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Notice of and reasons for the Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to list *Liopholis montana* (Donellan et al. 2002) as an ENDANGERED SPECIES in Part 2 of Schedule 1 of the Act. Listing of Endangered species is provided for by Part 4 of the Act.

The NSW Threatened Species Scientific Committee is satisfied that *Liopholis montana* (Donellan et al. 2002) has been duly assessed by the Commonwealth Threatened Species Scientific Committee under the Common Assessment Method (Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2022). and is eligible to be listed in accordance with section 4.4(4) of the Act on the basis of the risk of extinction in NSW. The acceptance of this assessment is provided for by Part 4.14 of the Act.

Summary of Conservation Assessment

The NSW Threatened Species Scientific Committee accepts the assessment outcome of the Commonwealth Threatened Species Scientific Committee in the DCCEEW 2022 Conservation Advice for *Liopholis montana*.

Liopholis montana (Donellan et al. 2002) was found to be Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3 (b)(d) and (e i,ii,iii,iv). The main reason for this species being eligible for listing in the Endangered category are its restricted area of occupancy, the number of locations has been assessed as one, ongoing loss and degradation of habitat and inferred decline in mature individuals.

The NSW Threatened Species Scientific Committee has found that:

1. The Mountain Skink is a stoutly built species that has two distinct colour morphs: a patterned morph and a plain morph (Robertson and Coventry 2019; Chapple *et al.* 2008). The basic colour of the head, body, limbs, and tail is grey-brown with most individuals being plain-backed with a reddish-brown dorsum (Donellan *et al*. 2002). The patterned morph has a series of dorsolateral blotches or vermiculation's, occasionally being sufficiently continuous to outline spots of the underlying brown colouring (Donellan *et al.* 2002). Individuals are considered to be adult at a snout–to-vent length of approximately 74 mm and mean and maximum adult snout–to-vent length is 92 mm and 111 mm respectively (Donellan *et al.* 2002). The Mountain Skink can be distinguished from *Liopholis whitii* by the absence of dark-edged pale ocellate markings, particularly above the base of the forelimb and can be distinguished from *Liopholis guthega* and by the absence of broad paravertebral stripes (Robertson and Coventry 2019).

2. The geographic distribution of the Mountain Skink is highly restricted. While the Extent of Occurrence (EOO) is calculated at 50,496 km^2 based on records from

1965-2017. The area of known and likely distribution is estimated by DAWE to be 17,118 km^2 (2021). The Area of Occupancy (AOO) is estimated at 196 km^2, based on records from 1965–2021 (DAWE 2021). Confidence in this AOO value is high; however, due to the inclusion of records dating back to 1965 and extensive survey work across the distribution producing few additional records, it is possible that the AOO value is over estimated (Clemann *et al.* 2018). The recent discoveries extending its western and southerly range in Victoria (Chapple and Farquhar 2021) are not likely to be followed by further discoveries that would cause the AOO to exceed the Endangered threshold of >500 km^2. The EOO was calculated using a minimum convex hull, and the AOO calculated using a 2 x 2 km grid cell method, based on the IUCN Red List Guidelines (2022).

3. The Mountain Skink occurs in montane and subalpine areas stretching from the Bimberi Range in the Australian Capital Territory (ACT), through the Snowy Mountains in New South Wales (NSW), into Victoria (Green & Osborne 2012). Populations also occur in Wombat State Forest to the northwest of Melbourne at an elevation of 620 m and at Sassafras in the Dandenong ranges, Victoria. (Farquhar *et al.* 2021; Chapple and Farquhar 2021). Throughout its range it occurs in a series of apparently isolated subpopulations at elevations ranging from 620 m (Wombat State Forest) to 1800 m (Mt Gingera, ACT) (Clemann *et al.* 2018; Wilson & Swan 2013, Cogger 2014, Green and Osborne 2012; Farquhar *et al.* 2021). The Mountain Skink occurs in at least three protected areas: Alpine National Park, Kosciuszko National Park and Namadgi National Park (Clemann et al. 2018). In NSW, specifically, it has been recorded at Rennix Gap, Whites River and near Smiggin Holes.

4. The Mountain Skink occupies habitat with granite and basalt boulders, rocks, slabs, rock screes or tors (Green and Osborne 1994; Donnellan *et al.* 2002; Chapple 2003; Cogger 2014) and large logs (W. Osborne and Z. Atkins pers. obs.) in tall open-forest, woodland, and heathland vegetation (Donnellan *et al.* 2002; Green & Osborne 1994) in montane and subalpine areas of south-east Australia from 600–1700m above sea level. This habitat provides the species with refugia from fires, extreme weather events and predators, and is used for foraging, breeding, burrowing, thermoregulation and social interactions. These habitat areas are known to be continuously, periodically, or occasionally occupied by the Mountain Skink or to have been occupied in the past but no longer do because of a threatening process.

5. The Mountain Skink constructs burrow networks beneath rocks (Donnellan *et al.* 2002). It lives in colonies and appears to exhibit stable pair bonds (Senior 2019), with females giving birth to up to four young (Donnellan *et al.* 2002). It has an omnivorous diet that includes seasonal fruits (Donnellan *et al.* 2002).

6. Information on population demographics of the Mountain Skink is lacking but the species appears to be uncommon, occurring in disjunct colonies with small subpopulations consisting of only one or two warrens each containing a small number of lizards (Senior 2019; Clemann *et al.* 2018). The species is likely to have poor dispersal ability (Atkins *et al.* 2018; Koumoundouros *et al.* 2009; Olsson & Shine 2003) and coupled with the isolation of subpopulations, suggests that

recolonization of sites under threat scenarios such as bushfires and or high predation pressure is highly unlikely and poses an extinction risk to subpopulations. The number of locations is assessed as one, given that it is plausible for a single fire event to impact a large portion or even the entire range of the Mountain Skinks habitat in alpine and subalpine woodlands and forests between 600-1700 m above sea level (DEECCW 2022).

7. The Mountain Skink is primarily threatened by the ongoing impacts of climate change, specifically increased frequency, extent and severity of wildfires (Ward et al. 2020), as well as; logging in parts of its range (Clemann et al.2018), prescribed burning by government agencies (Chapple and Farquhar 2021), predation by invasive predators (Watson 2006; Woinarski et al. 2018; Stobo-Wilson et al. 2021) and habitat degradation by feral horses and deer (Driscoll et al. 2019; Bartlett 2012; Hampton and Davis 2020). These threats are outline in the statements below in the order of greatest consequence to the species.

8. Increased wildfire frequency, as a consequence of ongoing climate change, presents a major, known, current and future threat to the Mountain Skink, resulting in mortality, increased predation risk and habitat degradation during post-fire succession. Approximately 32% (5389 km^2) of the known and likely modelled distribution of the species was burnt in 2019-20 bushfires (DAWE 2021). An expert elicitation process predicted up to 11% decline in population size 10 years post-fire, with a lower 80% confidence bound of 32% population loss, assuming no further extensive fire events (Legge *et al*. 2021). Being rock-dwellers and burrowers in addition to inhabiting logs which are likely diminished by fire, the Mountain Skink is afforded some protection from the direct effects of fire and is impacted primarily from predation post fire by feral cats, by loss of foraging habitat, and by habitat modification.

9. Much of the species' range falls within areas targeted for 'forest utilization', with both logging and road building ongoing within its range. This is a major, known, current and future threat to the Mountain Skink as the extent of logging is projected to expand within the species' range in Victoria as new logging coupes are approved or scheduled coupes are logged (Clemann et al. 2018).

10. Prescribed burns undertaken by government agencies that fall within the distribution areas of the Mountain Skink present a major, unknown current and future risk to abundance. Long-unburned forests and woodlands can be more important for reptile richness and abundance than areas with prescribed burning (Dixon *et al.* 2018).

11. Predation by feral cats and foxes, which are known to occupy Mountain Skink habitat (Watson 2006; Schulz and Wilks 2017), currently present a major, suspected threat to the species population. The Mountain Skink has many of the traits that make it vulnerable to cat predation, including having high predictability in activity with permanent burrows, being colonial and occurring in open areas (Woinarski *et al.* 2018).

12. Displacement of the Mountain Skink through a reduction of habitat, as a result of ongoing climate change presents a, major, suspected, future threat. Alpine habitats including sub alpine woodland is predicted to experience large change as a result of the climate by 2060–2079 (Love *et al.* 2019) potentially reducing the area of habitat available to the Mountain Skink and making some areas more favourable for lower elevation species (Atkins *et al*. 2018; Clemann *et al.* 2018).

13. The Mountain Skink is at suspected, current and future risk from habitat degradation caused by feral horses (*Equus caballus*), as demonstrated through impacts on *L. guthega*, in Koszciusko National Park (Driscoll *et al*. 2019). Deer may also be impacting the species through reductions in the availability of shelter and food as demonstrated by findings on other reptiles in Victoria (Bartlett 2012; Hampton and Davis 2020).

14. *Liopholis montana* (Donellan *et a*l. 2002) is eligible to be listed as an Endangered species as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing a very high risk of extinction in Australia in the near future as determined in accordance with the following criteria as prescribed by the *Biodiversity Conservation Regulation 2017*:

Assessment against *Biodiversity Conservation Regulation* 2017 criteria
The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome: Endangered under Clause 4.3 (b)(d) and (e i,ii,iii,iv)

Clause 4.2 – Reduction in population size of species
(Equivalent to IUCN criterion A)
Assessment Outcome: Data Deficient.

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

Clause 4.3 – Restricted geographic distribution of species and other conditions
(Equivalent to IUCN criterion B)
Assessment Outcome: Endangered under Clause 4.3 (b)(d) and (e i,ii,iii,iv)

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

Clause 4.4 – Low numbers of mature individuals of species and other conditions
(Equivalent to IUCN criterion Clause C)
Assessment Outcome: Data Deficient.

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

				(III)	for vulnerable species	low,
			(B)	all or nearly all mature individuals of the species occur within one population,		
			(C)	extreme fluctuations occur in an index of abundance appropriate to the species.		

Clause 4.5 – Low total numbers of mature individuals of species
(Equivalent to IUCN criterion D)
Assessment Outcome: Data Deficient.

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

Clause 4.6 – Quantitative analysis of extinction probability
(Equivalent to IUCN criterion E)
Assessment Outcome: Data Deficient

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

Clause 4.7 – Very highly restricted geographic distribution of species– vulnerable species
(Equivalent to IUCN criterion D2)
Assessment Outcome: Data Deficient.

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

Senior Professor Kristine French
Chairperson
NSW Threatened Species Scientific Committee

Supporting Documentation:

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2022). Conservation Advice for *Liopholis montana* (Mountain Skink). Canberra: Department of Climate Change, Energy, the Environment and Water

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