

**EPBC Nomination**  
***Litoria booroolongensis*, Booroolong Frog**

**Please note: in addition to any comments you may wish to make on the nomination below, the Threatened Species Scientific Committee is seeking input on the following specific issues:**

- has the nomination considered the entire geographic extent of the species?
- is the information used to identify the nationally threatened status of the species accurate?
- can you provide quantifiable data on the number of sites from which the species was previously known, and the number of sites from which it is currently known?
- can you provide any additional information to quantify the decline in numbers of the species, and in particular, whether or not numbers of the species have declined across its entire range?
- can you provide any additional information to quantify the decline of the species' distribution, and in particular, can you identify locations where the species does not currently exist but where it existed previously?
- can you provide any additional information on documented or potential threats to the species?
- can you recommend any actions that would abate the threats to this species?
- can you provide additional data relevant to this assessment?

**Nomination Form for listing, changing the status, or  
delisting a native species under the *Environment  
Protection and Biodiversity Conservation Act 1999*  
(EPBC Act)**

To fill out this form you **must** refer to the attached **Guidelines for species nominations.**

**Species Details**

**Scientific Name of the species:**

*Litoria booroolongensis*

**Common Name or Names (if any) by which the Species is known:**

Booroolong Frog

**Is the species conventionally accepted?**

Yes

No\*

**Category for which the species is nominated under the EPBC Act:**

- Extinct
- Extinct in the Wild
- Critically Endangered
- Endangered
- Vulnerable
- Conservation Dependent
- Delisting

**For a Critically Endangered, Endangered or Vulnerable species nomination, please provide material that shows why the species meets at least one of the criteria as listed in the Guidelines for nominations. The Committee encourages nominations which are as comprehensive as possible against as many of the criteria as are relevant.**

**Criterion 1 (Endangered). *It has undergone, is suspected to have undergone or is likely to undergo in the immediate future a severe reduction in numbers.***

The Booroolong frog, *Litoria booroolongensis*, is a riverine frog species in the family hylidae (Barker *et al.* 1995). Prior to 1990 the Booroolong frog, *Litoria booroolongensis*, was considered both common and secure (Tyler 1992). By the mid 1990's conservation managers and amphibian biologist were aware that this species was no longer present in areas where it was formerly abundant. Subsequently, in an Action Plan for Australian frogs, Tyler (1997) recognized that there was insufficient knowledge of the Booroolong frog's situation to determine its status and that the species may be of conservation concern. A more detailed study and review of the Booroolong frog revealed that the species was known to be persisting at only three localities (Gillespie and Hines 1999). The apparent dramatic decline in the Booroolong frog formed the basis for this species being listed as Endangered in New South Wales under the *Threatened Species Conservation Act 1995*. In 1998 researchers at the University of Canberra, NSW Department of Environment and Conservation (DEC, formerly National Parks and Wildlife Service) and the Arthur Rylah Institute in Victoria began undertaking surveys and research to determine the extent of the decline in the Booroolong frog and what factors may be driving this decline. This research confirmed that the Booroolong frog had undergone a rapid decline from more than 50 percent of its former known

distribution, and identified a number of factors that were likely to have contributed to this decline. These initial surveys also resulted in the first record of the Booroolong frog in Victoria (Gillespie and Hunter 2000). The single population of this species in Victoria occurs along a relative short section of stream and is listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988*. Ongoing research into the conservation and management of the Booroolong frog is continuing at the University of Canberra. In addition to this the NSW DEC has recently produced a Draft NSW Recovery Plan for this species. The information collected on the Booroolong frog to date forms a sound and justifiable basis for the listing of this species as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This information is outlined in detail below with respect to meeting Criterion 1 of the Threatened Species Scientific Committee and IUCN 2000 Guidelines for a species to be considered Endangered under the EPBC Act.

***Decline from greater than 50% of it's historic distribution.***

The historic known distribution of the Booroolong frog is restricted to New South Wales and north-eastern Victoria, predominantly along western-flowing streams of the Great Dividing Range, from 200 to 1300 meters above sea level (refer to Figure 1). The species occurs from catchments draining the Northern Tablelands to the Murray River in the Southern Highlands of NSW and north-eastern Victoria. (Heatwole *et al.* 1995; Anstis *et al.* 1998; Hunter and Gillespie 1999; Gillespie and Hunter 2000; NSW Wildlife Atlas; Victorian Wildlife Atlas). There are several historic records of the species from the eastern slopes of the Great Dividing Range north of Sydney that have been reliably confirmed (Mike Mahony (personal communications).

The Booroolong frog formerly occurred above 800 meters along streams draining the Northern Tablelands, and was observed to be both common and abundant through this region in the 1980's (Heatwole *et al.* 1995). The Booroolong frog has not been recorded from the Northern Tablelands during the past 15 years despite extensive fauna surveys in recent years by the North-east Forest Biodiversity Study (NSW NPWS 1994), Regional Forests Assessment Program, and others (Harry Hines and Mike Mahony pers. com.). Furthermore, a recent survey specifically targeting the Booroolong frog failed to locate this species from a number of historic localities and other streams with potentially suitable habitat in this region (Gillespie 2000). Field observations by other amphibian biologist support the suggestion that the Booroolong frog may now be extinct on the Northern Tablelands (Mike Mahony personal communications).

The Booroolong frog has recently been recorded from two streams near Tamworth (Gillespie 2000), which are the only known extant population in northern New South Wales (Figure 1). These populations appear to be highly restricted and surveys of other historic localities and streams with potentially suitable habitat in the Tamworth-Murrurundi area failed to locate additional extant Booroolong frog populations (Gillespie 2000).

The Booroolong frog has been recorded from 39 localities within and between tributaries of the Macquarie and Lachlan Rivers (Australian Museum records), suggesting that this species was historically widespread throughout this region. Surveys through this region have failed to locate the Booroolong frog along many of these streams (Gillespie 2000).

The Booroolong frog is persisting along the Turon River and Winburndale Creek, Winburndale Nature Reserve (I. Macartney, Ranger at Winburndale Dam, personal communications). The Booroolong Frog is also persisting within the Abercrombie River Catchment (Gillespie 2000).

In southern New South Wales there are relatively few historic records compared with the northern part of the range of the species (AM records, NSW Wildlife Atlas). Recent extensive stream surveys targeting riverine frog species in the southern highlands of NSW failed to locate the species in the Tumut River and Yarrangobilly River, where it historically occurred (National Wildlife Collection Records, CSIRO, Canberra); however, the species was located further down-stream along the Yarrangobilly River and in 13 other tributaries of the Tumut and upper Murray Rivers (Hunter and Gillespie 1999, Gillespie 1999, David Hunter unpublished data). These surveys provided new localities for the species, and located the frog in the vicinity of historic records.

In summary, recent surveys have confirmed that the Booroolong frog has suffered a dramatic decline across its range, and it is clear that this species has declined in recent years from greater than 50% of its former known distribution (Figure 1). In addition to this, many of the streams where the Booroolong frog still persists have undergone major habitat modifications and disturbance, and the species is no longer found along many of the historic localities along those streams. Given the recent population declines in this species, and the extensive habitat disturbance along many of the streams where this species currently persists, the viability of many of the extant populations of this species is likely to be extremely precarious.

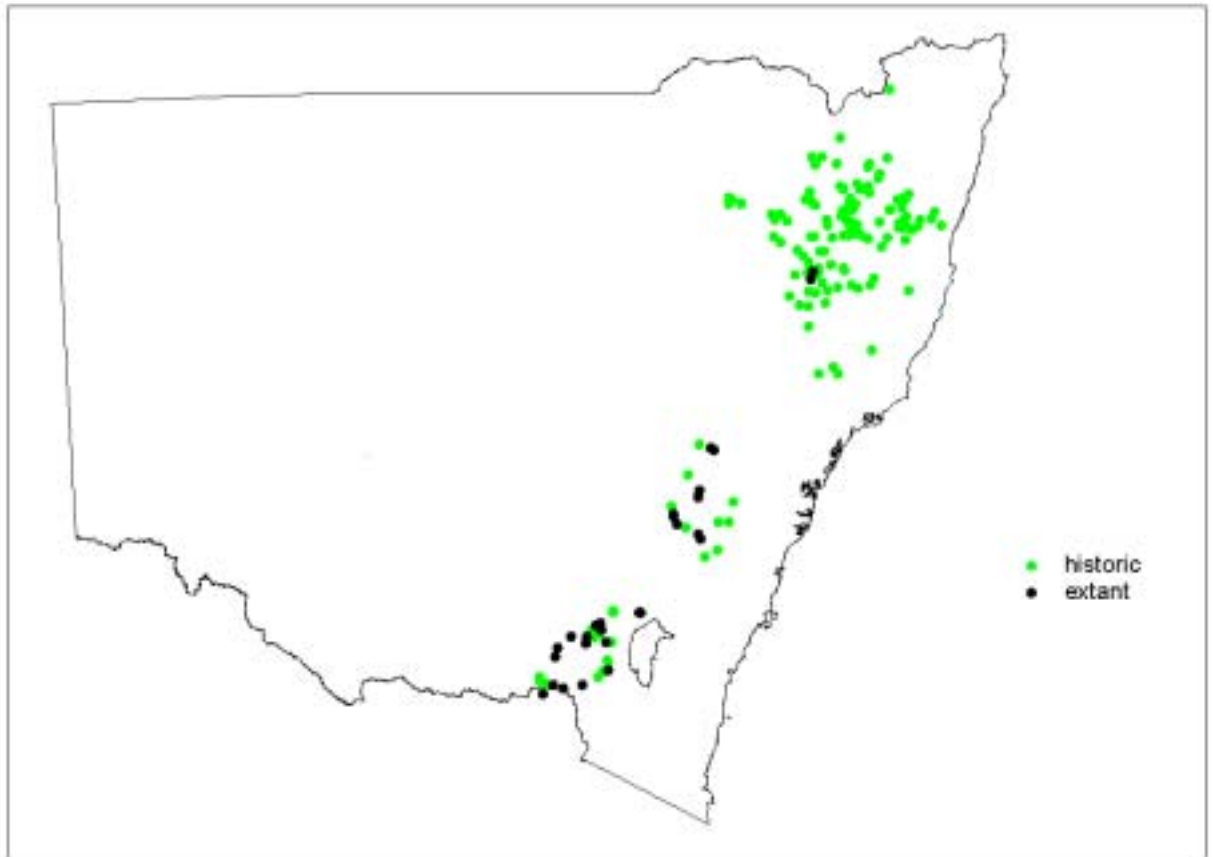


Figure 1. Map of locality records for the Booroolong frog in New South Wales. These records are based on NSW Wildlife Atlas records and recent unpublished survey data. Historic sites are confirmed localities for the Booroolong frog but where the species has not been recoded since 1990 despite surveys being undertaken. Extant sites are where the Booroolong frog has been located since 1990.

***Continued impact of the factors that have caused the decline in the Booroolong frog.***

Hypotheses as to what may have caused the recent decline in the Booroolong frog have been investigated over the past six years. Three factors have been identified as important in the recent decline of this species: habitat disturbance, the frog chytrid fungus and introduced fish. The following is a summary of the evidence supporting these hypotheses and an explanation of how these factors are continuing to threaten and cause further population decline in the Booroolong frog.

***Habitat Disturbance:***

Habitat modification and disturbance is likely to be a major contributor in the decline of the Booroolong frog. Land clearance, stock grazing and timber harvesting have occurred adjacent to many streams, or in the headwaters of catchments in which the species has

been recorded (Hunter and Gillespie 1999, Gillespie 1999, Gillespie 2000). Weed invasion, particularly by willows, has grossly modified riparian habitats along many streams in south-eastern Australia (Anstis and Littlejohn 1996, Anstis *et al.* 1998, Hunter and Gillespie 1999). Much of the Northern Tablelands, where Booroolong frogs formerly occurred, has been cleared (Gillespie 2000) and has degraded in a manner not conducive to the persistence of this species. In the southern parts of its range the Booroolong frog still persists in areas that have been cleared for pasture (Gillespie 1999), however these populations are typically small and highly fragmented (Hunter unpublished data). The majority of extant populations of the Booroolong frog occur along streams that are not within nature reserves and are continuing to be modified, primarily through cattle grazing and weed invasion, in a manner that is likely to cause continued decline in this species. Habitat modification will undoubtedly contribute to the continued decline of the Booroolong frog in the short term and increase the susceptibility of this species to other factors likely to be impacting on this species (i.e. disease and exotic fish).

#### *Frog Chytrid Fungus:*

Studies of ill and dead frogs have implicated a disease known as chytridiomycosis in the decline of frog populations in Australia and other parts of the world (Berger *et al.* 1998, Lips 1999). This disease is caused by a chytrid fungus, *Batrachochytrium dendrobatidis*, that infects the epidermis of the frog's skin (Berger *et al.* 1998), although exactly how this subsequently causes lethal chytridiomycosis is currently unknown. Retrospective screening of preserved museum material has failed to detect the presence of this fungus in Australia prior to observed frog declines (Aplin and Kirkpatrick 2000, Gerry Marantelli personal communications), suggesting a correlative link between the declines and the presence of this fungus and also that this pathogen may have been recently introduced into Australia. A recent genetic study of the chytrid fungus also supported the theory that this pathogen was only recently introduced into Australia and other continents where sudden frog declines have been observed (Morehouse *et al.* 2003). In laboratory experiments, lethal chytridiomycosis has been shown to occur in 100% of individuals infected with the frog chytrid fungus for several Australian frog species that have been tested (Berger *et al.* 1998, Gerry Marantelli unpublished data.). The frog chytrid fungus was recently listed under the EPBC Act (1999) as a key threatening process involved in the decline of Australian frog species and a Threat Abatement Plan aimed at minimizing the impact of this disease is currently being developed.

The frog chytrid fungus has been observed on several species of temperate riverine frogs in south-eastern Australia, including the Booroolong frog (Berger *et al.* 1998; L. Berger unpublished data, David Hunter unpublished data). Given the timing of the more recent and rapid decline in the Booroolong frog, it is likely that this pathogen contributed to the decline in this species. The suggestion that the frog chytrid fungus is involved in the decline of the Booroolong frog is also consistent with the decline of this species from higher altitude sites where the habitat remains intact and the species was historically recorded (e.g. Yarrangobilly River in Kosciuszko National Park, Hunter and Gillespie 1999). It is very likely that the frog chytrid fungus will continue to impact on the Booroolong frog and render populations of this species susceptible to local extinction.

#### *Introduced Fish:*

The impact of introduced fish species on amphibian populations has been well documented (refer to Gillespie and Hero 1999 for review). Introduced trout are believed to be responsible for population declines of amphibian species both overseas (Bradford 1989, Bradford *et al.* 1993, Vredenburg 2002) and in Australia (Gillespie 2001). Mosquito fish has been implicated in the decline of the green and golden bell frog in New South Wales (Hamer *et al.* 2002). Nearly all streams currently occupied by the Booroolong frog are also inhabited by a range of exotic fish species including: brown trout *Salmo trutta*, rainbow trout *Oncorhynchus mykiss*, European carp *Cyprinus carpio*, goldfish *Carassius auratus*, redfin perch *Perca fluviatilis* and mosquito fish *Gambusia holbrooki* (Hunter and Gillespie 1999, Gillespie 1999, Gillespie 2000). Recent experimental work has demonstrated that introduced trout, mosquito fish, redfin perch and European carp all have the potential to prey on the tadpoles of the Booroolong frog (Hunter 2003, Hunter unpublished data). Trout, in particular, are stocked in very high densities in a number of stream sections occupied by the Booroolong frog, often where this species is in very low numbers. Based on observations in the field and controlled experimental work, it is likely that introduced fish species are impacting on the Booroolong frog and increasing the susceptibility of this species to further population declines.

## References:

- Anstis, M., Alford, R. A. and Gillespie, G. R. (1998). Breeding biology of *Litoria booroolongensis* Moore and *L. lesueuri* Dumeril and Bibron (Anura: Hylidae). *Trans Roy. Soc. S. A.*, 122: 33-43.
- Anstis, M. and Littlejohn, M. J. (1996). The breeding biology of *Litoria subglandulosa* and *L. citropa* (Anura: Hylidae), and a re-evaluation of their geographic distribution. *Trans. Roy. Soc. S. A.*, 120: 83-99.
- Aplin, K. and Kirkpatrick, P. (2000) Chytridiomycosis in southwest Australia: historical sampling documents the date of introduction, rates of spread and seasonal epidemiology, and sheds new light on chytrid ecology (Abstract). Pp 24 in 'Getting the Jump! on amphibian disease'. Conference and Workshop Compendium. Rainforest Cooperative Research Centre, Australia.
- Barker, J., Grigg, G. and Tyler, M. J. (1995). *A Field Guide to Australian Frogs* (2<sup>nd</sup> Edition). Surrey Beatty, Chipping Norton, NSW.
- Berger, L., Speare, R., Daszak, P., Green, D. E., Cunningham, A. A., Goggin, C. L., Slocombe, R., Ragan, M. A., Hyatt, A. D., McDonald, K. R., Hines, H. B., Lips, K. R., Marantelli, G. and Parkes, H. (1998). Chytridiomycosis causes amphibian mortality associated with population declines in the rainforests of Australia and Central America. *Proceedings of the National Academy of Science, USA*, 95: 9031-9036.

- Bradford, D. F. (1989). Allopatric distribution of native frogs and introduced fishes in the high Sierra Nevada lakes of California: implication of the negative effect of fish introductions. *Copeia*, 1989: 775-778.
- Bradford, D. E., Tabatabai, F. and Graber, D.M. (1993). Isolation of remaining populations of the native frog, *Rana mucosa*, by introduced fishes in Sequoia and Kings Canyon National Parks, California. *Conservation Biology*, 7: 882-888.
- Gillespie, G. R. (1999). Survey of the Distribution and Habitat of the Booroolong frog *Litoria booroolongensis* on the South-western Slopes of the Great Dividing Range in New South Wales. Report to the NSW National Parks and Wildlife Service, Queanbeyan. Arthur Rylah Institute, Department of Natural Resources and Environment, Victoria.
- Gillespie, G. R. (2000). Survey, monitoring and management of the Booroolong frog and spotted tree frog in New South Wales. Report to the NSW National Parks and Wildlife Service, Queanbeyan. Arthur Rylah Institute, Department of Natural Resources and Environment, Victoria.
- Gillespie, G. R. (2001). The role of introduced trout in the decline of the spotted tree frog (*Litoria spenceri*) in south-eastern Australia. *Biological Conservation*, 100: 187-198.
- Gillespie, G. R. and Hero, J.-M. (1999). Potential impacts of introduced fish and fish translocations on Australian amphibians. In: A. Campbell (Ed.) *Declines and Disappearances of Australian Frogs*. Environment Australia, Canberra, pp. 131-144.
- Gillespie, G. R. and Hines, H. B. (1999). Status of Temperate Riverine Frogs in South-eastern Australia. In: A. Campbell (Ed.) *Declines and Disappearances of Australian Frogs*. Environment Australia, Canberra, pp. 109-130.
- Gillespie, G. R. and Hunter, D. A. (2000). The Booroolong Frog *Litoria booroolongensis* Moore 1961 (Anura: Hylidae): an addition to the frog fauna of Victoria. *Victorian Naturalist*, 116: 112-114.
- Hamer, A.J., Lane, S.J. and Mahony, M.J. (2002). The role of introduced mosquitofish (*Gambusia holbrooki*) in excluding the native green and golden bell frog (*Litoria aurea*) from original habitats in south-eastern Australia. *Oecologia*, 132(3): 445-452.
- Heatwole, H., De Bavay, J., Webber, P. and Webb, G. (1995). Faunal survey of New England. IV. The frogs. *Mem. Qld. Mus.*, 38: 229-249.
- Hunter, D. (2003). Potential impact of introduced trout on the Booroolong frog (*Litoria booroolongensis* Moore 1961): results from experiments testing palatability and



predation in artificial enclosures. Unpublished report to the New South Wales Fisheries.

Hunter, D. and Gillespie, G. R. (1999). The distribution, abundance and conservation status of riverine frogs in Kosciuszko National Park. *Australian Zoologist*, 31: 198-209.

Lips, K. R., (1999). Mass mortality and population declines of anurans at an upland site in western Panama. *Conservation Biology*, 13: 117-125.

Morehouse, E.A., James, T.Y., Ganley, A.R.D., Vilgalys, R., Berger, L., Murphy, P.J. and Longcore, J.E. (2003). Multilocus sequence typing suggests the chytrid pathogen of amphibians is a recently emerged clone. *Molecular Ecology*, 12(2): 395-403.

NSW NPWS (1994). Fauna of North-east NSW Forests. North-east Forests Biodiversity Study Report No. 3, Unpublished Report, NSW National Parks and Wildlife Service, Hurstville.

Tyler, M. J. (1992). *Encyclopedia of Australian Animals (Frogs)*. Harper Collins Publishers, Sydney.

Tyler, M. J. (1997) Action Plan for Australian Frogs, Wildlife Australia: Endangered Species Program, Canberra.

Vredenburg, V. T. (2004). Reversing introduced species effects: Experimental removal of introduced fish leads to rapid recovery of a declining frog. *Proceedings of the National Academy of Sciences*, 101(20): 7646-7650.