

Forest Protection Survey Program

Survey Guideline Frogs (V2)



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Photo credit

Cover photo: Booroolong Frog. Jamie Molloy

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1. Frogs

1.1 Context

Frog species that may be targeted for survey under the Forest Protection Survey Program (FPSP) are those with detection-, density- or habitat-based prescriptions. Surveys for frog species with timber harvesting prescriptions will be carried out in and near selected planned coupes, in areas where these species may occur.

Where logistically feasible, frog surveys may be undertaken alongside forest protection surveys targeting other taxa. This could include identifying potential frog breeding sites for later nocturnal surveys while deploying camera traps for terrestrial mammals, or nocturnal frog surveys on the same night and at the same location as spotlighting for arboreal mammals and owls.

1.2 Objectives

To detect frog species which have defined detection-based prescriptions impacting timber harvesting operations, in or near coupes prioritised for frog survey under the FPSP. Target species are listed in the appendices to the standard operating procedure (SOP).

1.3 Survey effort

It is important to employ survey techniques most suited to the target species and to the local environment to maximise detection probabilities. Some target species that occur in the same areas and occupy broadly similar habitats (e.g. Large Brown Tree Frog, Blue Mountains Tree Frog, Giant Burrowing Frog) may be surveyed for at the same time.

Each target coupe should be visited once during the day to identify potential sites for later nocturnal frog survey. The number of potential survey sites per coupe will vary; surveyors should aim to maximise coverage of the coupe area, as well as up to 1 km outside coupe boundaries. The number of potential survey sites per coupe should be limited to as many as can be realistically surveyed by a pair of observers in one night.

Each coupe should be subject to up to three nights of nocturnal frog surveys, plus remote acoustic recorders for Giant Burrowing Frog surveys. The three survey nights may be consecutive or non-consecutive and must occur during the most favourable conditions for frog survey.

Surveyors are to employ the most suitable combination of methods for the target species. For example, call playback surveys are suitable for Large Brown Tree Frogs under favourable conditions, but tadpole surveys and remote acoustic recorders capturing time periods around significant rain events are more likely to detect Giant Burrowing Frogs than call playback.

Recommended time spent on call surveys is given below.

1.4 Staff requirements

Field survey teams of at least two people.

Staff are required to be experienced and competent in conducting field surveys for amphibians. This includes:

- familiarity with all frog species that may occur in the survey area
- ability to identify frogs to species, both visually and aurally
- specialist knowledge and experience in tadpole identification, or access to an experienced staff member who can train less experienced staff
- competent in collection of voucher specimens

- ability to recognise the preferred habitat of target species
- adherence to all hygiene and handling protocols.

1.5 Survey equipment

- | | |
|---|--|
| <input type="checkbox"/> 2x Spotlights or bright headlamps | <input type="checkbox"/> Larvae key/s (e.g. Anstis 2018) |
| <input type="checkbox"/> Low-light torches/headlamps (for animal ID) | <input type="checkbox"/> Gloves – single-use, unpowdered |
| <input type="checkbox"/> Playback equipment (e.g. MP3 player with speaker) | <input type="checkbox"/> Hand and equipment disinfectant/wash — e.g. 1% sodium hypochlorite solution |
| <input type="checkbox"/> Recordings of regional frog calls for playback | <input type="checkbox"/> Boot and vehicle tyre/wheel arch disinfectant/wash – e.g. 1% sodium hypochlorite solution |
| <input type="checkbox"/> Sound recording device (for unknown frog calls) | <input type="checkbox"/> Reflective safety vests (for road/track walking transects) |
| <input type="checkbox"/> Dip-nets for larval sampling (e.g. 30 cm diameter, fine mesh, long handle) | <input type="checkbox"/> 2x GPS |
| <input type="checkbox"/> Digital camera suitable for high quality macro-photography | <input type="checkbox"/> 2x time-keeping devices |
| <input type="checkbox"/> Water-tight containers or snap-lock bags for viewing/carrying tadpoles | <input type="checkbox"/> 2x hand-held compasses |
| <input type="checkbox"/> Frog handling bags | <input type="checkbox"/> Appropriate spare batteries for all equipment |
| <input type="checkbox"/> Measuring callipers | <input type="checkbox"/> FPSP Frog Survey Data Sheets on electronic-based pro-formas |
| <input type="checkbox"/> 10x hand-lens or binocular microscope | <input type="checkbox"/> Back-up hard copy of data sheet on waterproof paper on clipboard |

1.6 Site selection

Survey site locations within coupes should be determined in advance via a combination of desktop assessment, field reconnaissance or during other FPSP fieldwork (e.g. coupe habitat and sign surveys (CHASS) or when setting/retrieving cameras). Frog survey sites should be marked via GPS to better facilitate relocating them.

During daytime coupe visits, survey effort should focus on likely macrohabitat and microhabitat used by the target species. Some frog habitat may intersect with the existing road network and be accessible by vehicle, however much of the frog habitat present in or adjacent to a coupe may be away from roads, for example along drainage lines, standing water in fallen logs, or ponds. Every effort should be taken to locate all potential frog survey sites throughout the coupe. These can then be targeted during nocturnal surveys if terrain and vegetation thickness allow reasonably safe access at night or sampled with a remote acoustic recorder if night-time access is unsafe.

Sites may be natural or artificial and should comprise water bodies that form potential frog breeding locations. These include flowing, stationary or ephemeral water bodies such as streams, ponds, swamps, road-side ditches, culverts, fire dams, quarries, rain-filled stumps and logs, banks along water courses, wet forest and rainforest gullies, depending on the target species.

The area of consideration for survey should prioritise areas within, or near to, target coupes, but may extend up to 1 km from target coupe boundaries. Some management prescriptions include potential landscape impacts of harvesting operations (e.g. elevated sediment input to local streams). For some target species (e.g. Giant Burrowing Frog), detection-based prescriptions exclude timber harvesting from areas 1 km upstream and downstream of confirmed records.

1.7 Conducting the survey

Targeted frog survey methods under the FPSP comprise multiple survey techniques, applied during repeated site visits. These comprise initial daytime searches for potential breeding sites, and site occupancy surveys at night, detailed below.

To maximise likelihood of detection, surveys should be carried out during the breeding season of the target species, when frogs are most active. Target months for calling males and larval stages are listed in Table 1.

Table 1. Calling periods and larval periods for FPSP target frog species

Species	Calling period	Larval period
Giant Burrowing Frog	Aug-May	Jan-Nov
Large Brown Tree Frog	Feb-May; Aug-Oct	Sep-Mar
Spotted Tree Frog	Oct-Feb	Nov-Mar
Alpine Tree Frog	Sep-Dec	Nov-Jan
Blue Mountains Tree Frog	Sep-Nov	Nov-Mar

Environmental conditions

Surveys should be carried out when conditions are favourable for detecting frogs – during breeding seasons when males may be calling, following major local rainfall events, under conditions of low wind and elevated humidity and temperature. Rainfall events are particularly relevant when surveying for the Large Brown Tree Frog (*Litoria littlejohni*) and the Giant Burrowing Frog (*Heleioporus australiacus*).

For these species, surveys should be limited to:

- Within 10 days of large rainfall events (10+ mm)
- Midnight temperatures > 8°C
- Relative humidity > 60%
- Still or light wind conditions.

Detection probability for the Large Brown Tree Frog at occupied sites drops from very high to near zero once these conditions are no longer present. Detection probabilities for the Giant Burrowing Frog are not known, although calling may occur throughout the year following rainfall (R. Bilney pers. comm.).

Frog surveys under the FPSP should not commence unless favourable environmental conditions are met, and surveys underway should cease upon these conditions no longer prevailing, with the exception of remote acoustic recorder surveys.

Call surveys and visual spotlight search

For surveys targeting:

- Large Brown Tree Frog
- Giant Burrowing Frog
- Blue Mountains Tree Frog
- Alpine Tree Frog.

This method is a combination of listening for calling males, call playback aiming to elicit response, followed by actively searching the survey site for individual frogs.

For obligate stream-dwelling species such as the Blue Mountains Tree Frog, actively searching in stream environments with a spotlight may be more successful than call playback, and may be applied throughout the warmer months rather than only during the spring breeding season.

- Observers should approach site quietly, to reduce disturbance, and avoid using lights once within ~10-20 m of the site.
- Once within ~5 m of site, conduct timed passive listening and call playback:
 - 5 minutes passive listening
 - 1 minute call playback
 - 2 minutes passive listening
 - 1 minute call playback
 - 2 minutes passive listening.
- Record all calling frog species heard before, during and after call playback.

At the completion of this ~10 minute call survey, conduct a visual spotlight search for adult frogs. Record the start and end times of this active search. Active search duration will be dependent on the size of the site/waterbody being searched, approximately two minutes (roadside puddles, water in fallen logs) to 10-20 minutes (continuous stream reaches and riparian habitat).

Move on to next pre-identified site within coupe area and repeat method.

Visual and call playback surveys for Large Brown Tree Frog and Giant Burrowing Frog are to be conducted following a >10mm rainfall event in the survey area. These surveys are to be conducted within ten days of the rainfall event.

Remote acoustic recorders

For surveys targeting:

- Giant Burrowing Frog (*Heleioporus australiacus*).

The Giant Burrowing Frog is cryptic and notoriously difficult to detect. Detection rates are very low or negligible using methods such as visual surveys, call playback surveys, pitfall trapping and driving road transects after rain (Gillespie 1990, Daly 1996, Lemckert et al. 1998). Remote acoustic recorders are proposed for survey of potential breeding sites of Giant Burrowing Frogs in or near coupes, informed by current knowledge of the ecology of the species.

Giant Burrowing Frog ecology

It is estimated that adult Giant Burrowing Frogs spend at least 97% of their lives underground, in eucalypt forest habitat away from breeding sites (Penman et al. 2008). In these locations the species is virtually impossible to detect using current techniques, thus to maximise the chance of detection, surveys should target locations where, under the right conditions, Giant Burrowing Frogs congregate to call and breed.

Penman et al. (2008) found that individual Giant Burrowing Frogs move between multiple burrows in non-breeding habitat, in activity areas averaging 500 m². The average distance between repeatedly-used burrows was 7.6 m, and burrows may be located from lower slopes through to ridgelines. In that study, central points of non-breeding activity areas were 20-250 m from breeding sites (Penman et al. 2008).

Giant Burrowing Frogs may be active throughout the year, although movement between burrows is reduced in the colder months. Penman et al. (2008) reported activity peaks in late summer and autumn. Activity is strongly positively correlated with rainfall – rainfall over 5 mm usually resulted in activity in radio-tracked Giant Burrowing Frogs, with rainfall over 10 mm always resulting in activity (Penman et al. 2006). Bilney (2015) reported Giant Burrowing Frogs calling at breeding sites in February, March, April, August and September. Migrations to breeding sites are always associated with rainfall (Gillespie 1990, Penman et al. 2008), with individuals moving on the night of, or within 10 days of, rainfall more than 20 mm. Breeding sites are usually semi-permanent pools in intermittently flowing 1st and 2nd order streams, but may also be roadside ponds (Gillespie 1990, Penman et al. 2008) and Bilney (2015) reported calling Giant Burrowing Frogs from a 4th order stream. Bilney's 2015 paper reported 16 incidences of calling Giant Burrowing Frogs, from pools in streams with no, or very limited, flow. Streams/pools occupied by calling males were 0.8 - 10 m wide and < 5 – 70 cm deep.

Penman et al. (2008) reported that radio-tracked Giant Burrowing Frogs spent only 1-12 days (mean 5 days) at breeding sites, sheltering nearby by burrowing into the ground or beneath vegetation or woody debris. Bilney (2015) noted that “calling activity sometimes differed dramatically between consecutive nights, with frogs calling consistently one night and seemingly being inactive the next, despite apparently similar and suitable climatic conditions.” Call playback is not a successful detection method for this species and calling frogs have stopped calling in response to call playback (R. Bilney pers. comm.).

When adult frogs are calling, they tend to call relatively continuously (R. Bilney pers. comm.). For remote acoustic recorders to detect a Giant Burrowing Frog, recording equipment must be within 30-50m of a calling individual, as the calls are usually quite soft (R. Bilney pers. comm., L. Bluff pers. comm.).

Remote acoustic recorder method

While there is as yet no prescribed model of recorder, suitable units include SongMeters, AudioMoths or digital sound recorders (ie. Olympus L3, LS-7 or similar). Remote acoustic recorders should be positioned at potential breeding sites of Giant Burrowing Frogs, within or up to 100 metres outside of target coupes and left in place for four weeks. The number of potential breeding sites to be monitored acoustically per coupe will depend on the availability of recording equipment. It is desirable to maximise the number of potential breeding sites monitored (survey effort) per coupe. During a pilot study of remote acoustic recorders for Giant Burrowing Frog surveys in 2016, recorders were stationed at 23 potential breeding sites approximately 200 m apart in Mount Alfred State Forest, in an area (8 km x 9 km) with recent Giant Burrowing Frog records and presumably still occupied by the species. In 78 nights of sampling, only one recorder detected a Giant

Burrowing Frog (*L. Bluff pers. comm.*), suggesting that maximising survey effort within an area is preferable to spreading survey effort too thinly across multiple areas.

- Initial acoustic monitoring surveys will establish one acoustic monitor per identified breeding site up to a maximum of five acoustic monitoring devices per coupe.
- Acoustic monitors are not to be co-located at spacings less than 50m.
- In the event that there are no potential breeding sites within coupe boundaries (which may be the case as breeding sites are likely to be on stream lines), sampling may occur in areas outside of the coupe that could result in a detection that would affect how the coupe is harvested (i.e. up to 1km away).

Remote acoustic recorders should be set to record audio for 10 continuous minutes, three times during the first half of each night. The 3 x 10-minute recordings should be spaced approximately two hours apart, beginning in the first hour after sunset.

Visual inspection of spectrograms is adequate until recogniser algorithms for this species are developed. See Figure 1 for an example spectrogram of a frog breeding site with calling Giant Burrowing Frogs, with the distinctive call structure around 0.3 kHz.

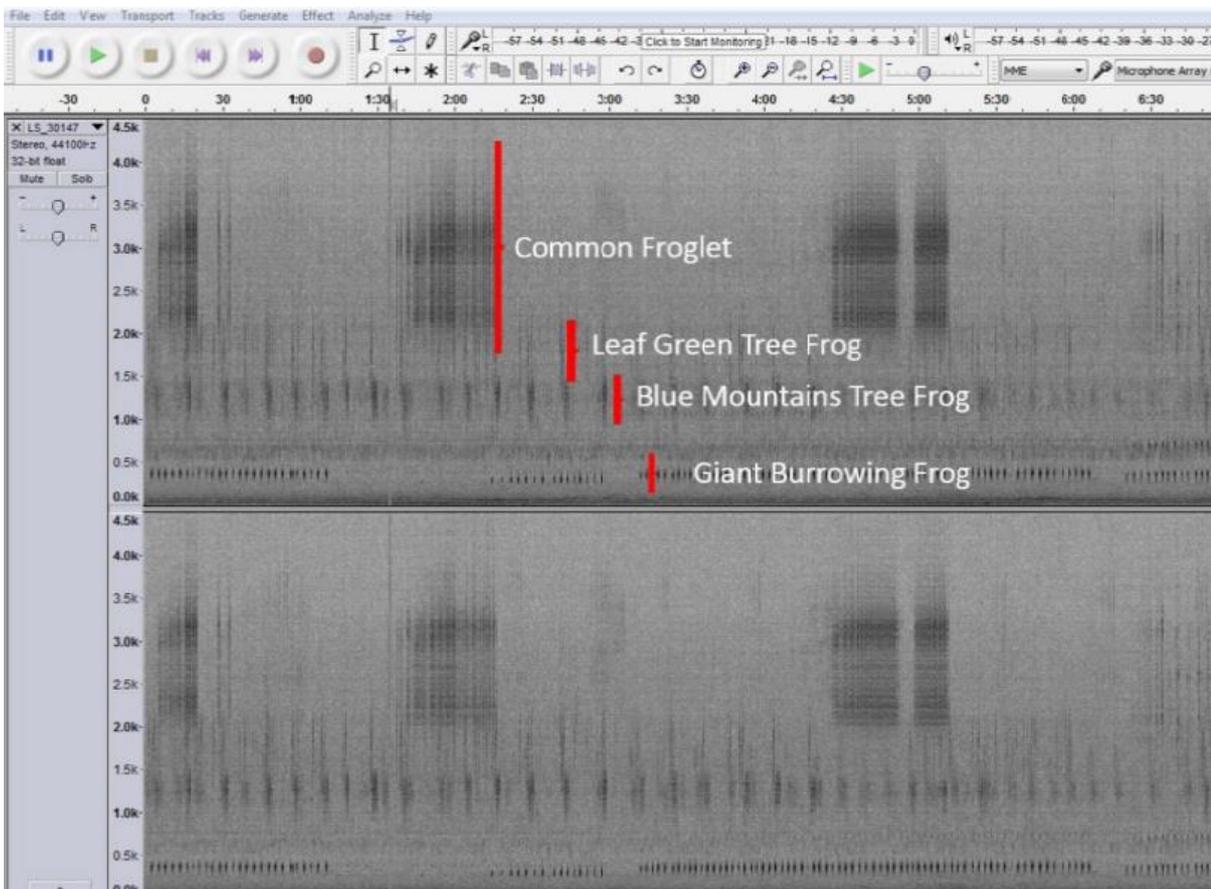


Figure 1. Spectrogram of calls of four frog species, including the Giant Burrowing Frog, *H. australiacus*. Source: Forestry Corporation of NSW.

Tadpole survey

For surveys targeting:

- Giant Burrowing Frog
- Large Brown Tree Frog

- Alpine Tree Frog.

Tadpoles generally have a higher probability of detection than adult frogs, as they are often more conspicuous and usually persist at breeding sites for much longer. However, this is counterbalanced with tadpoles being difficult to identify to species.

Tadpoles in pre-identified potential frog breeding sites should be surveyed by dip-netting. The types of habitat surveyed for tadpoles should reflect the breeding site preferences of the target species, ie. lentic waterbodies for Large Brown Tree Frogs, and pools in slow-flowing 1st-3rd order streams for Giant Burrowing Frogs.

Dip-netting can be done either during daytime or night time surveys, although tadpoles may be more active at night and more likely to be found in the water column rather than sheltering in litter or logs. Dip-nets should be dragged through water at a constant speed. Observers should record the number of dip-net sweeps and the time per sweep at each breeding site, to document survey effort. Number and length of dip-net sweeps will be dependent on the type of breeding site. If surveying pool habitats along a stream, tadpole sampling should be conducted in all pool habitats along approximately 500 m stream lengths, if available.

For large areas (e.g. dams, permanent streams) the net may be dragged along a transect. For small areas (e.g. pools, shallow creeks with obstructions) the net can be moved through the water column in a series of short sweeps of consistent speed (e.g. one metre sweep through the water at a speed of about one metre per second).

Samples should be taken from different depths in the water column (i.e. bottom, mid-water and surface) and from both near the bank and as far out as an observer can safely reach. Include sampling sweeps close to and under rocks, logs and other debris if possible.

Tadpoles should be placed in containers for identification, using keys such as Anstis (2018). Observers should be experienced or well-familiarised with all local frog species and the diagnostic features of their tadpoles at different stages. Tadpoles of some target species (ie. Giant Burrowing Frog) are relatively distinct, however distinguishing a Giant Burrowing Frog tadpole from other Limnodynastid species, such as *Limnodynastes dumerillii* and *L. peroni*, requires experience. However, for surveys at higher altitudes within the potential range of the Alpine Tree Frog, this species is the only hylid taxon likely to be encountered at such altitudes, making tadpole identification more straightforward.

Detailed, high quality photographs should be taken of tadpoles that observers have identified as a target species, or suspect may be a target species. Photographs should document lateral, dorsal and ventral views of tadpoles, and observers should keep careful record of which photos are attributable to which individual tadpoles and locations. Tadpoles not suspected to be of a target species do not need to be photographed.

Frog handling and hygiene protocols

These survey guidelines do not include detailed frog handling and hygiene protocols or advice on pathogen and disease management. The following precautionary procedures should be employed by all persons undertaking survey work, following Murray et al. (2011) and NSW DECC (2008):

- Spray bottles and tubs of pre-mixed disinfectant should be prepared. To achieve a dilution of 1% sodium hypochlorite, add 250 ml commercial bleach (4% sodium hypochlorite) to 750 ml water.
- thoroughly clean and disinfect footwear at the start of fieldwork and between each sampling site.
- thoroughly clean and disinfect nets, balances, callipers, bags, scalpels, headlamps, torches, wetsuits and waders etc between each sampling site.
- re-usable items should be in contact with wet bleach for at least one minute between sites.
- spray/flush vehicle tyres with a disinfecting solution in high risk areas where necessary.
- only handle frogs when necessary, and minimise the risk of pathogen transfer between frogs by:
 - cleaning or disinfecting hands between samples or using a new pair of disposable gloves for each sample, and

- Bags and gloves should not be reused. Dispose of these single-use items in a resealable plastic container.

1.8 Data reporting requirements

Data requirements are outlined in the Amphibian data sheet. FPSP data is to be reported in accordance with the procedures outlined in the SOP.

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