



Consultation Document on Listing Eligibility and Conservation Actions

***Macroderma gigas* (ghost bat)**

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

- 1) the eligibility of *Macroderma gigas* (ghost bat) for inclusion on the EPBC Act threatened species list in the Vulnerable 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.

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 25 November 2015.

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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.

Macroderma gigas

Ghost bat

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 are reflective of the desire to achieve efficiency over preparation of a large number of advices by adopting the approach of the Action Plan for Australian Mammals in presentation of information and do not reflect any difference in the evidence used to develop the recommendation.

Taxonomy

Conventionally accepted as *Macroderma gigas* (Dobson, 1880).

Macroderma is a monotypic genus endemic to Australia. There is a possibility that *Macroderma* exists in Papua New Guinea (Filewood, 1983) but this has never been confirmed. The ghost bat is the largest species in the family and comprises several disjunct subpopulations across northern Australia.

A second subspecies from the Kimberley, *M. gigas saturata*, was described by Douglas (1962) using diagnoses based on pelage and skin colour. However, it has now been synonymised with *M. gigas* (Koopman, 1984; Simmons, 2005). Studies of morphological and genetic variation across the species' distribution found clinal variation in size (northern ghost bats were smaller; Hand and York, 1990), and a high degree of population subdivision with greater connectedness amongst colonies in northern subpopulations (Worthington Wilmer et al., 1994, 1999). However, these findings were not suggested as a basis for subspecific taxonomic distinctness, and no subspecies are recognised.

Population genetic studies indicate a high degree of female philopatry (remaining in, or returning to, an individual's birthplace) at natal roosts based on mitochondrial DNA markers, and gene flow within regions mediated by male movements was suggested from nuclear microsatellite markers (Worthington Wilmer et al., 1994, 1999). Northern groups had higher heterozygosity and less marked phylogeographic structure than southern groups, which was interpreted to be a consequence of the limited availability and greater separation of roost sites with suitable microclimates in more arid areas. Recent studies that have built on the work by Worthington Wilmer et al. (1994, 1999) by adding individuals from the Pilbara and Kimberley regions, have also highlighted the distinctness of these two subpopulations, high female philopatry, and gene flow within regions from male movements (K. Armstrong et al. pers. comm., cited in Woinarski et al., 2014). The implication from all genetic studies is that losses of maternity sites containing breeding females have the potential to reduce the area of occupancy significantly.

Species Information

Description

The ghost bat is the largest microchiropteran bat in Australia, with a head and body length of 10-13 cm and a forearm length of 10-11 cm. It is Australia's only carnivorous bat. Its fur is light to dark grey above and paler below. It has long ears which are joined together, large eyes, a simple noseleaf and no tail (Richards et al., 2008).

Distribution

Fossil data show that the ghost bat was once distributed widely over much of Australia except Victoria and Tasmania, including the arid zone, but contracted northwards during the Holocene (Molnar et al., 1984; Churchill & Helman, 1990). A study that combined information from ancient

DNA obtained from remains in extinct southern populations, newly-generated and existing genetic data from extant northern populations, and ecological niche modelling based on past and present climatic conditions (Thomson et al., 2012), suggested that the ghost bat expanded southwards during periods of higher humidity (interglacials) and contracted northwards in response to increasing aridity (e.g. preceding the last glacial maximum). The combined analyses support previous statements that the ghost bat is a geographically relictual species in southern, arid landscapes, present only because caves provide suitable roost microclimates.

At the time of European settlement, remnant arid zone subpopulations remained. Since the arrival of Europeans, ghost bats have contracted further northwards, with much of their arid zone distribution disappearing in the past few decades (Molnar et al., 1984; Churchill & Helman, 1990). Burbidge et al. (1988) reported that western desert Aboriginal people stated that ghost bats only ever occurred in a few favourable areas and that they were still present. However, searches of several central Australian sites where they once occurred have since failed to locate any (Churchill & Helman, 1990). The last arid zone specimen was collected in 1961 (Butler, 1962). The major range contraction from central Australia happened more than three generations (24 years) ago.

Ghost bats occur in the Pilbara (Armstrong & Anstee, 2000; McKenzie & Bullen, 2009), Kimberley (including several islands, McKenzie & Bullen, 2012), northern Northern Territory (including Groote Eylandt), and coastal and near coastal eastern Queensland from Cape York to near Rockhampton (Richards et al. 2008). Burbidge et al. (2009), using modern, historical and subfossil data, found that the ghost bat occurred in 37 of Australia's 85 bioregions, and that it was extinct in 12. Worthington Wilmer (2012) considered that only 14 maternity roosts were known.

Relevant Biology/Ecology

Ghost bats are the largest microchiropteran bat in Australia and the second largest in the world, weighing up to 150 g and having a wingspan of 60 cm. They currently occupy habitats ranging from the arid Pilbara to tropical savanna woodlands and rainforests. During the daytime they roost in caves, rock crevices and old mines. Roost sites used permanently are generally deep natural caves or disused mines with a relatively stable temperature of 23°-28°C and moderate to high relative humidity of 50-100% (Pettigrew et al., 1986; Churchill & Helman, 1990; Churchill, 1991; Armstrong & Anstee, 2000; J. Toop unpublished data). They are carnivores, with a broad diet comprising small mammals including other bats, birds, reptiles, frogs and large insects (Pettigrew et al., 1986; Schulz, 1986; Boles, 1999; J. Toop unpublished data). The proportion of food items in the diet varies with availability. At Pine Creek in the Northern Territory, diet was predominantly comprised of birds as large as the dollarbird (*Eurystomus orientalis*), which weighs 125-140 g (Schulz, 1986; Pettigrew et al., 1986). At Mount Etna diet has at times been mostly large insects, while at other times the prey included vertebrates such as birds, bats, rats and mice (J. Toop, unpublished data).

The ghost bat has a surface foraging strategy with two modes. It perches in vegetation to ambush passing prey (either on the ground or in the air), and it also gleans surfaces such as the ground while in flight. Its echolocation calls show wide variation (McKenzie & Bullen, 2009). Tidemann et al. (1985) found that foraging areas were centred, on average, 1.9 km from the day roost. The mean size of foraging areas was 61 ha and tagged bats generally returned to the same areas each night. Hunting behaviour within foraging areas consisted of observation at vantage points with brief sallies to capture prey (mostly insects on the ground), although hawking of flying insects was also observed. Vantage points were changed about every 15 minutes during foraging periods, and the mean distance between them was 360 m. Foraging areas were not exclusive; there was overlap between the ranges of several tagged individuals, and in one case an area was used by 20 bats.

Hoyle et al. (2001), who studied the southernmost known colony in Queensland, found that female bats gave birth to a single young in late spring, but only 40% (22–70%, 95% CI) of females bred in their second year, increasing to 93% (87–97%, 95% CI) for females ≥ 2 years

old. Sixty-five percent of juveniles captured were female. Annual adult survival ranged between 0.57–0.77 for females and 0.43–0.66 for males, and was lowest over winter–spring and greatest in autumn–winter. Juvenile survival for the first year ranged between 0.35–0.46 for females and 0.29–0.42 for males. Adult survival varied among seasons, and was negatively associated with rainfall but not associated with temperature apart from being lower in late winter. Poor survival may result from the inferior daytime roosts that bats must use if water seepage forces them to leave their normal roosts. Although these age-specific rates of fecundity and survival suggested a declining population, mark–recapture estimates of the population trend indicated stability over the study period. Counts at daytime roosts also suggested a population decline, but were considered unreliable because of an increasing tendency of bats to avoid detection. At Mount Etna, Toop (1985) found that pregnant females congregated in the warmest caves and gave birth over a month commencing in mid-October. As caves became warmer as summer progressed, some mothers shifted the young to other caves. Juvenile bats commenced flying at seven weeks with all young capable of flight by the end of January.

Ghost bats disperse widely when not breeding, but concentrate in a relatively few maternity roost sites when breeding. Few of these sites are known (Richards et al., 2008; Worthington Wilmer, 2012), and most are not protected or managed.

Roost sites include caves, rock crevices and disused mine adits. In the Hamersley Range in the Pilbara, preferred roosting habitat appears to be caves beneath bluffs of low rounded hills composed of Marra Mamba geology, and larger hills of Brockman Iron Formation; in the eastern Pilbara caves beneath bluffs composed of Gorge Creek Group geology and granite rockpiles are preferred (Armstrong & Anstee, 2000). The species’ persistence in the arid Pilbara depends on the physiologically benign day-roosts found deep underground in humid, temperature-stable caves (Leitner & Nelson, 1967; Hall et al., 1997; Armstrong & Anstee 2000; McKenzie & Bullen, 2009).

Ghost bats are easily disturbed when roosting. Young may be dislodged by adults in rapid take-offs (J. Toop, unpublished data), and may not return to the roost site (K. Armstrong pers. comm., cited in Woinarski et al., 2014). This makes counting individuals at roost sites difficult and repeated counts may be unreliable (Armstrong, 2010). Such susceptibility to disturbance also threatens the viability of roosts with unregulated human visitation, including surveys which target caves and may inadvertently flush individuals into daylight.

Females breed at age two to three years (Hoyle et al., 2001). Longevity in the wild is unknown, but is likely to be somewhat less than the maximum 22.6 years in captivity (AnAge, 2012). Generation time is assumed to be 8 years (Woinarski et al., 2014).

Threats

Threats to the ghost bat are outlined in the table below (Woinarski et al., 2014).

Threat factor	Consequence rating	Extent over which threat may operate	Evidence base
Disturbance of (human visitation at) maternity roost sites	severe	moderate	ghost bats easily disturbed and may abandon sites where disturbance occurs (K. Armstrong pers. comm., cited in Woinarski et al., 2014)

Habitat loss: destruction of, or disturbance to, roost sites (and nearby areas) due to mining	moderate-severe	moderate	Mt Etna and surrounding area contains maternal roost sites; some maternal roost sites destroyed; Mt Etna now protected in a national park and visited by tourists; declines reported at Mt Etna following mining (Worthington Wilmer, 2012); Mount Consider cave west of Cairns destroyed; other sites still vulnerable; most Pilbara roosts are vulnerable to iron ore mining and the deterioration and disturbance of old underground gold and copper mines
Collision with fences, especially those with barbed wire	moderate	moderate	ghost bats have low fecundity and survival (Hoyle et al., 2001), often fly at about fence height and substantial numbers are known to be killed when colliding with fencing wire (Armstrong & Anstee, 2000; McKenzie & Bullen, 2009)
Collapse or reworking of old mine adits	minor-moderate	minor-moderate	many of the known nursery roosts are in old mine workings that are collapsing, flooding or subject to disturbance (Hall et al., 1997; Armstrong, 2001); e.g. the Pine Creek colony roosts in an adit that is in danger of collapse (Richards et al., 2008)
Contamination by mining residue at roost sites	moderate	moderate	several roosting sites in old mines have high levels of pollutants
Disease	unknown	unknown	a possible herpes type virus appears to be affecting the Mt Etna population, but pathology yet to be confirmed (J. Augusteyn pers. comm., cited in Woinarski et al., 2014)

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 [except A3]
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:

Woinarski et al. (2014) estimate the population size of the ghost bat to be <10 000, with an estimated continuing decline of >10% in 24 years (3 generations). It is declining in Queensland and is projected to be declining in the Pilbara, Western Australia. In the Pilbara its maternity roosts are confined to underground gold/copper mines that are now collapsing or being open cut, and caves in banded ironstone strata that are may be mined-out over the next 30-50 years. On current trends, most of its Pilbara roost sites may be destroyed over the next 30 years.

The data presented above appear to be insufficient 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.

Criterion 2. Geographic distribution is precarious 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:			
(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:

Woinarski et al. (2014) estimate the extent of occurrence to be 2 480 000 km² and is stable. They estimate the area of occupancy to be < 10 km² based on known roost sites, with a decreasing trend. The species occurs at >10 locations, the population is not severely fragmented and does not suffer extreme fluctuations (Woinarski et al., 2014).

The data presented above appear to be insufficient 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.

Criterion 3. Small 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 generations (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 are no robust measures of abundance across the full range of the ghost bat. The species can be counted readily when it leaves caves and mine roosts after dusk because of its large size and pale colour. Monitoring of colony size has been conducted mostly on an *ad hoc* basis over the past three decades at certain large colonies, and data have been collected from some colonies over several years. The number of individuals at the largest colonies have been around 400 at the Bulletin mine in the Pilbara region (Hall et al., 1997), and 1200-1500 at Pine Creek in the Northern Territory (Pettigrew et al., 1986; Macroderma Expert Group, 1990, cited in Worthington Wilmer et al., 1999), but such regional maxima are atypical of most colony sizes (Richards et al., 2008). Hall and McKenzie (2008) estimated the global population size at between 7000 and 9000 individuals, with differences amongst the regional subpopulations. In a more recent assessment, Worthington Wilmer (2012) suggested that the total Australian population was between 4000 and 6000 individuals (comprising 750-850 in Queensland, 2500-3500 in the Northern Territory and about 1500 in Western Australia), but did not provide calculations on which the suggestions were based. However, this assessment predated the latest information from the Pilbara, Kimberley and Mount Etna.

The Queensland subpopulations are located in only 4-5 highly disjunct localities and have been estimated at fewer than 1000 individuals, and the major colony at Mount Etna has declined in the last 10 years. The Northern Territory subpopulations are thought to be more or less stable at 2500-3500 individuals and distributed among at least 6-7 main centres. The largest known colony (Kohinoor Adit at Pine Creek: Pettigrew et al. 1986) contained about 560 individuals at the most recent count (July 2010: Grant et al., 2010). Unregulated human visitation, collapse, and possibly contaminated water threaten this colony. In Western Australia, ghost bats occur in two separate regions: in the Pilbara, Armstrong and Anstee (2000) estimated 1200 individuals; however, surveys for environmental impact assessments have discovered several larger colonies in the past decade (Armstrong, 2011) and activities associated with mining have had an undocumented effect at several known roost sites (K. Armstrong pers. comm., cited in Woinarski

et al., 2014). In the Kimberley a population of around 3000-4000 individuals have been inferred (McKenzie & Hall, 2008).

Abandoned mine adits (horizontal tunnels) comprise a significant portion of the known roost sites; indeed the presence of mines may have allowed the species to extend its range and expand its population size (e.g. Worthington Wilmer et al., 1999). Hall et al. (1997) reported subpopulation size data from Western Australian mines:

- Comet: 35 (26 April 1981); 37+ (14 October 1993); 100+ (19 July 1996)
- Klondyke: 40 (1 May 1981); 98+ (24 April 1994); 20+ (14 July 1994); 40+ (18 July 1995); counts by Armstrong (2010) varied between 107 and 366 for the period 12 June 2011 to 5 July 2001
- Bulletin: 406 (23 April 1994); 200+ (18 July 1995).

Monitoring has been undertaken irregularly at the largest known maternity site at Kohinoor Adit, Pine Creek, Northern Territory. Sampling precision has varied with methods used, and counts vary depending upon season of count (and breeding stage). Grant et al. (2010) summarised the counts to that date (Table 1).

Table 1. Counts of ghost bats at various dates at the largest known maternity site, Kohinoor Adit.

date	count
July 1981	300
May 1983	445
June 1984	780
May 1985	1100
April 1987	1300
February 1988	1400
August 1988	1300
January 1990	1500
July 2010	564

In southern Queensland, recent data show that ghost bats are continuing to decline at the Mount Etna Caves National Park and the surrounding karst system with only 26 individuals captured over several months, whereas Worthington Wilmer (1996) caught 25 individual bats over two nights in 1993 at a similar time of year, at the same site and using the same methodology. Preliminary results from a genetic coalescence study suggested an effective population size of between 15 and 30 depending on the method used (J. Augusteyn pers. comm., cited in Woinarski et al., 2014). On Cape York Peninsula, maternity sites are known at Mitchell-Palmer limestone and Kings Plains station, with a suspected site near the Iron Range (Reardon et al., 2010). Other available Queensland estimates are of 150 at Giringun-Gugu Badhun West of Ingham / Cardwell and 500 at Kuku Nyungkul – Kuku Bubogun south of Cooktown (C. Clague pers. comm., cited in Woinarski et al., 2014). Recent trapping of the Cape Hillsborough wintering roost also indicates that the wintering population is declining when compared with numbers caught and recorded from these caves from mid 1970s to early 1990s (M. Cali pers. comm., cited in Woinarski et al., 2014).

McKenzie and Bullen (2009) found the ghost bat to be more common in the Pilbara than previously thought, despite detectability constraints caused by its cryptic calls. They found it at 21 of their 24 survey areas, and in all four Pilbara sub-regions, despite the sparsity of their sampling and the low intensity of *M. gigas* calls (bat detector range is <3 m for *M. gigas*). McKenzie and Bullen (2012, p. 90) also found the ghost bat to be 'widespread and common' on islands of the north-western Kimberley, observing it on five of the islands surveyed and detecting its calls on six others despite sparse sampling and the low intensity of its in-flight calls.

Woinarski et al. (2014) estimate the global population size at <10 000 individuals, based on a combination of counts of colony size at some roosts plus calculations based on area of occupancy. The size of each of the various subpopulation isolates has been estimated at between <1000 and 4000 individuals. There is a projected continuing decline of >10% in a future 24 year period (Woinarski et al., 2014).

The data presented above appear to demonstrate that the species is **eligible for listing as Vulnerable** under criterion C1. 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. Very small population			
	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
Number of mature individuals	< 50	< 250	< 1,000

Evidence:

The population size is estimated at > 1 000 mature individuals (see information on population abundance under Criterion 3).

The data presented above appear to be insufficient 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.

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:

No population viability analysis has been undertaken.

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.

Conservation Actions

Recovery Plan

A decision about whether there should be a national 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 Objectives

1. Maintain current range and abundance
2. Ameliorate threats posed by mining, including environmental impact assessment surveys.

Conservation and Management Actions

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

Theme	Specific actions	Priority
Active mitigation of threats	protect land with significant colonies	high
	replace barbed wire in fences close to roost sites with single-strand wire	high
	protect roost sites from disturbance	medium
	where appropriate, modify roost site areas to reduce risks of collapse	low
Captive breeding	n/a	
Quarantining isolated populations	n/a	
Translocation	n/a	
Monitoring	monitor at key sites and where impact from mining is occurring or likely	high
Community engagement	educate people not to disturb roost sites	medium
Reduce disturbance of roost sites	where there are known roosts in proximity to mining or other activities, take steps to ensure disturbance is minimised by undertaking environmental assessment and mitigation measures	high

Information and research priorities

Information and research priorities are outlined in the table below (Woinarski et al., 2014).

Theme	Specific actions	Priority
Survey to better define distribution	collate and review all information on Pilbara roost sites, and identify banded-ironstone areas in all parts of the region that are proposed to be mined or may be quarantined from mining	high
	additional surveys, especially to locate maternity roost sites, required in remote parts of the Pilbara, Kimberley and Northern Territory	high
	assess population size (and significance) of all known subpopulations	medium-high

Assess impacts of threats on species	assess impacts of disturbance of maternity roost sites, and identify appropriate buffer zones around roost sites so mining and other activities do not lead to abandonment	high
Establish or enhance monitoring program	develop cost-effective monitoring protocols (e.g. thermal tracking software) at a set of standardised sites that contain most of the known population	medium
Assess effectiveness of threat mitigation options	assess options for establishment of new/artificial roost sites (as a last resort only), and mitigation options to reduce impacts of mining	medium
Resolve taxonomic uncertainties	n/a	
Assess habitat requirements	assess seasonal access to foraging areas in the Pilbara remote from major roosts	medium
Assess diet, life history	assess proximity to roosts of foraging habitats used by lactating females compared to other adults	medium

References cited in the advice

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Consultation questions

1. Do you agree with the current taxonomic position of the Australian Faunal Directory for this taxon (as identified in the draft conservation advice)
2. Can you provide any additional references, information or estimates on longevity, age of maturity, average life span and generation length?
3. Has the survey effort for this taxon been adequate to determine its national distribution and adult population size?
4. Do you accept the estimate provided in the nomination for the current population size of the taxon?

5. For any population with which you are familiar, do you agree with the population estimate provided? If not, are you able to provide a plausible estimate based on your own knowledge? If so, please provide in the form:
 - Lower bound (estimated minimum):
 - Upper bound (estimated maximum):
 - Best Estimate:
 - Estimated level of Confidence: %
6. Can you provide any additional data, not contained in the current nomination, on declines in population numbers over the past or next 10 years or 3 generations, whichever is the longer?
7. Is the distribution as described in the nomination valid? Can you provide an estimate of the current geographic distribution (extent of occurrence or area of occupancy in km²) of this taxon?
8. Has this geographic distribution declined and if so by how much and over what period of time?
9. Do you agree that the taxon is eligible for inclusion on the threatened species list, in the category listed in the nomination?
10. Do you agree that the threats listed are correct and that their effects on the taxon are significant?
11. To what degree are the identified threats likely to impact on the taxon in the future?
12. Can you provide additional or alternative information on threats, past, current or potential that may adversely affect this taxon at any stage of its life cycle?
13. In seeking to facilitate the recovery of this taxon, can you provide management advice for the following:
 - What individuals or organisations are currently, or need to be, involved in planning to abate threats and any other relevant planning issues?
 - What threats are impacting on different populations, how variable are the threats and what is the relative importance of the different populations?
 - What recovery actions are currently in place, and can you suggest other actions that would help recover the taxon? Please provide evidence and background information.
14. Can you provide additional data or information relevant to this assessment?