Expert Witness Report

Report prepared on instructions of:
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Curriculum Vitae Attached (Appendix I)

I have read the Expert Witness Code of Conduct and agree to be bound by it.

Graeme Gillespie
23 February 2010

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 Giant Burrowing Frog, I encountered this species on several occasions between 1986 and 1992 while undertaking and supervising pre-logging biodiversity surveys in East Gippsland, Victoria. 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. I am familiar specifically with the scientific literature on the Giant Burrowing Frog.

Between 1986 and 1992 I conducted amphibian surveys in East Gippsland and observed the Giant Burrowing Frog on five occasions (see Victorian Wildlife Atlas records; Gillespie 1990; 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 Giant Burrowing Frog, I have also visited other localities at which the species has been recorded previously within Victoria.

Publications that I have authored or co-authored which are directly relevant to the Giant Burrowing Frog:

1. **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.
2. **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.
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., 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.

Description of the Species

The following description of the Giant Burrowing Frog, *Heleioporus australiacus*, is derived from Lee (1967) and Barker et al. (1995). The species is a relatively large and rotund or stocky species with a maximum body length of 100mm (Appendix II). Dorsal body colour is chocolate or dark grey and white ventrally, with scattered yellow or cream spots, usually capping warts, on the flanks. The dorsum and flanks are covered with small warts each with a small black spine. The ventral surface is mostly smooth and white, apart from the throat, which may be brown and may also have spines. The tympanum (ear) is distinct and the pupil is vertical. Mature males have sturdy forelimbs usually exceeding the girth of the hind limbs. Males have a series of conspicuous conical spines on the first and usually the second fingers.

The Giant Burrowing Frog is confined to eastern slopes of the Great Dividing Range and coastal regions from the southern end of the Olney State Forest north of Sydney, NSW (Gillespie and Hines 1999), to Walhalla, in the Central Highlands of eastern Victoria (Littlejohn and Martin 1967; Victorian Wildlife Atlas unpublished data). The species has been found near sea level on the coast, and almost 100 km inland, along the escarpment of the Great Dividing Range, up to 1000 m asl. (Gillespie and Hines 1999). Most records are concentrated at the northern end of the range, in the Sydney region on the Hawkesbury sandstone formation. Most other records are from the southern part of the range, in eastern Victoria and the south-east corner of NSW (Gillespie 1990). However, these constitute much fewer, sparsely-distributed documented records (Gillespie and Hines 1999).

Subspecies

A distinct disjunction of 100km occurs in the distribution of the Giant Burrowing Frog records between Jervis Bay and Narooma (Lemckert et al. 1998; Gillespie and Hines 1999). There is genetic, morphological and bioclimatic evidence that populations to the north and south of this gap are distinct and separate evolutionary lineages (Penman et al. 2005a; Mahony et al. unpublished data). It is my opinion that these data are strong evidence of two distinct sub-species, although they have not yet been formally described as such. It has also been argued that they represent separate species (Penman et al. 2004, 2005a). Based upon the available evidence, these populations are different evolutionary and ecological management units and therefore should be treated as distinct taxa from a conservation perspective; here-in referred to as northern and southern forms of the Giant Burrowing Frog.

Type and range of habitats

The Giant Burrowing Frog has been found in a range of forest communities, including lowland, dry, damp and wet forest and montane woodland. Northern populations in the Sydney and region are associated with heathland habitats (Mahony 1993). There are no records from rainforest or Ash-dominated montane forest. The species has never been recorded in cleared farmland and would seem to be dependent upon forested habitat (Gillespie 1990; Penman et al. 2004).

The Giant Burrowing Frog breeds mostly in small low-order streams. The species has been observed at fire dams and there is one record of egg-laying in a dam (Gillespie 1990), but the vast majority of breeding records have been from 1st to 3rd order streams, indicating that this is its preferred breeding habitat (Penman et al. 2004, 2008b). When not breeding, frogs disperse into the forest, occupying non-riparian habitats up to 250 m away from breeding habitats (Penman et al. 2008a), where they spend over 95% of their time (Lemckert and Brassil 2003; Penman 2008a,b).

Reproductive Biology

Age to sexual maturity or longevity for either form of the Giant Burrowing Frog is unknown. Calling by males has been heard throughout the year (Gillespie 1997). Peak breeding periods appear to be in Summer and Autumn (Gillespie 1997). Penman et al. (2006, 2008b) report individuals moving to breeding sites during this time after heavy rain. Eggs appear to be deposited in burrows or crevices (Gillespie 1990) and tadpoles may take up to 12 months to develop into frogs.

Little is known about fertility and fecundity. Female clutch sizes have been report as 698-807 eggs (Penman et al.2004). Number of clutches laid is unknown but is likely to be once annually, typical of temperate anurans (Wells 2007).

Data is inadequate to determine differences, if any, in breeding biology between the northern and southern forms of the species.

Distribution

Records of the Giant Burrowing Frog in Victoria are all on southern side of the Great Dividing Range, extending from Walhalla in Central Gippsland east to the New South Wales Border in Coast Range area. Only 21 separate sites are confirmed for the Giant Burrowing Frog in Victoria (Appendix III). There are no records east of the Cann River or south of the Princes Hwy. In Victoria, the species has only been found in eucalyptus dominated forest habitats, not heathland. Because of the paucity of records of the species from Victoria, it is not clear whether or not the species shows any preference for particular forest types or ecological communities over others, but there are no records from cleared land or regenerating clear-felled habitats (Gillespie 1990; Victorian Wildlife Atlas unpublished data 2010). Most records from Victoria are from mid-slope and ridge habitats.

Surveys have been carried out for the Giant Burrowing Frog in Victoria historically, but these have been relatively patchy and not comprehensive. General biodiversity surveys carried out during the 1980s and early 1990s as part of the prelogging flora and fauna survey program included many forest blocks within the species' general range. These surveys yielded several records of the species (Gillespie 1990). A targeted amphibian survey was undertaken in the mid-1990's in far East Gippsland for the Giant Burrowing Frog and other rare amphibian species, which only yielded one additional record of the species (Holloway and Osborne 1997).

No systematic and rigorous survey has been undertaken for the Giant Burrowing Frog throughout its range in Victoria. The species is extremely cryptic so in the absence of targeted thorough surveys using the most optimal techniques, it is likely that historical surveys have not been very effective. Recent research by Penman et al. (2006,,2008b) indicates that there are specific optimal weather conditions and seasons for best detecting the species; however even when meeting these criteria the probability of detecting the species at known sights of occupancy remains quite low. In Victoria I have personally revisited some known Giant Burrowing Frog sites on over 20

occasions and not resighted the species. The consequence of this is that the absence of detection of the species is currently virtually meaningless, because there is a significant but un-known probability of the species being present at a site without it being detected.

Penman et al. (2008b) advocates tadpole surveys as the most effective way of surveying for the giant Burrowing Frog because tadpoles are less cryptic and persist in streams for many months. A combination of tadpole and adult survey methods undertaken under the right conditions and during the right seasons would be required to systematically assess the distribution and current status of the species in Victoria. With the exception of the survey undertaken by Holloway and Osborne (1997) this approach was not used in previous surveys in Victoria, the existing data provides a record only of where the species has been found; does provide a record of where the species is known to occur and known not to occur, nor does it provide a rigorous assessment of habitat associations or any aspect of population demography.

Since the mid-1990's there has been virtually no amphibian survey or monitoring work undertaken within the range and potential habitats of the Giant Burrowing Frog. Currently it is not possible to say if the species persists at sights that it occurred at historically, let alone where else in the landscape the species occurs. Given the range of forest habitats that the species is known to use, and given its cryptic nature, for any given area of forest it is not possible to presume anything about status of the Giant Burrowing Frog until such time that appropriate surveys have been undertaken. For these reasons the FFG Action Statement published in 2003 does not reflect the current distribution of the Giant Burrowing Frog.

The FFG Action Statement for the Giant Burrowing Frog accurately summarizes available information on the distribution of the species up until 2003. Since then, one additional sighting of the species has been recorded (Victorian Wildlife Atlas, unpublished data). The implications of the information in the FFG Action Statement are that; either species is very rare throughout its known range, or that it is very cryptic and difficult to detect.

In terms of viability of the Giant Burrowing Frog, available data suggests that where the species does occur it is presenting very low densities, certainly compared to other non-threatened species. No more than four individuals have ever been found on one occasion. Therefore, even if the species is more widespread than current records suggest, overall population size is likely to be low. The population viability of the Giant Burrowing Frog may therefore be relatively low compared to other species.

Conservation Status

In Victoria the species is has been listed as threatened under the Flora and Fauna Guarantee Act 1988, and is considered Vulnerable according to the "Advisory List of Threatened Vertebrate Fauna in Victoria 2007". This requires the development of an Action Statement, which describes species management and research actions required to ensure the conservation of the species. The current published Action Statement was compiled prior to 2003. This Action Statement lists a range of such Actions

The Action Statement required to be reviewed when new information comes to light or after five years. No such review has been undertaken to my knowledge.

The Giant Burrowing Frog is listed as Vulnerable under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. 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 management and research 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.

To my knowledge a National Recovery Plan for the Giant Burrowing Frog has been drafted but not approved by State or Federal Governments.

In my opinion, the conservation status of the Giant Burrowing 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 Giant Burrowing Frog.

7. *Threats*

There are several threats to the continued survival of the Giant Burrowing 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 Giant Burrowing 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 Giant Burrowing Frog:

- The species is 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 Giant Burrowing 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 Giant Burrowing 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.
- As the name suggests the Giant Burrowing Frog is a burrowing species. It burrows between 1 and 30 cm underground and uses multiple burrows within its home range (Penman et al. 2008a). Soil compaction by timber harvesting activities, especially at landings and along snig tracks, may crush frogs or render soils unsuitable burrowing (Penman et al. 2008b). The dense lower structure of regenerating forest may also reduce the availability of suitable burrowing sites for this species. The loss of burrowing sites result in increased predation or dessication. Penman et al. (2008a) found evidence that availability of suitable burrowing sites may have a significant influence on the distribution of the species.
- 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). As a large terrestrial species, the Giant Burrowing Frog may be vulnerable to predation by introduced predators, such as foxes (Gillespie 1997). Timber harvesting and associated increased road networks may facilitate access for these predators to forest areas, thus increasing predation impacts on vulnerable species.
- There is some evidence that the Gaint Burrowing Frog may specialize in eating ants (Gillespie 1990). The impacts of forest management on specific food for this species are unknown.
- 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 Giant Burrowing 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 Giant Burrowing 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 Giant Burrowing Frog is a stream breeding species. The potential impacts of timber harvesting on stream-breeding amphibian is well documented (deMaynadier and Hunter 1995; Gillespie 2002a,b). Breeding success of the

Giant Burrowing Frog may adversely affected by increased sedimentation, changed flow regimes, changes in stream water temperature, and changes in predator communities (see Gillespie 2002a,b).

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). Given the widespread distribution of this disease, however, it is highly likely that the Giant Burrowing 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 Giant Burrowing 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 Giant Burrowing Frog is unknown. Given its dependence upon small low-order streams for reproduction, and the association with heavy rain events for becoming active (Penman et al. 2006), it is likely that this species has been significantly and adversely affected by the low-rainfall 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 may provide high quality habitat for the Giant Burrowing 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).

Impacts of Forestry Operations on the Giant Burrowing 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, much of the known habitat of the Giant Burrowing 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.

Action Statement

The distinction between stream and non-stream records reflects the presumed importance of streams for breeding. If the species is found near a stream then by implication that area is probably important for breeding. The prescriptions are aimed at offering some protection to the breeding habitat as well as non-breeding habitat. Whereas if an individual is found in forest away from any stream, then the prescription is aimed at protecting non-breeding habitat.

The justification for the distinction between first and second order streams is unclear. The species is known to breed on both first and second order streams and there is no evidence to suggest that one is more or less important for breeding than the other. Some of the potential impacts of forest management on breeding habitat operate at the catchment level, such as flow regimes and sediment inputs from upstream road crossings. Irrespective of wherein the catchment the breeding sites were found, these upstream catchment values would still need to be protected. Furthermore, based upon nature of this species, if a record is found at one point down stream in a catchment then these is a strong likelihood that the species will be using the catchment more broadly.

There is no biological or scientific significance that I am aware of for the 100m buffer width described on page 3 of the Action Statement. Based upon the known biology of the Giant Burrowing Frog, Penman et al. (2008b) suggest that a 100m buffer width is inadequate to protect non breeding habitat of females, which readily disperse and occupy forest further from streams than 100m. Studies on other stream-breeding amphibians in Victoria and subsequent development of forest management prescriptions have identified 300m buffers around all potential habitat (not just known records) as the requirement, based upon an assessment of requirements to effectively manage hydrological values and off-stream habitat(see O'Shaughnessy and Associates 1995; Gillespie 2000),. Multi species studies from over seas have suggested that buffer zones of a minimum of 300 m around breeding sites will protect a significant proportion of a number of species' populations (Semlitsch and Bodie 2003).

There is similarly no biological or scientific basis for the 1km buffer up and down stream of records of frogs. This presumes that such a distance is adequate for protecting the local population. However, no information is available from any Victorian localities on population density, population size, distribution of the population in the local area, or specific sections of streams important for breeding. Whilst a distance of 1km will protect some catchment values and non-breeding habitat, evidence suggests that important non-breeding habitat away from riparian zones will not be adequately protected. Furthermore impacts to tributaries upstream of the 1 km zone may still adversely affect stream flows and water quality within the zone which may adversely effect breeding habitat.

My interpretation of "off-stream records" is sightings of the species that are not close to or associated with stream or riparian habitats; however it is unclear from the Action Statement at what distance from a stream this evaluation is made. I.e. there is no specific definition.

The figure of 50 ha block around a record is intended to provide protection from habitat disturbance around specific records of individuals. It assumes that this area is adequate to conserve not only the territory of this individual but also the local population. Penman (2005) found that the Giant Burrowing Frog has a non breeding home range of on average 0.05 ha. Theoretically, 50 ha could support 1000 non-overlapping Giant Burrowing Frogs, but this assumes that all the habitat is suitable and that all the suitable habitat is actually occupied. The 50ha does not specifically provide any protection for breeding requirements of the local population, or connectivity with other local populations. Penman et al. (2008b) has suggested that many of the current prescriptions for the Giant Burrowing Frog are inappropriate.

My understanding of an "equivalent area of suitable habitat nearby" is an area that is assessed to meet the habitat requirements of the species, and is close enough to the sight to offer adequate refuge for an adequate representative sample of that local population. For this to be assessed and identified would require the following knowledge:

- Detailed information on the local habitat requirements of the species
- Detailed information on how the species was using both breeding and non-breedng habitat in the area
- Information in population density (number of individuals per ha in a given habitat type
- Evidence or statistical confidence that this information could then be extrapolated to other locations nearby.

None of the above information is available for this species in Victoria.

Based upon my observations at Brown Mountain, the forestry coupes at Brown Mountain and the stream running through them offer potentially highly suitable habitat for the Giant Burrowing Frog.

<u>East Gippsland</u>

The Giant Burrowing Frog was known to be present in East Gippsland up until 2005 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 Giant Burrowing 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 a few localities, all known Victorian records occur in East Gippsland (Appendix III). Within East Gippsland, all records occur north of the Princess Highway, and are scattered throughout the foothill regions, with a small cluster on northern part of the Errinundra Plateau in the Coast range area (Appendix III).

At this stage the security status of all populations is unknown. The species has not been recorded since 2005 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.

Brown Mountain

In order to ascertain whether or not Giant Burrowing 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 during climatic conditions deemed optimal for detecting the species (these are described in detail by Penman et al. 2006). Due to the highly cryptic nature of the species, multiple surveys would need to be undertaken to confidently ascertain the species status in the area. Surveys would need to thoroughly investigate the streams in the area for tadpoles of the species.

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 Giant Burrowing 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 inspected the stream running through the proposed coupes 840-502-15 and 840-502-0019 and in my opinion it is suitable for the Giant Burrowing Frog to breed.

My level of confidence that the Giant Burrowing 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 and in broadly similar habitat.
- No surveys or other assessments have been undertaken to diminish the likelihood that the species is present.

Given that it is likely that Giant Burrowing frogs reside in the Brown Mountain coupes, it is highly likely that logging will impact individual members of the species. 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 Giant Burrowing 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.

It is not known if, and how long it would take for, the Giant Burrowing 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.

Assuming that VicForests adheres to the prescriptions outlined in the Brief by creating a 100m stream buffer for the stream that runs along the eastern boundary of coupe no. 840-502-0015, this would not change my answers above because these prescriptions are not adequate to conserve the ecological requirements of the Giant Burrowing Frog, as pointed out elsewhere in this document. Retention of a 100 m along the stream will protect some habitat likely to be important to the species. However, the species (especially females) utilize habitat up to 250m from streams in which they breed. Other studies have suggested that 100m buffers along streams are inadequate to protect all the breeding and non-breeding ecological requirements of stream-breeding amphibians.

Precautionary Principle

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.

In my opinion the proposed logging would not be consistent with the precautionary principle in respect to the Giant Burrowing Frog, because:

- The Giant Burrowing 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 the 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 forest).
- The Giant Burrowing Frog is known from the general area and, based on current knowledge, the forest habitats in the Brown Mountain coupe areas are suitable for the species and potentially high quality. It is therefore highly likely that the species resides and traverses the area of proposed operations.
- 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 Giant Burrowing Frog.
- No steps are proposed to monitor or evaluate the impacts of forestry operations on the Giant Burrowing Frog.

References

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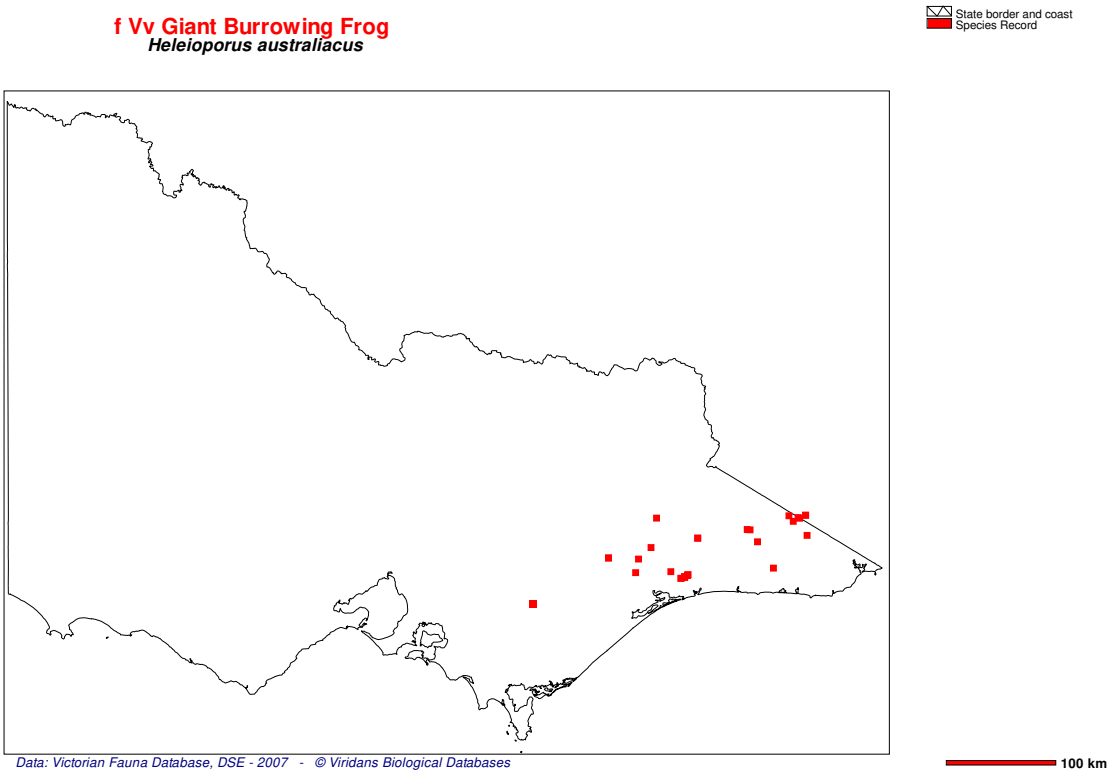
Appendix II:

Photo of the Giant Burrowing Frog *Heleioporus australiacus*.

Appendix III:

Distribution of the Giant Burrowing Frog in Victoria (Atlas of Victorian Wildlife records, February 2010).

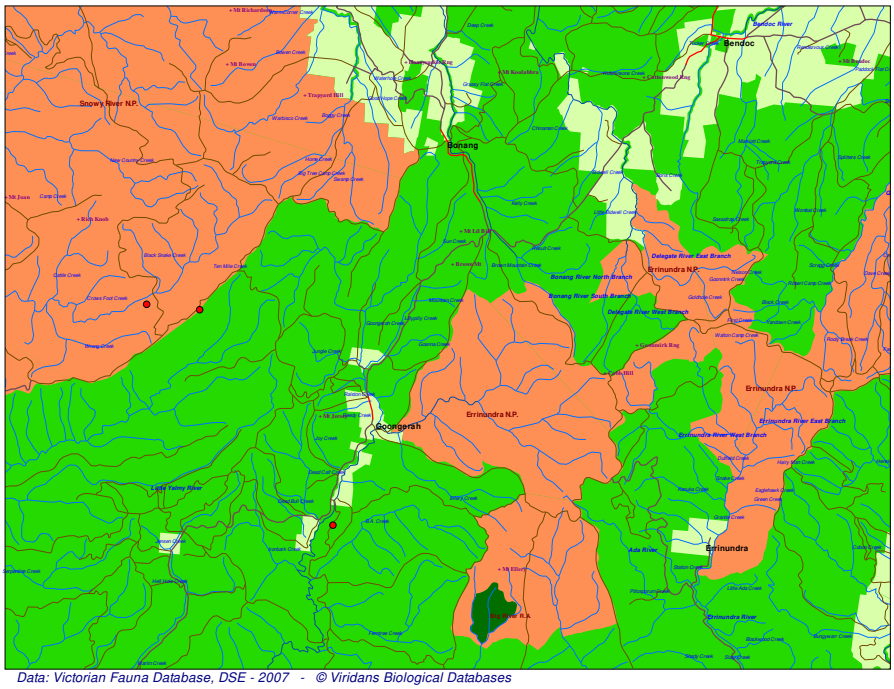


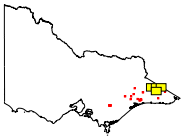
Appendix IV:

Distribution of the Giant Burrowing Frog in Brown Mountain Area (Atlas of Victorian Wildlife records, February 2010).

f Vv Giant Burrowing Frog
Heleioporus australiacus

State border and coast
Species Record





5 km

Data: Victorian Fauna Database, DSE - 2007 - © Viridans Biological Databases