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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 Martin's toadlet *Uperoleia martini* Davies & Littlejohn, 1986 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 Martin's toadlet *Uperoleia martini* Davies & Littlejohn, 1986 has been duly assessed by the Commonwealth Threatened Species Scientific Committee under the Common Assessment Method, as provided by Section 4.14 of the Act. After due consideration of Commonwealth DCCEEW (2023), the NSW Threatened Species Scientific Committee has made a decision to list the species as Endangered.

Summary of Conservation Assessment

Martin's toadlet *Uperoleia martini* Davies & Littlejohn, 1986 was found to be Endangered in accordance with the following provisions in the *Biodiversity* Conservation *Regulation 2017*: Clause 4.2 (1)(b)(2)(c) and Clause 4.3 (b)(d)(e i,ii,iii) because: i) it has undergone a large reduction in numbers over three generations (13 years); ii) it has a highly restricted distribution with an Area of Occupancy of 180 km^2; iii) it is known from only five threat-defined locations; and iv) there is an inferred continuing decline in the number of mature individuals, the geographic distribution of the species, and habitat area, extent and quality due to vegetation clearing, adverse fire regimes, increased frequency and duration of drought due to climate change, and habitat degradation by feral Deer.

The NSW Threatened Species Scientific Committee has found that:

1. Martin's toadlet *Uperoleia martini* Davies & Littlejohn, 1986 is a small, terrestrial frog from the family Myobatrachidae. Like other members of the *Uperoleia* genus, it is commonly referred to as a toadlet due to its toad-like appearance, but it is not a 'true' toad. Males have a snout-to-vent length (SVL) of up to 34 mm. Female size is unknown, but the closely related species, with similarly sized males, *U. tyleri* (Tyler's toadlet) and *U. mahonyi* (Mahony's toadlet), show little difference in body length between the sexes. Martin's toadlet has a broad head with a short, rounded snout. The eyes are golden, and the tympanum is not visible. The dorsum can be light grey-brown to dark grey with darker patches. The skin has many yellow or red-tipped tubercles (raised nodules), which sometimes form a row along the vertebrae. A ridge of yellow or white tubercles extends from the corner of the mouth, along the jaw. The upper parts of the forelimbs are yellow or red-brown, whilst the groin and back of the thighs on the long hindlimbs are yellow. The smooth underside is dark brown with white speckles, with the throat darker in males during the breeding season. The fingers are short and slightly fringed, whilst the toes are long and without fringing. Both fingers and toes have large metatarsal tubercles and no webbing between digits (Anstis 2017; Sanders 2021).

2. Tadpoles grow to 41 mm total length with a body length of approximately 16 mm. The snout and body are rounded. The eyes are positioned dorsolaterally, and the iris is primarily black but may be golden around the pupil. The large nares are close together. The back is dark brown to black with gold iridophores. The underside of the body is lighter and has metallic flecks. The tail fins are moderately arched and have large black and gold spots (Anstis 2017).

3. Martin's toadlet is mostly restricted to the Gippsland coast in Victoria, with the species' distribution extending 320 km from near Yarram, Victoria to just across the Victorian/New South Wales (NSW) border into Nadgee Nature Reserve (Clulow *et al.* 2016; Cutajar *et al.* 2022). It has been recorded up to 36 km inland from the coast (GBIF 2021). Based on records over the past 10 years, extant subpopulations are presumed to exist at Holey Plains State Park, Gippsland Lakes (Dutson Downs), Cape Conran Coastal Park, the Cann River, and Croajingolong National Park (Wingan Swamp and Howe Flat) (Collyer and Reside 2012; R. Bilney pers comm 2013; T. Jessop pers comm 2013; G. Gillespie and R. Catullo pers comm 2013, all cited in DELWP 2015, which was compiled by Nick Clemann). There is no estimate of the number of mature individuals (Commonwealth DCCEEW 2023).

4. Martin's toadlet has a highly restricted geographic distribution. The Area of Occupancy (AOO) of Martin's toadlet was estimated to be 180 km^2 using 2 x 2 km grid cells, the scale recommended by IUCN (2022). The Extent of Occurrence (EOO) was estimated to be 11,656 km^2 and is based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2022). Whilst the AOO was calculated to be 180 km^2 based on existing, expertly vetted records, it is likely an underestimate due to lack of sampling within the EOO. It is considered unlikely, however, that the true AOO exceeds the threshold for Endangered due to the already restricted geographic distribution of Martin's toadlet, the inferred continuing decline in the extent and quality of its habitat, and inferred continuing decline in the number of mature individuals.

5. Martin's toadlet primarily occurs in moderately sized permanent or semipermanent swamps and ponds surrounded by woodland or coastal scrub (DELWP 2015; Sanders 2021; R. Catullo pers. comm. September 2021) but has also been found around dams and flooded grassland. Martin's toadlet usually stays close to water during the breeding season, but individuals are sometimes found away from free water in depressions prone to flooding (Clemann and Swan in press). The size of a waterbody is an important factor influencing the probability of occurrence, with surveys suggesting that Martin's toadlet tends to be absent from both small ephemeral pools and large bodies of water (R. Catullo pers. comm. 2013, cited in DELWP 2015). Around waterbodies, the species has been recorded from dry sclerophyll forest, woodlands, shrublands, grasslands, coastal heaths, sedgeland, and Melaleuca thickets (Cogger 2014; DELWP 2015; Sanders 2021; Clemann and Swan in press). Martin's toadlet is rarely recorded from disturbed or cleared areas. While the species has been recorded calling from paddocks some distance from intact native vegetation (N. Clemann pers. comm. March 2023), recording sites in cleared areas are usually adjacent to intact woodlands (M. Clancy pers. comm.

October 2021). Land clearing has reduced the extent of the species' habitat, which is now generally restricted to protected areas and state forests (DELWP 2015).

6. The male breeding call consists of a single, repeated, drawn-out note (Davies and Littlejohn 1986; Sanders 2021) lasting about a second, and repeated every two to three seconds. Males begin calling in early to mid-spring (Davies and Littlejohn 1986). They are primarily known to call from the base of emergent vegetation in flooded grasslands and densely vegetated swamps and ponds (Anstis 2017) as well as from leaf litter at the edge of waterbodies (DELWP 2015). Breeding events typically occur only during, or after, significant rain when the ground is saturated (J. Tscharke pers. comm. October 2021).

7. Females lay eggs singularly and attach them to submerged grass stems or other materials (Anstis 2017). Eggs are medium-sized (ova ~2 mm in diameter) and mostly white. Clutch size is unknown. Tadpoles hatch in approximately eight days and complete metamorphosis in late summer to autumn (Anstis 2017). Tadpoles live on the bottom of ponds where they are feed on algae and detritus. They are fast swimmers and, being secretive, they are often hard to see among submerged leaf litter (Anstis 2017).

8. Little is known about the behaviour of Martin's toadlet. Like other *Uperoleia* species, it is inferred to have poor dispersal ability, and likely burrows underground during unsuitable climatic conditions (Westgate *et al*. 2012; DELWP 2015). It is also thought to burrow to avoid predation (R. Catullo pers. comm. cited in DELWP 2015).

9. The main threats to Martin's toadlet are habitat loss resulting from the clearing of vegetation, adverse fire regimes, changes in rainfall, increased frequency of droughts due to climate change, habitat degradation by feral deer and potentially chytridiomycosis caused by amphibian chytrid fungus. 'Clearing of native vegetation', 'Anthropogenic climate change', 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition', 'Herbivory and environmental degradation caused by feral deer' and 'Infection of frogs by amphibian chytrid causing the disease chytridiomycosis' are listed as Key Threatening Processes under the Act.

10. When the most serious plausible threats of adverse fire regimes and increasing frequency of droughts are considered, Martin's toadlet is considered to occur at no more than five threat-defined locations. The Martin's toadlet distribution is spread over two coastal bioregions with different land use histories, the largely protected South East Corner IBRA Bioregion (SEC) (straddling the bottom corner of the Victorian/NSW border) and the intensively modified South East Coastal Plain IBRA Bioregion (SCP). Given the heavily forested nature of the SEC, the most serious plausible threat to Martin's toadlet in this bioregion is high severity fire. Although a large-scale fire could adversely affect a sizeable portion of the population in the SEC, fires are patchy in nature and high severity fire in a single fire season is unlikely to occur at, or adversely affect, all Martin's toadlet sites, meaning up to four locations are considered to occur in this bioregion. In contrast to the heavily forested SEC, the SCP is mostly cleared of native grassland and eucalyptus forests for agriculture and forestry (Thackway and Cresswell 1995; BAP 2018). Within this landscape, the most serious plausible threat to Martin's toadlet is drought, meaning

the SCP is considered to be one location. This means that there is a maximum of five threat-defined locations across the species' range.

11. Martin's toadlet is inferred to be suffering continuing decline in geographic distribution and in area, extent, and quality of habitat due to vegetation clearance for agriculture, timber harvesting, and the construction and maintenance of roads and utilities. The species is rare or absent in cleared habitats (DELWP 2015). Loss of habitat is likely to have the greatest adverse effect on adult females, who generally spend more time in the surrounding vegetation, away from water bodies, than do breeding males. Given that calling males are usually used as a proxy for species presence/population size, and that *Uperoleia* species require more terrestrial habitat than previously thought (N. Clemann pers. comm. March 2023), the importance of surrounding terrestrial habitat has often been understated.

12. Adverse fire regimes, particularly increased occurrences of severe wildfires, are inferred to be causing continuing decline in the quality of habitat and number of mature individuals of the Martin's toadlet. Severe wildfires are likely to directly eliminate or degrade the species' terrestrial habitat, on which females are particularly reliant. Severe wildfires can also adversely affect pond breeding habitat by increasing water temperature, altering water chemistry (Lyon and O'Connor 2008), and creating sediment/ash runoff 'slugs' that can form in waterways following rainfall (Lyon and O'Connor 2008; Alexandra and Finlayson 2020). These slugs can promote toxic algal blooms (Alexandra and Finlayson 2020) that can deoxygenate the water and cause egg and tadpole death. In the range of the Martin's toadlet, much soil and ash were present in waterbodies during recent breeding seasons since the 2019-20 bushfires, likely decreasing tadpole survival (N. Clemann pers. comm. October 2021). An analysis also showed that 24% of the distribution of Martin's toadlet was affected by the 2019/20 fires (with 8% burnt in high to very high severity fire, and a further 16% was burnt in low to moderate severity fire). An overall population decline relative to the pre-fire population was estimated to be 14% at 10 years post-fire but could be within the range of a 35% decline to 1% increase (bound of 80% confidence limit) given recovery remains plausible (Legge *et al*. 2021).

13. Changes in rainfall and increased frequency of droughts due to climate change are inferred to have caused a population reduction in, and to be contributing to continuing decline in the area, extent and quality of habitat of Martin's toadlet. Climate projections for southeastern Australia include decreased rainfall, increased average temperatures, and more frequent droughts (Hagger *et al.* 2013; Pearson *et al.* 2014; CSIRO and BOM 2020). Martin's toadlet is dependent on water for breeding and shelter sites (DELWP 2015). Its range was reduced due to the Millennium Drought (1996-2010) and the drought preceding the 2019-20 bushfires (N. Clemann pers. comm. October 2021). The species is unlikely to disperse across large areas of unsuitable habitat (including habitat rendered unsuitable by drought) to find more suitable habitat (N. Clemann pers. comm. October 2021). Analysis of the Victorian population of Martin's toadlet over the past 15 years (2006-21) concluded that the population was suspected to have declined by 50–85% due to drought conditions, with breeding ponds drying up combining with habitat loss from the 2019-20 bushfires (expert opinion cited in DELWP 2021). This analysis also suspected the Victorian population would continue to decline

over the next three generations (2022-35) by 40–70% due to an increased frequency and severity of these threats induced by climate change.

14. Feral deer are inferred to be contributing to continuing decline in the habitat quality of Martin's toadlet. Deer, including hog deer (*Axis porcinus*), sambar deer (*Rusa unicolor*), and potentially fallow deer (*Dama dama*). They tramplevegetation and create wallows in Martin's toadlet habitat, degrading vegetation and reducing water quality in swamps and ponds (McDowell 2007; Claridge 2016; J. Tscharke pers. comm. October 2021).

15. Chytridiomycosis caused by amphibian chytrid fungus may have contributed to recent population decline in Martin's toadlet (DELWP 2015), but the severity of this threat to the species remains uncertain. Mortality associated with amphibian chytrid fungus erodes the capacity of the population to sustain loss of recruitment associated with drought and reduces resilience to climate change (Scheele *et al*. 2016).

16. Considering both analyses above (DELWP 2021 and Legge *et al*. 2021), a population reduction of >50% is inferred to have occurred over the past three generations (13 years) in the Martin's toadlet, and these reductions are likely to continue into the future.

17. Martin's toadlet *Uperoleia martini* Davies & Littlejohn, 1986 is not eligible to be listed as a Critically Endangered species.

18. Martin's toadlet *Uperoleia martini* Davies & Littlejohn, 1986 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 4.2 (1)(b)(2)(c) and 4.3 (b)(d)(e i, ii, iii).
Clause 4.2 – Reduction in population size of species
(Equivalent to IUCN criterion A)
Assessment Outcome: Endangered under Clause 4.2 (1)(b)(2)(c)

(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)(e i,ii,iii).

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 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: Not met.

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

Senior Professor Kristine French
Chairperson
NSW Threatened Species Scientific Committee

Supporting Documentation:

Commonwealth DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2023). Conservation Advice for *Uperoleia martini* (Martin's toadlet) Australian Government, Canberra, ACT.

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