The Minister approved this listing advice and included this species in the Extinct category, effective 03/03/2021

Listing Advice

Perameles notina

South-eastern Striped Bandicoot

Taxonomy

Conventionally accepted as *Perameles notina* Thomas, 1922.

As part of a subspecies complex, *Perameles notina* (South-eastern Striped Bandicoot) was previously described as *Perameles bougainville notina*. This complex consisted of three extinct species: the South-eastern Striped Bandicoot, *P. fasciata* (Liverpool Plains Striped Bandicoot) (previously *P. b. fasciata*), and *P. myosuros* (Marl) (previously *P. b. myosuros*), together with the extant *P. b. bougainville* (Shark Bay Bandicoot). Recently, Travouillon & Phillips (2018) revised the taxonomy, elevating the three extinct species to full species level, stating that they are sufficiently distinct to warrant elevation. This revision is recognised by the Australian Faunal Directory.

Summary of assessment

Conservation status

Following a listing assessment of the South-eastern Striped Bandicoot, the Threatened Species Scientific Committee (the Committee) has determined that there is sufficient evidence to list the South-eastern Striped Bandicoot in the Extinct category under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Species can be listed 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 listing assessment by the Threatened Species Scientific Committee

This advice follows assessment of new information provided to the Committee to list species included in the former *Perameles bougainville* subspecies complex.

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 31 business days between 31 July 2020 and 11 September 2020. Any comments received that were relevant to the listing of the species were considered by the Committee as part of the assessment process.

Species/sub-species information

Description

The South-eastern Striped Bandicoot resembled the other bandicoots in the former *Perameles bougainville* subspecies complex. However, there are few preserved specimens of the species available for examination, making it difficult to describe in detail (Woinarski et al. 2014b; Travouillon & Phillips 2018).

From the available descriptions, the fur was grizzled and brown-grey in colour from above, becoming a darker brown-black colour on the hindquarters. On the rump, three broad, golden-brown bars radiated downwards over the sides of the body from the back, interrupted at

the midline. From below, the fur was mostly grey with patches of cream. The tail and forelimbs were grey. The feet were also grey and elongated, with the three inner toes large, while the outer toes were reduced. The toe-pads were pronounced and hairless. The muzzle was slender and long. Dark whiskers were present at the front of the snout, above the eye, and on the cheek below the eye. The ears were quite long (average 38 mm) and absent of any markings (Thomas 1922; Travouillon & Phillips 2018). Few body measurements are available for the South-eastern Striped 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) (Travouillon & Phillips 2018), suggesting that it was similarly small and lightly built. No head-body length or weight is recorded, but the Shark Bay Bandicoot has an average head-body length of 236 mm and weight of 244 g (Friend 2008).

Distribution

The South-eastern Striped Bandicoot was distributed from south-east South Australia (SA) through to all parts of the Murray River, flowing through Victoria and New South Wales (NSW) (Krefft 1866; Thomas 1922; Woinarski et al. 2014a). There are five records of the South-eastern Striped Bandicoot in the Atlas of Living Australia, all within the Murray and Darling Rivers junction, with locations identified as Mildura, Victoria and Gannawarra, Victoria.

Gould (1863) described the habitat of a banded *Perameles* species he encountered in SA (identified as the Liverpool Plains Striped Bandicoot but, given the location, more likely the South-eastern Striped Bandicoot) as the stony ranges in the open plains of SA.

Extinction date

The extinction date is unknown. The species was last collected in 1857 (Woinarski et al. 2014a).

Relevant biology/ecology

Little is known about the South-eastern Striped Bandicoot. However, its ecology can be surmised from other known bandicoot species, which (notwithstanding their wide range of habitats) are considered an ecologically uniform group (Stodart 1977). Therefore, behaviours are likely to have been shared with the better known Shark Bay Bandicoot.

Bandicoots are mainly 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 an 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 are recorded ranging from one to four (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, young are covered with short hair and the eyes are open (Lerner & Wilmoth 2014). The Shark Bay Bandicoot has been recorded to live for over four years (Friend 2008).

Threats

The causes of decline and extinction of the South-eastern Striped Bandicoot are unknown. However, likely contributing factors are surmised from threats known to have occurred shortly after European settlement in Australia. The assumption has been made that threats that affect many bandicoot species would also have impacted on the South-eastern Striped Bandicoot.

Table 1: Probable causes of decline towards extinction for the South-eastern Striped Bandicoot in approximate order of impact, based on available evidence.

Threat factor	Threat type and status	Evidence base
Introduced predators		
Predation by feral cats (*Felis catus*)	Suspected past	Feral cats are thought likely to have been present throughout the historical distribution range of the South-eastern Striped Bandicoot prior to the mid-19th century (Abbott 2008b). 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; Woinarski et al. 2015; Hardman et al. 2016; Davies et al. 2017; Radford et al. 2018; Woolley et al. 2019), with vertebrate prey up to four kg taken (Fancourt 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 do not utilise shelter like arboreal, rock-dwelling, or burrowing mammals. 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 (*Vulpes vulpes*) 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 fox free islands and mainland fenced enclosures (Legge et al. 2018). Intense fire and heavy grazing can amplify the impacts of predation on small and medium-sized mammals by reducing ground cover (Smith & Quinn 1996; Leahy et al. 2015). The number of predators attracted to the burnt area (Hradsky et al. 2017), 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 fire and grazing. Therefore, the threat from predation would have increased as livestock and introduced herbivores like rabbits spread through parts of the species' distribution.

Predation by European red fox (*Vulpes vulpes*)	Suspected past	The European red fox was released in Melbourne in the 1860s (Coman 1973) and arrived in mainland SA shortly after 1870. Predation by foxes 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; Woinarski et al. 2015; Radford et al. 2018) and was identified by Smith & Quin (1996) as having a significant impact on small isolated populations of threatened species, being able to eliminate them even at low densities. As identified above, the likely impact from predation by foxes can be deduced from conservation efforts for the Shark Bay Bandicoot. As identified above, fire and heavy grazing by introduced herbivores can amplify the impacts of predation on small and medium-sized mammals (Leahy et al. 2015; McGregor et al. 2015; Hradsky et al. 2017).
Habitat loss and fragmentation		
Habitat degradation and resource depletion by livestock	Suspected past	Stock grazing began in the 19th century, predominantly in the semi-arid and temperate south-east region of Australia (Johnson 2006), with overstocking hastening the demise of native species (Tunbridge 1993; Robinson et al. 2000; Johnson 2006). In particular, a rapid decline in small-medium sized native mammals was observed in the lower Murray-Darling region in 1856, which coincided with the arrival of stock (Menkhorst 2009). In SA, temperate forests were mostly cleared during the 19th and early 20th centuries (Szabo et al. 2011 cited in Bradshaw 2012); in Victoria, about 66 percent of native vegetation has been cleared, mostly prior to the 1890s (Bradshaw 2012); and in NSW, most of the arid and semi-arid inland areas were occupied by stock by 1878 (Condon 1978 cited in Dickman 1993; Lunney 2001). Grazing by stock removes shrub cover (Dennis 2001; McDowell et al. 2015) that may have limited the ability of the South-eastern Striped 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). Trampling by stock compacts and powders topsoil, renders soil too loose for digging (Dickman 1993). The South-eastern Striped

		Bandicoot, like other bandicoot species, likely excavated much of its food, which would have been more difficult following the arrival of stock.
Habitat degradation and resource depletion by introduced European rabbits (*Oryctolagus cuniculus*)	Suspected past	The European rabbit was released into Victoria in 1859, and by the 1880s, it was recorded throughout the known historical distribution range of the South-eastern Striped Bandicoot (Fenner 2010). Rabbits compete with native fauna for food and degrade the habitat by intensively grazing on 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 bandicoots to construct nests for protection from predators and extremes of temperature, and limited foraging sites for their invertebrate diet (Richards 2004). Rabbits, with high standing biomass and high rate of increase, provide abundant prey for predators as native mammal species decline. Therefore, rabbit presence supports elevated predator populations and predation pressures on native species. Also, native species are easier to catch, being without the appropriate behavioural or morphological defences to avoid detection or capture by introduced predators (Richards 2004; Pedler et al. 2016; Radford et al. 2018).
Fire		
Change in fire regime	Suspected past	The degree to which a change in fire regime impacted the South-eastern Striped Bandicoot is unknown. Johnson (2006) believed that a change in fire regime (following European settlement) 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). However, it is possible that shifts in fire regimes towards more extensive and intense fire could have reduced the heterogeneity of available food resources.

How judged by the Committee in relation to the EPBC Act criteria and regulations

The South-eastern Striped Bandicoot is assessed by the Committee to be eligible for listing as Extinct under the EPBC Act. A native species is eligible to be included in the Extinct category if there is no reasonable doubt that the last member of the species has died.

The South-eastern Striped Bandicoot was predominantly collected in SA, with the species thought to have been distributed from south-east SA through to all parts of the Murray River

flowing through Victoria and NSW (Krefft 1866; Thomas 1922; Woinarski et al. 2014a). The species was last collected in 1857 and has not been recorded since in biological surveys conducted in its known distribution range (Dickman et al. 1993; DEWNR 2009; Harris 2016). However, this may be (in part) due to the South-eastern Striped Bandicoot being synomysed with the Shark Bay Bandicoot up until it was recognised as a separate subspecies in 1922 (and later a full species in 2018), which is post the last recorded collection date of the species. The species is not recorded in the Atlas of Living Australia or the NSW BioNet database. However, the Victorian Biodiversity Atlas has four records (dated 1857) and identifies the species as extinct.

Bandicoots and bilbies (family: *Peramelidae*) have suffered the greatest decline of all Australian native mammals (Ride & Wilson 1982, cited in Richards 2004; Menkhorst & Seebeck 1990). Nearly half (seven out of 16 species) are nationally extinct (DAWE 2020), while in SA, three-quarters (six out of eight) are state extinct (Robinson et al. 2000), and in Victoria, half (three out of six) are state extinct (Menkhorst & Seebeck 1990; Seebeck & Menkhorst 2000). In addition, the South-eastern Striped Bandicoot was previously grouped in a subspecies complex together with three other bandicoot species (see Taxonomy section). Three of these species are extinct, and the remaining taxon (Shark Bay Bandicoot) is now restricted to predator-free, off-shore islands and mainland fenced enclosures (Woinarski et al. 2014b; Legge et al. 2018).

The extended absence of the South-eastern Striped Bandicoot from the biological record, together with the observed catastrophic impact to native mammals from the spread of introduced species (predators and herbivores) and habitat loss and degradation (all of which began around the mid-19th century and continue to modern-day), and the recorded decline and extinction of other bandicoot species, leaves no reasonable doubt that the last individual of the species has died. Therefore, the species has met the relevant requirement to make it eligible for listing as Extinct.

The South-eastern Striped Bandicoot is not listed under legislation in all three states that comprise the known distribution range: SA (*South Australia National Parks and Wildlife Act 1972*), Victoria (*Advisory List of Threatened Vertebrate Fauna in Victoria 2013*), and NSW (*Biodiversity Conservation Act 2016*). The South-eastern Striped 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.

Recommendations

The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **including** in the list in the Extinct category: *Perameles notina.*

Threatened Species Scientific Committee

24/09/2020

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