



## Consultation Document on Listing Eligibility

### *Perameles bougainville myosuros* (Marl)

You are invited to provide your views and supporting reasons related to the eligibility of *Perameles bougainville myosuros* (Marl) 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](mailto: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.**

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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/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 bougainville myosuros*

Marl

## **Taxonomy**

Conventionally accepted as *Perameles bougainville myosuros* Wagner, 1841.

Four subspecies of *Perameles bougainville* have been described (*P. b. myosuros* (Marl), *P. b. fasciata* (Liverpool Plains Striped Bandicoot), *P. b. notina* (South-eastern Striped Bandicoot), and *P. b. bougainville* (Shark Bay Bandicoot)) (Woinarski et al. 2014a). Only the Shark Bay Bandicoot, also known as the Western Barred Bandicoot, is known to be extant. Few preserved specimens of the three extinct subspecies are available for examination and subsequently there has been difficulty in describing the taxonomy of this group (Woinarski et al. 2014a; Travouillon & Phillips 2018).

Travouillon & Phillips (2018) believe that the subspecies are sufficiently distinct to warrant elevation to full species status but deferred from doing so until further genetic examination is conducted to confirm the suspected divergence. In an update to the *Action Plan for Australian Mammals 2012* that included newly-described taxa, Woinarski et al. (2014a) revised all four, raising them to full species status. However, as Travouillon & Phillips (2018) did not formally change the taxonomic status, the Australian Faunal Directory still recognises the subspecies level.

## **Species/Sub-species Information**

### **Description**

From available descriptions and specimens, the Marl resembled the other subspecies of *Perameles bougainville*. Gould (1863) described the Marl as having a grey-brown colour when viewed from above, with the sides of the muzzle, feet, and ventral surface an off-white. A broad, indistinct, dark band was visible across the flanks, just above the hind-limbs, and a saddle-like mark discernible on the centre of the back. The fore-limbs were brownish-grey. The tail was two-toned, being dark brown above and off-white below. The ears were proportionally quite long (average 35 mm), and tricoloured (rusty-red near the base, turning to dark brown, with the apex a light grey-brown).

Few body measurements are available for the Marl, with only skull, ear, hind-foot, and tail length recorded. These measurements correspond to those of the other subspecies of *Perameles bougainville* (being on the larger end of the scale) (Travouillon & Phillips 2018), giving the likelihood that it was similarly small and lightly built. For comparison, the slightly smaller 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 Marl averaged 102 mm, and the hind-foot 55 mm. Unique amongst the *Perameles bougainville* subspecies, the female was distinctively larger than the male (Travouillon & Phillips 2018).

### **Distribution**

The Marl is known from specimens collected in Western Australia (WA), including the Wheatbelt on the south-west, and near coastal areas of the Nullarbor Plain (Woinarski et al. 2014a; Travouillon & Phillips 2018).

The Wheatbelt of WA formerly had extensive eucalypt woodland but, since European settlement, it now occurs in mostly small, scattered remnants. Other than eucalypt woodland, the most extensive vegetation types are shrubland and mallee scrub communities, dominated by mallee eucalypts or species of *Acacia*, *Casuarina* or *Melaleuca* (DoEE 2016). The vegetation of coastal areas of the Nullarbor Plain differs from inland areas (consists mainly of chenopod species), being predominantly open myall woodlands, interspersed with eucalyptus shrubs (McKenzie et al. 1989).

## Extinction date

The presumed extinction date of the Marl is around 1910 (Woinarski et al. 2014a).

## Relevant Biology/Ecology

Gould (1863) provides an account of the Marl from observations in the mid-19th century. This account can be expanded on from the ecology 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, whose historical distribution range included mainland WA (Travouillon & Phillips 2018).

Gould (1863) observed the Marl in dense scrub, particularly seedlings of *Casuarina* species (Ironwoods). The Marl excavated much of its food, which consisted of insects, seed and grain. When alarmed, it would seek shelter in hollow trunks of fallen trees, and excavated holes in the earth. The Marl sheltered during the day in compact nests (constructed from grasses and other plant material), concealed in hollows on the ground.

More generally, bandicoots are nocturnal and solitary, with males occupying a larger home range than females. The home range for the Shark Bay Bandicoot is 2.5–14.2 ha for males and 1.4–6.2 ha for females. Bandicoots shelter during the day in concealed nests, constructed from grasses and other vegetation, made in small hollows under shrubs (Richards 2004). Foraging at night, bandicoots feed predominantly on insects and their larvae, but they are opportunistic feeders and will also consume fruit, berries, seeds, and fungi. Prey is either dug out of the soil or gleaned from the surface (Lerner & Wilmoth 2014).

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 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-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 Marl 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"><li>– Status: Historical</li><li>– Confidence: Suspected</li><li>– Consequence: Severe</li><li>– Extent: Across the entire range</li></ul>	<p>Feral cats are thought to have been present throughout the distribution range of the Marl by 1890–1900 (Abbott 2008b), with cats found to be widespread and common in later surveys (McKenzie &amp; 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 &amp; Quin 1996; Woinarski et al. 2014c; Hardman et al. 2016; Davies et al. 2017; Radford et al. 2018; Woolley et al. 2019), with vertebrate prey up to four kg taken (DoE 2015). Woinarski et</p>

		<p>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 &amp; 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"> <li>– Status: Historical</li> <li>– Confidence: Suspected</li> <li>– Consequence: Severe</li> <li>– Extent: Across the entire range</li> </ul>	<p>The European red fox arrived in the Nullarbor around 1915, and continued westward through the Wheatbelt to Geraldton, WA by 1925 (King &amp; Smith 1985; Richards &amp; Short 1996).</p> <p>The presumed extinction date of the Marl pre-dates the arrival of the red fox. However, if remnant populations were still extant at that time, the arrival of foxes would have impacted their survival. 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 &amp; 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 livestock	<ul style="list-style-type: none"> <li>– Status: Historical</li> <li>– Confidence: Suspected</li> <li>– Consequence: Severe</li> <li>– Extent: Across the entire range</li> </ul>	<p>Stock grazing in WA began in the mid-19th century, and by 1930 almost all of the semi-arid and arid western half of WA were under pastoral lease (van Etten 2013).</p> <p>Grazing by stock removes shrub cover (Dennis 2001; McDowell et al. 2015) that may have limited the ability of the Marl 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 Marl, like other bandicoot species, likely excavated much of its food, which would have been more difficult following the arrival of stock.</p>
Habitat degradation and resource depletion by introduced European rabbits ( <i>Oryctolagus cuniculus</i> )	<ul style="list-style-type: none"> <li>– Status: Historical</li> <li>– Confidence: Suspected</li> <li>– Consequence: Severe</li> <li>– Extent: Across the entire range</li> </ul>	<p>By 1910, the European rabbit was recorded throughout the distribution range of the Marl (Fenner 2010).</p> <p>Rabbits compete with native fauna for food and degrade the habitat by intensively grazing on native vegetation and ringbarking trees (Richards 2004). 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 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</p>

		defences to avoid detection or capture (Richards 2004; Pedler et al. 2016; Radford et al. 2018).
Fire		
Change in fire regime	<ul style="list-style-type: none"> <li>– Status: Historical</li> <li>– Confidence: Suspected</li> <li>– Consequence: Unknown</li> <li>– Extent: Across the entire range</li> </ul>	The degree to which a change in fire regime impacted the Marl is unknown. 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 and not the fire itself (Leahy et al. 2015; McGregor et al. 2015; Hradsky et al. 2017).

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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 Marl is known from specimens collected from 1818-1906, predominantly from the south-west of WA, east of a line joining Geraldton, Toodyay, Katanning, Cranbrook and Bremer Bay (Abbott 2008a).

The Marl was noted as disappearing rapidly around 1890 (Abbott 2008a) and has a presumed extinction date of around 1910 (Woinarski et al. 2014a). The Marl is listed Extinct under the WA *Biodiversity Conservation Act 2016*, the only state the species was known to have inhabited. The Marl 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. The Marl has not been recorded in biological surveys in WA (DEWNR 2009), including surveys conducted in the WA Wheatbelt (Kitchener et al. 1980) and the Nullarbor (McKenzie & Robinson 1987).

Declines and extirpation of native mammal species have 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). Of the four subspecies of *P. bougainville* that have been described, only the Shark Bay Bandicoot is known to be extant, and is now restricted to predator-free, off-shore islands and mainland fenced enclosures (Woinarski et al. 2014b; Legge et al. 2018).

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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