

Action Statement No. 255

Large Brown Tree Frog *Litoria littlejohni*
Flora and Fauna Guarantee Act 1988



© The State of Victoria Department of Environment and Primary Industries 2014



This work is licensed under a Creative Commons Attribution 3.0 Australia licence. You are free to re-use the work under that licence, on the condition that you credit the State of Victoria as author. The licence does not apply to any images, photographs or branding, including the Victorian Coat of Arms, the Victorian Government logo and the Department of Environment and Primary Industries logo. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/3.0/au/deed.en>

ISBN 978-1-74326-930-5 (pdf)

Accessibility

If you would like to receive this publication in an alternative format, please telephone the DEPI Customer Service Centre on 136186, email customer.service@depi.vic.gov.au via the National Relay Service on 133 677 www.relayservice.com.au. This document is also available on the internet at www.depi.vic.gov.au

Disclaimer

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

Front cover image: Stephen Mahony

Large Brown Tree Frog *Litoria littlejohni*

Description

The Large Brown Tree Frog *Litoria littlejohni* (White *et al.* 1994) is part of the *Litoria ewingii* species complex, which is a group of closely related species, similar in appearance and behaviour (Barker *et al.* 1995, White *et al.* 1994). Other common names include the Heath Frog and Littlejohn's Tree Frog (Lemckert 2010, NSW OEH 2014).

Adult females are larger than males and range in size from 48 to 72 mm from snout to vent, males from 38 to 56 mm (Barker *et al.* 1995, White *et al.* 1994). Large Brown Tree Frogs are pale brown on the dorsal surface, with dark speckles and a broad, sometimes indistinct, dark brown band running from the head to the vent (Barker *et al.* 1995, White *et al.* 1994). The ventral surface is white or cream and the groin, armpit and back of the thighs are bright orange (Barker *et al.* 1995, White *et al.* 1994). There is also a narrow dark brown to black band running from the nose past the eyes to the shoulder (Barker *et al.* 1995, White *et al.* 1994).

Large Brown Tree Frogs are similar in appearance to the Jervis Bay Tree Frog, *Litoria jervisiensis*, with which it was previously confused. The Large Brown Tree Frog has a broader head and lacks the white glandular stripe of the Jervis Bay Tree Frog (White *et al.* 1994). The mating call of the Large Brown Tree Frog is described as a series of rapidly repeated notes sounding like a slow, reedy whistle that is distinct from other related species (White *et al.* 1994, Barker *et al.* 1995). Large Brown Tree Frog tadpoles are black or very dark grey, grow to 65 mm in length and can be distinguished from other tadpoles of the *Litoria ewingii* complex by their moderately large size, dark colour and blue belly (Anstis 2002; Anstis 2013).



Large Brown Tree Frog (Murray Littlejohn)

Distribution

The Large Brown Tree Frog is relatively widely distributed within its south east coastal range, but has only been recorded at a small number of sites within that range (Lemckert 2004b, 2010). Records extend along the eastern coast of the Great Dividing Range from near Newcastle in New South Wales, to East Gippsland in Victoria (White and Ehmann 1997).

As of March 2014 there are 79 Victorian records of the Large Brown Tree Frog in the Victorian Biodiversity Atlas (VBA) (DEPI 2014). The most recent record is from 1996. These records are confined to East Gippsland and extend from the NSW border in Croajingalong National Park to approximately 18 km west of Ensay. Within Victoria, the majority of records are associated with the wetter forests of the Errinundra Plateau (DEPI 2014). The limits to the Large Brown Tree Frog's distribution in Victoria are unknown as there have been no systematic surveys. Therefore, information on the occurrence of the Large Brown Tree Frog is likely to be conservative record of where and when the species has been found, rather than an accurate picture of where it does and does not actually occur.



Distribution in Victoria (Victorian Biodiversity Atlas DEPI 2014)

Habitat

In comparison, the NSW and Victorian species appear to occupy different habitat types and have differing breeding requirements. In NSW the species occupies a range of habitats including heath, woodland and dry and wet sclerophyll forest, at higher elevations and near the coast. Its distribution is patchy however, and the characteristics that determine the species' presence are unknown (Lemckert 2004b, Lemckert 2010, White and Ehmann 1997). Meanwhile Victorian records are predominantly from wet sclerophyll forests away from the coast (Martin and Littlejohn 1966; Chesterfield *et al.* 1988; Opie *et al.* 1990). Habitat recorded from NSW is primarily woodland (to 15 m height) with a thick shrub layer (Daly and Craven 2007).

Breeding has been observed in a variety of habitats including stationary and ephemeral water bodies such as road side ditches, fire dams, ponds, swamps, oxbow lakes, rain-filled tree stumps and logs and more commonly in NSW, in slow-moving streams (Chesterfield *et al.* 1988, Daly and Craven 2007, Lemckert 2004b, 2010, Martin and Littlejohn 1966; Opie *et al.* 1990, Scroggie *et al.* 2011).

The area of terrestrial habitat around breeding sites and the specific habitat characteristics required by Large Brown Tree Frogs are unknown (Lemckert 2010). An average distance of 300 m around breeding sites has been proposed as adequate to protect a range of amphibian species, although there is considerable variation between species (Lemckert 2004a, Semlitsch and Bodie 2003).

Life history and ecology

Breeding (tadpoles and calling males) has been recorded throughout the year and in NSW appears to be more common in late summer/early autumn, late winter/early spring and after heavy rain events (Lemckert and Mahony 2008 and Scroggie *et al.* 2011). There are too few records in Victoria to estimate peak periods of breeding activity, although Scroggie *et al.* (2011) recommend surveying for the species in June, July and August and following significant rain events in spring and summer. Calling sites used by males vary and include low lying vegetation and the ground around water bodies (White *et al.* 1994, Anstis 2013).

Large Brown Tree Frogs have a relatively low number of eggs per clutch (Anstis 2002, Daly and Craven 2007) in comparison to other tree frog species which can have a complement of several hundred to several thousand eggs (Gillespie 2002a; Morrison and Hero 2002). Females lay clusters of up to 60 eggs attached to submerged twigs, stems or overhanging branches. A single female may lay multiple egg clusters, however the total number of eggs laid in a year is unknown (Anstis 2002, Daly and Craven 2007).

Conservation status

National conservation status

Large Brown Tree Frog (*Litoria littlejohni*) is listed as Vulnerable under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.

Other States conservation status

Large Brown Tree Frog (*Litoria littlejohni*) is listed as Vulnerable under the New South Wales *Threatened Species Conservation Act 1995*.

Victorian conservation status

Large Brown Tree Frog (*Litoria littlejohni*) is listed as threatened under the *Flora and Fauna Guarantee Act 1988*.

Large Brown Tree Frog (*Litoria littlejohni*) is listed as Endangered in Victoria according to the Advisory List of Threatened Vertebrate Fauna in Victoria – 2013 (DSE 2013).

Threats

Since the Large Brown Tree Frog was first described in the 1980s, very little information on the species biology has been published (Daly and Craven 2007). The most recent Victorian record in the VBA was in 1996 and it is not known if the Large Brown Tree Frog has experienced a contraction in its distribution or decline in abundance (Scroggie *et al.* 2011). In the months preceding the development of this Action Statement, East Gippsland experienced large bushfires which may have impacted on Large Brown Tree Frog habitat and individual survivorship. Daly and Craven (2007) indicate fire frequency may be an issue for the sustainable management of *L. littlejohni* but the authors note "an important finding was that wildfire (intense at some sites) did not eliminate populations of frogs". Further research is needed to determine the impact of this event.

Australia's frogs are threatened by a skin infection known as Chytridiomycosis which is caused by the amphibian Chytrid fungus (*Batrachochytrium dendrobatidis*) (DEH 2006). Chytrid fungus was first detected in Australia in the 1970s and now occurs in four zones in eastern Australia (from Big Tableland in north Queensland to Melbourne in Victoria, south-western Western Australia, Adelaide, and Tasmania) (DEH 2006). Chytridiomycosis is strongly implicated in severe declines and losses of a number of Australian frog species on the east coast (Osborne *et al.* 1999, Speare *et al.* 2001, Hero *et al.* 2006, Clemann *et al.* 2009, Hunter *et al.* 2010, Clemann and Gillespie 2011, Gillespie and Clemann 2011). The impact of Chytridiomycosis on Large Brown Tree Frog populations is unknown, however it is likely to be a threat as the disease is believed to affect other species of the *Litoria ewingi* complex (Clemann *et al.* 2009). If the Large Brown Tree Frog has declined in abundance and distribution due to Chytridiomycosis, maintaining potential habitat will be important to facilitate re-colonisation if populations recover and expand (Scheele *et al.* 2014).

South-eastern Australia has recently experienced one of its worst droughts (Bond *et al.* 2008). While it is likely that the drought and seasonally high temperatures have had adverse effects, no direct research has been conducted of the impacts on the Large Brown Tree Frog.

Studies conducted on other frog species have shown that similar climatic changes have caused the loss of breeding sites and therefore may impact on the reproductive success (Lemckert and Penman 2012). Future climate projections for south-eastern Australia predict reduced rainfall, increased average temperatures, more frequent droughts and increases in the frequency of weather events associated with high fire risk (CSIRO and Bureau of Meteorology 2002). If these predictions eventuate they could have severe negative impacts on the Large Brown Tree Frog's available breeding and non-breeding habitat, fecundity and reproductive success.

In Victoria, records of the Large Brown Tree Frog are restricted to East Gippsland and are associated with forest habitats. The majority of these records occur outside of the parks and reserve system and often occur in areas available for timber harvesting. However, past surveys that detected the Large Brown Tree Frog were predominantly performed in State Forest as part of a pre-harvest survey program. Therefore the higher occurrence of records in State Forest in the distribution of the records may reflect a skew in survey effort rather than the true distribution of the species. Timber harvesting may adversely impact on Large Brown Tree Frog populations by causing habitat degradation, clearance and fragmentation. Timber harvesting may also indirectly affect this species by reducing availability and viability of breeding habitat, affecting availability of food, increasing predation rates by removing or altering vegetation, altering habitat (e.g., light penetration, soil moisture, thermal regime etc.) and isolating populations (Gillespie 2009).

Standard threat	Source of Threat	Explanation
Carnivory	Introduced predators, including foxes, cats and rodents	Although no direct research has been conducted, Foxes (<i>Vulpes vulpes</i>) and Cats (<i>Felis catus</i>) prey on frog species which is very likely to include the Large Brown Tree Frog.
Disease	Disease - Chytrid Fungus	Chytrid fungus has had a devastating impact on frog populations worldwide and may be impacting on Large Brown Tree Frog populations.
Habitat damage or loss	Climate change	Future projections of climate suggest reduced rainfall, increased average temperatures and more frequent droughts across much of south-eastern Australia, with associated vegetation change and increased risk of more frequent and severe bushfires (CSIRO and Bureau of Meteorology 2002). These potential changes may alter the suitability of current breeding and non-breeding habitat for Large Brown Tree Frog.
Habitat damage or loss	Timber harvesting	Timber harvesting may adversely impact the species by creating habitat fragmentation, degradation and loss (Gillespie 2002b; Gillespie and Hollis 1996, 2006)
Inappropriate fire regime	Fire frequency	Little research has been conducted on the impact of fire on the Large Brown Tree frog. Daly and Craven (2007) observed a decline in abundance at sites following a fire, however the effect could not be isolated from other impacts such as drought. Fire frequency may be an issue for the management of the species.

Important populations

As a nationally threatened species that is subject to significant threatening processes and whose Victorian populations have not been monitored, all known and discovered populations should be considered important

until such time as rigorous investigations indicate that they are not. The intended management actions address the lack of knowledge about the distribution and abundance of the species and thus important populations.

Past management actions

Action	Result explanation
Survey	Records of the Large Brown Tree Frog have been predominantly generated by pre-harvest fauna surveys in forest blocks in the 1980s and 1990s (e.g. Opie <i>et al.</i> 1990). These records are available through the Victorian Biodiversity Atlas (DEPI 2014).

Conservation objectives

Long term objective

The long-term conservation objective for the Large Brown Tree Frog is to ensure that the species persists across its range and maintains its potential for evolutionary development in the wild.

Objectives of this Action Statement

- To secure populations or habitat from potentially incompatible land use or catastrophic loss
- To increase knowledge of biology, ecology or management requirements
- To maintain or improve condition of habitat

Intended management actions

To assist the conservation of the Large Brown Tree-frog, DEPI will consider the following actions when developing regulation, investment strategies and ecological, fire and land management policies.

The intended management actions listed below are further elaborated in DEPI's Actions for Biodiversity Conservation (ABC) system. Detailed information about the actions and locations, including priorities, is held in this system and will be provided annually to land managers and other authorities.

Standard objective	Targets	
To increase knowledge of biology, ecology or management requirements	A key objective of the Large Brown Tree Frog Action Statement is to increase the knowledge of biology and ecology in order to effectively manage this threatened species. The key areas of focus are distribution and abundance and the impacts of known and likely threats.	
Action	Details	Responsible agents
Conduct survey to determine abundance/extent	Conduct systematic surveys for Large Brown Tree Frogs and their tadpoles across all public tenures to increase our knowledge of the species' distribution. Surveys should be conducted by experienced amphibian biologists according to the standard described in Scroggie <i>et al.</i> (2011) and initially would target sites of historic records. Surveys must also apply suitable hygiene precautions (Murray <i>et al.</i> 2011) to minimise as far as possible the risk of introducing or spreading pathogens. All populations of Large Brown Tree Frogs that are detected during surveys should be concurrently sampled for the Amphibian Chytrid Fungus. Improving our understanding of the species' distribution and ecology will inform future actions to manage the impacts of threats.	DEPI, Parks Victoria, East Gippsland CMA
Undertake research to determine habitat	When more information on the species' current distribution is obtained (see above), investigate breeding and non-breeding habitat requirements of the species and the key aspects that influence the quality, availability and occupancy of suitable habitat. Improving our understanding of the habitat requirements of the species will inform habitat modelling and habitat based approaches to managing the impacts of threats.	DEPI
Undertake detailed population monitoring and collect demographic information	When more information on the species' distribution is obtained (see above), important populations should be monitored. Understanding any trends in the status of populations will coincide with and inform the assessment of threats (see below) and will inform management actions.	DEPI, Parks Victoria
Assess threats	When more information on the species' distribution is obtained (see above) , investigate the impacts on the Large Brown Tree Frog of timber harvesting and associated forestry practises, fire management, introduced predators, drought and climate change, and the impacts of Chytrid fungus. Improving our understanding of the impact of threats will inform management priorities and approaches.	DEPI
Conduct priority research projects as specified	Conduct research into the biology and ecology of the Large Brown Tree Frog. Key attributes for investigation include breeding requirements, larval period, fecundity, home range, dispersal ability, diet and sensitivity to disturbance.	DEPI, Universities

Conduct priority research projects as specified	A Habitat Distribution Model (HDM) for the Large Brown Tree Frog has been produced by DEPI, but requires refinement before it is suitable for the Action Statement's purpose. Improve the Large Brown Tree Frog HDM as new information from the research actions described above becomes available Habitat distribution modelling will inform future management of the Large Brown Tree Frog and reviews of this Action Statement.	DEPI
Ensure records of species, communities and locations are documented on the relevant databases	Submit all records of Large Brown Tree Frog to the Victorian Biodiversity Atlas.	DEPI

Standard objective	Targets	
To maintain or improve condition of habitat	A key objective of the Large Brown Tree Frog Action Statement is to identify major threats and to begin the process of mitigating their impacts on important populations. Possible threats operating on the Large Brown Tree Frog include, but are not limited to, loss and / or degradation of habitat and disease (especially Chytridiomycosis).	
Action	Details	Responsible agents
Manage disease	Minimise the arrival and/or spread and impact of the pathogenic Amphibian Chytridiomycosis. Appropriate protocols have been prepared by Murray <i>et al.</i> (2011).	DEPI, Parks Victoria
Provide input into regional fire management and operations plans	Ensure that locations of known or discovered populations are included in planned burning and fire suppression planning so that efforts can be made to minimise the impact of fire on these populations.	DEPI
Control introduced animals	Undertake concurrent fox and cat control near key locations. Continue fox control in East Gippsland, using the most efficient control protocols available. Implement broad scale cat control across as much of the distribution of the Large Brown Tree Frog as possible when an effective technique becomes available.	DEPI, Parks Victoria, East Gippsland CMA

Establish Management Areas or Special Protection Zones

A strategic review of biodiversity management in Victoria's forests is underway and may change the way timber harvesting and threatened species are managed in the future.

DEPI

Pending a new approach it is necessary to adopt the following management:

- If a Large Brown Tree Frog (adult, sub-adult, tadpole or egg cluster) is detected in State Forest and the record is verified by DEPI according to the standards in Scroggie *et al.* (2011), establish a 28 ha protected area by creating a special protection zone (SPZ) that includes the detection site. As far as possible, the SPZ boundaries should follow recognizable landscape features such as ridges, spurs, watercourses or roads but must not be less than 300 m wide at any point. The new SPZ may include areas of pre-existing SMZ, SPZ or areas otherwise unavailable for harvesting. The new SPZ may be smaller than 28 ha where a detection is adjacent to an existing park or reserve and the total 28 ha protected area is comprised of both SPZ and park and reserve.
- Create a new 28 ha protected area, subject to the conditions above, for important past records in State Forest. Important past records will be determined by DEPI.

Review this prescription by 2017 or when 25 records, that provide additional information (30 percent in novel 10 minute grids), from within any tenure are verified; whichever occurs first. The review will be informed by the results of the research actions outlined above. All records must be spatially and temporally independent. For example ten tadpoles within a pool or repeat detections at the same location would each constitute one record. Any record verified during or after 2014 constitutes a new record, even if it occurs at the same location as an historic record.

Rationale:

The detection based prescription above is designed to afford interim protection to potential sites of conservation significance while further research is being carried out. 28 ha is approximately equal to the area of a circle with a radius of 300 m; a distance estimated as an average terrestrial buffer from breeding sites adequate to protect a range of amphibian species (Lemckert 2004a, Semlitsch and Bodie 2003).

References

- Anstis, M. (2002). Tadpoles of South-eastern Australia: A Guide with Keys. Reed New Holland, Frenchs Forest NSW
- Anstis, M. (2013). Tadpoles and Frogs of Australia. New Holland Publishing, Sydney, NSW (832 pp.)
- Barker, J., Grigg, G. C. and Tyler, M. J. (1995). A Field Guide to Australian Frogs. Surrey Beatty and Sones, Chipping Norton, NSW
- Bond, N.R., Lake, P.S. and Athington, A.H. (2008) The Impacts of drought on freshwater ecosystems: an Australian perspective.. *Hydrobiologia* 600: 3 - 16
- Chesterfield, E. A., Hurley, V. A., Henry, S. R., Schulz, M. and Pyrke, A. F. (1988). Flora and Fauna of the Brodribb Forest Block, East Gippsland, Victoria. Department of Conservation, Forests & Lands, Ecological Survey Report No. 19
- Clemann, N. and Gillespie, G. (2011). Draft National Recovery Plan for the Alpine Tree Frog *Litoria verreauxii* alpina. Department of Sustainability, Environment, Water, Population and Communities, Canberra
- Clemann, N., Hunter, D., Scroggie, M., Pietsch, R. and Hollis, G. (2009). Vanishing frogs: prevalence of the Amphibian Chytrid Fungus (*Batrachochytrium dendrobatidis*) in key populations of frog species in the Australian Alps. Unpublished report to the Department of the Environment, Water, Heritage and the Arts, Canberra
- CSIRO and Bureau of Meteorology. (2002). State of the Climate 2012. 12 pp. www.csiro.au/State-of-the-Climates-2012
- Daly, G. and Craven, P. (2007) Monitoring populations of the Heath Frog *Litoria littlejohni* in the Shoalhaven region on the south coast of New South Wales. *Australian Zoologist* 34 (2): 165-172
- Department of the Environment and Heritage (DEH) (2006). Threat Abatement Plan for infection of amphibians with Chytrid fungus resulting in Chytridiomycosis. [Online]. Available from: <http://www.environment.gov.au/biodiversity/threatened/publications/tap/chytrid.html>
- Department of Environment and Primary Industries (DEPI). (2014). Victorian Biodiversity Atlas, extracted 10/03/2014. [Online] available from <https://vba.dse.vic.gov.au>
- DSE (2013). Advisory List of Threatened Vertebrate Fauna in Victoria – 2013. Department of Sustainability and Environment, East Melbourne
- Gillespie G. R. (2002a). Ecology of the Spotted Tree Frog *Litoria spenceri*: An investigation of causes of population decline. Unpublished PhD Thesis, University of Melbourne, Parkville
- Gillespie, G. R. (2002b). Impacts of sediment loads, tadpole density, and substratum on the growth and development of tadpoles of the Spotted Tree Frog *Litoria spenceri*: an in-stream experiment. *Biological Conservation* 106: 141-150
- Gillespie, G. (2009) Dr Graeme Gillespie, Report (Large Brown Tree Frog) 22 December 2009, 11-13 In. Environment East Gippsland Inc vs. VicForests. (2010). VSC 335. Osborne J [496] [Online]. Available from: <http://www.austlii.edu.au/cgi-bin/sinodisp/au/cases/vic/VSC/2010/335>
- Gillespie, G. and Clemann, N. (2011). Revised draft National Recovery Plan for the Spotted Tree Frog *Litoria spenceri*. Department of Sustainability, Environment, Water, Population and Communities
- Gillespie, G. R., and Hollis, G. (1996). The distribution and habitat of the Spotted Tree Frog, *Litoria spenceri* Dubois (Anura: Hylidae), and an assessment of potential causes of population declines. *Wildlife Research* 23: 49-75
- Hero, J.-M., Morrison, C., Gillespie, G. R., Roberts, J. D., Newell, D., Myer, E. McDonald, K., Lemckert, F., Mahony, M., Osborne, W., Hines, H., Richards, S., Hoskins, C., Clarke, J., Doak, N., and Shoo, L. (2006). Overview of the conservation status of Australian frogs. *Pacific Conservation Biology* 12: 314-320
- Hunter, D., Speare, R., Marantelli, G., Mendez, D., Pietsch, R. and Osborne, W. (2010). Presence of the amphibian Chytrid fungus *Batrachochytrium dendrobatidis* in threatened corroboree frog populations in the Australian Alps. *Diseases of Aquatic Organisms* 92 (2-3): 209-216
- Lemckert, F. (2004a). Variations in anuran movements and habitat use: Implications for conservation. *Applied Herpetology* 1: 165-181
- Lemckert, F. (2004b). The biology and conservation status of the heath frog *Litoria littlejohni*. *Herpetofauna* 34: 99-104
- Lemckert, F. (2010). Habitat relationships and presence of the threatened heath frog *Litoria littlejohni* (Anura: Hylidae) in central New South Wales, Australia. *Endangered Species Research* 11: 271-278
- Lemckert, F. and Mahony, M. (2008) Core calling periods of the frogs of temperate New South Wales, Australia. *Herpetological Conservation and Biology* 3: 71-76
- Lemckert, F. and Penman, T. (2012). Climate change and Australia's frogs: how much do we need to worry?. In D. Lunney & P. Hutchings (Eds.), *Wildlife & Climate Change: Towards Robust Conservation Strategies for Australian Fauna* (pp. 92-97). Mosman, N.S.W.: Royal Zoological Society of New South Wales
- Martin, A. A. and Littlejohn, M. J. (1966). The breeding biology and larval development of *Hyla jervisiensis* (Anura: Hylidae). *Proceedings of the Linnean Society of New South Wales* 91: 49-57
- Morrison, C. and Hero, J.-M. (2002). Geographical variation in life history characteristics of Amphibians in mid-eastern Australia: reproductive traits. In: Natrass, R. (Ed.) *Frogs in the Community*. Proceedings of the Brisbane Conference 13-14 Feb. 1999, Brisbane: Queensland Frog Society Inc. pp. 52-61

Murray, K., Skerratt, L., Marantelli, G., Berger, L., Hunter, D., Mahony, M. and Hines, H. (2011). Hygiene protocols for the control of diseases in Australian frogs. Department of Sustainability, Environment, Water, Population and Communities. Canberra. [Online]. Available from: <http://www.environment.gov.au/resource/hygiene-protocols-control-diseases-australian-frogs>

New South Wales Office of Environment and Heritage (2014) Littlejohn's Tree Frog - profile [Online] available from <http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10488>

Opie, A. M., Gillespie, G. R., Henry, S. R., Hurley, V. A., Lobert, B. O. and Westaway, J. (1990). Flora and Fauna Survey of the Coast Range Forest Block, (Southern Part), East Gippsland, Victoria. Department of Conservation, Forests & Lands, Ecological Survey Report No. 24

Osborne, W., Hunter, D. and Hollis, G. (1999). Population declines and range contraction in Australian alpine frogs. In: Campbell, A. (ed.). Declines and Disappearances of Australian Frogs. Environment Australia, Canberra

Semlitsch, R.D., Bodie, J.R., (2003). Biological Criteria for Buffer Zones around Wetlands and Riparian Habitats for Amphibians and Reptiles. Conservation Biology 17(5): 1219-1228

Scheele, B. C., Guarino, F., Osborne, W., Hunter, D.A., Skerratt, L.F., Driscoll, D.A., (2014) Decline and re-expansion of an amphibian with high prevalence of Chytrid fungus, Biological Conservation, Volume 170, pp 86-91

Scroggie, M., Clemann, N. and Lumsden, L. (2011). Approved Survey Standards: Large Brown Tree Frog *Litoria littlejohni*. Department of Sustainability and Environment

Speare, R. and Core Working Group of Getting the Jump on Amphibian Disease (2001). Nominations for listing of Amphibian Chytridiomycosis as a key threatening process under the Environment Protection and Biodiversity Conservation Act 1999. In: R. Speare and Steering Committee of Getting the Jump! On Amphibian Disease (Eds.) Developing Management Strategies to Control Amphibian Diseases: Decreasing the Risks due to Communicable Diseases. School of Public Health and Tropical Medicine, James Cook University, pp 186-208

White, A. W. and Ehmann, H. (1997). Heath frog, *Litoria littlejohni*. In: Ehmann (Ed.), Threatened Frogs of New South Wales: Habitats, Status and Conservation. Frogs and Tadpole Study Group of New South Wales, Sydney South

White, A. M., Whitford, R. W. and Mahony, M. J. (1994). A new species of *Litoria* (Anura: Hylidae) from eastern Australia. Proceedings of the Linnean Society of New South Wales 114: 3-10

Customer Service Centre **136 186**

www.depi.vic.gov.au