

THREATENED SPECIES SCIENTIFIC COMMITTEE

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

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

Conservation Advice

Litoria kroombitensis

(Kroombit Tree Frog)

Taxonomy

Conventionally accepted as *Litoria kroombitensis* (Hoskin et al. 2013).

Summary of assessment

Conservation status

Critically Endangered: Criterion 2 B1 (a),(b)(i,iii,iv,v)

The highest category for which *Litoria kroombitensis* is eligible to be listed is Critically Endangered.

Litoria kroombitensis has been found to be eligible for listing under the following categories:
Criterion 2: B1 (a),(b)(i,iii,iv,v): Critically Endangered

Litoria kroombitensis has been found to be eligible for listing under the Critically 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 *Litoria kroombitensis*.

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 31 business days between 17 January 2018 and 2 March 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

Litoria kroombitensis (Kroombit Tree Frog) is a small (< 45 mm snout-to-vent length (SVL)) green or greenish-brown frog with distinct, rounded finger and toe pads; a thin gold line running from naris over eye and tympanum to above forelimb; white gilding on the trailing edges of the fore- and hindlimbs; unpatterned orange posterior thighs; a gold iris; a blunt, gently rounded snout in profile; a smooth dorsum; and a mating call consisting of a short whine followed by one

or more chirps (Hoskin et al. 2013). Females are larger than males, being an average of 1.25 times the SVL of males. The overall body shape also differs, with females being rotund in body shape (body width is wider than head), whereas the male body width starts equal to head then tapers as an inverse triangle (Hoskin et al. 2013).

Eggs are darkly pigmented and laid in masses of 100 – 300. Kroombit Tree Frog tadpoles have a brown body with darker areas over the braincase and gut and are difficult to distinguish from those of the closely related but allopatric *L. pearsoniana* and *L. barringtonensis* (Hoskin et al. 2013).

Distribution

The Kroombit Tree Frog is restricted to Kroombit Tops, south-west of Gladstone, east Australia. Kroombit Tops is an isolated northern outlier to the temperate wet forests of south-east Queensland/north-east New South Wales. Based on extensive surveys since the mid 1990s, the Kroombit Treefrog is known only from the headwaters of five streams that rise on the plateau on the eastern side of Kroombit Tops; namely Dry, Griffiths, Kroombit, Three Moon and Munholme Creeks. Records are restricted to an elevational range of about 550 – 900 m above sea level. Survey effort at lower altitudes has been less intensive than at higher altitudes, but the species has not been recorded from several surveys in the lower sections of streams (e.g., Kroombit Creek) (Hoskin et al. 2013).

Relevant Biology/Ecology

The Kroombit Tree Frog is a wet forest, stream-breeding species. It inhabits rainforest and adjoining wet sclerophyll forest, where calling males and gravid females are encountered along flowing streams. Non-breeding adults and sub-adults are rarely encountered but presumably feed and shelter along the streams and in adjacent forest. Breeding activity (amplexus and/or spawning) has been recorded in all months from August through to February (Hines pers comm 2017). Egg masses attributable to the Kroombit Tree Frog, comprising roughly 100 – 300 darkly pigmented eggs encapsulated in jelly, have been found wrapped around submerged twigs and branches in pools with largely static or slow-flowing water (Hoskin et al. 2013).

Kroombit Tree Frog tadpoles are found in quiet pools along and adjacent to slow and intermittently flowing streams in rainforest and adjoining wet sclerophyll forest. Though only recorded during spring and summer (from August to mid-February) (Hines pers comm 2017), tadpoles may be present at other times of year as well (e.g. early autumn). Tadpoles nearing metamorphic climax and/or recently metamorphosed frogs have been recorded from November to February. Kroombit Tree Frog tadpoles are largely benthonic, feeding on sediment (most commonly silt) at the bottom of pools. Recently-metamorphosed frogs have been recorded in summer sitting out on stream-side vegetation, including *Archontophoenix cunninghamiana* (Palm) seedlings and *Elatostema reticulatum* (Rainforest Spinach). Breeding pools in rainforest occupied by Kroombit Tree Frog tadpoles are free of fish except for the occasional *Anguilla reinhardtii* (Longfin Eel).

The generation length of the Kroombit Tree Frog is unknown but is thought to be four to five years, based on an estimate for the closely related and morphologically similar *L. piperata* (Peppered Tree Frog) (Hoskin et al. 2013; NSW Scientific Committee 2008).

Threats

Threats to the Kroombit Tree Frog include amphibian chytrid fungus (*Batrachochytrium dendrobatidis*), habitat degradation by invasive species and climate change. 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	Disease		
1.1	Amphibian chytrid fungus	Known current	<p>Chytridiomycosis is an infectious disease caused by the amphibian chytrid fungus that affects amphibians worldwide, causing mass die-offs and some species extinctions (Department of the Environment and Energy 2016).</p> <p>Surveys of this species since the mid-1990s identified population declines from the late 1990s (Hoskin et al. 2013). Moribund and dead frogs were found with the causative agent identified as the amphibian chytrid fungus (Berger 2001; Murray et al. 2010).</p>
2.0	Habitat loss and degradation		
2.1	Clearing, trampling, fragmentation, altered hydrology, salinity	Known current	<p>The weed lantana (<i>Lantana camara</i>) is invading the habitat of this species (Hines 2012) and has the potential to smother native vegetation. It is also likely that colonisation by weeds such as lantana impede the regeneration of rainforest patches post fire events (Gentle and Duggin 1997).</p> <p>Feral pigs (<i>Sus scrofa</i>), cattle (<i>Bos taurus</i>) and horses (<i>Equus caballus</i>) are also present and cause habitat destruction and fouling of water in Kroombit Tops National Park, mainly by trampling (Hines 2012).</p>
2.2	Climate change (temperature increase, extreme weather events e.g. cyclones, droughts)	Known current	<p>Recent rainfall data for Kroombit Tops show a downward trend in annual totals over the past two decades and, with most climate models projecting a drier future climate, this trend may continue. 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 rainforest at Kroombit Tops is likely.</p>
2.3	Unmanaged and inappropriately timed fires	Known current	<p>Kroombit Tops is susceptible to wildfire (Hines 2012; Hoskin et al. 2013), and predicted climate change is expected to increase their frequency and severity. For example, a high intensity wildfire burnt into many rainforest patches used by the species in 1994 (Hines et al. 1999) causing significant damage to these ecosystems.</p>
3.0	Predation by invasive species		

3.1	Feral Pigs (<i>Sus scrofa</i>) and cats	Known current	Feral pigs are widespread within the habitat of the Kroombit Tree Frog and are likely to prey upon adults and disturb shelter sites. Feral cats may threaten the Kroombit Treefrog given they are found at low density in the stream habitat of the species (Hines pers comm 2017).
3.2	Cane toads (<i>Rhinella marina</i>)	Suspected current	Cane toads may act as a vector for the amphibian chytrid fungus and may predate on adults and juveniles (although, there has been no direct evidence of predation).

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%
<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>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.</p> <p>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]</p> <p>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.</p>	<p><i>based on any of the following</i></p> <ul style="list-style-type: none"> (a) direct observation [except A3] (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat (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 Kroombit Tree Frog is estimated to be four to five years, (Hoskin et al. 2013; NSW Scientific Committee 2008), the appropriate time scale for this criterion is likely to be between 12 and 15 years.

Surveys since the mid-1990s have recorded significant declines from the late 1990s (Hoskin et al. 2013) but the extent of decline has not been estimated.

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 (a),(b)(i,iii,iv,v) for listing as Critically Endangered

The calculated extent of occurrence (EOO) is 34 km² (Hoskin et al. 2013, QPWS unpublished data), and the area of occupancy (AOO) is 16 km² (unpublished data DoEE 2018). These figures are based on the mapping of point records from 1994 to 2011, 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 Critically Endangered under subcriteria B1 and the AOO meets the threshold for listing as Endangered under subcriteria B2.

Within this area the Kroombit Tree Frog is restricted to the headwaters of five streams, although the vast majority of records and known habitat for the species is contained within the three most southern streams, i.e. Kroombit, Three Moon and Munholme Creeks (Hoskin et al. 2013). These populations are relatively isolated and have therefore been considered to be fragmented. However, future genetic analysis may show that contemporary gene flow occurs between these streams and if this is so then the species could be considered to exist at a single location.

While the distribution is fragmented, the entire range of the species is within a few kilometres in any straight line distance. Given that significant threats such as the amphibian chytrid fungus and climate change would likely impact the entire area virtually at once, the species can be considered to be contained at a single location (IUCN Standards and Petitions Subcommittee 2017). 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).

Continuing decline may be inferred based on the likely reduction in number of individuals due to ongoing threats from the amphibian chytrid fungus and climate change.

The Committee considers that the species' extent of occurrence is very restricted, and the geographic distribution is precarious for the survival of the species because it occurs at only two locations and a decline in habitat quality has been observed. Therefore, the species has met the relevant elements of Criterion 2 to make it eligible for listing as Critically 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 (whichever is longer)	High rate 20% in 5 years or 2 generation (whichever is longer)	Substantial rate 10% in 10 years or 3 generations (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
(a) (ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b) Extreme fluctuations in the number of mature individuals			

Evidence:

Insufficient data to determine eligibility

There is no estimate of population size available for the Kroombit Tree Frog. Population density varies greatly across sites, with the maximum number of adult males recorded on four transects varying considerably: 5, 10, 28 and 62 (standardised per 100 m) (QPWS unpublished data, 1996–2011 cited in Hoskin et al. (2013)).

The Committee considers that there is insufficient information to determine the eligibility of the species for listing in any category under 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 km2 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:

Insufficient data to determine eligibility

There is no estimate of population size available for the Kroombit Tree Frog. The Committee considers that there is insufficient information to determine the eligibility of the species for listing in any category under 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 Kroombit Tree Frog is located in a relatively small area on the border between two jurisdictions and the Conservation Advice sufficiently outlines the priority research and conservation actions needed to support the recovery of this species.

Conservation and Management priorities

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.

Invasive species

- Manage priority sites to reduce the impacts of habitat destruction by cattle, feral pigs and feral horses by maintaining fencing and controlling numbers.

Fire

- Fires must be managed to ensure that prevailing fire regimes do not disrupt the life cycle of the Kroombit Tree Frog, so that they support rather than degrade the habitat, that they do not promote invasion of exotic species, and that they do not increase impacts of grazing/predation.

- Avoid any use of managed fire research and other activities that impact upon the persistence of the population unless there is evidence to show the impact would have a positive and enduring effect on the persistence of the Kroombit Tree Frog.
- Ensure that a high proportion of the habitat is maintained with a post-fire age sufficient to provide adequate cover (or habitat) to the Kroombit Tree Frog.
- Ensure immediate and ongoing post-fire predator control within the habitat when fires do occur.
- Ensure grazing by introduced herbivores is minimised or excluded post-fire until adequate vegetation recovery has occurred.
- Ensure that areas of dense ground cover/ leaf litter are retained within the habitat when prescribed fires are implemented. Reduce the frequency of high intensity fires sufficiently to retain hollow logs and large woody debris on the ground.

Stakeholder Engagement

- 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.
- Provide advice and information on the use of herbicides / biocides against pests and diseases in areas with threatened frogs.
- Assist stakeholders in developing and maintaining the skills and knowledge required to manage threats to the Kroombit Tree Frog.

Survey and Monitoring priorities

- Conduct targeted surveys throughout the range of the Kroombit Tree Frog to better define its distribution and abundance.
- Undertake survey work in suitable and potential habitat to locate any additional populations to more precisely assess population size and distribution.
- Establish and maintain a monitoring program based on these data to:
 - determine trends in population size and distribution, mortality and timing of life history stages;
 - determine the extent of threats and their impacts; and
 - monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Information and research priorities

- Investigate options for linking, enhancing or establishing additional populations.
- Improve understanding of the extent and impact of infection by the amphibian chytrid fungus on the Kroombit Tree Frog to better inform how to apply existing or new management actions relevant to the recovery. This includes knowledge on:
 - the different strains of the fungus;
 - levels of virulence;
 - mechanisms for resistance to the disease;

- treatment options; and
- the potential of other species (e.g. *Litoria wilcoxii* (Eastern Stony Creek Frog) and freshwater crayfish) to act as reservoirs or vectors for transmission of the fungus (Department of the Environment and Energy 2016).
- Improve understanding of the likely impacts of climate change on the Kroombit Tree Frog due to altered temperatures, rainfall, environmental stressors and diseases.
- Improve understanding of husbandry methods for the species and investigate the possible establishment of captive populations and targeted translocation strategies.
- Improve understanding of the impacts of environmental toxins.

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 Critically Endangered category: *Litoria kroombitensis*
- (ii) The Committee recommends that there not be a recovery plan for this species.

Threatened Species Scientific Committee

27/07/2018

References cited in the advice

- Berger L (2001). Diseases in Australian Frogs. PhD Thesis. James Cook University.
- Gentle CB and Duggin JA (1997). *Lantana camara* L. invasions in dry rainforest – open forest ecotones: the role of disturbances associated with fire and cattle grazing. *Australian Journal of Ecology* 22: 298–306.
- Hines H, Mahony M and McDonald K (1999). An assessment of frog declines in wet subtropical Australia. In 'Declines and Disappearances of Australian Frogs' (ed A Campbell).
- Hines HB (2012). Cascade Treefrog (Kroombit Tops population). In: Curtis LK, AJ Dennis, KR McDonald, PM Kyne, D S.J.S. (eds) Queensland's Threatened Animals. CSIRO Publishing. Collingwood. pp 162-163.
- Hoskin CJ, Hines HB, Meyer E, Clarke J & Cunningham M (2013). A new treefrog (Hylidae: Litoria) from Kroombit Tops, east Australia, and an assessment of conservation status. *Zootaxa* 3646,426-446.
- IUCN (2001). IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission. IUCN, Gland Switzerland and Cambridge, UK.
- IUCN (2012). IUCN Red List Categories and Criteria: Version 3.1. Second edition. Gland Switzerland and Cambridge, UK.
- IUCN (2017). IUCN Standards and Petitions Subcommittee 2017. Guidelines for Using the IUCN Red List Categories and Criteria: Version 13. In Standards and Petitions Subcommittee.
- Murray K, Retallick R, McDonald K, Mendez D, Aplin K, Kirkpatrick P, Berger L, Hunter D, Hines H, Campbell R, Pauza M, Driessen M, Speare R, Richards SJ, Mahony M, Freeman A, Phillott AD, Hero JM, Kriger KM, Driscoll DA, Felton A, Puschendorf R & Skerratt LF (2010). The distribution and host range of the pandemic disease chytridiomycosis in Australia, spanning surveys from 1956–2007. *Ecology* 91,1557-1558.
- Williams SE, Bolitho EE & Fox S (2003). Climate change in Australian tropical rainforests: an impending environmental catastrophe. *Proceedings of the Royal Society of London B* 270,1887-1892.

Other sources cited in the advice

- Department of the Environment and Energy (2016). Threat abatement plan for infection of amphibians with chytrid fungus resulting in chytridiomycosis, Commonwealth of Australia 2016. Available from: <http://www.environment.gov.au/biodiversity/threatened/publications/tap/infection-amphibians-chytrid-fungus-resulting-chytridiomycosis-2016>
- Department of the Environment and Energy (2018). Area of Occupancy and Extent of Occurrence for *Litoria kroombitensis*. Unpublished report, Australian Government Department of the Environment, Canberra.
- Hines H (2017). Personal communication by email, December 2017.
- Murray K.A, Skerratt L, Marantelli G, Berger L, Hunter D, Mahony M and Hines H (2011). Hygiene protocols for the control of diseases in Australian frogs. Available from: <http://www.environment.gov.au/biodiversity/invasive-species/publications/hygiene-protocols-control-diseases-australian-frogs>.
- NSW Scientific Committee (2008). Peppered Tree Frog *Litoria piperata* Review of current information in NSW. July 2008. Available from: <http://www.environment.nsw.gov.au/resources/nature/schedules/PepperedTreeFrog.pdf>
- Queensland Parks and Wildlife Service (QPWS). Unpublished data, provided by H Hines by email, January 2018.