

THREATENED SPECIES SCIENTIFIC COMMITTEE

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

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

Conservation Advice

Phyloria frosti

(Baw Baw Frog)

Taxonomy

Conventionally accepted as *Phyloria frosti* (Spencer, 1901)

Summary of assessment

Conservation status

Critically Endangered: Criterion 1 A2(a),(e) and Criterion 2 B1 (a),(b)(i,iii,iv,v)

Endangered: Criterion 3 C2(a)(ii)

Vulnerable: Criterion 4

The highest category for which *Phyloria frosti* is eligible to be listed is Critically Endangered.

Phyloria frosti has been found to be eligible for listing under the following categories:

Criterion 1: A2(a),(e): Critically Endangered

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

Criterion 3: C2(a)(ii): Endangered

Criterion 4: Vulnerable

Phyloria frosti 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 *Phyloria frosti*.

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

Phyloria frosti (Baw Baw Frog) is a medium sized frog, females grow to about 52 mm snout-vent length (SVL) and males about 45 mm SVL (Littlejohn 1963). The dorsal surface of adults is

predominantly brown to dark brown with cream–yellow flecks or spots, and/or larger patches spreading from the top of the head and snout to the back. A characteristic brown-black lobe shaped parotoid gland occurs behind each eye, extending back over each shoulder. The skin is covered with small tubercles or warts, particularly on the sides and rump. The ventral surface is smooth and cream to yellow, heavily pigmented with brown flecking. The tympanum is hidden and fingers and toes are unwebbed. As well as the difference in maximum size, the sexes can be distinguished by other external features. Males have a dark brown-black throat, longer legs and wider heads, while females possess a flanged inner first and second finger. Following metamorphosis, juvenile frogs are cream to brown with dark brown irregular flecks and patches, and a distinct dark-brown band occurs from the snout through the eye to the base of the forelimb (Hollis 2011).

The male advertisement call is a short “clunk” repeated in sequences of up to 30 calls (Littlejohn 1963). Egg masses are deposited in a foam nest about 8 cm diameter and 4 cm deep (Littlejohn 1963) at the calling site, or nearby, during inguinal amplexus. Clutch sizes range from 50 – 185 eggs (Littlejohn 1963; Malone 1985 a, b). Eggs are white, unpigmented and about 4 mm in diameter (Malone 1985a). Tadpoles have a rounded body and tail about twice body length and are creamish-white and unpigmented at hatching, with pigment increasing during development (Littlejohn 1963; Barker et al. 1995; Cogger 2014).

Distribution

The Baw Baw Frog is restricted entirely to the Baw Baw Plateau and escarpment area, located in the Central Highlands of Victoria, approximately 120 km east of Melbourne, in the IBRA Australian Alps bioregion. The species has an extent of occurrence (EOO) of about 135 km², encompassing sub-alpine habitats (1260–1560 m) and montane habitats down to 940 m elevation on the south-western escarpment of the Baw Baw Plateau, and 1200 m elevation on the north-eastern escarpment (Hollis 2004). This area includes 75 km² within the Baw Baw National Park, 3 km² within the Mt Baw Baw Alpine Resort, and 56 km² within State Forest.

The distribution of the extant population is now approximately 50 km². In 1996, a lower-elevation population was recorded on the south-west escarpment of the Baw Baw Plateau at 960 m to add to the known sub-alpine population above 1300 m. Sightings as low as 940 m have now been recorded, with a one-off unconfirmed record at 820 m. The initial contraction in distribution range from sub-alpine elevations above 1300 m occurred sometime in the mid 1980s after the baseline survey of Malone (1985b). Declines have continued to occur at elevations below 1300 m since 1996, but have accelerated since 2005 (Hollis personal communication). Recent survey data (2014 - 2017) indicates that further substantial declines have occurred (Baw Baw Frog recovery team personal communication; unpublished data).

Relevant Biology/Ecology

Male Baw Baw Frogs call during the breeding season from September to December, with a peak in calling and egg laying occurring over a shorter interval between October and November (Malone 1985b, a; Hollis 1995, 2004). Males can also be heard calling between January and March (Hollis 2004). The egg mass may be deposited at varying depths in vegetation, or below the ground surface to a metre or more in depth, depending on the structural attributes of the site (G. Hollis pers. obs. in Hollis 2004).

Oviposition of more than one clutch may occur at a single site (Malone 1985a), and it is also possible that females deposit a portion of their eggs at more than one site (Malone 1985b). Eggs are deposited in natural cavities formed from vegetation, logs, rocks and soil that act as catchments for water (Littlejohn 1963; Malone 1985b; Hollis 2004). Eggs hatch in 5 – 8 weeks and tadpoles do not feed, hatching with a residual yolk mass that sustains them through to metamorphosis (Malone 1985a, b).

Larval development occurs at the oviposition site which, while wet, usually has very little free water, although larvae retain the ability to swim (Malone 1985b, a). The larval period ranges from 5–10 weeks, with individuals metamorphosing at about 7 mm snout-vent length (Malone 1985a, b).

The duration of the breeding season appears closely linked with temperature and rainfall. Longer breeding seasons are positively correlated with greater total rainfall and negatively correlated with increasing average temperature (Hollis 2004). Commencement of the breeding season appears to coincide with the arrival of warmer spring temperatures, although completion occurs with daily ambient and substratum temperatures increasing by 2.8°C and 0.4°C respectively (Hollis 2004).

Adult Baw Baw Frogs are relatively sedentary. During the breeding season, most males remain at breeding sites for the duration of calling activity. Towards the end of the breeding season, males disperse into drier habitats adjacent to the breeding sites, with linear movements up 82 m occurring. Female frogs enter breeding sites during the peak of male calling activity to lay eggs (2 – 3 weeks), then return into adjacent drier habitats following the breeding season (Hollis 2004). Adult frogs move about when conditions are wet, with movement limited by increased temperature and reduced humidity (Hollis 2004). Virtually nothing is known about the movements of juveniles and sub-adults, although recently metamorphosed frogs probably remain in close proximity to breeding sites (M. Littlejohn pers. comm.; G. Hollis pers. obs. in Hollis 2011) and sub-adults may potentially be more mobile.

The maximum age recorded is about 15 years, with males reaching sexual maturity at 3.5 years and females at 4.5 – 5.5 years (Hollis 2004). Generation time is estimated to be approximately 8 - 10 years.

Threats

While a range of threats to the Baw Baw Frog have been identified, the cause of the decline, which began in the early 1980s is unclear. Below are listed the range of threats that may have contributed, drawn from the national recovery plan (Hollis 2011).

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	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). It has not been determined whether the amphibian chytrid fungus caused the initial observed decline of this species (in the 1980s) as that event occurred prior to the notable decline of other species in the 1990s, attributed to the chytrid disease epidemic. Nevertheless, the amphibian chytrid fungus has been detected in some tissue samples of Baw Baw Frogs (Hollis 2011) as well as <i>Crinia signifera</i> (Common Eastern Froglet) population on the Baw Baw Plateau (Clemann et al. 2009). Researchers have therefore implicated the disease in the decline of this species (Skerratt et al. 2016). The sympatric Common Eastern Froglet has been identified as a potential reservoir host for the amphibian chytrid fungus (Hunter et al. 2008). Activity that may increase the

			distribution or density of the Common Eastern Froglet into areas occupied by the Baw Baw Frog should be considered a potentially threatening process (Hunter et al. 2008).
2.0	Habitat loss and degradation		
2.1	Climate change (temperature increase, extreme weather events e.g. cyclones, droughts)	Known potential	The impact of climate change is particularly relevant to the Baw Baw Frog, given that it is confined to sub-alpine and montane habitats in a very limited area. The confinement of most of the Baw Baw Frog population to the south-western escarpment of the Baw Baw Plateau, which is wetter and cooler than other areas within the distribution of the species (Hollis 2004), supports the hypothesis that a warming and drying climate may be a major factor in the population decline and distribution shift observed in the species (Hollis 2011).
2.2	Clearing, trampling, fragmentation, altered hydrology, salinity	Known potential	Sambar deer and feral cattle occur on the Baw Baw Plateau, where their grazing and browsing on native vegetation, and trampling and use of breeding habitat as wallows, is a potential threat (Hollis 2011). (Hollis 2011). In more recent times, cattle have not been observed on the Baw Baw Plateau (G. Hollis pers. obs.). Forestry activities were considered a potential threat to the species through destruction of habitat and altered stream hydrology but since 2008 habitat has been permanently protected within a Special Protection Zone by the Victorian State Government.
2.3	Inappropriate fire regimes	Known potential	Bushfires on the Baw Baw Plateau are uncommon due to its wet climate, but may pose a threat to the Baw Baw Frog in particular circumstances. The Baw Baw Plateau, or parts of it, have been burnt on a number of occasions previously, most recently in 1939. The plateau has been free of serious fires for the past 78 years.
2.4	Invasive species	Known potential	Due to their invasive nature, exotic flora that may be of threat to the frog include grey willow (<i>Salix cinerea</i>), blackberry (<i>Rubus sp.</i>) and bulbous rush (<i>Juncus bulbosus</i>). Incursions of weeds through adjacent forestry activities remains as a potential threat to the habitat of the Baw Baw Frog (Hollis 2011). Little is known about predation on the Baw Baw Frog but feral predators (such as cats and foxes) may present a threat to adults (Hollis 2011).

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. 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. 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] 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. based on any of the following (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:

Eligible under Criterion 1 A2(a),(e) for listing as Critically Endangered

The generation length for this species is eight to ten years (Hollis 2004), therefore the relevant time span for this criterion is 24-30 years, extending to approximately 1987.

The number of calling males at greater than 1400 m elevation declined from approximately 750 to fewer than 15 in the years 1993-2002 (Hollis 2011). From 2006 to 2009 no calling males were recorded. Two were recorded in 2010 and no males were again recorded in 2011 (Hollis 2013) and 2017 (unpublished data).

Populations between 1300 and 1400 m elevation have only been monitored since 1997. Estimates of numbers of calling males ranged between 45 and 85 until 2002 but less than 10 were recorded each year from 2006 until 2011 (Hollis 2013) and 2 frogs were recorded during the 2017 survey (unpublished data).

Populations at elevations 950–1299 m also have only been monitored since 1997, declining from approximately 120 calling males to around 10 individuals in 2010 and 2011 (Hollis 2013) and one frog in 2017 (unpublished data).

A population estimate of 7000 adult males was derived from the 1998 and 1999 surveys, based on population-density estimates derived for the extent of habitat located at different elevations on the Baw Baw Plateau escarpment (Hollis 2004). The corresponding estimate based on the 2010 and 2011 surveys is approximately 1300 (Hollis 2013), a decline of over 80 percent. Given that this excludes the substantial decline demonstrated for at least the populations above 1400 m altitude, and that the most recent surveys (2014-2017) indicate ongoing decline (Hollis personal communication) the overall decline within the timespan relevant to this criterion is estimated to be substantially greater than 80 percent.

The Committee considers that the species has been observed to have undergone a very severe reduction in population size over a three generation time span. Therefore, the species has met the relevant elements of Criterion 1 to make it eligible for listing as Critically Endangered.

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 historical EOO and area of occupancy (AOO) of the Baw Baw Frog were both approximately 135 km² (Hollis 2011) but these have now been reduced to approximately 50 km² as surveys in 2014-2017 have not recorded frogs at elevations above 1400 m above sea level (Baw Baw Frog recovery team personal communication). The calculated EOO is 110 km² and the AOO is 60 km² (unpublished data DoEE 2017). These figures are based on the mapping of point records to 2011, compiled from state and Commonwealth agencies along with museums, herbaria, 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.

The species occurs at a single location and continuing decline may be inferred based on the likely reduction in number of individuals due to ongoing threats from the amphibian chytrid fungus and habitat fragmentation and degradation.

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:			
(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:

Eligible under Criterion 3 C2(a)(ii) for listing as Endangered

In 1985 the adult male population of Baw Baw Frogs was estimated to be over 10 000 individuals (Malone 1985b). Surveys conducted between 1993 and 2002 indicate that the adult male population had declined by 98 percent at sub-alpine elevations (greater than 1300 m) (Hollis 1995; 2004). The IUCN assessment (Hero et al. 2004) of this species found that it had disappeared from 80 percent of its former range. Survey data from 2003 to 2008 (Hollis 2004; Hollis & Scroggie 2010) supported the patterns of population decline and range contraction and it was considered that the population of adult male Baw Baw Frogs was likely to be less than 1300, based on further substantial decline from the surveys presented in Hollis (2013). However, recently completed surveys in 2017 (Hollis 2017) found that the adult male population is now actually likely to be less than 500 individuals. The sex ratio of the species is unknown but a ratio of 1:1 is likely (Hollis 2004) so the population is likely to be fewer than 1000 mature individuals, confirming the continuation of this population decline.

A continuing decline is inferred and all of the individuals are in one subpopulation.

The Committee considers that the species' population size is low and likely declining. Therefore, the species has met the relevant elements of Criterion 3 to make it eligible for listing as Endangered.

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	-	-	D2. Typically: area of occupancy < 20 km ² or

number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time			number of locations ≤ 5
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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:

Eligible under Criterion 4 for listing as Vulnerable

Based on recent survey data from 2017, the total adult population is expected to be less than 1000 individuals (unpublished data 2017), which is low. Therefore, the species has met the relevant elements of Criterion 4 to make it eligible for listing as Vulnerable.

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:	$\geq 50\%$ in 10 years or 3 generations, whichever is longer (100 years max.)	$\geq 20\%$ in 20 years or 5 generations, whichever is longer (100 years max.)	$\geq 10\%$ in 100 years

Evidence:

Insufficient data to determine eligibility

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

Conservation Actions

Recovery Plan

A recovery plan for the Baw Baw Frog was developed in 2011 by the Victorian Department of Sustainability and Environment (Hollis 2011).

The Committee recommends that the recovery plan not be updated at this time as that plan and this Conservation Advice sufficiently outline the priority research and conservation actions needed to support the recovery of this species.

Primary Conservation Actions

- The primary conservation action for the Baw Baw Frog is the continuing implementation of the current captive husbandry and breeding program to ensure the continued survival of the species (Baw Baw Frog recovery team personal communication 2017).

Conservation and Management Priorities

Captive Breeding

- Improve maintenance and breeding protocols for the species.

- Continue the development of an ex-situ captive insurance population.
- Establish an in-situ (semi wild) population.
- Trial reintroduction of captive-bred individuals into the wild.

Disease

- Minimise the spread of the amphibian chytrid fungus in potential habitat for the Baw Baw Frog 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.

Habitat loss and disturbance

- Investigate options for enhancing the resilience of the species' habitat to climate change and disease (amphibian chytrid fungus).
- Control and monitor the impacts of Sambar Deer (and feral cattle if required) on the species habitat.
- Control invasive predator species (cat, fox and rabbit) within the Mt Baw Baw Alpine Resort and Baw Baw National Park if they are identified to be a significant threat to the species.
- Continue control and monitoring of pest plants in alpine resort, National Park and State Forest.
- Protect the areas of occupancy of the Baw Baw Frog during the planning and implementation of controlled burns in the region.
- Continue track maintenance, particularly of board-walks, and relocation of tracks, recreational activities and roads away from sensitive wetland habitat and breeding sites (Victorian Scientific Advisory Committee 1991).

Survey and Monitoring priorities

- More precisely assess the population size, distribution and ecological requirements of the Baw Baw Frog using the established modelling and analytical methods.

Information and Research priorities

- Complete a population and habitat model using a spatially explicit, decision support tool to model the impact of various land use scenarios on population viability.
- Understand how weather contributes to natural population fluctuations.
- Understand the potential influence of climate change on the long-term survival prospects of the species.
- Understand the ecology of the amphibian chytrid fungus on the Baw Baw Plateau, its contribution to the decline of the Baw Baw Frog and how this is influenced by the distribution and increased transfer from reservoir species (such as the Common Eastern Froglet) and feral species.

Recommendations

(i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **transferring** from the Endangered category to the Critically Endangered category:

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(ii) The Committee recommends that the current recovery plan should be retained and updated as required.

Threatened Species Scientific Committee

25/07/2018

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