented by relatively flat, seasonally inundated vlei, and covered by tall grass and sedge. Woody vegetation was represented by lala palm (*Hyphaene coriacea*) in these low-lying areas. The area was densely covered by herbaceous material with a high basal cover percentage.
- The frequency of rodent captures differed significantly at grid C (n = 634).
- The bottom slope was divided into three sampling transects based on management activity. The frequency of rodent captures differed significantly between outside 1C (n = 318), inside the enclosure 2C (n = 180) and the sodic area inside the enclosure site 3C (n = 136)



## SMALL MAMMAL RECORDS ON THE MANAGEMENT AT THE N'WASHITSHUMBE ENCLOSURE SITE



Graph illustrating the comparison of small mammal capture success between the different management areas at the N'washitshumbe enclosure site



## Small mammal records from outside the N'washitshumbe enclosure site

- Data was recorded outside the enclosure site and referred to as transects 1A, 1B and 1C.
- Outside the site was represented by top, middle and bottom slope habitats. The primary difference was the influence of fire and elephant impact on the vegetation density and diversity outside, when compared with the inside.
- The frequency of rodent captures differed significantly outside the enclosure (n = 970). Outside sites were divided into three sampling transects based on management activity.
- Nine species were collected at sites outside the enclosure: *Mastomys natalensis*, *Mastomys coucha*, *Saccostomys campestris*, *Tatera leucogaster*, *Lemniscomys rosalia*, *Aethomys chrysophilus*, *Mus minutoides*, *Crocidura hirta* and *Steatomys pratensis*.
- No records of *Graphiurus murinus* or *Paraxerus cepapi* were recorded outside the enclosure site. This is a clear indication of changes in habitat affecting species diversity.



## Small mammal records from the fire break surrounding the N'washitshumbe enclosure site

- Data was recorded in the fire break around the enclosure site and referred to as transects 2A and 2B.
- The fire breaks surrounding the enclosure site were represented by top and middle slope habitats. No fire break was present at the bottom slope as a result of the vlei being an effective fire barrier.
- The frequency of rodent captures were insignificant in the fire break area ( $n = 631$ ) when compared with outside sites. Fire break sites were divided into two sampling transects based on slope. The frequency of rodent captures were insignificant between top slope fire break 2B ( $n = 310$ ) and middle slope fire break 2A ( $n = 333$ )
- The following frequencies were recorded in the fire breaks during the study period: *Mastomys* species ( $n = 524$ ), *Saccostomys campestris* ( $n = 79$ ), *Tatera leucogaster* ( $n = 13$ ), *Lemniscomys rosalia* ( $n = 11$ ) and *Mus minutoides* ( $n = 4$ ). An inverse relationship occurred between *Mastomys* and other species in the area
- No record of *Aethomys chrysophilus*, *Steatomys pratensis*, *Graphiurus murinus* or *Paraxerus cepapi* were recorded in the fire break sites.



## Small mammal records from inside the N'washitshumbe enclosure site

- Data was recorded inside the enclosure site and referred to as transects 3A, 3B and 2C.
- The sites inside the enclosure were represented by top, middle and bottom slope habitats. The primary difference being the absence of fire and elephant impact on the vegetation, compared with the outside and fire break sites.
- This has resulted in a substantially greater amount of herbaceous material and a greater abundance of woody plants. The frequency of rodent captures were significant lower inside the enclosure (n = 589) compared with the outside sites. The frequency of rodent captures were insignificant between the top 3B (n = 206) and middle slope 3A (n = 203) on the inside. However fewer animals were collected at the bottom slope 2C (n = 180) on the inside.
- Nine species were collected inside the enclosure site: *Mastomys natalensis*, *Mastomys coucha*, *Saccostomys campestris*, *Tatera leucogaster*, *Lemniscomys rosalia*, *Aethomys chrysophilus*, *Mus minutoides*, *Graphiurus murinus* and *Paraxerus cepapi*
- No records of *Steatomys pratensis* or *Crocidura hirta* were recorded inside the enclosure site.



## Small mammal records from the sodic site inside the N'washitshumbe enclosure site

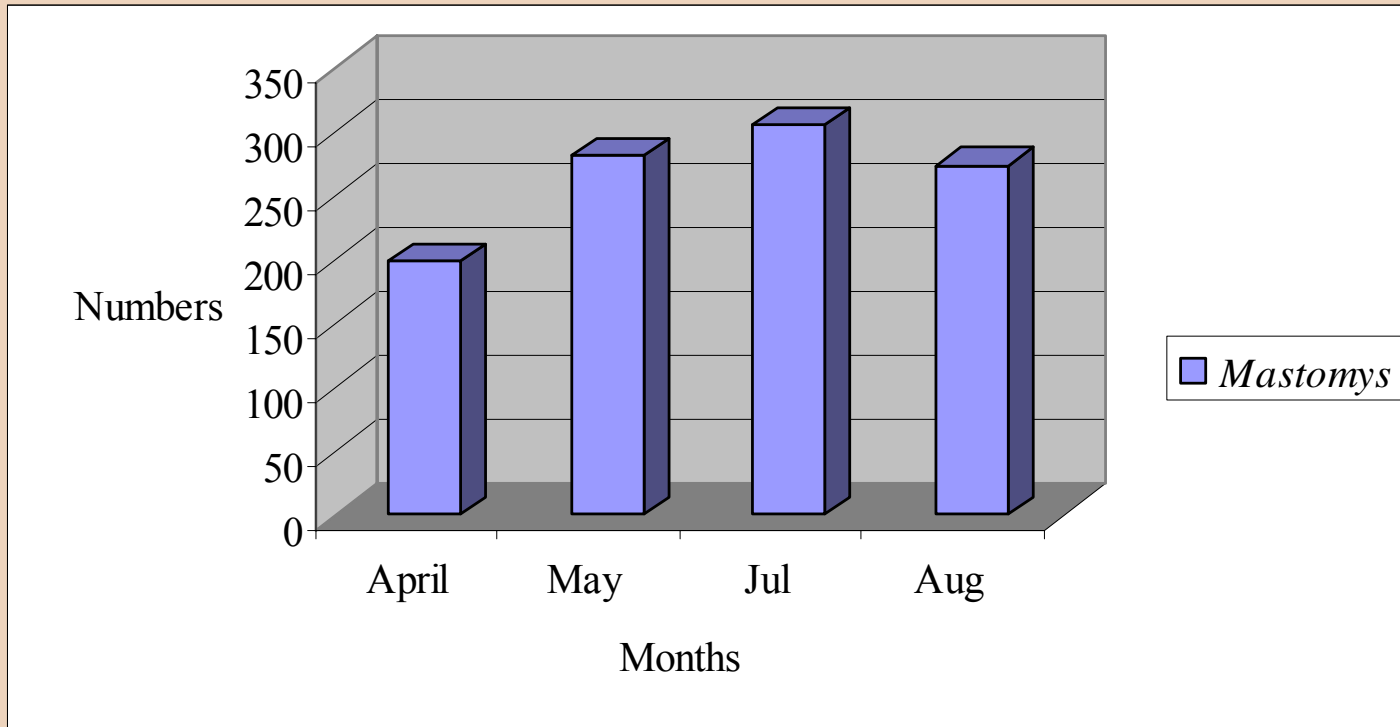
- Data was recorded from a sodic site inside the enclosure referred to as transect 3C.
- This site was chosen as a representative of a sodic area on the bottom slope of the catena. This site was not compared with other such sites outside the enclosure but rather as a stand alone in the survey area. This area was represented by sparse grass cover in an absence of woody plants. The frequency of rodent captures were significant lower (n = 136) in the sodic area when compared with other transect lines at the site.
- The following frequencies were recorded in the sodic site during the study period: *Mastomys* species (n = 104), *Saccostomys campestris* (n = 23) and *Tatera leucogaster* (n = 9).
- No records of *Lemniscomys rosalia*, *Mus minutoides*, *Aethomys chrysophilus*, *Steatomys pratensis*, *Graphiurus murinus*, *Crocidura hirta* or *Paraxerus cepapi* were recorded in the sodic site. This is a clear indication of the dependency of small mammals for sufficient cover for protection from predators.



## July 2004 block burn...

- Large numbers of juveniles collected late summer – resulted in the population explosion in winter
- Decrease in *Mastomys* only noticeable after winter months
- Certain areas 100% burn/close to 100% capture success
- December *Tatera* dominated





The following four monthly frequencies recorded for *Mastomys* were: April 2004 ( $n = 199$ ), May 2004 ( $n = 282$ ), July 2004 ( $n = 306$ ) and August ( $n = 274$ ).

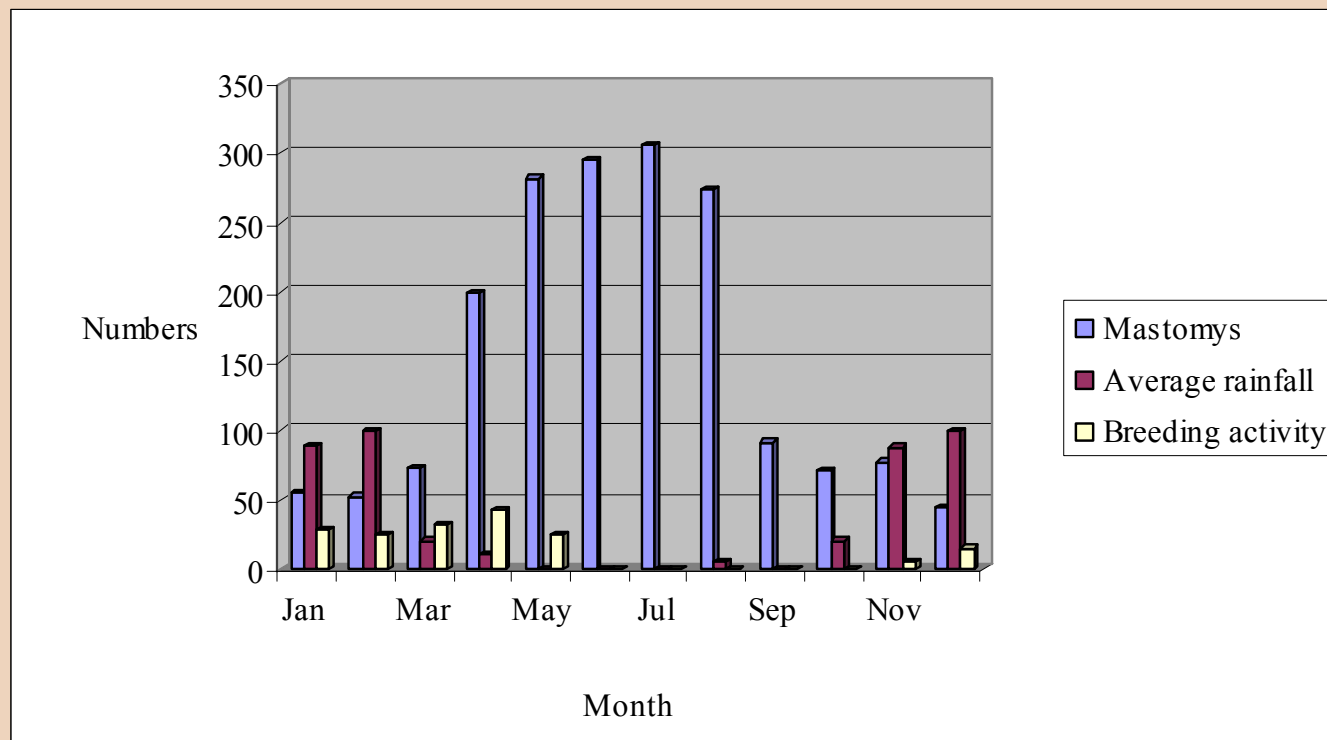


## ECTO-PARASITES ON RODENT SPECIES AT THE N'WASHITSHUMBE ENCLOSURE SITE

- Larvae of *B. decoloratus* were collected on three species of rodent found at the enclosure site. These included *S. campestris*, *M. natalensis*, and *T. leucogaster*
- *Rhipicephalus appendiculatus* were not collected on any of the small mammals collected but in low numbers on vegetation.
- Nymphs and larvae of *R. simus* were recorded on *Mastomys* species at the N'washitshumbe enclosure site
- Nymphs of *R. lunulatus* were collected on *Mastomys* species at the N'washitshumbe enclosure site
- The major species collected on vegetation at the enclosure site being the larvae of *Amblyomma hebraeum*.
- Large mites (*Laelaps giganteus*), similar in size to many of the nymphs of many tick species, infested all the rodents collected.



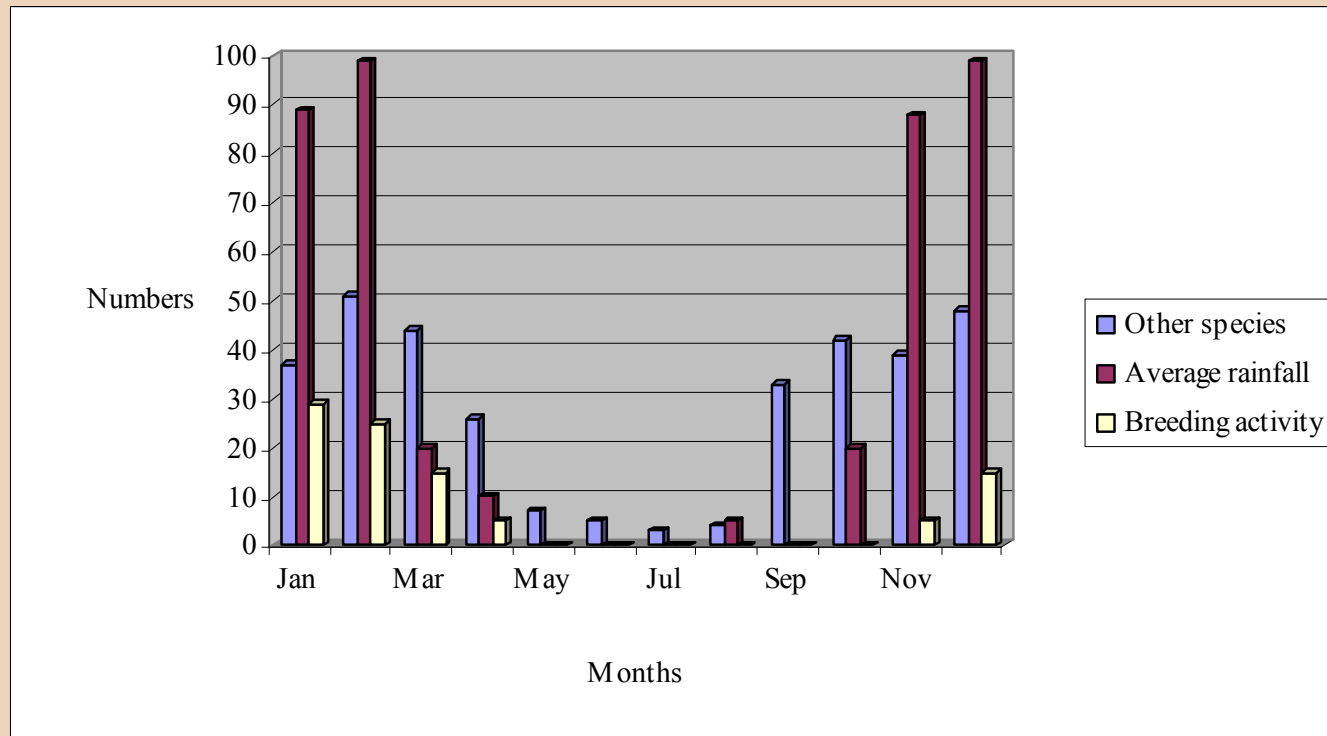
## *Mastomys* Breeding activity



A histogram illustrating breeding activity of *Mastomys* species in relation to average rainfall.



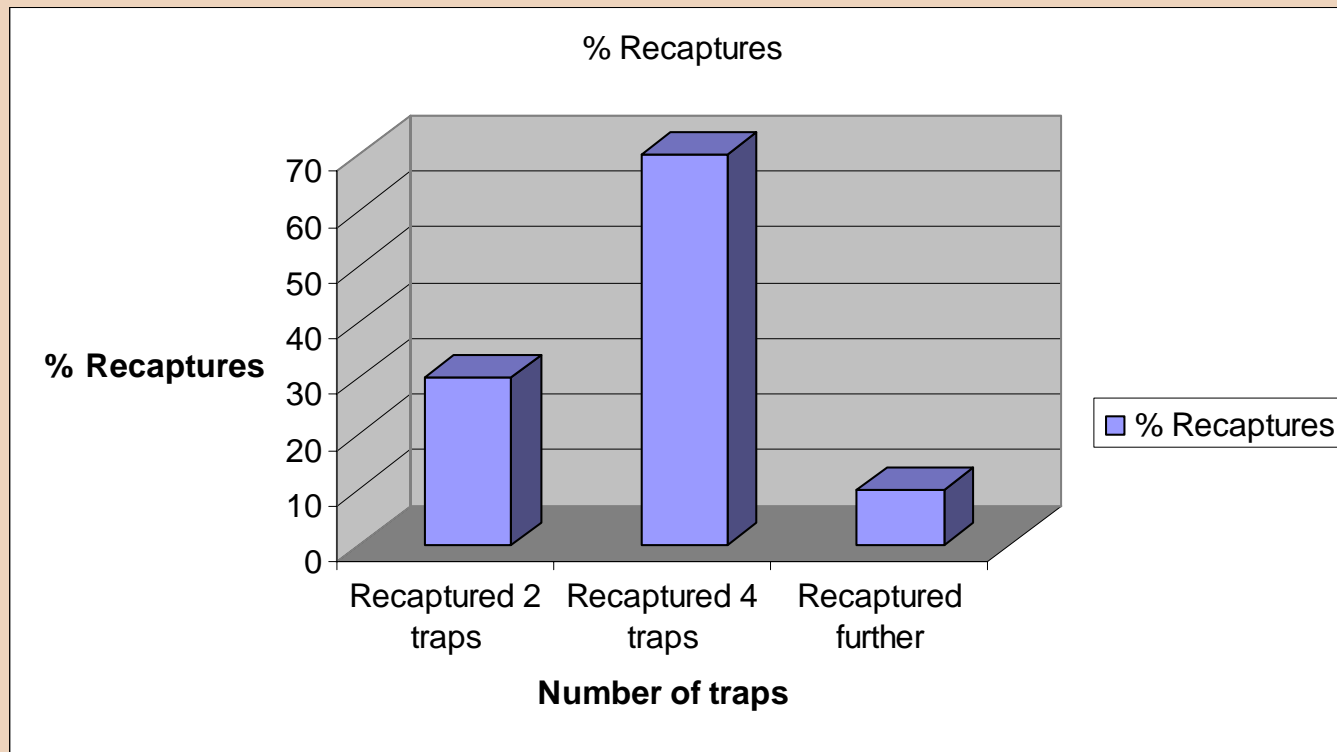
## Other species Breeding activity



A histogram illustrating breeding activity of *less abundant species* in relation to average rainfall.



# GENERAL MOVEMENT



A histogram illustrating breeding activity of *less abundant species* in relation to average rainfall.



## *Mastomys* total body length analysis

Result of ANOVA analysis of variance on variables analyzed for *Mastomys* total body length.

Source	DF	F Value	Pr > F
Grid	2	8.85	0.0002
Place	3	1.13	0.3340
Grid* Place	3	0.38	0.7650
Climate	3	6.62	0.0002



## *Mastomys* mass analysis

Result of ANOVA analysis of variance on variables analyzed for *Mastomys* mass.

Source	DF	F Value	Pr > F
Grid	2	6.53	0.0015
Place	3	3.25	0.0212
Grid* Place	3	0.29	0.8360
Climate	3	30.27	< 0.0001



## *S. campestris* total body length analysis

Result of ANOVA analysis of variance on variables analyzed for *Saccostomys* total body length.

Source	DF	F Value	Pr > F
Grid	2	0.05	0.9527
Place	3	0.82	0.4848
Grid* Place	3	0.35	0.7870
Climate	2	16.74	< .0001



## *S. campestris* mass analysis

Result of ANOVA analysis of variance on variables analyzed for *Saccostomys* mass.

Source	DF	F Value	Pr > F
Grid	2	0.78	0.4606
Place	3	1.14	0.3364
Grid* Place	3	1.16	0.3295
Climate	2	14.33	< .0001



## ***T. leucogaster* total body length analysis**

Result of ANOVA analysis of variance on variables analyzed for *Tatera* total body length.

Source	DF	F Value	Pr > F
Grid	2	0.60	0.5547
Place	3	0.19	0.9017
Grid* Place	2	2.82	0.0694
Climate	3	0.61	0.6141



## *T. leucogaster* mass analysis

Result of ANOVA analysis of variance on variables analyzed for *Tatera* mass.

Source	DF	F Value	Pr > F
Grid	2	2.30	0.1112
Place	3	0.37	0.7735
Grid* Place	2	0.67	0.5149
Climate	3	4.38	0.0084



## Final Points and Conclusions

- Difference in abundance more prevalent than differences in diversity
- Rodent movement restricted in and out the site i.e. only few records/fire breaks
- Some local movements i.e. vlei winter/summer (C1)
- General movement 4/5 traps up/down i.e. relatively permanent
- *Mastomys coucha* dominant *Mastomys* spp. in the area
- No representative specimens sampled harbored *Encephalomyocardis* virus



## CONTINUE....

- Representative specific species found in or outside...
- Limited number of shrews i.e. *Crocidura* recorded i.e. only vlei
- Capture success improved in wet conditions
- Inverse relationship between *Mastomys* numbers and other dominant species i.e. *Tatera* and *Saccostomys*



## Acknowledgements

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**THANK YOU**

