



Consultation Document on Listing Eligibility and Conservation Actions

***Notomys aquilo* (northern hopping-mouse)**

You are invited to provide your views and supporting reasons related to:

- 1) the eligibility of *Notomys aquilo* (northern hopping-mouse) for inclusion on the EPBC Act threatened species list in the Critically Endangered category; and
- 2) the necessary conservation actions for the above species.

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 and Energy.

Responses are to be provided in writing either by email to:
species.consultation@environment.gov.au

or by mail to:

The Director
Terrestrial Threatened Species Section
Biodiversity Conservation Division
Department of the Environment and Energy
PO Box 787
Canberra ACT 2601

Responses are required to be submitted by 22 November 2017.

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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/biodiversity/threatened/pubs/guidelines-species.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>.

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 aquilo

northern hopping-mouse

Taxonomy

Conventionally accepted as *Notomys aquilo* Thomas, 1921 (northern hopping-mouse).

Species Information

Description

The northern hopping-mouse is a medium-sized rodent, with a head and body length of 91–112 mm and a tail length of 158–173 mm (Woinarski and Flannery 2008). It has features typical of hopping-mice in general, with very long narrow hind feet, large ears and eyes, and a very long partly tufted tail (Woinarski 2004). It is the only representative of its genus in northern Australia, and its morphology is highly distinctive, being sandy-brown above and paler below (Woinarski 2004). Hopping-mice move with a distinctive gait and its bipedal tracks may provide the most conspicuous signs of its presence (Woinarski 2004).

Distribution

The original specimen of the northern hopping mouse was collected before 1867 on Cape York Peninsula, but it has not been recorded from Queensland since and the provenance of the original specimen is doubtful (Dickman 2012). In the 1930s and 1940s, Donald Thomson recorded *N. aquilo* from Groote Eylandt and reported sightings from the Northern Territory mainland near the mouth of the Roper River (Dixon and Huxley 1985), and in 1948 Johnson (1964) collected specimens on Groote Eylandt. Subsequently, there have been some additional confirmed and unconfirmed records from the Arnhem Land mainland (including as far west as near the Cadell River, in 1973), and many further records from Groote Eylandt, particularly on coastal dunes and sand sheets (Woinarski et al, 1999). However, there have been no confirmed records from the Australian mainland for over 20 years (Woinarski and Burbridge 2016). The species is now only known from three locations on Groote Eylandt (Diете et al, 2016).

Relevant Biology/Ecology

The northern hopping-mouse is a nocturnal rodent, with a diet comprising mostly of seeds and plant stems as well as some invertebrates (Woinarski et al, 2014). It occurs in a range of environments (including eucalypt open forests, heathlands or grasslands and dunefields), on sandy substrates (Woinarski et al, 1999; R Diете 2016, unpublished data 22 January). It shelters in complex burrow systems in deep sandy soils (Johnson 1964; Dixon and Huxley 1985). Little is known regarding the species' response to a variety of fire regimes (Woinarski et al, 2014).

The generation length is estimated to be 2.5 years, based on an age of sexual maturity of 3-4 months in other *Notomys* species and a maximum longevity of around 5 years (Watts and Aslin 1981).

Threats

There is a lack of specific information on threats to the northern hopping-mouse. However, the threats most likely to be affecting this species may be inferred from evidence of a more general decline in native mammal assemblages across parts of northern Australia (Woinarski et al, 2001; Watson and Woinarski 2003; Pardon et al, 2003; McKenzie and Burbidge 2002). The northern hopping-mouse is likely to be subject to some of the pervasive threatening processes of vegetation change through altered fire regimes and (on the mainland) introduced herbivores [buffalo (*Bubalus bubalis*), cattle (*Bos taurus*), donkeys (*Equus asinus*), horses (*Equus caballus*), pigs (*Sus scrofa*), and rusa deer (*Cervus timorensis*)], and predation by feral cats (*Felis catus*). It is also likely to be subject to some impacts from strip-mining on north-eastern Arnhem Land and Groote Eylandt (Woinarski 2004). Feral cats are known to occur on Groote Eylandt albeit in low numbers and may pose a direct threat to the species.

Table 1 – Threats impacting the northern hopping-mouse in approximate order of severity of risk, based on available evidence

Threat factor	Threat type and status	Evidence base
Habitat loss and fragmentation		
Strip mining for manganese and bauxite	suspected current	Parts of the species range are subject to extensive strip mining for manganese and bauxite
Invasive species		
Predation by feral cats	suspected current	Not demonstrated, but highly plausible given feral cats occur in high numbers in Northern Australia and are also known to occur on Groote Eylandt. Feral cats are known to prey on small mammals such as the northern hopping-mouse.
Grazing and trampling by introduced herbivores	suspected current	Not demonstrated, but plausible given the response of similar-sized rodents to the presence of introduced herbivores in northern Australia. One study in the Mornington Wildlife Sanctuary in the central Kimberley of Western Australia, showed that the removal of introduced herbivores increased the species richness and abundance of small native rodents and dasyurids (Legge et al, 2010).
Fire		
frequent or intense fire	suspected current	In other <i>Notomys</i> species such as <i>N. alexis</i> (spinifex hopping-mouse) hot wildfires caused population numbers of this species to fall dramatically (Pastro et al, 2011). Cool patchwork burns have been shown to have a small positive or negligible effect on population numbers of the spinifex hopping-mouse (Letnic 2003; Letnic and Dickman 2005). Some areas of Groote Eylandt experiences hot fires one or two times a year and these fires could potentially reduce suitable habitat for the northern hopping-mouse and reduce population numbers (Diete et al, 2016). Frequent or intense fires can amplify predation, including by feral cats, as fires may reduce vegetation cover which provides protective cover to shelter small to medium sized mammals.

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

Criterion 1. Population size reduction (reduction in total numbers)			
Population reduction (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.	<i>based on any of the following</i>	(a) direct observation [<i>except A3</i>]
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.		(b) an index of abundance appropriate to the taxon
A3	Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]		(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
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.		(d) actual or potential levels of exploitation
			(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

Evidence:

The original specimen of this species which was collected before 1867 was found on the Cape York Peninsula. However, it has not been recorded from Queensland since and the accuracy of this record is doubtful (Dickman 2012). Historically, this species was considered common and known from the Roper River near Mataranka in the Northern Territory; the Cadell River in Arnhem Land; and numerous locations on Groote Eylandt in the Gulf of Carpentaria. However, there have been no confirmed records of this species from the Australian mainland for over 20 years (Woinarski and Burbridge 2016). On Groote Eylandt the species was not detected in any of the areas where it was confirmed by Woinarski et al, (1999) and is now only known from three locations where population numbers are low (Dieté et al, 2016). This represents an observed decline in the extent of occurrence (EEO) and the area of occupancy (AOO) from an EEO of 2,356 km² and an AOO of 104 km² to the current EEO and AOO of 12 km². Consequently, there has been an observed severe reduction in population numbers over the past 10 years as a result of the threats acting on this species (see Table 1 above), based on direct observation and a decline in the area of occupancy, extent of occurrence and the effects of an introduced taxa.

The data presented above appear to demonstrate that the species is **eligible for listing as Endangered (A2ac)** under this criterion. Assessment under A2 was considered appropriate as there is evidence of past decline in the past 10 years where the causes of the reduction have not ceased; are not well understood and may not be reversible. 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.

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 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
AND at least 2 of the following 3 conditions indicating distribution is precarious for survival:			
(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			

Evidence:

The northern hopping-mouse's EOO and AOO is estimated to be 12 km² (DEE, 2017), which is very restricted. These figures are based on the mapping of point records in 2016, obtained from the Department of the Environment and Energy and the NT Department of Environment and Natural Resources. The EOO was calculated using a minimum convex hull, and the AOO calculated using a 2x2 km grid cell method, based on the IUCN Red List Guidelines 2014 (DEE 2017).

It can be inferred that there will be a continuing decline in its EOO, AOO, extent and quality of habitat, number of subpopulations and number of mature individuals as a result of ongoing threats such as mining, domestic and feral animals and mismanaged fire. It can also be inferred that the northern hopping-mouse will continue to decline as the species has declined on Groote Eylandt since observations were made by Woinarski et al, 1999 and is now only known from three locations on the island (Diete et al, 2016).

The data presented above appear to demonstrate that the species is **eligible for listing as Critically Endangered** under this criterion. 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.

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			

Evidence:

It is currently estimated that there are less than 2000 extant mature individuals of the species which is low (R Diets 2016, unpublished data 22 January). Only 39 individuals were captured on Groote Eylandt during surveys from 2012 to 2014 (Diets et al, 2016). The species is projected to continue to decline as it has not been identified on the Australian mainland for over 20 years and as the species has declined on Groote Eylandt since observations were made by Woinarski et al, 1999 and is now only known from three locations on the island (Diets et al, 2016). In addition, the threats acting on the species such as mining, domestic and feral animals and mismanaged fire are continuing to affect the species. As the species is now only known from three locations on Groote Eylandt, with a total population of less than 2000 mature individuals, each subpopulation is thought to have less than 1000 mature individuals, but greater than 250 mature individuals.

The data presented above appear to demonstrate that the species is **eligible for listing as Vulnerable** under this criterion. 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.

Criterion 4. Number of mature individuals			
	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
Number of mature individuals	< 50	< 250	< 1,000

Evidence:

It is currently estimated that there are less than 2000 extant mature individuals of the species (R Diets 2016, unpublished data 22 January).

Consequently, the data presented above appear to demonstrate the species is not eligible for listing under this criterion. 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.

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

Evidence:

Population viability analysis appears to have not been undertaken. Therefore, there appears to be insufficient data to demonstrate if the species is eligible for listing under this criterion.

The data presented above appears to demonstrate that the species is not eligible for listing under this criterion. 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.

Conservation Actions

The conservation actions below are based on information provided in Woinarski (2004) and Woinarski et al, (2014).

Recovery Plan

A decision about whether there should be a recovery plan for this species has not yet been determined. The purpose of this consultation document is to elicit additional information to help inform this decision.

Primary Conservation Actions

Control and prevent any new introductions of feral animals (especially feral cats) on Groote Eylandt. Feral cats are already present on the island in low numbers. Prevent any further habitat loss by preventing mining activities in the species' habitat; reduce the impact of current mining activities on the species' habitat; and rehabilitating mined areas so that they provide suitable habitat for the northern hopping-mouse.

Conservation and Management Priorities

Theme	Specific actions	Priority
Active mitigation of threats	Implement fire management that reduces the frequency, intensity and extent of fires. Cool patchwork burns are thought to have a positive effect on similar species such as the spinifex hopping-mouse and may reduce predation by feral cats and other predators (Letnic 2003; Letnic and Dickman 2005)	High
	Implement cost-effective control measures for feral cats that minimise impacts of predation	High
	Implement post-mining rehabilitation procedures that provide for re-colonisation by this species	Medium-High
	Reduce the populations of introduced herbivores	Medium
Captive breeding	Develop an insurance captive population on Groote Eylandt	Medium
Quarantining isolated populations	Maintain or enhance constraints on cat imports on Groote Eylandt; prevent imports of introduced herbivores	Medium
Translocation	Examine options for reintroductions to mainland areas that no longer support extant populations	Medium
	Use captive-bred animals to experimentally assess reintroduction options at former mine sites	Medium
Community engagement	Engage land owners and managers such as Indigenous ranger groups in the survey, monitoring and management of the species and its habitat	High

Survey and Monitoring priorities

Theme	Specific actions	Priority
Survey to better define distribution	Undertake targeted surveys in Arnhem Land	High
	Undertake targeted surveys on Cape York Peninsula	Medium
	Undertake more detailed mapping of the species distribution on Groote Eylandt	Medium
Establish or enhance monitoring program	Establish an integrated monitoring program to describe long-term trends in abundance, and responses to management actions	Medium-High
	Monitor the effectiveness of management actions, and adapt/refine them accordingly	Medium-High

Information and research priorities

Theme	Specific actions	Priority
Improve sampling techniques	Evaluate options for increasing the efficiency of sampling protocols at sites of known occurrence to improve the reliability of detection	Medium-High
Assess relative impacts of threats	Undertake a detailed autecological study to more specifically identify the impacts of threatening processes	Medium-High
	Determine the response of the species to a range of fire regimes	Medium-High
	Determine the major causes of mortality (in particular the impacts of cats on the species)	Medium-High
Assess effectiveness of threat mitigation options	Assess the impacts of mining activities on the species and its habitat Assess the effectiveness of mine rehabilitation measures for providing suitable habitat	Medium-High
	Assess the effectiveness of a range of possible cat control mechanisms	Medium
Assess habitat requirements	Identify critical features that define suitable habitat for the species	Medium
Assess diet	Assess critical components of diet, and associated management requirements	Medium
Assess fecundity	Identify factors influencing reproductive success	Medium
Undertake research to develop new or to enhance existing management mechanisms	Develop methods for broad-scale and targeted feral cat control	Medium
Undertake research into optimal post-mining rehabilitation procedures for this species' habitat	Develop post-mining rehabilitation procedures that provide for re-colonisation by this species	Medium

Collective list of questions – your views

SECTION A GENERAL

1. Can you provide additional data or information relevant to this assessment?

PART 1 – INFORMATION TO ASSIST LISTING ASSESSMENT

SECTION B ARE YOU AWARE OF THE STATUS OF THE TOTAL NATIONAL POPULATION OF THE SPECIES? (If no, skip to section C)

Population size

2. Do you accept the estimate of the total population size of the species? If not, please provide justification for your response.
3. If not, can you provide a further estimate of the current population size of mature adults of the species (national extent)? Please provide supporting justification or other information.

If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible subspecies numbers, and also choose the level of confidence you have in this estimate:

Number of mature individuals is estimated to be in the range of:

- 1–250 251–1000 1001–2500 2500–5000 5001–10 000

Level of your confidence in this estimate:

- 0–30% - low level of certainty/ a bit of a guess/ not much information to go on
- 31–50% - more than a guess, some level of supporting evidence
- 51–95% - reasonably certain, information suggests this range
- 95–100% - high level of certainty, information indicates quantity within this range
- 99–100% - very high level of certainty, data are accurate within this range

SECTION C ARE YOU AWARE OF TRENDS IN THE OVERALL POPULATION OF THE SPECIES? (If no, skip to section D)

Evidence of total population size change

4. Are you able to comment on the extent of decline in the species/subspecies' total population size over the last approximately 10 years? Please provide justification for your response.

If, because of uncertainty, you are unable to provide an estimate of decline, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of decline, and also choose the level of confidence you have in this estimated range.

Decline estimated to be in the range of:

1–30% 31–50% 51–80% 81–100% 90–100%

Level of your confidence in this estimated decline:

- 0–30% - low level of certainty/ a bit of a guess/ not much information to go on
- 31–50% - more than a guess, some level of supporting evidence
- 51–95% - reasonably certain, suggests this range of decline
- 95–100% - high level of certainty, information indicates a decline within this range
- 99–100% - very high level of certainty, data are accurate within this range

SECTION D ARE YOU AWARE OF INFORMATION ON THE TOTAL RANGE OF THE SPECIES? (If no, skip to section E)

Current Distribution/range/extent of occurrence, area of occupancy

5. Has the survey effort for this species/subspecies been adequate to determine its national distribution? If not, please provide justification for your response.
6. Is the distribution described in the assessment accurate? If not, please provide justification for your response and provide alternate information.
7. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the extent of occurrence and/or area of occupancy?

If, because of uncertainty, you are unable to provide an estimate of extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of extent of occurrence, and also choose the level of confidence you have in this estimated range.

Current extent of occurrence is estimated to be in the range of:

<100 km² 100 – 5 000 km² 5 001 – 20 000 km² >20 000 km²

Level of your confidence in this estimated extent of occurrence

- 0–30% - low level of certainty/ a bit of a guess/ not much data to go on
- 31–50% - more than a guess, some level of supporting evidence
- 51–95% - reasonably certain, data suggests this range of decline
- 95–100% - high level of certainty, data indicates a decline within this range
- 99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of area of occupancy, and also choose the level of confidence you have in this estimated range.

Current area of occupancy is estimated to be in the range of:

- <10 km² 11 – 500 km² 501 – 2000 km² >2000 km²

Level of your confidence in this estimated extent of occurrence:

- 0–30% - low level of certainty/ a bit of a guess/ not much data to go on
- 31–50% - more than a guess, some level of supporting evidence
- 51–95% - reasonably certain, data suggests this range of decline
- 95–100% - high level of certainty, data indicates a decline within this range
- 99–100% - very high level of certainty, data is accurate within this range

PART 2 – INFORMATION FOR CONSERVATION ADVICE ON THREATS AND CONSERVATION ACTIONS

SECTION E DO YOU HAVE INFORMATION ON THREATS TO THE SURVIVAL OF THE SPECIES? (If no, skip to section G)

8. Do you consider that all major threats have been identified and described adequately?
9. To what degree are the identified threats likely to impact on the species/subspecies in the future?

SECTION F DO YOU HAVE INFORMATION ON CURRENT OR FUTURE MANAGEMENT FOR THE RECOVERY OF THE SPECIES? (If no, skip to section H)

10. Can you recommend any additional or alternative specific threat abatement or conservation actions that would aid the protection and recovery of the species/subspecies?
11. Would you recommend translocation (outside of the species' historic range) as a viable option as a conservation action for this species/subspecies?

SECTION G DO YOU HAVE ANY INFORMATION ON STAKEHOLDERS INVOLVED IN THE RECOVERY OF THE SPECIES?

12. What individuals or organisations are currently, or potentially could be, involved in management and recovery of the species/subspecies?

References cited in the advice

- Department of the Environment and Energy (DEE) (2017) Area of Occupancy and Extent of Occurrence for *Notomys aquilo*. Unpublished report, Australian Government Department of the Environment, Canberra.
- Dickman C (2012) Northern hopping-mouse *Notomys aquilo*, in L. K. Curtis, A. J. Dennis, K. R. McDonald, P. M. Kyne & S. J. S. Debus (eds), *Queensland's threatened animals*. CSIRO Publishing. Collingwood. pp. 400-401
- Diete RL, Meek PD, Dickman CR & Leung LK (2016) Ecology and conservation of the northern hopping-mouse (*Notomys aquilo*). *Australian Journal of Zoology* 64, 21–32.
- Dixon J M & Huxley L (1985) Donald Thomson's mammals and fishes of northern Australia. Nelson. Melbourne.
- IUCN (2014) Guidelines for using the IUCN Red List Categories and Criteria. Version 11. Prepared by the Standards and Petitions Subcommittee. IUCN. Gland.
- Johnson D H (1964) Mammals of the Arnhem Land expedition, in R. L. Specht (ed), Records of the American Australian scientific expedition to Arnhem Land. Volume 4. Zoology. Melbourne University Press. Melbourne pp. 427–516
- Legge S, Kennedy MS, Lloyd R, Murphy SA & Fisher A (2010) Rapid recovery of mammal fauna in the central Kimberley, northern Australia, following the removal of introduced herbivores. *Austral Ecology* 36, 791–799.
- Letnic M (2003) The effects of experimental patch burning and rainfall on small mammals in the Simpson Desert, Queensland. *Wildlife Research* 30, 547–563.
- Letnic M and Dickman CR (2005) The responses of small mammals to patches regenerating after fire and rainfall in the Simpson Desert, central Australia. *Austral Ecology* 30, 24–39.
- McKenzie N L & Burbidge A A (2002) *Australian mammal audit*. Report to National Land and Water Resources Biodiversity Audit. WA Department of Conservation and Land Management, Perth.
- Pardon LG, Brook BW, Griffiths AD & Braithwaite RW (2003) Determinants of survival for the northern brown bandicoot under a landscape-scale fire experiment. *Journal of Animal Ecology* 72, 106–115.
- Pastro LA, Dickman CR & Letnic M (2011) Burning for biodiversity or burning biodiversity? Prescribed burn vs. wildfire impacts on plants, lizards, and mammals. *Ecological Applications* 21, 3238–3253.
- Watson M & Woinarski J (2003) Vertebrate monitoring and resampling in Kakadu National Park, 2002. Report to Parks Australia North. Parks and Wildlife Commission of the Northern Territory. Darwin.
- Watts CHS & Aslin HJ (1981) The rodents of Australia. Angus & Robertson. Melbourne.
- Woinarski JCZ (2004) National Multi-species Recovery Plan for the Carpentarian Antechinus *Pseudantechinus mimulus*, Butler's Dunnart *Sminthopsis butleri* and Northern Hopping-mouse *Notomys aquilo*, 2004 - 2009. Northern Territory Department of Infrastructure Planning and Environment. Darwin.

Woinarski JCZ, Burbidge AA & Harrison PL (2014) *The Action Plan for Australian Mammals 2012*. Collingwood, Australia: CSIRO Publishing.

Woinarski JCZ & Flannery TF (2008) Northern Hopping-mouse *Notomys aquilo*, in S. Van Dyck and R. Strahan (eds) *The mammals of Australia*. Third edition. Reed New Holland. Sydney. pp. 599-600

Woinarski JCZ, Gambold N, Wurst D, Flannery TF, Smith, AP, Chatto R & Fisher A (1999) Distribution and habitat of the Northern Hopping Mouse *Notomys aquilo*. *Wildlife Research* 26, 495–511.

Woinarski, JCZ, Milne DJ & Wanganeen G (2001) Changes in mammal populations in relatively intact landscapes of Kakadu National Park, Northern Territory, Australia. *Austral Ecology* 26, 360–370.

Other sources cited in the advice

Diete R (2016) Unpublished data by email, 22 January 2016, University of Queensland, Gatton.

Woinarski J & Burbidge AA (2016) *Notomys aquilo*. *The IUCN Red List of Threatened Species 2016*.

Available on the Internet at:

<http://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T14862A22401364.en>