

Publication date: 11 October 2024

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 the Hunter Valley delma *Delma vescolineata* Mahony, Cutajar & Rowley, 2022 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 the Hunter Valley delma *Delma vescolineata* Mahony, Cutajar & Rowley, 2022 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 (2024), the NSW Threatened Species Scientific Committee has made a decision to list the species as Endangered.

Summary of Conservation Assessment

The Hunter Valley delma *Delma vescolineata* Mahony, Cutajar & Rowley, 2022 was found to be Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3(b)(d)(e i,ii,iii) because: 1) the species has a highly restricted geographic distribution with an estimated extent of occurrence (EOO) of 1,825 km² and an estimated area of occupancy (AOO) of 48 km²; 2) the species is known from a maximum of two threat-defined locations; 3) continuing decline is inferred in the EOO, AOO, and area, extent, and quality of habitat due to clearing for mining and agriculture, adverse fire regimes, and increased frequency and intensity of drought; and 4) continuing decline in the number of mature individuals is inferred due to predation from invasive species.

The NSW Threatened Species Scientific Committee has found that:

1. The Hunter Valley delma *Delma vescolineata* Mahony, Cutajar & Rowley, 2022 (family Pygopodidae) is a legless or flap-footed lizard that grows to approximately 25 cm in total length, with a maximum snout-vent length (SVL) of 10 cm (Mahony *et al.* 2022). As with other legless lizards, the Hunter Valley delma lacks forelimbs and has very reduced hind limbs which are apparent as small flaps on either side of the vent. The top of the head is dark grey to light brown and uniform or with darker streaks or spots. There are scattered dark bars, spots or smudges on the scales bordering the mouth, the ear and sides toward the front of the body. Behind the ears and along the sides, the colour may be a slightly rusty-yellow colour. The rest of the body is light brown, often with some dark flecks along the top of the side of the body. Most individuals have a pale line running from behind the ear along the body. Some individuals may have two such lines. The underside is white, and the internasal scale is fused to the 1 supralabial scale (Mahony *et al.* 2022). Too few specimens of this species have been collected, or observed, to determine if it is sexually dimorphic. A single juvenile has been discovered which had a dark head tending towards black which extended to the top and sides of the neck, the rest of the body being brown and without pattern (Mahony *et al.* 2022).

NSW Threatened Species Scientific Committee

2. Until recently, *Delma vescolineata* was considered to be a subpopulation of the more widespread *Delma impar* (striped legless lizard). Recent morphological and molecular analyses of the phylogenetic relationships between *D. impar sensu stricto* and individuals of what are now known as *D. vescolineata* revealed the latter to be a separate species (Mahony *et al.* 2022).
3. *Delma vescolineata* is known almost entirely from a 25 km wide corridor in the Hunter Valley, between Maitland and Muswellbrook, New South Wales (Mahony *et al.* 2022). A further specimen has been identified from just north of Parraweena on the Liverpool Plains, approximately 80 km north-west of Muswellbrook (Mahony *et al.* 2022). It is possible that *D. vescolineata* is more widespread in this region. The sites where the species has been detected include rehabilitated mine sites and pastoral land used for cattle grazing (Mahony *et al.* 2022, S. Mahony pers. comm. May 2022). At this time, no sites occur within a protected area. There are insufficient genetic samples of this species to determine if there is any sub-structuring of the population.
4. It is assumed that the population in the Hunter Valley is adequately connected to represent one subpopulation per the IUCN (2024) definition, with the isolated record 80 km to the north-east currently considered a separate subpopulation. No population census for *Delma vescolineata* has been undertaken, hence there is insufficient information available to estimate the number of mature individuals.
5. *Delma vescolineata* has been recorded in secondary native grassland remaining after the removal or dieback of previous woody canopy vegetation (Benson 1996) in association with sparse box-gum or ironbark woodland (Mahony *et al.* 2022). The primary canopy species consists of *Eucalyptus melliodora* and *E. crebra*, with a diverse ground cover layer containing multiple grasses including *Austrostipa* spp., *Bothriochloa* spp., and *Chloris* spp. (Mahony *et al.* 2022). It has been found sheltering under rocks and discarded rubbish, including building rubble, metal and organic waste. *Delma vescolineata* has also been detected under dried cow pats in agricultural land that is heavily disturbed by livestock and contain no natural surface refugia (Mahony *et al.* 2022) and sheltering in roadside verges (Mahony *et al.* 2022; S. Mahony pers. comm. May 2022). This suggests at least some capacity for dispersal within the landscape where most records for the species occur.
6. The closely related striped legless lizard feeds mainly on crickets, spiders, Lepidopteran larvae, and cockroaches (Coulson 1990; Nunan 1995; Kutt *et al.* 1998). Legless lizards actively forage for food as well as exhibit sit-and-wait ambush feeding (Nunan 1995). Several *Delma vescolineata* specimens have been collected while active during the day (Mahony *et al.* 2022), indicating both diurnal and either crepuscular, or nocturnal activity.
7. Adult females in other *Delma* species are thought to lay up to two eggs annually in December–January under rocks and in soil cavities (Rauhala 1996; Peterson and Rohr 2010; Osborne and Dimond 2008). It is likely that *D. vescolineata* displays similar behaviour.
8. The primary threat to *Delma vescolineata* is habitat clearance for mining, agriculture and urban development. Other identified threats include adverse fire regimes, increased frequency and intensity of drought, intensive grazing and predation by European red foxes, dogs, and feral cats. ‘Clearing of native

NSW Threatened Species Scientific Committee

vegetation', 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition', 'Anthropogenic climate change', 'Predation by the European Red Fox *Vulpes Vulpes* (Linnaeus, 1758)', 'Predation and hybridisation by Feral Dogs, *Canis lupus familiaris*' and 'Predation by the Feral Cat *Felis catus* (Linnaeus, 1758)' are listed as Key Threatening Processes under the Act.

9. The species is considered to occur at two threat-defined locations, based on the threat of habitat loss through mining, urbanisation and clearing for agriculture.
10. More than 90% of the area where *Delma vescolineata* is known to occur has been modified due to open cut mining or agriculture (Mahony *et al.* 2022). There are 41 coal mines throughout the Hunter Valley region (McArtney 2019), with at least 20 mines occurring within the species' range (NSW Mining 2022). The main area in the Hunter Valley from where the species has been recorded is at risk of further degradation due to mining and urban expansion (S. Mahony pers. comm. May 2022). There are ten mining projects currently proposed for the Hunter Valley (Denniss *et al.* 2021). Installation of new open cut mines will remove further habitat. Direct habitat loss and modification also increases habitat fragmentation in an already fragmented habitat. This has the potential to increase the susceptibility of this species to becoming locally extinct due to disturbance, or the impacts of climate change, such as increased frequency and severity of fires, and drought.
11. Fire has been recorded as causing mortality in the closely related striped legless lizard (Coulson 1990; Walton 1995). Hadden (1995) and O'Shea (2005) both recorded the striped legless lizard in recently burnt sites. Burning at a frequency of greater than once every five years is considered to be detrimental to the striped legless lizard as it may reduce vegetation cover and complexity, thus reducing prey availability and potentially increasing the risk of predation (O'Shea 2005). It is therefore likely that *Delma vescolineata* would be similarly negatively affected by fire. *Delma vescolineata* may also be threatened by fire effects on predator-prey interactions. Fire alters movement behaviour and can increase foraging efficiency in a range of predators, including European red foxes and feral cats (Hradsky 2020; DAWE 2022). Sensory cues enable predators to converge on burnt areas during and after fire (Hovick *et al.* 2017; Nimmo *et al.* 2018; DAWE 2022). Increased predator densities and reduced shelter can expose *D. vescolineata* to greater risks of predation.
12. Drought has the potential to result in reduced ground cover, reducing refugia and increasing mortality risk for grassland species. Climate projections for southeastern Australia include reduced rainfall during the spring and winter seasons, increased average temperatures including more hot days and extended warm periods and, more frequent droughts (CSIRO and BOM 2020). Increased drought is likely to make *Delma vescolineata* more susceptible to predation by making them more visible to potential predators. Drought will also result in habitat being more susceptible to fire. Dry periods may also increase the likelihood of egg desiccation and mortality, as observed in another grassland reptile, *Tympanocryptis lineata* (Canberra grassland earless dragon) (ACT Government 2017). Drought may also reduce food availability which could also affect reproductive capacity as decreased soil moisture and increased surface temperatures under drought conditions result in lower abundance and diversity of arthropods (Bell 1985; Prather *et al.* 2020).

NSW Threatened Species Scientific Committee

Pre-fire drought may dispose the species to high mortality in the post-fire environment, as reduced resources may result in a reduced physiological condition which cannot sustain individuals through a further reduction in resource availability (DAWE 2022).

13. There is no direct evidence of dogs, European red foxes or feral cats preying upon *Delma vescolineata*; however, both feral cats and European red foxes are major predators of small reptiles (Woinarski *et al.* 2018, Stobo-Wilson *et al.* 2021). In addition to the threat posed by feral individuals, urban development has the potential to increase the local abundance of domestic pet cats and dogs that also have the potential to act as predators of *D. vescolineata*.
14. The Hunter Valley delma *Delma vescolineata* Mahony, Cutajar & Rowley, 2022 is not eligible to be listed as a Critically endangered species.
15. The Hunter Valley delma *Delma vescolineata* Mahony, Cutajar & Rowley, 2022 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)(e i,ii,iii)

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)(e i,ii,iii)

The geographic distribution of the species is:

NSW Threatened Species Scientific Committee

	(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.

NSW Threatened Species Scientific Committee

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:

Commonwealth DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2024) Conservation Advice for *Delma vescolineata* (Hunter Valley delma). Australian Government, Canberra, ACT.

NSW Threatened Species Scientific Committee

References:

- ACT Government (2017). *ACT Native Grassland Conservation Strategy and Action Plans* (Environment, Planning and Sustainable Development, Canberra).
- Bell HL (1985) Seasonal variation and the effects of drought on the abundance of arthropods in savanna woodland on the Northern Tablelands of New South Wales. *Austral Ecology* **10**: 207–221.
- Benson JE (1996) What is a native grassland? In 'Proceedings of the 11th Annual Conference of the Grasslands Society of NSW Inc.' pp. 92–96. (Grasslands Society of NSW, Wagga Wagga).
- Coulson G (1990) Conservation Biology of the Striped Legless Lizard (*Delma impar*): An initial investigation. Arthur Rylah Institute for Environmental Research. Technical Report Series No. 106. Department of Conservation and Environment.
- CSIRO and BOM (Commonwealth Scientific and Industrial Research Organisation and The Bureau of Meteorology) (2020) The State of the Climate 2020. URL: <https://www.csiro.au/en/research/environmental-impacts/climate-change/State-of-the-Climite> (accessed 6 June 2021).
- DAWE (Department of Agriculture, Water and the Environment) (2022) Fire regimes that cause declines in biodiversity. URL: <https://www.dcceew.gov.au/environment/biodiversity/threatened/key-threatening-processes/fire-regimes-that-cause-declines-in-biodiversity> (accessed 25 May 2023).
- Denniss R, Campbell R, Littleton E (2021) One Step Forward, Two steps back – New coal mines in the Hunter Valley. *The Australia Institute*.
- Hadden S (1995) Distribution, population habitat estimates and habitat requirements for the Striped Legless Lizard *Delma impar* (Fischer). Report to the Australian Nature Conservation Agency. Department of Conservation & Natural Resources, Melbourne.
- Hovick TJ, Mcgranahan DA, Elmore RD, Weir JR, Fuhlendorf SD (2017) Pyric-carnivory: raptor use of prescribed fires. *Ecology and Evolution* **7**: 9144–9150.
- Hradsky BA (2020) Conserving Australia's threatened native mammals in predator-invaded, fire-prone landscapes. *Wildlife Research* **47**: 1–15.
- IUCN (2024) Guidelines for Using the IUCN Red List Categories and Criteria. Version 16 (March 2024). Standards and Petitions Committee of the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.
- Kutt AS, Coulson G Wainer J (1998) Diet of the Striped Legless Lizard *Delma impar* (Squamata: Pygopodidae) in a western (basalt) plains grassland, Victoria. *Australian Zoologist* **30(4)**: 412-418.
- Mahony SV, Cutajar T, Rowley JJJ (2022) A new species of *Delma* Gray 1831 (Squamata: Pygopodidae) from the Hunter Valley and Liverpool Plains of New South Wales. *Zootaxa* **5162**: 541-556.
- McArtney G (2019) Mining in the Hunter Valley: the black star. *The Australian Mining Review*.

NSW Threatened Species Scientific Committee

- Nimmo DG, Carthey AJR, Jolly CJ, Blumstein DT (2021) Welcome to the Pyrocene: animal survival in the age of megafire. *Global Change Biology* **27**: 5684–5693.
- NSW Mining (2022) Map of NSW mines. URL: <https://nswmining.com.au/mining-in-nsw/map-of-nsw-mines/> (accessed 18 August 2022).
- Nunan D (1995) Diet and feeding ecology of the Striped Legless Lizard *Delma impar* (Fischer, 1882) within the Australian Capital Territory. Canberra: ACT Parks & Conservation Service.
- O'Shea M (2005) *Methods for assessment and techniques for management of Striped Legless Lizard Delma impar populations in south-eastern Australia*. PhD thesis, Victoria University, St Albans, Victoria.
- Osborne W, Dimond W (2008) Survey for the Grassland Earless Dragon (*Tympanocryptis pinguicolla*) at Section 1 Symonston, Fyshwick, ACT. Report for ACT Planning and Land Authority (Institute for Applied Ecology, University of Canberra, Canberra).
- Peterson GNL, Rohr DH (2010) *Delma impar* (Striped Legless Lizard) repeated use of communal nesting site. *Herpetological Review* **41**: 78-79.
- Prather RM, Castillioni K, Welti EAR, Kaspari M, Souza L (2020) Abiotic factors and plant biomass, not plant diversity, strongly shape grassland arthropods under drought conditions. *Ecology* **101**: e03033.
- Rauhala M (1997) 1996 Monitoring program for the Striped Legless Lizard, *Delma impar*. Internal Report 97/1. Wildlife Research Unit, ACT Parks & Conservation Service.
- Stobo-Wilson AM, Murphy BP, Legge SM, Chapple DG, Crawford HM, Dawson SJ, Dickman CR, Doherty TS, Fleming PA, Gentle M, Newsom TM (2021) Reptiles as food: predation of Australian reptiles by introduced red foxes compounds and complements predation by cats. *Wildlife Research* **48(5)**: 470-480.
- Walton S (1995) *The effects of fire on grassland herpetofauna and habitat structure*. B.Sc. Honours thesis. Deakin University, Geelong.
- Woinarski J, Murphy B, Palmer R, Legge S, Dickman C, Doherty T, Edwards G, Nankivell A, Read J, Stokeld D (2018) How many reptiles are killed by cats in Australia? *Wildlife Research* **45**: 247-266.