

NSW Threatened Species Scientific Committee

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 frog Mahony's Toadlet *Uperoleia mahonyi* Clulow, Anstis, Keogh & Catullo 2016 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 has found that:

1. Mahony's Toadlet *Uperoleia mahonyi* Clulow, Anstis, Keogh & Catullo 2016 (family Myobatrachidae) is a small (males 30 mm, female 32 mm) but robustly built frog (Clulow *et al.* 2016). Like other members of the genus *Uperoleia*, this species has large parotoid glands covering the tympanum, unwebbed fingers, vomerine teeth vestigial or absent, inguinal colouration present and presence of inner and outer metatarsal tubercles (Clulow *et al.* 2016). This species is distinguished from all other *Uperoleia* species by a combination of ventral pigment (ventral surface completely covered with black and white marbling), presence of maxillary teeth, toes unwebbed, lack of colour patch below the knee and a "squelch" as a call (Clulow *et al.* 2016). The belly patterns of black and white patches appear marbled, more similar to the bellies of *Pseudophryne* spp., rather than simply stippled as commonly observed in *Uperoleia* spp. (Clulow *et al.* 2016). Inguinal (groin) and femoral (thigh) colour patches are orange with the femoral colour patch irregular in shape and large and always closer to knee than vent (Clulow *et al.* 2016). Tadpoles are indistinguishable from those of other *Uperoleia* species (see Anstis 2013) and are described in detail in Clulow *et al.* (2016).
2. *Uperoleia mahonyi* was first collected in 2007 and formally described in 2016 (Clulow *et al.* 2016). Prior to formal description this species was referred to as *Uperoleia* sp. Oyster Cove, *Uperoleia* sp. nov. (Oyster Cove, NSW) or *Uperoleia* sp. undescribed species (Lemckert 2010; OEH 2011, 2013; Anstis 2013; Parsons Brinkerhoff 2016). Letnic and Fox (1997a) referred to this species as *U. laevigata* (M. Letnic *in litt.* November 2016).
3. *Uperoleia mahonyi* is endemic to the mid-north coast of New South Wales (NSW) and is found between Kangy Angy and Seal Rocks. Mahony's Toadlet has been recorded almost exclusively on a substrate of leached (highly nutrient impoverished) white sand and is commonly associated with acid paperbark swamps (Clulow *et al.* 2016). *Uperoleia* species in general tend to be highly substrate specific and are limited to substrates (in this case sand) in which they are adapted to burrow (R. Catullo *in litt.* November 2016). Thom *et al.* (1992) and OEH (2012) describe the geomorphology and distribution of marine sediments in this area. Vegetation communities in which *U. mahonyi* has been found include wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland (Clulow *et al.* 2016). Aquatic vegetation at breeding sites includes sedges (*Schoenoplectus* spp., *Baumea* spp. and *Lepironia articulata*) and Broadleaf Cumbungi (*Typha orientalis*) (Clulow *et al.* 2016). Breeding habitat for Mahony's Toadlet appears to be similar to that for Tylers Toadlet *U. tyleri*, which occupies permanent or semi-permanent swamps and ponds of moderate size with no apparent flow of water (Clemann 2015; R. Catullo *in litt.* November 2016). Outside of the breeding period, adults of *U. mahonyi* are terrestrial. During non-breeding periods the species has been recorded up to 400 m from standing water within intact native vegetation, indicative of a need for large vegetation buffers around breeding sites to ensure persistence of this species (Westgate *et al.* 2012; Clemann 2015; Clulow *et al.* 2016). Females of other frog species move further away from waterbodies, so may be more sensitive to clearing than males (Penman *et al.* 2008; Clemann 2015). This

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species has also been recorded in disturbed environments, a golf course dam and a swale created by sand mining (Clulow *et al.* 2016), however Letnic and Fox (1997a) reported that it (as *U. laevigata* M. Letnic *in litt.* November 2016) prefers later successional stages with established vegetation. Disturbed sites where this species has been reported all have intact native vegetation around breeding habitat (Clulow *et al.* 2016).

4. Several other threatened species of frog specialise in the oligotrophic and acidic conditions typical of wallum habitats which are wholly or largely restricted to lowland sand plains, dunes and sand islands of coastal south-eastern Australia (*e.g.* Olongburra Frog *Litoria olongburensis*, Cooloola Tree Frog *L. cooloolensis*, Freycinet's Frog *L. freycineti* and Wallum Froglet *Crinia tinnula*; see Meyer *et al.* 2006), so this specialisation is not unique. Mahony's Toadlet *U. mahonyi* has been recorded near the Dusky Toadlet *U. fusca* and at sites with a range of other frog species including Rocket Frog *Litoria nasuta*, Peron's Tree Frog *Litoria peronii*, Tyler's Tree Frog *L. tyleri*, Eastern Dwarf Tree Frog *L. fallax*, Jervis Bay Tree Frog *L. jervisiensis*, Striped Marsh Frog *Limnodynastes peronii*, Haswell's Froglet *Paracrinia haswelli*, Common Eastern Froglet *Crinia signifera* and Wallum Froglet *C. tinnula* (Clulow *et al.* 2016).
5. Breeding in *Uperoleia mahonyi* occurs in March (autumn) and October-November (spring) (Clulow *et al.* 2016). In the wild, the eggs are likely to be attached to thin strands of submerged vegetation and substrate such as leaf litter similar to the sites chosen by all other members of this genus (Anstis 2013; Clulow *et al.* 2016). The clutch size is unknown. Longevity is unknown but has been estimated at 5–14 years for *U. martini* (Clemann 2015). It is also estimated that it takes at least a year for individuals to reach maturity (R. Catullo *in litt.* 29 November 2016).
6. The diet of *Uperoleia mahonyi* is unstudied, however other *Uperoleia* species have been reported eating ants, pill bugs, springtails, beetles, termites and mites (Tyler 1999; Tyler and Knight 2011; R. Catullo *in litt.* November 2016). Tadpoles of similar species (*e.g.* *U. laevigata*) are pond adapted, bottom dwellers which feed on sediment and algae (Anstis 2013). *Uperoleia* species are capable burrowers (in appropriate sediments) and have limited ability to move large distances across land or through urbanised areas so are likely to seek shelter near breeding sites during unfavourable conditions (Clemann 2015; R. Catullo *in litt.* November 2016). Rocks, logs and leaf litter may also be used for shelter and provide important refuges for invertebrate prey items (Lindenmayer *et al.* 2002).
7. Clulow *et al.* (2016) and S. Clulow *in litt.* (November 2016) report this species occurring in eight locations on sand beds in the Port Stephens, Myall Lakes and northern Central Coast areas. Sites include Wyrabalong National Park, Tomago, Oyster Cove, Nelson Bay, Fingal Bay, Seal Rocks and Kangy Angy. Population size is unknown, however, at waterbodies where they are recorded, the estimated abundance is in the hundreds (S. Clulow *in litt.* November 2016).
8. The distribution of *Uperoleia mahonyi* is highly restricted. The extent of occurrence (EOO) is 1,905 km² based on a minimum convex polygon enclosing all mapped occurrences of the species in NSW (Clulow *et al.* 2016), the method of assessment recommended by IUCN (2016). The area of occupancy (AOO) is estimated to be 36 km² based on nine 2 x 2 km grid cells, the scale recommended for assessing AOO by IUCN (2016). Due to the recent discovery of this species, both the AOO and EOO may increase with further targeted surveys. Despite the potential for some future increase in the known distribution, it is not expected that the geographic range will increase dramatically and so exceed the threshold for highly restricted, as *U. mahonyi* is a habitat specialist and the required habitat is limited.

9. *Uperoleia mahonyi* faces a range of threats including habitat loss, habitat degradation and disease. Historical and ongoing urban and agricultural development, which is widespread in coastal NSW, results in the loss and fragmentation of habitat and also degrades adjoining uncleared areas through changes in water flow regimes and water quality. Historical clearing for housing (and other purposes) around the city of Newcastle, smaller satellite towns (e.g. Port Stephens, Hawks Nest, Tea Gardens) and the development of the foreshores of Tuggerah Lakes and Lake Macquarie have resulted in the loss of 31–44% of the potential habitat for this species in these areas (OEH 2012, 2016). Human populations in coastal areas are predicted to grow rapidly (ABS 2016). Human population growth is linked with extinction risk, habitat loss and degradation (Harte 2007) and in NSW the human population is projected to increase by 48% in the period 2007–2056 (ABS 2016), which will increase the environmental impacts of land clearing, effluent disposal and water extraction. Population projections (percentage increase between 2011 and 2036) for the local government areas where this species is found are as follows: Port Stephens (37.9%), Central Coast (28.6%), Newcastle (27.5%), Lake Macquarie (15.2%) and Mid-Coast (8.4%) (Planning NSW 2016). The protected area system (e.g., National Parks and Nature Reserves) provides limits on the extent of clearing, however protected areas are still vulnerable to other threats and ongoing degradation from historical land uses (Brewer and Whelan 2003). Habitat suitable for *U. mahonyi*, consisting of trees or shrubs on suitable soils, is of naturally limited extent (OEH 2012, 2016). Remaining suitable habitat in the coastal areas between the Hawkesbury River and Port Macquarie is well reserved with 69% or 18,000ha of suitably vegetated podzols and 54% (19,280 ha) of suitably vegetated siliceous sands occurring in the reserve system (OEH 2012, 2016). This estimate is based on a larger area than the current known range and, within the known range of this species (the EOO with a 2km buffer applied) 62% (of a total of ~18,000 ha) of potentially suitable habitat is in reserves. Three of the eight known sites are in reserves. Non-reserved habitat is expected to be progressively cleared over time and clearing of other native vegetation will contribute further fragmentation.

Elevated nitrate loads (often present in urban or agricultural runoff), agricultural chemicals and pesticides (including mosquito control agents) are all potentially hazardous to frogs and tadpoles (Mann and Bidwell 1999; Meyer *et al.* 2006; DOE 2016). Eutrophic runoff can result in the establishment of exotic weeds (e.g. Boneseed and Bitou Bush, *Chrysanthemoides monilifera*) in low nutrient environments (Brewer and Whelan 2003; DOE 2016). Change of water permanence resulting from water extraction, sand mine rehabilitation, building of roads or clearing may be detrimental for a species that requires access to waterbodies for breeding and tadpole development (Brewer and Whelan 2003; DOE 2016).

One of the locations where this species has been recorded, the Tomago sand beds, has historically been harvested for water, potentially impacting breeding sites. Water harvesting has recently been suspended due to per- and poly-fluorinated alkyl substances (PFAS) contamination from the Williamstown Air Force Base. While PFAS are of low to moderate toxicity to frogs (OECD 2002, cited in Colville and McCarron 2003) it is unknown if these chemicals have had any detrimental impact on this species.

Sand mining, clearing, fire and industrial fallout, in the form of gaseous hydrogen fluoride and particulate fluorides, from Tomago Aluminium Smelter have also altered the patterns of vegetation at Tomago with changes in herpetofauna communities being reported (Fox *et al.* 1996; Letnic and Fox 1997ab; Taylor and Fox 2001). At sites with high fluoride levels, frogs,

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including *U. mahonyi* (which was formerly referred to as *Uperoleia laevigata* M. Letnic *in litt.* November 2016), were absent (Letnic and Fox 1997a). *Uperoleia mahonyi* was mainly found in late successional stages with established canopy cover, indicative of a need for native vegetation cover and suggesting that disturbance such as fire and clearing would negatively impact this species (at least in the short term) (Letnic and Fox 1997a). At Tomago in the late 1990s, at sites studied by Letnic and Fox (1997a), *U. mahonyi* was abundant and frogs were commonly caught in pitfall traps during wet weather in suitable habitat (M. Letnic *in litt.* November 2016).

Introduced red foxes and cats are potential predators of this species (Clemann 2015). The Plague Minnow *Gambusia holbrooki* is an introduced egg and tadpole predator. NPWS (2003) predicts that other *Uperoleia* are moderately impacted by Plague Minnow and by inference *U. mahonyi* is likely to be impacted by this species. Susceptibility to the amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) is unconfirmed in *U. mahonyi*. The low elevation coastal locations in which this species is found are at risk of sea level rise (Meyer *et al.* 2006) and, due to coastal development, coastal sand deposits at many locations are likely to be negatively impacted by infrastructure protection, accelerating the adverse effects of sea level rise (Defeo *et al.* 2009).

Meyer *et al.* (2006) reported that the presence of the Eastern Dwarf Tree frog *Litoria fallax* or the Rocket frog *Litoria nasuta* at wallum sites is indicative of disturbance (both have been reported to coexist with *U. mahonyi* by Clulow *et al.* 2016). There is potential for these more common species to displace Mahony's Toadlet through competition or to act as reservoirs for the amphibian chytrid fungus (Meyer *et al.* 2006; Clemann 2015). Once displaced, recolonisation is unlikely due to patchy habitat distribution and presumed limited mobility of this species. The introduced Cane Toad, *Rhinella marina* is a potential future threat (Shine 2010; Anstis 2013).

'Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands', 'Anthropogenic Climate Change', 'Clearing of native vegetation', 'Infection of frogs by amphibian chytrid causing the disease chytridiomycosis', 'Invasion of native plant communities by *Chrysanthemoides monilifera*', 'Predation by the European Red Fox *Vulpes vulpes* (Linnaeus, 1758)', 'Predation by the Feral Cat *Felis catus* (Linnaeus, 1758)' and 'Predation by *Gambusia holbrooki* Girard, 1859 (Plague Minnow or Mosquito Fish)' are listed as Key Threatening Processes under the Act.

10. The recent discovery of *Uperoleia mahonyi* prevents any quantification of decline in this species. However, it is assumed that habitat loss and other threats would have negatively impacted *U. mahonyi* over the last 150 years, given the history of urban and agricultural development as well as habitat disturbance of coastal areas within the species known distribution.
11. *Uperoleia mahonyi* Clulow, Anstis, Keogh & Catullo, 2016 is not eligible to be listed as a Critically Endangered species.

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12. *Uperoleia mahonyi* Clulow, Anstis, Keogh & Catullo, 2016 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*:

Clause 4.3 - Restricted geographic distribution of species and other conditions
(Equivalent to IUCN criterion B)

The geographic distribution of the species is:	
(b)	for endangered species highly restricted.
and the following 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,

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NSW Threatened Species Scientific Committee

Exhibition period: 01/12/17 – 26/01/18

Proposed Listing date: 01/12/17

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**A notice of determination to provisionally list this species
as an endangered species was gazetted on 10/03/17**