



Consultation Document on Listing Eligibility

Perameles papillon (Nullarbor Barred Bandicoot)

You are invited to provide your views and supporting reasons related to the eligibility of *Perameles papillon* (Nullarbor Barred Bandicoot) for inclusion on the EPBC Act threatened species list in the **Extinct** category.

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

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

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

or by mail to:

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

Responses are required to be submitted by 11 September 2020.

Contents of this information package	Page
General background information about listing threatened species	2
Information about this consultation process	3
Draft information about the common name and its eligibility for listing	4
References cited	9
Collective list of questions – your views	9

General background information about listing threatened species

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

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

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

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

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

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

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

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

Privacy notice

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

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

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

The Department's Privacy Policy contains details about how respondents may access and make corrections to personal information that the Department holds about the respondent, how respondents may make a complaint about a breach of an Australian Privacy Principle, and how the Department will deal with that complaint. A copy of the Department's Privacy Policy is available at: <http://environment.gov.au/privacy-policy>.

Information about this consultation process

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

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

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

Perameles papillon

Nullarbor Barred Bandicoot

Taxonomy

Conventionally accepted as *Perameles papillon* Travouillon & Phillips, 2018.

Species/Sub-species Information

Description

Perameles papillon (Nullarbor Barred Bandicoot) is known from specimens collected prior to 1930 and from subfossil material unearthed from caves in the Nullarbor Plain and adjacent Roe Plain (Woinarski et al. 2014a).

Travouillon & Phillips (2018) describe the Nullarbor Barred Bandicoot as having resembled subspecies of *Perameles bougainville*: *P.b. myosuros* (Marl); *P.b. notina* (South-eastern Striped Bandicoot) and *P. b. bougainville* (Shark Bay Bandicoot). The Nullarbor Barred Bandicoot was a dark brown-grey colour when viewed from above, with the chin, throat, belly, tops of the feet, and the inner part of the limbs cream coloured. A complex pattern of different coloured bars, resembling a butterfly wings shape when viewed from above, was present on the rump. The tail was short and tricoloured (dark brown dorsally, beige laterally, and cream ventrally). A bracelet of light brown fur was visible around the wrists, and covering the heel of the foot, and the posterior edges of the footpad. The ears were large and erect, marked with a dark coloured horizontal bar. Long dark whiskers were present at the front of a pointy snout, above the eye, and on the cheek below the eye. The feet were elongated, with the three inner toes large, whilst the outer toes were reduced. Few body measurements are available for the Nullarbor Barred Bandicoot, with only skull, ear, hind-foot, and tail length recorded. These measurements correspond to those of the Shark Bay Bandicoot, also known as the Western Barred Bandicoot, giving the likelihood that it was similarly small and lightly built. For comparison, the Shark Bay Bandicoot has an average head and body length of 202 mm, and a weight of 244 g (Friend 2008). The tail of the Nullarbor Barred Bandicoot averaged 75 mm, and the hind-foot 49 mm. The female was distinctively larger than the male.

The Nullarbor Barred Bandicoot was distinguished from the morphologically similar subspecies of *Perameles bougainville* by the dark butterfly wing pattern on the rump, the tricoloured tail, and the marking on the ears, wrist and feet (Travouillon & Phillips 2018).

Distribution

The Nullarbor Barred Bandicoot is believed to have inhabited the Nullarbor Plain (Western Australia (WA) and South Australia (SA)) and the Roe Plain (south-east of WA) (Woinarski et al. 2014a). The Nullarbor Plain is one of the largest desert karsts in the world, dominated by broad, gently undulating limestone plains (McKenzie et al. 1989; Gillieson et al. 1996). The soils on the Nullarbor are shallow with an average depth of less than one metre (Gillieson et al. 1996). The coastal belt is semi-arid, whilst the remainder of the inland region is arid, with seasonally uniform but spatially unreliable rainfall (McKenzie et al. 1989).

The name Nullarbor means “treeless”, and the vegetation is predominantly chenopod with a number of *Atriplex* (bluebush) and *Maireana* (saltbush) species. Low, open myall woodlands are found at the periphery of the plain, particularly in the north and west. Eucalyptus shrubs are interspersed amongst the woodlands in the south (McKenzie et al. 1989). The Roe Plain has denser vegetation than the Nullarbor Plain, with mallee communities dominating the limestone scree slopes and sandy surfaces, whilst the coastal plains support eucalypt woodlands and low, open myall woodlands (DPAW 2013).

Extinction date

The extinction date of the Nullarbor Barred Bandicoot is unknown but believed to be around the late 1930s, with the last collection recorded in 1928 (Woinarski et al. 2014a).

Relevant Biology/Ecology

Wood-Jones (1924), cited in Woinarski et al. (2014a), provided an account of the ecology of the Nullarbor Barred Bandicoot. This account can be expanded on from knowledge of other known bandicoot species, which, despite their wide range of habitats, are a fairly uniform group in terms of behaviour (Stodart 1977). Similarities are particularly likely to have been shared with the Shark Bay Bandicoot that inhabited a similarly arid habitat.

In general, bandicoots are solitary, with males occupying a larger home range than females. For comparison, the home range for the Shark Bay Bandicoot is 2.5–14.2 ha for males and 1.4–6.2 ha for females (Richards 2004). From Wood Jones' description, the Nullarbor Barred Bandicoot occupied the open plains of the Nullarbor region. This habitat provided little shelter, with the level stretches being broken only by sand-hills, outcrops of limestone, and shrubby vegetation. Like other bandicoots, the Nullarbor Barred Bandicoot was observed to be nocturnal, sheltering during the day in nests (constructed from grasses and other plants), concealed under the available vegetation. These nests were described to have been like those of the Short-nosed Bandicoots (genus *Isododon*) but excavated to a greater degree to accumulate more nesting materials. The Nullarbor Barred Bandicoot foraged predominantly on insects and insect larvae, and, when alarmed, would spring into the air before scurrying away.

As with all marsupials, bandicoot young are born at a very early stage of development, usually after a gestation period of just 12 days, which is one of the shortest periods of any mammal. The average litter size for the morphologically similar Shark Bay Bandicoot is two but litters ranging from one to four have been recorded (Richards 2012). Juveniles remain in the pouch for about 50 days before being weaned by the mother. By the time they are seven weeks old, they are covered with short hair and the eyes are open (Lerner & Wilmoth 2014). Longevity of over four years has been recorded for the Shark Bay Bandicoot (Friend 2008).

Likely Causes of Decline and Extinction

Likely causes of decline and extinction are surmised from threats known to have occurred in the early to mid-20th century and a presumption that its ecology was similar to that of the Shark Bay Bandicoot.

Table 1: Probable causes of decline towards extinction for the Nullarbor Barred Bandicoot in approximate order of impact, based on available evidence.

Threat factor	Threat status and severity*	Evidence base
Introduced predators		
Predation by feral cats (<i>Felis catus</i>)	<ul style="list-style-type: none">– Status: Historical– Confidence: Suspected– Consequence: Severe– Extent: Across the entire range	<p>Feral cats are thought to have been present throughout the Nullarbor region by 1890–1900 (Tunbridge 1993; Abbott 2008), with cats found to be widespread and common in later surveys (McKenzie & Robinson 1987).</p> <p>Predation by feral cats has been implicated in the extinction and ongoing decline of many terrestrial, non-volant, mammal species (Dickman 1993; Smith & Quin 1996; Woinarski et al. 2014c; Hardman et al. 2016; Davies et al. 2017; Radford et al. 2018; Woolley et al. 2019), particularly in arid and semi-arid habitats (Christensen &</p>

		<p>Burrows 1994; Moseby et al. 2011; Davies et al. 2018; Woolley et al. 2019), with vertebrate prey up to four kg taken (DoE 2015). Woinarski et al. (2014c) considered predation by feral cats to be the most critical factor in the decline and extirpation of Australia's mammal fauna. McKenzie et al. (2007) observed that bandicoots are particularly prone to predation, as they dwell on the ground's surface and don't utilise shelter like arboreal, rock-dwelling or burrowing mammals.</p> <p>The likely impact from predation can be deduced from conservation efforts for the Shark Bay Bandicoot. This species is identified as being extremely susceptible to predation and needs to be completely (or almost completely) separated from the feral cat and the European red fox (<i>Vulpes vulpes</i>) to avoid extinction (Legge et al. 2018). The feral cat was identified as influential in the extinction of the Shark Bay Bandicoot on mainland Australia in the 1930s (Richards 2004), and following an attempt to reintroduce the species to the mainland (1995-1996), predation was identified as the primary cause of the population's extirpation (Short 2016). The Shark Bay Bandicoot is now restricted to feral cat and red fox free islands and mainland fenced enclosures (Legge et al. 2018).</p> <p>Fire and stock grazing can amplify the impacts of predation on small mammals by reducing ground cover, particularly following high-intensity burns (Smith & Quinn 1996; Leahy et al. 2015). The number of predators attracted to the burnt area (Hradsky et al. 2017), individual predator activity (Leahy et al. 2015), and hunting success (McGregor et al. 2015) have all been observed to increase where habitat has been modified through frequent burning. Therefore, predation would have increased as European settlement spread throughout the accepted distribution range.</p>
Predation by European red fox (<i>Vulpes vulpes</i>)	<ul style="list-style-type: none"> – Status: Historical – Confidence: Suspected – Consequence: Severe – Extent: Across the entire range 	<p>The European red fox arrived in the Nullarbor around 1915, with early settlers observing it 'killing most of the marsupials' (Richards & Short 1996). Red foxes were found to be widespread and common in later surveys (McKenzie & Robinson 1987).</p> <p>Predation by the red fox has been implicated in the extinction and decline of many terrestrial, non-volant mammal species in Australia (Richards 2004; DEWHA 2008; Woinarski et al. 2014c; Radford et al. 2018) and was identified by Smith & Quin (1996) as having a significant impact on small isolated populations of</p>

		<p>threatened species, being able to eliminate them even at low densities.</p> <p>As identified above, the likely impact from predation by foxes can be deduced from conservation efforts for the Shark Bay Bandicoot.</p> <p>As identified above, fire can amplify the impacts of predation on small and medium-sized mammals (Leahy et al. 2015; McGregor et al. 2015; Hradsky et al. 2017).</p>
Habitat loss and fragmentation		
Habitat degradation and resource depletion by introduced European rabbits (<i>Oryctolagus cuniculus</i>)	<ul style="list-style-type: none"> – Status: Historical – Confidence: Suspected – Consequence: Severe – Extent: Across the entire range 	<p>European rabbits were release in 1859, and by 1900 they were recorded throughout the Nullarbor region (Gillieson et al. 1996; Richards & Short 1996; Fenner 2010).</p> <p>Gillieson et al. (1996) observed that the major land degradation of the Nullarbor had occurred by the beginning of the 20th century, with rabbits held to be the principal cause of accelerated soil loss on pastoral lands. Richards & Short (1996) recorded early settler observations of the impact of rabbits to the habitat, including intensive grazing on native vegetation and ring-barking trees. In large numbers, rabbits turn areas of productive, well vegetated country into a virtual desert, greatly impacting sympatric mammals (Johnson 2006). A reduction in shrub cover may have limited the ability of the Nullarbor Barred Bandicoot to construct nests for protection from predators and extremes of temperature, and limited foraging sites for their invertebrate diet (Richards 2004).</p> <p>Rabbits, with high standing biomass and high rate of increase, provide abundant prey for predators as native species decline. Therefore, rabbit presence supports elevated predator populations and predation pressures on native mammalian species. Also, native species are easier to catch, being without the behavioural or morphological defences to avoid detection or capture (Richards 2004; Pedler et al. 2016; Radford et al. 2018).</p>
Habitat degradation and resource depletion by livestock	<ul style="list-style-type: none"> – Status: Historical – Confidence: Suspected – Consequence: Severe – Extent: Across the entire range 	<p>Only a small area of the Nullarbor has historically been occupied by pastoral leases, with the first stations established in the SA portion by the 1850s, whilst the WA portion was largely untouched before 1955. However, where pastoral leases ran stock, mismanagement led to over-grazing in many parts (McKenzie & Robinson 1987).</p> <p>Grazing by stock removes shrub cover (Dennis 2001; McDowell et al. 2015) that may have limited</p>

		<p>the ability of the Nullarbor Barred Bandicoot to construct nests and forage for invertebrate food and may have degraded or destroyed potential refuges during times of drought (Richards 2004; Tunbridge 1993; Morton et al. 1995).</p> <p>Trampling by stock compacts and powders topsoil, renders soil too loose for digging (Dickman 1993). The Nullarbor Barred Bandicoot, like other bandicoot species, likely excavated much of its food, which would have been more difficult following the arrival of stock.</p>
Fire		
Change in fire regime	<ul style="list-style-type: none"> – Status: Historical – Confidence: Suspected – Consequence: Unknown – Extent: Across the entire range 	<p>The degree to which a change in fire regime impacted the Nullarbor Barred Bandicoot is unknown. Environmental surveys found the pastures in the Nullarbor in poor condition by the beginning of the 20th century, with fire recorded as a major cause (Gillieson et al. 1996). Later surveys recorded serious erosion and habitat degradation in over 77 percent of surveyed areas (McKenzie & Robinson 1987). However, Johnson (2006) believed that a change in fire regime made little direct contribution to mammal extinctions, with declines related to increased predator activity after fire, rather than the fire itself (Leahy et al. 2015; McGregor et al. 2015; Hradsky et al. 2017).</p>

Status: “historical/ current/ future” – identify the temporal nature of the threat
 Confidence: “suspected/ inferred/ known” – identify the extent to which we have confidence about that threat
 Consequence: “severe/ moderate/ low/ unknown” – identify the severity of that threat
 Trend: “decreasing/ static / increasing / unknown” – identify the extent to which it will continue to operate on the species
 Extent: “across the entire range/across part of its range / unknown.” – identify its spatial context

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

The Nullarbor Barred Bandicoot is known from specimens collected prior to 1930 and from subfossil material found in caves on the Nullarbor Plain, and adjacent Roe Plain (Woinarski et al. 2014a). So little information is available on the Nullarbor Barred Bandicoot that the decade of extinction cannot be readily estimated. However, Woinarski et al. (2014a) put a likely extinction date of the late 1930s.

The Nullarbor Barred Bandicoot is listed Extinct under the *WA Biodiversity Conservation Act 2016* and not listed under the *South Australia National Parks and Wildlife Act 1972*, which are the only states the species was known to have inhabited. The Nullarbor Barred Bandicoot is listed Extinct in the Action Plan for Australian Mammals (Woinarski et al. 2014a) but has yet to be evaluated under the IUCN Red List.

Most of the biological knowledge of the Nullarbor has been obtained from collections or observations taken at particular localities, with biological surveys only conducted towards the end of the 20th century (McKenzie & Robinson 1987). The Nullarbor Barred Bandicoot was described by Wood-Jones (1924) but has not been recorded since its last known collection date in 1928. In particular, the Nullarbor Biological Survey, which included the Nullarbor Plain and the Roe Plain, failed to detect any Bandicoot species (McKenzie and Robinson 1984).

Declines and extirpation of Australian mammal species has been greatest in arid regions (McKenzie et al. 2007). Since the mid-20th century, almost 90 percent of WA arid zone mammals, in the critical weight range for predation (35-5500 g), have declined or gone extinct (Burbidge & McKenzie 1989). In particular, bandicoots and bilbies have suffering the greatest decline of all native mammals, with nearly half (eight out of 18 species) thought to be extinct (Ride & Wilson 1982 cited in Richards 2004; DAWE 2020), and the Nullarbor identified as having one of the highest rates of attrition (McKenzie et al. 2007).

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

Collective list of questions – your views

Information to aid listing assessment

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

Any other information

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

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