



Consultation Document on Listing Eligibility and Conservation Actions

Pseudantechinus mimulus (Carpentarian antechinus)

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

- 1) the eligibility of *Pseudantechinus mimulus* (Carpentarian antechinus) for inclusion on the EPBC Act threatened species list; 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.

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

or by mail to:

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

Responses are required to be submitted by Friday 1 June 2018.

Contents of this information package	Page
General background information about listing threatened species	2
Information about this consultation process	2
Draft information about the species and its eligibility for listing	3
Conservation actions for the species	9
References cited	10
Consultation questions	12

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.

Pseudantechinus mimulus

Carpentarian antechinus

Note: The information contained in this Conservation Advice was primarily sourced from 'The Action Plan for Australian Mammals 2012' (Woinarski et al., 2014). Any substantive additions obtained during the consultation on the draft will be cited within the advice. Readers may note that Conservation Advices resulting from the Action Plan for Australian Mammals show minor differences in formatting relative to other Conservation Advices. These reflect the desire to efficiently prepare a large number of advices by adopting the presentation approach of the Action Plan for Australian Mammals, and do not reflect any difference in the evidence used to develop the recommendation.

Taxonomy

Conventionally accepted as *Pseudantechinus mimulus* (Carpentarian antechinus) (Thomas 1906). No subspecies are recognized.

Species Information

Description

The Carpentarian antechinus is a small marsupial, with a head and body length of 63–91 mm and a tail length of 56–76 mm (Johnson et al., 2008). It is closely related to and superficially similar to other dasyurids that typically occupy rocky areas in northern and central Australia, including the sandstone antechinus (*Pseudantechinus bilarni*), ningbing antechinus (*P. ningbing*), fat-tailed antechinus (*P. macdonnellensis*) and Woolley's antechinus (*P. woolleyae*), but is slightly smaller than these species (Woinarski 2004). All five species have a somewhat flattened head and pointed muzzle, large ears, and are generally brown above and pale below. The Carpentarian antechinus has a patch of reddish fur around the ears, and probably feeds on a variety of invertebrates and small vertebrates (Woinarski 2004). *Pseudantechinus* species can store fat in their tail, and the tail becomes carrot-shaped when food is plentiful (Woinarski 2004).

Distribution

The Carpentarian antechinus is restricted to sandstone formations on some islands in the Gulf of Carpentaria (Vanderlin, North, Centre and South-west in the Sir Edward Pellew group) (Woinarski et al., 2011). It is also found on some ranges in the Gulf hinterland, comprising: Craven's Peak; Mt Isa, extending as far east as the Selwyn Ranges; and, at Pungalina – Seven Emu and Wologorang Stations (Sanders & Slater 2004; Baker & Griffiths 2005; Kanowski et al., 2010, 2011; Woolley 2011; Moran & Kanowski 2012; Lloyd et al., 2013; EcOz 2016; Umbrello et al., 2017; DENR unpublished data). The type locality (Alexandria Station, on the Barkly Tablelands) appears atypical, and the species has not been recorded at that site since; the original specimen is likely to have been collected from the Mittiebah Ranges to the north-east of Alexandria (Woolley 2011). It has not been recorded in rocky areas to the north of Mt Isa (i.e. the Lawn Hill [Boodjamullah] area) despite considerable sampling (White & Mason 2011). However, the species has been found among rocky, spinifex habitat and around the slopes or bases of sandstone ranges, as well as high rocky hills, in the proximity of Mt Isa itself (Woolley 2011; Burnett et al. 2014; EcOz 2016).

In the (largely unresolved) mainland portion of its range in the Northern Territory, it overlaps at a broad scale with the sandstone antechinus (Fisher et al., 2000). However, detailed survey work on Australian Wildlife Conservancy's Pungalina – Seven Emu Wildlife Sanctuary has detected this species only in the low rocky hills between Pungalina Creek and the Calvert River; elsewhere in and around that property only the sandstone antechinus has been reported in similar habitat, suggesting that these species are allopatric at a localised scale (Kanowski & Legge 2012). Similarly, surveys conducted in the Selwyn Range in north-west Queensland

found that the species was confined to rocky habitats (Burnett et al., 2014). Camera traps detected the species recently (2017) at two new locations on Wollogorang Station during a survey of sandstone gorge habitat targeting Carpentarian Rock-rats (*Zyomys palatalis*) (DENR unpublished data).

Relevant Biology/Ecology

The Carpentarian antechinus is a nocturnal, generalist predator of invertebrates and small vertebrates. It occurs across a range of rugged rocky areas, mostly associated with sandstone, but some recent records have been in limestone formations (Lloyd et al., 2013). The species has been recorded from a range of vegetation types, but always at rocky sites (Johnson & Kerle 1991; Woolley 2011; Ward 2012). Surveys in the Selwyn Range found massive rock features, including boulders, outcrops, rubble and scarp to be key predictors of antechinus presence, while the likelihood of the species occurring at a given site was significantly greater at sites featuring low woodland to open forest of lancewood (*Acacia shirleyi*) (Burnett et al., 2014).

The limited relevant records suggest that breeding is seasonal, with young born in August and September (Woolley 2011). Generation length is taken here as 1-2 years, based on longevity in the wild of at least 2 years for the similar sandstone antechinus (Begg 1981).

Threats

Given the lack of specific information, some assessment of threats likely to be affecting this species may be inferred from evidence of a more general decline in native mammal assemblages across much of northern Australia (Woinarski et al., 2001; McKenzie & Burbidge, 2002; Pardon et al., 2003; Watson & Woinarski, 2003). The Carpentarian antechinus is likely subject to at least some of the pervasive threatening processes of vegetation change through altered fire regimes, and predation by feral cats (Woinarski 2004).

Threat factor	Consequence rating	extent over which threat may operate	evidence base
Inappropriate fire regimes	Severe	Large (fire impacts may be reduced in rugged areas)	Not demonstrated, but plausible. The impacts of severe fires have been demonstrated for the similar sandstone antechinus (Begg et al., 1981). However, in the Selwyn Ranges, the species was detected at seven of 18 sites that had been burnt within the preceding two years (Burnett et al., 2014)
Predation by feral cats	Moderate	Large (cat impacts may be reduced in rugged areas)	Not demonstrated, but plausible. There is also a potential interaction between cat predation and fire as in the Kimberley it has been shown that cats hunt more efficiently in recently burnt areas.
Habitat change associated with invasive weeds	Moderate	Moderate	Noted as a threat (mostly through driving increased fire impacts) for parts of the range (White & Mason 2011; Lloyd et al., 2013), particularly for buffel grass (<i>Cenchrus ciliaris</i>)
Poisoning by cane toads <i>Rhinella marina</i>	Moderate	Moderate	Not demonstrated, but plausible. However, many records post-date toad invasion

Habitat loss from mining	Moderate	Minor	'Heap leach' mining is under consideration in an area known to harbour antechinus (RBC 2016)
Pollution (lead and other deposits)	Minor	Minor	Reasonable correlative evidence from structured sampling across a pollution gradient around Mt Isa (Baker & Griffiths 2005)

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.		
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 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.		
		(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	
		<i>based on any of the following</i>	

Evidence:

On the Sir Edward Pellew islands, the Carpentarian antechinus has been sampled through repeat (if irregular) surveys (Woinarski et al., 2011). In contrast to most other native mammal species on the islands, monitoring hasn't demonstrated any pronounced population trend, except for a possible decline on North Island, and results suggest the species may persist with feral cats (Woinarski et al., 2011). The occurrence of the species is being monitored at known localities in Pungalina – Seven Emu Wildlife Sanctuary, with a sampling frequency of three years (Kanowski & Legge, 2012), however trends are not yet available. There are also recent records of the species in the vicinity of Mt Isa (Woolley 2011), again trends are not available. Woinarski et al. (2014) inferred that the rate of decline was less than ten percent in ten years, however they were unable to provide direct evidence of this and considered their estimate to be of low-medium reliability.

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 change 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:

Extent of occurrence is estimated to be 41 092 km², and area of occupancy is estimated to be 128 km². These figures are based on the mapping of point records from 1997 to 2017, obtained from state governments, museums and CSIRO. 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 (DotEE 2017). These calculations differ from Woinarski et al. (2014) which estimated EOO at 26 764 km² and AOO at 72 km², however AOO was considered a significant underestimate due to the small number of records and limited sampling across the species' range. For example, the total area of islands occupied by this species in the Sir Edward Pellew group is 492 km², most of which is suitable habitat. Recent records from the Northern Territory mainland (Woolley 2011) and from north-western Queensland suggest that the mainland AOO is probably greater than 2000 km² (Woinarski et al., 2014). Nevertheless, this assessment uses the first figures presented above, which were calculated by the Department of the Environment and Energy based on the most recent dataset available.

The *Action Plan for Australian Mammals 2012*, estimated that the species occurs at fewer than ten locations (Woinarski et al., 2014). According to IUCN guidelines "The term 'location' defines a geographically or ecological distinct area in which a single threatening event can rapidly affect all individuals of the taxon present" (IUCN 2012). Woinarski et al. (2014) state in the *Action Plan for Australian Mammals 2012* that their assessments adhere to the IUCN definition of a 'location'. In the Northern Territory, the species is currently recognised as occurring on four islands and at least two mainland locations (DENR 2012), with Wollogorang Station potentially representing an additional location. Recent records from Queensland, centred around Mt Isa and Cravens Peak, suggest the species occurs at two locations in that State. Inappropriate fire regimes are recognised as the most significant potential threat to the Carpentarian antechinus and have the potential to operate over a large extent (Woinarski et al., 2014). The area of occupancy of the Carpentarian antechinus may be limited and it may occur at <10 locations. Woinarski et al. (2014) inferred that the rate of decline (at the time of their assessment around 2012) was less than ten percent in ten years, however they were unable to provide direct evidence and considered their estimate to be of low-medium reliability.

The data presented above appear to be insufficient to assess the eligibility of this species 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 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:

There is no information available about population size of the Carpentarian antechinus, other than some accounts of trap success rate (typically less than 1% on the Pellew Islands: Woinarski et al., 2011). Trap success is similarly low at Pungalina – Seven Emu; however, the species appears to be more readily detected by camera trap surveys than standard live-trapping (Kanowski pers. comm., cited in Woinarski et al., 2014).

Woinarski et al. (2014) inferred there was likely to be >10 000 mature individuals, providing a low reliability estimate of 20 000 mature individuals, however they noted there was no reliable estimate of population size available. At the time, the species was inferred to be undergoing a low rate of decline (<10% in 10 years), however there was more than one subpopulation and the number of mature individuals in the largest subpopulation was inferred to be >1000 (Woinarski et al., 2014). There is also a lack of trend data to indicate whether there have been any extreme fluctuations in population size.

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 4. Number of mature individuals			
	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
Number of mature individuals	< 50	< 250	< 1,000
D21 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 km ² 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 that demonstrate eligibility for listing under other criteria may include information relevant to D2. This information will not be considered by the Committee in making its assessment 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](#).

Evidence:

There is inadequate information available about population size (see Criterion 3), however, Woinarski et al. (2014) inferred there was likely to be >10 000 mature individuals

The Carpentarian antechinus exceeds the thresholds for listing under IUCN Criterion D2 as its AOO is >20km² and the number of locations is >5.

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 not to have been undertaken, and there are insufficient data to demonstrate if the species is 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.

Consideration for delisting

Under s186 of the EPBC Act (Amending list of threatened native species), the Commonwealth Minister for the Environment must take certain matters into consideration before deleting native species from a category, as follows:

- (2A) The Minister must not delete (whether as a result of a transfer or otherwise) a native species from a particular category unless satisfied that:
 - (a) the native species is no longer eligible to be included in that category; or
 - (b) the inclusion of the native species in that category is not contributing, or will not contribute, to the survival of the native species.
- (2B) In deciding whether to delete a native species from a particular category (whether as a result of a transfer or otherwise), the only matters the Minister may consider are matters relating to:
 - (a) whether the native species is eligible to be included in that category; or
 - (b) the effect that the inclusion of the native species in that category is having, or could have, on the survival of the native species.

The Carpentarian antechinus is currently listed as Vulnerable under the EPBC Act. The assessment presented in this Consultation Document suggests the species may not meet any of the current EPBC listing criteria. However, the species may be considered as data deficient as there is uncertainty around several aspects of several criteria, with a lack of data available to determine the species population size and a reliable estimate of population trends. Assessing the species against the listing criteria is further complicated as it is unknown whether the species is rare or whether it may be more common but difficult to detect. There is also no robust estimate of area of occupancy, due to the small number of records and limited sampling in suitable habitat. It is possible that the species may meet Criterion 2 under B2(a)(b)(v). Given the uncertainty in the assessment, there appears to be insufficient evidence to demonstrate that the Carpentarian antechinus is ineligible for listing as Vulnerable under the EPBC Act.

Furthermore, it is not clear whether or not inclusion of the Carpentarian antechinus in the Vulnerable category is contributing to the survival of the species. The EPBC Act requires project proponents to refer a proposal for assessment if it may have a significant impact on a threatened species. Thus any proposals within the distribution of Carpentarian antechinus currently need to consider, and if necessary mitigate, any potentially significant impacts to the species. Where necessary, the Department can issue conditions requiring proponents to avoid, minimise or mitigate impacts on listed species. Therefore, inclusion of the Carpentarian antechinus on the list of threatened species, could potentially have an impact on the survival of the species.

Conservation Actions

Recovery Plan

There is no recovery plan currently in place for this species. The 'National multi-species recovery plan for the Carpentarian Antechinus *Pseudantechinus mimulus*, Butler's Dunnart *Sminthopsis butleri* and Northern Hopping-mouse *Notomys aquilo*' ceased to be in effect from 1/10/2015. The primary objective of the recovery plan was to "recover each species in their habitats through management solutions informed by targeted surveys and studies". A review of the plan concluded that this objective was only partially met due to a systemic lack of funding and low accessibility to the habitat areas.

A decision about whether there should be a new 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

1. Reduce the frequency, intensity and extent of fires within the species' range.
2. Undertake long-term monitoring and targeted surveys to determine the species' distribution, population size and trends.
3. Undertake research to identify the impacts of threatening processes on the species.

Conservation and Management Priorities

There has been no specific management directed towards the conservation of this species. However, North Island is managed as a conservation reserve (Barranyi National Park) and the species currently-known Northern Territory mainland range (Pungalina – Seven Emu) is managed for conservation by the Australian Wildlife Conservancy. In these areas, management seeks to reduce fire frequency and intensity.

Recommended management actions are outlined in the table below (Woinarski 2004; Woinarski et al., 2014).

Theme	Specific actions	Priority
Active mitigation of threats	Implement fire management that reduces the frequency, intensity and extent of fires	Medium-high
	Implement cost-effective control measures for feral cats that minimise impacts of predation	Medium
	Reduce impacts of invasive weeds (particularly buffel grass)	Medium
Community engagement	Develop conservation covenants on lands with high value for this species	Medium-High
	Involve Indigenous ranger groups in survey, monitoring and management	Medium-High

Survey and Monitoring priorities

Theme	Specific actions	Priority
Survey to better define distribution	Undertake a targeted survey of all suitable habitat within the species' range using high detection methods, such as camera trapping during May-July	Medium-High
	Assess population size (or relative abundance) of all subpopulations, and then prioritise subpopulations for management investment	Medium
Establish or enhance monitoring program	Establish an integrated monitoring program to describe long-term trends in abundance, and responses to management actions (based upon the optimal field survey techniques outlined in Burnett et al., 2014)	Medium-High
	Assess the effectiveness of management actions, and adapt/refine accordingly	Medium-High

Information and Research priorities

Theme	Specific actions	Priority
Assess relative impacts of threats	Undertake detailed autecological study to more specifically identify impacts of threatening processes	Medium-High
	Assess impacts of a range of possible fire regimes	Medium-High
	Assess incidence, impacts and distributional trends for invasive weeds (particularly buffel grass)	Medium-High
	Assess abundance and impacts of feral predators, and potential correlations with fire history	Medium
Assess relative effectiveness of threat mitigation options	Assess efficacy of a range of management regimes for non-native predators	Medium
	Assess effectiveness of fire management practices	Medium
	Assess effectiveness of a range of management options to reduce extent and cover of weeds	Medium
Resolve taxonomic uncertainties	Assess extent of genetic variation and exchange between subpopulations	Low
Assess habitat requirements	Identify critical habitat factors	Low-Medium
Assess diet, life history	Identify key dietary items, and their responses to habitat change, fire regimes and management actions	Low-Medium
Undertake research to develop new or enhance existing management mechanisms	Develop methods of broad-scale, targeted feral cat control	Medium

References cited in the advice

- Baker, B. A., and Griffiths, A. D. (2005). Changes in savanna biodiversity at Mount Isa following a reduction in sulphur dioxide emissions. Final report to Xstrata, Mount Isa. CSIRO, Darwin.
- Begg, R. J. (1981). The small mammals of Little Nourlangie Rock, N.T. II. Ecology of *Antechinus bilarni*, the Sandstone Antechinus (Marsupialia: Dasyuridae). *Australian Wildlife Research* 8, 57-72.
- Begg, R. J., Martin, K. C., and Price, N. F. (1981). The small mammals of Little Nourlangie Rock, N.T. V. The effects of fire. *Australian Wildlife Research* 8, 515-527.
- Burnett, S., McDonald, K., and Nugent, D. (2014). *Optimising field surveys and exploring habitat associations of the carpentarian false antechinus, Pseudantechinus mimulus in the Selwyn Range, north-western Queensland*. University of the Sunshine Coast, Sippy Downs. Available on the internet at: <http://www.chinovaresources.com/images/pdf/Burnet%20et%20al%20Pseudantechinus%20mimulus%20Report%202014.pdf>.

- Department of the Environment and Natural Resources (DENR) (2012). *Threatened Species of the Northern Territory – Carpentarian antechinus Pseudantechinus mimulus*. Department of the Environment and Natural Resources, Darwin.
- EcOz Environmental Consultants (2016). Threatened Species Surveys. In Jemena (Eds.), *Jemena Northern Gas Pipeline Pty Ltd – Draft Environmental Impact Statement* (pp.38-142). Report to the Northern Territory Environment Protection Authority. Available on the Internet at: <https://ntepa.nt.gov.au/environmental-assessments/register/jemena/draft-eis>.
- Fisher, A., Woinarski, J. C. Z., Churchill, S., Trainor, C., Griffiths, A. D., Palmer, C., and Cooper, N. (2000). Distribution of the rock-dwelling dasyurids *Pseudantechinus bilarni* and *Pseudantechinus ningbing* in the Northern Territory. *Northern Territory Naturalist* 16, 1-13.
- Johnson, K. A., and Kerle, J. A. (Eds) (1991). *Flora and vertebrate fauna of the Sir Edward Pellew group of Islands, Northern Territory*. Report to the Australian Heritage Commission. Conservation Commission of the Northern Territory, Alice Springs.
- Johnson, K.A., Woinarski, J. C. Z., and Langford, D.G. (2008). Carpentarian *Pseudantechinus mimulus*. In *The mammals of Australia*. Third edition. (Eds S. Van Dyck and R. Strahan), pp. 71-72. Reed New Holland, Sydney.
- Kanowski, J., and Legge, S. (2012). A plan for measuring the ecological health of Pungalina-Seven Emu Wildlife Sanctuary. Australian Wildlife Conservancy, Perth.
- Kanowski, J., Mulder, E., Jensen, R., Lloyd, R., Murphy, S. A., and Legge, S. (2010). Pungalina-Seven Emu wildlife sanctuary: 2010 survey. Australian Wildlife Conservancy, Perth.
- Kanowski, J., Mulder, E., and Jensen, R. (2011). Pungalina-Seven Emu wildlife sanctuary: 2011 survey report. Australian Wildlife Conservancy, Perth.
- Lloyd, P., Sanders, M., Reis, T., and Abbott, A. (2013). Targeted trapping surveys shed new light on the distribution and habitat characteristics of the Carpentarian *Pseudantechinus (Pseudantechinus mimulus)*, a threatened dasyurid marsupial. *Australian Mammalogy* 35, 220-223.
- McKenzie, N. L., and Burbidge, A. A. (2002). *Australian mammal audit*. Report to National Land and Water Resources Biodiversity Audit. WA Department of Conservation and Land Management, Perth.
- Moran, C., and Kanowski, J. (2012). Pungalina-Seven Emu wildlife sanctuary: report on joint ecological survey by AWC and Garawa Rangers, 2012. Australian Wildlife Conservancy, Perth.
- Pardon, L. G., Brook, B. W., Griffiths, A. D., and Braithwaite, R. W. (2003). Determinants of survival for the northern brown bandicoot under a landscape-scale fire experiment. *Journal of Animal Ecology* 72, 106-115.
- RBC Environmental (2016). *Mt Dore Heap Leach Project Pseudantechinus mimulus Camera Trapping Report*. Report to Chinova Resources, Cloncurry. Available on the internet at: <http://www.chinovaresources.com/images/pdf/RBC%20Environmental%20Pseudantechinus%20mimulus%20Report%202016.pdf>.

- Sanders, M. G., and Slater, L. (2004). New distribution and habitat data for the Carpentarian false antechinus (*Pseudantechinus mimulus*). *Memoirs of the Queensland Museum* 49, 740.
- Umbrello, L. S., Wooley, P. A., and Westerman, M. (2017). Species relationships in the dasyurid marsupial genus *Pseudantechinus* (Marsupialia: Dasyuridae): a re-examination of the taxonomic status of *Pseudantechinus roryi*. *Australian Journal of Zoology* 65, 240-247.
- Ward, S. (2012). Carpentarian pseudantechinus *Pseudantechinus mimulus*. In *Queensland's threatened animals* (Eds L. K. Curtis, A. J. Dennis, K. R. McDonald, P. M. Kyne and S. J. S. Debus), pp. 346-347. CSIRO, Canberra.
- Watson, M., and 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.
- White, A. W., and Mason, D. R. (2011). The modern mammal fauna of Riversleigh and Boodjamullah National Park. *Australian Zoologist* 35, 599-618.
- Woinarski, J.C.Z. (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, J. C. Z., Burbidge, A. A., & Harrison, P. L. (2014). *The action plan for Australian mammals 2012*. Collingwood, Australia: CSIRO Publishing.
- Woinarski, J. C. Z., Milne, D. J., and Wanganeen, G. (2001). Changes in mammal populations in relatively intact landscapes of *Kakadu National Park, Northern Territory, Australia*. *Austral Ecology* 26, 360-370.
- Woinarski, J. C. Z., Ward, S., Mahney, T., Bradley, J., Brennan, K., Ziembecki, M., and Fisher, A. (2011). The mammal fauna of the Sir Edward Pellew Islands, Northern Territory: refuge and death-trap. *Wildlife Research* 38, 307-322.
- Woolley, P. A. (2011). *Pseudantechinus mimulus*: a little known dasyurid marsupial. *Australian Mammalogy* 33, 57-67.

Other sources cited in the advice

- Department of Environment and Natural Resources (DENR) (2018). Unpublished data provided by email, 2 February 2018. Northern Territory Department of Environment and Natural Resources.

Consultation questions

PART 1 – INFORMATION TO AID LISTING ASSESSMENT

1. Do you have any additional information in the **ecology or biology** of the species?
2. Can you provide any additional information or estimates on **longevity, average life span or generation length** for the species?
3. Do you have additional information to support an **estimate of the current population size** of mature adults of the species (national extent)?
4. Do you have additional information on **population trends** over 3 generations, or an historic population size for the species (national extent)?
5. Do you have additional information on **current range** (national extent) or **location of populations** for the species?
6. Can you provide additional information on any **change in range** or **location of populations**, or an **historic range** (national extent)?

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

7. Do you further information on the historic, current or potential **threats** facing the species?
8. Do you have further information on current or potential **management actions** to support protection and recovery of the species?
9. Do you have further information on current or potential **monitoring** or **research activities** for the species?
10. Are you aware of **other knowledge** (e.g. traditional ecological knowledge) that may help better understand the threats and management actions to aid recovery of the species?
11. Are you aware of any **cultural importance or use** that the species has?
12. What **individuals or organisations** are currently, or potentially could be, involved in management and recovery of the species?

PART 3 – ANY OTHER INFORMATION

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