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Notice of and reasons for the Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to list the southern long-nosed potoroo *Potorous tridactylus trisulcatus* (McCoy, 1865) as a VULNERABLE SPECIES in Part 3 of Schedule 1 of the Act. Listing of Vulnerable species is provided for by Part 4 of the Act.

The NSW Threatened Species Scientific Committee is satisfied that the southern long-nosed potoroo *Potorous tridactylus trisulcatus* (McCoy, 1865) has been duly assessed by the Commonwealth Threatened Species Scientific Committee under the Common Assessment Method, as provided by Section 4.14 of the Act. After due consideration of DCCEEW (2022), the NSW Threatened Species Scientific Committee has made a decision to list the species as Vulnerable.

Summary of Conservation Assessment

The southern long-nosed potoroo *Potorous tridactylus trisulcatus* (McCoy, 1865) was found to be Vulnerable in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.2(1 c)(2 c,e) and Clause 4.3(c)(d)(e i,ii,iii,iv) because: 1) a moderate population reduction of 36–46% in the number of mature individuals has been estimated as a result of adverse fire regimes, habitat degradation, and predation by introduced apex predators over a three-generation timespan (12 years); 2) the subspecies has a moderately restricted geographic distribution with an area of occupancy (AOO) of 1,856 km²; 3) the subspecies is considered to be severely fragmented; and 4) there is an estimated and inferred continuing decline in AOO, habitat quality, number of threat-defined locations, and number of mature individuals from adverse fire regimes and predation from introduced apex predators.

The NSW Threatened Species Scientific Committee has found that:

1. The southern long-nosed potoroo *Potorous tridactylus trisulcatus* (McCoy, 1865) (family Potoroidae) is one of three subspecies of the long-nosed potoroo *Potorous tridactylus* (Kerr, 1792). The long-nosed potoroo is a compact, medium-sized marsupial with a maximum body and head length of 31–34 cm, a tail length of 23 cm and a weight range of 660–1640 g (Johnston 2008). The hind limbs are 85–88 mm long and well developed, enabling the animals to hop at great speeds. Their forearms are shorter and muscular with short, strong claws, well adapted to digging. The species has small, rounded ears, large eyes, and, as its name suggests, a long muzzle with a bare tip. The body has two fur layers, a soft, short dark grey fur on the back with coarser hair protruding from it and which can range in colour from yellow-white to brown with a black tip. The underside of the animal is covered in coarse white fur, with a grey base layer. Females have a well-developed pouch that opens anteriorly and contains four mammae (Johnston 2008).

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2. The three subspecies of the long-nosed potoroo *Potorous tridactylus* are *P. t. tridactylus*; *P. t. trisulcatus* (McCoy, 1865) and *P. t. apicalis* (Gould, 1851). Each was originally described as a valid species. Taxonomic division of *Potorous tridactylus* into northern and southern subspecies is supported by three mitochondrial and four nuclear genetic markers (Frankham *et al.* 2012; Frankham *et al.* 2016; ABRS 2020). The Tasmanian long-nosed potoroo, *P. t. apicalis*, occurs on the Tasmanian mainland and islands of the Bass Strait (Frankham *et al.* 2020), while the two mainland subspecies, the northern long-nosed potoroo *P. t. tridactylus* and the southern long-nosed potoroo, *P. t. trisulcatus*, occur on the south-eastern mainland of Australia. *Potorous tridactylus trisulcatus* has a smaller average body size than *P. t. tridactylus*, and typically weighs under one kilogram (Norton *et al.* 2010; Frankham *et al.* 2011). *Potorous tridactylus trisulcatus* also has a longer and thinner muzzle than the northern subspecies. A white tip to the tail is seen more often in southern subpopulations (Johnston and Sharman 1976).
3. *Potorous tridactylus trisulcatus* has a broad and highly fragmented distribution. It occurs between the Great Dividing Range (generally up to 800 m above sea level) and the coastal plains. The species is restricted to habitats receiving an annual rainfall greater than 760 mm (Seebeck 1981; Johnston 2008). The most northern records of occurrence are at Barren Grounds Nature Reserve and Budderoo National Park in New South Wales (Norton *et al.* 2010; NSW Office of Environment and Heritage 2016). The subspecies occurs in isolated habitat patches along the coastal plains of southern New South Wales and Victoria and inland to the slopes and foothills of the Great Dividing Range. One island population exists at French Island in Western Port Bay, Victoria.
4. The Extent of Occurrence (EOO) for *Potorous tridactylus trisulcatus* is estimated at 216,962 km², and the Area of Occupancy (AOO) is estimated at 1,856 km². Contracting EOO is evidenced in the literature (Woinarski *et al.* 2014), with the entire population historically widespread and now persisting in a comparatively small area. The EOO is likely to continue contracting due to loss of suitable habitat resulting from further land clearing and fragmentation, exacerbated by events such as the 2019–20 bushfires.
5. Prior to the 2019-20 bushfires, the estimated population of *Potorous tridactylus trisulcatus* was 20,000 (range 18,000–254,000) mature individuals, based on expert opinion in The Action Plan for Australian Mammals 2012 (Woinarski *et al.* 2014).
6. Long-nosed potoroos are mainly nocturnal and utilise dense vegetative cover, making them difficult to survey (Norton *et al.* 2010). There have not been any robust estimates of population size for any of the three subspecies of the long-nosed potoroo (Martin and Temple-Smith 2012; Woinarski *et al.* 2014). Subpopulations of *Potorous tridactylus trisulcatus* are typically small, ranging in abundance from 23 (Long 2001) to 180 individuals (Bennett 1987). Capture rates indicate that the coastal subpopulations are more abundant than other subpopulations (DCCEEW 2022). Although *P. t. trisulcatus* lives in fire-prone

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habitats, forest patches with a fire-free period of more than 20 years were found to have the greatest abundance of *P. t. trisulcatus* (Claridge *et al.* 2000; Martin and Temple-Smith 2012). *Potorous tridactylus trisulcatus* numbers decrease rapidly post-fire (Catling *et al.* 2001). They tend to recover slowly until the forest canopy recovers, at which point recovery can be positively associated with both tree canopy cover and rainfall (Catling *et al.* 2001; Arthur *et al.* 2012), and negatively associated with the post-fire presence of the European red fox *Vulpes vulpes* (Arthur *et al.* 2012).

7. In general, *Potorous tridactylus trisulcatus* occurs in a range of vegetation types from coastal scrub and heathy woodland to wet sclerophyll forest and rainforest (Norton *et al.* 2010; Andren *et al.* 2013; Trent 2015). Subpopulations are often separated by large areas of unsuitable habitat (Seebeck 1981; Short 1998; Frankham *et al.* 2016). The optimum habitat has a dense understorey layer to provide cover, but with sufficient open space beneath the sub-canopy to allow foraging (Norton *et al.* 2010; Andren *et al.* 2013). In Naringal, Victoria, *P. t. trisulcatus* occurred often in patches with ground covers of either *Pteridium*, *Lepidosperma* or *Tetrarrhena* species (Bennett 1990b). The subspecies has often been recorded in gullies and near creeks, which may provide refuge during fire and drought (Seebeck 1981; Claridge *et al.* 1993; Martin and Temple-Smith 2012). Habitat patch size is important, as the long-nosed potoroo rarely occurs in remnant vegetation patches smaller than 0.1 km². Martin and Temple-Smith (2012) report that whilst some occurrences are in habitats of 0.16–0.40 km², most occurrences are in habitats 0.41–1 km².
8. All subspecies of the long-nosed potoroo are omnivorous, feeding on fruits, seeds, leaves, roots and flowers, and invertebrates (Bennett and Baxter 1989). The most significant food source (contributing between 30–90% of the diet) is sporocarps of hypogean fungi (i.e. fruiting bodies of underground fungi) (Claridge *et al.* 1993; Claridge and Cork 1994). *Potorous tridactylus trisulcatus* are nocturnal feeders, locating the underground fungi by smell and digging them up with their sharp front claws, leaving characteristic diggings in the soil (Martin and Temple-Smith 2012). The diet of *P. t. trisulcatus* varies seasonally. *Potorous tridactylus trisulcatus* feeds on underground fungi less in spring and summer and more in autumn and winter (Claridge *et al.* 1993), when fungi contribute as much as 80–90% of *P. t. trisulcatus* diet (Tory *et al.* 1997). These studies suggest underground fungi are an essential dietary item for the subspecies, and the ecological processes surrounding the consumption of fungi are also crucial for forest health.
9. Long-nosed potoroos become sexually mature at one year of age, producing a single young that remains with the mother for four months (Johnston 2008). Mature adults have between two and three offspring per year (Seebeck *et al.* 1989; Woinarski *et al.* 2014). They may breed throughout the year but more frequently in late winter to early spring and late summer (Johnston 2008). The species has a promiscuous genetic mating system, though with some repeat paternity (Frankham *et al.* 2012). The long-nosed potoroo lives up to seven years in the wild and can survive up to 12 years in captivity (Johnston 2008).

10. The main threats to *Potorous tridactylus trisulcatus* are adverse fire regimes; habitat loss and fragmentation; predation by invasive species, particularly European red foxes *Vulpes vulpes* and feral cats *Felis catus*; and habitat degradation including loss of food resources due to plant pathogens (DCCEEW 2022). 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition', 'Clearing of native vegetation', 'Predation by the European red fox *Vulpes Vulpes* (Linnaeus, 1758)', 'Predation by the feral cat *Felis catus* (Linnaeus, 1758)', 'Infection of native plants by *Phytophthora cinnamomi*', 'Introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae' and 'Competition and habitat degradation by feral pigs *Sus scrofa* (Linnaeus, 1758)' are listed as Key Threatening Processes under the Act.
11. *Potorous tridactylus trisulcatus* is considered to occur in 5–10 threat-defined locations considering the threat of adverse fire regimes. The minimum plausible value for the number of threat-defined locations is five based on the recent effects of the 2019–2020 bushfires, which burnt 57% of the plausible distribution (Legge *et al.* 2021) and is projected to have caused an immediate loss of 36% of the population within a year (Legge *et al.* 2021). Given that bushfires are predicted to increase in frequency and intensity under climate change scenarios (CSIRO and Bureau of Meteorology 2015), it is reasonable to predict that the available habitats offering optimum habitat (including those which are 20+ years unburnt) will decrease in number. Thus, the maximum number of threat-defined locations is considered to be less than ten.
12. Continuing decline is estimated and inferred in the AOO, the habitat quality, number of locations, and the number of mature individuals of *Potorous tridactylus trisulcatus* from adverse fire regimes, habitat loss and fragmentation, predation by invasive species, particularly European red foxes and feral cats, and habitat degradation (due to, for example, forestry activities, livestock, feral herbivores and weeds). The preferred food source of *P. t. trisulcatus* (underground fungi) is at risk from additional threats, including decreasing annual precipitation, consumption by native and feral species, and forest dieback from either *Phytophthora cinnamomi*, myrtle rust (*Austropuccinia psidii*) or other causes. Threats can operate synergistically and be cumulative, e.g., inappropriate fire management can result in loss of refugial habitats, loss of shallow subsurface food resources, and increased exposure to predation. The sequence of events is also likely to be important, as increased foraging activities into open post-burnt areas by *P. t. trisulcatus* can co-occur with an increase in predator activity, which may increase threats to a point where subpopulations disappear entirely (see Robley *et al.* 2016).
13. *Potorous tridactylus trisulcatus* populations are predicted to have declined 36% (and as much as 46%) in the year following the 2019–2020 bushfires (Legge *et al.* 2021). In the three generations (12 years) following the bushfires, populations are predicted to decline by 33%, but potentially by as much as 56%

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(Legge *et al.* 2021). This estimate does not include the potential for future catastrophic bushfires, as may be expected under climate change (CSIRO and Bureau of Meteorology 2015).

14. Due to the effects of the above threats, *Potorous tridactylus trisulcatus* is estimated to have undergone a moderate reduction in the number of mature individuals over three generations (c. 12 years) and the causes, especially adverse fire regimes, habitat loss, and predation from introduced species, have not ceased.
15. *Potorous tridactylus trisulcatus* (McCoy, 1865) is not eligible to be listed as an Endangered or Critically Endangered species.
16. *Potorous tridactylus trisulcatus* (McCoy, 1865) is eligible to be listed as a Vulnerable species as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing a high risk of extinction in Australia in the medium-term future as determined in accordance with the following criteria as prescribed by the *Biodiversity Conservation Regulation 2017*:

Assessment against *Biodiversity Conservation Regulation 2017* criteria

The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome: Vulnerable under Clause 4.2(1 c)(2 c,e) and Clause 4.3(c)(d)(e i,ii,iii,iv)

Clause 4.2 – Reduction in population size of species (Equivalent to IUCN criterion A)

Assessment Outcome: Vulnerable under Clause 4.2(1 c)(2 c,e)

(1) - The species has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of the taxon:			
	(a)	for critically endangered species	a very large reduction in population size, or
	(b)	for endangered species	a large reduction in population size, or
	(c)	for vulnerable species	a moderate reduction in population size.
(2) - The determination of that criteria is to be based on any of the following:			
	(a)	direct observation,	
	(b)	an index of abundance appropriate to the taxon,	
	(c)	a decline in the geographic distribution or habitat quality,	
	(d)	the actual or potential levels of exploitation of the species,	
	(e)	the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.	

Clause 4.3 – Restricted geographic distribution of species and other conditions

(Equivalent to IUCN criterion B)

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Assessment Outcome: Vulnerable under Clause 4.3(c)(d)(e i,ii,iii,iv)

The geographic distribution of the species is:		
(a)	for critically endangered species	very highly restricted, or
(b)	for endangered species	highly restricted, or
(c)	for vulnerable species	moderately restricted.
and at least 2 of the following 3 conditions apply:		
(d)	the population or habitat of the species is severely fragmented or nearly all the mature individuals of the species occur within a small number of locations,	
(e)	there is a projected or continuing decline in any of the following:	
	(i)	an index of abundance appropriate to the taxon,
	(ii)	the geographic distribution of the species,
	(iii)	habitat area, extent or quality,
	(iv)	the number of locations in which the species occurs or of populations of the species.
(f)	extreme fluctuations occur in any of the following:	
	(i)	an index of abundance appropriate to the taxon,
	(ii)	the geographic distribution of the species,
	(iii)	the number of locations in which the species occur or of populations of the species.

Clause 4.4 – Low numbers of mature individuals of species and other conditions

(Equivalent to IUCN criterion Clause C)

Assessment Outcome: Not met.

The estimated total number of mature individuals of the species is:		
(a)	for critically endangered species	very low, or
(b)	for endangered species	low, or
(c)	for vulnerable species	moderately low.
and either of the following 2 conditions apply:		
(d)	a continuing decline in the number of mature individuals that is (according to an index of abundance appropriate to the species):	
	(i)	for critically endangered species very large, or
	(ii)	for endangered species large, or
	(iii)	for vulnerable species moderate,
(e)	both of the following apply:	
	(i)	a continuing decline in the number of mature individuals (according to an index of abundance appropriate to the species), and
	(ii)	at least one of the following applies:
	(A)	the number of individuals in each population of the species is:
		(I) for critically endangered species extremely low, or
		(II) for endangered species very low, or
		(III) for vulnerable species low,
	(B)	all or nearly all mature individuals of the species occur within one population,

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		(C)	extreme fluctuations occur in an index of abundance appropriate to the species.
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Clause 4.5 – Low total numbers of mature individuals of species

(Equivalent to IUCN criterion D)

Assessment Outcome: Not met.

The total number of mature individuals of the species is:			
	(a)	for critically endangered species	extremely low, or
	(b)	for endangered species	very low, or
	(c)	for vulnerable species	low.

Clause 4.6 – Quantitative analysis of extinction probability

(Equivalent to IUCN criterion E)

Assessment Outcome: Data Deficient.

The probability of extinction of the species is estimated to be:			
	(a)	for critically endangered species	extremely high, or
	(b)	for endangered species	very high, or
	(c)	for vulnerable species	high.

Clause 4.7 – Very highly restricted geographic distribution of species–

vulnerable species

(Equivalent to IUCN criterion D2)

Assessment Outcome: Not met.

For vulnerable species,	the geographic distribution of the species or the number of locations of the species is very highly restricted such that the species is prone to the effects of human activities or stochastic events within a very short time period.
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NSW Threatened Species Scientific Committee

Supporting Documentation:

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2022). Conservation advice for *Potorous tridactylus trisulcatus* (Southern Long-nosed Potoroo). Australian Government, Canberra, ACT.

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