



## Consultation Document on Listing Eligibility

### *Notomys robustus* (Broad-cheeked Hopping Mouse)

You are invited to provide your views and supporting reasons related to the eligibility of *Notomys robustus* (Broad-cheeked Hopping Mouse) for inclusion on the EPBC Act threatened species list in the **Extinct** category.

Evidence provided by experts, stakeholders and the general public are welcome. Responses can be provided by any interested person.

Anyone may nominate a native species, ecological community or threatening process for listing under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or for a transfer of an item already on the list to a new listing category. The Threatened Species Scientific Committee (the Committee) undertakes the assessment of species to determine eligibility for inclusion in the list of threatened species and provides its recommendation to the Australian Government Minister for the Environment.

Responses are to be provided in writing either by email to:  
[species.consultation@environment.gov.au](mailto:species.consultation@environment.gov.au)

or by mail to:

The Director  
Marine and Freshwater Species Conservation Section  
Biodiversity Conservation Division  
Department of Agriculture, Water and the Environment  
PO Box 787  
Canberra ACT 2601

**Responses are required to be submitted by 11 September 2020.**

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## General background information about listing threatened species

The Australian Government helps protect species at risk of extinction by listing them as threatened under Part 13 of the EPBC Act. Once listed under the EPBC Act, the species becomes a Matter of National Environmental Significance (MNES) and must be protected from significant impacts through the assessment and approval provisions of the EPBC Act. More information about threatened species is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/index.html>.

Public nominations to list threatened species under the EPBC Act are received annually by the department. In order to determine if a species is eligible for listing as threatened under the EPBC Act, the Threatened Species Scientific Committee (the Committee) undertakes a rigorous scientific assessment of its status to determine if the species is eligible for listing against a set of criteria. These criteria are available on the Department's website at:

<http://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/tssc-guidelines-assessing-species-2018.pdf>.

As part of the assessment process, the Committee consults with the public and stakeholders to obtain specific details about the species, as well as advice on what conservation actions might be appropriate. Information provided through the consultation process is considered by the Committee in its assessment. The Committee provides its advice on the assessment (together with comments received) to the Minister regarding the eligibility of the species for listing under a particular category and what conservation actions might be appropriate. The Minister decides to add, or not to add, the species to the list of threatened species under the EPBC Act. More detailed information about the listing process is at:

<http://www.environment.gov.au/biodiversity/threatened/nominations.html>.

To promote the recovery of listed threatened species and ecological communities, conservation advices and where required, recovery plans are made or adopted in accordance with Part 13 of the EPBC Act. Conservation advices provide guidance at the time of listing on known threats and priority recovery actions that can be undertaken at a local and regional level. Recovery plans describe key threats and identify specific recovery actions that can be undertaken to enable recovery activities to occur within a planned and logical national framework. Information about recovery plans is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/recovery.html>.

## Privacy notice

The Department will collect, use, store and disclose the personal information you provide in a manner consistent with the Department's obligations under the Privacy Act 1988 (Cth) and the Department's Privacy Policy.

Any personal information that you provide within, or in addition to, your comments in the threatened species assessment process may be used by the Department for the purposes of its functions relating to threatened species assessments, including contacting you if we have any questions about your comments in the future.

Further, the Commonwealth, State and Territory governments have agreed to share threatened species assessment documentation (including comments) to ensure that all States and Territories have access to the same documentation when making a decision on the status of a potentially threatened species. This is also known as the '[common assessment method](#)'. As a result, any personal information that you have provided in connection with your comments may be shared between Commonwealth, State or Territory government entities to assist with their assessment processes.

The Department's Privacy Policy contains details about how respondents may access and make corrections to personal information that the Department holds about the respondent, how respondents may make a complaint about a breach of an Australian Privacy Principle, and how

the Department will deal with that complaint. A copy of the Department's Privacy Policy is available at: <http://environment.gov.au/privacy-policy>.

### **Information about this consultation process**

Responses to this consultation can be provided electronically or in hard copy to the contact addresses provided on Page 1. All responses received will be provided in full to the Committee and then to the Australian Government Minister for the Environment.

In providing comments, please provide references to published data where possible. Should the Committee use the information you provide in formulating its advice, the information will be attributed to you and referenced as a 'personal communication' unless you provide references or otherwise attribute this information (please specify if your organisation requires that this information is attributed to your organisation instead of yourself). The final advice by the Committee will be published on the department's website following the listing decision by the Minister.

Information provided through consultation may be subject to freedom of information legislation and court processes. It is also important to note that under the EPBC Act, the deliberations and recommendations of the Committee are confidential until the Minister has made a final decision on the nomination, unless otherwise determined by the Minister.

# *Notomys robustus*

## Broad-cheeked Hopping Mouse

### **Taxonomy**

Conventionally accepted as *Notomys robustus* Mahoney, Smith & Medlin, 2008.

### **Species/Sub-species Information**

#### **Description**

*Notomys robustus* (Broad-cheeked Hopping Mouse) has never been recorded alive and is recognised only from subfossil skull material. No physical description is available for the species. The skull dimensions indicate that its body size may have been similar to *N. amplus* (Short-tailed Hopping Mouse), which was one of the largest Australian hopping mice species (weighing 100 g) (Pavey 2006; Mahoney et al. 2008; Medlin 2008). The greatly enlarged cheek arch and distinctive dentition allow for easy differentiation from the remains of the Short-tailed Hopping Mouse (Mahoney et al. 2008; Medlin 2008).

The genus *Notomys* contains ten species of Australian hopping mice of which five are thought to be extinct, including the Broad-cheeked Hopping Mouse. The five remaining extant species are characterised by their very long hind legs and hopping gait. These nocturnal rodents have large eyes and long, thin, tufted tails (Breed 1975; Mahoney et al. 2008).

#### **Distribution**

Known only from subfossil skull material taken from caves in the Davenport and Flinders Ranges, the Broad-cheeked Hopping Mouse is thought to have been endemic to South Australia (SA), distributed from the north to the east of the state. The collection sites are in arid and semi-arid rocky ranges, with a dominant plant cover of native grasses and hardy (drought and salt tolerant) low shrub species belonging to various genera of *Chenopodiaceae* (Medlin 2008; DEWNR 2009; Carnegie 2016).

#### **Extinction date**

The Broad-cheeked Hopping Mouse has a presumed extinction decade of the 1860s or 1870s (Woinarski et al. 2014a).

#### **Relevant Biology/Ecology**

Almost nothing is known about the biology of the Broad-cheeked Hopping Mouse. The skull composition and distinctive dentition suggest a different feeding niche from other *Notomys* species (Medlin 2008). More broadly, the remaining extant species of hopping mice share the ecological trait of living in burrows, which they do not venture more than a few metres from during night-time forages (Watts & Kempler 1989).

#### **Likely Causes of Decline and Extinction**

Likely causes of decline and extinction are surmised from threats known to have occurred in the 19th century and an assumption that the threats that affect many conilurine rodents would also impact on the Broad-cheeked Hopping Mouse.

Table 1: Probable causes of decline towards extinction for the Broad-cheeked Hopping Mouse in approximate order of impact, based on available evidence.

Threat factor	Threat status and severity*	Evidence base
Introduced predators		
Predation by feral cats ( <i>Felis catus</i> )	<ul style="list-style-type: none"> <li>– Status: Historical</li> <li>– Confidence: Suspected</li> <li>– Consequence: Severe</li> <li>– Extent: Across the entire range</li> </ul>	<p>Feral cats are thought to have been present in SA prior to the mid-19th century (Tunbridge 1993).</p> <p>Predation by feral cats has been implicated in the extinction and ongoing decline of many terrestrial, non-volant, mammal species (Dickman 1993; Smith &amp; Quin 1996; Woinarski et al. 2014b; Hardman et al. 2016; Davies et al. 2017; Radford et al. 2018; Woolley et al. 2019). Abundance of the feral cat has been found to be the best predictor of decline of small sized conilurine rodents (10–90 g) (Smith &amp; Quin 1996) and Woinarski et al. (2014b) considered predation by feral cats to be the most critical factor in the decline and extirpation of Australia's mammal fauna.</p> <p>Fire and stock grazing can amplify the impacts of predation on small mammals by reducing ground cover, particularly following high-intensity burns (Smith &amp; Quinn 1996; Leahy et al. 2015). The number of predators attracted to the burnt area (Hradsky et al. 2017), individual predator activity (Leahy et al. 2015), and hunting success (McGregor et al. 2015) have all been observed to increase where habitat has been modified through frequent burning. Therefore, threats from predation would have increased as European settlement spread throughout the accepted distribution range.</p>
Predation by European red fox ( <i>Vulpes vulpes</i> )	<ul style="list-style-type: none"> <li>– Status: Historical</li> <li>– Confidence: Suspected</li> <li>– Consequence: Severe</li> <li>– Extent: Across the entire range</li> </ul>	<p>The European red fox arrived in SA shortly after 1870, with the open plain and lightly wooded habitat an ideal environment promoting their abundance (Johnson 2006). By 1910 the red fox range extended throughout the region of the Flinders Ranges (Tunbridge 1993).</p> <p>Predation by the red fox has been implicated in the extinction and decline of many terrestrial, non-volant mammal species in Australia (Richards 2004; DEWHA 2008; Woinarski et al. 2014b; Radford et al. 2018) and was identified by Smith &amp; Quin (1996) as having a significant impact on small isolated populations of threatened species, being able to eliminate them even at low densities.</p> <p>As identified above, fire can amplify the impacts of predation on small and medium-sized</p>

		mammals (Leahy et al. 2015; McGregor et al. 2015; Hradsky et al. 2017).
Habitat loss and fragmentation		
Habitat degradation and resource depletion by livestock	<ul style="list-style-type: none"> <li>– Status: Historical</li> <li>– Confidence: Suspected</li> <li>– Consequence: Severe</li> <li>– Extent: Across the entire range</li> </ul>	<p>Overstocking soon after European settlement in arid and semi-arid SA coincided with a series of droughts from the mid to late 1800s, hastening the demise of native species (Tunbridge 1993; Robinson et al. 2000; Johnson 2006; Medlin 2008). In particular, there was a major drought in the Flinders Ranges between 1864–1866 (Tunbridge 1991, cited in Woinarski et al. 2014a).</p> <p>Grazing impacts small, granivorous mammals by removing both shelter and the green stems, leaves and seeds that comprised the bulk of their diet (Dickman 1993) and degrades or destroys potential refuges for native species during times of drought (Tunbridge 1993; Morton et al. 1995).</p> <p>Trampling by stock compacts and powders topsoil, renders soil too loose for digging (Dickman 1993). It is unknown whether the Broad-cheeked Hopping Mouse was a sub-surface burrower and possibly severely impacted by trampling. However, the remaining extant <i>Notomys</i> species are known to burrow and it is likely the Broad-cheeked Hopping Mouse shared this behaviour.</p>
Habitat degradation and resource depletion by introduced European rabbits ( <i>Oryctolagus cuniculus</i> )	<ul style="list-style-type: none"> <li>– Status: Historical</li> <li>– Confidence: Suspected</li> <li>– Consequence: Severe</li> <li>– Extent: Across the entire range</li> </ul>	<p>European rabbits were recorded throughout most of arid and semi-arid SA by 1880–1890 and were in high abundance throughout the Flinders Ranges (Tunbridge 1993).</p> <p>Rabbits compete with native fauna for food and degrade the habitat by intensively grazing on native vegetation and ringbarking trees (Richards 2004). In large numbers, rabbits turn areas of productive, well-vegetated country into a virtual desert, greatly impacting sympatric mammals (Johnson 2006). Where rabbits are found in abundance, conilurine rodents experience significantly greater reductions in population than in areas which have fewer rabbits (Smith &amp; Quin 1996).</p> <p>Rabbits, with high standing biomass and high rate of increase, provide abundant prey for predators as native species decline. Therefore, rabbit presence supports elevated predator populations and predation pressures on native mammalian species. Native species are also easier to catch, being without the behavioural or morphological defences to avoid detection or capture (Richards 2004; Pedler et al. 2016; Radford et al. 2018).</p>

Fire		
Change in fire regime	<ul style="list-style-type: none"> <li>– Status: Historical</li> <li>– Confidence: Suspected</li> <li>– Consequence: Unknown</li> <li>– Extent: Across the entire range</li> </ul>	<p>The degree to which a change in fire regime impacted the Broad-cheeked Hopping Mouse is unknown. Tunbridge (1993) observed that there is no evidence for any significant role played by fire in the Flinders Ranges.</p> <p>Johnson (2006) believed that a change in fire regime made little direct contribution to mammal extinctions, with declines related to increased predator activity after fire and not the fire itself (Leahy et al. 2015; McGregor et al. 2015; Hradsky et al. 2017).</p>

Status: “historical/ current/ future” – identify the temporal nature of the threat

Confidence: “suspected/ inferred/ known” – identify the extent to which we have confidence about that threat

Consequence: “severe/ moderate/ low/ unknown” – identify the severity of that threat

Trend: “decreasing/ static / increasing / unknown” – identify the extent to which it will continue to operate on the species

Extent: “across the entire range/across part of its range / unknown.” – identify its spatial context

### **Assessment of available information in relation to the EPBC Act Criteria and Regulations**

The Broad-cheeked Hopping Mouse has never been recorded alive and is recognised only from subfossil skull material collected in SA. The species was first recognised in 2008 (Smith & Medlin, 2008) and so little information is available that the extinction date cannot be readily estimated. However, the intact form of at least some owl pellets (containing Broad-cheeked Hopping Mouse subfossil material) and their close proximity to the surface in many of the cave deposits could indicate that they are not more than 200 years old (Mahoney et al. 2008). Tunbridge (1991) estimates the year of extinction to have occurred around 1850-1900 in the Flinders Ranges. Woinarski et al. (2014a) give the likely extinction decade of the 1860s or 1870s.

The Broad-cheeked Hopping Mouse is listed Extinct under the IUCN Red List (Burbidge & Woinarski 2016) and in the Action Plan for Australian Mammals (Woinarski et al. 2014a). The species is Not Listed under the *South Australia National Parks and Wildlife Act 1972*, with SA the only state in which the species remains have been recorded.

The Broad-cheeked Hopping Mouse is believed to have been endemic to SA, with an accepted historical distribution range from the north across to the east of the state. Biological surveys for rodents conducted throughout this range have not detected the species. Robinson et al. (2000) assessed the status of native rodents in SA using locality records from museums, literature records and Indigenous knowledge. Of the original 27 native rodent species identified, 11 were found to be extinct, including the Broad-cheeked Hopping Mouse. In particular, biological surveys in the Flinders Ranges (where subfossil material of the species has been found) did not detect any evidence of the species’ persistence.

The conilurine rodents of Australia have undergone a more severe rate of extinction than that of the total mammalian fauna (Smith & Quin 1996). Breed & Ford (2007) observed that most of the recent rodent extinctions have occurred in the arid and semi-arid zones, and among rodents that exceed 60 g, only *Pseudomys australis* (Plains Mouse) and *Zyzomys pedunculatus* (Central Rock-rat) have survived. In the Flinders Ranges, two-thirds of the terrestrial mammal species are believed to have gone extinct during the first 50 years of European settlement. This includes four of the five known hopping mice species that inhabited the region. Only *Notomys fuscus* (Dusky Hopping Mouse) persists, being listed as Vulnerable under the *South Australia National Parks and Wildlife Act 1972* (Tunbridge 1993; Mahoney et al. 2008).

The data presented above appear to demonstrate that the species is **eligible for listing as Extinct**. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

### **Collective list of questions – your views**

#### **Information to aid listing assessment**

1. Do you have further information on past or potential searches or research activities for the species?
2. Can you provide information on specimen records, including collection location and date?
3. Can you provide additional information on the range or location of populations, or a historic range (national extent)?
4. Do you have any additional information in regard to the ecology or biology of the species?
5. Do you have further information on the historic threats that faced the species?
6. Are you aware of other knowledge (e.g. indigenous ecological knowledge) that may help better understand the species?
7. Are you aware of any cultural importance or use that the species had?

#### **Any other information**

8. Do you have comments on any other matters relevant to the assessment of this species?

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