Mastomys spp. – Multimammate Mouse

Mastomys coucha – Richard Yarnell

Regional Red List status (2016)	
Mastomys coucha	**Least Concern**
Mastomys natalensis	**Least Concern**
National Red List status (2004)	
Mastomys coucha	Least Concern
Mastomys natalensis	Least Concern
Reasons for change	No change
Global Red List status (2016)	
Mastomys coucha	Least Concern
Mastomys natalensis	Least Concern
TOPS listing (NEMBA) (2007)	None
CITES listing	None
Endemic	No

Multimammate mice are generalist species and are often the first to colonise areas recovering from disturbance. The two species cannot be distinguished by appearance alone and, as such, their respective distribution ranges remain uncertain (Kneidinger et al. 2014).

Taxonomy

Mastomys coucha (Smith 1834)

Mastomys natalensis (Smith 1834)

ANIMALIA - CHORDATA - MAMMALIA - RODENTIA - MURIDAE - *Mastomys*

Synonyms: For *M. natalensis*: *Mastomys hildebrandtii* (Peters 1878); *Myomys fumatus* (Peters 1878)

Common names: *M. coucha*: Southern Multimammate Mouse, Southern African Mastomys (English), Vaalveldmuis (Afrikaans), Lehomo (Sesotho); *M. natalensis*: Natal Multimammate Mouse, Natal Mastomys (English), Natalse Vaalveldmuis (Afrikaans), Lehomo (Sesotho)

Taxonomic status: Species

Taxonomic notes: A good review of the systematics of *Mastomys* is provided by Granjon et al. (1997). *Mastomys* spp. are cryptic and difficult to distinguish morphologically but clearly separable by molecular and chromosomal markers (Britton-Davidian et al. 1995; Lecompte et al. 2005). For example, within the assessment region, *M. coucha* and *M. natalensis* can be distinguished only through chromosome number (in *M. coucha* 2n = 36; in *M. natalensis* 2n = 32) and molecular markers (Colangelo et al. 2013) but not on cranio-dental features, nor a multivariate analysis (Dippenaar et al. 1993).

Assessment Rationale

Both species are listed as Least Concern as they have a wide distribution within the assessment region, where they likely occur in most protected areas, are abundant in human-transformed areas, including agricultural areas and areas affected by human disturbances, and because there are no significant threats that could cause range-wide decline. Additionally, these species are known as prolific breeders with population numbers likely to recover quickly after a decline. Because of their reproductive characteristics, population eruptions often occur under favourable conditions. Landowners and managers should pursue ecologically-based rodent management strategies and biocontrol instead of rodenticides to regulate population explosions of this species.

Regional population effects: For *M. coucha*, significant dispersal is unlikely because the bulk of the population occurs within the assessment region. There are two disjunct populations in Angola–Namibia and Zimbabwe–Mozambique. For *M. natalensis*, dispersal is highly possible through contiguous habitat along north and northeastern borders and because they utilise transformed habitats.

Distribution

These species have a very wide distribution across the savannahs, grasslands and agricultural landscapes of sub-Saharan Africa (Monadjem et al. 2015). *Mastomys natalensis* has the widest distribution of all African rodents (Colangelo et al. 2013), and are almost ubiquitously distributed across the African continent (van Hooft et al. 2008). *Mastomys coucha* is restricted to the grasslands and semi-arid savannahs of South Africa, Zimbabwe and Namibia, occurring south of the Zambezi River (Monadjem et al. 2015). It probably occurs in eastern and southern Botswana where there are records of *Mastomys* (previously assigned to *M. natalensis*; for example, de Graaff 1981) but that have not been sequenced or karyotyped. Similarly, its status in Mozambique is currently unknown. There are disjunct subpopulations in Angola–Namibia and Zimbabwe–Mozambique (Leirs 2013a). The exact distribution of these latter two populations should still be verified (Skinner & Chimimba 2005).

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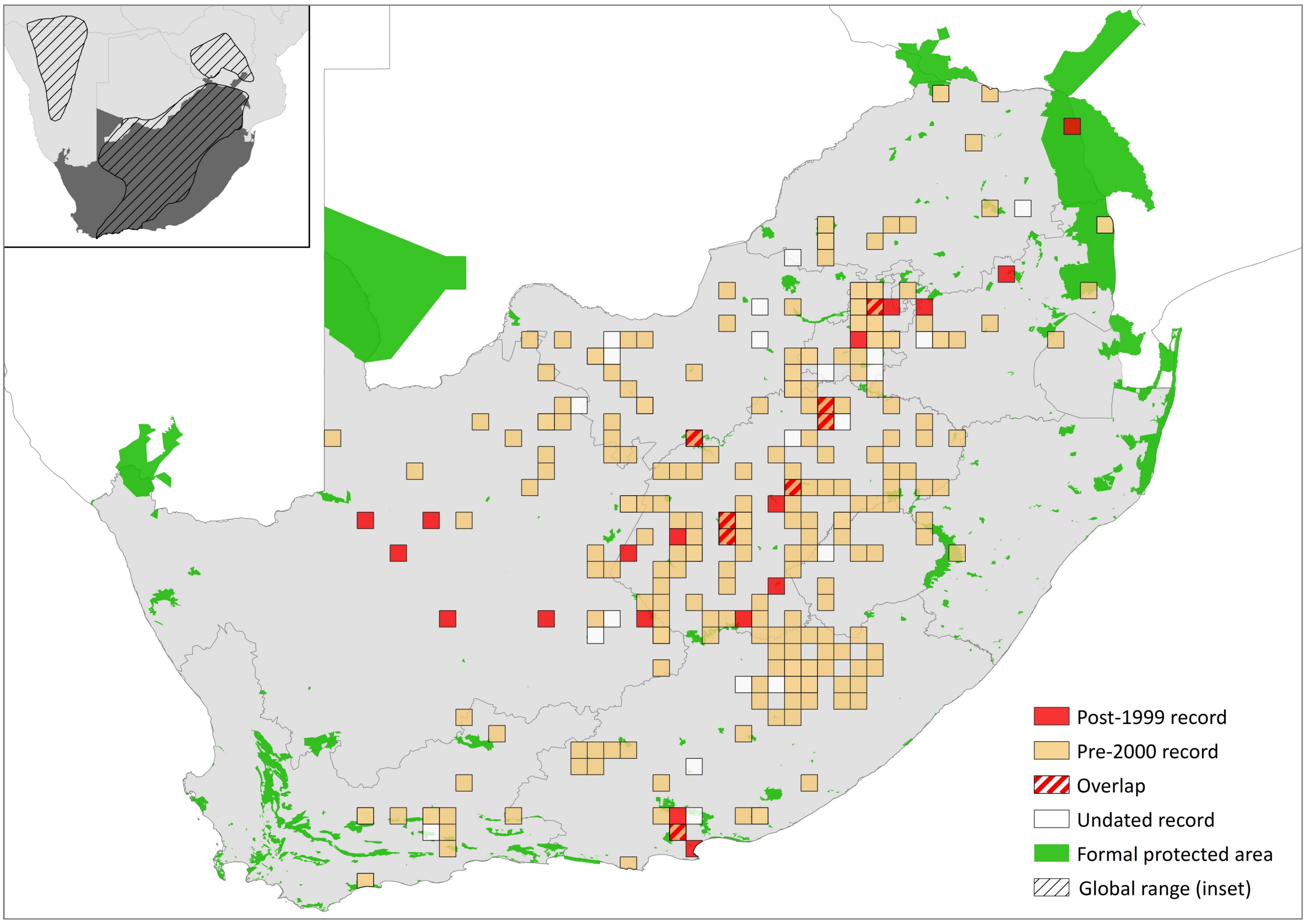

Figure 1. Distribution records for Southern Multimammate Mouse (*Mastomys coucha*) within the assessment region

Table 1. Countries of occurrence within southern Africa

Country	Presence	Origin
Botswana		
M. coucha	Presence uncertain	Native
M. natalensis	Extant	Native
Lesotho		
M. coucha	Extant	Native
M. natalensis	Extant	Native
Mozambique		
M. coucha	Presence uncertain	Native
M. natalensis	Extant	Native
Namibia		
M. coucha	Extant	Native
M. natalensis	Extant	Native
South Africa		
M. coucha	Extant	Native
M. natalensis	Extant	Native
Swaziland		
M. coucha	Presence uncertain	Native
M. natalensis	Extant	Native
Zimbabwe		
M. coucha	Extant	Native
M. natalensis	Extant	Native

Within the assessment region, *M. coucha* generally occurs in the high altitude/moderate rainfall regions in the central and northeastern part of South Africa (Venturi et al. 2004) (Figure 1). It occurs throughout the North West Province (Skinner & Chimimba 2005; Leirs 2013a), where it is the most widespread and common murid (Power 2014), and the Free State (Lynch 1983; Skinner & Chimimba 2005; Leirs 2013a), where it is likely the only *Mastomys* species (Avenant 1996). It also occurs throughout the Limpopo and Gauteng provinces, throughout most of the Mpumalanga Province, excluding the southern parts, in the northeastern and eastern parts of the Northern Cape Province, in the southeastern and eastern parts of the Western Cape Province and in the western and northwestern parts of the Eastern Cape Province (Skinner & Chimimba 2005; Leirs 2013a). Lynch (1994) found that it is relatively uncommon in Lesotho, although later suggestions by Ambrose (2006) are that it may be more common. It occurs from the low lying regions to altitudes exceeding 2,500 m asl within Lesotho (Avenant 1996; Lynch 1994). According to Leirs (2013a), *M. coucha* may occur in a very small part of northern Swaziland, the possibility of which is not precluded by Monadjem (1998). *Mastomys coucha* co-occurs only marginally with *M. natalensis* in South Africa (Venturi et al. 2004), with a possible zone of overlap along the eastern escarpment. It overlaps more extensively in southern Zimbabwe (Gordon 1978) and northern Namibia (Monadjem et al. 2015). Additional research is still needed to determine the precise zone of parapatry (Venturi et al. 2004).

Within the assessment region, *M. natalensis* is predominantly found in the wetter, eastern regions (east of the Drakensberg escarpment), or in the low altitude/high

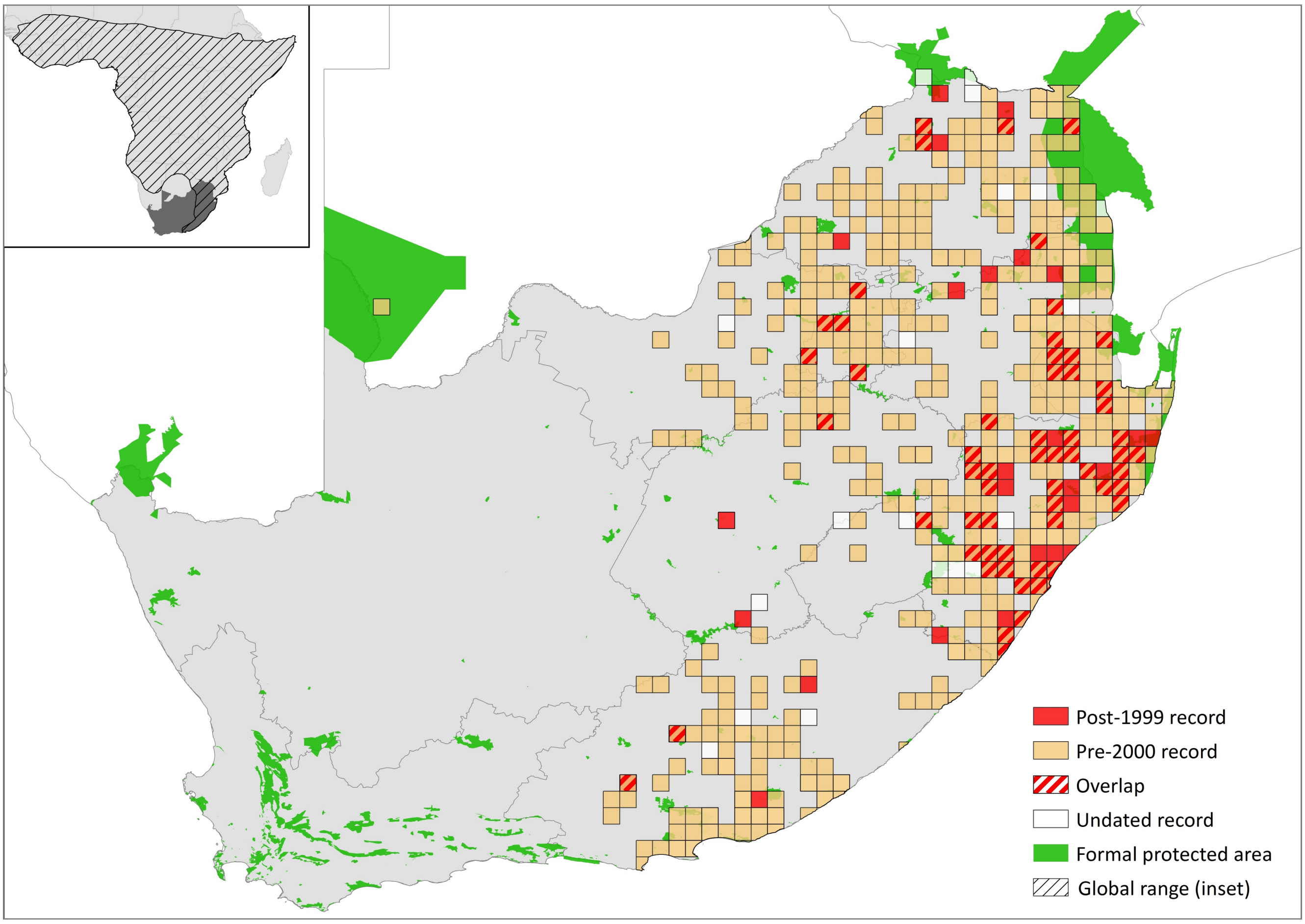

Figure 2. Distribution records for Natal Multimammate Mouse (*Mastomys natalensis*) within the assessment region

rainfall eastern coastal region, extending to northeastern South Africa (Venturi et al. 2004) (Figure 2). This habitat preference appears to apply at small spatial scales too. For example, in Roan Camp, Kruger National Park, *M. natalensis* dominated in wetter areas, whereas *M. coucha* was found in relatively more high-altitude, low-rainfall areas (Kneidinger et al. 2014). *Mastomys natalensis* has been documented in Gauteng Province (Venturi et al. 2004), but as yet, not in the North West Province (Power 2014). A recent landscape genetics study of *M. natalensis* from the Hluhluwe-iMfolozi Park, KwaZulu-Natal Province, showed that the most significant landscape features shaping gene flow are slope aspect, vegetation cover, topographic complexity and rivers (Russo et al. 2016). Eastern facing slopes and thicket vegetation promote gene flow/movement throughout the landscape, whereas, topographic complexity and rivers act as barriers to gene flow (Russo et al. 2016).

There are likely to be errors in the distribution maps due to the inability of being able to separate the two species on morphological evidence. Even sperm morphology is very similar between *M. natalensis* and *M. coucha* (Breed 1995). The use of molecular research to vet and reclassify museum records should be used to more accurately delineate the areas of sympatry of these two species.

Population

Mastomys is often the most abundant genus in an area. For instance, MacFadyen (2007) found that in the Roan Camp, Kruger National Park, *Mastomys* spp. were the most abundant genus in, around and outside the enclosure, comprising 81% of captures. *Mastomys coucha* is a common species throughout their distribution range (Leirs 2013a) with expected cyclic fluctuations in population numbers (Avenant 2011). Its numbers generally dominate in human disturbed habitats or in areas exposed to a natural disturbance (Avenant et al. 2008; MacFadyen et al. 2012). On transects set near Kgomo-Kgomo in the North West Province, Power (2014) recorded 1–4 individuals in every trap set. Due to an opportunistic breeding behaviour, population outbreaks are often associated with this species under favourable conditions (Skinner & Chimimba 2005; MacFadyen et al. 2012), which may cause it to become an agricultural pest (Skinner & Chimimba 2005; Monadjem et al. 2011). Similarly, *M. natalensis* often sharply increases in abundance after some form of disturbance, such as fire (Monadjem et al. 2015). When *M. natalensis* numbers decrease in a population it may be associated with an increase in general small mammal species diversity (Monadjem & Perrin 2003). Rautenbach et al. (2014) found that *M. natalensis* was the most frequently captured rodent species at Phinda Private Game Reserve, KwaZulu-Natal Province, where abundance differed significantly amongst vegetation types but not amongst seasons, and it was most common in *Acacia karroo* and *Combretum apiculatum* woodlands*.* Dispersal rates and dispersal distances per generation in *M. natalensis* have been shown to be relatively high (van Hooft et al. 2008). Given these dispersal dynamics, *M. natalensis* exhibits a pattern of kin clustering at smaller geographic scales (van Hooft et al. 2008). It has also been recorded that individuals can move over distances larger than 400 m.

Mastomys natalensis – Isa-Rita Russo

Current population trend: Stable/increasing, based on no net decline in habitat and possible range expansions in the assessment region.

Continuing decline in mature individuals: No

Number of mature individuals in population: Unknown

Number of mature individuals in largest subpopulation: Unknown

Number of subpopulations: Unknown

Severely fragmented: No, occurs extensively in agricultural and disturbed areas and has high dispersal rates (van Hooft et al. 2008).

Habitats and Ecology

As the common and generic names suggest, there is a large number of mammae present, between eight and 12 pairs from the sternum to inguinal region. Both species are terrestrial and nocturnal with a diet that varies from granivorous to omnivorous, sometimes including arthropods and carrion (Monadjem et al. 2015). For example, in Umvoti Vlei Conservancy, KwaZulu-Natal Province, while *Rhabdomys pumilio* was primarily granivorous, *M. natalensis* preferred green plant foods (Fuller & Perrin 2001), where its diet changed from predominantly plant material in summer to mainly seeds in winter. They are to some extent dependent on water but occur in areas where water is only seasonally available, such as along the Orange River valley in the Northern Cape (Skinner & Chimimba 2005). They have also been observed to swim (Hickman & Machiné 1986; Power 2014).

Mastomys coucha demonstrates a wide habitat tolerance (Skinner & Chimimba 2005; Leirs 2013a; Power 2014) in high altitude/moderate rainfall regions (Venturi et al. 2004). It is often associated with human-dominated landscapes and is regularly found inside and around human dwellings (Skinner & Chimimba 2005; Leirs 2013a). It is abundant in human disturbed areas or in areas that are recovering from a natural disturbance. In disturbed areas, its abundance generally decreases, although it never disappears as succession proceeds (Avenant et al. 2008; MacFadyen et al. 2012). For example, it may stay on in an area during and directly after a fire (Avenant 2011). Similarly, *M. natalensis* is typically associated with agricultural fields and homes, but also occurs in natural savannahs and grasslands (Leirs 2013b). *Mastomys natalensis* tolerates disturbance well and can be abundant in *Aristida* and disturbed grasslands (Fuller & Perrin 2001). It is a generalist species that rapidly colonises areas following disturbance, such as fire, overgrazing and cultivation (Meester et al. 1979; Monadjem 1997). Home ranges of *M. natalensis* in Swaziland were 626 ± 86 m^2 for males and 718 ± 88 m^2 for females (Monadjem & Perrin 1998). Leirs et al. (1996) reported home ranges of > 1,000 m^2 for *M. natalensis*.

Due to its high abundance in agricultural landscapes, *M. natalensis* is a significant crop pest and frequently digs up newly-planted maize seeds or climbs maize stalks to feed on the seeds (Leirs 2013b), as well as feeding on stored grains inside dwellings. Although the specific impact of *M. coucha* on agricultural crops has not yet been assessed, it is widely accepted that it may cause extensive losses similar to that observed for *M. natalensis* (Skinner & Chimimba 2005; Leirs 2013a). According to Mulungu et al. (2011), damages to maize by *M. natalensis* during population outbreaks may exceed 80% of the harvest in some areas.

Both *M. coucha* and *M. natalensis* are opportunistic breeders that have the ability to breed throughout the year whenever conditions are favourable, and breeding is strongly correlated with rainfall. In most areas, however, reproduction does not occur during winter. They are known as prolific breeders and, although this rarely happens, they can carry up to 24 foetuses at once, under favourable conditions. Their gestational periods and the interval between litters are also relatively short, with litter sizes varying from 1–27 young.(Monadjem et al. 2015). Due to their reproductive characteristics, multimammate mice populations are known to erupt under favourable conditions (Skinner & Chimimba 2005; Leirs 2013a, 2013b).

Ecosystem and cultural services: *Mastomys* spp. are indicators of poor ecosystem integrity as they become the dominant small mammals in a community during and after a disturbance (Avenant & Kuyler 2002; Avenant et al. 2008; Avenant 2011). They are also vectors of disease, where *M. coucha* is more susceptible to experimental plague infection than *M. natalensis*, and thus more implicated in plague epidemiology (Isaäcson et al. 1981; Venturi et al. 2004). Both species may act as seed dispersers, pollinators, and form a forage resource for carnivores, especially in post-fire landscapes, as they do not vacate the area following fires.

Use and Trade

Both species are used for the pet industry. However, this is not expected to impact the populations.

Threats

These species are important from a human health purview because they are a reservoir host for a number of organisms that cause human diseases (Keogh & Price 1981; Venturi et al. 2004; Skinner & Chimimba 2005; Leirs 2013a), and because their distributions are closely related to the outbreak of plague in some areas (Isaäcson et al. 1981). They may also be considered an agricultural pest in some areas, especially during population outbreaks (Monadjem et al. 2011). Due to these threats, rodenticides are often used to control these species (Makundi & Massawe 2011). It is, however, envisaged that poisoning will only have a short-term impact on *Mastomys* population numbers (Makundi & Massawe 2011), with

Table 2. Threats to multimammate mice (*Mastomys* spp.) ranked in order of severity with corresponding evidence (based on IUCN threat categories, with regional context)

Rank	Threat description	Evidence in the scientific literature	Data quality	Scale of study	Current trend
1	*9.3.3 Herbicides & Pesticides*: rodenticides used to control population explosions in agricultural areas.	-	Anecdotal	-	Stable/short-term impact.

populations likely to recover due to their reproductive characteristics (Skinner & Chimimba 2005). In Limpopo Province, for example, subsistence farmers whom experienced damage to staple crops from *Rattus rattus*, *R. norvegicus* and *Mastmys* spp. reported low success from rodenticides and kill-traps to control the damages (von Maltitz et al. 2003). Perhaps more important are the knock-on effects such poisons may have within the broader ecosystem through bioaccumulation or unintentional poisoning of non-target species, thus incentivising the use of ecologically-based management methods. It also is uncertain how the diseases associated with *Mastomys* species affect the rodents themselves (Leirs 2013b).

Current habitat trend: Stable or increasing. It is commensal with humans and can thrive on agricultural landscapes.

Conservation

These species are associated with a wide range of habitats, varying from disturbed areas to areas with more pristine habitat (Avenant et al. 2008; MacFadyen et al. 2012), and thus likely occur in most protected areas throughout their distribution range. As such, no specific interventions are necessary at present. However, the use of ecologically-based rodent management (EBRM) should be encouraged over the use of pesticides to limit population explosions (Makundi & Massawe 2011). Overall, EBRM relies on a strong ecological understanding of the target species and the development of species-specific management strategies at the farming level. It may include the reduction of key resources, such as food and nesting sites, at critical times of the year through habitat modification and the selective use of techniques for culling rodents at specific times of the year and in specific habitats (Singleton et al. 2004, 2007). For example, the use of owl nest boxes has been suggested as an important bio-control method in both small mammal ecosystem services (pollinators and seed dispersers) and management (Russo et al. 2016). In a recent study, no difference in *M. natalensis* population dynamics was observed within monocultures or mosaic agricultural lands, meaning that management in both agricultural systems could focus on the same aspects of the species' ecology (Sluydts et al. 2009).

Bio-control should also be encouraged as an alternative single control method, although Vibe-Peterson et al. (2006) demonstrated that the introduction of more predators into an area may not have a clear impact on *Mastomys* population densities due to the influence of compensatory breeding.

Recommendations for land managers and practitioners:

- Development and implementation of EBRM strategies suitable to *Mastomys* and applicable to specific areas (Makundi & Massawe 2011). For example, as has been trialled in Limpopo Province (von Maltitz et al. 2003).
- The use of bio-control, such as owl boxes, to mitigate the threat of *Mastomys* as an agricultural pest and as a threat to human health.

Research priorities:

- Accurate distributions of *M. natalensis* and *M. coucha*, including areas of sympatry, need to be determined using molecular markers (for example, Kneidinger et al. 2014).
- Applied ecological studies need to be conducted that can inform and form the basis of EBRM strategies (Makundi & Massawe 2011).
- The contribution of *Mastomys* spp. to the distribution and transfer of human diseases is also an important research area.

Encouraged citizen actions:

- Farmers could contribute to the development and implementation of EBRM strategies.
- Promotion of bio-control to regulate population explosions by attracting predators to an area. One method is to erect perches and install owl nest boxes in urban and rural green spaces.

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Table 3. Conservation interventions for multimammate mice (*Mastomys* spp.) ranked in order of effectiveness with corresponding evidence (based on IUCN action categories, with regional context)

Rank	Intervention description	Evidence in the scientific literature	Data quality	Scale of evidence	Demonstrated impact	Current conservation projects
1	*2.1 Site/Area Management*: the use of ecologically-based rodent management, including bio-control.	-	Anecdotal	-	-	ECORAT, Agricultural Research Council (2007–2009)

Data Sources and Quality

Table 4. Information and interpretation qualifiers for the multimammate mice (*Mastomys* spp.) assessment

Data sources	Field study (literature, unpublished)
Data quality (max)	Inferred
Data quality (min)	Inferred
Uncertainty resolution	Expert consensus
Risk tolerance	Evidentiary

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Details of the methods used to make this assessment can be found in *Mammal Red List 2016: Introduction and Methodology.*