

# Assessment of the status of the threatened Bibron's Toadlet and Southern Toadlet in areas affected by the Kilmore East-Murrindindi fires

Black Saturday, Victoria 2009 - Natural values fire recovery program

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**Front cover photo:** Southern Toadlet *Pseudophryne semimarmorata* (Katie Howard).

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## Summary

The Southern Toadlet *Pseudophryne semimarmorata* and Bibron's Toadlet *P. bibronii* are suspected to be in a state of decline. Both species are listed on the advisory list of threatened vertebrate fauna in Victoria (vulnerable and endangered respectively), with Bibron's Toadlet listed as a threatened taxon under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG). The Southern Toadlet is not listed under the FFG, or at a national level.

On the 7th February 2009 a large and intense wildfire (one of the 'Black Saturday' fires) swept through the urban – rural fringe to the north and north-east of Melbourne. This fire burnt large tracts of land containing historical records of both toadlet species. The impacts of the fire, combined with the status of these frogs and the effects of more than a decade of low rainfall, led to concerns about the persistence of toadlets in the fire-affected areas.

To investigate their current status we conducted surveys in the vicinity of historical records of both species in fire-affected and nearby unburnt areas. A total of 106 sites were sampled in March – May 2010. We detected four male toadlets at separate sites (two Bibron's Toadlets, one Southern Toadlet and one toadlet that was not captured, and therefore could not be confidently identified to species level).

All toadlets were detected in comparatively undisturbed habitat, in unburnt areas.

This paucity of detections and a lack of pre-fire data prevent any strong conclusions about the impact of the fires on these species. However, it is likely that both species of toadlets had undergone severe declines in at least some parts of the study area well before the fires. Remaining, small, isolated populations may have been particularly susceptible to the impact of the fires. Sampling for the Amphibian Chytrid Fungus, a cause of dramatic amphibian declines around the world, demonstrated that the fungus is present in the area, but small sample sizes precluded an assessment of the relative prevalence of the fungus between burnt and unburnt sites. We provide suggestions for the management of these species in the study area.

# 1 Introduction

Many species of frogs have declined dramatically in recent years in south-eastern Australia. In addition to environmental threats such as habitat loss and degradation, it is likely that Amphibian Chytrid Fungus *Batrachochytrium dendrobatidis*, which causes the disease chytridiomycosis, has played a significant role in many declines (e.g., Murray *et al.* 2010).

While most species of south-eastern Australian frogs breed in spring or summer, Bibron's Toadlets *Pseudophryne bibronii* and Southern Toadlets *P. semimarmorata* breed in autumn. Toadlets require both aquatic and terrestrial habitats for breeding: eggs are laid in terrestrial environments in refuges around the margins of depressions. Tadpoles are flushed into waterbodies after rain and localised flooding of low lying areas. The February 2009 fires occurred just prior to the breeding season. The Kilmore East-Murrindindi fires intensively burnt large sections of both species' ranges. Possible impacts of the fires on these frogs include direct mortality of adult frogs, loss of breeding sites and associated terrestrial habitat (possibly leading to increased exposure and risk of predation), degradation of water quality at a key time of the year for tadpoles, loss of prey species, and dramatic changes to thermal microenvironments due to initial loss of vegetation and ground debris during the fire, and dense regrowth in the months and years after the fire. The extent to which chytridiomycosis is impacting these species is unknown, as is the interaction between fire and this disease.

Prior to the Black Saturday fires, the status of these two species was poorly known. Concern had been raised over apparent declines in these species, which resulted in their listing as threatened species (Bibron's Toadlet is listed as Endangered and the Southern Toadlet as Vulnerable [DSE 2007]; Bibron's Toadlet is listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988*). Whilst there are numerous historical records of both species (Figures 1 and 2), there have been few contemporary surveys for these species; and because they breed in autumn, whereas most other frogs breed in spring or summer, general frog surveys are often undertaken at times when the toadlets are not calling, and hence detection is unlikely. Both species have been found within the study area and hybridisation occurs where their geographic ranges coincide. A narrow hybrid zone was located at Wallan during a long term study in the 1970s (McDonnell *et al.* 1978).

## 1.1 Objectives

- 1) The primary objective of this project was to gain a better understanding of the status of Bibron's Toadlet and Southern Toadlet in and around the areas affected by the Kilmore East-Murrindindi fires, and use this information to inform management of the species in this area.
- 2) As the disease chytridiomycosis is considered a major threat to many species of threatened frogs in Australia (e.g., Murray *et al.* 2010) we also aimed to collect swab samples from any toadlets that were located during this work in order to test for the presence of the Amphibian Chytrid Fungus, to investigate potential differences in infection rates between burnt and unburnt areas.

Figure 1. Distribution of Bibron's Toadlet in Victoria (source: Victorian Fauna Database, accessed May 2010).

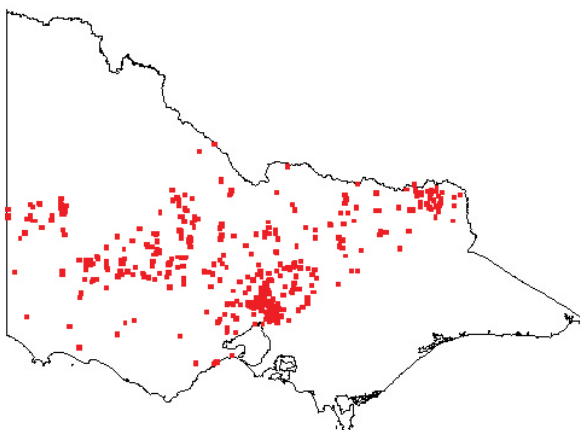


Figure 2. Distribution of the Southern Toadlet in Victoria (source: Victorian Fauna Database, accessed May 2010).



Historical records of Bibron's Toadlet and the Southern Toadlet within and around the area affected by the Kilmore East-Murrindindi fires were sourced from the Victorian Fauna Database. Surveys focused on potential breeding sites (lowland, wetter habitats), in the vicinity of these records, with a total of 106 sites sampled (Appendix 1).

Surveys involved call census (listening for calling male frogs), as well as active searches for frogs beneath rocks, logs and other debris. A minimum of eight minutes was spent listening at each site, including a three minute period of call playback conducted through a megaphone. Although males tend to be non-chorusing, not responding to other individual's calls, call play back was still attempted to encourage the commencement of calling. A recording of calling males of both Southern and Bibron's Toadlets was used at each site (recorded at Healesville and Dunolly, respectively, by Ed McNabb), and this was played after a minimum of five minutes was spent listening. When conditions are suitable for calling, there is a greater than 90% chance of detecting calling within two minutes, and greater than 99% chance within four minutes (C. Cleeland, unpublished data).

At each site, the following attributes were recorded: geographic location, using a hand-held Global Positioning System unit; altitude; Black Saturday fire condition (i.e., burnt or unburnt); and whether or not the site was near an historical record (some sites with suitable habitat within the study area that did not have historical records of toadlets were surveyed opportunistically). The following environmental variables were recorded for each survey: temperature, barometric pressure, humidity, wind speed, cloud cover, and rainfall during the survey and for the previous 24 hours (Appendix 2).

All toadlets that were captured were swabbed in order to test for the presence of the Amphibian Chytrid Fungus. Where time permitted, other frog species caught during surveys were also swabbed. Swabs were systematically drawn across the dorsal (back) and ventral (belly) surfaces of each frog, as well as the groin and palms of the hands. After swabbing, the frogs were immediately released at their point of capture and the disposable gloves that were used to handle each frog were changed to prevent transmission of pathogens between individuals. Researcher's hands and footwear were sprayed with a solution of methylated spirits and water between sites to prevent the spread of pathogens. The Australian Animal Health Laboratories (Australian Commonwealth Scientific and Industrial Research Organisation – CSIRO) tested the swabs for Amphibian Chytrid Fungus, using Taqman real-time PCR assay, following the methods described by Boyle *et al.* (2004).

### 3.1 Surveys

Surveyed sites extended from the vicinity of Darraweit Guim in the west, to Yea in the north, Buxton in the east and Wonga Park in the south (Figure 3). Of the 106 sites surveyed, 36% were in areas burnt by the 2009 fires, 55% were located on public land and 54% were at, or near, historical records. Historical records dated from 1957 to 1999, with no records post 1999 within the study area. Habitat type, elevation and land usage was variable. Most sites located on private land were grazed by domestic stock. Areas that had been burnt by the 2009 fire were thick with regrowth, with dense ground-level regeneration of vegetation (Figures 4 and 5).

Figure 3. Distribution of 106 sites surveyed for Southern Toadlet and Bibron's Toadlet between 28th March and 27th May 2010.

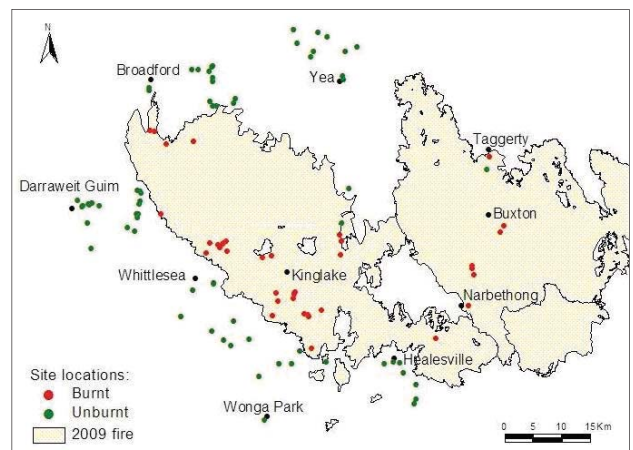


Figure 4. Dense regrowth at Site 51. Southern Toadlets were recorded in this location in 1967, but not in 2010.



Figure 5. A burnt gully line in the Kinglake National Park. Southern Toadlets were recorded in this area in 1988, but not in 2010.



Eleven species of frog were recorded during the surveys (Table 1): Bibron's Toadlet, Southern Toadlet, Common Froglet *Crinia signifera*, Plains Froglet *Crinia parinsignifera*, Victorian Smooth Froglet *Geocrinia victoriana*, Spotted Marsh Frog *Limnodynastes tasmaniensis*, Eastern Banjo Frog *Limnodynastes dumerilii*, Striped Marsh Frog *Limnodynastes peronii*, Southern Brown Tree Frog *Litoria ewingii*, Verreaux's Tree Frog *Litoria verreauxii verreauxii*, and the nationally threatened Growling Grass Frog *Litoria raniformis*. In some instances, certain frogs could only be identified as being members of the *Litoria ewingii*-complex of frogs (these would be either Southern Brown Tree Frogs, Plains Tree Frogs *Litoria paraewingii* or Verreaux's Tree Frog). These species overlap in some areas of their distribution within the study area and have extremely similar advertisement calls (Watson *et al.* 1971, Watson 1972). On one occasion a toadlet *Pseudophryne* sp. was heard that could not be confidently identified as either Bibron's Toadlet or Southern Toadlet, as the calls of these two species are indistinguishable (Table 1). The frog species that was most frequently recorded was the Common Froglet (detected at 66 sites [62%]).

Bibron's Toadlet was recorded at two sites (Sites 54 and 59), the first within Tallarook State Forest in a roadside drain, and the second on a grassy road edge, bordering the Tallarook State Forest and privately owned farm land (Figures 6 and 7). Neither of these sites were close to historical locations for these species. An unidentified toadlet was heard at Site 60 (Appendix 3), also on a grassy road edge, bordering the Tallarook State Forest and privately-owned farm land. One Southern Toadlet was detected at Site 94 (see photo on front cover), an historical record on land managed by Melbourne Water, approximately 5 km east of Whittlesea. It was found within a grass tussock in a dry shallow depression.



Table 1. The number of sites at which frogs were recorded during surveys conducted in 2010 in and around areas burnt by the Kilmore East-Murrindindi fires on Black Saturday in February 2009.

Species	Common name	Unburnt sites	Burnt sites
<i>Pseudophryne semimarmorata</i>	Southern Toadlet	1 (1%)	0
<i>Pseudophryne bibronii</i>	Bibron's Toadlet	2 (3%)	0
<i>Pseudophryne sp.</i>	<i>Pseudophryne sp.</i>	1 (1%)	0
<i>Crinia signifera</i>	Common Froglet	41 (60%)	24 (63%)
<i>Crinia parinsignifera</i>	Plains Froglet	5 (7%)	3 (8%)
<i>Geocrinia victoriana</i>	Victorian Smooth Froglet	14 (21%)	13 (34%)
<i>Limnodynastes peronii</i>	Striped Marsh Frog	1 (1%)	0
<i>Limnodynastes dumerilii</i>	Eastern Banjo Frog	3 (4%)	0
<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	5 (7%)	0
<i>Litoria raniformis</i>	Growling Grass Frog	1 (1%)	0
<i>Litoria verreauxii verreauxii</i>	Verreaux's Tree Frog	6 (9%)	2 (5%)
<i>Litoria ewingii</i>	Southern Brown Tree Frog	21 (31%)	24 (63%)
<i>Litoria ewingii</i> complex	<i>Litoria ewingii</i> complex	6 (9%)	0
Sites where no frogs were recorded		11 (16%)	10 (26%)
<b>Total number of sites sampled</b>		<b>68</b>	<b>38</b>

Figure 6. Site 54 (left), and a male Bibron's Toadlet captured at this site (right). This frog was calling under fallen bark on the edge of a dry drainage line.



Figure 7. Site 59 (upper), and a male Bibron's Toadlet (lower) captured whilst calling from the roadside, under a piece of wood (lower photo: Raelene Hobbs, Melbourne Zoo).



### 3.2 Amphibian Chytrid Fungus analyses

Fourteen frogs, comprising six species, were swabbed for the Amphibian Chytrid Fungus (Table 2). Three of these swabbed frogs were toadlet species (two Bibron's Toadlets, one Southern Toadlet). The small number of samples that were able to be collected from other frog species reflect the timing of surveys (not ideal for spring or summer breeding frogs) and the low number of detections of toadlet species. Four swabs returned equivocal, inhibited results, seven swabs were negative, and three were positive for the Amphibian Chytrid Fungus (Table 2). At both sites where positive fungus swabs were collected (Site 88 at Glenburn and Site 37 at Wallan) negative swabs were also collected. At Glenburn one Common Froglet tested positive whilst in Wallan two Spotted Marsh Frogs tested positive for the fungus. Both of these sites were located at or near historical toadlet records. Of the toadlets that were swabbed, the Southern Toadlet and one of the Bibron's Toadlets returned inhibited results; the other Bibron's Toadlet returned a negative result. The Growling Grass Frog sampled from Darraweit Guim returned a negative result.

Table 2. Results of swab samples collected to test for the Amphibian Chytrid Fungus. Datum for coordinates is GDA94. Inhibited results represent a failure of the diagnostic test and should not be interpreted as either positive or negative.

Date	Location	Species	Common name	Sex and age	Number of samples	Result
28/03/2010	Wallan – Wallan Road	<i>Litoria ewingi</i> complex	<i>Litoria ewingi</i> complex	Unknown	1	Negative
28/03/2010	Wallan – Wallan Road	<i>Limnodynastes dumerilii</i>	Eastern Banjo Frog	Juvenile	1	Inhibited
6/04/2010	Site 22 – Taggerty	<i>Crinia signifera</i>	Common Froglet	Unknown	1	Negative
15/04/2010	Site 37 – Wallan	<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	Adult female	1	Positive (127 zoospore equivalent)
15/04/2010	Site 37 – Wallan	<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	Juvenile	3	One inhibited, one negative and one positive, (65 zoospore equivalent)
30/04/2010	Site 59 – Broadford	<i>Pseudophryne bibronii</i>	Bibron's Toadlet	Adult male	1	Inhibited
5/05/2010	Site 54 – Broadford	<i>Pseudophryne bibronii</i>	Bibron's Toadlet	Adult male	1	Negative
19/05/2010	Site 94 – Yan Yean	<i>Pseudophryne semimarmorata</i>	Southern Toadlet	Adult male	1	Inhibited
26/05/2010	Site 88 – Glenburn	<i>Crinia signifera</i>	Common Froglet	Adult male	3	Two negative and one positive (647 zoospore equivalent)
14/04/2010	Site 3 – Darraweit Guim	<i>Litoria raniformis</i>	Growling Grass Frog	Juvenile	1	Negative

## 4 Discussion

A major impediment to understanding the impact of fire on many Australian vertebrates is a lack of pre-fire data (Clarke 2008). This impediment is particularly pronounced for ectothermic fauna such as invertebrates and herpetofauna which have traditionally received less attention and investigation (e.g., Clemann 2009). The present study typifies this issue. Whilst anecdotal reports suggested declines in the Southern Toadlet and Bibron's Toadlet, no comprehensive surveys had been conducted across these species' ranges that were adequate to allow a rigorous assessment of their status, prior to the fires on Black Saturday. Whilst some surveys for the Southern Toadlet have been conducted to the east and south-east of Melbourne in recent decades (C. Cleeland, unpublished data), the areas within and close to the Kilmore East-Murrindindi complex fire had not been surveyed in recent years, with the exception of some sites around Wallan (C. Cleeland, unpublished data). Thus, there is no contemporary context for interpreting our results.

All toadlets detected during this study were located in unburnt areas. However, detections of toadlets were too few to permit inferences about the impact of the Black Saturday fires on these species. Whilst the fires may have had a deleterious impact on these species, the low level of detection and uncertainty about the species' pre-fire status means that the effects of fire remain unclear. However, the extremely small number of detections of these species in the unburnt areas suggests that their status in the region was precarious before the fires. Consequently, the impact of the fires on any remaining populations may have been particularly devastating.

Despite this uncertainty, there are some anecdotal observations on the short-term fate of populations of the Southern Toadlet after fire. Historical records from the 1980's were re-surveyed within the Bunyip State Park in 2010 (C. Cleeland, unpublished data). Toadlets were calling from ash beds produced by the recent fire. These ash bed sites contained little or no vegetation and the toadlets were nesting in the ash bed. Unburnt sites within the area may have provided recruitment into burnt areas, although the short time since fire and the perceived lack of mobility and high fidelity of males to calling sites suggest that it is possible that these animals survived the fire.

All species of *Pseudophryne* utilise terrestrial breeding sites that rely on flooding (Woodruff 1976). Southern Toadlets and Bibron's Toadlets utilise ephemeral depressions in a range of vegetation types. An individual breeding site can range from the soak zone of a large clay-based dam to the depression of an uprooted tree (C. Cleeland, unpublished data). In foothill regions populations tend to extend along flood plains with permanent streams and gullies between ridge lines. Sites where flood plains abut elevated land are particularly favoured by these species. In sandy coastal plain regions ephemeral wetlands form the dominant breeding sites (C. Cleeland, unpublished data).

The only toadlets detected during the present study were from relatively remote areas with little disturbance compared to most of the region (i.e., they were found either on forested public land or on the verge of public land on roadsides not subject to much human visitation). Persistence of threatened species in areas with comparatively little disturbance or frequency of human visitation is common (e.g., Clemann *et al.* 2009, Howard *et al.* in prep.). The most plausible reasons for this are either that habitat for the species remains more suitable than in disturbed areas, the impacts of humans and / or their commensals is limited, or, as is often the case for frogs, a lack of visitation and intrusion means that pathogens such as Amphibian Chytrid Fungus have not yet reached an area (e.g., Clemann *et al.* 2009, Howard *et al.* in prep.).

However, where habitat appears to remain suitable (especially in terms of hydrology), both toadlet species will utilise disturbed sites, such as depressions in paddocks (Homan 2007), drainage channels (observed in Churchill National Park), fire dams (observed in Strzelecki State Forest), and even wheel ruts (C. Cleeland, unpublished data). Southern Toadlets have even been heard calling from urban backyards when displaced from their original habitat (as occurred during development for the Eastlink Tunnel through Donvale – although persistence at this site was short term). During surveys conducted at Wallan in the 1970s, changes to hydrology and the conversion of land to farmland appeared to lead to an increase in suitable habitat for toadlets, with larger populations found in these areas. For some time now, large tracks of land in Wallan have been developed into housing blocks and this may have contributed to the apparent decline of these species from this area. Both species appear to be highly susceptible to human-induced landscape modifications that can result in unfavourable changes to local hydrology leading to the drying of sites at critical times (C. Cleeland, unpublished data).

Site selection for this study was guided by historical records. Many of these records are dated (going back to the 1950s), and there have been considerable changes to the landscape and land uses since many records were collected. Examples of these changes include the conversion of land from forest to cleared farmland or residential land, conversion of farmland to residential land, changes to drainage and construction of roads. As well as the obvious ways that these changes remove or degrade habitat for species such as toadlets, changes to hydrology will usually have a negative impact on the toadlet's ability to breed successfully (C. Cleeland, unpublished data). Changes to the landscape that have a negative effect on toadlet species are likely to have been exacerbated by drought. Toadlets rely on rain to flood breeding burrows so that tadpoles can enter waterbodies. More than a decade of below average rainfall across the region is likely to have lowered recruitment rates for both species in the study area.

Effects of drought have been evident in a number of populations to the east of Melbourne. In the last decade populations of Southern Toadlets near Healesville have completely failed to recruit; egg nests either desiccated or hatching occurred but the failure of follow-up rain resulted in the drying of nest sites (C. Cleeland, unpublished data). In 2009, there was no recruitment from a population of Southern Toadlets in Donvale, east of Melbourne. At that site ponds dried up with early stage tadpoles still present, and in 2009 every nest at the Healesville population desiccated before tadpoles hatched (C. Cleeland, unpublished data).

The few toadlets recorded during this study were calling in isolation – no aggregations of calling males were detected. A combination of factors (few detections, apparently isolated calling males, known declines in places such as Wallan – C. Cleeland, unpublished data) across an area with many historical records of these species suggests that anecdotal reports of declines are valid. Populations of both toadlet species persisted along a narrow hybrid zone in Wallan and were the focus of many studies during the 1970's (Woodruff 1972, Woodruff 1976, McDonnell *et al.* 1978, Woodruff 1979). Southern Toadlet populations in this location have failed to call for some time (C. Cleeland, unpublished data) and this study failed to find Bibron's Toadlet. It is difficult to disentangle the possible impacts of the fire from pre-fire declines, which are likely to include the impacts of the Amphibian Chytrid Fungus (our results show that the fungus is present in areas where the toadlets have declined, such as Wallan – Table 2), and loss and degradation of habitat.

The techniques we used to survey for toadlets (listening, call playback and active searches in the vicinity of historical records during the breeding season) may not have been optimal for detecting these species. At two unburnt areas surveyed for toadlets during this study, Castella and the area around Sugarloaf Reservoir, toadlets were not detected. However, Bibron's Toadlet was recorded at Castella in 2008 and the Southern Toadlet at Sugarloaf Reservoir from 2008 to 2010 (Richard Rettalick pers. comm.). Although the techniques used in this study are commonly used for other species, they may be particularly appropriate for those frogs that breed in consistently predictable locations such as discrete waterbodies. Toadlets rarely gather at waterbodies to breed. Although they typically occur in low-lying areas such as gullies, they can also occur in areas where there is no apparent water and no obvious flood-prone terrain (e.g., Site 59, where we detected a Bibron's Toadlet calling from a road side with no culvert or obvious drainage area). Three of the four toadlets that we detected were calling before we attempted call playback, and no toadlets responded to call playback during these surveys. Southern Toadlets do not typically respond to call playback (C. Cleeland, unpublished data) and Bibron's Toadlet appears not to; however, a Bibron's Toadlet at Site 59 seemed to call in response to the sound of a conversation between fieldworkers.

At the time that the survey was initiated, we were unaware that playback has, at best, inconsistent results for Southern Toadlets and is not at this stage considered a particularly useful technique for eliciting calls from males (C. Cleeland, unpublished data). Loftus-Hills (1973) studied the behavioural responses of calling male Southern Toadlets to different acoustic stimuli. He concluded that the mating call was inhibited by above-threshold calls of conspecific males. Similarly, Littlejohn and Martin (1969) showed inhibition of calling in male Southern Toadlets in the frequency band used for acoustic signalling at intensities above a certain threshold. The volume and use of acoustic stimuli needs to be considered for future surveys. At this stage no reliable method has been developed to initiate calling in males of this species.

Reliability of survey data for toadlets is highly dependent on the environmental conditions, and the time of year of the survey. Males call in response to seasonal and environmental triggers, with the most intense calling on still evenings, after rain in April to early May. On the nights toadlets were recorded, there was little to no wind, temperatures were above 12.5°C but rain had not always fallen within the previous 24 hours (Appendix 2). Woodruff (1972) suggested a calling period from 10th March till 29th May, with a breeding period between April 3rd and May 28th. The four toadlets detected were calling within this time frame. Pit fall trapping and automated call logging of a population near Healesville between 2003 and 2005 is congruent with the beginning of the calling season as noted by Woodruff, and extends the end of the calling season into early June, but early and late season calling is intermittent and can be interspersed with more than a week of no calling activity (C. Cleeland, unpublished data).

Results from surveys conducted outside of April / early May need to be interpreted cautiously; surveys outside of this period may fail to detect toadlets even if they are present, and should involve repeated visits over the season, or at least over consecutive seasons. Fifty-seven percent of sites were surveyed within this key period. Of the 43% surveyed outside of this, 15% were surveyed on March 29th to March 31st and the remaining 28% were surveyed during late May (Appendix 1). Even in peak breeding season long periods of calling inactivity can occur when weather conditions are not favourable, and this can be particularly pronounced in smaller populations (C. Cleeland, unpublished data).

On still nights, large calling populations (e.g., Southern Toadlets in the Mornington Peninsula Park wetland) can be clearly heard from 200 - 300 m (C. Cleeland, unpublished data). However, many sites have few individuals calling from scattered and isolated depressions (e.g., Lysterfield National Park) and detection of toadlets at these sites requires surveyors to be within approximately 20 m (C. Cleeland, unpublished data). This makes broadscale surveys for new populations problematic and time- and labour-intensive.

We endeavoured to visit as many historical sites as possible. Future surveys may be more productive if they aim to visit fewer sites on a more frequent basis, timing surveys to coincide with favourable weather conditions. Historical sites can often be linked via a gully network or floodplains, and survey techniques focussing on transects through these areas, rather than sites being treated as point localities, may prove more successful. Visiting a known 'reference' population within the general area of the survey may help to establish if the conditions are conducive for calling, prior to undertaking the survey. Three dimensional profiling of the terrain using software such as Memory-Map can assist in detecting suitable drainage lines and allows ease of navigation in the field (Memory Map, Universal Publishers Pty Ltd 2008).

### Amphibian Chytrid Fungus

Relatively few swab samples were collected for testing for the Amphibian Chytrid Fungus during this project. Surveys were conducted at a time of diminishing activity for many spring- and summer-breeding frogs, and few toadlets were detected during the surveys. Combined with inhibition in four of our 14 swabs, our ability to draw inferences about the prevalence and impact of the Amphibian Chytrid Fungus in this area is limited. As a consequence, this limitation extends to our ability to comment on the relative prevalence and impact of the fungus in burnt and non-burnt parts of the study area.

At sites where we detected the fungus, we also collected swabs that returned a negative result. Our sample sizes were far too small for anything but the broadest of conclusions. Skerratt *et al.* (2008) suggest that 60 individuals per population need to be tested to achieve 95% certainty of detecting one positive frog using the detection techniques applied by the CSIRO to our samples. This number is dependent on the actual prevalence of the fungus, but 60 samples may be a good target number of swabs to have sufficient samples taken from each site. Given the apparent rarity of toadlets in the study area, collecting sufficient samples to determine disease prevalence with any useful level of precision, may be very difficult to achieve.

Chytrid Fungus occurs in and around the areas affected by the Black Saturday fires (this study, Howard *et al.* in prep.), and extends into and along the Great Dividing Range in south-eastern Australia (Clemann *et al.* 2009). It is generally considered that the fungus has already had a major impact on frog biodiversity globally and in Australia – Skerratt *et al.* (2007) note that "the impact of chytridiomycosis on frogs is the most spectacular loss of vertebrate biodiversity due to disease in recorded history" (p. 125). Although other factors are also likely to be responsible, it is plausible that this disease has played a significant role in the apparent decline of these toadlet species in the area considered during this project.

### Management implications and future directions

The lack of pre-fire data combined with few detections of toadlets during this study prevents us drawing any definitive conclusions on the impact of the Black Saturday fires on Bibron's Toadlet and the Southern Toadlet. Although some sites were sampled outside the peak calling period, the number of non-detections in unburnt areas suggests that these species have undergone a decline in range and abundance across the entire region since many of the historical records were collected. Consequently, the status of the species in the study area is probably precarious, and as such populations are likely to be particularly susceptible to stochastic events such as fires. Furthermore, the scarcity of toadlet populations in the landscape suggests that their ability to re-colonise habitat after perturbation is limited (and probably non-existent in many places).

Consequently, we suggest that the following actions will benefit Bibron's Toadlet and the Southern Toadlet in the study area, and / or permit a more thorough understanding of their status in the area:

- Further surveys using a more focused approach at fewer sites and specific timing will provide a better understanding of the species' distribution and population status in the area.
- Where populations of the species are located, long-term monitoring will provide a basis for understanding population demographics and dynamics, and pre-event data for future stochastic events such as wildfires.
- The Amphibian Chytrid Fungus has had a devastating impact on frog species around the world, including south-eastern Australia (e.g., Murray *et al.* 2010). A recent revision of hygiene protocols when working with frogs, or in areas where threatened frogs occur, has been produced (Phillott *et al.* 2010). Phillott *et al.* (2010) also provide a scheme for ranking the risks of disease introduction to certain areas. The methods recommended by Phillott *et al.* (2010) should be implemented during work on toadlet species, and work in areas where these species are known or likely to occur.
- As well as disease, habitat loss and degradation remain the most likely proximate causes of decline for Bibron's Toadlet and the Southern Toadlet. Factors that would typically contribute to this loss and degradation include land clearing for housing, intensive agriculture, overgrazing, changes to hydrology, construction of new roads and tracks, logging, and firewood collection. Ceasing, limiting or minimising these activities at locations close to known occurrences may be beneficial to toadlets.
- Where possible, pre-fire surveys should be conducted within the range of both toadlet species before planned burning occurs. These surveys should use appropriate and adequate methods over an appropriate duration at the right times of the year. Where possible and practical, sampling for the Amphibian Chytrid Fungus should be undertaken during these surveys.

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# Appendix 1

Sites surveyed for frogs in and around areas burnt during the Black Saturday fires. Coordinates are in UTM GDA94 datum, Zone 55. Sites visited twice were examined during the day with a follow-up night survey; sites visited once were searched opportunistically during night hours only. Some historical sites were inaccessible and the nearest location surveyed. These were classified as non-historical if the site was more than one kilometre from the original location.

Site	Date	Number of visits	Location	Easting	Northing	Location of historical toadlet record?	Burn status	Land tenure
Site 1	28/03/2010	2	Darraweit Guim	0314632	5859878	No	Unburnt	Private
Site 2	28/03/2010	2	Darraweit Guim	0315456	5858800	No	Unburnt	Private
Site 3	28/03/2010	2	Darraweit Guim	0315578	5858989	No	Unburnt	Private
Site 4	28/03/2010	2	Wallan	0316433	5859212	Yes	Unburnt	Public and private
Site 5	28/03/2010	2	Wallan	0316653	5859177	No	Unburnt	Public
Site 6	28/03/2010	2	Wallan	0317193	5859377	No	Unburnt	Private
Site 7	28/03/2010	2	Wallan	0318320	5859025	Yes	Unburnt	Private
Site 8	28/03/2010	2	Darraweit Guim	0316337	5855971	Yes	Unburnt	Public and private
Site 9	28/03/2010	2	Beveridge	0317031	5851606	Yes	Unburnt	Public and private
Site 10	31/03/2010	2	Yan Yean	0334572	5844333	Yes	Unburnt	Public (Melbourne Water)
Site 11	31/03/2010	2	Yan Yean	0332578	5839761	Yes	Unburnt	Public and private
Site 12	31/03/2010	2	Arthurs Creek	0341598	5839000	Yes	Unburnt	Public
Site 13	31/03/2010	2	Cottles Bridge	0344292	5835812	No	Unburnt	Public
Site 14	31/03/2010	2	Cottles Bridge	0341144	5834669	Yes	Unburnt	Private
Site 15	31/03/2010	2	Nutfield	0339946	5835630	No	Unburnt	Private
Site 16	31/03/2010	2	Nutfield	0337835	5837264	Yes	Unburnt	Private
Site 17	06/04/2010	2	Granton	0382972	5848518	Yes	Burnt	Private - forestry
Site 18	06/04/2010	2	Granton	0383269	5847046	No	Burnt	Private
Site 19	06/04/2010	2	Buxton	0387862	5854390	No	Burnt	Private
Site 20	06/04/2010	2	Buxton	0388558	5855541	No	Burnt	Private
Site 21	06/04/2010	2	Taggerty	0385977	5867464	Yes	Burnt	Private
Site 22	06/04/2010	2	Taggerty	0385545	5865200	No	Unburnt	Public and private
Site 23	06/04/2010	1	Granton	0383019	5848101	No	Burnt	Public
Site 24	14/04/2010	2	Christmas Hills	0353188	5833816	No	Unburnt	Private
Site 25	14/04/2010	2	Christmas Hills	0355139	5834268	No	Burnt	Private
Site 26	14/04/2010	2	Christmas Hills	0349561	5831547	Yes	Unburnt	Public
Site 27	14/04/2010	2	Watsons Creek	0346133	5829346	Yes	Unburnt	Public
Site 28	14/04/2010	1	Yarra Glen	0357715	5831897	Yes	Unburnt	Public and private
Site 29	15/04/2010	2	Wallan	0325508	5861544	Yes	Unburnt	Private
Site 30	15/04/2010	2	Wallan	0325025	5861594	Yes	Unburnt	Private
Site 31	15/04/2010	2	Wallan	0325599	5861197	Yes	Unburnt	Public and private

Site	Date	Number of visits	Location	Easting	Northing	Location of historical toadlet record?	Burn status	Land tenure
Site 32	15/04/2010	2	Wallan	0325394	5859702	Yes	Unburnt	Private
Site 33	15/04/2010	2	Wallan	0325349	5859195	Yes	Unburnt	Public and private
Site 34	15/04/2010	2	Wallan	0324885	5857474	Yes	Unburnt	Private
Site 35	15/04/2010	2	Wallan	0325139	5857534	Yes	Unburnt	Private
Site 36	15/04/2010	2	Wallan	0324567	5854613	Yes	Unburnt	Private
Site 37	15/04/2010	2	Wallan	0323226	5855217	Yes	Unburnt	Public and private
Site 38	15/04/2010	2	Wallan	0325065	5856945	Yes	Unburnt	Private
Site 39	15/04/2010	2	Wallan	0329145	5857520	Yes	Burnt	Private
Site 40	16/04/2010	2	Yea	0355090	5884663	No	Unburnt	Private
Site 41	16/04/2010	2	Yea	0356319	5889044	No	Unburnt	Private
Site 42	16/04/2010	2	Yea	0357808	5888241	No	Unburnt	Private
Site 43	16/04/2010	2	Yea	0352069	5889503	Yes	Unburnt	Private
Site 44	16/04/2010	2	Yea	0352709	5887014	Within 1km of historical record	Unburnt	Private
Site 45	16/04/2010	2	Yea	0355487	5885695	No	Unburnt	Public and private
Site 46	16/04/2010	2	Yea	0360551	5881502	No	Unburnt	Private
Site 47	16/04/2010	1	Yea	0360720	5880850	No	Unburnt	Public
Site 48	16/04/2010	1	Yea	0363063	5886495	No	Unburnt	Private
Site 49	16/04/2010	1	Yea	0360991	5885710	No	Unburnt	Private
Site 50	30/04/2010	2	Clonbinane	0327942	5871857	Yes	Burnt	Public
Site 51	30/04/2010 05/05/2010	2	Clonbinane	0334686	5870143	Yes	Burnt	Public
Site 52	30/04/2010 05/05/2010	2	Clonbinane	0329980	5869675	No	Burnt	Private
Site 53	30/04/2010 05/05/2010	2	Clonbinane	0327220	5871925	No	Burnt	Private
Site 54	30/04/2010 05/05/2010	2	Broadford	0338034	5881087	No	Unburnt	Public
Site 55	05/05/2010	2	Broadford	0327034	5878913	No	Unburnt	Public and private
Site 56	05/05/2010	2	Strath Creek	0338103	5876241	No	Unburnt	Private
Site 57	05/05/2010	2	Strath Creek	0341984	5877535	Yes	Unburnt	Private
Site 58	5/05/2010	2	Strath Creek	0341606	5876673	No	Unburnt	Private
Site 59	30/04/2010 05/05/2010	2	Broadford	0334462	5882483	No	Unburnt	Public
Site 60	30/04/2010 05/05/2010	2	Broadford	0335576	5882527	No	Unburnt	Public
Site 61	05/05/2010	1	Broadford	0327073	5879441	Yes	Unburnt	Public and private
Site 62	05/05/2010	1	Strath Creek	0337516	5876956	No	Unburnt	Private



Site	Date	Number of visits	Location	Easting	Northing	Location of historical toadlet record?	Burn status	Land tenure
Site 63	05/05/2010	1	Strath Creek	0337979	5880421	No	Unburnt	Public
Site 64	05/05/2010	1	Strath Creek	0337972	5883222	No	Unburnt	Public
Site 65	05/05/2010	1	Strath Creek	0337816	5883000	No	Unburnt	Public
Site 66	05/05/2010	1	Strath Creek	0337479	5882176	No	Unburnt	Public
Site 67	08/05/2010	2	Healesville	0373212	5827993	No	Unburnt	Public
Site 68	08/05/2010	2	Healesville	0372929	5824651	No	Unburnt	Public and private
Site 69	08/05/2010	2	Healesville	0371046	5830048	No	Unburnt	Public
Site 70	08/05/2010	2	Healesville	0367825	5831677	Yes	Unburnt	Private
Site 71	08/05/2010	2	Healesville	0370371	5831781	Yes	Unburnt	Public and private
Site 72	08/05/2010	2	Healesville	0369318	5831975	Yes	Unburnt	Unsure
Site 73	08/05/2010	1	Healesville	0373215	5825460	No	Unburnt	Public
Site 74	17/05/2010	2	Kinglake West	0340367	5852865	Yes	Burnt	Public
Site 75	17/05/2010 20/05/2010	2	Kinglake West	0339938	5852453	Yes	Burnt	Public
Site 76	17/05/2010 20/05/2010	2	Kinglake West	0339803	5852299	Yes	Burnt	Public
Site 77	17/05/2010 19/05/2010	2	Kinglake West	0339023	5852115	No	Burnt	Public
Site 78	17/05/2010 19/05/2010	2	Kinglake West	0339237	5851798	No	Burnt	Public
Site 79	17/05/2010 19/05/2010	2	Kinglake West	0340492	5851136	Yes	Burnt	Public
Site 80	17/05/2010 19/05/2010	2	Kinglake West	0337565	5852560	Yes	Burnt	Public
Site 81	20/05/2010	1	Steels Creek	0353911	5840187	No	Burnt	Public
Site 82	17/05/2010 20/05/2010	2	Kinglake	0352269	5843997	Yes	Burnt	Public and private
Site 83	17/05/2010 20/05/2010	2	Kinglake	0352110	5843658	No	Burnt	Private
Site 84	17/05/2010 20/05/2010	2	Kinglake	0352105	5842993	No	Burnt	Public and private
Site 85	17/05/2010 20/05/2010	2	Steels Creek	0354550	5840075	Yes	Burnt	Public
Site 86	17/05/2010 20/05/2010	2	Steels Creek	0354707	5839798	Yes	Burnt	Public
Site 87	26/05/2010	2	Glenburn	0360366	5856043	Yes	Unburnt	Public and private
Site 88	26/05/2010	2	Glenburn	0359977	5853915	Yes	Burnt	Public
Site 89	26/05/2010	2	Glenburn	0361693	5861890	Yes	Unburnt	Private
Site 90	26/05/2010	2	Glenburn	0360225	5850510	No	Burnt	Public
Site 91	26/05/2010	2	Glenburn	0360401	5852801	No	Burnt	Public

Site	Date	Number of visits	Location	Easting	Northing	Location of historical toadlet record?	Burn status	Land tenure
Site 92	26/05/2010	1	Yarra Ranges	0376747	5836002	Yes	Burnt	Public
Site 93	26/05/2010	1	Narbethong	0382300	5841600	Yes	Burnt	Public
Site 94	19/05/2010	1	Yan Yean	0338204	5845414	Yes	Unburnt	Public
Site 95	19/05/2010	1	Yan Yean	0338204	5845569	Yes	Unburnt	Public
Site 96	20/05/2010	1	Toorourrong Reservoir	0336997	5850800	Yes	Burnt	Public
Site 97	27/05/2010	2	Strathewen	0349110	5843876	Yes	Burnt	Private
Site 98	27/05/2010	2	Pheasant Creek	0348200	5850250	Yes	Burnt	Public and private
Site 99	27/05/2010	2	Pheasant Creek	0346750	5850050	Yes	Burnt	Unsure
Site 100	27/05/2010	2	Mittons Bridge	0348403	5839928	Yes	Burnt	Unsure
Site 101	27/05/2010	2	Steels Creek	0356847	5840938	Yes	Burnt	Public
Site 102	14/04/2010	1	Christmas Hills	0351653	5831615	No	Unburnt	Private
Site 103	27/05/2010	1	Strathewen	0349409	5842427	No	Burnt	Public
Site 104	05/05/2010	1	Strath Creek	0338677	5876264	No	Unburnt	Private
Site 105	20/05/2010	1	Kinglake	0352182	5843715	Yes	Burnt	Private
Site 106	14/04/2010	2	Wonga Park	0347048	5821827	Yes	Unburnt	Private

## Appendix 2

Environmental variables recorded at each site during each visit. Temperature is measured in degrees Celsius. Average wind speed was recorded in metres per second over a ten second period. Cloud cover is scored from zero (no cloud) to eight (full cloud). Rain is scored from zero (no rain) to three (heavy rain) and recorded for the time of survey / previous 24 hours. Rainfall denoted with a ? indicates uncertainty of rain in previous 24 hours. Altitude was measured using a Garmin Global Positioning System unit. All other variables were measured using a hand-held Kestrel weather station.

Site	Location	Date	Time	Altitude (metres above sea level)	Barometric Pressure	Humidity	Temperature	Wind	Cloud	Rain
Site 1	Darraweit Guim	28/03/2010	16:25	311			21.8	2.6	8	0/0
Site 1	Darraweit Guim	28/03/2010	20:30	311		81.7	18.9	2	8	1/0
Site 2	Darraweit Guim	28/03/2010	17:08	305			21.8	1.3	8	1/0
Site 2	Darraweit Guim	28/03/2010	20:50	305		79.6	20.7	0.8	8	1/0
Site 3	Darraweit Guim	28/03/2010	17:19	297		59	21.8	1.3	8	1/0
Site 3	Darraweit Guim	28/03/2010	21:11	297		83.3	18.7	0.4	8	1/0
Site 4	Wallan	28/03/2010	17:30	296			21.8	1	8	1/3
Site 4	Wallan	28/03/2010	21:42	296		73.6	21.5	0.4	8	1/0
Site 5	Wallan	28/03/2010	17:40	304			21.8	1	8	1/3
Site 5	Wallan	28/03/2010	22:00	304			21.5	0.4	8	1/3
Site 6	Wallan	28/03/2010	17:45	321			21.7	0.3	8	1/0
Site 6	Wallan	28/03/2010	22:15	321		68.4	19.7	1.5	8	1/0
Site 7	Wallan	28/03/2010	17:50	391			21.8	0.5	8	1/0
Site 7	Wallan	28/03/2010	22:23	391		74.4	18.7	1.4	8	1/0
Site 8	Darraweit Guim	28/03/2010	18:05	291			21.8	0.5	8	1/0
Site 8	Darraweit Guim	28/03/2010	22:53	291		79.8	19.3	2	8	1/0
Site 9	Beveridge	28/03/2010	18:18	274			21.7	0.9	8	1/0
Site 9	Beveridge	28/03/2010	23:11	274		81.3	19.1	0.9	8	1/0
Site 10	Yan Yean	31/03/2010	16:15	190		57.5	24.5	0.6	1	0/0
Site 10	Yan Yean	31/03/2010	22:33	190		75.5	17.1	0	0	0/0
Site 11	Yan Yean	31/03/2010	17:07	177		52.5	23.4	0.6	1	0/0
Site 11	Yan Yean	31/03/2010	22:42	177		86.7	13.4	0	0	0/0
Site 12	Arthurs Creek	31/03/2010	17:25	117		67	24	0	1	0/0
Site 12	Arthurs Creek	31/03/2010	21:52	117		80.6	16.9	0	0	0/0
Site 13	Cottles Bridge	31/03/2010	17:55	109		52	27.2	0.3	1	0/0
Site 13	Cottles Bridge	31/03/2010	20:22	109		57.6	19.5	0	1	0/0
Site 14	Cottles Bridge	31/03/2010	16:29	103		58.1	22.4	0.4	0	0/0
Site 14	Cottles Bridge	31/03/2010	20:45	103		63.9	20.3	NA	1	0/0
Site 15	Nutfield	31/03/2010	18:38	100		63	20.7	0.7	0	0/0
Site 15	Nutfield	31/03/2010	21:09	100		69.5	18.5	0	0	0/0

Site	Location	Date	Time	Altitude (metres above sea level)	Barometric Pressure	Humidity	Temperature	Wind	Cloud	Rain
Site 16	Nutfield	31/03/2010	18:52	118		59.7	21.5	0.4	0	0/0
Site 16	Nutfield	31/03/2010	21:29	118		71.6	17.8	0	0	0/0
Site 17	Granton	6/04/2010	17:04	320		56.1	20.7	0.5	8	0/0
Site 17	Granton	6/04/2010	21:44	320		73.3	19.2	0.7	8	0/0
Site 18	Granton	6/04/2010	17:18	318		43.6	23.3	0.3	8	0/0
Site 18	Granton	6/04/2010	22:11	318		86.9	15.8	0.6	8	1/0
Site 19	Buxton	6/04/2010	17:39	322		44.5	21.2	1.4	8	0/0
Site 19	Buxton	6/04/2010	21:21	322		55.8	21.3	5	8	1/0
Site 20	Buxton	6/04/2010	17:45	223		41	22	0.5	8	0/0
Site 20	Buxton	6/04/2010	20:53	223		52.3	22.4	1.3	8	0/0
Site 21	Taggerty	6/04/2010	18:16	225		49.5	23.9	0	8	0/0
Site 21	Taggerty	6/04/2010	20:03	225		43.5	24.5	0	8	0/0
Site 22	Taggerty	6/04/2010	16:31	225		48	23	0	8	0/0
Site 22	Taggerty	6/04/2010	20:18	225		51.5	22.3	0.3	8	0/0
Site 23	Granton	6/04/2010	22:00	332		72.6	19.4	0.4	0	1/0
Site 24	Christmas Hills	14/04/2010	17:15	181	1000.8	48.6	19.8	0.5	7	0/0
Site 24	Christmas Hills	14/04/2010	20:38	181	1002	55.2	19.8	0	8	0/0
Site 25	Christmas Hills	14/04/2010	17:45	292	987.9	53	18.6	0.4	7	0/0
Site 25	Christmas Hills	14/04/2010	20:59	292	988.8	53.9	17.3	0	7	0/0
Site 26	Christmas Hills	14/04/2010	17:51	127	1007.9	53.7	20.6	0	7	0/0
Site 26	Christmas Hills	14/04/2010	17:51	127	1009.3	57.3	19.9	0	8	0/0
Site 27	Watsons Creek	14/04/2010	18:09	85	1007.9	53.7	20.6	0	7	0/0
Site 27	Watsons Creek	14/04/2010	19:53	85	1014.1	63.1	17.9	0	7	0/0
Site 28	Yarra Glen	14/04/2010	19:29	76	1014.2	54.6	18.8	0	8	0/0
Site 29	Wallan	15/04/2010	15:53	308	982.8	75.5	15.5	2	7	0/0
Site 29	Wallan	15/04/2010	20:19	308	983.4	84.2	14.5	1.9	6	0/0
Site 30	Wallan	15/04/2010	16:00	371	982.8	75.5	15.5	2	7	0/0
Site 30	Wallan	15/04/2010	20:06	371	981	87.4	15.4	2.5	6	0/0
Site 31	Wallan	15/04/2010	16:07	333	982.8	75.5	15.5	2	7	0/0
Site 31	Wallan	15/04/2010	20:30	333	985	85	14.2	1.6	2	0/0
Site 32	Wallan	15/04/2010	16:15	318	986.4	74.8	15.9	1.1	7	0/0
Site 32	Wallan	15/04/2010	20:49	318	987.3	83.9	14.5	0.6	4	0/0
Site 33	Wallan	15/04/2010	16:30	316	986.6	74.9	16.1	0.8	7	0/0
Site 33	Wallan	15/04/2010	21:13	316	987.5	84.9	14.7	0.8	6	0/0

Site	Location	Date	Time	Altitude (metres above sea level)	Barometric Pressure	Humidity	Temperature	Wind	Cloud	Rain
Site 34	Wallan	15/04/2010	16:38	305	NR	NR	NR	NR	NR	NR
Site 34	Wallan	15/04/2010	21:38	305	988.1	78.9	15.5	0.4	6	0/0
Site 35	Wallan	15/04/2010	16:45	321	986.4	73	16.5	1	7	0/0
Site 35	Wallan	15/04/2010	21:50	321	NR	NR	NR	NR	NR	NR
Site 36	Wallan	15/04/2010	17:00	305	NR	NR	NR	NR	NR	NR
Site 36	Wallan	15/04/2010	22:38	305	989.1	86.2	13.4	0.8	2	0/0
Site 37	Wallan	15/04/2010	17:14	303	988.5	79.5	15.8	0.7	7	0/0
Site 37	Wallan	15/04/2010	22:04	303	989.6	81.4	15.3	0.5	3	0/0
Site 38	Wallan	15/04/2010	17:31	307	988.2	78.3	15.8	1	7	0/0
Site 38	Wallan	15/04/2010	22:56	307	988.5	86.1	14.5	1.5	1	0/0
Site 39	Wallan	15/04/2010	17:49	300	989.9	71.5	16.8	0.7	8	0/0
Site 39	Wallan	15/04/2010	17:49	300	989.4	86.1	14.2	0.1	7	0/0
Site 40	Yea	16/04/2010	14:59	177	1003	45.1	27.6	1	1	0/0
Site 40	Yea	16/04/2010	23:16	177	1004.3	77.8	12.1	0.5	0	0/0
Site 41	Yea	16/04/2010	15:22	243	995	40.7	25.5	1.07	0	0/0
Site 41	Yea	16/04/2010	22:22	243	996.2	67.1	16.4	0.4	0	0/0
Site 42	Yea	16/04/2010	15:32	208	999.1	45.3	23.8	0.4	0	0/0
Site 42	Yea	16/04/2010	15:32	208	1000.1	78.9	13.8	0.6	0	0/0
Site 43	Yea	16/04/2010	16:00	209	998.8	41.6	26.2	0.7	0	0/0
Site 43	Yea	16/04/2010	21:44	209	1001.2	79.7	13.8	0	0	0/0
Site 44	Yea	16/04/2010	16:50	192	1000.2	57.6	22.2	0.5	0	0/0
Site 44	Yea	16/04/2010	21:26	192	1001.8	79.6	14.1	0.9	0	0/0
Site 45	Yea	16/04/2010	17:05	180	1002.2	54.4	23.1	0	0	0/0
Site 45	Yea	16/04/2010	22:09	180	1003.5	80.3	13.8	0	0	0/0
Site 46	Yea	16/04/2010	17:50	186	NR	NR	NR	NR	0	0/0
Site 46	Yea	16/04/2010	20:05	186	1002	61.6	17.8	0	0	0/0
Site 47	Yea	16/04/2010	20:13	172	1003.5	67.5	15.2	0	0	0/0
Site 48	Yea	16/04/2010	19:30	185	1002.2	56.6	20	0.2	0	0/0
Site 49	Yea	16/04/2010	19:46	175	1003	71.2	18.1	0.9	0	0/0
Site 50	Clonbinane	30/04/2010	14:27	246	997.5	61.2	16.1	1.6	5	0/1
Site 50	Clonbinane	30/04/2010	22:36	246	989.3	70.2	12.6	0	1	0/0
Site 51	Clonbinane	30/04/2010	14:45	561	960.8	58.4	20	0	4	0/1
Site 51	Clonbinane	5/05/2010	23:07	561	952.7	64	13.7	0.3	1	0/1
Site 52	Clonbinane	30/04/2010	15:07	316	989.6	66.7	16.7	1.8	5	0/1

Site	Location	Date	Time	Altitude (metres above sea level)	Barometric Pressure	Humidity	Temperature	Wind	Cloud	Rain
Site 52	Clonbinane	5/05/2010	22:51	316	981.5	68.5	10.4	0.6	1	0/1
Site 53	Clonbinane	30/04/2010	15:30	269	994.8	65	16.8	0.8	4	0/1
Site 53	Clonbinane	5/05/2010	23:26	269	987	70.3	12.1	0.4	1	0/1
Site 54	Broadford	30/04/2010	16:36	493	974.2	61.3	17.8	0	0	0/1
Site 54	Broadford	5/05/2010	20:00	493	966.9	62.9	13.2	1	7	0/0
Site 55	Broadford	5/05/2010	14:53	224	990.7	51	15.3	1.2	6	1/?
Site 55	Broadford	5/05/2010	18:45	224	992.2	60.2	14.1	0	8	1/0
Site 56	Strath Creek	5/05/2010	15:16	340	976.6	52.5	14.5	0.5	4	1/?
Site 56	Strath Creek	5/05/2010	21:35	340	978.5	65.6	12.5	1	1	0/1
Site 57	Strath Creek	5/05/2010	15:30	210	992	49.9	16.3	0.6	4	0/?
Site 57	Strath Creek	5/05/2010	22:08	210	994.2	69.3	12.2	0	1	0/1
Site 58	Strath Creek	5/05/2010	15:37	217	991.1	46	14.3	0	5	0/0?
Site 58	Strath Creek	5/05/2010	21:57	217	992.8	70.8	11.6	1.2	1	0/1
Site 59	Broadford	30/04/2010	19:10	285	NR	NR	NR	NR	NR	NR
Site 59	Broadford	5/05/2010	17:00	285	982.5	52.6	16.9	0	7	0/?
Site 60	Broadford	30/04/2010	20:15	315	NR	NR	NR	NR	NR	NR
Site 60	Broadford	5/05/2010	17:15	315	979.4	57.6	15.9	0	8	0/?
Site 61	Broadford	5/05/2010	19:00	222	992.9	63.2	13.8	0	7	1/0
Site 62	Strath Creek	5/05/2010	19:30	457	964.5	69.3	10.8	0.9	7	0/0
Site 63	Strath Creek	5/05/2010	19:47	441	966.8	60.3	12.2	0.8	7	0/0
Site 64	Strath Creek	5/05/2010	20:35	578	950.8	61.4	11.7	0.6	0	0/0?
Site 65	Strath Creek	5/05/2010	20:46	543	955.4	70.9	11.4	0.1	0	0/0?
Site 66	Strath Creek	5/05/2010	21:04	409	970.7	69.5	13	0	0	0/0?
Site 67	Healesville	8/05/2010	16:21	212	995.3	81.9	16	0	1	0/1?
Site 67	Healesville	8/05/2010	19:43	212	996.6	63.7	18.7	0.4	0	0/1
Site 68	Healesville	8/05/2010	16:48	606	950.9	84	16.7	0	0	0/1?
Site 68	Healesville	8/05/2010	20:19	606	951.8	72.8	14.3	0.3	0	0/1
Site 69	Healesville	8/05/2010	17:17	134	952.1	67.7	18.4	0.3	1	0/?
Site 69	Healesville	8/05/2010	20:55	134	1005.4	75.5	15.7	0	0	0/1?
Site 70	Healesville	8/05/2010	17:34	88	1007.1	69.9	14.8	0	1	0/1
Site 70	Healesville	8/05/2010	21:32	88	1011.1	83.8	14.3	0.7	0	0/1
Site 71	Healesville	8/05/2010	17:49	109	1012.3	74.4	13.7	0	1	0/1?
Site 71	Healesville	8/05/2010	19:23	109	1009.5	85.7	12.9	0.8	0	0/1

Site	Location	Date	Time	Altitude (metres above sea level)	Barometric Pressure	Humidity	Temperature	Wind	Cloud	Rain
Site 72	Healesville	8/05/2010	17:55	90	1009.5	85.7	12.9	0.8	1	0/1
Site 72	Healesville	8/05/2010	21:15	90	1011	71.6	15.7	0.4	0	0/1?
Site 73	Healesville	8/05/2010	20:04	NR	1011.6	80	12.1	0.8	0	0/1
Site 74	Kinglake West	17/05/2010	13:56	437	969.3	73.5	14.2	1.7	3	0/0?
Site 74	Kinglake West	17/05/2010	20:18	437	971	61.6	15.5	0	7	1/0
Site 75	Kinglake West	17/05/2010	14:13	373	977.9	67	15.4	0.4	3	0/0?
Site 75	Kinglake West	20/05/2010	20:28	373	980.9	73.4	14.5	0	7	1/0
Site 76	Kinglake West	17/05/2010	14:20	349	977.9	67	15.4	0.4	3	0/0?
Site 76	Kinglake West	20/05/2010	20:42	349	983.9	85.3	10.1	0.5	4	0/1
Site 77	Kinglake West	17/05/2010	14:29	316	977.9	67	15.4	0.4	3	0/0?
Site 77	Kinglake West	19/05/2010	20:29	316	987	56.1	9.7	0	0	0/0
Site 78	Kinglake West	17/05/2010	22:32	305	NR	NR	NR	NR	NR	NR
Site 78	Kinglake West	19/05/2010	20:11	305	989	64	10.7	0	0	0/0
Site 79	Kinglake West	17/05/2010	14:41	328	982.2	59.2	16	0	2	0/1?
Site 79	Kinglake West	19/05/2010	19:51	328	985.9	61.8	12	0	0	0/0
Site 80	Kinglake West	17/05/2010	15:06	261	988.5	64.1	18.1	0.7	4	0/1?
Site 80	Kinglake West	19/05/2010	19:15	261	992.2	66.5	12.1	0	0	0/0
Site 81	Steels Creek	20/05/2010	19:13	250	992.8	83.6	10.4	0.7	0	0/0
Site 82	Kinglake	17/05/2010	16:38	250	981.3	76	13.8	0.2	3	0/1?
Site 82	Kinglake	20/05/2010	18:23	321	983	63.5	16.9	0	7	0/0
Site 83	Kinglake	17/05/2010	16:45	298	981.3	76	13.8	0.2	3	0/1?
Site 83	Kinglake	20/05/2010	18:33	298	986.8	66.5	15.8	0	4	0/0?
Site 84	Kinglake	17/05/2010	16:55	277	981.3	76	13.8	0.2	3	0/1?
Site 84	Kinglake	20/05/2010	18:43	277	989.3	77.5	10.3	0	2	0/0
Site 85	Steels Creek	17/05/2010		213	NR	NR	NR	NR	NR	NR
Site 85	Steels Creek	20/05/2010	19:24	213	997.7	79.5	11.1	0	1	0/0
Site 86	Steels Creek	17/05/2010		192	NR	NR	NR	NR	NR	NR
Site 86	Steels Creek	20/05/2010	19:34	192	999.9	85.5	8.1	0	0	0/0
Site 87	Glenburn	26/05/2010	16:26	255	981.5	75.2	17.5	0	4	0/0
Site 87	Glenburn	26/05/2010	18:15	255	982.2	86.8	12.1	0.9	1	0/0
Site 88	Glenburn	26/05/2010	16:39	271	979.6	64	18.6	0	4	0/0
Site 88	Glenburn	26/05/2010	19:05	271	980.4	89.8	11.2	0.5	1	0/0
Site 89	Glenburn	26/05/2010	17:00	253	981.9	66.4	17.2	0	4	0/0

Site	Location	Date	Time	Altitude (metres above sea level)	Barometric Pressure	Humidity	Temperature	Wind	Cloud	Rain
Site 89	Glenburn	26/05/2010	19:54	253	982	80.2	13.1	0	0	0/0
Site 90	Glenburn	26/05/2010	17:21	306	975.7	71.4	15.8	0.5	5	0/0
Site 90	Glenburn	26/05/2010	19:19	306	977.5	83.5	11.8	0	0	0/0
Site 91	Glenburn	26/05/2010	17:31	276	979.6	58.4	16.7	0	2	0/0
Site 91	Glenburn	26/05/2010	17:31	276	980.7	78.9	13.3	0	1	0/0
Site 92	Yarra Ranges	26/05/2010	21:03	202	992.4	72.8	14.7	0	2	0/0
Site 93	Narbethong	26/05/2010	20:33	331	968	68.3	17.4	0	0	0/0
Site 94	Yan Yean	19/05/2010	17:50	85	995.7	69.5	12.9	0	1	0/1
Site 95	Yan Yean	19/05/2010	17:33	86	995.7	69.5	12.9	0	0	0/0
Site 96	Toorourrong Reservoir	20/05/2010	20:59	247	994.7	84.3	10.1	0.7	1	0/0
Site 97	Strathewen	27/05/2010	17:15	236	990.7	76.8	15.1	0.6	7	0/1
Site 97	Strathewen	27/05/2010	18:58	236	990.7	76.2	13	0.6	7	0/1
Site 98	Pheasant Creek	27/05/2010	14:20	516	955	66	14.5	1.1	7	1/0?
Site 98	Pheasant Creek	27/05/2010	19:32	516	956.2	74.3	12	1.4	7	0/1
Site 99	Pheasant Creek	27/05/2010	14:29	516	955	66	14.5	1.1	7	1/0?
Site 99	Pheasant Creek	27/05/2010	19:23	516	955.4	83.1	10.7	3.1	8	0/1
Site 100	Mittons Brindge	27/05/2010	14:57	181	996.9	72.1	16.2	0.8	7	1/0
Site 100	Mittons Brindge	27/05/2010	18:24	181	997.4	67.2	15.9	0	4	0/1
Site 101	Steels Creek	27/05/2010	16:40	181	996.1	82.3	14.3	0.4	7	1/0
Site 101	Steels Creek	27/05/2010	20:12	181	996.4	79.9	13.4	0.5	7	0/1
Site 102	Christmas Hills	14/04/2010	20:29	161	NR	NR	NR	0	8	0/0
Site 103	Strathewen	27/05/2010	18:46	234	990.5	62.6	16.4	0	6	0/1
Site 104	Strath Creek	5/05/2010	21:50	276	NR	NR	NR	NR	1	0/1
Site 105	Kinglake	20/05/2010	18:10	311	984.3	66.5	15.7	0	2	0/0
Site 106	Wonga Park	14/04/2010	16:14	104	1008.8	61.8	16.1	0.6	7	0/0
Site 106	Wonga Park	14/04/2010	16:14	104	1010.3	57	19.6	0	7	0/0



## Appendix 3

Results of frog surveys conducted in and around areas burnt by the Kilmore East-Murrindindi fires on Black Saturday. Abbreviations for age / sex are: AM = adult male; AF = adult female; J = juvenile. Count qualifiers: C1 = 1–10; C2 = 10–100. Abbreviations for type of record are: O = observed; H = heard; T = trapped (i.e., hand-held).

\* denotes frogs that were calling in the general area, but were not calling from the immediate site being surveyed.

(\*) denotes frogs that were heard calling at the site as well as away from the site.

Site	Location	Date	Species	Common name	Age/ sex	Count	Type of record
Site 1	Darraweit Guim	28/03/2010	<i>Litoria ewingii</i>	Southern Brown Tree Frog	AM	C1	H
			<i>Crinia parinsignifera</i>	Plains Froglet		1	
Site 2	Darraweit Guim	28/03/2010	<i>Litoria ewingii</i>	Southern Brown Tree Frog	AM	C2	H
Site 3	Darraweit Guim	28/03/2010	<i>Litoria raniformis</i>	Growling Grass Frog	AM	1	T
			<i>Crinia parinsignifera</i> *	Plains Froglet		C1	H
			<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog		C1	H
Site 4	Wallan	28/03/2010	<i>Litoria verreauxii verreauxii</i> *	Verreaux's Tree Frog	AM	C1	H
Site 5	Wallan	28/03/2010	<i>Litoria ewingii</i>	Southern Brown Tree Frog	AM	2	H
Site 6	Wallan	28/03/2010	Nil				
Site 7	Wallan	28/03/2010	Nil				
Site 8	Darraweit Guim	28/03/2010	<i>Litoria verreauxii verreauxii</i> (*)	Verreaux's Tree Frog	AM	C1	H
			<i>Crinia signifera</i> *	Common Froglet		C2	
Site 9	Beveridge	28/03/2010	Nil				
Site 10	Yan Yean	31/03/2010	<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	AM	C2	H
			<i>Limnodynastes dumerilii</i>	Eastern Banjo Frog		C1	
			<i>Crinia signifera</i>	Common Froglet		C2	
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		C2	
			<i>Crinia parinsignifera</i>	Plains Froglet		C1	
Site 11	Yan Yean	31/03/2010	<i>Limnodynastes tasmaniensis</i> *	Spotted Marsh Frog	AM	1	H
Site 12	Arthurs Creek	31/03/2010	<i>Crinia signifera</i> *	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i> - complex*	<i>L. ewingii</i> -complex		C1	
Site 13	Cottles Bridge	31/03/2010	<i>Litoria ewingii</i>	Southern Brown Tree Frog	AM	1	H
			<i>Crinia signifera</i>	Common Froglet		C1	
			<i>Crinia parinsignifera</i>	Plains Froglet		1	
			<i>Limnodynastes dumerilii</i>	Eastern Banjo Frog		1	
			<i>Geocrinia victoriana</i>	Victorian Smooth Froglet		C2	
Site 14	Cottles Bridge	31/03/2010	<i>Crinia signifera</i>	Common Froglet	AM	1	H
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		3	
Site 15	Nutfield	31/03/2010	<i>Limnodynastes dumerilii</i> *	Eastern Banjo Frog	AM	C1	H
			<i>Crinia signifera</i>	Common Froglet		C2	
			<i>Litoria ewingii</i> complex*	<i>L. ewingii</i> complex		C1	
Site 16	Nutfield	31/03/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		C2	
			<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog		2	

Site	Location	Date	Species	Common name	Age/ sex	Count	Type of record
Site 17	Granton	6/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i> complex(*)	Southern Brown Tree Frog / Plains Tree Frog		C1	
			<i>Crinia parinsignifera</i>	Plains Froglet		C1	
			<i>Geocrinia victoriana</i> *	Eastern Smooth Frog		C1	
Site 18	Granton	6/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i> - complex	Southern Brown Tree Frog / Plains Tree Frog		C1	
			<i>Crinia parinsignifera</i>	Plains Froglet		C1	
			<i>Geocrinia victoriana</i>	Victorian Smooth Froglet		C1	
Site 19	Buxton	6/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i> complex	Southern Brown Tree Frog / Plains Tree Frog		C1	
Site 20	Buxton	6/04/2010	<i>Litoria ewingii</i> complex	Southern Brown Tree Frog / Plains Tree Frog	AM	1	H
Site 21	Taggerty	6/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i> complex	Southern Brown Tree Frog / Plains Tree Frog		1	
			<i>Crinia parinsignifera</i>	Plains Froglet		1	
Site 22	Taggerty	6/04/2010	<i>Crinia signifera</i>	Victorian Smooth Froglet	AM	C1	H and T
			<i>Geocrinia victoriana</i>			C2	
Site 23	Granton	6/04/2010	<i>Crinia signifera</i> *	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i> complex	Southern Brown Tree Frog / Plains Tree Frog		C2	
Site 24	Christmas Hills	14/04/2010	<i>Geocrinia victoriana</i>	Victorian Smooth Froglet	AM	C2	H
			<i>Crinia signifera</i>	Common Froglet		C1	
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		C1	
			<i>Litoria verreauxii verreauxii</i>	Verreaux's Tree Frog		C2	
Site 25	Christmas Hills	14/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Geocrinia victoriana</i>	Victorian Smooth Froglet		C1	
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		C1	
			<i>Litoria verreauxii verreauxii</i>	Verreaux's Tree Frog		C1	
Site 26	Christmas Hills	14/04/2010	<i>Geocrinia victoriana</i> (*)	Victorian Smooth Froglet	AM	2	H
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		1	
Site 27	Watsons Creek	14/04/2010	<i>Geocrinia victoriana</i>	Victorian Smooth Froglet	AM	C1	H
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		C1	
Site 28	Yarra Glen	14/04/2010	<i>Crinia signifera</i> *	Common Froglet	AM	C1	H
			<i>Litoria verreauxii verreauxii</i> *	Verreaux's Tree Frog		C1	
			<i>Geocrinia victoriana</i> *	Victorian Smooth Froglet		C1	
Site 29	Wallan	15/04/2010	Nil				
Site 30	Wallan	15/04/2010	<i>Limnodynastes peronii</i>	Striped Marsh Frog	AM	1	H
Site 31	Wallan	15/04/2010	<i>Crinia signifera</i> *	Common Froglet	AM	1	H
Site 32	Wallan	15/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	10	H
Site 33	Wallan	15/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	1	H
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		1	
Site 34	Wallan	15/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	1	H
Site 35	Wallan	15/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H

Site	Location	Date	Species	Common name	Age/ sex	Count	Type of record
Site 36	Wallan	15/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		C1	
Site 37	Wallan	15/04/2010	<i>Crinia signifera</i>	Common Froglet	AM,	C1	H and T
			<i>Litoria ewingii</i> complex	L. ewingii complex	AF	C1	
			<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog	J	C2	
Site 38	Wallan	15/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i> *	Southern Brown Tree Frog		C1	
Site 39	Wallan	15/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		C2	
			<i>Geocrinia victoriana</i>	Victorian Smooth Froglet		C1	
			<i>Litoria verreauxii verreauxii</i>	Verreaux's Tree Frog		C2	
Site 40	Yea	16/04/2010	Nil				
Site 41	Yea	16/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
Site 42	Yea	16/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C2	H
			<i>Crinia parinsignifera</i>	Plains Froglet		C1	
Site 43	Yea	16/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C2	H
Site 44	Yea	16/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
Site 45	Yea	16/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
Site 46	Yea	16/04/2010	<i>Geocrinia victoriana</i>	Victorian Smooth Froglet	AM	C2	H
Site 47	Yea	16/04/2010	<i>Crinia signifera</i>	Victorian Smooth Froglet	AM	C1	H
			<i>Geocrinia victoriana</i>			C1	
			Common Froglet				
Site 48	Yea	16/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	3	H
Site 49	Yea	16/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
Site 50	Clonbinane	30/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Geocrinia victoriana</i>	Victorian Smooth Froglet		C1	
Site 51	Clonbinane	30/04/2010 5/05/2010	Nil				
Site 52	Clonbinane	30/04/2010 5/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	3	H
Site 53	Clonbinane	30/04/2010 5/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
Site 54	Broadford	30/04/2010 5/05/2010	<i>Pseudophryne bibroni</i>	Bibron's Toadlet	AM	1	H, T
			<i>Crinia signifera</i>	Common Froglet		1	
Site 55	Broadford	5/05/2010	<i>Litoria ewingii</i>	Southern Brown Tree Frog	AM	2	H
Site 56	Strath Creek	5/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i> complex	Southern Brown Tree Frog / Plains Tree Frog		C1	
Site 57	Strath Creek	5/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Geocrinia victoriana</i>	Victorian Smooth Froglet		C1	
Site 58	Strath Creek	5/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i> complex*	L. ewingii complex		C1	
			<i>Geocrinia victoriana</i>	Victorian Smooth Froglet		C1	
Site 59	Broadford	30/04/2010 5/05/2010	<i>Pseudophryne bibroni</i>	Bibron's Toadlet	AM	1	H, T
			<i>Crinia signifera</i>	Common Froglet		2	

Site	Location	Date	Species	Common name	Age/ sex	Count	Type of record
Site 60	Broadford	30/04/2010	<i>Pseudophryne</i> sp.	Toadlet sp.	AM	1	H
		5/05/2010	<i>Crinia signifera</i>	Common Froglet		1	
Site 61	Broadford	5/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		C1	
			<i>Geocrinia victoriana</i> *	Victorian Smooth Froglet		C1	
Site 62	Strath Creek	5/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	1	H
Site 63	Strath Creek	5/05/2010	Nil				
Site 64	Strath Creek	5/05/2010	Nil				
Site 65	Strath Creek	5/05/2010	Nil				
Site 66	Strath Creek	5/05/2010	Nil				
Site 67	Healesville	8/05/2010	<i>Geocrinia victoriana</i> *	Victorian Smooth Froglet	AM	C2	H
Site 68	Healesville	8/05/2010	Nil				
Site 69	Healesville	8/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
Site 70	Healesville	8/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	C2	H
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		C1	
			<i>Litoria verreauxii verreauxii</i>	Verreaux's Tree Frog		C1	
Site 71	Healesville	8/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	C2	H
			<i>Litoria ewingii</i>	Southern Brown Tree Frog		C1	
			<i>Litoria verreauxii verreauxii</i>	Verreaux's Tree Frog		C1	
Site 72	Healesville	8/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i> -complex*	L. ewingii-complex		C1	
Site 73		8/05/2010	Nil				
Site 74	Kinglake West	17/05/2010	Nil				
Site 75	Kinglake West	17/05/2010	Nil				
		20/05/2010					
Site 76	Kinglake West	17/05/2010	Nil				
		20/05/2010					
Site 77	Kinglake West	17/05/2010	Nil				
		19/05/2010					
Site 78	Kinglake West	17/05/2010	Nil				
		19/05/2010					
Site 79	Kinglake West	17/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	1	H
		19/05/2010	<i>Geocrinia victoriana</i> *	Victorian Smooth Froglet		C1	
Site 80	Kinglake West	17/05/2010 19/05/2010	<i>Geocrinia victoriana</i>	Victorian Smooth Froglet	AM	1	H
Site 81	Steels Creek	20/05/2010	Nil				
Site 82	Kinglake	17/05/2010 20/05/2010	Nil				
Site 83	Kinglake	17/05/2010	<i>Crinia ewingii</i>	Common Froglet	AM	C1	H
		20/05/2010	<i>Litoria ewingii</i> *	Southern Brown Tree Frog		C1	
Site 84	Kinglake	17/05/2010	<i>Crinia signifera</i>	Common Froglet	AM	2	H
		20/05/2010	<i>Litoria ewingii</i>	Southern Brown Tree Frog		1	
Site 85	Steels Creek	17/05/2010	Nil				
		20/05/2010					
Site 86	Steels Creek	17/05/2010	Nil				
		20/05/2010					
Site 87	Glenburn	26/05/2010	<i>Crinia signifera</i> (*)	Common Froglet	AM	C1	H
			<i>Litoria ewingii</i> complex	Southern Brown Tree Frog / Plains Tree Frog		2	

Site	Location	Date	Species	Common name	Age/ sex	Count	Type of record
Site 88	Glenburn	26/05/2010	<i>Crinia signifera</i> <i>Litoria ewingii</i> complex <i>Geocrinia victoriana</i>	Common Froglet Southern Brown Tree Frog / Plains Tree Frog Victorian Smooth Froglet	AM	C2 C1 C1	H and T
Site 89	Glenburn	26/05/2010	<i>Litoria ewingii</i> complex <i>Crinia signifera</i>	Southern Brown Tree Frog / Plains Tree Frog Common Froglet	AM	C1 C1	H
Site 90	Glenburn	26/05/2010	<i>Litoria ewingii</i> complex	Southern Brown Tree Frog / Plains Tree Frog	AM	C1	H
Site 91	Glenburn	26/05/2010	<i>Litoria ewingii</i> complex*	Southern Brown Tree Frog / Plains Tree Frog	AM	3	H
Site 92	Yarra Ranges	26/05/2010	<i>Crinia signifera</i> <i>Litoria ewingii</i> <i>Geocrinia victoriana</i>	Common Froglet Southern Brown Tree Frog Victorian Smooth Froglet	AM	1 1 1	H
Site 93	Narbethong	26/05/2010	<i>Litoria ewingii</i> complex	Southern Brown Tree Frog / Plains Tree Frog	AM	C1	H
Site 94	Yan Yean	19/05/2010	<i>Pseudophryne semimarmorata</i> <i>Litoria ewingii</i>	Southern Toadlet Southern Brown Tree Frog	AM	1 1	H
Site 95	Yan Yean	19/05/2010	<i>Litoria ewingii</i> *	Southern Brown Tree Frog	AM	1	H
Site 96	Toorourrong Reservoir	20/05/2010	<i>Crinia signifera</i> <i>Litoria ewingii</i> <i>Geocrinia victoriana</i>	Common Froglet Southern Brown Tree Frog Victorian Smooth Froglet	AM	C1 C1 C1	H
Site 97	Strathewen	27/05/2010	<i>Crinia signifera</i> <i>Litoria ewingii</i>	Common Froglet Southern Brown Tree Frog	AM	C1 C1	H
Site 98	Pheasant Creek	27/05/2010	<i>Crinia signifera</i> <i>Litoria ewingii</i> * <i>Geocrinia victoriana</i>	Common Froglet Southern Brown Tree Frog Victorian Smooth Froglet	AM	C1 C1 C1	H
Site 99	Pheasant Creek	27/05/2010	<i>Crinia signifera</i> <i>Litoria ewingii</i>	Common Froglet Southern Brown Tree Frog	AM	C1 C1	H
Site 100	Mittons Bridge	27/05/2010	<i>Crinia signifera</i> <i>eocrinia victoriana</i> <i>Litoria ewingii</i>	Common Froglet Victorian Smooth Froglet Southern Brown Tree Frog	AM	C1 C1 C1	H
Site 101	Steels Creek	27/05/2010	<i>Crinia signifera</i> (*) <i>Litoria ewingii</i> (*)	Common Froglet Southern Brown Tree Frog	AM	C1 C2	
Site 102	Christmas Hills	14/04/2010	<i>Crinia signifera</i>	Common Froglet	AM	C1	H
Site 103	Strathewen	27/05/2010	<i>Crinia signifera</i> <i>Litoria ewingii</i> <i>Geocrinia victoriana</i>	Common Froglet Southern Brown Tree Frog Victorian Smooth Froglet	AM	1 1 C1	H
Site 104	Strath Creek	5/05/2010	<i>Crinia signifera</i> <i>Litoria ewingii</i> complex <i>Geocrinia victoriana</i>	Common Froglet L. ewingii complex Victorian Smooth Froglet	AM	C1 C1 C1	H
Site 105	Kinglake	20/05/2010	<i>Crinia signifera</i> <i>Litoria ewingii</i>	Common Froglet Southern Brown Tree Frog	AM	C2 C1 H	
Site 106	Wonga Park	14/04/2010	<i>Crinia signifera</i> <i>Litoria ewingii</i> <i>Geocrinia victoriana</i>	Common Froglet Southern Brown Tree Frog Victorian Smooth Froglet	AM	C1 1 1	H

