Australian Capital Territory

Nature Conservation (Broad-toothed Rat) Conservation Advice 2024

Notifiable instrument NI2024-249

made under the

Nature Conservation Act 2014, s 90C (Conservation advice)

---

1 Name of instrument

This instrument is the *Nature Conservation (Broad-toothed Rat) Conservation Advice 2024*.

2 Commencement

This instrument commences on the day after its notification day.

3 Conservation advice for Broad-toothed Rat

Schedule 1 sets out the conservation advice for Broad-toothed Rat (*Mastacomys fuscus mordicus*).

4 Revocation

The *Nature Conservation (Broad-toothed Rat) Conservation Advice 2019* (NI2019-233) is revoked.

Arthur Georges
Chair, Scientific Committee
21 May 2024

Schedule 1

(see s 3)

ACT Government
Environment, Planning and Sustainable Development

ACT Scientific Committee

CONSERVATION ADVICE

BROAD-TOOTHED RAT (mainland)

Mastacomys fuscus mordicus

CONSERVATION STATUS

The Broad-toothed Rat (mainland) *Mastacomys fuscus mordicus* Thomas, 1922 is recognised as threatened in the following jurisdictions:

International	Near Threatened (species), International Union of Conservation of Nature (IUCN) Red List
National	**Endangered**, *Environment Protection and Biodiversity Conservation Act 1999*
	Vulnerable, The Action Plan for Australian Mammals *2012*
ACT	**Endangered**, *Nature Conservation Act 2014*
NSW	**Endangered**, *Biodiversity Conservation Act 2016*

ELIGIBILITY

The Broad-toothed Rat (mainland) is eligible to be included in the Endangered category of the ACT Threatened Native Species List under the *Nature Conservation Act 2014* (NC Act) under the IUCN Criterion A — A2(b)(c)(e), A3(b)(c)(e), A4(b)(c)(e).The main factors making it eligible are an overall population decline exceeding 50% over 10 years, due to population reduction and habitat destruction caused by the 2019–2020 bushfires, and a continuing decline in extent of occurrence (EOO), area of occupancy (AOO), number of individuals and populations and increased fragmentation of an already fragmented distribution (DEECCW 2023).

Broad-toothed Rat (Ken Green – ANU)

DESCRIPTION AND ECOLOGY

The Broad-toothed Rat – Luda (Winanggaay Ngunnawal Language Aboriginal Corporation 2022) is a mostly nocturnal herbivorous rodent that has a head/body length of 14–17 cm and a tail length of 10–13 cm. It has a broad face, short tail and stocky body. It has characteristically large molars in a rounded head, with well-developed cheeks and large jaw muscles. The ears are small and round with tufts of hair inside. It has fine, dense fur, which is brown tinged with rufous above, merging to a paler grey underneath and may have a green tinge

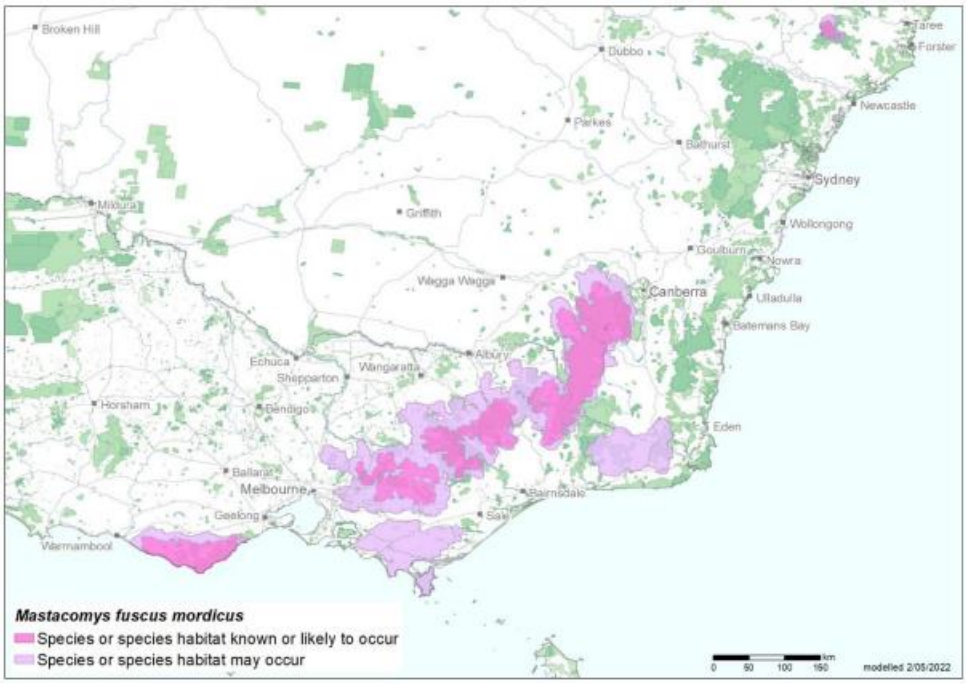
due to the presence of algae. The feet are brown and the tail is lightly haired and darker above (Happold 2008; Australian Museum 2018).

Breeding is seasonal, with females giving birth to one or two litters (of 1–4 young) per season between October and March (Happold 2011). Sexual maturity is reached in 8-10 months and longevity is up to two years (Happold 2011). Generation length is assumed to be 1−2 years (Woinarski et al. 2014; Woinarski and Burbidge 2016). The diet of the Broad-toothed Rat is mostly the stems of sedges and grasses, some seeds and moss sporangia, leaves and bark of shrubs (Carey et al. 2003).

DISTRIBUTION AND HABITAT

The Broad-toothed Rat (mainland) has a highly fragmented distribution, with scattered records across the Great Dividing Range from near Warburton (Victoria) to the Brindabella Range (Australian Capital Territory (ACT)) and around Barrington Tops (New South Wales (NSW)), with at least one poorly-known subpopulation in coastal areas of far East Gippsland and south-eastern NSW (Map 1) (Seebeck and Menkhorst 2000; Green and Osborne 2003; C. Dickman pers. comm. in Woinarski et al. 2014). Historically, the subspecies was far more widespread.

Map 1. Modelled distribution of the Broad-toothed Rat (mainland) (DCCEEW 2023)



Source: Base map Geoscience Australia; species distribution data Species of National Environmental Significance database.

The Broad-toothed Rat habitat is characterised by mean annual temperatures less than 10°C and mean annual rainfall and greater than 1000 mm and is largely determined by the availability of cover and grasses (Green and Osborne 2003). It inhabits wet heaths and sphagnum bogs generally above 1400m in the ACT where it lives in burrows and forms extensive runways and systems through dense vegetation and sphagnum (Carey et al. 2003).

Historical distribution of the species across its range was broader, with records from lower elevation and drier sites (<700mm rainfall and <100m in elevation) but it is now considered locally extinct in most of these lower and drier habitats (Menkhorst 1995; Bilney et al. 2010; Fusco et al. 2016; McDowell et al. 2023). It currently occupies a fragmented distribution in a few alpine and subalpine regions as well as

coastal heath (Green and Osborne 2003; Woinarski and Burbidge 2016). An examination of Broad-toothed Rat distributional change in Victoria by Shipway et al. (2020) found that only 32 or 68 historical sites (prior to 1990) were occupied. They found sites with higher elevation and precipitation more likely to be occupied, sites with higher temperature less likely to be occupied and the best predictor of persistence was minimum temperature of the coldest month (Shipway et al. 2020).

Prior to the study by Milner et al. (2015), there was limited information in the ACT on the distribution, abundance and ecology of the Broad-toothed Rat. An individual was captured at Murrays Gap in 1973 (Eberhard and Schulz 1973 in Milner et al. 2016) and in 1986 (Lintermans 1986). During 1988–1990 and 1999–2001 evidence of Broad-toothed Rat activity (runways and scats) was recorded from sites, within or bordering the ACT, (Green and Osborne 2003). A skull was collected and runways and scats were commonly observed at Cotter hut from 1989–1992 (Lintermans pers. obs.). In 2003, fires burnt 70 to 90 % of habitat with moderate to high severity resulting in a lack of ground cover and exposed runways leading to probable reduced availability of food and increased susceptibility to predation. Despite this, droppings and other evidence of the species were found at unburnt survey sites at Ginini Flats and Snowy Flats, however, no droppings were found in the burnt areas surrounding these habitat refuges (Carey et al. 2003).

Evidence of Broad-toothed Rats was detected from 13 sub-alpine bogs in Namadgi National Park that were surveyed for scats and vegetation characteristics in March 2013 (Milner et al. 2015, 2016). The species showed a positive habitat preference for larger bogs, closer to drainage lines with heath, sedge and *Poa* dominated vegetation types and was found to occur across a variety of habitat types in the ACT, including rocky outcrops, tussock grasslands, sedgelands and heathlands, frequently within proximity to watercourses. The results of this study increased the number of known sites that may support the Broad-toothed Rat in the ACT from 14 to 23, suggesting that the populations of the species were relatively stable before the 2020 fire, albeit with a small and patchy distribution. Milner et al. (2016) provide a baseline for longer-term monitoring of distribution, abundance and habitat use of the Broad-toothed Rat.

Surveys were conducted in 2020 after the Orroral Valley Fires burnt 80% of Namadgi National Park, and the majority of known Broad-toothed Rat sites. There was no evidence of Broad-toothed Rats persisting at any of the six burnt sites surveyed, while signs of occupation prior to the fire was evident from burnt runs at all sites. Active runs and/or scats were detected at the two unburnt sites surveyed (Ginini East and West). Sites were resurveyed in 2023, with some sign of Broad-toothed Rat detected at four of seven surveyed burnt sites.

THREATS

Threats to the Broad-toothed Rat (mainland) are detailed in the Commonwealth Conservation Advice (TSSC 2016; DCCEEW 2023) which are drawn from those in the Mammal Action Plan (Woinarski et al. 2014), as well as the study by Milner et al. (2016) in the ACT and include:

- predation by foxes and feral cats
- fire regimes that cause declines in biodiversity, i.e., too frequent and too severe
- climate change reducing habitat suitability
- habitat loss, fragmentation and degradation due to feral herbivores
- weed invasion, especially promoted by fire
- dieback caused by *Phythophthora cinnamomi* (which can be spread by feral pigs)
- competition and other agnostic interaction with introduced rodents, also increasing the potential for disease threats

- competition with native rodents for food.

The local extirpation of the Broad-toothed Rat following high severity fire may fragment and isolate populations, making them more susceptible to stochastic extinction (Walker et al. 2021). Also, fire-induced reductions of Broad-toothed Rat occupancy and abundance are likely to have long-term implications as evidenced by the preference for long-unburnt sites (80 years) and steady decline in abundance with an increasing number of fires (Walker et al. 2021). Following fire, the impact of feral herbivores on regenerating soils and vegetation is compounded as trampling and herbivory disturbances impair habitat regeneration such that burnt areas may not return to the same quality of habitat pre-fire (Walker et al. 2021).

Greville (1990) warned of possible extinction of marginal populations due to restriction of gene flow and a very real possibility of this occurring given a combination of threats from livestock grazing, the activities of feral animals and global climate change. Milner et al. (2016) found relative abundance in the ACT was: positively related to specific vegetation types (heath, sedge and *Poa*) and site size; and negatively related to disturbance due to feral animals, and distance from creek drainage lines. This study indicates that specific habitat preferences and threats associated with environmental change and introduced species may threaten populations in the ACT (Milner et al. 2016).

MAJOR CONSERVATION OBJECTIVES

The priority management objective is to contribute to regional and national conservation of the species to protect the species and its habitat, especially in the ACT.

CONSERVATION ISSUES AND PROPOSED MANAGEMENT ACTIONS

Recommended management actions are provided and prioritised in the Commonwealth Conservation Advice (TSSC 2016; DCCEEW 2023) and Mammal Action Plan (Woinarski et al. 2014). The most suitable habitat for this species in the ACT exists in reserved areas and the following summary of actions may be relevant in the ACT, including to:

- maintain and protect habitat
- identify and include the species and habitat location and requirements specifically in the ACT Ecological Guidelines (ACT Government 2019a) and on-ground management applications
- mitigate threats, particularly implementing predator control programs, reducing the frequency of extensive and intense fires, and reducing the impacts of feral herbivores
- monitor the abundance/incidence of and assess impacts of feral predators, feral herbivores and fire
- establish long-term population monitoring and vegetation assessments to enable long-term trends to be identified
- actively seek opportunities to involve members of local indigenous communities in on ground activities
- consider the need for translocation if the populations are unnaturally fragmented and do not recover unassisted.

CONSERVATION ISSUES

It is recommended that quantitative targets and resourcing requirements are clearly identified in any Action Plan or other related projects/programs relevant to this species. Broader conservation issues need

to be considered in developing and implementing actions arising from this advice and the species listing assessment (DCCEEW 2023).

Critical Habitat

The Commonwealth Conservation Advice (DCCEEW 2023) identifies all habitat where the Broad-toothed Rat occurs, or could occur, to be considered critical to the survival of the species. No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat under the EPBC Act (DCCEEW 2023).

Climate Change

Climate change impacts are inevitable and will affect the likelihood of persistence, within the ACT, of many species. Most vulnerable in this regard are those species that occupy highly fragmented habitat with highly restricted distributions, such as the Broad-toothed Rat. Capacity must be developed to model the impact on the Broad-toothed Rat and its habitat under likely climate change scenarios if we are to anticipate and manage the impacts of climate change. This will require a combination of research and the development of in-house capacity for the collection of relevant data and its application in climate change modelling.

Population Viability

With highly fragmented and declining species, such as the Broad-toothed Rat, it is important to ensure actions maintain connectivity and genetic diversity to prevent functional extinction. This occurs when populations declined in abundance and become fragmented to such an extent and that the genetic diversity of the species is reduced leading to genetic problems (e.g., inbreeding depression) and such that the species no longer has the capacity to rebound should conditions improve or to respond to management intervention. An assessment of genetic variation and inbreeding risk should be made in the case of the Broad-toothed Rat, particularly for small and isolated populations to inform risks. If genetic problems exist, more intensive options for bringing the species to a position where it has the potential to recover may need to be explored, such as genetic rescue.

Jurisdictional Collaboration

The location of the species habitat in the ACT high country along the NSW border requires the development of any policies and action/recovery plans to be discussed between relevant jurisdictional entities.

Ngunnawal Community Engagement

The ACT Government should actively facilitate, the inclusion of the Ngunnawal people in the conservation of this species and its habitat as part of Ngunnawal Country. Reference to the draft Cultural Resource Management Plan (ACT Government in prep.) would be useful to inform culturally appropriate resource management including of native species that aligns with achieving conservation outcomes for the species.

OTHER RELEVANT ADVICE, PLANS OR PRESCRIPTIONS

- ACT Conservation Advice — High Country Bogs and Fens (Scientific Committee 2019)
- ACT Action Plan – High Country Bogs and Fens (ACT Government 2024)
- Commonwealth Conservation Advice — Broad-toothed Rat (DCCEEW 2023)
- The Action Plan for Australian Mammals (Woinarski et al. 2012)

LISTING BACKGROUND

The Broad-toothed Rat (mainland) *Mastacomys fuscus mordicus* was first listed as Vulnerable under the *Environment Protection and Biodiversity and Conservation Act 1999* (EPBC Act) on 15 May 2016. In 2019, under the *Nature Conservation Act 2014,* the ACT Scientific Committee recommended the Broad-toothed Rat (mainland) be listed in the Vulnerable category in the ACT Threatened Native Species List to align with the EPBC Act listing.

The Broad-toothed Rat (mainland) *Mastacomys fuscus mordicus* was reassessed after the 2019–2020 bushfires and listed as Endangered under the *Environment Protection and Biodiversity and Conservation Act 1999* (EPBC Act) on 15 November 2023. In 2024, under the *Nature Conservation Act 2014,* the ACT Scientific Committee recommended the Broad-toothed Rat (mainland) be listed in the Endangered category in the ACT Threatened Native Species List to align with the EPBC Act listing.

ACTION PLAN DECISION

The ACT Scientific Committee does not recommend that the Minister for the Environment should make the decision to have an action plan for the species in the ACT under the *Nature Conservation Act 2014*. The key habitat areas of the species in the ACT are in Namadgi National Park and its habitat is protected there. There are also specific actions for the Broad-toothed Rat in the High Country Bogs and Fens Action Plan (ACT Government 2024).

The Scientific Committee notes that a National Recovery Plan is not required to be prepared for the species as the approved Commonwealth Conservation Advice (DCCEEW 2023) is deemed to provide sufficient direction to implement priority actions and mitigate against key threats.

REFERENCES

ACT Government 2019a. *Ecological Guidelines for Fire, Fuel and Access Management Operations*. Environment, Planning and Sustainable Development Directorate, Canberra. https://www.environment.act.gov.au/__data/assets/pdf_file/0009/1483830/Ecological-Guidelines-2019-ver-1.3.pdf

ACT Government 2020. Namadgi National Park Feral Horse Management Plan. Environment, Planning and Sustainable Development Directorate, ACT Government, Canberra.

ACT Government 2024. High Country Bogs and Associated Fens Action Plan. Environment, Planning and Sustainable Development Directorate, ACT Government, Canberra.

Australian Museum 2018. Animal species: broad-toothed rat. Accessed 30 January 2019: http://australianmuseum.net.au/broad-toothed-rat

Bilney RJ, Cooke R and White JG 2010. Underestimated and severe: small mammal decline from the forests of south-eastern Australia since European settlement, as revealed by a top order predator. *Biological Conservation* 143(1): 52–59. https://doi.org/10.1016/j.biocon.2009.09.002

Carey A, Evans M, Hann P, Lintermans M, MacDonald T, Ormay P, Sharp S, Shorthouse D, Webb, N 2003. *Wildfires in the ACT 2003: Report on initial impacts on natural ecosystems*. Technical Report 17. Environment ACT, Canberra.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2023. *Conservation Advice for Mastacomys fuscus mordicus (broad-toothed rat (mainland))*. Department of Climate Change, Energy, the Environment and Water (Commonwealth), Canberra. http://www.environment.gov.au/biodiversity/threatened/species/pubs/87617-conservation-advice-15112023.pdf.

Fusco DA, McDowell MC and Prideaux GJ 2016. Late-Holocene mammal fauna from southern Australia reveals rapid species declines post-European settlement: Implications for conservation biology. *The Holocene* 26(5): 699–708.

Green K and Osborne WS 2003. The distribution and status of the Broad-toothed rat *Mastacomys fuscus* (Rodentia: Muridae) in New South Wales and the Australian Capital Territory. *Australian Zoologist* 32: 229-237. Accessed 30 January 2019: http://publications.rzsnsw.org.au/doi/10.7882/AZ.2003.004

Greville W 1990. Genetic variation in the Broad-toothed Rat *Mastacomys fuscus*. Unpublished honours thesis, Australian National University, Canberra.

Happold DCD 2008. Broad-toothed Rat *Mastacomys fuscus*. In *The Mammals of Australia*. Third edition. Eds S. Van Dyck & R. Strahan, 589-591. Reed New Holland, Sydney.

Happold DCD 2011. Reproduction and ontogeny of *Mastacomys fuscus* (Rodentia, Muridae) in the Australian Alps and comparisons with other small mammals living in alpine communities. *Mammalian Biology* 76(5): 540-548. 10.1016/j.mambio.2010.11.006. Accessed 30 January 2019: https://www.researchgate.net/publication/251699878_Reproduction_and_ontogeny_of_Mastacomys_fuscus_Rodentia_Muridae_in_the_Australian_Alps_and_comparisons_with_other_small_mammals_living_in_alpine_communities

Lintermans M 1986. The Broad-toothed Rat *Mastacomys fuscus* in the ACT. Unpublished internal report ACT Parks and Conservation Service, Canberra.

McDowell, MC, Morris, SD, Johnson, CN, Martin, B and Brook BW 2023. Modelling of fossil and contemporary data suggest the Broad-toothed rat (Mastacomys fuscus) currently occupies a small part of its available climatic niche: Implications of paleontological data for conservation of a threatened species. *Austral Ecology* 48(7): 1292–1305. https://doi.org/10.1111/aec.13350

Menkhorst, PW 1995. Broad-toothed Rat, *Mammals of Victoria* (ed. P. W. Menkhorst), pp 208–210, Oxford University Press, Melbourne.

Milner R, Starrs D, Hayes G and Evans MC 2015. Distribution and habitat preference of the broad-toothed rat (*Mastacomys fuscus*) in the Australian Capital Territory, Australia. *Australian Mammalogy* 37(2): 125–131.

Milner R, Starrs D, Hayes G and Evans M 2016. *Distribution and Ecology of the Broad-toothed Rat in the ACT*. Technical Report 35. Environment and Planning Directorate, ACT Government, Canberra.

Ngunnawal Language Sketch Grammar 2022. Winanggaay Ngunnawal Language Aboriginal Corporation. In possession of the authors.

Scientific Committee 2019. *Conservation Advice – High Country Bogs and Associated Fens Ecological Community*. Environment Planning and Sustainable Development Directorate, ACT Government, Canberra.

Shipway S, Rowe KMC and Rowe KC 2020. Persistence of the broad-toothed rat (*Mastacomys fuscus*) across Victoria is correlated with climate and elevation. *Wildlife Research* 47(3): 267–278.

Thomas O 1922. A new species of Mastacomys from a cave in South Australia. *Annals and Magazine of Natural History* 9 (10): 550–551. https://www.biodiversitylibrary.org/item/78257

Threatened Species Scientific Committee (TSSC) 2016. *Approved Conservation Advice for Mastacomys fuscus mordicus (Broad-toothed Rat (mainland))*. Department of the Environment. Australian Government, Canberra.

Walker Z, Driscoll D, Ritchie E, Whisson D and Sato C 2021. *Impacts of severe and extensive fire and feral herbivores on a native rodent and four skinks in south-eastern Australia*, Technical report prepared for the Department of Agriculture, Water and Environment (Commonwealth), Canberra.

Woinarski J and Burbidge AA 2016. *Mastacomys fuscus. The IUCN Red List of Threatened Species 2016*. https://www.iucnredlist.org/species/18563/22429430

Woinarski JCZ, Burbidge AA and Harrison PL 2014. *The Action Plan for Australian Mammals 2012*. CSIRO Publishing, Collingwood.

FURTHER INFORMATION

Further information on this species or other threatened species and ecological communities can be obtained from Environment, Planning and Sustainable Development Directorate (EPSDD).
Phone: (02) 132281, EPSDD Website: https://www.environment.act.gov.au/nature-conservation

ATTACHMENT A: LISTING ASSESSMENT (DCCEEW 2023)

The Threatened Species Scientific Committee finalised this assessment on 7 June 2023.

Attachment A: Listing Assessment for *Mastacomys fuscus mordicus*

Reason for assessment

The broad-toothed rat (mainland) was listed as Endangered under the *Endangered Species Protection Act 1992* and transferred to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) when it commenced in July 2000.

This assessment follows evaluation by experts of the conservation status of the species following the 2019/2020 bushfires.

Assessment of eligibility for listing

This assessment uses the criteria set out in the EPBC Regulations. The thresholds used correspond with those in the IUCN Red List criteria except where noted in criterion 4, sub-criterion D2. The IUCN criteria are used by Australian jurisdictions to achieve consistent listing assessments through the Common Assessment Method (CAM).

Key assessment parameters

Table 4 includes the key assessment parameters used in the assessment of eligibility for listing against the criteria. The definition of each of the parameters follows the Guidelines for Using the IUCN Red List Categories and Criteria.

Table 4 Key assessment parameters

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Number of mature individuals	Unknown			There are no robust estimates of total population size, nor that of most populations, of the broad-toothed rat (mainland). Woinarski et al. (2014) reported that the population size is probably substantially > 10 000 mature individuals but no methodology was provided. In suitable habitat, the subspecies may attain relatively high densities. For example, the density of one population in Kosciuszko National Park was 12.1 individuals/ha (range 8-19/ha) during a 12-year period (Happold 1989, 1998). However, most sources consider the subspecies to be scarce and patchily distributed. Seebeck & Menkhorst (2000) noted that the subspecies was generally rare and localised but may be locally common in appropriate habitat. Happold (2008) considered it sparse to common, whilst the IUCN (2008) did not consider the subspecies to be common. Based on the available data on occupancy reductions across the subspecies range further declines will occur as threats to the subspecies continue. The most plausible estimate for the number of mature individuals is unknown but declining.

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Trend	Declining			Trend is declining based on evidence of local extirpations at 36 out of 68 sites across Victoria (Shipway et al. 2020). There is evidence of decline of populations in Victoria, New South Wales and Australian Capital Territory following large fire events including 2019/2020 (see Fire Ecology section of the CA). There is also evidence of continuing decline in habitat suitability (See Table 2 Threats and Table 1 Subpopulations of the broad-toothed rat (mainland)). It is expected that further declines and site extirpations will occur as threats to the species are ongoing. Based on expert elicitation, one year after the 2019/2020 bushfires, an overall population decline of around 18% (or up to 26.5%, the lower 80% confidence bound) is suspected under current management. This is expected to increase to 22.2% (or up to 37.3%) in ten years after the fires (Legge et al. 2021).
Generation time (years)	1-2 years	1 year	2 years	Sexual maturity is reached at 6-12 months (Happold 2008, 2011); longevity is probably 2-3 years (Happold 2011), so generation length is here assumed to be 1-2 years (Woinarski & Burbidge 2016). Mark-recapture studies at Barrington Tops never re-captured animals in consecutive years, which suggested 1 year was more likely (NSW DPE 2022c. pers comm 13 April).
Extent of occurrence	52 290 km^2	52 290 km^2	60 149 km^2	The Extent of Occurrence (EOO) was calculated using a minimum convex hull as described in Guidelines for Using the IUCN Red List Categories and Criteria (IUCN 2022) and using location records from either the past 5 years or from the past 10 years. The EOO was calculated based on records that had been compiled from state governments, along with museums, research institutions and non-government organisations. The EOO from the past 5 years and 10 years are approximately 52 290 km^2 (2017–2022) and 60 149 km^2 (2012–2022) respectively. The decision regarding how many years of data to include is a trade-off between increasing accuracy by including more years of data (thus increasing sample size) and increasing the currency of the estimate by using only data from more recent years (TSSC 2021).

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Trend	Contracting			The Barrington Tops National Park population (NSW) at the northern extreme of the distribution is disjunct from the rest of the subspecies range and is experiencing declines due to continued threats, such as climate change. As there is no altitudinal range for the subspecies to shift to in a warming climate it will likely become locally extirpated. The Wilsons Promontory (Vic) population at the southern extreme of the distribution may become locally extirpated within 5 years (by 2027) due to risk of encroachment by weeds, intensive overgrazing by invasive species and severe reduction of *Poa* grass. The decline in the extent of occurrence will likely continue since the main threats, such as climate change, fires that cause reductions in biodiversity, weed encroachment, and overgrazing, competition and predation from introduced species are compounding and have not ceased.
Area of Occupancy	912 km^2	912 km^2	1152 km^2	The Area of Occupancy (AOO) was calculated using location records from either the past 5 years or from the past 10 years and applying the 2 x 2 km grid cells recommended by the IUCN Red List Categories and Criteria (2022). The calculation resulted in an estimated AOO of 912 km^2 (2017–2022) and 1152 km^2 (2012–2022) using recent data provided by state governments, museums, research institutions and non-government organisations. The 2x2 km grid cell method is likely to Overestimate AOO for the broad-toothed rat (mainland) as the subspecies are patchily distributed and are unlikely to occupy 4 km^2 continuously (Rowe 2022. pers comm 17 May). TSSC (2016) provided an AOO estimation of 444 km^2. This figure was based on the mapping of point records from the 20-year period, 1995-2015, however it was noted that the AOO could possibly be as high as 1256 km^2. Woinarski et al. (2014) suggested that their estimate of 428 km^2 for the AOO was likely to be a significant under-estimate due to limited sampling across the occupied range and considered that the AOO is likely to be greater than 2000 km^2. The decision regarding how many years of data to include is a trade-off between increasing accuracy by including more years of data (thus increasing sample size) and increasing the currency of the estimate by using only data from more recent years (TSSC 2021). As with most area calculations, AOO estimates for the broad-toothed rat (mainland) also depends on the availability of monitoring data across its geographic range.

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
AOO is a standardised spatial measure of the risk of extinction, that represents the area of suitable habitat known, inferred or projected to be currently occupied by the taxon. It is estimated using a 2 x 2 km grid to enable comparison with the criteria thresholds. The resolution (grid size) that maximizes the correlation between AOO and extinction risk is determined more by the spatial scale of threats than by the spatial scale at which AOO is estimated or shape of the taxon's distribution. It is not a fine-scale estimate of the actual area occupied. In some cases, AOO is the smallest area essential at any stage to the survival of existing populations of a taxon (e.g., breeding sites for migratory species).				
Trend	Contracting			AOO is contracting due to most populations having declining occupancy due to combined pressure from predation from introduced predators such as the European red fox and feral cats, habitat degradation and competition from feral herbivores, fires that cause declines in biodiversity and climate change, making some historical habitat patches no longer suitable (Shipway et al. 2020 and see Table 1). For example, the population in the Dandenong Ranges (Vic) has not been detected since 1992 despite multiple surveys and may be locally extirpated. The Barrington Tops (NSW) and the Wilsons Promontory (Vic) populations will likely become extinct due to climate change and the range of compounding threats as described in EOO section above.
Number of subpopulations	20	10	20	See below
Trend	Decreasing			
Basis of assessment of subpopulation number	Data are lacking to clearly define the number of subpopulations across the range but there are 10-20 areas that could be identified from Table 1. The Dandenong ranges is possibly locally extirpated and Wilsons Promontory is likely to become extirpated within the next 5-10 years. Thus, the trend in number of subpopulations is decreasing.			
No. locations	<10	5	10	See below
Trend	Declining			
Basis of assessment of location number	The IUCN definition of a location is 'a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present' (IUCN 2019). Given the extent and severity of the 2019/2020 fires, the most likely threat that could affect large areas of the subspecies range in one generation is likely to be one or two consecutive extreme fire seasons. Despite heterogeneity of fire scars, and potential for unburnt refugia, extreme fire events have immediate impacts of widespread mortality and delayed impacts effecting longer term population viability across large parts of the subspecies range. The 2019/2020 bushfire events burnt a large area of Eastern Australia (100 000 km^2), overlapping c. 27% of the broad-toothed rat (mainland) distribution (Legge et al 2021). It is thus plausible that the subspecies range comprises 5-10 locations based on the regions listed in Table 1.			

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Fragmentation	The distribution may be severely fragmented. The habitat occupied by the broad-toothed rat (mainland) is naturally discontinuous. The broad-toothed rat (mainland) has a high habitat specificity and small home range sizes (Ensbey et al. 2022), prompting a fragmented distribution for the subspecies. Additionally, many areas of apparently suitable habitat are unoccupied (Green & Osborne 2003), suggesting the subspecies may have limited ability to disperse across unfavourable habitat (O'Brien et al. 2008). Although data are lacking to clearly define subpopulations for the broad-toothed rat (mainland), there are isolated subpopulations in the Otways, far East Gippsland (Victoria), Barrington Tops (New South Wales), and scattered across the Great Dividing Range from near Healesville (Victoria) to the Brindabella Range (Australian Capital Territory) (Woinarski et al. 2014, TSSC 2016, Table 1). A study by Seebeck and Menkhorst (2000) considered the subspecies to be scarce and patchily distributed, noting it may be locally common in appropriate habitat. Ongoing and recent declines in occupancy (especially due to the 2019/2020 fires) is increasing fragmentation across the range due to increases in distance between occupied sites. The effective fragmentation caused by selective predation at disturbed sites (due to fires or feral herbivores) is limiting dispersal potential and success and thereby increasing fragmentation further.			
Fluctuations	The broad-toothed rat (mainland) is not subject to extreme fluctuations in population size or distribution over any time period i.e., no parameter (EOO, AOO, number of locations or number of mature individuals) changes by at least an order of magnitude.			

Criterion 1 Population size reduction

Reduction in total numbers (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered Very severe reduction	**Endangered Severe reduction**	**Vulnerable Substantial reduction**
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected, inferred or suspected to be met in the future (up to a maximum of 100 years) [*(a) cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

Based on any of the following

(a) direct observation [except A3]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

Criterion 1 evidence

Eligible under Criterion 1 A2bce+3bce+4bce for listing as Endangered

Generation length for the subspecies is 1-2 years (Woinarski & Burbidge 2016). Thus 10 years (which is longer than three generations) is the appropriate time period on which to base the assessment, i.e., 2012-2022.

Population declines

Sub-criterion A2bc and A3bc) Table 5 extrapolates the population size reduction over the 10-year assessment time period (2012-2022) using occupancy as an index of abundance. Declines include post-fire assessments as well as general decline assessments where available. The observed occupancy reductions of the surveyed areas range from 26% to 100% with most reductions being greater than 50% of historically occupied surveyed sites. The key one-year post-2019/2020 fire declines we can draw from are 75% (Vic, Macak & Rowe 2022), 83% (ACT, ACT Government 2022. pers comm 29 April) and 92% (NSW, NSW DPE 2022). An average of all surveyed declines across the subspecies range (including from declines unrelated to the 2019/2020 fires) is 55.2%. When the observed occupancy changes are extrapolated to their equivalent changes from 2012-2022 based on the assumption of linear decline, the estimated overall reduction for the subspecies is 74%.

Occupancy modelling by Walker et al. (2021) based on surveys in burnt and unburnt areas of the Australian alpine region, in the Australian Capital Territory, New South Wales, and Victoria, and alpine resorts adjacent to these parks, showed that the probability that a site was occupied substantially decreased with increasing fire intensity. Broad-toothed rats (mainland) were more abundant at long-unburnt sites (no fire in the past 80 years), and abundance models showed that abundance declined with increasing fire severity, increasing number of past fires and increasing horse impacts. The local extirpation of broad-toothed rat (mainland) following high severity fire may fragment and isolate populations, making them more susceptible to stochastic extinction (Walker et al. 2021).

The 2019/2020 fires affected c. 27% of the known distribution of the subspecies (Legge et al. 2021), and we can assume similar impacts on the subspecies occupancy across all fire-effected areas. These are set on a background of a 53% decline across Victoria pre 1990 – 2014/2015 (Shipway et al. 2020).

Additionally, the Barrington Tops population is classified as an Endangered population under Schedule 1 of the NSW Biodiversity Conservation Act 2016 based on life history susceptibility (small litters, low fecundity and slow growth rate) to habitat degradation and introduced predators and herbivores leading to population decline (NSW SC 2001). The Barrington tops population has continued to decline since that classification due to a range of threats, but especially the impact of feral horses (NSW DPE 2022b. pers comm 2 May).

Sub-criterion A2e and A3e) Evidence of population declines due to introduced taxa have been recorded; Shultz et al. 2019 has noted extirpations due to feral horse impacts while selective predation by feral predators (Green and Osborne, 1981, Green, 2002, Schroder et al. in review) and the subspecies being in the critical weight range, make it suspectable to declines and extinction due to predation from feral predators. Introduced taxa are still present and impacting the broad-toothed rat (mainland) throughout the subspecies range, and it is unlikely that their combined impact will be alleviated sufficiently to stall declines due to known challenges with eradicating introduced taxa (Driscoll et al. 2019). It is therefore reasonable to expect declines of broad-toothed rat (mainland) will continue at current rates (see Table 2 Threats for further evidence).

Sub-criterion A4) In a project run by the Threatened Species Recovery Hub (Legge et al. 2021), expert elicitation was used to estimate the extent of population decline after fires of varying severity, and the predicted population trajectories out to three generations after the 2019/2020

fires. Information on population response to fires of varying severity was combined with spatial estimates of the overlaps between the subspecies distribution and fire severity mapping. The analysis suggests that *site-level* decline at severely affected sites is around 70.3 percent (80 percent confidence bounds: 83.5 to 57.3 percent) one week after the fires and 61 percent (80 percent confidence bounds: 81 and 38 percent) ten years after the fires (Legge et al 2021), with the 10–year estimate based on an assumption of no further extreme fire seasons. These estimates are lower than the site-level one-year post-fire empirical declines summarised in Table 1; 75% (Vic, Macak & Rowe 2022), 83% (ACT, ACT Government 2022. pers comm 29 April) and 92% (NSW, NSW DPE 2022) so the actual outlook for the subspecies is likely worse than or near the upper bound inferred by Legge et al. (2021).

Moreover, habitats of the broad-toothed rat (mainland) have been transformed by the 2019/2020 fires and may never return to pre-fire structure, for example alpine areas are easily disturbed and slow to recover (Williams 2019).

Conclusion

Although the rate of decline is not well established across the subspecies' range, there is evidence of continuing decline in most regions of the range, in habitat suitability and extent, and area of occupancy. Threats are ongoing and some appear to be increasing (e.g., the impact of feral herbivores, feral predators, spread of weeds, effects of climate change, and increased fire frequency). Post-fire surveys have found that broad-toothed rat (mainland) is a fire sensitive species with declines of at least 75% in fire affected areas. Based on the scale of impacts from the bush fires in 2019/2020 and the increased impact from feral horses, impacts of climate change on key habitats, and the compounding impact of feral predators, we infer the overall population size reduction to be greater than 50 percent over 10 years (74% across fire and non-fire effected areas Table 5).

Therefore, the subspecies has met the relevant elements of Criterion 1 to make it eligible for listing as Endangered.

Criterion 2 Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy

		Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1.	Extent of occurrence (EOO)	**< 100 km²**	**< 5,000 km²**	**< 20,000 km²**
B2.	Area of occupancy (AOO)	**< 10 km²**	**< 500 km²**	**< 2,000 km²**
AND at least 2 of the following 3 conditions:				
(a)	Severely fragmented OR Number of locations	**= 1**	**≤ 5**	**≤ 10**
(b)	Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c)	Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Criterion 2 evidence

Eligible under Criterion 2 B2ab(i,ii,iii,iv,v) for listing as Vulnerable

Extent of occurrence (EOO) and area of occupancy (AOO)

The EOO from the past 5 years and 10 years are approximately 52 290 km2 (2017–2022) and 60 149 km2 (2012–2022), respectively. The AOO was calculated using records from either the past 5 years or from the past 10 years, resulting in estimates of 912 km2 (2017–2022) and 1152 km2 (2012–2022).

Taking the lower estimates of the ranges; EOO is > 20,000 km² and therefore the subspecies does not meet the criterion based on the EOO. AOO is < 2000 km² and so the subspecies has a limited AOO under criterion B2.

Number of locations

The 2019/2020 bushfire season burnt a large area of Eastern Australia (100 000 km2), overlapping c. 27% of the broad-toothed rat (mainland) distribution (Legge et al. 2021), thus it is plausible that the broad-toothed rat (mainland) range is comprised of 5-10 locations based on the regions listed in Table 1.

Severely fragmented

The habitat occupied by the broad-toothed rat is naturally discontinuous, the broad-toothed rat has a high habitat specificity and small home range sizes (Ensbey et al. 2022), prompting a fragmented distribution for the subspecies. Additionally, many areas of apparently suitable habitat are unoccupied (Green & Osborne 2003), suggesting the species may have limited ability to disperse across unfavourable habitat (O'Brien et al., 2008).

Broad-toothed rats have been observed dispersing over several hundred metres (Bubela et al., 1991, Belcher, 1988, Green, 2000) and 2 males were observed dispersing up to 1km at an alpine

ski resort (Whisson et al. (2015). However, long distance movements are uncommon, especially in the absence of riparian cover or creek lines (Bubela et al. 1991, Happold 1995, O'Brien 2008, Milner et al. 2016). 2021 surveys detected the presence of broad-toothed rat in small, isolated patches of suitable habitat (such as a few square metres of grass or sedge on a roadside). The patches were up to hundreds of metres from the nearest large grassy meadow, suggesting that broad-toothed rat may be able to disperse through the landscape to these isolated patches (Kazi pers. comm., 2022).

In addition, effective fragmentation is increased with the presence of introduced predators as the success rate of dispersal attempts is reduced even when the quality and carrying capacity of habitat patches is stable. Selective predation on broad-toothed rat by feral foxes (Green and Osborne, 1981, Green, 2002, Schroder et al, in review) and feral cats (Schroder et al, in review) has been documented in areas throughout the subspecies range. Invasive predators often have increased activity and hunting success in burnt habitats, particularly following high severity fire (McGregor et al. 2016, Geary et al. 2020, Hradsky 2020). Predation is also intensified in any small unburnt patches of refugia where the subspecies may be confined following fire. Thus, predation by feral predators on dispersing individuals is contributing to increasing effective fragmentation of subspecies across its range. When combined with factors that have fragmented habitat, via destruction and/or degradation of vegetation cover (such as bushfires, feral herbivores, land management practices) and reduced snow fall and cover from subnivean spaces (climate change impacts), the impacts of feral predators are compounded such that effective fragmentation and geographic fragmentation are increased.

The broad-toothed rat (mainland) distribution is severely fragmented with isolated subpopulations in the Otways, far East Gippsland, Barrington Tops, Wilsons Promontory, and scattered across the Great Dividing Range from near Healesville (Victoria) to the Brindabella Range (ACT) (Woinarski et al., 2014, TSSC 2016). Most sources consider it scarce and patchily distributed: Seebeck and Menkhorst (2000) noted that it was 'generally rare and localised but may be locally common in appropriate habitat'. Happold (2008) considered it 'sparse to common', and IUCN (2008) considered it 'not a common species' (TSSC 2016). With the documented declines in occupancy (see Criterion 1) and common threats throughout the species range, we can infer similar declines throughout the range thus it is plausible that the distribution of the broad-toothed rat is severely fragmented and the processes rendering it such are expected to continue.

Continuing decline (EOO, AOO, number of subpopulations, number of mature individuals)

(bi) This distribution has declined since European settlement and with changing climate in more recent years (Shipway et al. 2020). Continued declines at disjunct populations on the boundaries of the subspecies range such as Barrington Tops in the north, far East Gippsland in the east, and Wilsons Promontory in the south, may reduce the EOO in the near future. The historically documented estimates for EOO for broad-toothed rat are probably a gross underestimate of their natural distribution on the mainland since they were not detected until the 1930s, after much of their range was already lost to habitat conversion. Thus, declines in EOO are likely substantially greater than estimates from survey data show (Rowe 2022. pers comm 17 May).

(bii) The AOO has declined, most recently due to the impacts of the 2019/2020 bushfires (Walker et al. 2021, Macak & Rowe 2022, ACT Government 2022) and, over the last 10 years, due to the ongoing and pervasive range of threats the subspecies faces across its range (selective

predation by feral foxes and cats, habitat degradation and destruction by feral herbivores, climate change, inappropriate fire regimes, habitat destruction of remnant habitat due to management practices at roadsides, alpine resorts etc)(Schroder et al. in review, Schulz et al. 2019, Kazi, pers. comm., 2022, Parrott pers comm., 2022, Whisson et al. 2015, Beilharz & Whisson 2016). There is evidence of reductions in AOO with 53% decline in occupancy across Victoria (Shipway et al. 2020), declines and potential extirpation of the populations in the Dandenong Ranges (See Table 1), reduction of AOO north of Forest Way in the Barrington Tops where broad-toothed rat have not been found since 2002 despite yearly surveys (NSW DPE 2022c. pers comm 13 April).

(biii) Habitat degradation and destruction by feral herbivores is a key threat to the broad-toothed rat throughout the subspecies range. Following fire, the impact of feral herbivores on regenerating soils and vegetation is compounded as trampling and herbivory disturbances impair habitat regeneration such that burnt areas may not return to the same quality of habitat pre-fire (Walker et al. 2021). Fires can also promote weed invasion which degrades the quality of the habitat for the broad-toothed rat. Many areas of habitat are highly susceptible to destruction and disturbance from mowing or fire hazard reduction operations. With the 53% decline in occupancy across Victoria, areas more likely to have persisting populations of broad-toothed rat where at higher altitudes, cooler and wetter, providing evidence that climate change is rendering lower lying areas unsuitable/less suitable habitat (Shipway et al, 2020). Habitats in alpine resorts becoming unsuitable or are being completely removed due to management practices (Whisson et al. 2015, Beilharz & Whisson 2016, Whisson, pers. comm., 2022). Alpine sphagnum bogs and associated fens, important habitat for the broad-toothed rat, are a threatened community due to climate change and the impacts of feral herbivores.

(biv) Given declines in AOO and habitat quality it follows that the number of subpopulations is likely to also have declined. Subpopulations of broad-toothed are not clearly defined, but areas such as the Dandenong Ranges, and north of the Barrington Tops are examples where numbers of subpopulations have declined given the lack of detections during the last 10 years. The number of subpopulations is also likely to have declined in some fire effected areas since the 2019/2020 bushfires.

(bv) Given declines in AOO and habitat it follows that the number of mature individuals is likely to have declined throughout the fire effected areas since the 2019/2020 bushfires. Declines of mature individuals are also likely to underpin the widespread declines in occupancy documented throughout the subspecies' range over the last 10 years.

Conclusion

The AOO estimate is less than 2000 km^2, (B2), the distribution is comprised of less than 10 locations and may be severely fragmented (a). There is also evidence of continuing declines (b) in EOO (i), AOO (ii), habitat quality (iii) and number of subpopulations (iv), and therefore number of mature individuals (v) (also see Criterion 1). Therefore, the subspecies has met the relevant elements of Criterion 2 to make it eligible for listing as Vulnerable.

Criterion 3 Population size and decline

	Critically Endangered Very low	Endangered Low	Vulnerable Limited
Estimated number of mature individuals	< 250	< 2,500	< 10,000
AND either (C1) or (C2) is true			
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	**Very high rate** **25% in 3 years or 1 generation** **(whichever is longer)**	**High rate** **20% in 5 years or 2 generation** **(whichever is longer)**	**Substantial rate** **10% in 10 years or 3 generations** **(whichever is longer)**
C2. An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(a) (i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(a) (ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b) Extreme fluctuations in the number of mature individuals			

Criterion 3 evidence

Insufficient data to determine eligibility

There are no estimates of total population size, nor that of most subpopulations, of the broad-toothed rat (mainland). Therefore, it is not possible to determine an estimate for the number of mature individuals.

The Committee considers that there is insufficient information to determine the eligibility of the subspecies for listing in any category under this criterion.

Criterion 4 Number of mature individuals

	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
D. Number of mature individuals	< 50	< 250	< 1,000
D2.[1] *Only applies to the Vulnerable category* Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time			D2. Typically: area of occupancy < 20 km² or number of locations ≤ 5

[1] The IUCN Red List Criterion D allows for species to be listed as Vulnerable under Criterion D2. The corresponding Criterion 4 in the EPBC Regulations does not currently include the provision for listing a species under D2. As such, a species cannot currently be listed under the EPBC Act under Criterion D2 only. However, assessments may include information relevant to D2. This information will not be considered by the Committee in making its recommendation of the species' eligibility for listing under the EPBC Act, but may assist other jurisdictions to adopt the assessment outcome under the *common assessment method*.

Criterion 4 evidence

Insufficient data to determine eligibility

There are no estimates of total population size, nor that of most subpopulations, of the broad-toothed rat (mainland). Therefore, it is not possible to determine an estimate for the number of mature individuals.

The Committee considers that there is insufficient information to determine the eligibility of the subspecies for listing in any category under this criterion.

Criterion 5 Quantitative analysis

	Critically Endangered Immediate future	Endangered Near future	Vulnerable Medium-term future
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Criterion 5 evidence

Insufficient data to determine eligibility

Population viability analysis has not been undertaken. Therefore, there is insufficient information to determine the eligibility of the subspecies for listing in any category under this criterion.

Adequacy of survey

The survey effort has been considered adequate and there is sufficient scientific evidence to support the assessment.

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 31 business days between 3 January 2023 and 15 February 2023 inclusive. Any comments received that were relevant to the survival of the subspecies were considered by the Committee as part of the assessment process and provided to the Minister for the Environment with the Committee's advice.

Listing and Recovery Plan Recommendations

The Threatened Species Scientific Committee recommends:

i) that the list referred to in section 178 of the EPBC Act be amended by **transferring** *Mastacomys fuscus mordicus* in the list from Vulnerable to the Endangered category.

ii) that there not be a Recovery Plan for this species in accordance with the provisions of the EPBC Act and the Committee's conservation planning principles as follows:

- An approved Conservation Advice is an effective, efficient and responsive document to guide the implementation of priority management actions, mitigate key threats, and support the recovery for this EPBC Act listed Endangered species.
- Although the species has significant and interacting threats across its range, many populations are on managed lands and the large number of stakeholders are actively and effectively working together to understand the status and needs of the species and support its recovery.
- Implementation of many recovery actions is already underway.
- The cross-jurisdictional context and the need to support complex actions such as translocations and fire management require co-ordination, but given stakeholders are effectively working together, the Committee believes that these can be guided via a Conservation Advice aligned with other existing planning mechanisms.
- The TSSC also recommended that the department facilitate the formation and coordination of a national recovery team to support national coordination.

Having regard to the above factors, the approved Conservation Advice for *Dasyuroides byrnie*, the TSSC's initial and final advice that a Recovery Plan is not required for this species, the precautionary principle, and the recommendations of the department on this decision, a Recovery Plan is not required as it would not provide a significant conservation planning benefit above existing mechanisms.

As an approved, updated, and detailed Conservation Advice for the species would provide sufficient direction to implement priority conservation actions, mitigate against key threats, enable recovery and provide foundation for further planning, a national Recovery Plan is not required at this time.

Consequently, the Threatened Species Scientific Committee has not recommended that a recovery plan be required (see Attachment A for TSSC recommendations regarding the need for a recovery plan).