The Minister approved this conservation advice and included this species in the Vulnerable category, effective from 5 May 2016

Conservation Advice

Antechinus minimus maritimus

swamp antechinus (coastal Victoria and far south-eastern South Australia)

Note: The information contained in this Conservation Advice was primarily sourced from 'The Action Plan for Australian Mammals 2012' (Woinarski et al., 2014). Any substantive additions obtained during the consultation on the draft have been cited within the advice. Readers may note that Conservation Advices resulting from the Action Plan for Australian Mammals show minor differences in formatting relative to other Conservation Advices. These reflect the desire to efficiently prepare a large number of advices by adopting the presentation approach of the Action Plan for Australian Mammals, and do not reflect any difference in the evidence used to develop the recommendation.

Taxonomy

Conventionally accepted as *Antechinus minimus maritimus* (Finlayson 1958).

A limited amount of genetic analysis (Smith 1983) provides equivocal support for the recognition of two subspecies. The other subspecies is *A. m. minimus* (Tasmania and Bass Strait Islands) (Smith 1983).

Summary of assessment

Conservation status

Vulnerable: Criterion 1 A2(b)(c)(e) and Criterion 2 B2(a),(b)(ii-v)

Species can be listed as threatened 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 conservation assessment by the Threatened Species Scientific Committee

This advice follows assessment of new information provided to the Committee to list *Antechinus minimus maritimus*.

Public Consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 40 business days between 30 September 2015 and 25 November 2015. Any comments received that were relevant to the survival of the subspecies were considered by the Committee as part of the assessment process.

Species/subspecies Information

Description

The swamp antechinus is a small carnivorous marsupial with a head to body length of 95−140 mm, and a tail length which is 70 percent of the head to body length. It has a long slender muzzle, long foreclaws, short ears that do not protrude far beyond the fur, and pale eye-rings. The upperparts are brown with a yellow or rufous wash, particularly on the rump, flanks and hindlegs, with paler buff or grey-yellow underparts and pale claws (Menkhorst 2004).

The swamp antechinus (coastal Victoria and far south-eastern South Australia) subspecies has eight teats, while the Tasmanian and Bass Strait islands subspecies has six teats (Menkhorst 2004).

Distribution

The swamp antechinus (coastal Victoria and far south-eastern South Australia) has a highly fragmented distribution in coastal areas, ranging from near Robe in South Australia to Wilson's Promontory (and the nearby Great Glennie, Rabbit, Kanowna and Snake Islands) in Victoria, with isolated records extending inland as far as Casterton in western Victoria, the Otway Ranges, Korumburra and Gembrook (Menkhorst 1995; Wilson et al., 2001; Bachmann & van Weenen 2001). The elevational range extends from sea level to 220 m above sea level (Menkhorst 1995), but a very high proportion of records are from low elevation areas (Wilson et al., 2001; Gibson et al., 2004). Habitat suitability modelling indicates that only a small proportion (10−15 percent) of the distributional extent provides high quality habitat for the subspecies (Wilson et al., 2001; Gibson et al., 2004; Magnusdottir et al., 2008).

In contrast to the above conventional distributional delineation, Smith (1983) noted that individuals from Flinders Island showed greater genetic similarity to mainland subpopulations (i.e. *A. m. maritimus*) than to Tasmanian subpopulations (*A. m. minimus*), and noted that the Flinders Island subpopulation should be tentatively included within *A. m. maritimus*.

Relevant Biology/Ecology

The swamp antechinus (coastal Victoria and far south-eastern South Australia) is a terrestrial insectivorous marsupial. It mainly occurs in damp areas, particularly at sites with dense vegetation at about 1−2 m above ground level. Its habitat includes dense wet heathlands, tussock grasslands, sedgelands, damp gullies, swamps and some shrubby woodlands (Menkhorst 1995), often in landscape settings with little exposure to the sun (Wilson et al., 2001). In the south-east of South Australia, the subspecies is heavily reliant on silky tea-tree (*Leptospermum lanigerum*) dominated wetlands (Bachmann 2002). It appears to be more of a habitat specialist than the more common species it is frequently found to co-occupy habitat with (e.g. bush rats (*Rattus fuscipes*), swamp rats (*Rattus lutreolus*) and introduced house mice (*Mus musculus*) (Bachmann pers. comm., 2015).

At mainland sites it is at least partly diurnal (Sale & Arnould 2009). When inactive it shelters in a short burrow in the topsoil or beneath thick leaf litter (Menkhorst 1995). It is social, with individuals exhibiting a high degree of spatial overlap and sharing of den sites (Sale & Arnould 2009). Its diet includes a wide range of invertebrates, particularly moth larvae and beetles, and some small vertebrates and seeds (Sale et al., 2006).

The subspecies is a very late post-fire succession recoloniser of woodland habitats (Wilson et al., 2001), and requires mature dense vegetation with thick ground cover. Monitoring of known populations before and after a severe bushfire demonstrated that the fire caused local extinction of some populations (with no recolonisation in 15 years subsequent to fire). However, some populations survived (especially where burns were patchy), and other extinguished populations were gradually re-colonised, mostly 15 years post-fire (Wilson et al., 2001).

There is evidence that populations of the subspecies are strongly influenced by rainfall (Magnusdottir et al., 2008; Sale et al., 2009). In studies at Anglesea, peak abundance was recorded following the highest total annual rainfall for two decades. The population was characterised by high-weight breeding males and females and young that gained weight faster than other cohorts. Birth dates also occurred three weeks earlier and juveniles entered the trappable population earlier than in other years. Rainfall decreased subsequently and a year later the population had declined to 10 percent of the peak.

Mating is highly synchronised, with females giving birth to up to eight young in June−August (Wilson & Bourne 1984; Wilson 1986; Sale et al., 2006; Bachmann pers. comm., 2015). Males die after mating, but some females continue to a second or even a third breeding season

(Wilson & Bourne 1984; Wilson 1986; Magnusdottir et al., 2008; Bachmann pers. comm., 2015). Generation length is assumed to be one year (Woinarski et al., 2014).

Dispersal appears to strongly coincide with the lead up to the annual synchronised breeding season, with a core number of females (that appeared to either establish or maintain a home territory) found to remain in the vicinity of their original home territory (Bachmann pers. comm., 2015). Young of both sexes were found to remain in the vicinity of their maternal territory until reaching independence, in the lead up to this annual period (Bachmann pers. comm., 2015).

Threats

Threats to the swamp antechinus (coastal Victoria and far south-eastern South Australia) are outlined in the table below (Woinarski et al., 2014).

Threat factor	Consequence rating	Extent over which threat may operate	Evidence base
Too frequent burning	Severe	Large	Subpopulations of this subspecies have been shown to be eliminated by wildfire, and recolonisation may be slow or absent (Wilson et al., 2001; Wilson & Bachmann 2008). Changes to fuel reduction burning in Victoria, arising from recommendations of the 2009 Victorian Bushfires Royal Commission, may result in inappropriate age structure for the subspecies' habitat (Wilson pers. comm., 2015).
Habitat loss and fragmentation, and small remnant habitat size	Severe	Large	Much of the subspecies' habitat has been cleared and swamps drained, and fragmented populations may be at ongoing high risk of local extinction (Bachmann & van Weenen 2001; Wilson et al., 2001; van Weenen & Menkhorst 2008; Wilson & Bachmann 2008). Populations at Aireys Inlet, which were identified to be at high risk from fragmentation impacts (Wilson et al., 2001), are no longer extant (Wilson & Garkaklis 2014, 2015; Zhuang-Griffin 2015).
Predation by foxes	Moderate	Large	Predation has been demonstrated, and population-level risks assumed to be substantial (Wilson et al., 2001; van Weenen & Menkhorst 2008). Risks may be magnified where grazing has reduced ground cover (van Weenen pers. comm., cited in Woinarski et al., 2014)
Predation by feral cats	Moderate	Large	Occasional kills by domestic cats have been recorded where human settlements have come into contact with populations (Bachmann pers. comm., 2015).

Habitat degradation due to grazing by livestock and feral herbivores	Moderate	Moderate	Livestock have been shown to reduce habitat suitability and population viability (Bachmann & van Weenen 2001).
Habitat degradation due to 'over-grazing' by native herbivores	Moderate	Moderate	In some areas dense populations of macropods may reduce ground cover (van Weenen pers. comm., cited in Woinarski et al., 2014)
Disease	Severe	Local	*Phytophthora* infestation was identified as a major threat at three inland sites where the subspecies was recorded during the 2013−2015 Otway surveys (Wilson & Garkaklis 2014, 2015; Zhuang-Griffin 2015).
Climate change	Severe	Large (future threat)	Drier conditions would substantially change the wetland characteristics of the subspecies' preferred habitat, exacerbated by the small size of remaining habitat patches and the subspecies' limited dispersal ability (SA DEWNR 2015). Significant population declines occurred during periods of below average rainfall and drought (Magnusdottir et al., 2008; Sale et al., 2008).

How judged by the Committee in relation to the EPBC Act Criteria and Regulations

Criterion 1. Population size reduction (reduction in total numbers) Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered **Very severe reduction**	**Endangered** **Severe reduction**	**Vulnerable** **Substantial reduction**
A1	**≥ 90%**	**≥ 70%**	**≥ 50%**
A2, A3, A4	**≥ 80%**	**≥ 50%**	**≥ 30%**

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(*a*) *cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

Evidence:

Eligible under Criterion 1 A2(b)(c)(e) for listing as Vulnerable

There is limited information on the population size and population trends of the swamp antechinus (coastal Victoria and far south-eastern South Australia). Its distribution is highly fragmented, and while some subpopulations have been monitored there is no integrated monitoring program in place (Woinarski et al., 2014). Broad-scale targeted surveys are labour intensive and time-consuming due to its rare and cryptic nature (Bachmann pers. comm., 2015).

However, population trends may be inferred from changes to the subspecies' habitat and distribution, results of a long-term monitoring study in the Otways, and ongoing threats which may increase in severity in the future (e.g. an increase in the intensity and frequency of fires due to climate change).

The extent of occurrence and, particularly, area of occupancy are likely to have declined substantially since European settlement due to habitat loss, degradation and fragmentation. The area of occupancy is likely to be undergoing continuing decline due to fragmentation legacy effects, some ongoing coastal residential and other development, and the subspecies' limited ability to recolonise areas after fire. The population size is suspected to be undergoing continuing decline due to past and continuing habitat loss, degradation and fragmentation, and ongoing impacts of feral predators and fire (Woinarski et al., 2014).

The remaining small, isolated populations are vulnerable to wildfire and feral predators. The cumulative impacts of fragmentation, increased predation and declining rainfall at sites are likely to result in the demise of small populations at increased rates (Wilson & Garkaklis 2014, 2015; Wilson et al., 2015). The subspecies' limited ability to persist in sub-optimal habitats, driven by short longevity and high turnover rates, compound the impact of these threats (Bachmann pers. comm., 2015).

Throughout Victoria, the subspecies' distribution declined significantly between the periods 1990−2009 and 2010−2014 (Vic DELWP 2015). Long-term monitoring in the eastern Otways demonstrated declines in abundance and the number of subpopulations (Wilson & Garkaklis 2014, 2015; Wilson et al., 2015). The subspecies was recorded at 25 sites over the period 1969−2001 (Wilson et al., 2001), and recorded at 19 out of 57 sites in 2001−02 (Gibson et al., 2004). Surveys undertaken over the period 2013−2015 recorded the subspecies at only five sites where the subspecies had been recorded previously, and two new sites; it was not recorded at ten sites where it had been previously recorded (Wilson & Garkaklis 2014, 2015; Zhuang-Griffin 2015). The surveys failed to record the subspecies at sites that once supported high density populations (15 to 28 individuals per hectare) over a number of years (Wilson et al, 2001; Magnusdottir et al., 2008; Sale et al., 2008). Altogether, only six individuals were captured during trapping conducted at 33 sites (4695 trap nights) (Wilson & Garkaklis 2014, 2015).

Previous monitoring of the subspecies identified local extinctions of populations following the 1983 wildfire in the Otways, with recolonisation taking around 20 years (Wilson et al., 2001). The 2013−2015 surveys demonstrated that local extinctions of at least 10 populations had occurred; however, fire was not implicated as the cause of these extinctions (Wilson & Garkaklis 2014, 2015). Factors driving the decline in the eastern Otways are not well understood, but possible factors include: habitat fragmentation, decline in fauna habitat quality (impact of the plant pathogen *Phytophthora cinnamommi*), climate change (rainfall decline, increased temperature), changed fire regimes, increased predation, or combinations of all or some of these factors (Wilson & Garkaklis 2014, 2015; Wilson et al., 2015).

These surveys suggest that the subspecies' distribution has declined in the eastern Otways by approximately 40 percent between 2001 and 2015, and that there is a continued decline in population, extent of occurrence and area of occupancy, probably at a rate greater than 30 percent over 10 years (Wilson pers. comm., 2015). This pattern of decline is likely to be similar in comparable habitats across the subspecies' distribution (Wilson pers. comm., 2015).

In the south-east of South Australia, swamp antechinus habitats are severely fragmented, having been preferentially cleared and drained for agricultural development of fertile soils of the coastal areas (SA DEWNR 2015) until laws to prevent broadacre land clearance came into force in the early 1980s (Bachmann pers. comm., 2015). The bulk of the decline in the subspecies' distribution in the state (estimated at 80−90 percent) likely occurred in the 1950s and 1960s, although a form of extinction debt, and ongoing risks to coastal habitats, mean that further minor declines would also have continued since (Bachmann pers. comm., 2015).

The subspecies has been recorded at more than 10 sites in South Australia, but most records are quite old and there has been little consistent survey effort at historical sites since 2001 (SA DEWNR 2015). However, there has been a gradual decline of the subspecies' preferred habitats in the lower south-east of the state, from which a decline in population size and distribution may be inferred (SA DEWNR 2015). This decline is expected to continue at sites subject to direct threats such as clearing and overgrazing; much of the subspecies' habitat exists on private land (SA DEWNR 2015). Little broad-scale surveying has been undertaken since the intensive targeted surveys of Bachmann & van Weenen (2001), however, one subpopulation appears to have disappeared since that time. In 2000 the subspecies was recorded in the swampy margins around Buck's Lake; after the site was drained through water diversion, causing the loss of much of the vegetation, no individuals were caught in re-sampling attempts in 2009 (G. Medlin pers. comm., cited in Woinarski et al., 2014).

Following assessment of the available information, the Committee considers that the subspecies is more likely than not to have undergone a substantial reduction in numbers over a ten year period, equivalent to at least 30 percent and the reduction has not ceased, the cause has not ceased and is not understood. Therefore, the species has met the relevant elements of Criterion 1 to make it eligible for listing as Vulnerable.

Criterion 2.	**Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy**		
	Critically Endangered Very restricted	**Endangered Restricted**	**Vulnerable Limited**
B1. Extent of occurrence (EOO)	**< 100 km²**	**< 5,000 km²**	**< 20,000 km²**
B2. Area of occupancy (AOO)	**< 10 km²**	**< 500 km²**	**< 2,000 km²**
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	**= 1**	**≤ 5**	**≤ 10**
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Evidence:

Eligible under Criterion 2 B2(a),(b)(ii-v) for listing as Vulnerable

The extent of occurrence is estimated at 48 796 km^2, and the area of occupancy estimated at 360 km^2. These figures are based on the mapping of point records from 1995 to 2015, obtained from state governments, museums and CSIRO. The EOO was calculated using a minimum convex hull, and the AOO calculated using a 2x2 km grid cell method, based on the IUCN Red List Guidelines 2014 (DotE 2015a). Mapped point records from 1965 to 1995, which give an EOO of 64 374 km^2 and an AOO of 892 km^2 (DotE 2015a), show that the historical distribution was much larger. Woinarski et al. (2014) noted that the AOO, which they estimated to be 328 km^2, is likely to be a significant under-estimate due to limited sampling across the occupied range, but is still likely to be less than 2000 km^2. As it cannot be concluded with certainty that the AOO is less than 500 km^2, it is likely to be somewhere between 500 km^2 and 2000 km^2.

The swamp antechinus (coastal Victoria and far south-eastern South Australia) occurs at more than 10 locations, but the population is severely fragmented. The subspecies has poor dispersal ability, and there may be ongoing high risk of local extinction with subpopulations likely to disappear incrementally. There is an inferred continuing decline in area of occupancy, extent and quality of habitat, number of subpopulations and number of mature individuals (Woinarski et al., 2014).

In South Australia, the subspecies is associated with silky tea-tree (*Leptospermum lanigerum*) dominated low wet woodlands/shrublands (Bachmann & van Weenen 2001). The EOO for these communities in the south-east of South Australia has been estimated at 1300 km^2 (Bonifacio & Pisanu 2013), which provides an estimate of the maximum EOO for the subspecies in South Australia (SA DEWNR 2015). The AOO for these communities is difficult to determine accurately but is likely to be very small; Bachmann & van Weenen (2001) estimate that no more than five percent of the original silky tea-tree community remains in the south-east of South Australia (SA DEWNR 2015).

The Committee considers that the subspecies' area of occupancy is limited, and the geographic distribution is precarious for the subspecies' survival because it is severely fragmented, and a decline in extent of occurrence, area of occupancy, habitat, number of individuals and number of locations may be inferred or projected. Therefore, the subspecies has met the relevant elements of Criterion 2 to make it eligible for listing as Vulnerable.

Criterion 3. Population size and decline				
		Critically Endangered Very low	**Endangered Low**	**Vulnerable Limited**
Estimated number of mature individuals		**< 250**	**< 2,500**	**< 10,000**
AND either (C1) or (C2) is true				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	**Very high rate 25% in 3 years or 1 generation (whichever is longer)**	**High rate 20% in 5 years or 2 generation (whichever is longer)**	**Substantial rate 10% in 10 years or 3 generations (whichever is longer)**
C2	An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	**≤ 50**	**≤ 250**	**≤ 1,000**
(a)	(ii) % of mature individuals in one subpopulation =	**90 – 100%**	**95 – 100%**	**100%**
(b)	Extreme fluctuations in the number of mature individuals			

Evidence:

Not eligible

Woinarski et al. (2014) estimate the population size at 100 000 mature individuals. However, there has been no robust estimate of the total population size or any subpopulations of the subspecies. Population densities vary widely between locations. At four sites in coastal areas near Anglesea, sampled over at least two years, maximum population densities were 1.1, 3.4, 15 and 17.5 individuals per hectare (Wilson et al., 2001); at one nearby site sampled over five years, the density varied from 1 to 28 individuals per hectare (Magnusdottir et al., 2008). At one site in Walkerville (mainland South Gippsland) the density was 10 individuals per hectare (Wainer 1988). Appreciably higher population densities have been recorded for some island populations, including 80 and 98 individuals per hectare for Great Glennie (60 ha) and Kanowna (31 ha) Islands respectively, with a seasonal peak of 127 individuals per hectare recorded for the latter (Wainer 1988; Sale et al., 2006, 2008; Sale & Arnould 2009).

The Committee considers that, although there is no robust estimate of the population size, the total number of mature individuals is unlikely to be less than 10 000. Therefore, the subspecies has not met this required element of this criterion.

Criterion 4. Number of mature individuals			
	Critically Endangered Extremely low	**Endangered Very Low**	**Vulnerable Low**
Number of mature individuals	**< 50**	**< 250**	**< 1,000**

Evidence:

Not eligible

There is no robust estimate of population size. However, density estimates suggest that there are likely to be greater than 10 000 mature individuals. Woinarski et al. (2014) estimate the total population size at 100 000 mature individuals.

The Committee considers that the total number of mature individuals is greater than 1000. Therefore, the subspecies has not met this required element of this criterion.

Criterion 5. Quantitative Analysis			
	Critically Endangered Immediate future	**Endangered Near future**	**Vulnerable Medium-term future**
Indicating the probability of extinction in the wild to be:	**≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)**	**≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)**	**≥ 10% in 100 years**

Evidence:

Not eligible

Population viability analysis has not been undertaken.

Conservation Actions

Recovery Plan

The Committee recommends that there should not be a recovery plan for *Antechinus minimus maritimus* (swamp antechinus (coastal Victoria and far south-eastern South Australia)), as approved Conservation Advice provides sufficient direction to implement priority actions and mitigate against key threats.

Primary Conservation Actions

1. Reduce the frequency and intensity of prescribed burns, and maintain habitat refugia.
2. Protect areas of habitat, particularly high quality habitat.
3. Restore degraded habitat, and increase connectivity between habitat patches.

Conservation and Management Actions

There are currently no targeted management actions for the subspecies. In Victoria most of its range lies in reserves, including several large conservation reserves (notably Wilson's Promontory and Greater Otway National Parks) which are subject to active fire management. Intensive fox control has been established over parts of its range over the past decade (e.g. Glenelg Ark; Robley et al., 2009), but it's possible that this has led or will lead to increases in the density of feral cats.

In South Australia efforts are being made to protect and enhance silky tea-tree habitat on private land, and some parcels of land with habitat for the subspecies have been added to the system of reserves (SA DEWNR 2015). Stock exclusion fencing occurred in the South East NRM region (SA) at a number of swamp antechinus sites, via the Silky Tea-tree and Cutting Grass Wetland Rehabilitation Project, from 1999 to 2002 (Bachmann 2002). Wetland hydrological restoration and habitat protection activities over the past decade have enhanced habitat for the subspecies in some of the near coastal wetlands in South Australia (Bachmann pers. comm., 2015).

Other plans that will benefit the subspecies include:

- the Threat Abatement Plan and background document for predation by the European red fox (DEWHA 2008a,b).
- the Threat Abatement Plan and background document for predation by feral cats (DotE 2015b,c).

Recommended management actions are outlined in the table below (Woinarski et al., 2014).

Theme	Specific actions	Priority
Active mitigation of threats	Implement optimum fire regimes and fire control measures that benefit this subspecies, including maintaining areas of mature dense vegetation and thick ground cover.	High
	Restore degraded habitats and habitat connectivity (particularly linking core productive habitats).	High
	Implement broad-scale management of feral predators, and intensive local-scale implementation of predator control programs, at and around important subpopulations.	Medium-high
	Constrain total grazing pressure to within acceptable levels at sites important for this subspecies.	Medium-high
	Ensure that important sites and subpopulations for this subspecies are appropriately considered in land development, and protected where possible.	High

Captive breeding	N/A	
Quarantining isolated populations	Maintain the feral predator-free status of islands supporting this subspecies.	High
Translocation	N/A	
Community engagement	Develop conservation covenants on lands with high value for this subspecies.	Low-medium

Survey and monitoring priorities

Theme	Specific actions	Priority
Survey to better define distribution	Define fine-scale distribution patterns across the subspecies' range, and the number of individuals in subpopulations.	Medium-high
Survey to assess habitat condition	Identify if there is a correlation between changes to habitat condition and population size/decline, and possible causes of these changes.	Medium
Establish or enhance monitoring program	Design an integrated monitoring program across subpopulations linked to an assessment of management effectiveness.	High
	Monitor the incidence of fire, and vegetation response, at key subpopulations.	Medium
	Monitor the abundance of feral predators at key subpopulations, in response to management actions (e.g. with sites inside and outside the Glenelg Ark program of intensive fox baiting).	Medium

Information and research priorities

Theme	Specific actions	Priority
Assess impacts of threats	Assess the abundance of feral cats, dogs and foxes in the range of this subspecies, and the impact of predation on population viability.	Medium-high
	Assess population-level responses to a range of fire regimes, and model population viability across all fire scenarios.	Medium
	Assess population-level responses to habitat fragmentation and isolation.	Medium
	Assess population-level responses to habitat degradation caused by livestock, feral herbivores and native herbivores, and the interaction of ground cover loss with predation.	Medium
	Assess the spatial fire history information in the subspecies' habitat to determine optimum fire regimes.	High
	Assess the relative importance of threats (fire frequency and intensity, predation, rainfall decline, vegetation decline (e.g. *Phythophthora cinnamommi*)) and potential interactions.	High
Assess effectiveness of threat mitigation options	Assess the effectiveness of options for broad-scale control of feral predators; or of local-scale control at sites with important populations.	Medium-high
	Assess the efficacy and impacts of management options to reduce the incidence, extent and intensity of fires, and promote appropriate heterogeneity of a fire mosaic.	Medium-high
	Assess the efficacy of restored habitat and of habitat corridors to increase population viability.	Medium-high
Resolve taxonomic uncertainties	Assess and interpret the level of genetic variation across subpopulations.	Low-medium
Assess habitat requirements	Identify habitat refugia.	Medium-high
Assess diet, life history	N/A	
Undertake research to develop new, or enhance existing, management mechanisms	Develop broad-scale, targeted feral cat control methods.	Medium
	Trial predator-proof enclosures at selected sites, to provide refugia and aid in population recovery.	Medium
Reintroductions	Assess the feasibility of reintroductions or translocations to improve the viability of small isolated populations.	Low

Recommendations

(i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **including** in the list in the Vulnerable category:

Antechinus minimus maritimus

(ii) The Committee recommends that there not be a recovery plan for this subspecies.

Threatened Species Scientific Committee
2/3/2016

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