Qualifications and Experience

Please see my curriculum vitae (Appendix I) for my general qualifications and experience.

My Ph.D. in zoology focussed specifically on the conservation biology and ecology of frog species in south-eastern Australia. I have 23 years of field and scientific experience studying amphibians and their conservation and management in south-eastern Australia. I have published 24 refereed scientific papers and 38 technical reports on amphibian ecology, conservation and management. I am recognised throughout Australia as an authority on the frog fauna of Victoria, specifically with respect to conservation issues, and I am regularly asked to provide advice on such matters to individuals, government conservation and land management agencies, and non-government organisations.

With regard to the Large Brown Tree Frog, I encountered this species on numerous occasions between 1986 and 1992 while undertaking and supervising pre-logging biodiversity surveys in East Gippsland, Victoria. Many of these records are documented in the Victorian Wildlife Atlas. During this period, I gained knowledge of the species' habitat associations, breeding biology, some aspects of its behaviour and an appreciation of its conservation status in Victoria (see Opie *et al.* 1990; Westaway *et al.*1990; Lobert *et al.* 1991).

Because of my research into amphibian conservation and management, I am highly familiar with the existing literature on the impact of various forest management activities on amphibians and the implications of these activities for amphibian conservation. Although no specific studies have investigated the effects of forest management on the Large Brown Tree Frog, this general knowledge provides insight into the potential impacts of forest management on this species.

Between 1986 and 1992 I conducted amphibian surveys in East Gippsland and observed the Large Brown Tree Frog on ten occasions (see Victorian Wildlife Atlas records; Opie *et al.* 1990; Westaway *et al.*1990; Lobert *et al.* 1991). In order to gain insight into the distribution and habitat requirements of the Large Brown Tree Frog, I have also visited other localities at which the species has been recorded previously.

3. Publications that I have authored or co-authored which are directly relevant to the Large Brown Tree Frog:

1. **Gillespie, G. R.**, Henry, S. R., Mueck, S. and Scotts, D. J. (1990). Flora and Fauna of the Pheasant Creek and Upper Buenba Forest Blocks, Alpine Area, Victoria. Dept. Conserv., For. & Lands Ecol. Surv. Report No. 29.

2. Peacock, R., Brown, G. W., **Gillespie, G. R.**, Robinson, D. and Scotts, D. J. (1992). Flora and Fauna of the Sardine Forest Block, East Gippsland, Victoria. Dept. Conservation & Environment Ecol. Surv. Report No. 34.

3. Lobert, B. O., **Gillespie, G. R.**, Lunt, I. D., Peacock, R. J. and Robinson, P. D. (1991). Flora and Fauna of the Goolengook Forest Block, East Gippsland, Victoria. Dept. Conservation & Environment Ecol. Survey Report No. 35.

4. 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, Part II, East Gippsland, Victoria. Dept. Conserv., For. & Lands, Ecol. Survey Report No. 24.

5. Westaway, J., Cherry, K. A., **Gillespie, G. R.**, Henry, S. R. and Mueck, S. G. (1990). Flora and Fauna of the Fainting Range and Lower Wilkinson Forest Blocks, East Gippsland, Victoria. Dept. Conserv., For. & Lands, Ecol. Survey Report No. 27.

6. Westaway, J., Henry, S. R., **Gillespie, G. R.**, Mueck, S. G. & Scotts, D. J. and (1990). Flora and Fauna of the West Errinundra and Delegate Forest Blocks, East Gippsland, Victoria. Dept. Conserv., For. & Lands, Ecol Survey Report No. 31.

See CV (Appendix I) for other publications relevant to my field of expertise.

<u>The Species</u>

1. *Description*

The Large Brown Tree Frog, *Litoria littlejohni*, is a member of the *Litoria ewingii* species group, which comprises a group of morphologically, ecologically and behaviourally similar tree frog species in south-eastern Australia (Martin and Littlejohn 1966; Barker et al. 1995). It is a medium-sized tree frog species: males are 38 – 56mm from snout to vent, females 48 – 72 mm. The dorsal surface is light

brown or cream with a broad, undivided, dark stripe that runs from between the eyes to the vent. The underside is paler, typically cream or yellowish. A distinct black stripe runs from the nostril through the eye to the shoulder. The sides and under-surface of the thigh, tibia and armpit and upper arm are bright red-orange. The dorsal skin has a warty texture whilst the ventral surface is granular. The toes are half webbed and the fingers are free of webbing (White *et al.* 1994; Barker *et al.* 1995). Juveniles resemble adults but the inner surface of the thighs is paler (Anstis 2002).

Tadpoles of the Large Brown Tree Frog grow to 65 mm in total length. Anstis (2002) describes the tadpole as follows: "Body moderately large, cylindrical and as wide as deep or a little wider than deep across abdomen. Snout rounded to truncate. Eyes lateral with a prominent cornea, iris copper-gold. Nares small, widely spaced and open anterolaterally. Spirical short, broad and opens ventroposteriorly well below body axis, near mid-point of body. Vent tube dextral, short and opens halfway up from edge of ventral fin…Fins well arched and taper to a fine flagellum. Dorsal fin arches from about half way onto the body to near midpoint and tapers down to fine tip. Ventral fin often more deeply arched in anterior third and maybe deeper than dorsal fin. Musculature moderate and tapers to a fine point...Dorsum uniform dense black or very dark grey and gradually turns dark brown through development. Ventor dusky dark grey with a slight coppery tint and blue sheen which continues up sides of body ".

Sub species

There are no recognised sub-species of the Large Brown Tree Frog. However, the species is closely related to the Jervis Bay Tree frog, *Litoria jervisiensis*, from which it was formally distinguished in 1994 (White *et al.* 1994).

The disjunction in distribution between NSW and Victorian records of the Large Brown Tree Frog, combined with some differences in habitat and ecology, may indicate the presence of distinct subspecies, or at least separate evolutionary management units, but this requires further investigation. These differences are as follows: in Victoria, populations are generally associated with Wet and Damp Forest ecological vegetation classes, rarely Dry Forest and never Coastal Woodlands, and the species invariably breeds in either temporary or semi- permanent stationary water bodies (Martin and Littlejohn 1966; Chesterfield *et al*. 1988; Opie *et al*. 1991; G.

Gillespie pers. obs.). In NSW, the species typically occurs along the sandstone escarpment woodland and heathland habitats, as well as the coastal plans near Sydney, and breeding is often associated with flowing streams or associated pools (White and Ehmann 1997; Lemckert 2004).

2. *Distribution*

The Large Brown Tree Frog is distributed along the eastern side of the Great Dividing Range in south-eastern Australia, from the Watagan Mountains near Wyong in New South Wales to north of Bruthen in East Gippsland, Victoria (Fauna Atlas of NSW 2009; Atlas of Victorian Wildlife 2009). The species occurs over an elevation range of 100 – 950 m above sea level in NSW and 145 – 1160 m above sea level in Victoria.

Within this range, the species is uncommon with only 279 independent records in NSW and 79 in Victoria. Furthermore the distribution is significantly disjunct, with no records from south of the Australian Capital Territory to the Victorian border, despite extensive amphibian surveys in the region.

Fertility and fecundity

Based upon records throughout its range in Victoria and NSW, breeding activity (identified by calling males) has been detected sporadically in every month of the year. Using records predominantly from NSW, Lemckert (2004) identified a higher frequency of calling activity in February compared with other months, but acknowledged that survey data for winter months was scant. In Victoria, the species has also been heard calling sporadically at various times of the year, often after heavy rain. However, most calling has been heard in June (G. Gillespie pers. obs.). Anstis (2002) also reports most Large Brown Tree Frog calling and breeding activity in late winter and spring. In Victoria, tadpoles have been found in September through to January, but egg-laying has also been observed in March (G. Gillespie pers. obs.).

Little is known about the fecundity of the Large Brown Tree Frog. Clusters of up to 60 eggs have been observed for this species (Anstis 2002; G. Gillespie pers. obs.), but it is not known whether these clutches represent the full annual egg compliment of female Large Brown Tree Frogs. It is not uncommon for female frogs of other species to spread their eggs between different localities and amongst different mates in order to maximise fitness and survival, but it is unknown whether the female Large Brown Tree Frog also exhibit this behaviour. Given the temperate distribution of the

species, females are likely to produce only one egg clutch per year (see Wells 2007). Nevertheless the Large Brown Tree Frog appears to have relatively low fecundity compared to other similar-sized frogs in the same genus, which typically have egg compliments of several hundred to several thousand eggs (e.g. Gillespie 2002a; Morrison and Hero 2002).

The rates of actual egg fertility and survivorship are unknown for this species.

3. Distribution in Victoria

A map of the Victorian distribution of the Large Brown Tree Frog is provided in Appendices II and III. The 79 records of the Large Brown Tree Frog in the Victorian Wildlife Atlas come from only 47 different localities. These are distributed between near Mount Elizabeth, north of Bruthen, and the Victorian border, southeast of Bendoc and east of Cann River.

Within Victoria, the Large Brown Tree Frog has been found in Wet Forest, Damp Forest and Shrubby Dry Forest (see Department of Conservation and Natural Resources, 1995, for descriptions of these ecological vegetation types). There is also one record from Lowland Forest in Victoria. However, this record from the Atlas of Victorian Wildlife (Ref. Code A1806641) is questionable: it is the lowest elevation recorded from Victoria, and occurs much further east and closer to the coast than all other records. This is close to the distributional limit of the closely related *Litoria jervisiensis*, and is more typical of the habitat of *Litoria jervisiensis* than the Large Brown Tree Frog (see Anstis 2002). No specimen was lodged with the Museum of Victoria and so the record cannot be confirmed but, in my opinion, this record may in fact be *Litoria jervisiensis*.

In NSW, the Large Brown Tree Frog has been reported from wet or dry sclerophyll forests with rocky outcrops (Barker et al. 1995), high elevation woodlands in the Sydney area (Griffiths 1997), or coastal woodland and heath (Cogger 2000; White *et al*. 1994; Anstis 2002). These reports suggest that the species may occur in a wider range of natural vegetation types in NSW than Victoria.

Most records of the Large Brown Tree Frog are from Wet Forest, followed by Damp Forest and Warm-temperate Rainforest (Martin and Littlejohn 1966; Chesterfield *et al*. 1988; Opie *et al*. 1991, 1994; Lobert *et al*. 1991; G. Gillespie pers. obs.). The

species has never been recorded from cleared forest, such as farmland or forest plantation.

The vast majority of records represent breeding sites at which males have been found calling or tadpoles have been located. In Victoria all recorded breeding sites have been stationary water bodies, rather than part of flowing streams, and have included: rain-filled pools created by up-turned tree stumps, rain-filled pools in logs, flooded old mine shafts, gravel pits, forest fire dams, and roadside ditches (Martin and Littlejohn 1966; Chesterfield *et al*. 1988; Opie *et al*. 1991, 1994; Lobert *et al*. 1991; G. Gillespie pers. Obs.). Approximately 30 % of breeding records in NSW have been along streams (Lemckert 2004); however this has never been observed in Victoria.

The Large Brown Tree Frog has been recorded breeding in both natural and man-made water-bodies (e.g. fire dams and road side ditches). This suggests that the Large Brown Tree Frog is a generalist pond-breeding species, typical of closely related species in the *Litoria ewingii* species group. Such species do not spend their lives near these breeding sites, but instead visit them only during suitable breeding conditions. Males may form small aggregations and call to attract females to the breeding sites from the surrounding environment. Most of the time such species are dispersed, foraging and sheltering throughout the surrounding landscape (Duellman and Trueb 1994; Wells 2007). Such water-body types are intrinsically relatively ephemeral: different sites may be more or less suitable for breeding in different seasons and different years.

The Large Brown Tree Frog has rarely been found when not breeding, or away from breeding locations. This further suggests that the species does not reside long-term in the vicinity of breeding sites and disperses widely into the surrounding forest. It is not uncommon for amphibians to be less detectable in the non-breeding season and away from breeding sites (Wells 2007). The lack of records away from breeding sites may reflect an inherent low population density, cryptic behaviour (such as limited nocturnal activity patterns), or use of habitats that limit detection (e.g. forest canopy or under tree bark). Apart from ecological vegetation classes, which describe broad habitat types, the specific habitats traversed by this species are unknown, as is the size of its home range, and the microhabitats that it uses for sheltering and foraging (Hero *et al*. 2002; Lemckert 2004).

The records of Large Brown Tree Frogs in Victoria have been accumulated in two general ways. Firstly, some records were collected by various amphibian field biologists and museum staff working across Victoria in the 1960s and 1970s. Specimens were typically lodged with the Museum of Victoria by these individuals. Secondly, through biodiversity surveys undertaken by government agencies, mostly as part of the pre-logging survey program between 1982 and 1992 (e.g. Chesterfield *et al*. 1988; Opie *et al*. 1991, 1994; Lobert *et al*. 1991; Westaway *et al.* 1990a,b). These surveys were conducted by multidisciplinary teams of zoologists and botanists, including staff with expertise in the detection and identification of amphibians (including myself). I am familiar with all the herpetologists (reptile and amphibian specialists) that worked on the biodiversity surveys throughout that period, and I have no reason to doubt the reliability of any of the records, with the exception of the one described earlier.

The extent of surveys undertaken by government wildlife agencies in eastern Victoria throughout the 1980s and early 1990s was, in my opinion, adequate to identify the general distribution and broad habitat associations of the Large Brown Tree Frog. However, these surveys and the earlier collections had the following limitations:

- Surveys were non-systematic: seasonal timing and sampling effort were not consistent between surveys, nor were sampling techniques and sampling effort standardised between surveys or staff. At that time, knowledge of systematic sampling techniques for amphibians was poor. The Large Brown Tree Frog may breed mostly in winter or early spring, whereas surveys were typically undertaken between October and March, thus greatly reducing the likelihood detecting this species.

- Surveys were of low intensity and so the survey effort was not necessarily adequate to confidently detect rare or cryptic species. The necessary sampling effort to reliably detect the Large Brown Tree Frog is unknown. Lemckert (2004) repeatedly visited previously confirmed calling sites for this species in NSW during seemingly suitable conditions but only detecting the species on 30% of occasions.

- Surveys were not comprehensive: not all places that the Large Brown Tree Frog potentially occurs were sampled.

Consequently, the available information on the occurrence of the Large Brown Tree Frog is likely to be conservative. It provides records of where and when the species has previously been found, rather than an accurate picture of where the species does and does not actually occur. Consequently the species is likely to have occurred throughout forest habitats away from water bodies where it has been recorded, and it was likely to have occurred in the vicinity of other water bodies and forest areas in which it has not yet been recorded.

The surveys also provide comparative data with other frog species in the region, and indicate that the Large Brown Tree Frog is either extremely rare, cryptic or both. This is because most other species known from the region were detected far more frequently and in greater numbers. Similar conclusions have been drawn from observations in NSW (Lemckert 2004).

Furthermore, surveys ceased in 1992. Since then no targeted surveys of this species have taken place. Apart from opportunistic visits from myself to the region, I am unaware of anyone looking for this species in Victoria since 1993. Species populations and distributions are dynamic, and are affected by a wide range of environmental factors. The distribution and abundance of the Large Brown Tree Frog may have undergone changes since the early 1990s due to habitat changes and other environmental factors. Consequently, current knowledge of the distribution and abundance of the Large Brown Tree Frog is virtually non-existent.

Since the late 1990s many amphibian species have suffered major population declines both globally and within Australia (Pechmann and Wilbur 1994; Blaustein and Kiesecker 2002; Collins and Storfor 2003; Stuart *et al*. 2004; Hero *et al.* 2006). Many factors have been implicated in these declines, including habitat loss and degradation (e.g. Gillespie and Hollis 1996), introduced predators (Beebee and Griffiths 2005; e.g. Gillespie 2001), emergent disease (Berger et al. 1998), pesticides and chemical pollutants and climate change (Beebee and Griffiths 2005). There is general consensus amongst amphibian biologists that at least 25 % of the world's amphibian species, including entire communities of amphibians in some cases, have been adversely affected by one or a combination of these factors over the past 30 years or so (Stuart *et al.* 2004). The impact of any one, or a combination, of these factors on the distribution and abundance of the Large Brown Tree Frog is unknown.

In Australia, amphibian species appear more vulnerable to decline if they have relatively restricted distributions, occur at relatively high elevations (> 400 m above sea level) and have relatively low fecundity (Hero *et al*. 2005).

Conservation Status

4. *Victorian Status*

The Large Brown Tree Frog is listed as *Threatened* in Victoria under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act). In my opinion, this means that the following steps should be taken:

- Further field investigations should be undertaken to assess the species' current distribution and abundance more precisely.
- Investigations should be undertaken to determine more precisely the species' ecological requirements, factors that limit the species' distribution and abundance, and the threatening processes that may be operating to cause potentialdeclines in distribution and abundance.
- An Action Statement should be prepared, which identifies the steps that need to be taken to adequately address the above knowledge gaps, and the management steps required to ensure conservation of the species in the wild.
- Once approved, the Victorian Government is required to implement the Action Statement under the FFG Act.

IN my opinion, the following are some of the necessary actions in the FFG Action Statement required to ensure the conservation of the species in the wild would include:

- Comprehensive surveys of appropriate sampling intensity to determine with high confidence the current distribution and abundance of the species within Victoria, and an assessment of how this has changed compared with historic records.
- Investigation of the habitat requirements of the species, both breeding and non-breeding, and investigation of factors influencing the quality and availability of suitable habitat for the species.

- Investigation of potentially threatening processes that may be adversely influencing the species' distribution and abundance. Potential threatening processes include: timber harvesting and associated forest management practices, fire management, invasive species (e.g. cats and foxes), the emergent amphibian disease – chytridiomycosis, drought and climate change.
- Identify measures required to adequately protect enough suitable for the species to ensure its persistence in the wild.
- Identify measures to mitigate the impact key threatening processes (once clearly identified) impinging upon the survival of the species the wild.
- Implement an appropriate monitoring program to evaluate the success or otherwise of these measures, and modify as necessary.

5. *Federal Status*

The Large Brown Tree Frog is listed as *Vulnerable* under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This species is also listed as vulnerable under the *Threatened Species Conservation Act 1995* (NSW). In my opinion this means that the following steps should be taken:

- A national Recovery Plan should be prepared, which identifies actions required to adequately address the above knowledge gaps, and the management steps required to ensure conservation of the species in the wild.
- Once approved by the relevant Victorian and NSW government agencies, the Recovery Plan should be implemented within 3 years.
- Necessary actions in the National Recovery Plan required to ensure conservation of the species in the wild would include those identified for the FFG Action Statement, but would apply to both Victoria and New South Wales.

6. In my opinion, the conservation status of the Large Brown Tree Frog at the State or Federal level will not change in the foreseeable future until significantly more information becomes available on its current distribution and abundance. However, any change in the foreseeable future is likely to be toward a higher risk level, because:

- General trends in amphibian declines both within and outside Australia suggest that this species is not secure.

- There are several potentially threatening processes that operate in East Gippsland, some of which potentially threaten the survival of the Large Brown Tree Frog.

The Large Brown Tree Frog is classified as *Least Concern* (not threatened) by the International Union for Conservation of Nature (IUCN) (Red List 2009), based upon the 2004 global amphibian assessment (Stuart *et al.* 2004). In my opinion, this classification will change in the foreseeable future because, in the absence of more current information on the species' population status, it will become *Data Deficient* under IUCN guidelines.

7. *Threats*

There are several threats to the continued survival of the Large Brown Tree Frog in Victoria. These include: timber harvesting and associated forest management practices, fire management, the emergent amphibian disease – chytridiomycosis, drought, and climate change.

Timber harvesting and associated forest management

By timber harvesting and associated forest management, I include: road construction, log extraction, coupe regeneration burns and subsequent management activities to ensure forest regeneration. There is no specific evidence that timber harvesting and associated forest management adversely affects populations of the Large Brown Tree Frog. However, it is difficult to assess the impacts of forestry operations on amphibians, due to their complex life cycles, cryptic nature and confounding environmental and historical land management factors (Gillespie and Hollis 1996; Goldingay et al. 1996; Gillespie and Hines 1999; Gillespie 2002a,b). However, the following evidence suggests that forestry operations probably do adversely affect the survival, population size and distribution of the Large Brown Tree Frog:

- The species appears to be dependent upon forest habitat for its survival.
- The types of forest and areas of forest that the species occurs in are subject to timber harvesting.
- Most of the known localities of the Brown Tree Frog in Victoria are outside of protected areas, such as National Parks (Appendix III).

- With the exception of species with highly generalised ecological requirements, or species that thrive on habitat disturbance, most species are adversely affected by significant changes to their habitats. Based upon what is known about the Large Brown Tree Frog, the adult stage does not have highly generalized ecological requirements and the species does not thrive in disturbed environments. Timber harvesting grossly alters the species' habitat by changing forest structure, light penetration levels, moisture and temperature regimes.

- Amphibians are ectotherms, meaning they depend upon the external environment to attain and maintain optimal temperatures for metabolic activity ('cold-blooded'). Amphibians have a moist skin; they exchange oxygen and carbon dioxide through their skin and it plays an important role in water balance and defense (Duellman and Trueb 1994; Wells 2007). The vast majority of amphibians therefore tolerate relatively narrow temperature ranges compared to other vertebrates, and are more sensitive to levels of environmental moisture (Duellman and Trueb 1994; Wells 2007). Consequently, factors that significantly alter these regimes will have a detrimental effect on individual survival.

- Timber harvesting may also remove or alter sheltering sites, which may be important for avoiding predators. Other arboreal forest frog species exploit tree hollows, exfoliating bark, fallen logs and leaf litter for shelter (Duellman and Trueb 1994; Barker *et. al*. 1995; Wells 2007). Timber harvesting may also affect food availability for frogs and the abundance of predators, as these species are also affected in various ways by changes in habitat brought about by timber harvesting (see Lindenmayer and Burgman 2005).

- Several studies have shown that clear-felling has a long-term detrimental affect on amphibian populations (Bury and Corn 1988; Corn and Bury 1989; deMaynadier & Hunter 1995). Populations of the Large Brown Tree Frog may be detrimentally affected by changes resulting from one or more of the above factors. The utility of different successional stages of forest post-logging by Large Brown Tree Frogs is also unknown. At a landscape level, timber harvesting may result in fragmentation of suitable habitat and isolation of non-viable populations over time.

- The impact of coupe fires or fuel reduction burning on the Large Brown Tree Frog is unknown. However, frogs have little defense against fire; they are slow and sedentary animals and cannot flee from fire. They also have low tolerance of extreme temperatures and desiccation. Non-burrowing frog species that do survive fire probably do so by sheltering in large logs or patches of unburnt forest. The restriction of the Large Brown Tree Frog to forest types that rarely burn, or typically experience small or cool burns, may reflect their inability to cope with fire. Coupe burns in high elevation wet forest are hot fires, which are likely to destroy any remaining refugia for the Large Brown Tree Frog.
- Available information suggests that the Large Brown Tree Frog may have relatively general breeding habitat requirements. This species may be able to temporally exploit breeding habitats created by forest management practices, such as fire dams and road side-ditches. However, the comparative reproductive success between natural and artificial water bodies is unknown. Artificial water bodies may serve as ecological traps through elevated drying rates or predation rates (deMaynadier and Hunter 1995). Other ecological generalist species may also be able to exploit these habitats more successfully and out-compete the large Brown Tree Frog. Increased water temperatures and evaporative rates in newly logged areas may reduce the viability and availability of natural breeding pools.

Timber harvesting has occurred throughout the entire range of the species, expect within some protected areas, such as National Parks or Special Protected Zones (DNCR 1995).

Amphibian Disease - Chytridiomycosis

Chytridiomycosis is a fungal skin disease that has caused mass mortality in amphibians at sites worldwide (Berger et al. 1998; Bosch *et al.* 2001; Muths *et al.* 2003). The disease appears to have emerged in the 1970s after being introduced into Australia and the Americas (Berger *et al.* 2009). The disease has been implicated in the extinction of several species of Australian frogs (Spear *et al.* 2001) and population declines in numerous other species (Hero *et al*. 2006; Berger *et al*. 2009). The disease is widespread across temperate, montane and wet tropical parts of Australia (see

Berger *et al.* 2009). I am not aware of any confirmed reports of Chytridiomycosis in the Large Brown Tree Frog.Given the widespread distribution of this disease, however, it is highly likely that the Large Brown Tree Frog has been exposed to it. Species that occur at higher elevations appear to be more vulnerable than those at lower elevations (Kriger and Hero 2008).

Chytridiomycosis is expected to affect the Large Brown Tree Frog throughout its entire range. Other factors which facilitate spread of the disease, or stresses that reduce the ability of frogs to cope with infection, may exacerbate its effect on the species in some parts of its range. For example, there is increasing anecdotal evidence that some common frog species may be hosting and spreading this disease (D. Hunter, Department of Environment, Climate Change and Water, NSW, pers com.; G. Gillespie pers. obs.). Some common frog species appear to benefit from habitat disturbance. Activities such as forestry operations that facilitate the dispersal of these species may therefore promote the spread of this disease.

Drought

South-eastern Australia has been subjected to protracted drought conditions throughout the last decade. The impact of this on the Large Brown Tree Frog is unknown. Given its association with moist forest types and its dependence upon ephemeral rain-filled water bodies to reproduce, it is likely that this species has been significantly and adversely affected by the low-rainfall and seasonally high temperatures experienced in recent years. These factors may have resulted in mortality of adults due to heat or water stress, or reduced reproductive success due to reduced availability and persistence of suitable breeding habitats. The resultant effect would be a decline in abundance and contraction of distribution to the most optimal refugia within the species' range. Mature Wet Forest potentially provides high quality habitat for the Large Brown Tree Frog, and may provide important refugia for this species during times of environmental stress.

Drought has affected the entire range of the species in one way or another. There may be interactive effects between drought and forest management practices within the range of the species, such as greater or lesser evaporative effects, increased temperature regimes causing physiological stress, reduced availability of breeding sites, or increased risk of wildfire.

Other Potential Threats

Amphibian declines have often been attributed to interactions among causal factors (Jennings and Hayes 1994; Kuzmin 1994; Pechmann and Wake 1997). Increased exposure to UV-B may alter species interactions, affect amphibian vulnerability to pathogens or cause changes in water pH (Kiesecker and Blaustein 1995; Long *et al.* 1995). Processes that fragment populations may lead to regional extinction by preventing recolonisation of population isolates (Bradford *et al.* 1994). Outbreaks of disease may only occur when other stresses reduce immune function (Carey 1993; Ovaska 1997; Donnelly & Crump 1998). Any factor that limits local abundance may interact with global climate change (Alford and Richards 1999).

Measures to Reduce Threats

There are no measures in place in Victoria to reduce the effects of chytridiomycosis or drought on amphibian declines.

Measures have been put in place in Victoria and East Gippsland, through the Forest Management Plan for the East Gippsland Area (Department of Conservation and Natural Resources 1995), to ameliorate the effects of timber harvesting on some selected amphibian species, but do not relate specifically to the Large Brown Tree Frog. Some Special Protection Zones and other forested areas excluded from timber harvesting by the Plan may contain Large Brown Tree Frogs. Some records of Large Brown Tree Frogs also occur in National Parks. However, most of the records occur outside of reserves or on the very edge of these reserves. Consequently, in my opinion, the measures in place (DCNR 1995) are inadequate to effectively reduce the impacts of timber harvesting and associated forest management practices on the Large Brown Tree Frog in both Victoria and East Gippsland specifically, which contains over 90% of the known records within the State.

8. *Impacts of Forestry Operations on the Large Brown Tree Frog and its Habitat*

As described above, forestry operations potentially have a significant impact upon this species, through direct loss of habitat to adults, changes to availability and quality of breeding habitat, and changes in food availability and predation.

It is not currently possible to quantify the impact of forestry operations on actual populations (Goldingay *et al.* 1996; Gillespie and Hines 1999). However, most of the known habitat of the Large Brown Tree Frog in Victoria has now been logged or

fragmented by forestry operations. This is likely to have had a significant adverse effect on the species across its range within Victoria.

East Gippsland

9. The Large Brown Tree Frog was known to be present in East Gippsland up until the 1990s and there is no reason to at this stage to believe that it is not still there.

A map showing the specific locations of the Large Brown Tree Frog in East Gippsland is provided in Appendix III. The known distribution of the species as described earlier in this document applies mostly to East Gippsland, because with the exception of two localities, all known Victorian records occur in East Gippsland (Appendix III). Within East Gippsland, the majority of records occur north of the Princess Highway, either in the vicinity of the Errinundra Plateau, or the ridges and slopes to the west, south and south-east of the Plateau (Appendix III).

10. At this stage the security status of all populations is unknown. The species has not been recorded since 1993 in Victoria. No monitoring has been undertaken, and since then forestry operations have continued throughout the region and there has been a period of prolonged drought.

Population sizes have never been established.. It is not known if populations are currently increasing, decreasing or stable.

<u>Brown Mountain</u>

11. In order to ascertain whether or not Large Brown Tree Frogs are, or are likely to be, present in or near the Brown Mountain Forestry coupes, thorough surveys would need to be undertaken. These surveys would need to involve appropriately experienced amphibian experts, who are familiar with the species' call, and its eggs and tadpole and adult morphology. Surveys would need to be undertaken at night, preferably on evenings after rain, which appear to be the best times to detect the species. Surveys would need to be undertaken at each coupe at least fourtimes across different seasons of the year to ensure likelihood of detection of the species. Surveys would need to thoroughly investigate the location of all water bodies (temporary and permanent) within each coupe and in surrounding areas.

12. On the basis of my sight visit to the Brown Mountain coupes, in my opinion all the remaining unlogged coupes contain highly suitable habitat for the Large Brown

Tree Frog. I did not detect the species during my visit, but conditions were dry at the time and, as explained above, multiple visits are required to ascertain the presence of this species with any confidence. I also visited several other historic sites during my visit and did not detect the species there either. In my opinion the species may occur in all the coupes. Adults of the species are likely to reside within the coupes and to traverse the area. I observed potential breeding sites in depressions throughout the forest, and pools adjacent to the stream between coupes 840-502-15 and 840-502-0019, which could potentially be used for breeding.

13. My level of confidence that the Large Brown Tree Frog either resides in or traverses the Brown Mountain Forestry coupes is reasonably high (above 60%), because:

- The habitat is suitable
- There are historic records of the species nearby
- No surveys or other assessments have been undertaken to diminish the likelihood that the species is present.

14. Given that it is likely that Large Brown tree frogs reside in the Brown Mountain coupes, it is highly likely that logging will impact individual members of the species. Meredith (2009) concluded that any population of the Large Brown Tree Frog in the nominated area provided a substantial contribution to the Victorian population, as at least 1 % of the known extant population occurs in the vicinity. Forestry operations are likely to greatly adversely affect this local population, and consequently the species in Victoria. Furthermore, the Brown Mountain coupes currently provide a potentially critical mature wet forest link between the Snowy River and Errinundra National Parks. Much of the surrounding forests have been logged, and so logging these remaining forests will increase the fragmentation and isolation of other Large Brown Tree Frog populations. Therefore the impact of logging these coupes is likely to be far greater than just the loss of the habitat itself.

The nominated area comprises much less then 1 % of the entire range of the species; however much of this area has now been impacted by forestry operations and remaining high quality patches of wet forest, such as the Brown Mountain coupes, may be highly important for the survival of the species as a whole. It is not possible to estimate this overall impact.

15. It is not known if, and how long it would take for, the Large Brown Tree population to recover from the intended logging operations. If the species is dependent upon mature wet forest for its survival, then populations will not fully recovery in the nominated area for at least 100 years or more. The rate of recovery will also depend upon recolonisation rates from adjacent un-logged areas. These rates are also unknown. But frogs in general are highly sedentary organisms. Forestry operations may place barriers to recolonisation.

16. Assuming that VicForests adheres to the prescriptions outlined, this would not change my answers to questions 14 and 15 because:

- These prescriptions are not designed to conserve the ecological requirements of the Large Brown Tree Frog. As pointed out elsewhere in this document, the Large Brown Tree Frog is dependent upon certain temperature and moisture regimes that will be drastically changed after forestry operations. Retention of five hollow-bearing trees per hectare will not ameliorate these changes. Whilst the specific microhabitats important to adults for shelter and foraging are not known, they most likely include the understorey forest vegetation structure and ground cover of logs and litter. These components of the forest will be either removed or grossly altered by forestry operations. The availability of remaining course woody debris and litter will be further reduced by coupe burns. It is unlikely that any large Brown Tree Frogs will survive coupe burns.
- Retention of a 100 m along the stream will protect some habitat likely to be important to the species. However, there is no evidence that this species uses the actual stream for breeding. Breeding sites important to the species are expected to be scattered throughout the forest. Assuming that the distribution and abundance of the Large Brown Tree Frog does not vary with respect to proximity to this water course, then the impact of forestry operations on the species will be more a function of the percentage of area logged versus that retained, irrespective of where the retention actually occurs.

<u>Precautionary Principle</u>

17. The precautionary principle states that if an action or policy has suspected risk of causing harm to the public or to the environment, in the absence of a scientific

consensus that this would not cause harm, then the burden of proof falls on those advocating the proposed action. In effect, this principle allows policy makers to make discretionary decisions in situations where there is evidence of potential harm in the absence of complete scientific proof. The principle implies that there is a responsibility to intervene and protect the public from exposure to harm where scientific investigation discovers a plausible risk in the course of having screened for other suspected causes. The protections that mitigate suspected risks can be relaxed only if further scientific findings emerge that more robustly support an alternative explanation.

18. In my opinion the proposed logging would not be consistent with the precautionary principle in respect to the Large Brown Tree Frog.

19. The reasons for my answer to 18 are as follows:

- The Large Brown Tree Frog is listed as *Threatened* in Victoria under the FFG Act and nationally *Vulnerable* under the EPBC Act.
- No steps have been taken to assess the adequacy of the current reserve system or forest management practices for protecting this species from population declines that may further increase its extinction risk.
- No steps have been taken to undertake the research required to determine the impact of key threatening process, specifically forestry operations, or how to ameliorate them on this species, by way of an FFG Action Statement or any other management document.
- Knowledge of the current population status is extremely poor due to a lack of current knowledge about the species' distribution and abundance.
- The species is known to be dependent upon habitats that are themselves restricted in distribution (i.e. mature wet or damp forest).
- The Large Brown Tree Frog is known to have occurred in the vicinity of the Brown Mountain coupes and, based on current knowledge, these forests are high quality habitat for the species. It is therefore highly likely that the species resides and traverses the area of proposed operations.

- The proposed forestry operations at Brown Mountain directly impinge on high quality habitat for the Large Brown Tree Frog that has been identified as critical to the survival of the species.
- There is no evidence that the prescriptions in the Code of Forest Practice (Department of Sustainability and Environment 2007) or the Forest Management Plan for East Gippsland (1995) will provide adequate protection for populations of the Large Brown Tree Frog.
- No steps are proposed to monitor or evaluate the impacts of forestry operations on the Large Brown Tree Frog.

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Appendix I:

Curriculum Vitae

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Date of Birth: 9th December, 1962

Languages: English – fluent

Bahasa Indonesia - partial

Academic Record:

'High School Certificate' - Caulfield Grammar School 1980

B.Sc. - Monash University, Melbourne, 1985

Zoology and Genetics majors

M. Prelim. Sc. (Population Genetics) - Monash University, Melbourne, 1989

Thesis Title: Development of minisatellite probes for studying genetic variation in populations of amphibians, with specific application to the Blue Mountains Tree Frog (*Litoria citropa*).

Ph.D. (Zoology) University of Melbourne, 2002

Thesis Title: Ecology of the Spotted Tree Frog *Litoria spenceri*: An Investigation of causes of Population Decline.

Awards

David Ashton Excellence in Biodiversity Research, 2002. Awarded by the Department of Natural Resources and Environment for research, development and implementation of the National Recovery Plan for the Spotted Tree Frog.

Honorary Positions

Research Fellow, Zoology Department, University of Melbourne, 2004 – present.

Employment Record

October 2004 – Present: Director, Wildlife Conservation and Science for Zoos Victoria.

As part of the senior executive team for Zoos Victoria, I manage the Wildlife Conservation and Science department, which leads and coordinates the implementation of all conservation and research activities for Zoos Victoria, through the development of effective strategies, in consultation with senior management and the Board. Specifically I am responsible for:

i. Ensuring the establishment of and implementation of effective conservation programs and activities, consistent with Victorian Government priorities and other regional priorities, that achieve sound biodiversity conservation outcomes, utilise the strengths and skills of Zoos Victoria, and integrate with other relevant organisational strategies and priorities.

ii. Ensuring the establishment of appropriate wildlife science and research programs that underpin and integrate with animal collection, veterinary, conservation and other organisational strategies and priorities.

iii. Ensuring the maintenance of appropriate national and international networks. Building partnerships with other conservation agencies and NGOs to achieve mutually agreed goals. Build partnerships with other research institutions to maximise research capacity.

iv. Ensuring appropriate research standards through the Animal Ethics Committee, Science Advisory Committee and peer review.

v. Providing specialist support and training to ensure efficacy and quality of programs and staff involvement.

vi. Communication of our research and conservation activities and achievements to staff and the broader community and maximise their participation.

vii. Enhance financial capacity for research and conservation programs through grant writing and by assisting the Zoos Victoria Foundation in fund-raising.

viii. Provision of information and advice to the CEO and Board on all research and conservation matters.

ix. Managing departmental budgets and contributing to development of Zoos Victoria business plans.

My staff and I also contribute generally to the development and implementation of state and national recovery programs for threatened species, provide advice to Victorian Government policy and planning staff on research and management priorities and strategies for threatened species, in particular those involving captive breeding programs.

I also maintain an active research role that focuses on (i) various aspects of conservation biology and population ecology, and (ii) faunal community composition and conservation in South-east Asia.

1997-2004: Senior Scientist with the Arthur Rylah Institute for Environmental Research, Department of Sustainability and Environment.

As part of the section management team I was responsible for development and implementation of various research programs primarily aimed at improving

conservation and management of biodiversity in Victoria. In particular I oversaw ARI's involvement in threatened species conservation research.

I played a key role in the day to day management of staff and operations of the Fauna Research Section, with direct responsibilities for supervision of scientific and technical staff; liaison with, and reporting to, a wide range of internal (DSE) and external clients; development of budgets; and internal organisation and business profiles.

During this period I also acted as Wildlife Section Manager or short periods.

1993 -1997: Research Scientist for the Spotted Tree Frog National Recovery Program, Arthur Rylah Institute, Department of Natural Resources and Environment (now DSE). This was primarily a research position, the objectives of which were to investigate factors responsible for population declines of the Spotted Tree Frog and provide advise for the development of appropriate conservation and management plans. I established and coordinated a long-term monitoring program to examine trends in populations and responses to management and environmental changes. I also developed and initiated implementation of the National Recovery Plan for the Spotted Tree Frog and contributed to the development of regional forest management plans for eastern Victoria. In addition I was responsible for providing expert advice to the Department on management and policy development pertaining to amphibians.

1993: Project Leader, Long-footed Potoroo Research Project, Orbost, Victoria, Department of Conservation and Natural Resources (now DSE). I was responsible for establishing a research program to develop improved detection techniques for Long-footed Potoroos, and techniques for tracking animals, such as radio-tracking, spooling and fluoro-dusting; establishing trap grids for comparative studies of the species in disturbed and undisturbed habitats.

1990 - 1992: Project Leader flora and fauna survey team, Department of Conservation and Natural Resources (now DSE), Orbost, Victoria. Lead a team of botanists and zoologists conducting biodiversity surveys of Forests in Eastern Victoria, and providing advice and recommendations for forest management planning on threatened species. I was responsible for project and staff management, along with specialist sampling of reptiles and amphibians, and overseeing data management and reporting.

1986 - 1991: Science Officer, Department of Conservation, Forests and Lands, with the Flora & Fauna Survey and Management Group, Arthur Rylah Institute. This position was part of a flora and fauna survey team conducting general biodiversity surveys throughout Victoria, and providing advice and recommendations for timber harvesting planning. I was the reptile and amphibian specialist on this program.

Other Work Experience

2000 – 2003 Biodiversity research project leader, Sulawesi, Indonesia. For four months each year from 2000 to 2002, I was seconded to work on a forest biodiversity research program in Sulawesi, Indonesia, with Operation Wallacea. I conducted extensive primary surveys and research on the herpetofauna and terrestrial mammal fauna of the region, documenting new species and investigating patterns of community structure and composition. In 2000 I also played a primary role in establishing a broad-based forest biodiversity inventory program and setting up a research station. In 2001 and 2002 I had overall responsibility for coordinating a diverse research program from this station, investigating various aspects of fauna biology and forest ecology, and providing information to assist in local and regional conservation planning. In addition to its research focus, this program had a strong focus on education of tertiary students, and engagement and capacity building of local communities.

In 2003 I participated in the development of a forest conservation and sustainable management strategy for the region, which lead to a successful funding bid to the World Bank, and implementation of a Global Environment Fund program from 2004 – 2008.

1998 Assisted staff at the Department of Environment, Queensland and Griffith University with surveys and monitoring of frog populations in southeast Queensland.

1993 - 1998 Assisted the Department of Environment, Queensland, and staff at Griffith and James Cook Universities with various surveys, research projects and on-going monitoring programs for declining frog populations in north-east Queensland.

1985 - 1986: Assisted the Land Conservation Council Fauna Survey Group with trapping and other data collection during the Mallee survey.

Teaching Experience

Lecturing:

Various guest lectures in amphibian ecology, conservation and wildlife management at Melbourne University and TAFE colleges; 1999 – present, at both undergraduate and post-graduate levels.

Tutoring:

Monash University Genetics Department 1989-1990.

Melbourne University Zoology Department 1994-1996.

Student project supervision:

Co-supervised two 1st class honours projects at University of Melbourne 2000 - 2004. Currently supervising one honours student at Deakin University.

Supervised 15 undergraduate and 2 MSc research projects and on herpetofauna and small mammal ecology in Sulawesi 2000 - 2008.

Publications and Reports

Refereed Journal Articles

1. **Gillespie, G. R.** (in press). Population age structure of the spotted tree frog *Litoria spenceri*: insights into population declines. *Wildlife Research*

2. **Gillespie, G. R**., Anstis, M., Howard, S. D. and Lockie, D. (2007). Description of the tadpole of the Rhacophorid frog *Rhacophorus georgii* Roux (Rhacophoridae) from Sulawesi, Indonesia. *Journal of Herpetology*, **41**: 150-153.

3. **Gillespie, G. R.**, Howard, S., Lockie, D., Scroggie, M. and Boeadi (2005). Herpetofaunal richness and community structure of offshore islands of Sulawesi, Indonesia. *Biotropica* **37**: 279-290.

4. **Gillespie, G. R.**, Lockie, D., Scroggie, M. P and Iskandar, D. T. (2004). Habitat use of stream-breeding frogs in south-eastern Sulawesi, and some preliminary observations on community organisation *Journal of Tropical Ecology* **20**: 1-10.

5. **Gillespie, G. R.** (2002). 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.

6. **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.

7. **Gillespie, G. R.** and Clemann, N. (2000). The dwarf tree frog *Litoria fallax* (Peters) (Anura: Hylidae): a recent introduction to Victoria? *Victorian Naturalist* **117:** 60-62.

8. **Gillespie, G. R.** and Hunter, D. (1999). The Booroolong Frog *Litoria booroolongensis* Moore (Anura: Hylidae): an addition to the frog fauna of Victoria. *Victorian Naturalist* **116**: 112-114.

9. **Gillespie, G. R.** and Hines, H. B. (1999). The current status of temperate riverine frog species in south-eastern Australia. In: A. Campbell (ed.) *Declines and Disappearances of Australian Frogs*. Environment Australia, Canberra. pp. 109-130.

10. **Gillespie, G. R.** and Hero, J-M. (1999). The impact of introduced fish upon Australian frogs In: A. Campbell (ed.) *Declines and Disappearances of Australian Frogs*. Environment Australia, Canberra. pp. 131-144.

11. **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.

12. **Gillespie, G. R.** (1996). Distribution, habitat and conservation status of the Green and Golden Bell Frog *Litoria aurea* in Victoria. **In:** G. Pyke and W. S. Osborne (eds) *The Green and Golden Bell Frog: Biology and Conservation*. Royal Zoological Society of New South Wales. pp. 199-207.

13. **Gillespie, G. R.** and Osborne, W. S. (1994). Update on the status of the Spotted Tree Frog *Litoria spenceri* in the Australian Capital Territory. *Victorian Naturalist* **111**: 182-183**.**

14. **Gillespie, G. R.** (1992). Survey of the Spotted Tree Frog (*Litoria spenceri*) in Victoria, February - March 1992. *Victorian Naturalist* **109:** 203-211.

15. **Gillespie, G. R.** (1990). The distribution, habitat and conservation status of the Giant Burrowing Frog (*Heleioporus australiacus*) (Myobatrachidae) (Shaw) in Victoria. *Victorian Naturalist* **107:** 144-153.

16. Christopher J. H., Brown, R. M., **Gillespie, G**., Setiadi, M. I., Linkem, C. W., Iskandar, D. T., Umilaela, Bickford, D. P., Riyanto, A., Mumpuni, and McGuire, J. A. (2008). A New species of bent-toed gecko *Cyrtodactylus* Gray 1827, (Squamata: Gekkonidae) from the islands of Sulawesi, Indonesia. *Herpetologica*, 64 (1): 109-120.

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29. **Gillespie, G. R.** Life history variation in the spotted tree frog *Litoria spenceri* from Australia. *Herpetologica* (in review).

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2. **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. Unpublished report to NSW National Parks and Wildlife Service, Southern Zone, Queanbeyan. Arthur Rylah Institute, Department of Natural Resources and Environment, Heidelberg, Victoria.

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2. **Gillespie, G. R.,** Banks, C. and Traher, R. Review of the role of zoos in amphibian conservation in Australia. ARAZPA conference, Perth, 2006.

3. **Gillespie, G. R.**, Thomas, J. and Thomas, J. The Tenkile project: achieving conservation outcomes in Papua New Guinea. Second Joint Annual Conference of SEAZA and ARAZPA, Melbourne, 2005.

4. **Gillespie, G. R.**, Scroggie, M. P., Roberts, D., Cogger, H., McDonald, K. R. and Mahony, M. J. Assessment of conservation priorities for Australian frogs. Joint meeting of the Australian, New Zealand and Fijian Societies of Herpetology, Springbrook, Queensland, 2005.

5. Todd, C., Scroggie, M. and **Gillespie, G. R.** Using mark-recapture analysis and population models to investigate management strategies for the Spotted Tree Frogs, *Litoria spenceri*. International Wildlife Management Society Congress, Christchurch, N.Z. 2003.

6. **Gillespie, G. R**., Howard, S., Scroggie, M. P. and Lockie, D. Herpetofaunal assemblage composition in relation to habitat disturbance in Sulawesi, Indonesia: Implications for management and conservation of tropical vertebrate biodiversity. International Wildlife Management Society Congress, Christchurch, N.Z. 2003.

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8. **Gillespie, G. R.** Biodiversity research in south-east Sulawesi, Indonesia: Community composition and habitat relationships of herpetofauna. Guest speaker, CSIR, Stellenbsch, South Africa, 2002.

9. **Gillespie, G. R.** The role of applied research in the development of threatened species recovery plans: the Spotted Tree Frog as a case study. Biodiversity Conference, Department of Natural Resources and Environment, Melbourne. 2001.

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11. **Gillespie, G. R.** Impacts of increased sediment loads on growth and development of tadpoles of the Spotted Tree Frog (*Litoria spenceri*). Australian Society of Herpetologists Annual General Meeting, Alice Springs, N.T. 1999.

12. **Gillespie, G. R.** Population dynamics and declines of the Spotted Tree Frog (*Litoria spenceri*) in south-eastern Australia. Joint Meeting of the American Society of Ichthyologists, American Society for the Study of Amphibians and Reptiles, and the Herpetologists League, Penn State University, USA. 1999.

13. **Gillespie, G. R.** Investigation of the causes of decline of the Spotted Tree Frog *Litoria spenceri* and development of recovery and management strategies. Guest Seminar Department of Zoology, University of California, Riverside, USA. 1999.

14. **Gillespie, G. R.** Investigation of the causes of decline of the Spotted Tree Frog *Litoria spenceri* and development of recovery and management strategies. Guest Seminar Department of Biological Sciences, Griffith University, Queensland. 1999.

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19. **Gillespie, G. R.** and Hines, H.B. Current status of temperate riverine frogs in south-eastern Australia. National Threatened Frog Workshop, University of Canberra, ACT, 1997.

20. **Gillespie, G. R.** Ecology of the Spotted Tree Frog: investigation of factors responsible for population declines. Guest Speaker, Zoology Department, La Trobe University, Victoria, 1997.

21. **Gillespie, G. R.** Impact of introduced fish on riverine amphibians in the Snowy Mountains. Disturbed Mountain Catchments Conference and Workshop, Canberra University, ACT, 1997.

22. **Gillespie, G. R.** Ecology of the Spotted Tree Frog (*Litoria spenceri*); an examination of possible causes of population declines. Applied Ecology Research Group, University of Canberra, 1996.

23. **Gillespie, G. R.** Impact of introduced fish on the Spotted Tree Frog. Australasian Wildlife Management Society Annual Meeting, Canberra University, ACT, 1996.

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25. **Gillespie, G. R.** Research for Conservation of the Spotted Tree Frog (*Litoria spenceri*). Flora and Fauna Branch, Department of Natural Resources and Environment, Melbourne, Victoria, 1996.

26. **Gillespie, G. R.** Review of the distribution, habitat and conservation status of the Spotted Tree Frog (*Litoria spenceri*). Arthur Rylah Institute for Environmental Research, DCNR, Heidelberg, Victoria, 1994

27. **Gillespie, G. R.** and Hollis, G. Distribution, habitat and conservation status of the Spotted Tree Frog (*Litoria spenceri*). Second World Congress of Herpetology, Adelaide, South Australia, 1993.

28. **Gillespie, G. R.** Status of the Spotted Tree Frog (*Litoria spenceri*) in Victoria, an update. Australian Society of Herpetologists Annual General Meeting, Sydney, 1992.

Professional Affiliations

Australasian Wildlife Management Society

The Australian Society of Herpetologists

Australasian Regional Association of Zoos and Aquariums

Victorian National Parks Association

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Natural history of reptiles and amphibians

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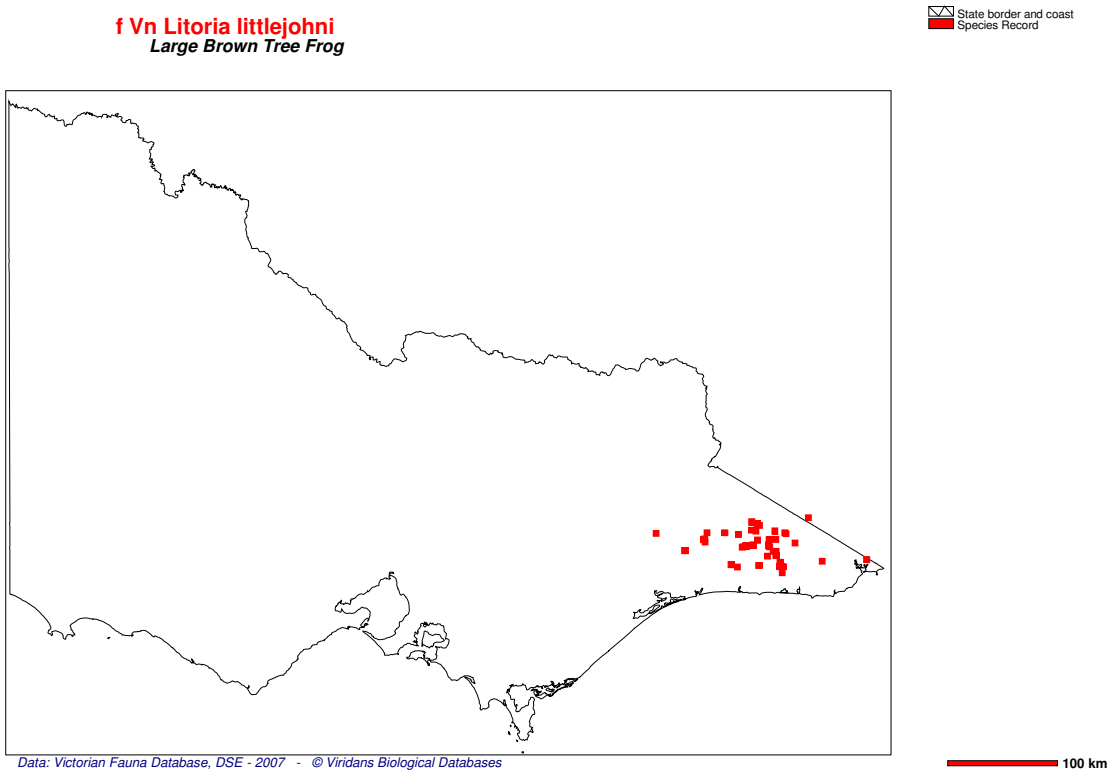
Appendix II:

Distribution of the Large Brown Tree Frog in Victoria (Atlas of Victorian Wildlife records, November 2009).



Appendix III

Distribution of the Large Brown Tree Frog in Victoria (Atlas of Victorian Wildlife records, November 2009).