Dasymys spp. – African Marsh Rat

Regional Red List status (2016)	
Dasymys capensis	**Vulnerable B1,2ab(ii,iii,iv)**
Dasymys incomtus	**Near Threatened B2ab(ii,iii,iv)***
Dasymys robertsii	**Vulnerable B2ab(ii,iii,iv)**
National Red List status (2004)	
Dasymys incomtus	Near Threatened C2
Reasons for change	
Dasymys capensis	Genuine change
Dasymys incomtus	No change
Dasymys robertsii	Genuine change
Global Red List status (2016)	
Dasymys incomtus	Least Concern
TOPS listing (NEMBA) (2007)	None
CITES listing	None
Endemic	
Dasymys capensis	Yes
Dasymys incomtus	Unknown
Dasymys robertsii	No

*Watch-list Data

These rodents are opportunistic omnivores and good swimmers, adapted to living in very marshy habitats where they build runways and nests in dense ground cover (Monadjem et al. 2015).

Taxonomy

Dasymys capensis Roberts 1936

Dasymys incomtus (Sundevall 1847)

Dasymys robertsii Mullin et al. 2004a

ANIMALIA - CHORDATA - MAMMALIA - RODENTIA - MURIDAE - *Dasymys*

Synonyms: *Dasymys alleni* (*D. capensis*) (Lawrence & Loveridge 1953)

Common names: African Marsh Rat, Common Dasymys, Shaggy Swamp Rat, Shaggy Rat, Water Rat (all, English), Cape Marsh Rat (*D. capensis*, English), Robert's Marsh Rat (*D. robertsii*, English), Waterrot (Afrikaans)

Taxonomic status: Species

Taxonomic notes: There are at least 14 *Dasymys* species recognised based on morphological evidence (Monadjem et al. 2015). Mullin et al. (2005) provided a biogeographical framework for 11 of these morphological species, showing that many of the range-restricted endemics were associated with endemic hotspots for other species of mammals. Of relevance to the assessment region, two species have been split from *D. incomtus*: *D. capensis* has been elevated to full species status based on cranial morphology and its isolated distribution in the Cape region (Mullin et al. 2004). Similarly, *D. robertsii* (from northern South Africa) was previously known as *D. incomtus* but is chromosomally, genetically and morphologically distinct (Mullin et al. 2002, 2004). Finally, *D. incomtus* now refers only to the population restricted to eastern South Africa (from where the type locality originates), leaving the populations outside of this region without a name and are referred to as *D.* cf *incomtus* for now (Monadjem et al. 2015). This genus is in urgent need of a continent-wide review.

Assessment Rationale

African Marsh Rats are dependent on intact rivers and wetland ecosystems, as they have not been found in artificial or degraded wetlands, and are thus patchily distributed within the assessment region. Furthermore, they are rare relative to *Otomys* spp., occurring at low densities with low reproductive rates within fragmented subpopulations. Although previously assessed as one species (*D. incomtus*), new data reveal three species within the assessment region: *D. capensis* endemic to the Cape region, *D. incomtus* probably endemic to the eastern areas of the assessment region, and *D. robertsii* occurring throughout northern South Africa and Zimbabwe. The extent of occurrence for both *D. incomtus* and *D. robertsii* is estimated to be far greater than 10,000 km^2 while that of *D. capensis* is inferred to be 17,880 km^2. The area of occupancy, calculated by summing the amount of remaining natural vegetation around wetlands within each species' range, is estimated to be between 615–4,262 km^2 for *D. capensis*, 2,382–

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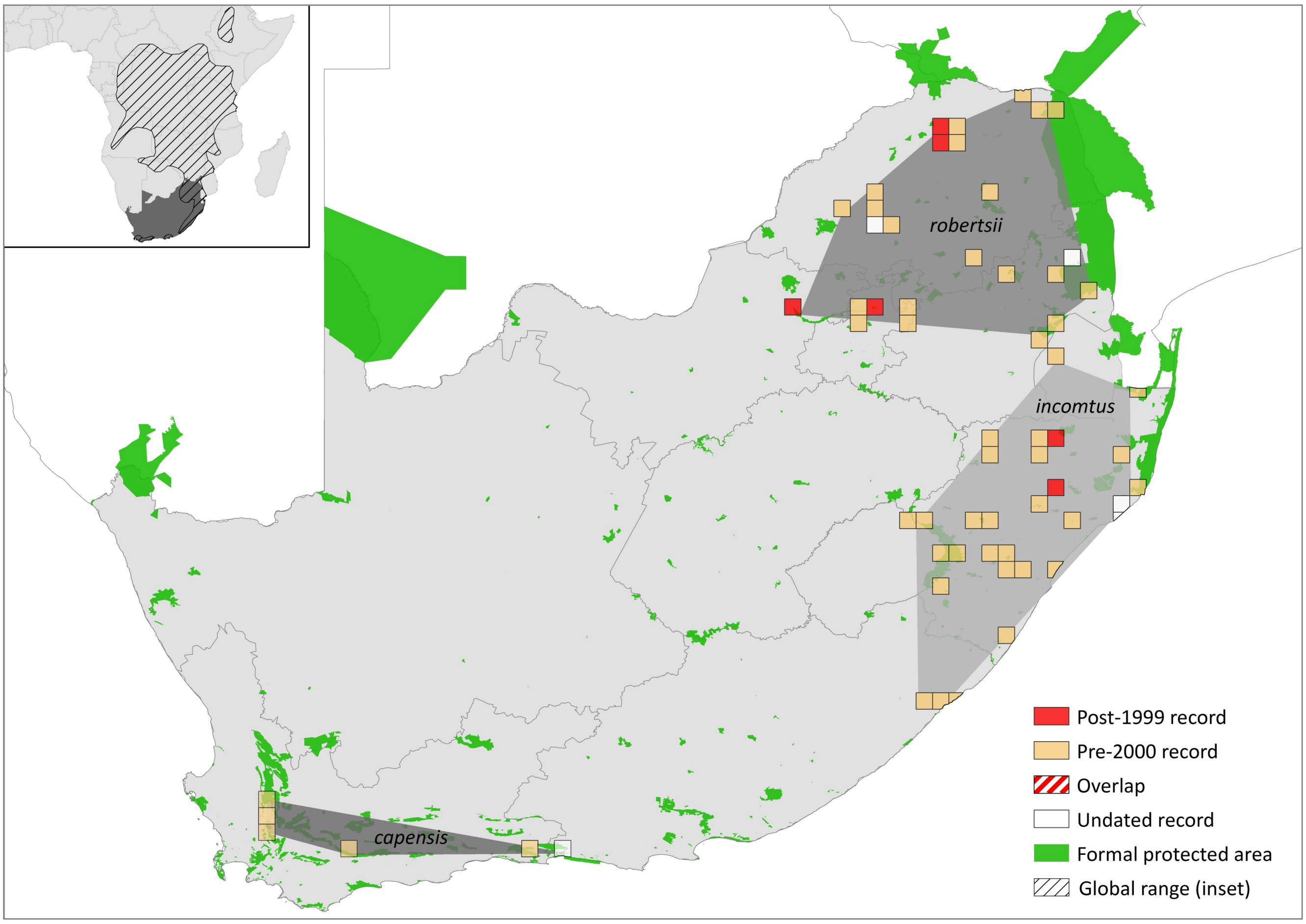

Figure 1. Distribution records for African Marsh Rat (*Dasymys* spp.) within the assessment region

Table 1. Countries of occurrence within southern Africa

Country	Presence	Origin
Botswana	Absent (all)	-
Lesotho	Absent (all)	-
Mozambique	Presence uncertain (*D. incomtus*)	Native
Namibia	Absent (all)	-
South Africa	Extant (all)	Native
Swaziland	Extant (*D. incomtus*)	Native
Zimbabwe	Extant (*D. robertsii*) Presence uncertain (*D. incomtus*)	Native

13,823 km² for *D. incomtus*, and 1,030–11,382 km² for *D. robertsii*. These values, however, do not account for degraded habitats and include potentially unoccupied patches (resulting from the poor dispersal ability of the species). Thus, we take a precautionary purview to this assessment by using the lower bound of the occupancy values.

Wetlands are continuing to be lost with agricultural and human settlement expansion, which in turn increases wetland degradation from overgrazing, water abstraction, pollution and invasive alien plant sprawl. For example, between 2005 and 2011 in KwaZulu-Natal Province, 7.6% (7,217 km²) of natural habitat was lost (1.3% per annum), which equates to a 13% loss of habitat over ten years (projecting to 2015). Given the restricted range, habitat fragmentation and ongoing loss of suitable wetland habitat we list *D. capensis* as Vulnerable B1,2ab(ii,iii,iv), *D. incomtus* as Near Threatened B2ab(ii,iii,iv), and *D. robertsii* as Vulnerable B2ab(ii,iii,iv). We note that *D. incomtus* would qualify for Vulnerable C2a(i) if density estimates suggested a population size of < 10,000 mature individuals. We consider these genuine changes, as 32.8% of wetlands nationally have been lost between 1990 and 2013/14 (although this includes many wetlands that are simply temporarily dry due to the wetter conditions in 1990). This species should be reassessed once density estimates in suitable habitat are available. Key interventions for these species include conserving and restoring strips of natural vegetation around wetlands and riverside, and extending protected wetland habitat area and connectivity through biodiversity stewardship schemes.

Regional population effects: Not applicable for *D. capensis*. Although we assume that *D. incomtus* is endemic to the eastern region of the assessment region, future molecular work is needed to affirm this. For *D. robertsii*, dispersal may be possible through corridors or riverine vegetation within the Greater Limpopo Transfrontier Park and Mapungubwe Transfrontier Conservation Area. However, wetland habitats are fragmented and this species is a poor disperser and thus it is unknown whether significant rescue effects are possible.

Distribution

These species are associated with rivers and wetlands within the northern and southern African savannas from Senegal in the west to Ethiopia in the east and south to the Western Cape Province of South Africa (Monadjem et al. 2015). The type specimen for the genus was collected in Durban. Mullin et al. (2002, 2005) provided molecular and biogeographical evidence for the existence of *D. incomtus* in the KwaZulu-Natal Province region, *D. robertsii* in the lowveld and northern provinces of South Africa, and *D. capensis* in the Western Cape Province (Figure 1). No *Dasymys* species has been recorded from Lesotho (Lynch 1994).

The African Marsh Rat, *D. incomtus*, was previously thought to range widely across Africa, including across South Africa (Friedmann & Daly 2004), but recent genetic and morphometric analyses show that it is endemic to eastern South Africa and Swaziland (Monadjem 1998; Mullin et al. 2002, 2004). Based on morphological similarity, the species may also occur in southeast Zimbabwe in the eastern Highlands (Mt. Selinda and Mazoe) (Mullin et al. 2005), but this has not been confirmed by chromosomal or molecular analysis. If it is the same species, there is a disjunct distribution between the populations of the assessment region and Zimbabwe. Its full distribution still needs to be confirmed by sampling more localities in Zimbabwe (Mullin 2003). It is associated with Tongaland-Pondaland coastal mosaic vegetation. The Drakensberg Mountain range largely separates *D. incomtus and D. robertsii* but the two species are connected via a possible dispersal route through Mpumalanga Province on the eastern side of the Drakensberg and thus it is not clear why there is such a strong distinction between *D. incomtus* and *D. robertsii* (Mullin et al. 2005). We suspect this species is range-limited within KwaZulu-Natal Province due to past and ongoing wetland modification, destruction and deterioration (Driver et al. 2012).

The Cape Marsh Rat, *D. capensis*, is endemic to the Western Cape Province where it is known from just a few localities, occurring from Wolsley to Knysna, and may occur in Tsitsikamma. It may represent an isolated relict population (Mullin et al. 2005). It is morphologically more similar to *D. incomtus* than *D. robertsii*, which indicates a coastal distribution between the two species and supports the hypothesis that there was a link between the lowlands of the Western Cape and Ethiopia through an east coast grassland corridor that was once inundated with flood-lands (Davis 1962).

The newly described *D. robertsii* is patchily distributed in the lowveld of northern South Africa and Zimbabwe. Although habitat may be contiguous between the two regions, as the species is a wetland specialist, we suspect that dispersal rates are hindered by the fragmented nature of wetland systems. Within the assessment region, it occurs predominantly in Limpopo, Mpumalanga and Gauteng provinces (Mullin et al. 2005), which corresponds to the Limpopo watershed area. Additionally, Power (2014) recently recorded the species in the North West Province for the first time in a wetland on a tributary of the Waterkloofspruit at Kgaswane. The species is also expected to occur in the Kgomo Kgomo floodplain wetlands (Power 2014).

The extent of occurrence (EOO) and area of occupancy (AOO) for each species is summarised in Table 2. While the EOO was calculated using all available records for each species, the AOO was systematically estimated by buffering wetlands within the EOO by both 500 m (strip width used to assess habitat condition around wetlands in the National Biodiversity Assessment, as it provides a good proxy for wetland condition; Driver et al. 2012) and 32 m (minimum buffer zone of no development around waterbodies, as set in the National Environmental Management Act, Activity 9 and 11 Listing 1 of Government Notice R544 and Activity 16 Listing 3 of Government Notice R546 of 2010), using the wetland layer created by the National Biodiversity Assessment (Nel et al. 2011). The amount of remaining natural vegetation was then calculated using a 2013–14 national land-cover dataset (GeoTerraImage 2015a). However, these data do not include degraded habitat and thus, in reality, AOO is likely to be smaller.

Population

The abundances and population sizes of these species is unknown. They are rare, and exist at low densities. For example, at Karkloof Forest in KwaZulu-Natal Province, where *Otomys* and *Dasymys* co-occur, sustained collecting in suitable habitats by K. Willan over a number of years resulted in 130 *Otomys* and only one *Dasymys* (P. J. Taylor, unpub. data based on records in the Durban Natural Science Museum). Similarly, *D. capensis* was relatively infrequently sampled through Barn Owl (*Tyto alba*) pellets in the Western Cape Province (Avery et al. 2005). As a wetland specialist that rarely emerges from the wetlands, it is trap-shy and thus difficult to monitor. Compared to other African rodents of similar size, *D. incomtus* has low reproductive output and delayed postnatal development, which may compromise its ability to cope with continued habitat loss (Pillay 2003).

Current population trend: Declining, based on ongoing habitat loss and degradation.

Continuing decline in mature individuals: Unknown

Number of mature individuals in population: Unknown

Number of mature individuals in largest subpopulation: Unknown

Number of subpopulations: Unknown

Severely fragmented: Yes. Their habitat is fragmented and they are suspected to be poor dispersers. Waterways and riparian vegetation are in decline (Nel et al. 2007; Driver et al. 2012), which will make the subpopulations more isolated. For example, only 53% of KwaZulu-Natal's

Table 2. Extent of occurrence (EOO) and area of occupancy (AOO) estimates for *Dasymys* spp. within the assessment region, showing AOO values for both 500 m and 32 m buffer distances around wetlands; the values reflect remaining natural vegetation within the summed buffer strips

Species	Extent of occurrence (km^2)	Area of occupancy 500 m buffer (km^2)	Area of occupancy 32 m buffer (km^2)
Dasymys capensis	17,880	4,262	615
Dasymys incomtus	104,281	13,823	2,382
Dasymys robertsii	118,431	11,382	1,030

natural habitat remained in 2011 (Jewitt et al. 2015), which is below the minimum connectivity threshold of 70% and thus the species (*D. incomptus*) has probably lost the ability to disperse effectively (*sensu* Dobson et al. 2006).

Habitats and Ecology

These species have been recorded from a wide variety of habitats, including forest and savannah, swampland and grasslands, but they rely on intact wetlands in these areas. They have not been recorded from agricultural landscapes or dam areas. They occur specifically in reed beds and among semi-aquatic grasses in wetlands or swampy areas or along rivers and streams, as well as in grassy areas close to water wherein they co-occur with *Otomys* spp. (Skinner & Chimimba 2005). African Marsh Rats construct complex, intricately woven nests in holes along the banks of rivers and ponds (Pillay 2003). Nests extend into water and might serve as a bolt hole during attack from predators. Sub- and above-surface runways extend from the nest cavities and would serve as travel routes. These rodents are opportunistic omnivores, feeding predominantly on the succulent stems and fruiting heads of semi-aquatic grasses (Skinner & Chimimba 2005), supplementing their diets with insects, especially during reproduction (Pillay 2003). They are good swimmers, adapted to living in very marshy habitats where they build runways and nests in dense ground cover (Monadjem et al. 2015). Based on a captive study, the gestation period is 29 days and litter size varies from two to five (Pillay 2003; Skinner & Chimimba 2005). Maximum reproductive output during one artificial breeding season was 18 young.

Photo 1. Agricultural land use extending to the wetland edge and not providing a buffer area (D. Jewitt & J. Craigie 2011)

Young are altricial and nipple-cling, and reproductive output is low compared to other African rodents (Pillay 2003). In the assessment region, they occur at altitudes from sea level to 1,500 m asl in the Drakensberg Mountains (Skinner & Chimimba 2005).

Ecosystem and cultural services: Potential to become flagship wetland species for biodiversity stewardship schemes.

Use and Trade

This species is not known to be traded or utilised in any form.

Table 3. Threats to the African Marsh Rat (*Dasymys* 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	*2.1 Annual & Perennial Non-Timber Crops* and *2.2 Wood & Pulp Plantations*: habitat loss from agricultural expansion. Current stress *1.2 Ecosystem Degradation*: altered hydrological regimes and increased pollution levels.	Jewitt et al. 2015	Indirect (land cover change from remote sensing)	Regional	Continuing: 1.2% natural habitat lost per annum.
2	*1.1 Housing & Urban Areas*: wetland habitat lost to human settlement development. Current stress *1.3 Indirect Ecosystem Effects*: fragmentation and isolation of remaining habitat patches with limited dispersal between.	GeoTerraImage 2015a	Indirect (land cover change from remote sensing)	Regional	Continuing. Area of rural and urban development has increased between 2000 and 2013 by 7–9% and 11–15%, respectively.
3	*7.2 Dams & Water Management/Use*: wetland loss through drainage/water abstraction during agricultural, industrial and urban expansion.	Driver et al. 2012	Indirect (land cover change from remote sensing)	National	Increasing with settlement expansion; 65% of wetland ecosystem types threatened already.
4	*2.3.2 Small-holder Grazing, Ranching or Farming*: wetland and grassland degradation through overgrazing (removal of ground cover).	Bowland & Perrin 1989	Empirical	Local	Possibly increasing with human settlement expansion and intensification of wildlife farming.
		Driver et al. 2012	Indirect	National	45% of remaining wetland area exists in a heavily modified condition.
5	*7.1.2 Suppression in Fire Frequency/Intensity*: human expansion around forests has decreased natural fire frequency. Current stress *1.2 Ecosystem Degradation*: altered fire regime leading to bush encroachment (including alien vegetation invasion) and thus loss of moist grasslands.	-	Anecdotal	-	-

Threats

There are several major threats to this species, which revolve around habitat loss and degradation. Wetlands are the country's most threatened ecosystem, with 65% of wetland ecosystem types threatened (48% of all wetland types Critically Endangered, 12% Endangered and 5% Vulnerable) because they are highly productive and hence become transformed for agriculture (Driver et al. 2012). The 1990–2013/14 South African National Land-Cover change report found a 32.78% decline in wetlands, nationally, during the study period (GeoTerraImage 2015a). However, this is partially confounded by 1990 being generally wetter than 2013/14 and so many wetlands in the drier western regions may not be lost, but just temporarily dry. Habitat loss due to land transformation in the surrounding matrix further isolates wetlands from one another and exacerbates the degradation of individual wetlands. For example, sugarcane plantations are often planted right up to wetlands edges, not respecting the appropriate buffer (D. Jewitt pers. obs. 2015; Photo 1). Water abstraction or filling in of wetlands from human settlement and industrial expansion also leads to habitat loss. Compounding this is wetland degradation from overgrazing rank grasses surrounding wetlands, which leads to the loss of ground cover and decreases small mammal diversity and abundance (Bowland & Perrin 1989, 1993). Similarly, suppression of natural ecosystem processes, such as fire, can also lead to habitat degradation through bush encroachment or loss of plant diversity through alien invasive species, and is suspected to be increasing with human settlement expansion. Overall, 45% of our remaining wetland area exists in a heavily modified condition, due primarily to onsite modification from crop cultivation, coal mining, urban development, dam construction, and overgrazing (and thus erosion) and off-site modifications from disruptions to flow regime and deterioration of water quality (Driver et al. 2012). For example, the number of dams in KwaZulu-Natal Province has increased from approximately 14,455 in 2005 to over 20,980 in 2011 (Jewitt et al. 2015), which represents a 45% increase in the number of dams and a 26% increase in the extent of dams. This has obvious impacts on flow levels causing drying out of hydromorphic grasslands during dry periods.

Current habitat trend: There is an inferred continuing decline in the populations of all species from ongoing natural habitat loss. For *D. capensis*, Pence (2014) calculated that in the Western Cape Province, between 2006 and 2011, 536 km^2 of land was converted to agriculture (107 km^2 per year). Overall, a total of approximately 2,120 km^2 of natural habitat has been lost between 2000 and 2013 (G. Pence, unpublished data, CapeNature). Of particular concern for *D. capensis* is the finding that 31% of wetlands (including a 32 m buffer) and riparian areas have been lost to agricultural land use, despite the fact that they are water resources protected under the Water Act, the Conservation of Agricultural Resources Act and the National Environmental Management Act (Pence 2012).

In KwaZulu-Natal Province, *D. incomtus* is threatened by habitat loss at a rate of 1.2% per annum and, over approximately 10 years (2000–2011), natural habitat was reduced from 62% to 53% (Jewitt et al. 2015). Worryingly, in just six years (2005–2011), 7.6% (7,217 km^2) of natural habitat was lost (1.3% per annum), due primarily to agriculture (5.2% increase; 4,962 km^2), but also plantations, built environments and settlements, mines and dams (Jewitt et al. 2015).

For *D. robertsii*, although wetlands within Mpumalanga Province at least are well protected and 89% are still considered natural (M. Lotter, unpubl. data, Mpumalanga Parks & Tourism Board), available data also do not allow for a clear estimate of wetland loss in Limpopo. River health is, however, in a steady decline throughout the province (S. Rodgers pers. comm. 2014). However, continued agricultural, mining, commercial forestry and human settlement expansion is likely leading to wetland loss and degradation (Desmet et al. 2013; MTPA 2014). For example, new land cover data from 2000 and 2013

Table 4. Conservation interventions for the African Marsh Rat (*Dasymys* 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	*1.2 Resource & Habitat Protection*: stewardship agreements with private landowners to conserve wetlands and grasslands.	-	Anecdotal	-	-	Multiple organisations
2	*2.2 Invasive/Problematic Species Control*: Maintain stocking rates of livestock and wildlife at ecological carrying capacity.	Bowland & Perrin 1989	Empirical	Local	Small mammal diversity and abundance significantly higher after decrease in grazing pressure.	-
3	*2.1 Site/Area Management*: maintain/restore natural vegetation around wetlands.	-	Anecdotal	-	-	-
4	*2.2 Invasive/Problematic Species Control*: Clear alien vegetation from watersheds and wetlands to restore habitat quality.	-	Anecdotal	-	-	Working for Water, Department of Environmental Affairs
5	*4.3 Awareness & Communications*: educating landowners in the importance of wetlands.	-	Anecdotal	-	-	-

show that Limpopo, Mpumalanga and North West provinces experienced rural expansion of 7–9%, while urban expansion proceeded at 11–15% (GeoTerraImage 2015b). Such settlement expansion indicates both a loss of habitat and an increase in human encroachment on wetland resources, which we infer as ongoing habitat degradation.

Conservation

D. capensis presumably occurs in several protected areas in Western Cape. Further surveys are needed to compile a protected area checklist for the species. In KwaZulu-Natal, *D. incomtus* occurs in Ndumo Game Reserve and the Maloti Drakensberg Park at least. In Limpopo and Mpumalanga, *D. robertsii* occurs in Kruger National Park and presumably other formally and privately protected areas. Similarly to *D. capensis*, protected area managers should compile an inventory of protected areas in which *Dasymys* species currently exist. There are two important types of intervention that are a priority for these species:

1. **Conserve and create wetland clusters and corridors**. Biodiversity stewardship schemes should be promoted if landowners possess wetlands close to core protected areas or remaining habitat patches, and the effects on small mammal subpopulations should be monitored. Protecting such habitats may create dispersal corridors between patches that will enable adaptation to climate change.
2. **Conserve or restore riparian vegetation around wetlands**. Retaining ground cover and rank vegetation is the most important management tool to increase small mammal diversity and abundance around wetlands. This can be achieved through lowering grazing pressure (Bowland & Perrin 1989), or by maintaining a buffer strip of natural vegetation around wetlands (Driver et al. 2012). Small mammal diversity and abundance is also higher in more complex or heterogeneous landscapes, where periodic burning is an important tool to achieve these (Bowland & Perrin 1993). Removing alien vegetation from watersheds, watercourses and wetlands is also an important intervention to improve flow and water quality, and thus habitat quality. Education and awareness campaigns should be employed to teach landowners and local communities about the importance of conserving wetlands.

Recommendations for land managers and practitioners:

- Working for Water managers should continue to work with private landowners in key wetland areas to remove alien vegetation.
- Landowners and communities should be incentivised to stock livestock or wildlife at ecological carrying capacity and to maintain a buffer of natural vegetation around wetlands.
- Enforce regulations on developments that potentially impact on the habitat integrity of grasslands and wetlands.
- Publicise these species for conservancies as symbols of wetland conservation and thus biodiversity stewardship agreements.

Data Sources and Quality

Table 5. Information and interpretation qualifiers for the African Marsh Rat (*Dasymys* spp.) assessment

Data sources	*D. capensis* ~ Museum records, indirect information (unpublished, expert knowledge) *D. incomtus* ~ Museum records, field study (unpublished), indirect information (literature, expert knowledge) *D. robertsii* ~ Museum records, field study (unpublished), indirect information (literature, expert knowledge)
Data quality (max)	*D. capensis* ~ Inferred *D. incomtus* ~ Estimated *D. robertsii* ~ Estimated
Data quality (min)	*D. capensis* ~ Suspected *D. incomtus* ~ Inferred *D. robertsii* ~ Inferred
Uncertainty resolution	Maximum/minimum values (all)
Risk tolerance	Precautionary (all)

Research priorities:

- Field surveys to more accurately delineate geographic distribution, especially in the Eastern Cape Province, and investigating particularly whether these species occur within artificial waterbodies, agricultural landscapes and urban/rural gardens.
- Similarly, density estimates need to be produced. *Dasmys incomtus* should be re-assessed once such data become available.
- Estimating current and future rates of wetlands and/or natural habitat loss within the species' ranges.

Encouraged citizen actions:

- Private landowners should continue to work with Working for Water to conserve wetlands and improve ecosystem functioning.
- Similarly, citizen scientists can collect owl pellets for deposit at natural history museums and help experts to identify small mammal species.

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