



Conservation Advice for *Perameles gunnii* Victorian subspecies (Eastern Barred Bandicoot (Mainland))

In effect under the *Environment Protection and Biodiversity Conservation Act 1999* from 29 September 2021.

This document provides a foundation for conservation action and further planning.



Perameles gunnii Victorian subspecies (Eastern Barred Bandicoot – Mainland) © Copyright, Museum Victoria's Catching the Eye Project (from Mount Rothwell Bioscan 2013)

Conservation status

Perameles gunnii Victorian subspecies (Eastern Barred Bandicoot (Mainland)) is listed in the Endangered category of the threatened species list under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act) effective from 16 July 2000. The species is eligible for listing because prior to the EPBC Act, it was listed as Endangered under the *Endangered Species Protection Act 1992* (Cwlth).

The main factors that make the species eligible for listing in the Endangered category are restricted and fragmented distribution, small population size and threats, such as invasive species, habitat loss, disturbance or modification, climate change, and disease.

Species can also be listed as threatened under state and territory legislation. For information on the current listing status of this species under relevant state or territory legislation, see the Species Profile and Threat Database.

Species information

Taxonomy

Conventionally accepted as *Perameles gunnii* Gray (1838).

A genetic distinction between the Eastern Barred Bandicoot on the mainland and Tasmania (TAS) has been reported (Robinson et al. 1993; Robinson 1995). This distinction is considered at least at the level commonly ascribed to subspecies (Maxwell et al. 1996). Some morphological differences have also been reported between mainland and Tasmanian subpopulations (George et al. 1990; Seebeck 2001). Although analysis by Westerman & Krajewski (2000) failed to support the differentiation, Clayton et al. (2006) and Woinarski et al. (2014a) recognise two distinct subspecies, *Perameles gunnii gunnii* (Eastern Barred Bandicoot (Tasmania)) and *Perameles gunnii* Victorian subspecies (Eastern Barred Bandicoot (Mainland)). However, there has not yet been a formal subspecies description or name applied to the mainland subpopulation (ABRS 2020).

Description

The Eastern Barred Bandicoot (Mainland) is a medium-sized, ground-dwelling marsupial. Adults weigh approximately 800 g, with a head-body length of approximately 300 mm and a tail length of approximately 110 mm. The dorsal fur is grey-brown to buff, while the underbelly, forefeet and upper hindfeet are creamy white. The hindquarters have three to four distinct, pale bars. This description is drawn from Seebeck (1979) and Brown (1989).

The Eastern Barred Bandicoot (Mainland) has a slightly smaller body size than the Eastern Barred Bandicoot (Tasmania) (Seebeck 2001). The Eastern Barred Bandicoot (Mainland) can be distinguished from *Perameles nasuta* (Southern Long-nosed Bandicoot) by the presence of distinct, pale bars on the hindquarters (Dickman & Stodart 2008). However, some Southern Long-nosed Bandicoots also have a faint barred pattern on the hindquarters (Dickman & Stodart 2008). The Eastern Barred Bandicoot (Mainland) can be distinguished from *Isodon obseulus* (Southern Brown Bandicoot) by a longer and more pointed muzzle and ears, as well as the barring on the body, which is absent in the Southern Brown Bandicoot (Seebeck & Menkhorst 2008).

Distribution

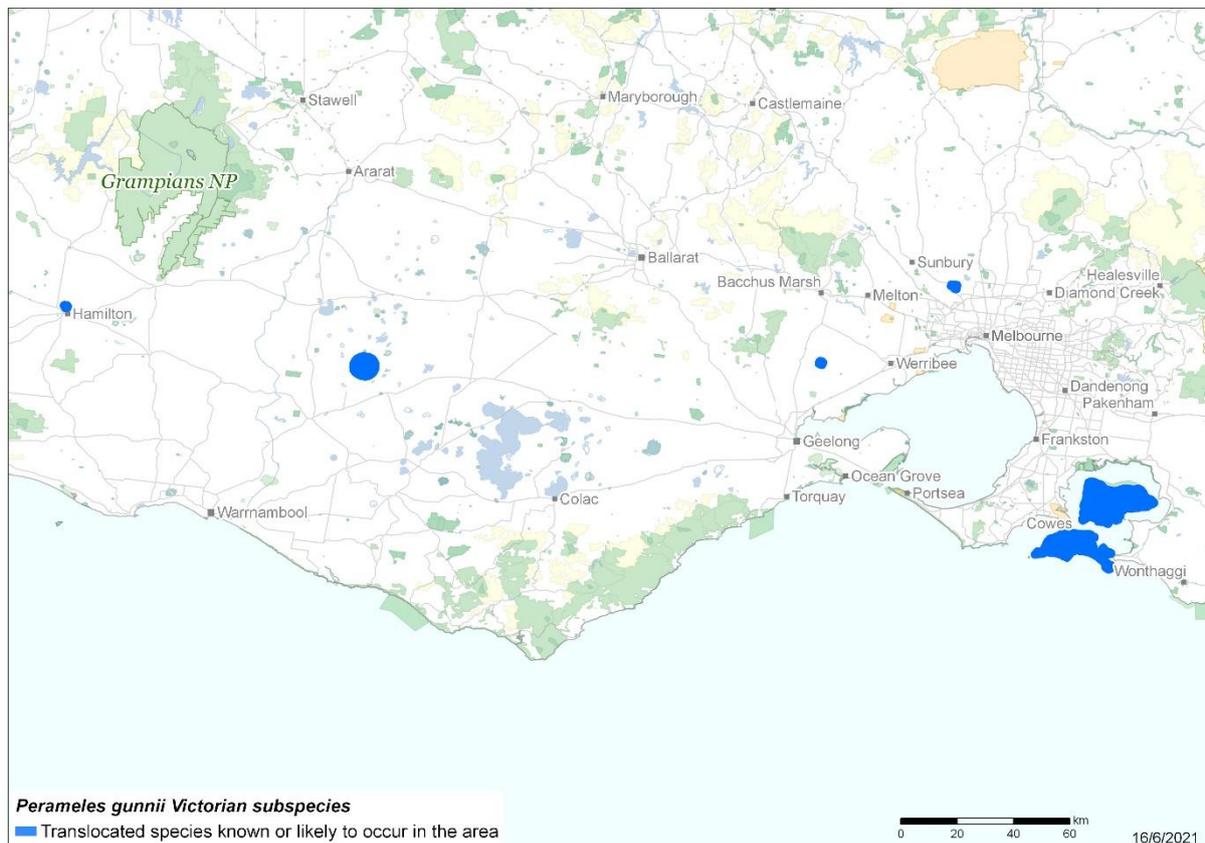
Historical distribution

The Eastern Barred Bandicoot (Mainland) is endemic to south-eastern Australia. Historically, its range extended from Melbourne, Victoria (Vic) to the far south-eastern corner of South Australia (SA), within the Victorian Volcanic Plain (Seebeck 1979; Brown 1989; Kemper 1990). However, since European colonisation, the Eastern Barred Bandicoot (Mainland) has undergone a widespread and catastrophic decline in range and abundance (Hill et al. 2010). The Eastern Barred Bandicoot (Mainland) is long extinct in SA, with the last specimen collected in the late 1800s (Kemper 1990). In Vic, it was still widespread and even common in some districts up until 1930 (Brown 1989). After 1930, there are far fewer records and they are restricted to a much smaller area in the western part of the range (Brown 1989). The last remaining wild subpopulation, near Hamilton in western Vic, was extirpated in approximately 2002 (Hill et al. 2010).

Current distribution

Since 2002, all wild subpopulations of Eastern Barred Bandicoot (Mainland) were presumed to be extinct (Hill et al. 2010). Since 1989, reintroductions have been attempted at eight sites within the former range of the Eastern Barred Bandicoot (Mainland) and three island sites outside of the historical range (Winnard & Coulson 2008; Hill et al. 2010; DELWP 2020). In 2021, there are four extant reintroduced subpopulations within the historical range, at Woodlands Historic Park (2.3 km²), Hamilton Community Parklands (1 km²), Mt Rothwell (4 km²) and Tiverton Station (with animals introduced to the last site in October 2020) (Winnard & Coulson 2008; Hill et al. 2010; DOE 2015a; DELWP 2021b). These subpopulations are all enclosed by predator-barrier fences (Winnard & Coulson 2008; Hill et al. 2010). There are also three extant introduced subpopulations outside the historical range, on Churchill Island, Phillip Island and French Island (Zoos Victoria 2019; DELWP 2020). Churchill Island is predator-free, however, French and Phillip Islands have established feral Cat (*Felis catus*) populations (DELWP 2020; DELWP 2021a).

Map 1 Modelled distribution of the Eastern Barred Bandicoot (Mainland)



Source: Species distribution data Species of National Environmental Significance_database, base map Geoscience Australia

Caveat: The information presented in this map has been provided by a range of groups and agencies. While every effort has been made to ensure accuracy and completeness, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein.

Species distribution mapping: The species distribution mapping categories are indicative only and aim to capture (a) the specific habitat type or geographic feature that represents to recent observed locations of the species (known to occur) or preferred habitat occurring in close proximity to these locations (likely to occur); and (b) the broad environmental envelope or geographic region that encompasses all areas that could provide habitat for the species (may occur). These presence

categories are created using an extensive database of species observations records, national and regional-scale environmental data, environmental modelling techniques and documented scientific research.

Cultural and community significance

Bandicoots feature in Dreaming Stories across Australia. Bandicoots were likely an important food source for Indigenous Peoples and incorporated into the social and ceremonial fabric of local Indigenous culture and tradition. The Eastern Barred Bandicoot (Mainland) currently or historically occurred on country owned by the following Traditional Owner groups:

- Bunurong Land Council Aboriginal Corporation (country intersects Churchill, Phillip and French Islands).
- Wurundjeri Tribe Land and Compensation Cultural Heritage Council (country intersects eastern part of range including Woodlands Historic Park).
- Wathaurung Aboriginal Corporation (country intersects eastern part of range including Mt Rothwell).
- Eastern Maar Aboriginal Corporation (country intersects mid part of range including 'Tiverton').
- Gunditj Mirring Traditional Owners Aboriginal Corporation (country intersects western part of range including Hamilton Community Parklands).
- Bunganditj or Boandik people (country includes the coastal area from the south of Robe, South Australia, to the area around the mouth of the Glenelg River at Nelson, Vic).

Indigenous names for the Eastern Barred Bandicoot (Mainland) include *Warron* in Koornkopanoot, Peek Woorroong and Keerray-Woorroong dialects in south-west Vic (Dawson 1881; Martin & Handasyde 1999), *Waiting/Wydung* in Jardwadjali dialect in country north-west of Hamilton (Thornley 1878; Blake 2011) and *Watjun/Wateun* in Djab Wurrung dialect in country north-east of Hamilton (Dawson 1881; Blake 2011).

Relevant biology and ecology

Habitat ecology

Eastern Barred Bandicoots (Mainland) have primarily been associated with native perennial tussock grasslands and grassy woodlands on the Victorian Volcanic Plain, particularly along watercourses (Seebeck 1979; Brown 1989; Dufty 1994). Historical records from SA indicate the subspecies occurred in open forest and scrubland (Kemper 1990). The last wild subpopulation occurred along a watercourse on the outskirts of Hamilton, in highly modified habitats, including tree plantations, farmland, gardens and parklands (Brown 1989; Dufty 1994). The Eastern Barred Bandicoot requires structurally complex habitats with dense cover for nesting, adjacent to more open areas suitable for feeding (Dufty 1991; Cook 2001). Eastern Barred Bandicoots (Mainland) establish in a wider range of habitat types within fox-free sites (Winnard et al. 2013). At reintroduction sites, bandicoot diggings were associated with *Acacia mearnsii* (Black Wattle), *Acacia paradoxa* (Hedge Wattle), *Acacia salicina* (Willow Wattle), *Themeda triandra* (Kangaroo Grass) and herbs, and negatively correlated with *Pteridium esculentum* (Bracken) and *Arthropodium strictum* (Chocolate Lily) (Cook 2001).

Eastern Barred Bandicoots (Mainland) appear to prefer areas with high soil moisture content, such as swampy depressions, poorly drained areas and along creek margins (Seebeck 1979; Dufty 1991). During periods of low rainfall, the species is reported to concentrate in areas of

higher soil moisture, possibly due to the higher abundance of invertebrates or ease of foraging in moist soil (Seebeck et al. 1990; Robinson et al. 1991).

Reproductive ecology and home range

The subspecies is short-lived and generally only survives for two to three years in the wild but is highly fecund (Seebeck & Menkhorst 2008). Females are capable of breeding from three months of age (Seebeck & Menkhorst 2008), giving a generation length of one to two years (Woinarski et al. 2014a). Gestation lasts 12.5 days, with an average litter size of two to three young, although litters of up to five young are observed occasionally (Seebeck & Menkhorst 2008). Young bandicoots remain in the pouch for 55 days, and three months after birth they become independent and disperse (Seebeck & Menkhorst 2008). Reproduction can occur throughout the year, but is depressed during summer, and may cease during times of drought (Hill et al. 2010). In favourable conditions, a single female may produce up to five litters a year (Seebeck 1979).

Eastern Barred Bandicoots (Mainland) are solitary animals and only associate with other bandicoots when breeding (Dufty 1994). Individuals occupy partly overlapping home ranges, with males occupying significantly larger areas than females (females: 1.9 to 6.4 ha, males: 4 to 13 ha; Jenkins 1998). Male Eastern Barred Bandicoots (Mainland) range more widely, where there is more tree cover, although only outside the breeding season (Jenkins 1998). Historical densities have been reported as 0.45 to 5.25 individuals/ha (Brown 1989; Minta et al. 1990; Dufty 1991), with densities varying substantially within and between sites, and between years (Minta et al. 1990; Jenkins 1998). A density of 1.5 individuals/ha has been used to develop a habitat model at the species level (Reading et al. 1996) and 1 individual/ha has been used in population viability analyses (Lees et al. 2013).

Trophic ecology

The Eastern Barred Bandicoot (Mainland) feeds primarily on invertebrates, such as beetles, crickets, grasshoppers, moths and earthworms (Brown 1989; Dufty 1994; Cook 2001). Some plant material, including bulbs of Onion-grass (*Romulea rosea*) and orchard fruit is also consumed (Brown 1989; Dufty 1991).

Habitat critical to the survival

It is not practicable to describe habitat critical to the survival of this species. Large areas of potential habitat for this species are unsurveyed and confirmation as habitat can only be achieved through detection-based presence/absence field surveys. In the absence of confirmed occupancy, potential habitat can be identified as necessary to support the recovery of this species through verification of the presence of habitat attributes. The species eligibility for listing and key threat being the loss, degradation and fragmentation of habitat suggests that all habitat for the species either now or at some point in the near future is likely to be critical to the survival of the species.

No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat.

Important populations

In this section, the word population is used to refer to subpopulation, in keeping with the terminology used in the EPBC Act and state/territory environmental legislation.

All extant subpopulations of the Eastern Barred Bandicoot (Mainland) should be considered important for the long-term recovery and survival of this species. However, given the overall small number of populations and need to maintain minimum population size for genetic diversity retention, the highest priority populations are those sites that are largest in habitat area and therefore have the highest ultimate population potential:

- Mount Rothwell
- Phillip Island

Introduction sites that are likely to become high priority populations if releases are successful are:

- French Island
- Tiverton

Threats

The Eastern Barred Bandicoot (Mainland) is threatened by invasive species, small population size, habitat loss, disturbance or modification, climate change, and disease (Table 1). The species is threatened by several fire-related threats, including high severity fires, fire-drought interactions and fire-predator interactions.

Table 1 Threats impacting Eastern Barred Bandicoot (Mainland)

Threat	Status and severity ^a	Evidence
Invasive species		
Predation by the European Red Fox (<i>Vulpes vulpes</i>)	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: major • Trend: static • Extent: across the entire range 	<p>Predation by the European Red Fox (<i>Vulpes vulpes</i>) is listed as a Key Threatening Process (KTP) under the EPBC Act (DEWHA 2008) and has been implicated in the decline and extinction of many terrestrial, non-volant, mammal species, including bandicoots (Ashby et al. 1990; Menkhorst & Seebeek 1990; Dickman 1996; Scott et al. 1999; Woinarski et al. 2014b; Radford et al. 2018). The Eastern Barred Bandicoot (Mainland) is extremely susceptible to predation by the European Red Fox (Radford et al. 2018).</p> <p>Control of predators is considered a key requirement for the successful reintroduction of Eastern Barred Bandicoots (Mainland) (Watson & Halley 2000). European Red Foxes were present at all extirpated reintroduction sites (Winnard & Coulson 2008; Hill et al. 2010). If European Red Fox control is continuous and intensive, then Eastern Barred Bandicoot (Mainland) populations may persist at low numbers in the presence of foxes (Hill et al. 2010). However, subpopulations large enough to contribute to the Eastern Barred Bandicoot (Mainland) conservation population targets have not been established using this approach (Hill et al. 2010). The current recovery model concentrates on complete exclusion of European Red Foxes from reintroduction sites using</p>

Threat	Status and severity ^a	Evidence
		fencing, and in establishing translocated subpopulations on fox-free islands (Hill et al. 2010). Additionally, Italian guardian sheepdogs (Maremmas) have been trained in predator protection techniques and may be used in a trial program to protect unfenced, free-ranging subpopulations (Parrott et al. 2017).
Predation by feral Cats (<i>Felis catus</i>)	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: major • Trend: static • Extent: across the entire range 	<p>Predation by feral Cats (<i>Felis catus</i>) is listed as a KTP under the EPBC Act (DOE 2015b) and is implicated in the decline and extinction of many terrestrial, non-volant, mammal species (Ashby et al. 1990; Menkhorst & Seebeek 1990; Dickman 1996; Woinarski et al. 2014b; Radford et al. 2018). Eastern Barred Bandicoots (Mainland), particularly juveniles, are extremely susceptible to predation by feral Cats (Lenghaus et al. 1990; Radford et al. 2018). However, the impact of feral Cats is thought to be less significant than that of European Red Foxes (Hill et al. 2010).</p> <p>As described above, control of predators is considered a key requirement for the successful reintroduction of Eastern Barred Bandicoots (Mainland) (Watson & Halley 2000).</p>
Habitat degradation and resource competition with Rabbits (<i>Oryctolagus cuniculus</i>)	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: major • Trend: static • Extent: across the entire range 	<p>Rabbits (<i>Oryctolagus cuniculus</i>) are found in all states and territories of Australia and have been listed as a Key Threatening Process (KTP) under the EPBC Act (DOEE 2016). Grazing by Rabbits can damage habitat by preventing plant regeneration, disrupting the normal processes of plant succession, altering ecological communities and promoting weed invasion (DOEE 2016).</p> <p>At some reintroduction sites, particularly those that are fenced to exclude introduced predators, rabbits can reach very high densities (Winnard & Coulson 2008). Accordingly, habitat degradation and grazing may cause reduction in habitat quality for the Eastern Barred Bandicoot (Mainland) (Winnard & Coulson 2008). Rabbit populations are actively managed at all Eastern Barred Bandicoot (Mainland) reintroduction sites (Hill et al. 2010). However, Rabbits can become a serious threat if not appropriately managed.</p>
Weed invasion	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: moderate • Trend: static • Extent: across part of its range 	<p>Weeds can invade, establish in and outcompete native vegetation, particularly following disturbance events, such as bushfires (Hobbs 1991; Hobbs 2002; Brown et al. 2016). In particular, grassy weeds can increase fuel load and alter fire regimes (Milberg & Lamont 1995; Setterfield et al. 2013). These altered fire regimes can create conditions that are detrimental to the maintenance of native species and favourable to the establishment and spread of weeds (D'Antonio & Vitousek 1992; Grigulis et al. 2005). Accordingly, weed invasion may degrade habitat within Eastern Barred Bandicoot (Mainland) reintroduction sites. Weeds are actively managed at all reintroduction sites (Hill et al. 2010). However, this may become a more serious threat if not appropriately managed.</p>

Threat	Status and severity ^a	Evidence
Small population size		
Loss of genetic diversity	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: major • Trend: unknown • Extent: across the entire range 	<p>The entire population of Eastern Barred Bandicoots (Mainland) are descended from 19 founders collected in 1990 (Weeks et al. 2013). Since 1990, allelic richness, average allele numbers, observed heterozygosity and expected heterozygosity has declined substantially (Weeks et al. 2013). These concerns are compounded by the findings of a morphological deformity, ‘undercut jaw’, that has been discovered in captive and reintroduced subpopulations (Weeks et al. 2013).</p> <p>Weeks et al. (2013) recommended increasing population size rapidly, managing all subpopulations as a single metapopulation to minimise further loss of genetic diversity and introducing genetic diversity through gene-pool mixing with the Eastern Barred Bandicoot (Tasmania).</p>
Climate change		
Inappropriate fire regimes	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: moderate • Trend: increasing • Extent: across the entire range 	<p>Fires can cause mortality of medium-sized marsupials, including bandicoots, directly via high temperatures, toxic effects of smoke and oxygen depletion (Whelan et al. 2002); or indirectly via starvation and predation, linked to loss of suitable habitat, increased predator abundance and activity (McGregor et al. 2014; Leahy et al. 2016; Hradsky et al. 2017). Additionally, fires often follow drought, thereby exacerbating the declining abundance of small- and medium-sized marsupials caused by drought conditions (Crowther et al. 2018).</p> <p>In 2019-20, following years of drought (DPI 2020), catastrophic bushfire conditions resulted in extensive bushfires covering an unusually large area of eastern Australia. Fire severity varied across the bushfire extent, with many patches burning at extreme severity while others remained unburnt (DPIE 2020). The 2019-20 bushfires did not overlap with any Eastern Barred Bandicoot (Mainland) subpopulations. However, catastrophic bushfires are increasingly likely to occur due to climate change (CSIRO & Bureau of Meteorology 2015).</p>

Threat	Status and severity ^a	Evidence
Increased temperature and change to precipitation patterns	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: moderate • Trend: increasing • Extent: across the entire range 	<p>The CSIRO & Bureau of Meteorology (2015) predict eastern Australia will experience decreased rainfall, increased average temperatures and frequency of droughts. During the 1997-2002 drought, Eastern Barred Bandicoots (Mainland) at four reintroduction sites significantly declined (Winnard & Coulson 2008). These sites also experienced problems in maintaining effective predator control (Hill et al. 2010). The ongoing drought is thought to have reduced vegetation cover, impacting the availability of nesting and shelter sites and making the subspecies more susceptible to predation (Hill et al. 2010). At predator-free reintroduction sites, Eastern Barred Bandicoots (Mainland) appear more drought tolerant (Hill et al. 2010). For example, during a period of below-average rainfall and low resource availability at Mt Rothwell, Eastern Barred Bandicoots (Mainland) reproduced in the absence of European Red Foxes (Winnard et al. 2013). Accordingly, it is thought the cumulative impacts of predation and drought significantly elevate the likelihood of local extinction (Hill et al. 2010).</p>
Habitat loss, disturbance or modification		
Land clearing	<ul style="list-style-type: none"> • Timing: historical/future • Confidence: inferred • Consequence: major • Trend: decreasing • Extent: across the entire range 	<p>Over 99 percent of native grasslands and grassy woodlands within the former range of the Eastern Barred Bandicoot (Mainland) have been cleared or degraded (Scarlett et al. 1992). Indeed, many ecological communities currently or historically associated with the Eastern Barred Bandicoot (Mainland) are listed as threatened under the EPBC Act. Fragmentation of these grasslands and grassy woodlands is thought to have contributed to the extinction of remnant Eastern Barred Bandicoot (Mainland) subpopulations in the wild (Hill et al. 2010). As all reintroduced and introduced subpopulations of the Eastern Barred Bandicoot (Mainland) are actively managed in small reserves, land clearing is not considered a current threat to the species. However, if the species distribution extends into unmanaged areas, land clearing is likely to re-emerge as a threat.</p>
Habitat degradation and resource competition with other native mammals	<ul style="list-style-type: none"> • Timing: historical • Confidence: inferred • Consequence: major • Trend: decreasing • Extent: across part of its range 	<p>Native grazers can prevent plant regeneration and reduce plant recruitment (Hill et al. 2010). At some reintroduction sites, particularly those that are fenced, macropods can reach very high densities (Winnard & Coulson 2008). Trampling and grazing by macropods can cause reduction in habitat quality for the Eastern Barred Bandicoot (Mainland) (Winnard & Coulson 2008). Macropod populations are actively managed at all Eastern Barred Bandicoot (Mainland) reintroduction sites (Hill et al. 2010), however, this may become a more serious threat if not appropriately managed.</p>

Threat	Status and severity ^a	Evidence
Habitat degradation from agricultural practices and poisoning due to pesticides	<ul style="list-style-type: none"> • Timing: current • Confidence: suspected • Consequence: minor • Trend: unknown • Extent: across the entire range 	Pesticides and fertilisers may reduce the abundance of invertebrate prey resources, which may affect the diet of the Eastern Barred Bandicoot (Mainland) (Seebeck 1979). Brown (1989) suggest that some individuals may have been poisoned by 1080 baits used for predator control. Woinarski et al. (2014a) also suggest that pesticides used for insect control may accumulate in the tissues of Eastern Barred Bandicoots (Mainland).
Disease		
Toxoplasmosis caused by <i>Toxoplasma gondii</i>	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: major • Trend: static • Extent: across part of, or the entire range 	Toxoplasmosis is an infectious disease caused by the protozoan parasite, <i>Toxoplasma gondii</i> , and is spread by feral Cats. Toxoplasmosis was recognised as a cause of disease and mortality in Australian marsupials, including the Eastern Barred Bandicoot (Obendorf & Munday 1990; Bettiol et al. 2000; Hollings et al. 2013). Toxoplasmosis is severely impacting the Tasmanian subspecies (Obendorf & Munday 1990; Obendorf et al. 1996; Bettiol et al. 2000). Toxoplasmosis is present in the French and Phillip Island subpopulations and has caused mortality of Eastern Barred Bandicoots (Mainland) (Groenewegen et al. 2018; Johnston 2019; Adriaanse et al. 2020). Further research is required to document the prevalence of the pathogen, and the frequency and outcome of disease in reintroduced and introduced subpopulations. It is possible that the pathogen is rarer in the fenced subpopulations, as feral Cats are excluded from these sites, and in the subpopulation on Churchill Island, which is cat-free.

Timing—identify the temporal nature of the threat;

Confidence—identify the extent to which we have confidence about the impact of the threat on the species;

Consequence—identify the severity of the threat;

Trend—identify the extent to which it will continue to operate on the species;

Extent—identify its spatial content in terms of the range of the species.

Each threat has been described in Table 1 in terms of the extent that it is operating on the species. The risk matrix (

Table 2) provides a visual depiction of the level of risk being imposed by a threat and supports the prioritisation of subsequent management and conservation actions. In preparing a risk matrix, several factors have been taken into consideration, they are: the life stage they affect; the duration of the impact; and the efficacy of current management regimes, assuming that management will continue to be applied appropriately. The risk matrix and ranking of threats has been developed in consultation with experts and using available literature.

Table 2 Eastern Barred Bandicoot (Mainland) risk matrix

Likelihood	Consequences				
	Not significant	Minor	Moderate	Major	Catastrophic
Almost certain	Low risk	Moderate risk	Very high risk Increased temperature and change to precipitation patterns	Very high risk Loss of genetic diversity	Very high risk
Likely	Low risk	Moderate risk	High risk Inappropriate fire regimes	Very high risk	Very high risk
Possible	Low risk	Moderate risk Habitat degradation and poisoning due to pesticides	High risk Weed invasion	Very high risk Predation by feral Cats Predation by the European Red Fox Toxoplasmosis caused by <i>T. gondii</i> Habitat degradation and resource competition with Rabbits Habitat degradation and resource competition with other native mammals	Very high risk
Unlikely	Low risk	Low risk	Moderate risk	High risk Land clearing	Very high risk
Unknown	Low risk	Low risk	Moderate risk	High risk	Very high risk

Priority actions have then been developed to manage the threat particularly where the risk was deemed to be ‘very high’ or ‘high’.

Conservation and recovery actions

Primary conservation objective

To secure the long-term evolutionary potential of the mainland Eastern Barred Bandicoot by establishing and maintaining a minimum of four genetically diverse, spatially independent, self-sustaining reintroduced subpopulations which total no less than 2500 individuals.

Conservation and management priorities

Habitat loss disturbance and modifications

- Ensure no habitat occupied by the Eastern Barred Bandicoot (Mainland) is lost or fragmented, by providing advice to planning authorities and monitoring disturbance impacts.

Invasive species (including threats from grazing, trampling, predation)

- Develop a fence monitoring and maintenance strategy for all fenced sites, and monitoring for incursions of Cats and/or European Red Foxes at the island sites.
- Continue to implement predator management actions; prevent any introduction of the European Red Fox and/or feral Cats and implement control or eradication (as appropriate) actions if they are already present.
- Continue to implement weed management actions, using hand weeding or localised application of herbicide during the appropriate season to minimise the effect of herbicide on native vegetation.
- Continue to implement grazing management actions: prevent further introduction of Rabbits and implement control actions if they are already present.

Fire

- Manage prescribed burns to ensure that prevailing fire regimes do not disrupt the life cycle of the subspecies, support rather than degrade habitat, and do not increase impacts of predation.
- Develop and implement a fire management strategy that optimises the survival of the subspecies during planned burns and bushfires. Ensure that a high proportion of the habitat is maintained with a post-fire age sufficient to provide adequate cover to the subspecies.
- Provide maps of known occurrences to local and state Rural Fire Services and seek inclusion of mitigation measures in bushfire risk management plan/s, risk register and/or operation maps.
- Ensure immediate and ongoing post-fire predator control (at island sites where cats are present) following fires.

Climate change

- Understand and ameliorate the effects of climate change, particularly an increase in the frequency of drought, on the subspecies.

Disease

- Understand the prevalence of the *T. gondii* pathogen across subpopulations (including those that are cat-free), the incidence of disease, and the impact of toxoplasmosis on population establishment and persistence.
- Implement a toxoplasmosis management plan to ensure the disease is not introduced into known subpopulations of the Eastern Barred Bandicoot (Mainland), if required.

Breeding and other ex situ recovery action

- Continue maintenance of reintroduced subpopulations.
- Manage the captive breeding program to meet program needs, until termination as a source of animals for introductions, with adequate breeding managed to promote genetic diversity within the program and in the meta-population.
- Develop a strategy to introduce hybrid individuals (Tasmanian/Mainland crosses) to all established and new sites.

Stakeholder engagement/community engagement

- Engage and involve Traditional Owners in conservation actions, including by trialling the use of Indigenous fire management at Eastern Barred Bandicoot sites, as well as other survey, monitoring and management actions.
- Increase the recognition and support for the recovery of the Eastern Barred Bandicoot (Mainland), including the maintenance of ambassador animals by Zoos Victoria to assist in community and school engagement and fundraising efforts.

Survey and monitoring priorities

- Undertake annual monitoring of all subpopulations, including population size, stability and recruitment, and habitat condition, and the impacts from weed invasion, introduced species and diseases.
- Monitor genetic diversity, at least every two years or more often where necessary, using standard approaches.
- Develop triggers for management intervention based on habitat condition (which could trigger rabbit or overabundant herbivore control), population and genetic trajectories (which could trigger translocations of individuals for genetic outcomes) at all sites.
- Develop and implement a metapopulation management plan, to guide transfer of individuals and ensure all subpopulations are treated as a single metapopulation.

Information and research priorities

- Investigate the relationship between the density of feral cats and European Red Foxes and population growth rate of the Eastern Barred Bandicoot.
- Evaluate the survival and reproductive success of individuals translocated into established subpopulations (for metapopulation management and integrating Tasmanian Eastern Barred Bandicoot genetics) and identify strategies that maximise their rate of genetic contribution.
- Investigate the role of disease and parasite infestations in population regulation.
- Investigate the role of intrinsic regulation (e.g. territoriality, breeding suppression) in limiting population growth.
- Investigate the relationship between habitat quality, as influenced by browser density and climatic conditions, and population growth for refining management triggers.

Links to relevant implementation documents

National Recovery Plan for the Eastern Barred Bandicoot (mainland) Perameles gunnii unnamed subspecies (2010)

Threat abatement plan for competition and land degradation by Rabbits (2016)

Threat abatement plan for predation by Feral cats (2015)

Threat abatement plan for predation by the European Red Fox (2008)

Conservation Advice references

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