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CHAPTER 4 SMALL MAMMALS OF THE ZAMBEZI WETLANDS

Fenton Cotterill

4.1 INTRODUCTION

Small mammals make up a significant proportion of the mammal fauna of the Zambezi Basin. With the exception of the poorly known otter-shrew, *Potamogale velox* (known only from Mwinilunga District in NE Zambia), there are no specialized mammals occurring in the basin that are entirely dependent on wetlands. Yet wetlands are important habitats for small mammals; floodplains support fluctuating populations of rats and mice, as do riparian forests and woodlands, and shrews exploit the abundance of invertebrates found there. Bats are particularly well-adapted to exploit insect prey foraging over floodplains and open water, provided roosts are available on wetland margins.

The small mammal fauna of the Zambezi Basin is incompletely known. This deficiency applies to all groups (bats, insectivores and rodents). Most wetland habitats have been poorly surveyed, if at all. The main information available is limited to distributions and taxonomy, with very little known of different species' natural history and ecology. Knowledge of the small mammals of Barotseland is based primarily on specimens collected (mostly by W.F.H. Ansell) through the 1940s and into the 1970s. This taxonomic and biogeographical data for small mammals was included in Ansell's *Mammals of Zambia* (Ansell 1978). Smithers and Tello (1976) compiled an analogous treatment for Mozambique, the mammal fauna of which is one of the least known of all African countries. This deficiency of information is exemplified by the Zambezi Delta. Pioneering studies of African mammals were initiated on the lower Zambezi by R.H. Peters in the mid-19th century. Many larger mammals, together with some bats and rodents, were described to science by him. Examples include the porcupine (*Hystrix africaeaustralis*), Lichtenstein's hartebeest (*Sigmoceros lichtensteinii*), and the red squirrel (*Paraxerus palliatus*). Nevertheless, there have been no further scientific studies of small mammals of the Lower Zambezi and its delta. Small mammals were surveyed in some protected areas in Mozambique through the 1960s and early 1970s. This activity did not extend to Marromeu, where research was limited to monitoring of large mammals (summarised in Cumming *et al.* 1994) in the Marromeu Buffalo Reserve and surrounding hunting areas (coutadas).

This chapter presents the results of two surveys of important wetlands in the Zambezi Basin – Barotseland and the Zambezi Delta. The contributions of these new data to improved knowledge of the small mammal faunas of these areas are discussed in a national and regional context.

4.2 BAROTSELAND SMALL MAMMALS SURVEY

4.2.1 Introduction

As part of the Biodiversity Foundation for Africa/Zambezi Society wetlands biodiversity assessment project, a field survey of the small mammals of some of the wetlands of Barotseland, Western Zambia was carried out between 2-12 November 1998. The author was accompanied by Mr Aleck Ndlovu, technician in the Department of Mammals, Natural History Museum in Bulawayo. The trip was done in conjunction with a wetland bird survey (see Appendix 5.1).

Mammalian nomenclature follows Wilson and Reeder (1993), except for *Pipistrellus* where Hill and Harrison (1987) are followed.

4.2.2 Methodology

Owing to vehicle problems, only two sites were sampled – both dambos. The first site was 7 km west of Ndanda School, north of Mongu in a lower drainage valley classified as a wet riverplain R2 by Jeanes & Baars (1991). The woodlands near settlements had been modified, but extensive and dense tall stands of miombo occurred to the south. The second site was Litoya dambo next to a village near a large permanent pool also situated in a wet riverplain. The margins of the dambo were densely settled and cultivated; few livestock were seen. Woodlands near villages exhibited considerable modification with much regrowth and evidence of felling. This last site provided many bats but few terrestrial mammals.

4.2.3 Results

Total number of species collected was 26 (Table 4.1), representing a collecting effort of 43 net nights and 14 harptrap nights. The majority of bats were netted, with 34 bats captured in harptraps. Only five terrestrial mammals were collected, using snap traps baited with peanut butter and rolled oats, over 300 trap nights in eight days, while two rodents were collected in the pitfall trap arrays. Some invertebrates (insects, spiders and scorpions) and over 50 specimens of frogs and reptiles were also collected in the pitfalls and in swamps and pools near Ndanda School. All this material has been deposited in the Bulawayo Natural History Museum.

4.2.4 Discussion

Western Zambia has been poorly collected with respect to small mammals (Ansell 1978). Nonetheless, the occurrence of all these species is not unexpected. The bat fauna, as judged by captures in nets and harptraps, is dominated by vespertilionids and molossids. I suspect these bats roost in hollows and crevices in trees and under exfoliating bark in the tall woodlands bordering the Litoya and Ndanda dambos. The success in sampling of bats was the focus on permanent water bodies around which the bats congregated to drink and forage. This sampling strategy has also proved successful in Zimbabwe, especially during the hot, dry season in October and November. The high abundance of *C. pumila* at Litoya may reflect the occurrence of a large colony in a building in the vicinity, perhaps at the school.

The series of *Chaerephon chapini*, *Mops niveiventer*, *Laephotis botswanae*, *Pipistrellus anchietai* and *Scotoecus albigula* are of significant scientific taxonomic importance as such series are uncommon. The former, Africa's smallest molossid bat, is not common, with the Ndanda collection being the third recorded locality in Zambia. *M. niveiventer* and *L. botswanae* are known from a few scattered localities in Zambia and E Angola, with *L. botswanae* known from further south (Cotterill 1996).

House bats of the genus *Scotoecus* include some of Africa's most poorly known bats. Too few specimens have been collected to establish species boundaries with confidence. For example, *S. albofuscus* is only known from three specimens from the southern African subregion; two individuals from Zinave in central Mozambique (Smithers & Tello 1976) and one specimen collected near St Lucia in South Africa (Kearney & Taylor 1997). The series of *Scotoecus albigula* secured on this expedition is quite possibly the largest available from any single locality. These new specimens have been compared with the three specimens preserved in Bulawayo. Cranially, they are identical to a specimen of *S. cf. albigula* from the Luangwa Valley and conform to the key and

data in Hill (1974). As far as I am aware, the photographs obtained are also the first taken of this species. No further conclusions can be drawn on their taxonomic status until the specimens in the UK are examined. A similar situation applies to the unidentified specimens of *Pipistrellus* and *Scotophilus*.

Table 4.1. List of mammals collected in western Zambia, November 1998, by collecting site.

Species	Litoya	Ndanda	Remarks
Family Pteropididae			
<i>Epomophorus dobsoni</i>		X	
<i>Epomophorus gambianus</i>	X	X	
Family Molossidae			
<i>Mops midas</i> Midas free-tailed bat	X		locally common
<i>Mops condylura</i> Angola free-tailed bat	X	X	common
<i>Mops niveiventer</i> White-bellied free-tailed bat	X	X	locally common
<i>Chaerephon chapini</i> Long-crested free-tailed bat		X	rare
<i>Chaerephon pumila</i> Little free-tailed bat	X	X	common
<i>Chaerephon nigeriae</i> Nigerian free-tailed bat	X	X	locally common
Family Vespertilionidae			
<i>Scotophilus borbonicus</i> Lesser house bat	X	X	common
<i>Scotophilus dinganii</i> Yellow house bat		X	common
<i>Scotophilus</i> sp.	X		undescribed species, also known from SE Zimbabwe
<i>Scotoecus albigula</i>		X	rare
<i>Laephotis botswanae</i> Botswana long-eared bat		X	rare
<i>Pipistrellus capensis</i> Cape pipistrelle	X	X	common
<i>Pipistrellus melckorum</i> Melck's pipistrelle		X	rare
<i>Pipistrellus somalicus</i> Somali pipistrelle	X	X	common
<i>Pipistrellus anchietai</i> Anchieta's pipistrelle	X	X	locally common
<i>Pipistrellus rusticus</i> Rusty bat	X	X	common
<i>Pipistrellus kuhli</i> Kuhl's pipistrelle		X	rare
<i>Pipistrellus nanus</i> Banana bat		X	common
<i>Pipistrellus</i> sp.	X	X	
<i>Glauconycteris variegata</i> Butterfly bat		X	
Family Rodentia			
<i>Cryptomys damarensis</i> Damara molerat	X	X	common on Kalahari sand
<i>Dasymys incomtus</i> Water rat		X	
<i>Saccostomys campestris</i> Pouched mouse		X	
<i>Tatera leucogaster</i> Bushveld gerbil		X	

Overall, the significance of these new biogeographical data can be judged from the distribution maps given in Ansell (1978). In addition, important life history data was obtained for many of the species of bats collected – most females had recently given birth and were lactating, or births were imminent.

The mole rats were collected from colonies which occur along the edges of the dambos: their burrows extended into the open grassland. These specimens were trapped with modified Hickman traps (Hickman 1979) baited with potato, and were identified as *Damara molerat*, *Cryptomys damarensis*, which is widespread on Kalahari sands in south central Africa. This species was encountered at both Litoya and Ndanda. Fresh mounds, presumed to have been dug by *C. damarensis*, were seen elsewhere in Mongu District and between Senanga and Shesheke on the west bank of the Zambezi.

The paucity of rodents and insectivores encountered during the survey is an interesting result. I suggest that their absence is the result of human depredations and activities such as fire. The sampling period may also have coincided with dispersals and/or declines in rodent populations.

It is obviously difficult to assess the representativeness of data collected during this survey. Although only the eastern margins of the Barotse floodplain were sampled, I am confident that the two localities of Litoya and Ndanda represent the landscapes along the eastern extent of the floodplain. I suspect that the insectivorous bats in the region roost in woodlands and forage and drink over the neighbouring floodplain and dambos. Further surveys are required, especially within the floodplain proper and in the northern part of Barotseland.

4.2.5 Other observations

The Lozi farmers living along the Ndanda and Litoya dambos confirmed the lack of small mammals. They said these are frequently hunted for food. Evidence of springhares was seen.

Little evidence of large mammals was seen. Droppings of reedbuck, *Redunca arundinum*, were noted in the Ndanda dambo approximately 8 km west of Ndanda School. We were told about the occurrence of lechwe along the Luena Flats and also further west along the Litoya dambo near the Zambezi, but this could not be confirmed.

4.3 ZAMBEZI DELTA SMALL MAMMAL SURVEY

4.3.1 Introduction

This report provides details of a collection of 15 species of small mammals from the Marromeu District of central Mozambique made between 24 July and 7 August 1999. The author was accompanied by Mr Alec Ndlovu of the Natural History Museum in Bulawayo. The mammal survey team constituted part of a larger multidisciplinary party.

Little information is available on the mammals of the Marromeu District. Pioneering studies of African mammals were initiated in the environs of the lower Zambezi by R.H. Peters in the mid-19th Century: many of the more conspicuous larger mammals, together with some bats and rodents, were described to science by him as a result. Examples include the porcupine (*Hystrix africaeaustralis*), Lichtenstein's hartebeest (*Sigmoceros lichtensteinii*) and the red squirrel

(*Paraxerus palliatus*). Little further in the way of scientific studies of terrestrial mammals occurring along the Lower Zambezi and its delta has occurred since. Surveys of small mammals were completed for some protected areas in Mozambique some years ago, but did not include Marromeu. The major authority remains the *Mammals of Moçambique* (Smithers & Tello 1976) which collated existing knowledge at that time. With the exception of some monitoring of large mammals (summarised in Cumming *et al.* 1994) in the Marromeu Buffalo Reserve and surrounding hunting areas (coutadas), no scientific collections of small mammals had previously been made in the environs of the Zambezi Delta and Marromeu floodplain.

4.3.2 Methods

Small mammals were collected in the Marromeu district of central Mozambique from two sites, supplemented by some work in the town of Marromeu itself. One site was in Coutada 11 on the western edge of the floodplain. The bulk of collecting was carried out within a 2 km radius of the base camp on the ecotone between floodplain, palm savanna and forest. The second site was near the administrative centre of Malingapansi in the southern section of the delta along the Rio Micelo (18°40'36"S / 36°06'17"E). This is situated in an agro-ecolandscape in which remnants of fringing riparian forest and palm savanna had persisted.

A collapsible harp trap and standard 4 tier mistnets (12 x 2 m) were used for bats. These were set near the ground, and also suspended higher in the canopy in attempts to intercept flying bats. Snap traps, baited with peanut butter and rolled oats, were set in microhabitats (near grass tussocks, holes, hollow trees, under fallen logs etc). A total of 45 snap traps were deployed. Modified Hickman traps (Hickman 1979) were used to capture mole rats.

Pitfall trap arrays were set in two sites to trap rodents and shrews, as well as amphibians, small reptiles and invertebrates. Each array consisted of 20 litre PVC plastic buckets set in the ground, and interconnected by barriers of plastic sheeting. Plastic sheets were held in place with steel pegs and the bottom edge of the plastic buried in the soil. Some invertebrates (insects, spiders and scorpions) were collected in the pitfalls and have been deposited in the Natural History Museum of Zimbabwe.

Nomenclature follows Wilson & Reeder (1993), except in the case of *Pipistrellus* which follows Hill & Harrison (1987).

4.3.3 Results

Specimens collected

Specimens of 15 species were collected from the Marromeu wetland and Zambezi Delta (Table 4.2). All represent significant new locality records in Mozambique. The special significance of two species of fruit bats are discussed below. Nevertheless, these results are disappointing given the sampling effort. A total of only five terrestrial mammals were collected from Coutada 11. This was despite a trapping effort over nine days of 45 snaptraps (405 trap nights). These snap traps only captured one four-toed elephant shrew (*Petrodomus tetradactylus*) and one rodent. Similarly, the use of two pitfall arrays over eight nights collected a total of one shrew and one rodent. Trapping success was even lower near Malingapansi, where the majority of rodents were collected by the local community. These results were disappointing considering the sampling effort in apparently mammal rich habitat.

Captures of bats were also disappointing despite a sampling effort of 40 net nights, with the harp trap operating for seven nights. The large collection of molossids (notably *Mops condylura*) was taken in Marromeu, where large colonies of *M. condylura* and *Chaerephon pumila* have colonized the roofs of houses. *M. condylura* typically roosts in hollow trees, as evident in five specimens collected by a member of the local community in Coutada 11 from their daylight roost in a large tree.

Table 4.2. Small mammal species collected in Marromeu District, Mozambique between 24 July and 7 August 1999.

Taxon	Marromeu	Coutada 11	Malingapansi
Order Insectivora (Shrews)			
<i>Crocidura luna</i> , Dollman, 1910 Grey-brown musk shrew		X	
Order Chiroptera (Bats)			
<i>Eidolon helvum</i> (Kerr, 1792) Straw-coloured fruit bat	X		
<i>Epomophorus crypturus</i> Peters, 1852 Peters' epauletted fruit bat		X	X
<i>Epomophorus wahlbergi</i> (Sundevall, 1846) Wahlberg's epauletted fruit bat		X	X
<i>Lissonycteris angolensis goliath</i> Bergmans, 1997 Harrison's fruit bat		X	
<i>Pipistrellus somalicus</i> (Thomas, 1901) Somali pipistrelle		X	
<i>Pipistrellus nanus</i> (Peters, 1852) Banana bat		X	
<i>Mops condylura</i> (A. Smith, 1833) Angolan free-tailed bat	X	X	
<i>Chaerephon pumila</i> (Cretzschmar, 1830) Little free-tailed bat	X		
Order Rodentia (Squirrels, Rats and Mice)			
<i>Cryptomys darlingi</i> (Thomas, 1895) Darling's mole rat		X	
<i>Mastomys natalensis</i> (A. Smith 1834) Natal Multimammate mouse			X
<i>Mus minutoides</i> A. Smith, 1833 Pygmy mouse		X	
<i>Aethomys chrysophilus</i> (de Winton, 1897) Red veld rat		X	X
<i>Rattus rattus</i> (Linnaeus, 1758) House rat			X
Order Macroscelidea (Elephant Shrews)			
<i>Petrodomus tetradactylus</i> Peters, 1846 Four-toed elephant shrew		X	

A brief pulse of activity occurred near the base camp in Coutada 11, but lasted approximately one hour. Very few bats were captured despite erection of nets into the canopy. The harp trap only captured one *Pipistrellus somalicus*. More success was obtained with fruit bats, especially in the vicinity of fruiting trees: both at Malingapansi and Coutada 11. Nevertheless, capture should have been much higher overall.

A series of four-toed elephant shrews (*Petrodomus tetradactylus*) were collected by the local community further inland (near the headquarters of Coutada 11). Local inhabitants also said that this elephant shrew occurred in the vicinity of Malingapansi, but none were seen. The preferred habitat of this species is the understorey of dry, evergreen forest. *P. tetradactylus* is widely distributed across coastal Mozambique, extending eastwards where suitable habitat is available.

Several colonies of mole-rats were encountered in Coutada 11. Sustained trapping over several days near the base camp yielded two specimens with two others being captured by members of the local community. Although provisionally identified as *Cryptomys darlingi*, these might represent a taxonomically distinct population, for which the name *bierai* is available. Molecular studies (including mitochondrial DNA and karyology) are necessary to resolve this possibility.

Visual records of mammals

Specimen-based records were supplemented by records for 14 species based on either direct sightings or identification of spoor or scats (Table 4.3). Spoor of some antelope species was recorded in Coutada 11. Visual records were also obtained for warthog (*Phacocheirus aethiopicus*), bushbuck (*Tragelaphus scriptus*), buffalo (*Syncerus caffer*), oribi (*Ourebia ourebi*) and reedbuck (*Redunca arundinum*). Spoor and scats were also seen of Lichtenstein's Hartebeest (*Sigmoceros lichtensteinii*), red duiker (*Cephalophus natalensis*) and water mongoose (*Atilax paludinosus*).

Troops of samango monkey (*Cercopithecus mitis erythrarchus*) were seen and heard in Coutada 11 near the base camp on the floodplain and near the main hunting camp. A troop of this species was also seen near the mouth of the Zambezi Delta in mangrove forests approximately 2 km inland from the Indian ocean (W.R. Branch, *pers. comm.*). Troops of vervet monkey (*Cercopithecus aethiops*) were seen approximately 3 km SE of Malingapansi in a patch of mixed palm forest, including mango trees.

The calls of thick-tailed bushbaby (*Otolemur crassicaudatus*) were heard near the base camp in Coutada 11. A smaller galago (presumed to be *Galagoides zanzibaricus*, Grant's nightape) was also observed in the vicinity. A red squirrel (*Paraxerus palliatus*) was observed in forest edge along the base camp in Coutada 11.

In addition, the safari operator in Coutada 11 reported the occurrence of elephant (*Loxodonta africana*), sable (*Hippotragus niger*), suni (*Neotragus moschatus*) and blue duiker (*Cephalophus monticola*) in the hunting area. Details of visual records of larger mammal species are maintained in a log book by hunters.

Table 4.3. Mammals for which visual records were obtained in Marrromeu District, Mozambique between 24 July and 7 August 1999.

Taxon	Coutada 11	Delta area
Order Primata (Primates)		
<i>Otolemur crassicaudatus</i> (E. Geoffroy, 1812) Thick-tailed bushbaby	X	X
<i>Galagoides zanzibaricus granti</i> (Thomas & Wroughton, 1907) Grant's nightape	X	–
<i>Cercopithecus mitis erythrarchus</i> (Peters, 1852) Samango monkey	X	X
<i>Cercopithecus aethiops</i> (Linnaeus, 1758) Vervet monkey	–	X
Order Carnivora (Carnivores)		
<i>Atilax paludinosus</i> (G. Cuvier, 1829) Water mongoose	X	X
<i>Panthera pardus</i> (Linnaeus, 1758) Leopard	X	–
Order Tubulidentata (Antbears)		
<i>Orycteropus afer</i> (Pallas, 1766) Antbear	X	–
Order Ungulata (Antelopes, Pigs)		
<i>Phacochoerus aethiopicus</i> (Pallas, 1766) Warthog	X	–
<i>Syncerus caffer</i> (Sparrman, 1779) Buffalo	X	–
<i>Redunca arundinum</i> (Boddaert, 1785) Southern Reedbuck	X	–
<i>Ourebia ourebi</i> (Zimmermann, 1783) Oribi	X	–
<i>Sigmoceros lichtensteini</i> (Peters, 1849) Lichtenstein's hartebeest	X	–
Order Rodentia (Squirrels, Rats and Mice)		
<i>Paraxerus palliatus</i> (Peters, 1852) Red squirrel	X	–
<i>Hystrix africaeausstralis</i> (Peters, 1852) Porcupine	X	–

4.3.4 Significance of collected specimens

The mammal fauna of Mozambique is poorly known. The most up-to-date review remains Smithers & Tello (1976). Although, J. Tello, K. Tinley and colleagues collected small mammals from some protected areas in Mozambique through the 1960s into the early 1970s, these surveys concentrated on Gorongosa and Zinave National Parks. Few specimens, if any, were collected from the Zambezi

Delta and Marromeu. The nearest collecting activities to the delta were by R.H. Peters in the middle of the 19th century. In 1908, Austin Roberts (later the famous curator in Transvaal Museum) and F. Vaughan Kirby collected some mammals north west of Chinde and near Quelimane in 1908 (Brain 1998). These were mostly from the vicinity of Vila Pereira and Nhamacurra, some distance north of the Lower Zambezi.

The results of this expedition to Marromeu were disappointing. Far higher returns on mistnetting for bats and trapping for small terrestrial mammals were expected. This is probably because mammal activity had not re-commenced after the dry season with the rise in ambient temperatures. Nonetheless, some of the specimens obtained represent significant contributions to scientific knowledge of the species they represent. These are discussed in turn.

Harrison's Fruit Bat, *Lissonycteris angolensis goliath*

The single specimen of the fruit bat, *Lissonycteris angolensis goliath*, collected in Coutada 11 is an interesting record. This is a significant range extension from the Eastern Highlands in eastern Mozambique near the Zimbabwe border. The taxonomic distinctiveness of this population was only recently established (Bergmans 1997). The identity of this specimen is not in doubt as it has been compared with the holotype and paratypes in the Natural History Museum, Bulawayo. Few specimens are known of this recently-described fruit bat. This is the second known locality of the species from Mozambique, which has previously only been recorded from the vicinity of Chimoio. The only other known specimens have been collected in eastern Zimbabwe (Gleneagles, Nyanga and the Haroni-Rusitu forest). Although originally described as a subspecies, the allopatric distribution of this population suggests that full specific status is likely. *L. a. goliath* is significantly larger than fruit bats of the toptypical population restricted to west Africa. The specific status of *L. goliath* is conferred if an evolutionary species concept (recognising the phylogenetic distinctiveness of the allopatric population as an evolutionary lineage) is applied.

Straw-coloured Fruit Bat, *Eidolon helvum*

The permanent occurrence of *Eidolon helvum* in the town of Marromeu is of significant interest. The bats, estimated to number in their hundreds, roost in a large mango tree near the sugar refinery in eastern Marromeu close to the south bank of the Zambezi. The large, adult mammal collected was sexually active, and considerable fighting over roost space was observed. This strongly suggests that the colony was reproductively active. Small, permanent colonies of *Eidolon helvum* have been reported in Malawi (Ansell & Dowsett 1988). The Marromeu colony has been in residence at least since 1978 (B. Chande, pers. comm.). To the best of my knowledge, this is the only permanent colony of *Eidolon helvum* in southern Africa. Its conservation is of obvious importance. This large bat is migratory, and its range is centred on moist forests of west and central Africa. Individuals migrate widely from this region, and range across the subcontinent. It was previously believed that reproduction only occurred in equatorial regions, and only migratory individuals occurred in southern Africa (Smithers 1983).

Paucity of Small Mammals

The most likely explanation for the paucity of terrestrial mammals noted in this survey is the phenology of the environment. The floodplains may only provide suitable habitats for rodents once flooded grasslands have receded. This would occur later in the year (September through December) with populations continuing to increase through the wet season. In this case, populations would be localized and reduced by the end of the wet season.

Some evidence for this situation is illustrated in the characteristics of rodents captured near Malingapansi, notably multimammate mice (*Mastomys natalensis*). A large series of *M. natalensis* was collected by members of the local community in the environs of Malingapasi. This species is commensal with humans, and especially abundant in agroecolandscapes. Mice of the genus *Mastomys* are capable of high fecundity, and their rapid growth rates and early age of breeding account for population explosions. Many of these specimens captured in Malingapansi were juveniles and subadults, which suggest that a population explosion of *Mastomys* was underway in the area. In addition, 4 subadult specimens of the commensal house rat, *Rattus rattus* was collected in newly completed buildings in Malingapansi.

Based on experience in Zimbabwe and southern Zambia, most bats exhibit a seasonal decline in activity. Highest captures occur during the warmer months of the hot, wet season (September-April) when bats are reproductively active. During the cool, dry season (May-August) insectivorous bats tend to forage intermittently, and their metabolic demands are lower compared to when breeding.

4.3.5 Conclusions and suggestions

There remains considerable potential to improve scientific knowledge of the small mammals of the Marromeu wetland and Zambezi Delta, as for all the region's biodiversity. This will only accrue through further surveys. The most suitable season to survey small mammals in the Marromeu District is most likely in November, or possibly later during the summer months. Sampling through November into December will most likely provide the highest returns on sampling effort. Captures of rodents and shrews should also improve at this time.

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