The Minister approved this conservation advice and transferred this species from the Endangered to Critically Endangered category, effective from 15/02/2018

Conservation Advice

Zyzomys pedunculatus

central rock-rat

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 has been 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 *Zyzomys pedunculatus* (Waite 1896). No subspecies are recognised.

Summary of assessment

Conservation status

Critically Endangered: Criterion 1 A2

The highest category for which *Zyzomys pedunculatus* is eligible to be listed is Critically Endangered.

Zyzomys pedunculatus has been found to be eligible for listing under the following categories:
Criterion 1: A2: Critically Endangered
Criterion 2: B1 B2 (a),(b)(v),(c)(iv): Endangered
Criterion 3: C2(b): Endangered
Criterion 4: Vulnerable

Species can be listed as threatened under state and territory legislation. For information on the listing status of this species under relevant state or territory legislation, see http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

Reason for conservation assessment by the Threatened Species Scientific Committee

This advice follows assessment of new information provided to the Committee to change the listing status of *Zyzomys pedunculatus.*

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 32 business days between 30 January 2017 and 15 March 2017. Any comments received that were relevant to the survival of the species were considered by the Committee as part of the assessment process.

Species/subspecies information

Description

The central rock-rat is a nocturnal, terrestrial rodent with large ears, prominent eyes and a stout build (Watts & Aslin 1981). The weight is 70−150 g and the body grows to 14 cm long (Nano 2008). It has long, yellow-brown fur on the upperside of the body and has cream to white fur on the underside (Watts & Aslin 1981). The tail is slightly longer than the head and body, is densely furred and fattened at its base (Watts & Aslin 1981), with a distinctive tuft at the tip (Nano 2008).

Distribution

The central rock-rat formerly occurred in Western Australia and the Northern Territory, but is now only found in the Northern Territory. Its current distribution is restricted to the West MacDonnell Ranges and Haast's Bluff, west of Alice Springs in central Australia. Its historic distribution was substantially larger, with specimens recorded more extensively across rocky range country of central Australia, including The Granites (Tanami Desert), Davenport Range, Alice Springs and the Napperby Hills (Wurst 1990). Fossil and subfossil records extend this historic (or pre-European settlement) range even further across inland Western Australia to the coast at Cape Range, where the deposits are common (Baynes & Jones 1993; Burbidge 1996; Morris 2000).

In the early 1990s the central rock-rat was thought to be extinct (Wurst 1990; Gibson & Cole 1996), as it had not been recorded since 1960 despite targeted searches (Wurst 1990, 1995). However, from 1996 to 2002 the species was recorded from over 20 sites along a 60 km span of the West MacDonnell Ranges (Nano 2008). Between 2002 and 2006 the species was not recorded at any of these sites (Edwards 2013a).

Between 2009 and 2012, intensive sampling in the West MacDonnell Ranges, including locations where rock-rats had been caught during 1996−2002, recorded individuals at two new locations (at or around the summits of Mt Sonder and Mt Giles, with summit elevations of 1380 m and 1389 m respectively) (McDonald et al., 2013). Extensive camera trapping in 2014 only located the species at two locations in the West MacDonnell Ranges: a northern area near Mt Giles and a southern area at Counts Point (1117 m) (McDonald et al., 2015b). Since 2012 the species has not been detected at Mt Sonder and appears to have been extirpated from that location (McDonald et al., 2017a). In 2013 an isolated subpopulation was located near Mt Edward, an outlying quartzite range on Haast's Bluff about 50 km west of the West MacDonnell Ranges (McDonald et al., 2015a).

At the time this Conservation Advice was written, the species is only known to occur on higher-elevation ridgetops of the western Chewings Range (which includes Mt Giles) and Heavitree Range (which includes Counts Point) in Tjoritja (West MacDonnell) National Park, and west of Mt Edward on Haast's Bluff Aboriginal Land Trust (ALT) (McDonald et al., 2017a). Given the substantial survey effort at lower elevations and on other geologies (McDonald et al. 2013), higher elevation (>950 m) quartzite ridgetops appear to provide core refuge habitat for the species during contracted phases of the population cycle (McDonald et al., 2017a).

Relevant biology/ecology

The central rock-rat is a nocturnal terrestrial rodent. It can undergo large population fluctuations, with marked increases occurring in response to rainfall-driven resource pulses, and contractions to refuge areas during more typical dry periods (Edwards 2013a; McDonald et al., 2015a). However, population increases have not been observed after some large rainfall events.

Its diet comprises mainly seeds, but also includes some leaf and plant stem material and a low proportion of invertebrates (Nano et al., 2003; Edwards 2013b). In drier conditions, the proportion of seed in the diet declines and that of plant stem material increases (Edwards 2013a). Plants contributing most seed to the diet during an irruption phase include *Sida* spp. (sida), *Solanum* spp. (solanum), and *Triodia brizoides* (weeping spinifex); and most plant species reported in the irruption-phase diet are common, widespread and fire-tolerant (Edwards

2013a). From a limited data-set (from four individual rock-rats) collected in a non-irruptive phase (Jefferys 2011), seed and leaf material recorded in the diet was from a mix of heath-like species characteristic of the quartzite mountains, e.g. *Leucopogon sonderensis* (Mt Sonder beard-heath)*, Hibbertia glaberrima* (desert buttercup), and spinifex-community vegetation, e.g. *Exocarpus sparteus* (broom ballart), and *Pelatostylis cassioides* (butterfly bush).

The contemporary core refuge habitat of the species is quartzite mountains and ridge tops characterised by shallow gravelly soils and exposed rock outcrop, frequently with abundant rock-crevices (McDonald et al., 2017a). Vegetation has a mallee-heath-like form, with a ground layer of spinifex grasses (typically weeping spinifex or *T. spicata* (spike-flowered spinifex)) and a mixture of forbs and subshrubs (e.g. *Goodenia ramelii* (goodenia), *Ptilotus sessilifolius* (crimson foxtail)). The shrub layer is variable, but common species include *Gastrolobium brevipes* (hill wallflower poison)*, Mirbelia viminalis* (yellow broom) and desert buttercup (McDonald et al., 2015b,c). Species usually present in the sparse canopy include the tall shrubs *Acacia macdonnellensis* (hill mulga) and *Hakea grammatophylla* (hakea), and the mallee species *Corymbia eremaea* (mallee bloodwood)*, Eucalyptus gillenii* (mallee red gum) and *Eucalyptus minniritchi* (round-leaved mallee) (McDonald et al., 2015b,c).

Historically, and during the last major population irruption in 2000−2002, they were found in a much wider range of rocky landforms and vegetation types. These included scree slopes, hills and valley floors on granite, limestone, quartzite and sandstone supporting a range of vegetation types, including tussock and hummock grasslands, low shrublands and low open woodlands (Nano 2008, Wurst 1995). In core refuge habitat, the central rock-rat favours areas with recent fire history (less than 10 years since last fire), probably because of the increased abundance of important food plants, particularly sub-shrubs (McDonald et al., 2017a). These food plants are generally less abundant in later-succession vegetation as spinifex grasses increasingly dominate the groundcover. While spinifex seed provides important food at times (Edwards 2013b), spinifex mast-seeding events are infrequent and generally require periods of prolonged high rainfall over spinifex of sufficient maturity since the last fire (Wright et al., 2014).

After the last known population irruption (2000−2002), the central rock-rat disappeared from all monitoring sites at the onset of drought conditions and widespread wildfires (Edwards 2013a). However, most of the monitoring sites did not burn at this time and it was likely that the site extirpations coincided with high densities of feral cats following two years extreme rainfall (Legge et al., 2017). Analysis of cat scats collected from rock-rat refuge habitat revealed a high incidence of predation, with approximately 33 percent of scats containing rock-rat remains. Like other Australian desert rodents, the central rock-rat is likely to be particularly vulnerable to the impacts of feral predators in the period after major resource-pulse events (Letnic et al., 2005). Given the potential for interaction between wildfire and cat predation (McGregor et al., 2014), as well as the short-term removal of food resources, landscape-scale wildfires (e.g. hundreds of square kilometres) are also likely to impact the central rock-rat.

Little is known of reproduction seasonality or success. Captive females have given birth to 1–4 young (Cole 1999). In the wild, juvenile individuals have been reported in March, April, July and November, indicating that in suitable conditions breeding may occur throughout the year (Edwards 2013b). Generation length is assumed to be 1–2 years, based on age at sexual maturity (5–6 months; Begg 1981) and longevity (probably 2–3 years) for congeneric species.

Threats

The main threats to the central rock-rat are extensive fires and predation by feral cats.

Table 1 – Threats impacting the central rock-rat in approximate order of severity of risk, based on available evidence

Threat factor	Threat type and status	Evidence base
Fire		
Extensive, frequent and intense fires	known current	Given the potential for interaction between wildfire and cat predation (McGregor et al., 2014), as well as the short-term removal of food resources, landscape-scale wildfires (e.g. 100s of km^2) are likely to impact the central rock-rat. Conversely, several fire-encouraged plant species have been recorded in the central rock-rat diet (Nano et al., 2003; Edwards 2013b), and fire may therefore play an important role in the availability of foods for this species (McDonald et al., 2017a).
Invasive Species		
Predation by feral cats (*Felis catus*)	known current	Feral cats are a known predator of the central rock-rat (McDonald et al., 2015b; unpublished data). Central rock-rat remains have been recovered from cat scats and there is evidence that cats prefer rock-rats over alternative small mammal prey (McDonald et al unpublished data). Camera trapping data suggest that cats are resident in core refuge habitat (McDonald et al., 2015b). Given that central rock-rat populations are highly localised and likely have low fecundity during non-irruptive periods, they may be highly susceptible to even a single resident cat. This susceptibility may increase in the years following a wildfire event when vegetation groundcover has been eliminated or reduced (McDonald et al., 2017a).
Predation by foxes (*Vulpes vulpes*)	potential	Not demonstrated, but plausible (Woinarksi et al., 2014). Foxes are generally uncommon in the central ranges (G. Edwards pers. comm., cited in Woinarksi et al., 2014) and are absent from core refuge habitat (McDonald et al., 2017b).
Habitat degradation and resource depletion due to feral horses (*Equus ferus caballus*)	potential	Indicated as a threat to preferred food plants (Nano et al., 2003). Feral horses thrive in rugged terrain and potentially threaten the survival of the central rock-rat through habitat modification and competition for food. Horses cause erosion and soil compaction, damage vegetation, and, because they consume mainly grasses and forbs, may have considerable dietary overlap with the central rock-rat. However, horses are regularly managed in the West MacDonnell NP and are currently absent from the majority of the park. They occur at high densities surrounding the Mt Edward population on Haast's Bluff ALT, but there is no evidence that they frequent higher elevation quartzite landforms (McDonald et al., 2017a).

Habitat change due to buffel grass	potential	Not demonstrated, but plausible. The widespread occurrence of buffel grass (*Cenchrus ciliaris*) in the MacDonnell Ranges poses a potential threat to the central rock-rat, as this weed species increases both the frequency and the intensity of fire (Butler & Fairfax 2003; Franks 2002). Buffel grass may also indirectly affect the central rock-rat through competition with preferred food plant species (McDonald et al., 2017a). While buffel grass occurs in comparatively low density in quartzite range habitat, where the majority of rock-rat records occur, the weed and its interaction with fire regimes may prevent the natural spread of the species during irruptive phases of the population cycle, preventing recolonisation and genetic exchange (McDonald et al., 2017a).
Climate change		
Increased temperatures and reduced rainfall	potential (future)	The impact of climate change on Australia's arid zone within the next 20 years is projected to result in increased average temperatures, increased numbers of high temperature days, an increased number and length of heatwaves (Hughes 2003; Bastin 2014), and reduced average rainfall (Hennessy et al., 2004). More frequent and more severe droughts (Hennessy et al., 2004), and fewer but more extreme high rainfall events, are also predicted (e.g. Letnic & Dickman 2010). These changes are likely to lead to longer periods between resource pulses and more periods of extreme fire danger, which may impact the central rock-rat's ability to persist in the MacDonnell Ranges. Irruption phases of the species' population cycle may only occur after multiple years of above-average rainfall (it did not irrupt outside of core refuge habitat during the most recent above-average rainfall period in 2010-11) (McDonald et al., 2017a).
Parasites and disease		
Parasites and disease	potential	*Aspiculuris tetraptera* (roundworms) have been recorded in captive central rock-rat individuals. This species is common in rodents (McDonald et al., 2017a). Post-mortem examination of captive central rock-rats has shown the presence of diseases such as lymphosarcoma, a common neoplasm in rodents, and post-mortem examinations of wild and captive-bred animals have shown individuals to be susceptible to Acute Respiratory Distress Syndrome (ARDS), which has implications for husbandry in the captive breeding of the central rock-rat (McDonald et al., 2017a).

How judged by the Committee 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.

based on any of the following:

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

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

(d) actual or potential levels of exploitation

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

Evidence:

Eligible under Criterion A2(c) for listing as Critically Endangered

Survey data

There are limited data available for the central rock-rat. Nano (2008) considered it to be a 'boom-bust' species, but also "rare, extremely limited". From 1996 (when it was 'rediscovered') to 2002, the species was locally common at some sites in the West MacDonnell Ranges (Woinarski et al., 2014). Edwards (2013a) undertook 17 live trapping sessions across five sampled sites at Ormiston Gorge from 2000 to 2006. During 2001 and 2002, which were very wet years, there were spikes in abundance and trap success rates were around 10 individuals per 100 trap-nights.

The population in this area then crashed, and no individuals were reported at these sites in ten subsequent trapping periods, from 2002 to 2006 (Figure 1). The significant decline in the abundance of the central rock-rat in June 2002 was likely food- and predation-related, as it coincided was a marked decline in the amount of seed availability due to the dry conditions, and occurred during a period when feral cat densities were probably high (Edwards 2013b; Legge et al., 2017). However, whether central rock-rats reliably respond to large rainfall events with marked population increases is not clear.

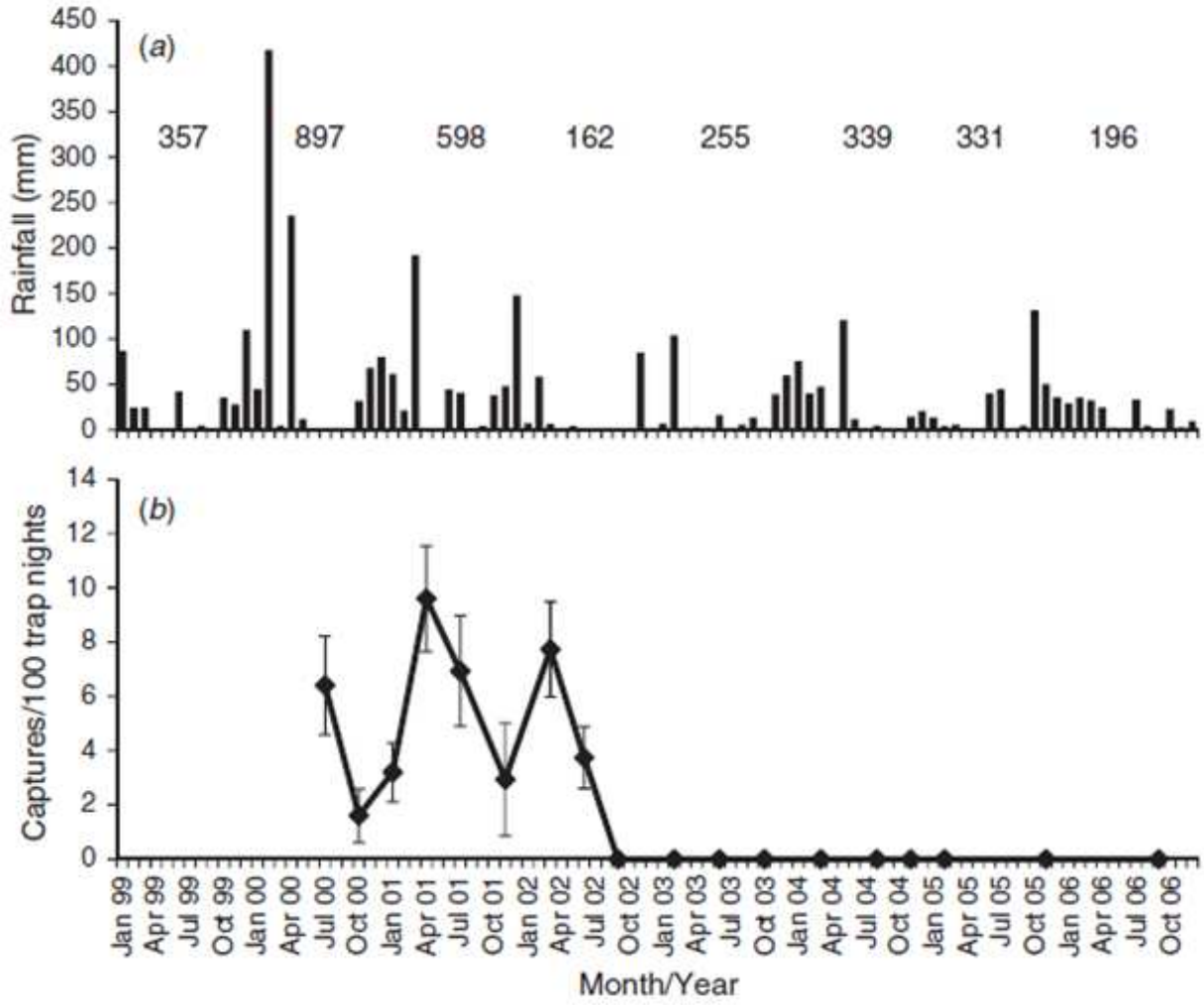

Figure 1. (a) Monthly rainfall at Ormiston Gorge for the period January 1999 to December 2006. The total rainfall for each calendar year is shown above the year; the mean annual rainfall is 321.4 mm.
(b) The number of central rock-rats captured per 100 trap-nights (+/-s.e.). From Edwards (2013a).

Further surveys in the West MacDonnell Ranges indicated that some sites continued to tenuously support small subpopulations (Table 2). Live trapping at targeted locations (sites of previous occurrence and modelled suitable habitat) from 2009 to 12 resulted in captures of only eight individuals (four near the summit of Mt Sonder, four near the summit of Mt Giles) at five 'sites', from 5000 trap-nights at 55 'sites' (detection rate of 0.16 per 100 trap nights) (McDonald et al., 2013). In late 2012 an additional individual was recorded from the Counts Point area, 14 km east of the most recent record, using a camera trap (McDonald et al., 2015a).

In 2013, live trapping around Mt Edward (at Haart's Bluff) resulted in no individuals captured from over 400 trap-nights (McDonald et al., 2015a). However, during the same survey period the species was recorded on seven nights on a single camera trap (three cameras deployed over a total of 276 trap-nights).

In 2014, landscape-scale camera trapping in the West MacDonnell Ranges recorded individuals at five sites at Mt Giles and Counts Point. Based on the results of this survey, an intensive follow-up camera trap survey was undertaken at Counts Point, which found high levels of occupancy (McDonald et al., 2015b).

Table 2 – Locations and dates of surveys for the central rock-rat, since its rediscovery in 1996 (Edwards 2013a; McDonald et al., 2013, 2015a, 2015b; P. McDonald pers. comm., 2017)

Location	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2017
Several locations (WM Ranges)	p	p	p	p										a	a	a	a			
Ormiston Gorge (WM Ranges)					p	p	p	a	a	a	a			a	a	a	a			
Mt Sonder (WM Ranges)														a	p	a	p		a	
Mt Giles (WM Ranges)														a	a	p	p		p	
Counts Point (WM Ranges)																	p		p	
Mt Edward (Haart's Bluff)																		p		p

Shaded areas indicate when surveys were undertaken; p = species present; a = species absent.

Recently in 2017, individuals were detected on camera traps at Mt Edward, confirming the existence of a subpopulation at Haart's Bluff (P. McDonald pers comm., 2017c).

The central rock-rat has not been detected on camera traps at Mt Sonder since it was last captured there in 2012 (McDonald et al., 2015b), and appears to have been extirpated from that location (McDonald et al., 2017a). If this site extirpation occurred in 2012, then it coincides with a post resource-period (2010−11 were wet years) when rodents are theoretically most vulnerable to cat-predation (Letnic et al., 2005).

Population trends

Robust estimates of population size or population trends are not available from the data. However, population trends can be inferred from changes in area of occupancy between time periods with comparable environmental conditions. McDonald (pers. comm., 2017b) determined the change in area of occupancy between the two wet periods 2000−2001 and 2010−2011 using the species distribution modelling software MaxEnt. Assuming a uniform population density, this analysis gave a population decline of at least 81 percent over the 10 year period. This rate of decline maybe be ongoing, given threats to the species are still present.

The Committee considers that the species has undergone a very severe reduction in numbers over a 10 year period, equivalent to at least 81 percent, and the reduction has not ceased, the cause has not ceased and is not understood. Therefore, the species has been demonstrated to have met the relevant elements of Criterion 1 to make it eligible for listing as Critically Endangered.

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

Evidence:

Eligible under Criterion 2 B1 B2 (a),(b)(v),(c)(iv) for listing as Endangered

McDonald et al. (2017a) estimated the extent of occurrence to be approximately 1000 km^2 and the area of occupied habitat (as distinct from area of occupancy *sensu* IUCN) to be less than 5 km^2. These estimates were based on the likely area of suitable habitat and observed occupancy rates. Monitoring data from winter 2016 showed that the occupancy rate was around 13 percent in core refuge mountain habitat in Tjoritja National Park (down from an occupancy rate of about 24 percent in winter 2015), which extrapolates to a total area occupied of 285 ha in the National Park (NP). The area occupied by the population on Haast's Bluff ALT is smaller than that occupied by the Tjoritja NP population, given the limited area of suitable refuge habitat there, which suggests that the global area occupied by the species was less than 500 ha (5 km^2) in 2016 (McDonald et al., 2017a).

However, for the purposes of listing, the AOO is required to be calculated using a 2x2 km grid cell method based on the IUCN Red List Guidelines 2017 (IUCN Standards and Petitions Subcommittee 2017). Following the IUCN guidelines, the EOO is estimated to be 906 km^2 (calculated using a minimum convex hull), and the AOO estimated to be 36 km^2 (DoEE 2017). These figures are based on the mapping of point records from 2007 to 2017, excluding points around Mt Sonder, obtained from P. McDonald (pers. comm., 2017a). A ten year time period was chosen because the species has not been recorded at Ormiston Gorge since 2002, despite intensive surveys at these sites undertaken in 2002−2006 (Edwards 2013a) and 2009−2012 (McDonald et al., 2013). These figures meet the thresholds for Endangered under subcriteria B1 and B2.

The home range size and movement patterns of the central rock-rat are not yet known; the determination of these is an action under the draft Recovery Plan (McDonald et al., 2017a). However, at the landscape-scale, distance to nearest occupied site was found to be the most important covariate influencing occupancy, with the species unlikely to be recorded more than 5 km from the nearest occupied site, suggesting that it occurs in localised and isolated subpopulations within a greater matrix of potentially suitable high-elevation quartzite habitat (McDonald et al., 2015b). Based on the current spread of records, the species can be considered to occur at three locations or subpopulations (western Chewings and Heavitree Ranges in Tjoritja NP, and Mt Edward on Haast's Bluff ALT), which meets subcriterion (a) for Endangered. As the number of locations has declined from four to three in the past 10 years, a continuing decline in the number of locations has been observed, which meets subcriterion (b)(iv).

There have been extreme fluctuations in abundance, which satisfies subcriterion (c)(iv). The central rock-rat was the most frequently trapped small mammal at some sites around Ormiston Gorge in 2000 and 2001 (Edwards 2013a). By contrast, they were not recorded in the area during 1991−1993 despite over 20 000 trap-nights of effort (Pavey 2007), and have not been trapped there since 2002 despite considerable effort (Pavey et al., 2010; Edwards 2013a; McDonald et al., 2013). The central rock-rat did not irrupt in response to high rainfall in 2010−11, demonstrating that large rainfall events alone are not a reliable predictor of population irruptions (McDonald et al., 2017a). Alternatively, the central rock-rat may be suffering an ongoing decline that is resulting in reduced occupancy in refuge habitat over time and therefore a reduced ability to respond numerically to resource pulses (McDonald et al., 2017a).

The Committee considers that the species' extent of occurrence and area of occupancy are restricted, and the geographic distribution is precarious for the survival of the species because it occurs at fewer than five locations, there is an observed decline in the number of locations, and the species undergoes extreme fluctuations in the number of individuals. Therefore, the species has met the relevant elements of Criterion 2 to make it eligible for listing as Endangered.

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**
	(ii) % of mature individuals in one subpopulation =	**90 – 100%**	**95 – 100%**	**100%**
(b)	Extreme fluctuations in the number of mature individuals			

Evidence:

Eligible under Criterion 3 C2(b) for listing as Endangered

The population size of the species is poorly known, as capture rates are low. Sampling targeted locations (sites of previous occurrence and modelled suitable habitat) from 2009−12 resulted in captures of only eight individuals at five “sites” (all at or around the summit of Mt Giles and Mt Sonder) from 5000 trap-nights at 55 “sites” (McDonald et al., 2013).

However, based on a rudimentary estimate of 1.6 individuals per hectare in refuge habitat (on average one individual is captured in an 80 m^2 grid on Mt Sonder and Mt Giles) and an estimated actual occupancy of <500 ha, the population is estimated to have fewer than 800 mature individuals (P. McDonald pers. comm., 2017a). Woinarski et al. (2014) estimates that the population has 1000 mature individuals. Both these population estimates meet the threshold for Endangered.

There is an observed continuing decline in the number of individuals and there have been extreme fluctuations in the number of individuals (see Criterion 2), which satisfies subcriterion (b).

The Committee considers that the estimated total number of mature individuals of this species is low, and the geographic distribution is precarious for the survival of the species because a decline in the number of individuals has been observed, and the species undergoes extreme fluctuations in the number of individuals. Therefore, the species has been demonstrated to have met the relevant elements of this criterion to make it eligible for listing as Endangered.

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

Evidence:

Eligible under Criterion 4 for listing as Vulnerable

The population size of the species is poorly known, but is estimated to be fewer than 1000 mature individuals (Woinarski et al., 2014), which meets the threshold for Vulnerable (see Criterion 3).

The total number of mature individuals is fewer than 1000 mature individuals, which is considered low. Therefore, the species has met this required element of this criterion to make it eligible for listing as Vulnerable.

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:

Insufficient data to determine eligibility

Population viability analysis has not been undertaken.

Conservation actions

Recovery plan

The Committee recommends that there should be a recovery plan for *Zyzomys pedunculatus* (central rock-rat). The species has experienced severe declines in extent of occurrence and area of occupancy, and populations are persisting at a low level with ongoing threats from extensive fires and predation by feral cats. Existing mechanisms are not adequate to enable recovery of the species.

A recovery plan for the central rock-rat was developed by the Northern Territory (Cole 1999) and adopted as a national recovery plan under the EPBC Act in 2007. An updated recovery plan has been drafted by the Northern Territory (McDonald et al., 2017a), and the process of adopting this plan as a national recovery plan is underway.

Primary conservation actions

1. Control the numbers of feral cats in areas occupied by central rock-rats.
2. Reduce the extent, frequency and intensity of fires within the species' range.

Conservation and management priorities

Fire

- Develop and implement fire management strategies that benefit the central rock-rat.
- Ensure a high proportion of the habitat is maintained with a post-fire age sufficient to provide adequate cover for the species.

- Ensure immediate and ongoing post-fire predator control within the habitat when fires occur.
- Provide maps of known occurrences of the species to managers of Aboriginal Land, National Parks and surrounding private land, as well as local and state Rural Fire Services.
- Seek inclusion of mitigation measures in bush fire risk management plans, risk registers and/or operation maps, for all areas adjacent to the species' current distribution.

Invasive species

- Control numbers of feral cats in and around central rock-rat populations, using broad-scale targeted methods where possible. Ensure there are minimal detrimental effects on other species, including dingoes which are likely to control cats.
- Monitor and, if necessary, control the density of feral horses within the species' range.
- Implement strategic management of invasive grasses, such as buffel grass, to reduce fire fuel loads within the species' range.

Breeding and other ex situ recovery actions

- Develop a translocation program that includes a plan for captive breeding, and a risk assessment of the captive breeding and translocation processes (including potential impacts on wild populations arising from the removal of individuals for captive breeding).
- Re-establish an insurance captive breeding program if the translocation program risk assessment indicates it is prudent to do so.
- Trial translocation to suitable areas within the species' former range (or nearby) where key threats have been controlled.

Stakeholder Engagement

- Consult with the Central Land Council and other relevant Aboriginal organisations and communities before undertaking recovery actions on Aboriginal land. Where possible, engage traditional owners/Indigenous ranger groups in undertaking survey, monitoring and management actions. Engage traditional ecologists to provide advice on biological aspects, threatening processes and the cultural significance of this species.
- Provide information to land managers neighbouring the central rock-rat distribution (including pastoralists and indigenous communities) about managing fire for the benefit of the species.
- Collaborate with appropriate research institutions to achieve the research components of the recovery actions.
- Establish education and information programs targeting public and private land managers, the general public and relevant non-government organisations.

Survey and Monitoring priorities

- Undertake targeted surveys to more precisely assess the species' entire geographic extent, changes in extent of occurrence and area of occupancy, relative abundance, and viability of populations across the species' range. Carry out mark-recapture surveys and radio tracking to obtain information on habitat use and movements.
- Establish an integrated monitoring program across all populations. In particular, monitor:
  - the incidence of fire, and vegetation response to fire
  - the response of central rock-rat populations to fire management
  - the abundance of feral cats, foxes and dingoes in the species' range

- the response of populations to predator control (e.g. monitor the pre- to post-bait response from central rock-rats and feral cats using camera traps).

- Maintain precise fire history records for areas containing extant populations and suitable habitat for the species.
- Survey suitable habitat, particularly core refuge habitat, to identify suitable sites for translocations.
- Monitor the progress of recovery, including the effectiveness of management actions, to inform future management strategies.

Information and research priorities

Fire

- Improve understanding of the species' response to different fire regimes, and identify appropriate fire regimes for the species. In particular:
  - Assess the extent to which preferred habitat may be affected by fire regimes.
  - Assess the extent to which food availability may be affected by fire regimes, and any limitations this may place on population size or reproductive success.
  - Identify current understandings of fire responses among related or functionally similar species, and incorporate information into the development of fire management strategies for the central rock-rat.
  - Assess the efficacy and impacts of fire management strategies on the species, and feedback learnings into the identification of appropriate fire regimes.

Invasive Species

- Assess the current and potential distribution of buffel grass in and around important populations, and consequential impacts on fire regimes. In addition, assess the effectiveness of control programs for buffel grass at and around sites with important habitat for rock-rats in their irruptive phase.
- Assess the impact of predation on population viability of the central rock-rat, and the effectiveness of options for broad-scale control of feral predators or of local scale control at sites with important populations.
- Assess the impacts of feral herbivores on important dietary plant species in and around occupied sites and suitable habitat.

Translocation

- Investigate factors limiting the success of captive breeding programs.

Disease and Parasites

- Investigate the incidence, and assess the potential impact of, diseases (such as lymphosarcoma and Acute Respiratory Distress Syndrome) and parasites (such as roundworms) on wild and captive populations of the central rock-rat. In particular, assess implications for husbandry in captive breeding populations.

Recommendations

(i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **transferring** from the Endangered category to the Critically Endangered category:

Zyzomys pedunculatus

(ii) The Committee recommends that the current recovery plan should be retained and updated as required.

Threatened Species Scientific Committee

14/09/2017

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