

THREATENED SPECIES SCIENTIFIC COMMITTEE

Established under the *Environment Protection and Biodiversity Conservation Act 1999*

The Minister approved this conservation advice and included this species in the Endangered category, effective from 04/07/2019.

Conservation Advice

Cophixalus aenigma

(Tapping Nursery Frog)

Taxonomy

Conventionally accepted as *Cophixalus aenigma* (Hoskin, 2004).

Summary of assessment

Conservation status

Endangered: Criterion 2 B1 and B2 (a),(b)(i,ii,iii,v)

The highest category for which *Cophixalus aenigma* is eligible to be listed is Endangered.

Cophixalus aenigma has been found to be eligible for listing under the following categories:
Criterion 2: B1 and B2 (a),(b)(i,ii,iii,v): Endangered

Cophixalus aenigma has been found to be eligible for listing under the Endangered category.

Species can be listed as threatened under state and territory legislation. For information on the listing status of this species under relevant state or territory legislation, see <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

Reason for conservation assessment by the Threatened Species Scientific Committee

This advice follows assessment of new information provided to the Committee to list *Cophixalus aenigma*.

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 30 business days between 7 September 2018 and 22 October 2018. Any comments received that were relevant to the survival of the species were considered by the Committee as part of the assessment process.

Species Information

Description

Cophixalus aenigma (Tapping Nursery Frog) is a moderately small (snout-to-vent length 16.8–22.6 mm) frog, belonging to the family Microhylidae. The dorsal pattern and colour of the Tapping nursery frog is highly variable, ranging from even grey, brown or sand, to mottled brown or orange, to dark brown or pale with dark flecking, to grey or dark with a gold 'cap' and golden ankles and elbows. Some individuals have a thin pale vertebral stripe while others have a broad dark mid-dorsal area and paler flanks. The ventral surfaces are evenly pale, grey or flushed with orange, especially in the axilla and groin. The last digits of the fingers and toes are pale and the discs are often orange or red. The pupil is bordered by a thin red line and the iris is dark but

heavily flecked with grey or lime green in the lower and, particularly, upper sections (Hoskin 2004).

The Tapping Nursery Frog can be distinguished from other *Cophixalus* species by a combination of the following characters: moderate size, eye to naris distance less than distance between the nares, short hind legs (tibia length/snout-to-vent length ratio is 0.36–0.44), and the tip of the first finger is disc-like though not expanded. The male call is a slow to medium-paced tapping, said to be reminiscent of a marble dropping on a tile (Hoskin 2004).

There is no evident sexual dimorphism (Hoskin 2004). The eggs are relatively large compared to other frog species and are laid in very moist soil. The tadpole develops inside the egg and when it has completed metamorphosis it hatches from the egg as a fully formed froglet (Zweifel 1985). Clutch sizes average 15 (8-21) and the eggs are laid linked in a "rosary chain" by a thin, gelatinous cord (Anstis 2017). Newly hatched froglets average 5.0 mm and are light brown with darker brown patches over the shoulders and lower back (Anstis 2017).

Distribution

The Tapping Nursery Frog was relatively recently described (Hoskin 2004) as it had previously been included in the species *C. concinnus*. The range of the Tapping Nursery Frog is from Mount Lewis (inland from Mossman) to just south of Cooktown in the Wet Tropics of northern Queensland. It has been mainly found in high and mid-elevation rainforest across the Carbine, Thornton, Finnigan and Bakers Blue Mountain uplands, north-east Queensland (Hoskin 2004) over an area of 930 km² (Williams 2007). Hoskin (2004) described its distribution as above 750 m asl (above sea level) but later extensive altitudinal surveys have found that while the species was frequently encountered within their known distribution it was not found at altitudes below 850 m (Shoo and Williams 2004).

Relevant Biology/Ecology

The Tapping Nursery Frog occurs in vine-fern forest and vine-fern thicket. Males generally call from concealed sites among leaf litter, exposed roots, rocks and fallen debris on the forest floor. Occasionally, males call from slightly elevated sites (less than 0.3 m) on logs, rocks and low vegetation.

The microhylids of the Australian Wet Tropics differ from most other frog species in that they are terrestrial breeders and do not need surface water to breed. They require high levels of soil and litter moisture to prevent dessication of the eggs during development (Williams 2007). One parent (usually the male) will generally attend to the eggs until hatching occurs (Felton et al 2006; Hoskin 2004; Williams 2007).

The generation length of the Tapping Nursery Frog is unknown, but is estimated to be 10 years, based on the known ages of breeding males being between 4-14 years for *Cophixalus ornatus* (Ornate Nursery Frog) (Felton et al. 2006).

Threats

Threats to the Tapping Nursery Frog include climate change, habitat degradation and introduced species. The table below lists the threats impacting the species in approximate order of severity of risk, based on available evidence.

Number	Threat factor	Threat status	Evidence base
1.0	Climate change		
1.1	Temperature increase, extreme	Known potential	The Tapping Nursery Frog is found only at high altitude on two mountains in the wet

	weather events e.g. cyclones, droughts		tropics of northern Queensland. Distribution modelling for this species suggests a population reduction of greater than 40% if temperatures increase by 1°C (Shoo 2005). In addition, upland rainforests of northern Australia have been predicted to shrink by 50% with a 1°C increase in temperature, with severe consequences for some frog populations (Williams et al. 2003). Accordingly, a large reduction in the area of available rainforest habitat for this species is likely. Changes in hydrology and associated effects of climate change (e.g. reduction in food supply) may also alter the susceptibility of frogs to disease, but these impacts are likely to be variable among species and sites (DoEE 2016).
2.0	Habitat loss and degradation		
2.1	Clearing, trampling, fragmentation, altered hydrology	Known potential	Feral pigs are responsible for riparian habitat damage and potentially cause adult frog mortality (Richards et al. 1993).
3.0	Invasive species		
3.1	Yellow Crazy Ants (<i>Anoplolepis gracilipes</i>)	Known potential	Yellow crazy ants spray formic acid to subdue prey, which causes burns and irritates the skin and eyes of animals. They can have severe impacts on a range of ecological processes and lead to significant loss of biodiversity. Yellow crazy ants were detected within the World Heritage Area and Little Mulgrave National Park in 2012 and now cover up to 61 ha (WTMA 2016) within these protected areas. In December 2013 yellow crazy ants were also detected in the Kuranda area (WTMA 2016).
4.0	Disease		
4.1	Amphibian chytrid fungus	Known current	Chytridiomycosis is an infectious disease caused by the amphibian chytrid fungus (<i>Batrachochytrium dendrobatidis</i>) that affects amphibians worldwide, causing mass die-offs and some species extinctions (Department of the Environment and Energy 2016). However, the prevalence of chytrid is extremely low in Australian microhylids (Hauselberger & Alford 2012).

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

Evidence:

Insufficient data to determine eligibility

Given that the generation length of the Tapping Nursery Frog is estimated to be approximately 10 years, the appropriate time scale for this criterion is likely to be 30 years. There are no data available to evaluate the population trend over any three generation period. The Tapping Nursery Frog was only relatively recently described (Hoskin 2004) as it had previously been included in the species *C. concinnus*.

The species may experience natural fluctuations in number due to seasonal and climatic variation and there is insufficient information to conclude whether or not the observed changes in population size are a result of natural fluctuations. The available data does not allow a quantitative estimate of decline, therefore the Committee considers that there is insufficient information to determine the eligibility of the species for listing in any category under this criterion.

Criterion 2. Geographic distribution as indicators 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 indicating distribution is precarious for survival:			
(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:

Eligible under Criterion 2 B1 & B2 (a),(b)(i,ii,iii,v) for listing as Endangered

The calculated extent of occurrence (EOO) is 1220 km², and the area of occupancy (AOO) is 44 km² (unpublished data DoEE 2017). These figures are based on the mapping of point records from post-1997 (20 year timeframe), compiled from state and Commonwealth agencies along with museums, research institutions and non-government organisations. The EOO was calculated using a minimum convex hull, and the AOO calculated using a 2x2 km grid cell method, based on the IUCN Red List Guidelines 2014. The EOO meets the threshold for listing as Vulnerable under subcriteria B1 and the AOO meets the threshold for listing as Endangered under subcriteria B2.

The IUCN defines the term ‘location’ as “a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include a part of one or many subpopulations. Where a taxon is affected by more than one threatening event, location should be defined by considering the most serious plausible threat” (IUCN 2001; 2012).

There are four major subpopulations of the Tapping Nursery Frog, at Carbine Tablelands, Thornton Uplands, Finnigan Uplands and Bakers Blue Mountain (Hoskin, 2004). While the distribution is fragmented, the entire range of the species is within a limited area and is restricted to altitudes above 850 asl. The IUCN Guidelines (2017) indicate that subpopulations such as these, located at the same altitudes in identical habitat on geographically similar mountains should be interpreted as a single location for the species because they may be affected by the same “most serious plausible threat” – in this case climate change. Therefore, despite their geographic separation these four subpopulations are considered to be a single location for the purposes of this assessment.

Given that the most significant threat to the species is climate change, which would likely impact the entire area virtually at once, the species can be considered to be contained at one location (IUCN Standards and Petitions Subcommittee 2017).

A continuing decline in area of occupancy and area, extent and/or quality of habitat, and therefore number of mature individuals, may be inferred based on climate change (Shoo 2005; Williams et al. 2003; Williams and Hilbert 2006). Species that are both geographically restricted and patchily distributed, such as *C. aenigma*, are at a higher risk of extinction, as local stochastic events may affect the entire population (Williams 2007).

The Committee considers that the species’ extent of occurrence is restricted, the area of occupancy is restricted and the geographic distribution is precarious for the survival of the species because it occurs at only one location and a decline in habitat quality and number of mature individuals has been inferred. Therefore, the species has met the relevant elements of Criterion 2 to make it eligible for listing as Endangered.

Criterion 3. 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	High rate 20% in 5 years or 2 generation	Substantial rate 10% in 10 years or 3 generations

		(whichever is longer)	(whichever is longer)	(whichever is 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	≤ 1,000
	(ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b)	Extreme fluctuations in the number of mature individuals			

Evidence:

Not Eligible

Surveys of calling males estimated density of the Tapping Nursery Frog at approximately 17 per hectare (Shoo and Williams, 2004; Williams, 2007). Over a range of 44 km² this equates to approximately 75 000 male frogs.

Following assessment of the data the Committee has determined that the number of mature individuals is not limited. Therefore, the species has not been demonstrated to have met the required element of this criterion.

Criterion 4. Number of mature individuals			
	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low (Medium-term future) ¹
Number of mature individuals	< 50	< 250	< 1,000
D2 ¹ Only applies to the Vulnerable category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time	-	-	D2. Typically: area of occupancy < 20 km ² or number of locations ≤ 5

¹ The IUCN Red List Criterion D allows for species to be listed as Vulnerable under Criterion D2. The corresponding Criterion 4 in the EPBC Regulations does not currently include the provision for listing a species under D2. As such, a species cannot currently be listed under the EPBC Act under Criterion D2 only. However, assessments that demonstrate eligibility for listing under other criteria may include information relevant to D2. This information will not be considered by the Committee in making its assessment of the species' eligibility for listing under the EPBC Act, but may assist other jurisdictions to adopt the assessment outcome under the [common assessment method](#).

Evidence:

Not Eligible

Surveys of calling males estimated density of the Tapping Nursery Frog at approximately 17 per hectare (Shoo and Williams, 2004; Williams, 2007). Over a range of 44 km² this equates to approximately 75 000 male frogs.

The Committee has determined that the number of mature individuals is not low. Therefore, the species has not been demonstrated to have met the required element of this criterion.

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

Evidence:

Insufficient data to determine eligibility

Population viability analysis has not been undertaken. Therefore, there are insufficient data to demonstrate if the species is eligible for listing under Criterion 5.

Conservation Actions

Recovery Plan

A recovery plan is not recommended because the Tapping Nursery Frog is located in a relatively small area in a single jurisdiction and the Conservation Advice sufficiently outlines the priority research and conservation actions needed to support the recovery of this species.

Conservation and Management priorities

Habitat loss and disturbance

- Implement a program ensuring suitable habitat is maintained in areas currently supporting populations of the Tapping Nursery Frog and investigate options for providing new habitat that would be suitable for the species under climate change scenarios.

Invasive species (including threats from grazing, trampling, predation)

- Reduce the impacts of habitat destruction by feral pigs on existing populations by using fencing (where feasible) and by reducing pig numbers.
- Control yellow crazy ants by baiting at critical stages of the ants' life cycle.

Disease

- Minimise the spread of the amphibian chytrid fungus by implementing suitable hygiene protocols (Murray 2011) to protect priority populations as described in the *Threat abatement plan for infection of amphibians with chytrid fungus resulting in chytridiomycosis* (Department of the Environment and Energy 2016).
- Provide disease identification and prevention protocols (methods of handling, diagnostic keys, etc.) to researchers and land managers for use in the field.

Stakeholder Engagement

- Collaborate with land managers bordering (outside of) the Wet Tropics World Heritage Area to protect and manage rainforest areas where the species occurs, or which contain potential habitat for the species, from threats due to disease and invasive species.
- Interested nature conservation, land management and land holder groups could be engaged in conservation management activities, such as survey and monitoring, but should be made aware of the need to follow correct field practices and hygiene protocols

to mitigate the risks of trampling and disease transmission. If necessary, use workshops to aid stakeholders in developing the skills and knowledge required to manage threats to this species while undertaking these activities.

- Inform the public about the status and recovery efforts for the species, e.g. by providing information to visitors to the Wet Tropics World Heritage Area and publicising the species through the media.

Survey and Monitoring priorities

- More precisely assess the population size, distribution and ecological requirements of the Tapping Nursery Frog.
- Design and implement a monitoring program for the Tapping Nursery Frog.

Information and research priorities

- Improve knowledge of the reproductive biology, age structure and growth rates of the Tapping Nursery Frog.
- Improve knowledge of the thermal tolerance limits of the Tapping Nursery Frog and assess its possible response to future climate scenarios.
- Improve understanding of how climate change will likely impact on the Tapping Nursery Frog due to altered temperatures, rainfall, environmental stressors and disease virulence.
- Improve understanding of husbandry methods for the species.
- Investigate the development of a strategic assisted colonisation (or translocation) strategy in response to the threat of climate change. The strategy should include consideration of the benefits and risks of undertaking a coordinated series of translocations of *Cophixalus* species to mountain tops further south as increased temperatures impact on their survival and reproductive success.
- Improve understanding of the impacts of feral pigs and yellow crazy ants on the Tapping Nursery Frog.

Recommendations

- (i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **including** in the list in the Endangered category:
Cophixalus aenigma
- (ii) The Committee recommends that there not be a recovery plan for this species.

Threatened Species Scientific Committee

26/02/2019

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