



Consultation Document on Listing Eligibility and Conservation Actions

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

You are invited to provide your views, and reasons supporting them, related to:

- 1) the eligibility of *Antechinus minimus maritimus* (swamp antechinus (coastal Victoria and far south-eastern South Australia)) for inclusion on the EPBC Act threatened species list in the Vulnerable category; and
- 2) the necessary conservation actions for the above subspecies.

Evidence provided by experts, stakeholders and the general public are welcome. Responses can be provided by any interested person.

Anyone may nominate a native species, ecological community or threatening process for listing under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or for a transfer of an item already on the list to a new listing category. The Threatened Species Scientific Committee (the Committee) undertakes the assessment of species to determine eligibility for inclusion in the list of threatened species and provides its recommendation to the Australian Government Minister for the Environment.

Responses are to be provided in writing either by email to:
species.consultation@environment.gov.au

or by mail to:

The Director
Marine and Freshwater Species Conservation Section
Wildlife, Heritage and Marine Division
Department of the Environment
PO Box 787
Canberra ACT 2601

Responses are required to be submitted by 25 November 2015.

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General background information about listing threatened species

The Australian Government helps protect species at risk of extinction by listing them as threatened under Part 13 of the EPBC Act. Once listed under the EPBC Act, the species becomes a Matter of National Environmental Significance (MNES) and must be protected from significant impacts through the assessment and approval provisions of the EPBC Act. More information about threatened species is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/index.html>.

Public nominations to list threatened species under the EPBC Act are received annually by the department. In order to determine if a species is eligible for listing as threatened under the EPBC Act, the Threatened Species Scientific Committee (the Committee) undertakes a rigorous scientific assessment of its status to determine if the species is eligible for listing against a set of criteria. These criteria are available on the Department's website at:

<http://www.environment.gov.au/biodiversity/threatened/pubs/guidelines-species.pdf>.

As part of the assessment process, the Committee consults with the public and stakeholders to obtain specific details about the species, as well as advice on what conservation actions might be appropriate. Information provided through the consultation process is considered by the Committee in its assessment. The Committee provides its advice on the assessment (together with comments received) to the Minister regarding the eligibility of the species for listing under a particular category and what conservation actions might be appropriate. The Minister decides to add, or not to add, the species to the list of threatened species under the EPBC Act. More detailed information about the listing process is at:

<http://www.environment.gov.au/biodiversity/threatened/nominations.html>.

To promote the recovery of listed threatened species and ecological communities, conservation advices and where required, recovery plans are made or adopted in accordance with Part 13 of the EPBC Act. Conservation advices provide guidance at the time of listing on known threats and priority recovery actions that can be undertaken at a local and regional level. Recovery plans describe key threats and identify specific recovery actions that can be undertaken to enable recovery activities to occur within a planned and logical national framework. Information about recovery plans is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/recovery.html>.

Information about this consultation process

Responses to this consultation can be provided electronically or in hard copy to the contact addresses provided on Page 1. All responses received will be provided in full to the Committee and then to the Australian Government Minister for the Environment.

In providing comments, please provide references to published data where possible. Should the Committee use the information you provide in formulating its advice, the information will be attributed to you and referenced as a 'personal communication' unless you provide references or otherwise attribute this information (please specify if your organisation requires that this information is attributed to your organisation instead of yourself). The final advice by the Committee will be published on the department's website following the listing decision by the Minister.

Information provided through consultation may be subject to freedom of information legislation and court processes. It is also important to note that under the EPBC Act, the deliberations and recommendations of the Committee are confidential until the Minister has made a final decision on the nomination, unless otherwise determined by the Minister.

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 will be 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 are reflective of the desire to achieve efficiency over preparation of a large number of advices by adopting the approach of the Action Plan for Australian Mammals in presentation of information 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).

Subspecies Information

Description

The swamp antechinus is a small carnivorous marsupial with a head to body length of 95-140mm, and a tail length 70% 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 populations have six teats (Menkhorst, 2004).

Distribution

The swamp antechinus (coastal Victoria and far south-eastern South Australia) is considered to have a highly fragmented distribution in coastal areas from near Robe in South Australia to Wilson's Promontory (and the nearby Great Glennie, Rabbit, Kanowna and Snake Islands), 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 a.s.l. (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%) of the distributional extent provides high quality habitat for this 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 occurs mainly 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, sedgeland, damp gullies, swamps and some shrubby woodlands (Menkhorst, 1995), often in landscape settings with little exposure to the sun (Wilson et al., 2001). 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 considered to be late successional (Wilson et al., 2001). 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% of the peak.

Mating is highly synchronised, with females giving birth to six to eight young in June-August (Wilson & Bourne, 1984; Wilson, 1986; Sale et al., 2006). Males die after mating, but some females endure to a second breeding season (Wilson & Bourne, 1984; Wilson, 1986; Magnusdottir et al., 2008). Generation length is assumed to be 1 year.

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
Inappropriate fire regimes	severe	large	subpopulations of this species have been shown to be eliminated by wildfire, and recolonisation may be slow or absent (Wilson et al., 2001; Wilson & Bachmann, 2008)
Habitat loss and fragmentation	severe	large	much of its 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)
Predation by red fox	moderate	large	predation 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 (J. van Weenen pers. comm., cited in Woinarski et al., 2014)

Predation by feral cats	moderate	large	impacts uncertain
Habitat degradation due to grazing by livestock and feral herbivores	moderate	moderate	livestock 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 (J. van Weenen pers. comm., cited in Woinarski et al., 2014)

Assessment of available information 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%
<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>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.</p> <p>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]</p> <p>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.</p> <p style="text-align: center;"><i>based on any of the following</i></p> <p>(a) direct observation [except A3]</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</p>			

Evidence:

There is limited information on the population size and population trends of the swamp antechinus (coastal Victoria and far south-eastern South Australia). The subspecies' distribution is highly fragmented; while some subpopulations have been monitored, there is no integrated monitoring program in place (Woinarski et al., 2014).

However, the population size is suspected to be undergoing continuing decline (probably at a rate of <30% over 10 years) due to past and continuing habitat loss, degradation and fragmentation, and ongoing impacts of feral predators and fire. The extent of occurrence and, particularly, area of occupancy are also likely to have declined substantially since European settlement due to habitat loss and 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 limited capability to recolonise areas after fire.

Wilson et al. (2001) demonstrated population loss and slow or no recolonisation after an extensive fire near Anglesea. In 2000 the subspecies was recorded in the swampy margins around Buck's Lake, South Australia. 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).

The data presented above appear to be insufficient to demonstrate if the subspecies is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 2. Geographic distribution is precarious for either extent of occurrence AND/OR area of occupancy			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
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:

Woinarski et al. (2014) estimate the extent of occurrence to be 16 800 km², and the area of occupancy likely to be < 2000km². The subspecies occurs at >10 locations, but the population is severely fragmented. The swamp antechinus (coastal Victoria and far south-eastern South Australia) 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).

The data presented above appear to demonstrate that the subspecies is **eligible for listing as Vulnerable** under criterion B2a,b(ii,iii,iv,v). However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 3. Small 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 generations (whichever is	Substantial rate 10% in 10 years or 3 generations (whichever is longer)

		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
	(ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%
(b)	Extreme fluctuations in the number of mature individuals		

Evidence:

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 hectares) and Kanowna (31 hectares) 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 data presented above appear to be insufficient to demonstrate if the subspecies is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

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

Evidence:

There is no robust estimate of population size. However, Woinarski et al. (2014) estimate the total population size at 100 000 mature individuals (Woinarski et al., 2014).

The data presented above appear to be insufficient to demonstrate if the subspecies is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

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
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Evidence:

No population viability analysis has been undertaken (Woinarski et al., 2014).

There are insufficient data to demonstrate if the subspecies is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Conservation Actions

Recovery Plan

A decision about whether there should be a national recovery plan for this subspecies has not yet been determined. The purpose of this consultation document is to elicit additional information to help inform this decision.

Primary Conservation Objectives

1. Manage threats to secure or increase overall population size.
2. Maintain viable populations at all known localities.

Conservation and Management Actions

There are no targeted management actions for the subspecies. However, 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 last decade (e.g. Glenelg Ark: Robley et al., 2009).

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

Theme	Specific actions	Priority
Active mitigation of threats	implement fire control measures that benefit this species	high
	restore degraded habitats and habitat connectivity	medium-high
	implement broad-scale management of feral predators; and intensive local-scale implementation at and around important subpopulations	medium-high
	constrain total grazing pressure 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	medium-high
Captive breeding	n/a	
Quarantining isolated populations	maintain the feral predator-free status of islands supporting this subspecies	high

Translocation	n/a	
Monitoring	implement an integrated monitoring programs across subpopulations, linked to assessment of management effectiveness (e.g. with sites inside and outside the Glenelg Ark program of intensive fox baiting)	medium
Community engagement	develop conservation covenants on lands with high value for this species	low-medium

Information and research priorities

Information and research priorities are outlined in the table below (Woinarski et al., 2014).

Theme	Specific actions	Priority
Survey to better define distribution	define fine-scale distribution patterns across range, and the number of individuals in subpopulations	medium-high
Assess impacts of threats on species	assess abundance of feral cats, dogs and red foxes in the range of this species, 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
Establish or enhance monitoring program	design an integrated monitoring program across subpopulations	medium-high
	monitor abundance of feral predators at key subpopulations, in response to management actions	medium
	monitor incidence of fire, and vegetation response, at key subpopulations	medium-high
Assess effectiveness of threat mitigation options	assess effectiveness of options for broad-scale control of feral predators; or of local-scale control at sites with important populations	medium-high
	assess efficacy and impacts of management options to reduce fire incidence, extent and intensity, and promote appropriate heterogeneity of fire mosaic	medium-high
	assess efficacy of restored habitat and of habitat corridors to increase population viability	medium-high
Resolve taxonomic uncertainties	assess and interpret level of genetic variation across subpopulations of this species	low-medium

Assess habitat requirements	n/a	
Assess diet, life history	n/a	
Undertake research to develop new or enhance existing management mechanisms	develop broad-scale, targeted feral cat control technology	medium

References cited in the advice

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Consultation questions

1. Do you agree with the current taxonomic position of the Australian Faunal Directory for this taxon (as identified in the draft conservation advice)
2. Can you provide any additional references, information or estimates on longevity, age of maturity, average life span and generation length?
3. Has the survey effort for this taxon been adequate to determine its national distribution and adult population size?
4. Do you accept the estimate provided in the nomination for the current population size of the taxon?
5. For any population with which you are familiar, do you agree with the population estimate provided? If not, are you able to provide a plausible estimate based on your own knowledge? If so, please provide in the form:
 Lower bound (estimated minimum):
 Upper bound (estimated maximum):
 Best Estimate:
 Estimated level of Confidence: %
6. Can you provide any additional data, not contained in the current nomination, on declines in population numbers over the past or next 10 years or 3 generations, whichever is the longer?
7. Is the distribution as described in the nomination valid? Can you provide an estimate of the current geographic distribution (extent of occurrence or area of occupancy in km²) of this taxon?
8. Has this geographic distribution declined and if so by how much and over what period of time?

9. Do you agree that the taxon is eligible for inclusion on the threatened species list, in the category listed in the nomination?
10. Do you agree that the threats listed are correct and that their effects on the taxon are significant?
11. To what degree are the identified threats likely to impact on the taxon in the future?
12. Can you provide additional or alternative information on threats, past, current or potential that may adversely affect this taxon at any stage of its life cycle?
13. In seeking to facilitate the recovery of this taxon, can you provide management advice for the following:
 - What individuals or organisations are currently, or need to be, involved in planning to abate threats and any other relevant planning issues?
 - What threats are impacting on different populations, how variable are the threats and what is the relative importance of the different populations?
 - What recovery actions are currently in place, and can you suggest other actions that would help recover the taxon? Please provide evidence and background information.
14. Can you provide additional data or information relevant to this assessment?