



Pre-Harvest Surveys – Targeted Species Survey Procedure

Version 2.0

31 March 2017

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1. General Information

Document Title	Pre-Harvest Surveys – Targeted Species Survey Procedure		
Version number:	2.0		
Description:	This document outlines VicForests procedures for undertaking Targeted Species Surveys for threatened species as part of VicForests Pre-Harvest Biodiversity Survey process for identifying threatened species in areas potentially affected by timber harvesting operations.		
Author:	Conservation Biologist		
Creation date:	February 2011		
Division, Business Unit	Stakeholders and Planning, Conservation and Research		
Document owner(s):	Manager Biodiversity Conservation and Research		
Review period (years)	2 years		
Review dates:	Last review date:	31/03/2017	Next review date: 31/03/2019

1.1. Approval

Approver	Position	Date
Lachlan Spencer	General Manager Planning	31 March 2017

2. Purpose

This Procedure outlines the recommended survey methods to be used by VicForests staff and/or contractors when undertaking Targeted Species Surveys in areas planned to be harvested.

3. Background

As part of VicForests framework for the management of biodiversity across Victoria's State Forest (Powell and Sedunary, 2012), VicForests undertakes Pre-Harvest Biodiversity

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Surveys in areas planned for harvest. The pre-harvest surveys undertaken by VicForests are complementary to the existing legislative framework governing sustainable forest management within Victoria's State forest. As a second step within this framework, Targeted Species Surveys provide an additional precautionary approach to enabling the detection and protection of threatened species within a subset of areas proposed for harvest. Detailed information regarding the process by which a coupe is identified as requiring a Targeted Species Survey is available within *VicForests Instruction – Pre-Harvest Biodiversity Surveys*.

4. Scope

This document is relevant to all staff or contractors engaged in undertaking Targeted Species Surveys for VicForests in coupes identified as requiring such a survey.

5. Procedure

5.1. Overview

The procedures outlined in this document set out the requirements for VicForests' Targeted Species Surveys. This includes information about survey methodologies to be used for target species, the minimum standards for field surveys, and requirements for recording of information and reporting of results. Development of the Targeted Species Survey methods follow best available science on survey methods for selected species.

The target species addressed in this document are generally cryptic in nature or more active nocturnally, and thus relatively difficult to identify. In addition, the probability of detection varies among species (DSE survey standards, 2011), so species-specific ecological and biological requirements must be taken into account when making decisions regarding survey effort and timing. VicForests' Targeted Species Survey procedures have been developed in conjunction with advice from species experts, advice from the DELWP, as well as peer-reviewed literature on the topic, resulting in the development of appropriate methods for target species surveys. VicForests also acknowledges that Targeted Species Surveys may yield valuable additional information about the presence of non-target threatened species, which will also be taken into consideration and reported on through this process.

The methods selected for VicForests Targeted Species Surveys are those that are well known, commonly used, effective and practicable for the species in question. The methods within this document have been assessed for their appropriateness and ability to detect target threatened species that occupy the forest areas within which VicForests operates. These methods will continue to be updated and refined in response to knowledge gained from surveys, ensuring an adaptive approach to threatened fauna management.

5.2. Survey Techniques

5.2.1. Walking Transects

Walking transects are a useful non-invasive method for the indirect detection of signs of presence and activity of a range of target species, including diurnal birds. This method also allows an opportunity to identify suitable habitat and evidence of occupancy that may subsequently be targeted by remote cameras, nocturnal spotlighting and active searches.

Walking transects will take place across fixed-width line transects of 2 ha, 400 x 50 m, and will be surveyed on foot at approximately 0.75 km/h. Conditions should be with little rain and

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take place during daylight hours. If the walking transect is aimed at a particular target species, then the transect should be placed in an area that will cover the potential preferred habitat of the target species, identified through desktop assessments (see [Section 7 – Targeted Species Survey Methods](#)). Otherwise transect placement can be determined before the survey begins and marked on 1:10,000 map where the transect begins and ends.

Habitat features and indirect signs of animal activity that should be searched and recorded include (but is not limited to):

- Potential denning and latrine sites used by spotted-tailed quoll (rocky outcrops, boulders and large fallen logs)
- Foraging and nesting signs of small burrowing mammals such as the Long-footed potoroo
- Feed trees used by greater gliders, yellow-bellied gliders and koalas
- Large hollow-bearing trees that may be used by possums, gliders, large forest owls and other birds
- Sign of owl activity such as whitewash, regurgitated pellets and prey remains under potential roost and nest trees
- Nests used by birds of prey
- Stands of allocasuarina and feeding sign of the Glossy Black Cockatoo
- Feathers, scat and any other sign that may be photographed or collected for identification purposes
- Streams and other water bodies that may be used by frogs, crayfish and native fish
- Burrows of burrowing and spiny crayfish

Equipment required:

- Navigation Equipment – GPS, map and datasheet to record location of transect and species detected.
- Binoculars and camera to obtain evidence of sign for identification purposes
- Sample bags to collect indirect animal sign

5.2.2. Remote Cameras

The use of remote digital cameras triggered by infrared movement, provide an excellent non-invasive survey method for the detection of many species. The minimum number of cameras and days of survey per site varies for different species, with the probability of detection significantly increasing with sampling effort (period of survey). The use of species-specific (or diet specific) baits to attract individuals to cameras results in this survey technique often being focused on one species or one trophic group of animals, however there are generally a range of opportunistic non-target species sightings recorded.

Setting cameras up in the field

Cameras should preferably be set up in suitable habitat for the species being targeted, in a location that is flat or gently sloping and clear of vegetation and ground cover, but shaded by tree cover. Ultimately, the location chosen for placement of cameras depends on the target species' habitat preference (see [Section 7 – Targeted Species Survey Methods](#)).

Bait stations should be located approximately 2.5 - 3 m from the camera. Any vegetation between the camera and the bait, 1 m behind and either side of the bait should be cleared or trimmed. If possible any objects that may obstruct the camera's view should be removed. It

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is also preferable to have easily identifiable features within the camera view, to ensure that any pictures can be easily verified to a specific site, if required.

Cameras should be fixed to a solid tree or stake that will not move in the wind, and the unit should face south to avoid direct sunlight.

Where more than 2 cameras are being used for a survey, cameras should be set at least 100 metres apart from each other to ensure a reasonable area is surveyed, however the minimum distance between cameras will depend on the target species' home range territory. For instance, as spotted-tailed quolls have a large home range (>1000 ha), cameras should be set 300 - 500 m apart to maximize coverage of the area that the species may utilize within their home range.

The height of the camera must be set at a height specific to the target species of the survey. Usually knee-high is sufficient to detect a range of small to medium sized species targeted by most camera surveys. Adjust the camera's position to ensure that the bait is in the centre of the detection zone. Check the SD memory card to ensure that the camera is working correctly. Once testing is complete set the camera to the desired mode.

Save the camera's exact location as a GPS coordinate onto the data record sheet and attach flagging tape approximately 5 m south of the camera to allow easy camera location detection on return. It is also useful to obtain photographic evidence of the camera set up as record of the habitat features surrounding the site.

Equipment required:

- Remote Cameras – Cameras should have camera mounting equipment (mounting straps) and camera accessories (digital memory card, high quality lithium batteries), the camera brand 'Hyperfire Reconyx' is preferred as the type of remote camera used.
- Bait station – Species specific bait (see below), rubber gloves, antibacterial hand wash, tools for establishment (e.g. Pole for attaching bait and bait container), pliers, hammer, tie wire, secateurs.
- Navigation – GPS (with an accuracy of <15 m) and map to record location of cameras, compass to determine orientation.

Baits:

In order to attract the target species to a camera station, species specific baits are to be used. The choice and placement of the bait depends on the target species of the survey (see [Section 7 – Targeted Species Survey Methods](#)).

Camera survey period:

While it is relatively easy to demonstrate the presence of a species at a given site, it is more difficult to determine if a species is truly absent, and not just absent during the period of surveying, or that the survey effort was not adequate enough to detect the species presence.

The camera survey deployment period for each species will depend on the home range size, dispersal ability, seasonal activity and population densities of the species being targeted. Observation periods with no detections may lead to uncertain results of absence unless there have been studies carried out using statistical models to determine the minimum number of survey days, and number of cameras required, to be reasonably sure that non-detection means that a species is in fact absent from a designated area. For example, a

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period of 21 - 30 days is sufficient to allow detection of the target species (Long-footed potoroo and spotted-tailed quoll) under optimal seasonal conditions (Nelson and Scroggie 2009).

5.2.3. Nocturnal Call Playback

Nocturnal call playback has been found to be a successful method for detecting a range of nocturnal birds, including various owl species (Loyn *et al.* 2001). Many owl species can be heard up to 1 - 2 km away and therefore, to reduce the chance that the same individual is recorded twice, play back sites must be at least 3 km apart. Nocturnal call playback can also be used to survey for some nocturnal arboreal marsupials such as the Yellow-bellied Glider, which is one of the most vocal Australian marsupial species (Goldingay 1994).

The location of call playback sites should optimise the chance of response (i.e. sites should be located somewhere that is relatively open where sounds are less likely to be muffled by dense vegetation or within a gully. Locate suitable habitat conditions for call playback station locations keeping in mind the limitations of equipment and topographic features that may reduce equipment capabilities. Windy and rainy nights should be avoided as they may inhibit the surveyor's ability to hear animal calls. Wind conditions greater than "3" on the Beaufort wind scale (see below) should be avoided for call playback surveys. Weather conditions are to be recorded for each survey and if not optimal at the time of surveying, the survey should be repeated on another night in better conditions.

Playback calls should be played on a good quality audio player and amplified through a 10 watt megaphone at 110% of natural volume. Vocalisations heard after the call playback should be recorded using a sound recorder for identification and verification purposes. Each call playback survey should begin with a listening period, which should be carried out at dusk (preferably half an hour before sunset), in calm weather when ambient noise is low. The dusk listening period should be carried out until a target species has been heard or for half an hour after the sun has set. Any vocalisations should be recorded on a voice recorder and a compass bearing of the approximate location and distance of calls heard ≤ 100 m of the observer should be recorded (DSE survey standards, 2011). Calls heard following playback surveys can often be triangulated to a position of origin. The estimated location should then be searched during the day to look for potential nests or roost sites.

The dusk listening period provides an opportunity to determine the presence of a species across its core habitat, however this method must be followed with a call playback survey. At each call playback survey station, each target species call should be played for 2 minutes followed by at least a 2 minutes listening period for a response. This routine is repeated only for one more call playback and listening session. IF no observations are recorded, move to the next survey station. If Powerful Owls are one of the target species, their call must be played first, as delayed responses are common in this species (Loyn *et al.* 2001). If Masked Owls are one of the target species, their call must be played at the end of the sequence, as this species often responds with just a single call, which could be obscured by other calls if played earlier on (Loyn *et al.* 2001). Playback should be immediately terminated once an owl response is heard and call play back sessions are to be followed by a 15 minute spotlight survey to search for individuals attracted to the call playback. Call playback sequences are to only be repeated once at each survey station on a given night if a response is not heard the first time.

When surveying for all target species using the nocturnal call playback method the following multi-species call sequence should be used:

1. Powerful Owl --- 2 mins

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2. Silence	--- 2 mins
3. Powerful Owl	--- 2 mins
4. Silence	--- 2 mins
5. Sooty Owl	--- 2 mins (6 territorial screams at 30 sec intervals)
6. Silence	--- 2 mins
7. Sooty Owl	--- 1 min (trilling)
8. Silence	--- 2 mins
9. Yellow-bellied glider	--- 2 mins
10. Silence	--- 2 mins
11. Yellow-bellied glider	--- 2 mins
12. Silence	--- 2 mins
13. Masked Owl	--- 2 mins (6 territorial screams at 30 sec intervals)
14. Silence	--- 2 mins
15. Masked Owl	--- 1 min (chattering)
16. Spotlight search	--- 15 mins

Beaufort wind scale

This scale outlines the method with which the wind speed should be determined to ensure that nocturnal call playback surveying isn't carried out on nights when the wind speed is greater than "3" on the scale.

- 0: calm (< 1 km/h); smoke rises vertically;
- 1: light air (1 - 5 km/h); wind direction shown by smoke-drift, but not by wind vanes;
- 2: light breeze (6 - 11 km/h); wind felt on face; leaves rustle; ordinary vanes moved by wind;
- 3: gentle breeze (12 - 19 km/h); leaves, twigs in constant motion; wind extends light flag;
- 4: moderate breeze (20 - 28 km/h); raises dust and loose paper; small branches are moved;
- 5: fresh breeze (29 - 38 km/h); small trees in leaf begin to sway; crested wavelets form on inland waters.

Equipment required:

- Audio player – with target species calls recorded in the correct sequence.
- Megaphone (10 - 15 W)
- Spotlight (30 - 50 W) or high (1000) lumen head torch
- Head torch - to allow accurate recording of information.
- Data record sheet
- Stop watch or device to measure time of calls/listening period.
- Sound recorder
- Binoculars and camera
- GPS

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5.2.4. Spot Light Transect Surveys

Spotlight transect surveys target a range of (generally arboreal) nocturnal animals such as arboreal marsupials, birds and amphibians. Spotlighting surveys are usually carried out following call playback surveys when multiple species are being targeted. Optimal conditions for spotlighting surveys include warm temps (>9 C), no rain, fog or bright moonlight and calm wind (< 15 km/h). Weather conditions are to be recorded for each survey and if not optimal at the time of surveying, the survey should be repeated on another night in better conditions.

Surveying should involve a slow, quiet walk (no slower than 500 m/hr) along a marked transect of total 1 km length and 50 m width (25 m either side of transect) for each coupe. If the spotlight survey is aimed at a particular target species, then the transect should be placed in an area that will cover the preferred habitat of the species (see Section 7). Depending on the dimensions of the coupe the 1km may be made up of a series of smaller transects (>100 m length, >100 m apart) to ensure representative coverage of the coupe. Where more than one transect is surveyed, adjacent transects should be surveyed simultaneously to avoid counting the same individual twice (DSE survey standards, 2011). Transects within coupes are limited to suitable and safe access at night. As an alternative, transects along roads adjoining coupes may be used if the habitat on the edge of the road is deemed to be suitable for the target species and is representative of the habitat present within the coupe being surveyed.

Spotlighting should be carried out by two observers using a 30 - 50 watt spotlight or head torch of equivalent brightness. Spotlighting can begin any time after dusk, as the time of night is known to have little influence on species detectability (Kavanagh and Peake 1993). However, some species are known to come out and forage earlier than others. For instance, yellow-bellied gliders tend to become active very soon after dusk, while greater gliders tend to be active later on in the night.

The time that transect surveys were conducted should be recorded. The location of the detected species should be estimated by recording the observer's GPS position and the perpendicular distance to the animal within the 25 m distance from the transect (for exceptions see section 7). Spotlighting transect tracks must also be saved on a GPS to allow evaluation of survey effort.

Where individuals are heard and not seen during a transect survey, location should be recorded (as above) for observations within 100 m of the transect and a follow-up search conducted once transects are completed. If subsequently seen or heard within 100 m of the observer, the observer's GPS position and an estimate of distance and compass bearing to the individual must be recorded.

Non-acceptable records of a species, which will not result in a positive sighting include those that are a brief glimpse of the target species and sightings of a species under poor visual conditions, even by an expert.

Equipment required:

- Spotlight – 50 watt or high lumen head torch
- Navigation – GPS and map to record location of transect and species detected
- Sound recorder to record unidentified vocalisations
- Head torch – to allow accurate recording of information
- Binoculars and camera to obtain visual evidence for identification

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5.2.5. Amphibian Surveys

Surveys should be carried out during the breeding season of the target species as they are often more active at this time, or immediately following significant rain events. As amphibian species are notoriously cryptic, in consultation with VicForests ecologists and research scientists, a scheme of survey techniques will be developed for each site to maximize the probability of detection.

Hygiene protocols must be carefully implemented when handling amphibians and moving between catchments in order to prevent the transmission of disease between animals and populations. For instance, single use unpowdered PVC gloves must be worn when handling individual animals and equipment and footwear must be sprayed with a 1% sodium hypochlorite solution when moving between sites. Vehicles must also be thoroughly washed between field trips to prevent the transmission of pathogens between catchments.

- **Driving surveys**

Calling individuals can sometimes be detected by driving slowly (5 - 20 km/h) and stopping every 200 m along roads within and beyond the survey area. If calls are heard, a GPS position, direction and distance of call should be recorded, followed by spotlighting (as above) to attempt to detect the calling individual/s.

- **Call Playback and Spotlight searches**

Potential breeding sites (i.e. stationary waterbodies such as forest fire dams, swamps, streamside pools, roadside ditches, and ephemeral streams) identified during daylight searches, spotlight transects or driving surveys should be surveyed after dark to listen for calling individuals (typically male frogs) of target amphibian species. On reaching the site, there should be a 5 minute listening period, followed by call playback specific to the species being targeted. The area should then be thoroughly searched for at least 10 minutes using a spotlight to look for non-calling individuals along stream banks and within streams and pools. Where possible, digital images of the species recorded should be taken and vocalisations recorded to facilitate species identification.

Additionally, sound recorders or songmeters may be deployed at potential breeding sites to record nocturnal calling individuals. This method may be particularly useful in areas identified as difficult to access on foot at night. Sound recorders could be deployed for the same time period as the remote cameras (minimum 21 days).

- **Tadpole surveys**

After the breeding season, potential breeding sites can also be surveyed for tadpoles using dip nets dragged along streams and waterbodies for approximately two minutes. Tadpoles should be placed in water-tight containers or snap-lock bags and forwarded to amphibian specialists for identification

Equipment required:

- Spotlight
- Megaphone and MP3 player with playback recordings
- Sound recorder or songmeter

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- Navigation – GPS and map to record location of transect and species detected.
- Head torch – to allow accurate recording of information.
- Digital camera to capture photographic evidence
- Dip-nets for catching tadpoles
- Water-tight containers or snap-lock bags for carrying tadpoles

5.2.6. Crayfish Surveys

- **Visual and Active Searches**

Potential crayfish habitat, such as streams and banks along creek beds should be visually searched during the day for burrowing activity and exoskeleton remains (in addition to Walking Transects, section 5.2.1). Burrowing crayfish can build burrows a distance from watercourses, therefore, diurnal active searches of streams and creek beds should also include areas of adjacent hillslope where conditions are suitable for crayfish burrows. Investigations under woody debris or rocky substrate should be conducted using a torch or may include burrow excavation (if ethics approved) to detect individuals which may be collected by hand and photographed for identification by crayfish experts. The diagnostic features that should be photographed are listed below. In addition, voucher specimens may be collected (if ethics approved) and forwarded to crayfish experts for more detailed analysis and identification. To maximize the probability of detection using active searching, minimum effort should include searching of a 200 m section for 30 minutes by two people. As crayfish are more active at night, searches can also be done after dusk if locations can be accessed. In consultation with VicForests ecologists and research scientists, a scheme of survey techniques will be developed for each site.

Equipment required:

- Spotlight
- Navigation – GPS and map to record location of transect and species detected.
- Head torch – to allow accurate recording of information.
- Digital camera to capture photographic evidence

Clear images of the following diagnostic features are required for accurate identification of crayfish species:

- Chelae – ventral, dorsal and side surfaces, including apical spines on propodus and dactylus.
- Merus – dorsal and ventral surfaces.
- Thorax – dorsal and side surfaces.
- Abdomen – dorsal and side surfaces.
- Dorsal surface of telson.

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- Male cuticle partition area.

5.2.7. Opportunistic Sightings/Additional Features to Record

In addition to the planned survey, any useful additional features found within the coupe or on the way to the coupe, as well as any opportunistic fauna sightings should be recorded. These features include; any live or dead specimens or any part of the animal including a sign that indicates their presence such as: calls, hair, feathers, skin, scats, diggings, nests, roosts and dens, latrine sites, sap feeding trees, bat tree roosts or bat cave roosts. Opportunistic sightings provide complementary information to the survey methods outlined above by providing information that may not be apparent within the desktop analysis of the environmental features of a coupe. The extent, and GPS coordinates of any features detected must be recorded to allow accurate management of features that require protection. If identification of features cannot be readily verified, photographic evidence or samples collected (scats, feathers, bones, etc...) should be forwarded to specialists for correct identification and verification.

6. Reporting

6.1. Data to Record and Issues for Consideration

For each coupe where a Targeted Species Survey is undertaken the following data must be recorded for each survey, during the survey or on the way to the survey any opportunistic sightings of threatened species must also be recorded:

- a) Date of survey (start and end date, for camera surveys).
- b) Survey start and end time.
- c) Surveyor(s) name.
- d) Name of the FMA.
- e) Coupe number & GPS coordinates or GIS boundary layer of the coupe location.
- f) GPS coordinates of survey location (camera placement, beginning/end of transects).
- g) Saved GPS tracks of diurnal and nocturnal surveys
- h) Description of locality (i.e. name and distance from the nearest road or track, creek etc.)
- i) GPS coordinates (Easting and Northing) of the location of the observer making the wildlife observation
- j) Compass bearing and estimated distance (in meters) to the location of the origination of the observation.
- k) Type of survey (method used).
- l) Weather conditions - wind (Beaufort scale) and night light (for nocturnal surveys)
- m) Number of individuals – number of individuals and observation type (vocal, visual, media) detected at each observation location.
- n) Records at locations with no observations.
- o) Opportunistic sightings (i.e. habitat features, numbers of species/individuals recorded and any additional features that may suggest target species presence).

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6.2. Sighting Reporting Process

All Targeted Species Survey results must be reported to VicForests' Biodiversity Conservation and Research team, who will coordinate their entry into *VicForests Threatened Species Detection Register* and forward on the information to DEWLP Forest Reports.

6.3. Survey Timing

Surveys should aim to be conducted at the most appropriate time (day, night, season) to ensure the best chance of identifying the target species (see survey period details for each target species in section 7).

6.4. Experience of Surveyor

VicForests will ensure that any persons undertaking Targeted Species Surveys have the relevant training and experience, which may include one or more of the following:

- i. Experience and training in undertaking fauna or flora surveys.
- ii. Experience in the field identification of fauna or flora, in particular in relation to the identification of threatened species and the relevant habitats in which they occur.
- iii. Relevant tertiary qualifications.

7. Target Species Survey Methods

The information in the following pages provides instruction on how to carry out VicForests Targeted Surveys for each potential target species, including features that, when detected, constitute a positive species presence result. The survey methods set out specific guidelines regarding the targeted species survey trigger, as per *VicForests Pre-harvest Biodiversity Survey Instruction* (Table 2), preferred survey method, the sampling effort required, the period within which the survey should take place, the habitat requirements as well as any additional information related to surveying each potential target species. For some species an actual sighting of an individual or minimum number of individuals is required before the species can be deemed “present”. In other cases, the sighting of specific habitat features or signs of activity by the species is enough to generate a positive presence report (DSE survey standards 2011; Specific Species Action Statements). For instance, obvious nesting sites of large forest owls or birds of prey, regurgitated pellets and species-specific scat, which can be sent to species experts for conclusive identification.

7.1. Greater Glider (*Petauroides volans*)

Targeted Species Survey Trigger	Preferred Survey Method(s)	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Spotlight Transect Survey	5 ha	>2 individuals per hectare	East Gippsland	(EPBC) – Vulnerable (FFG) – N/A (DELWP) – Vulnerable
		1 km transect walked no slower than 500 m/hr	>10 individuals per 1 km		
		60 minutes of spotlighting	>15 individuals per hour		

Species Description:

The nocturnal Greater Glider is the largest of the gliding possums and is distinguished by its dark grey, cream or mottled cream and grey fur with cream fur on its underside. This species also has a long furry tail and very large furry ears (VanDyck and Strahan 2008). Breeding takes place from late Summer to Autumn (Feb - May). Greater Gliders are relatively sedentary, do not vocalize and have very bright eye-shine.

Preferred Habitat:

Greater Gliders are selective folivores (Table 1), which occupy a range of eucalyptus-dominated habitats, ranging from low open forests on the coast to tall forests in montane regions. They are most abundant in high altitude mixed species tall forest, but also occur in coastal forests where preferred feed tree species are available. The species does not penetrate rainforest and requires large hollow bearing trees for resting and nesting during the day.

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Recommended Targeted Survey Methodology for Greater Glider

Survey Effort: Spotlight surveys are the most practical method to detect this species. As for all spotlight transect surveys, the survey area for the Greater Glider should total a 1 km distance and 50 m width (25 m either side of the transect). However, because of its sedentary behaviour and bright eye-shine, the species can be detected at distances >25 m with good accuracy (dependent on site attributes). Thus, visual records between 25 - 100 m should be recorded for the species when found. Surveys should be conducted well after dusk as this species tends to come out later in the night compared to some other nocturnal species. Surveys are best conducted when temperatures are warm (>9 C), with no rain, fog or bright moonlight. Wind should be calm (<15 km/h).

Survey Period: Surveys should be carried out during the warmer months from Spring to Autumn focusing a greater effort on the breeding season when Greater Gliders are likely to be more active. In Spring and Autumn, transect surveys should be repeated twice (on different nights) under optimal conditions (DSE survey standards 2011).

Other methods or features that may result in a species management action:

Walking transects that have identified large old trees with large hollows (preferably spouts) high up in the tree, a possible habitat feature to focus on during the survey effort.

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7.2. Yellow-bellied Glider (*Petaurus australis*)

Targeted Species Survey Trigger	Preferred Survey Method	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Dusk listen and nocturnal call playback followed by spotlight survey	Dusk listen: 10 minutes Call Playback: multi-species call playback sequence soon after dark Spotlight Survey: 1 km transect walked no slower than 500 m/hr	High density >5 individuals sighted per 1 km High Density >7 individuals sighted per hour	East Gippsland Horsham Otway Portland	(EPBC) – N/A (FFG) – N/A

Species Description:

The nocturnal Yellow-bellied Glider (YBG) is a medium sized possum. This species has grey fur and distinctive black dorsal stripe extending through the tail. Adults have a distinctive yellow belly (young have a white belly), with black markings on the feet, obliquely on the thigh and along the edge of the gliding membrane, ears are large and furless (VanDyck and Strahan 2008). Yellow-bellied Gliders breed from Spring to early Summer, but may be active all year round. YBGs tend to come out soon after dusk and are very vocal and active when foraging.

Preferred Habitat:

Areas that contain large hollow bearing trees in tall, mature eucalypt forest and a mixture of preferred feed trees (see Table 1), including Winter-flowering eucalypts.

Recommended Targeted Survey Methodology for Yellow-bellied Glider

Survey Effort: Surveying should involve a 10 minute dusk listen, followed by a multi-species call playback, which may include YBG calls. YBGs often respond well when owl calls are played as they are highly territorial. Call-playback should then be followed by a spotlight survey involving a slow, quiet walk (no slower than 500 m/hr) along a marked transect of total 1 km length, 200 m width (100 m either side) through areas of suitable habitat. The survey detection distance is increased for the species because of its propensity to loud vocalisations and spotlight-shyness resulting in predominantly aural detections (DSE survey standards, 2011). Surveys are best conducted when temperatures are warm (>9 C), with no rain, fog or bright moonlight. Wind should be calm (<15 km/h).

Pre-Harvest Surveys – Targeted Species Survey Procedure

Survey Period: Although surveys can be carried out across all seasons, they are best done during the warmer months from Spring to Autumn and during the breeding season when YBGs are likely to be more active.

Other methods or features that may result in a species management action:

Yellow-bellied Gliders are known to feed on the sap of various eucalyptus species (Table 1), using their oversized incisor teeth to make distinctive cuts into the trunk of the trees they feed on. These incisions often make a distinctive 'V' shapes, indicating their presence, but these markings are not enough on their own to result in a positive presence record. Feeding sign may however identify areas of suitable habitat that should be surveyed at night.

Pre-Harvest Surveys – Targeted Species Survey Procedure

Table 1 Examples of Greater Glider and Yellow-bellied Glider preferred tree species in South-eastern Australia.

Preferred Glider Feed Tree species		Greater Glider	Yellow-bellied Glider
<i>A. mabellae</i>	Mabel's wattle		X
<i>A. mearnsii</i>	Black wattle		X
<i>C. gummifera</i>	Bloodwood	X	X
<i>C. maculata</i>	Spotted gum	X	X
<i>E. angophoroides</i>	Apple-top box		X
<i>E. bosistoana</i>	Coast grey box		X
<i>E. botryoides</i>	Southern mahogany	X	X
<i>E. camphora</i>	Mt swamp gum	X	
<i>E. cypellocarpa</i>	MT grey gum	X	X
<i>E. dalrympleana</i>	Mt white gum	X	X
<i>E. delegatensis</i>	Alpine Ash	X	
<i>E. dives</i>	Broad leaved peppermint	X	
<i>E. fastigata</i>	Cut tail ash/brown barrel	X	X
<i>E. globoidea</i>	W stringybark	X	
<i>E. muelleriana</i>	yellow stringybark	X	
<i>E. nitens</i>	Shining gum	X	
<i>E. obliqua</i>	Messmate		X
<i>E. ovata</i>	swamp gum	X	X
<i>E. pilularis</i>	Blackbutt	X	X
<i>E. punctata</i>	Grey Gum		X
<i>E. radiata</i>	narrow leaf peppermint	X	
<i>E. rubida</i>	Candlebark gum	X	
<i>E. sclerophylla</i>	Hard-leaved scribbly gum		X
<i>E. viminalis</i>	Manna gum	X	X
<i>E. teretricornis</i>	Gippsland Red gum	X	

Pre-Harvest Surveys – Targeted Species Survey Procedure

7.3. Leadbeater's Possum (*Gymnobelideus leadbeateri*)

Targeted Species Survey Trigger	Preferred Survey Method(s)	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 2	Walking Transect Survey	3 hectares	Presence of species habitat: Zone 1A (Regrowth Ash Forest with 10 live hollow bearing trees per 3 ha) Zone 1B (Regrowth Ash Forest with >12 live or dead hollow bearing trees per 3 ha combined with a basal area >5 m ² of Acacia species over a minimum area of 10 ha)	Central Central Gippsland (Noojee only) Dandenong	(EPBC) – Critically Endangered (FFG) – Listed as Threatened (DELWP) – Critically Endangered
	Remote Camera Survey	3 cameras, 100 m apart over a minimum period of 28 days	Verified Sighting of an individual		

Species Description:

Leadbeater's Possum is a small omnivorous arboreal marsupial distinguishable by its grey to greyish brown fur and prominent dark mid dorsal stripe with a pale cream underside. This species lacks a gliding membrane and has a club shaped tail which is slightly broadened at the tip (VanDyck and Strahan 2008).

Preferred Habitat:

Areas that contain numerous large hollow-bearing trees for nesting and connectivity in the mid-storey to facilitate movement and foraging. Presence of Acacia as a food source is also an important habitat component.

Recommended Targeted Survey Methodology for Leadbeater's Possum Habitat

Walking Transect:

Survey Effort: Surveying involves walking of coupe areas to identify and exclude Leadbeater's Possum habitat as per the Action Statement and Forest Management Plan and *VicForests Guideline for the Identification and Protection of Leadbeater's Possum Habitat*.

Survey Period: All year.

Pre-Harvest Surveys – Targeted Species Survey Procedure

Recommended Targeted Survey Methodology for Leadbeater's Possum Colony Presence

Remote Camera Surveys:

Bait: Golden syrup

Survey Effort: 3 cameras positioned approximately 100 m apart over a minimum period of 28 days. Cameras should be positioned by suitably trained arborists in trees 3 - 20 m above the ground. The height of camera should be based on positioning the camera in areas adjacent to connectivity in the vegetation of the mid-story (where the possum is most likely to be moving through their environment to forage), facing the bait feeder. Further information regarding the survey approach are available in *VicForests Instruction – Leadbeater's Possum Pre-harvest Survey Process*.

Survey Period: Surveys can be carried out across all seasons.

Other methods or features that may result in a species management action:

Stag-watching may be used to identify and confirm actual sightings of the species. While thermal imaging cameras and call playback methods as described by Lumsden et al. (2013) are also some of the commonly used methods for the detection of individuals/colonies of this species.

Pre-Harvest Surveys – Targeted Species Survey Procedure

7.4. Powerful Owl (*Ninox strenua*)

Targeted Species Survey Trigger	Preferred Survey Method	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Dusk listen followed by Nocturnal call Playback and Spotlight Survey	Dusk listen: 10 min Call Playback: Multi-species call playback Spotlight Survey: 1 km transect walked no slower than 500 m/hr	Presence of nest or roost site	All	(EPBC) – N/A (FFG) – Listed as Threatened (DELWP) – Vulnerable
			Sighting of an individual or breeding pair		

Species Description:

Powerful Owls are the largest Australian owl species and are characterised by large, bright-yellow, forward facing eyes. Males are larger than females, both sexes are mottled dark grey-brown above and white below with feathered tarsus and dull-yellow feet. They are territorial, have very large home ranges, are long-lived and breed in winter.

Preferred Habitat:

Found in a range of forest and woodland types, most often in mixed-species foothill forests, but may occupy logged-unlogged mosaics if gullies are retained. The Powerful owl favours dense gullies for roosting and breeding and prefers older forests with large tree hollows for nesting, and where abundant arboreal prey items exist (Greater Gliders, ringtail possums). Powerful owls don't tend to occur in very wet forest or rainforest, where they are replaced by Sooty owls.

Recommended Targeted Survey Methodology for Powerful Owls

Survey Effort: Surveying should involve a 10 minute dusk listen as owls tend to give a single call as they leave their roost to forage at night, especially during breeding. The listening period should be followed by a multi-species call playback at 110% natural volume soon after dusk, with the powerful owl call played first as they can take a while to respond. Call-playback should then be followed by a spotlight survey involving a slow, quiet walk (no slower than 500 meters per hour) along a marked transect of 1 km to look for owls that may have responded to the playback. Because Powerful Owls can be heard from a distance of 1-2 km, care must be taken to ensure an individual is not counted twice where multiple transects are laid out across a coupe. As surveys are often done in conjunction with glider surveys, they are best conducted when temperatures are warm (>9C), with no rain, fog or bright moonlight. Wind should be calm (<15 km/h).

Pre-Harvest Surveys – Targeted Species Survey Procedure

Survey Period: Surveys to detect Powerful owls are most effective at the start of the breeding season (May - June) when the adults are active looking for next sites and then again in Spring (Oct - Dec) when young owls fledge the nest and roost nearby. Surveys should not be done late in the breeding season (July - Sep) as they may disturb females tending to their eggs in the nest. In Spring and late Autumn, surveys should be repeated twice at the same location (on different nights) under optimal conditions (DSE survey standards 2011).

Other methods or features that may result in a species management action:

Verified sightings of individuals through daytime surveys may lead to nesting or roosting sites. Calls heard following playback surveys can often be triangulated to a position of origin. The estimated location should then be searched during the day to look for potential nests or roost sites.

7.5. Sooty Owl (*Tyto novaehollandiae*)

Targeted Species Survey Trigger	Preferred Survey Method	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Dusk listen followed by call playback and spotlight survey	Dusk listen: 10 min Call Playback: multi-species call playback Spotlight Survey: 1 km transect walked no slower than 500 m/hr	Presence of nest or roost site	All	(EPBC) – N/A (FFG) – Listed as Threatened
			Sighting of an individual or breeding pair		

Species Description:

Sooty Owls are medium-large dark owls with short round wings, a very short tail and huge forward facing black eyes set in a discrete rounded facial disc. The feathers of the upper body are often sooty black with less dark underparts that are specked with white. They are territorial, have large home ranges and have variable breeding seasons in Autumn-Winter and early Spring.

Preferred Habitat:

Occurs in closed forests (rainforest), tall open forest and some open forests across a range of EVC's. They favour wetter sites with gullies and hollow-bearing trees for nesting. They roost in dense shrubby vegetation (i.e., silver wattle, blanket leaf, cherry balart), tree-fern crowns, caves, and ledges or crevices on rock faces.

Recommended Targeted Survey Methodology for Sooty Owls

Survey Effort: Surveying should involve a 10 minute dusk listen sessions at the beginning of the survey as owls tend to give a single call as they leave their roost to forage at night, particularly during breeding. The listening period should be followed by a multi-species call playback at 110% natural volume soon after dusk. Call-playback should then be followed by a spotlight survey involving a slow, quiet walk (no slower than 500 meters per hour) along a marked transect of 1km to look for owls that may have responded to the playback. As surveys are often done in conjunction with glider surveys, they are best conducted when temperatures are warm (>9 C), with no rain, fog or bright moonlight. Wind should be calm (<15 km/h). Because Sooty Owls can be heard from a distance of 1 - 2 km, care must be taken to ensure an individual is not counted twice where multiple transects are laid out across a coupe.

Pre-Harvest Surveys – Targeted Species Survey Procedure

Survey Period: Surveys can be carried out across all seasons for this species, however, they will be more active and easier to detect when breeding. Ideally, surveys at the same site should be conducted at least twice under optimal conditions, in Spring and in late Autumn (DSE survey standards 2011).

Other methods or features that may result in a species management action:

Verified sightings of individuals through daytime surveys may lead to nesting or roosting sites. Calls heard following playback surveys can often be triangulated to a position of origin. The estimated location should then be searched during the day to look for potential nests or roost sites.

Pre-Harvest Surveys – Targeted Species Survey Procedure

7.6. Masked Owl (*Tyto tenebricosa*)

Targeted Species Survey Trigger	Preferred Survey Method	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Dusk listen followed by Call Playback and Spotlight Survey	Dusk listen: 10 min	Verified nesting or roost site	All	(EPBC) – N/A (FFG) – Listed as Threatened (DELWP) – Endangered
		Call Playback: Multi-species call playback	Sighting of a breeding pair		
		Spotlight Survey: 1 km transect walked no slower than 500 m/hr			

Species Description:

Masked Owls have a range of colour morphs across Australia ranging from blackish-brown on parts and densely speckled white, with densely speckled white. The facial disk is prominent and often off white, with large forward facing black eyes. They have large feet and feathered legs. They are territorial, have large home ranges and have variable breeding seasons in Autumn-Winter and early Spring.

Preferred Habitat:

Inhabits a wide variety of lowland forests and woodlands that have hollow bearing trees. Tends to inhabit dense gullies for roosting and breeding sites. They tend to favour ecotones between closed and open forest and can live near cleared or agricultural land which they can forage in

Recommended Targeted Survey Methodology for Masked Owls

Survey Effort: Surveying should involve a 10 minute dusk listen session as owls tend to give a single call when they leave their roost to forage at night, particularly during breeding. The listening period should be followed by a multi-species call playback at 110% natural volume soon after dusk, with the masked owl call played last. Call-playback should then be followed by a spotlight survey involving a slow, quiet walk (no slower than 500 meters per hour) along a marked transect of 1 km to look for owls that may have responded to the playback. As surveys are often done in conjunction with glider surveys, they are best conducted when temperatures are warm (>9 C), with no rain, fog or bright moonlight. Wind should be calm (<15 km/h). Because Masked Owls can be heard from a distance of 1 - 2 km, care must be taken to ensure an individual is not counted twice where multiple transects are laid out across a coupe,.

Pre-Harvest Surveys – Targeted Species Survey Procedure

Survey Period: Surveys can be carried out across all seasons for this species, however, they will be more active and easier to detect when breeding. Ideally, surveys at the same site should be conducted at least twice under optimal conditions, in Spring and in late Autumn (DSE survey standards 2011).

Other methods or features that may result in a species management action:

Verified sightings of individuals through daytime surveys may lead to nesting and roosting sites. Calls heard following playback surveys can often be triangulated to a position of origin. The estimated location should then be searched during the day to look for potential nests or roost sites.

Pre-Harvest Surveys – Targeted Species Survey Procedure

7.7. Koala (*Phascolarctos cinereus*)

Targeted Species Survey Trigger	Preferred Survey Method(s)	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 3	Walking Transect Survey	Fixed-width line transect of 2 ha (400 x 50 m at 0.75 km/h)	Verified Sighting of a resident or high-density population	Benalla-Mansfield East Gippsland Central Gippsland Otways	(EPBC) – N/A (FFG) – N/A (DELWP) – N/A

Species Description:

Koalas are Australia's largest arboreal mammal. The species is characterised by woolly grey fur and a white-ish underbelly.

Preferred Habitat:

Occupy a range of forest types from tall eucalypt forests to open woodlands. Their occupancy of a site is dependent on the presence of their feed trees (For example, Blue gum - *Eucalyptus globulus* and Mana gum - *Eucalyptus viminalis*).

Recommended Targeted Survey Methodology for Koalas

Walking Survey:

Survey Effort: Walking transects will take place across fixed-width line transects of 2 ha, 400 x 50 m, and will be surveyed on foot at approximately 0.75 km/h. Conditions should be with little rain and take place during daylight hours.

Survey Period: Surveys can be carried out across all seasons for this species.

Other methods or features that may result in a species management action:

Verified sightings of individuals through spotlight surveys may result in a positive presence record.

Pre-Harvest Surveys – Targeted Species Survey Procedure

7.8. Long-footed Potoroo (*Potorous longipes*)

Targeted Species Survey Trigger	Preferred Survey Method(s)	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Remote Camera Survey	2 cameras (100m apart) across a minimum area of 22 ha for a period of at least 21 days	Verified Sighting of an Individual	Benalla-Mansfield East Gippsland North East Tambo	(EPBC) – Endangered (FFG) – Listed as Threatened (DELWP) – Vulnerable

Species Description:

The Long-footed Potoroo is a medium sized rat-kangaroo distinguished from other Potoroo species by its long hind foot (which is longer than the head of this species). They are known to breed throughout the year (VanDyck and Strahan 2008), but have a main breeding season in the Spring.

Preferred Habitat:

This species occurs in a range of EVC's, particularly in wet and damp EVC's and riparian forest. Preferred sites are characterised by sheltered aspects, moist soils, mixed species overstorey and a dense understorey.

Recommended Targeted Survey Methodology for Long-footed Potoroo

Bait: Oats, peanut butter, golden syrup and pistachio essence rolled into balls placed in a tea strainer or similar bait holder.

Survey Effort: 2 cameras across a minimum area of 22 ha for a period of at least 21 days. Studies carried out on this species found that the probability of detecting Long-footed Potoroos at an occupied site, with 2 remote cameras (set approximately 100 m apart) deployed for 21 days was close to 100% (Lumsden et al. 2010). Areas where potoroo activity such as diggings and burrows are detected during daylight walking transects should be targeted for positioning remote cameras.

Survey Period: Surveying for this species can take place at any time of the year, although spring is optimal.

Other methods or features that may result in a species management action:

There are no other features that can be used to record a positive species presence unless an individual is clearly observed and identified during remote camera survey, or opportunistically during a walking transect or spotlight survey. Accurate identification during walking transects or spotlight surveys can be very difficult however, therefore adequate evidence of such a sighting must be provided before it will be used as evidence of presence.

Pre-Harvest Surveys – Targeted Species Survey Procedure

7.9. Spot-tailed Quoll (*Dasyurus maculatus*)

Targeted Species Survey Trigger	Preferred Survey Method	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Remote Camera Survey	2 cameras (500 m apart) per 100 ha over a period of minimum 21 days	Verified Sighting of an individual	East Gippsland Tambo Central Gippsland	(EPBC) – Endangered (FFG) – Listed as Threatened
	Walking Transect Survey	200 m per 10 ha	Presence of latrine or den sites		

Species Description:

This wide ranging species is the largest carnivorous marsupial in Victoria. Individuals are identified by white spots on light to very dark brown fur on their body and tail. Their breeding season is generally between 1 May and early August (VanDyck & Strahan 2008).

Preferred Habitat:

Spot-tailed Quolls occur across a wide range of forest types. Habitat complexity is important to this species, so areas where there is a complex under and overstorey with abundant rocks, rocky escarpments and fallen logs for den sites are likely habitat. They are also known to occupy gullies, drainage lines and escarpments. This species uses latrine sites, which are likely to be located on top of boulders, logs and in and around rocky outcrops.

Recommended Targeted Survey Methodology for Spot-tailed Quolls

Bait: Chicken drumstick or Maryland, together with pilchards placed within a small cage (tuna oil poured at the base of the bait can increase the chance of detection).

Survey Effort: 2 cameras set 500 m apart per 100 ha area over a minimum 21 days (Nelson *et al.* 2010a), in suitable Quoll habitat.

Survey Period: To maximize rates of detection, surveys should take place during the breeding season (May - August) when they are most active.

Other methods or features that may result in a species management action:

The confirmed presence of Spot-tailed Quoll active latrine or active den sites is adequate for recording a positive detection of this species. Active sign at these important sites requires verification with species experts. Spot-tailed Quoll scats have a strong and distinctive odour and are deposited as isolated scats, or in communal defecation sites called latrines, often in exposed areas like rock ledges. This species shelters and rears their young in

Pre-Harvest Surveys – Targeted Species Survey Procedure

dens. Den sites are often located within rocky outcrops, caves, rock crevices, hollow logs, tree hollows and rabbit and small wombat burrows (VanDyck and Strahan 2008).

Pre-Harvest Surveys – Targeted Species Survey Procedure

7.10. Large Brown Tree Frog (*Litoria littlejohni*)

Targeted Species Survey Trigger	Preferred Survey Method(s)	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Diurnal search for potential breeding sites and tadpoles	10 minutes per site dipnet drag for 2 min	Verified Sighting of an individual	Central Gippsland (Erica, Heyfield, Yarram) East Gippsland Tambo	(EPBC) – N/A (FFG) – Listed as Threatened (DELWP) – Endangered
	Active search via spotlight and call playback at potential breeding sites	10 minutes per site			
	Deployment of sound recorder or songmeter at potential breeding sites if appropriate	The same time period used for remote camera deployment can be used			
	Slow drive at night to listen for calls	5-15 km/h for 10 minutes stopping every 200 m			

Species Description:

Large Brown Tree Frogs are pale brown on the dorsal surface, with dark speckles and a broad, sometimes indistinct, dark brown band running from the head to the vent (Barker *et al.* 1995, White *et al.* 1994). The ventral surface is white or cream and there are bright orange patches on the groin, armpit and back of the thighs (Barker *et al.* 1995, White *et al.* 1994). There is also a narrow dark brown to black band running from the nose past the eyes to the shoulder (Barker *et al.* 1995, White *et al.* 1994). Large Brown Tree Frog tadpoles are black or very dark grey, grow to 65 mm in length and can be distinguished from other tadpoles of the *Litoriae wingii* complex by their large size and dark colour. The breeding season extends from Autumn to early Spring.

Pre-Harvest Surveys – Targeted Species Survey Procedure

Preferred Habitat:

Little is known about the preferred habitat of this species in Victoria. The majority of records are from wet sclerophyll forests away from the coast. Breeding is known to occur in stationary and ephemeral water bodies such as road side ditches, fire dams, ponds, swamps, oxbow lakes, rain filled tree stumps and log.

Recommended Targeted Survey Methodology for Large Brown Tree Frog

Survey Effort: Diurnal searches should target potential breeding sites and waterbodies, which should be searched for 10 minutes and include dragging a dip net for 2 minutes to capture any tadpoles that may be present. Sound recorders or songmeters may be deployed at potential breeding sites to detect nocturnal calling individuals. These may be set up for the same time period as the remote cameras (minimum 21 days) and may be particularly important if night access to sites is deemed to be restricted or unsafe. If safe to do so, active nocturnal searches will consist of searching the suitable habitat of this species for 10 minutes, followed by call playback of the same species. If a call is heard responding to the playback, the surrounding area should be searched for another 10 minutes. Digital images of the species recorded should be taken to facilitate species identification. As this species is highly elusive, it is recommended that multiple methods be used over multiple days to increase the probability of detection (DSE survey standards 2011).

Hygiene protocols must be carefully implemented when handling amphibians and moving between catchments in order to prevent the transmission of disease between animals and populations. For instance, single use PVC gloves must be worn when handling individuals and equipment and footwear must be sprayed with a 1% sodium hypochlorite solution. Vehicles must also be thoroughly washed between field trips to prevent the transmission of pathogens between catchments.

Survey Period: Surveys for adult frogs should be carried out during the breeding season (Apr - Aug) when males are likely to be calling and after significant rain events. Surveys for tadpoles should be carried out in Spring when they are likely to be present at breeding sites.

Other methods or features that may result in a species management action:

Verified sightings of individuals through walking or driving surveys or identification of tadpoles may result in a positive presence record.

Pre-Harvest Surveys – Targeted Species Survey Procedure

7.11. Giant Burrowing Frog (*Heleioporus australiacus*)

Targeted Species Survey Trigger	Preferred Survey Method(s)	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Diurnal search for potential breeding sites and tadpoles	10 minutes per site dipnet drag for 2 min	Verified Sighting of an individual	Central Gippsland (Erica, Heyfield, Yarram) East Gippsland Tambo	(EPBC) – Vulnerable (FFG) – Listed as Threatened (DELWP) – Critically Endangered
	Active search via spotlight and call playback at potential breeding sites	10 minutes per site			
	Deployment of sound recorder or songmeter at potential breeding sites if appropriate	The same time period used for remote camera deployment can be used			
	Slow drive at night to listen for calls	5-15 km/h for 10 minutes stopping every 200 metres			

Species Description:

The Giant Burrowing Frog is a large species of frog with a maximum body length of 100 mm. Body colour is chocolate brown above and white beneath with scattered yellow spots, usually capping warts, on the flanks and around the cloaca. The underside is usually smooth and white. They breed from February to June.

Preferred Habitat:

Pre-Harvest Surveys – Targeted Species Survey Procedure

Prefer a variety of forest types, woodland and heathland and known to use small flowing streams as breeding sites, they are also known to shelter in burrows. There have been numerous records of this species far from water bodies, where they are known to spend the majority of their time (Penman *et al.*, 2008).

Recommended Targeted Survey Methodology for Giant Burrowing Frog

Survey Effort: Diurnal searches should target potential breeding sites and waterbodies, which should be searched for 10 minutes and include dragging a dip net for 2 minutes to capture any tadpoles that may be present. Sound recorders or songmeters may be deployed at potential breeding sites to detect nocturnal calling individuals. These may be set up for the same time period as the remote cameras (minimum 21 days) and may be particularly important if night access to sites is deemed to be restricted or unsafe. If safe to do so, active nocturnal searches will consist of searching the suitable habitat of this species for 10 minutes, followed by call playback of the same species. If a call is heard responding to the playback, the surrounding area should be searched for another 10 minutes. Digital images of the species recorded should be taken to facilitate species identification. As this species is highly elusive, it is recommended that multiple methods be used over multiple days to increase the probability of detection (DSE survey standards 2011).

Hygiene protocols must be carefully implemented when handling amphibians and moving between catchments in order to prevent the transmission of disease between animals and populations. For instance, single use PVC gloves must be worn when handling individuals and equipment and footwear must be sprayed with a 1% sodium hypochlorite solution. Vehicles must also be thoroughly washed between field trips to prevent the transmission of pathogens between catchments.

Survey Period: Surveys for adult frogs should be carried out during the breeding season (Feb - Jun) when males are likely to be calling and after significant rain events.

Other methods or features that may result in a species management action:

Verified sightings of individuals through walking or driving surveys or identification of tadpoles may result in a positive presence record.

Pre-Harvest Surveys – Targeted Species Survey Procedure

7.12. Southern Barred Frog (*Mixophyes balbus*)

Targeted Species Survey Trigger	Preferred Survey Method	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Diurnal search for potential breeding sites and tadpoles	10 minutes per site dipnet drag for 2 min	Verified Sighting of an individual	East Gippsland	(EPBC) – Vulnerable (FFG) – Listed as Threatened
	Active search via spotlight and call playback at potential breeding sites	10 minutes per site			
	Deployment of sound recorder or songmeter at potential breeding sites if appropriate	The same time period used for remote camera deployment can be used			
	Slow drive at night to listen for calls	5-15 km/h for 10 minutes stopping every 200 m			

Species Description:

The Southern Barred Frog is a large species that is brown above blending to pale yellow underneath, with irregular shaped blotches between the eyes to half way down the back. This species has mid to dark brown bars on at least the hind limbs and have a dark line running from the eye. The eye has a blue crescent under the upper lid. The breeding season extends from Spring to Autumn.

Pre-Harvest Surveys – Targeted Species Survey Procedure

Preferred Habitat:

The Southern Barred Frog is found in wet gullies and streams in rainforest and wet forest. It nests in shallow running water. Males call from under leaf litter or within holes near water. They are associated with permanent streams through temperate rainforest and wet sclerophyll forest.

Recommended Targeted Survey Methodology for Southern Barred Frog

Survey Effort: Diurnal searches should target potential breeding sites and waterbodies, which should be searched for 10 minutes and include dragging a dip net for 2 minutes to capture any tadpoles that may be present. Sound recorders or songmeters may be deployed at potential breeding sites to detect nocturnal calling individuals. These may be set up for the same time period as the remote cameras (minimum 21 days) and may be particularly important if night access to sites is deemed to be restricted or unsafe. If safe to do so, active nocturnal searches will consist of searching the suitable habitat of this species for 10 minutes, followed by call playback of the same species. If a call is heard responding to the playback, the surrounding area should be searched for another 10 minutes. Digital images of the species recorded should be taken to facilitate species identification. As this species is highly elusive, it is recommended that multiple methods be used over multiple days to increase the probability of detection (DSE survey standards 2011)

Hygiene protocols must be carefully implemented when handling amphibians and moving between catchments in order to prevent the transmission of disease between animals and populations. For instance, single use PVC gloves must be worn when handling individuals and equipment and footwear must be sprayed with a 1% sodium hypochlorite solution. Vehicles must also be thoroughly washed between field trips to prevent the transmission of pathogens between catchments

Survey Period: Surveys for adult frogs should be carried out during the breeding season (Sep - May) when males are likely to be calling and after significant rain events.

Other methods or features that may result in a species management action:

Verified sightings of individuals through walking or driving surveys and identification of tadpoles may result in a positive presence record.

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7.13. Orbost Spiny Crayfish (*Eustaceus diversus*)

Targeted Species Survey Trigger	Preferred Survey Method	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Active searching by day or night	200 metres for 30 min by 2 people	Verified Sighting of an individual	East Gippsland	(EPBC) – N/A (FFG) – Listed as Threatened (DELWP) – Endangered

Species Description:

The Orbost Spiny Crayfish (Orbost Spiny Freshwater Crayfish) is a small freshwater crayfish. Distinguished by spines on its exoskeleton, with one or two marginal squamal spines and the absence of dorsal thoracic spines. This species is olive green in colour and is of the smallest species of its genera. Breeding season is from Spring to early Summer.

Preferred Habitat:

Found in streams/rivers/creeks and surrounding waterways, known to venture onto land in and round very moist riparian areas.

VicForests Survey Methodology for Orbost Spiny Crayfish

Survey Effort: Visual and active searching is to be carried out in conditions when turbidity is low, in suitable habitat. Searches will cover a minimum of 200 metres of suitable habitat for at least 30 minutes by 2 people. Surveyors should search for burrowing activity, exoskeleton remains and individual crayfish amongst instream woody debris and rocky substrate. Burrows may also be excavated if ethics approval has been sought. Night searches using a spotlight can be done if areas can be safely accessed in the dark.

Hygiene protocols must be carefully implemented when handling amphibians and moving between catchments in order to prevent the transmission of disease between animals and populations. For instance, single use PVC gloves must be worn when handling individuals and equipment and footwear must be sprayed with a 1% sodium hypochlorite solution. Vehicles must also be thoroughly washed between field trips to prevent the transmission of pathogens between catchments

Digital images of the sighted individuals must be taken to facilitate species identification. Minimum records required for species identification of Crayfish are clear, digital images of adult specimens showing the following features:

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- Chelae – ventral, dorsal and side surfaces, including apical spines on propodus and dactylus.
- Merus – dorsal and ventral surfaces.
- Thorax – dorsal and side surfaces.
- Abdomen – dorsal and side surfaces.
- Dorsal surface of telson.
- Male cuticle partition area.

Survey Period: Surveys can be carried out at any time, but best done during the breeding season (Spring - Summer) when crayfish are more likely to be active and after significant rain events. Ideally, surveys should be undertaken in wet conditions when pools of water are present.

Other methods or features that may result in a species management action:

Verified sightings of individuals through walking surveys may result in a positive presence record. In addition, walking transects may identify sites with burrowing activity that may be targeted by subsequent surveys.

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7.14. Mallacoota Burrowing Crayfish (*Engaeus mallacoota*)

Targeted Species Survey Trigger	Preferred Survey Method	Minimum Survey Effort Required	Density Threshold Triggering Prescriptive Action	Known FMA(s)	Conservation Status (EPBC, FFG and/or DELWP Advisory Status)
Criterion 1	Active searching by day or night	200 m for 30 min by 2 people	Verified Sighting of an individual	East Gippsland	(EPBC) – N/A (FFG) – Listed as Threatened (DELWP) – Vulnerable

Species Description:

The Mallacoota Burrowing Crayfish is a small freshwater crayfish. Adults having a carapace length of approximately 20 mm, with large dimorphic chelae also present in adults of this species. This species has only been detected in two sites in Victoria (in the western region of the Mallacoota inlet and in Croajingalong National Park) however the complete distribution of this species is poorly known. Breeding season is from Spring to early Summer.

Preferred Habitat:

This species is predominately a burrower and generally found in burrows on steep clear banks (free of vegetation) in silty sandy soil in areas of warm temperate rainforest.

Recommended Targeted Survey Methodology for Mallacoota Burrowing Crayfish

Survey Effort: Visual and active searching is to be carried out in conditions when turbidity is low, in suitable habitat. Searches will cover a minimum of 200 m of suitable habitat for at least 30 minutes by 2 people. Surveyors should search for burrowing activity, exoskeleton remains and individual crayfish amongst instream woody debris and rocky substrate. Burrows may also be excavated if ethics approval has been sought. Night searches using a spotlight can be done if areas can be safely accessed in the dark.

Hygiene protocols must be carefully implemented when handling amphibians and moving between catchments in order to prevent the transmission of disease between animals and populations. For instance, single use PVC gloves must be worn when handling individuals and equipment and footwear must be sprayed with a 1% sodium hypochlorite solution. Vehicles must also be thoroughly washed between field trips to prevent the transmission of pathogens between catchments

Pre-Harvest Surveys – Targeted Species Survey Procedure

Digital images of the sighted individuals must be taken to facilitate species identification. Minimum records required for species identification of Crayfish are clear, digital images of adult specimens showing the following features:

- Chelae – ventral, dorsal and side surfaces, including apical spines on propodus and dactylus.
- Merus – dorsal and ventral surfaces.
- Thorax – dorsal and side surfaces.
- Abdomen – dorsal and side surfaces.
- Dorsal surface of telson.
- Male cuticle partition area.

Survey Period: Surveys should be carried out during the breeding season (Spring - early Summer) when crayfish are more likely to be active and after significant rain events. Ideally, surveys should be undertaken in wet conditions when pools of water are present.

Other methods or features that may result in a species management action:

Verified sightings of individuals through walking surveys may result in a positive presence record. In addition, walking transects may identify sites with burrowing activity that may be targeted by subsequent surveys.

8. Summary of Detection Methods and Optimal Survey Season for Detection of Target Species

The tables below summarize the preferred survey methods and optimal seasons for detection of 14 target species. For each species, there is a primary method (X) that should be used and additional methods that may provide supplementary information (S) about the presence of threatened species. NB: Frogs are best surveyed during the breeding season and after significant rain, particularly in Spring and Summer when males are potentially likely to be calling. Crayfish can potentially be surveyed at any time of year, but for best results should be surveyed during the breeding season and at night when they are most active. Other species are also best surveyed during the breeding season as this is when they are most active, except for the Powerful Owl, which is susceptible to disturbance late in the breeding season when females are tending to the eggs in the nest. Gliders, Owls and frogs should ideally be surveyed in both seasons as an increase in survey effort will maximize the probability of detection (DSE survey standards, 2011). Remote cameras to detect Long-footed potoroo can be set at any time of year, including Spring or Autumn. Cameras to detect spotted-tailed quoll should only be set in Autumn to coincide with the start of the breeding season when levels of activity increase throughout the landscape as animals move around in search of potential mates.

RCS - Remote Camera Survey; **SS** - Spotlight Survey; **CP** - Call Playback; **ASR** -Active Search of Riparian areas; **WT** - Walking Transect.

Species	RCS	SS	CP	ASR	WT	Optimal survey season
Greater Glider (<i>Petaurus volans</i>)		X			S	Spring - Autumn
Yellow-bellied Glider (<i>Petaurus australis</i>)		X	X		S	Spring - Autumn
Leadbeater's Possum (<i>Gymnobelideus leadbeateri</i>)	X	S	S		X	Spring - Autumn
Powerful Owl (<i>Ninox strenua</i>)		X	X		S	Sept - Dec; Apr - Jun
Sooty Owl (<i>Tyto novaehollandiae</i>)		X	X		S	Sept - Dec; Apr - Jun
Masked Owl (<i>Tyto tenebricosa</i>)		X	X		S	Sept - Dec; Apr - Jun
Koala (<i>Phascolarctos cinereus</i>)		X			X	Spring - Autumn
Long-footed Potoroo (<i>Potorous longipes</i>)	X	S			S	Any, Spring - Autumn
Spot tailed Quoll (<i>Dasyurus maculates</i>)	X	S			S	Autumn – Winter (Apr - Jul)
Large Brown Tree Frog (<i>Litoria littlejohni</i>)		X	X	X	S	Aut – Spr (Apr – Oct)
Giant Burrowing Frog (<i>Heleioporus australiacus</i>)		X	X	X	S	Sum – Aut (Feb – May)

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Species	RCS	SS	CP	ASR	WT	Optimal survey season
Southern Barred Frog (<i>Mixophyes balbus</i>)		X	X	X	S	Spr – Aut (Sep – May)
Orbost Spiny Crayfish (<i>Euastacus diversus</i>)				X	S	Any (Autumn-Spring)
Mallacoota Burrowing Crayfish (<i>Engaeus Mallacoota</i>)				X	S	Any (Autumn-Spring)

	Spring			Summer			Autumn			Winter		
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Greater Glider												
Yellow-bellied Glider												
Leadbeater’s Possum												
Powerful Owl												
Sooty Owl												
Masked Owl												
Koala												
Long-footed Potoroo												
Spot tailed Quoll												
Large Brown Tree Frog												
Giant Burrowing Frog												
Southern Barred Frog												
Orbost Spiny Crayfish												
Mallacoota Burrowing Crayfish												

optimal survey timing
 breeding season

Survey seasons that capture the majority of target species

9. Document Administration

9.1. References

Document Title	Version Number	Document Owner
<i>Sustainable Forests (Timber) Act 2004</i>		Minister Agriculture
<i>Forest Management Plans (various)</i>		DELWP
<i>Action Statements (various)</i>		DELWP
<i>VicForests Instruction – Pre-Harvest Biodiversity Survey Process</i>		VicForests
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Lumsden, L., Scroggie, M., Chick, R., Douglas, A., Howard, K., Woodford, L. and Alexander, J. (2010). <i>Assessing management strategies and wildfire impact on Long-footed Potoroos in the Great Dividing Range area, Victoria. 4th Progress report</i> . Arthur Rylah Institute for Environmental Research. Department of Sustainability and Environment, Heidelberg, Victoria.		
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Nelson, J. L., Main, M. Chick, R. and Scroggie, M. (2010b) <i>The status of Smoky Mouse population at historic sites in Victoria, and an assessment of two non-invasive survey techniques</i> . Unpublished report to the Department of Environment, Water, Heritage and the Arts, and the Goulburn Broken Catchment Management Authority. Arthur Rylah Institute for Environmental Research, Department of Sustainability and Environment, Heidelberg, Victoria.		
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9.2. Risk

This instruction addresses the following risks:

Risk	Risk Rating
153: Failure to identify threatened flora and fauna on planned coupes	Medium
154: Failure to conform with legislative requirements	High
156: Inadequate protection of threatened species or ecosystems	Medium
261: Leadbeater's Possum is detected within 200m of a proposed current timber harvesting coupe	Medium

9.3. Document Management and Retention

Unless stipulated within this Instruction, documentation generated from this Instruction must be managed according to VicForests Records Management Policy and Procedures.

This Instruction should be retained for a minimum of 7 years after it is superseded by another version. If this instruction needs to be retained for a longer period of time, this needs to be stated clearly, with justification in this section.

9.4. Recent Revision History

A summary of the recent document revision history is outlined below.

Version number	Revision date	Revision author(s)	Revision notes
1.5	25/03/2014	C. Powell	Added survey methods for Large Brown Tree Frog, update survey methods
1.6	20/11/2014	C. Powell	Updated survey guidelines for amphibians
1.7	07/05/2015	C. Powell	Updated survey guidelines for Leadbeater's Possum
1.8	30/5/2016	C. Powell	Updated survey guidelines for Leadbeater's Possum in line with <i>VicForests Instruction – Leadbeater's Possum Pre-harvest Survey Process</i>
1.9	24/06/2016	J. Allen	Updated title, risks, format and wording changes to maintain terminology consistency with <i>VicForests Pre-Harvest Biodiversity Survey Process Instruction</i>
1.9	06/03/2017	E. Pryde	Reviewed general survey program and species specific survey methods
2.0	31/03/17	M. Cardoso	Reviewed general survey methodologies and species-specific survey methods
2.0	31/03/2017	T. McBride	Reviewed general survey program and species specific survey methods

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9.5. Reviewers

<p>Required reviewers One of the following positions are required to review this document prior to approval of any major revisions:</p>
Manager Biodiversity Conservation and Research
Field Ecologist
Biodiversity Research Scientist
<p>Reviewers This version was reviewed by:</p>
Manager Biodiversity Conservation and Research

10. Definitions and Abbreviations

Term	Definition
Coupe	A single area of native forest of variable size, shape and orientations from which timber is harvested from one operation.
DELWP	Department of Environment, Land, Water and Planning
EVC	Ecological Vegetation Class
GPS	Global Positioning System
SD	Secure Digital
VBA	Victorian Biodiversity Atlas