# Pilot survey for Long-nosed Potoroo and Southern Brown Bandicoot using remote camera in the Grampians National Park, February to April 2009


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Note: Cover picture, Long Nosed Potoroo (*Potorous tridactylus*)

Parks VICTORIA

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# Introduction and Aim

This study was completed between February and April 2009 in the Grampians National Park, Victoria, Australia. The investigation was completed as part of a pilot program employing the use of remote digital cameras to assist in searches of two species of national significance and conservation importance for the Grampians National Park; the nationally vulnerable Long-nosed potoroo (*Potorous tridactylus)* and endangered Southern Brown bandicoot (*Isoodon obesulus obesulus)*.

The aims of the study were:

1. to pilot a Geographic Information System (GIS) habitat model based on extrapolation of historic records to direct survey efforts
2. to test the application of remote digital cameras mounted horizontally in thick Heathland habitats prior to a full scale Deakin University honours project
3. to collect pilot data to assist:
    a. the development of a monitoring protocol using remote digital cameras for target species in the Grampians National Park, and
    b. testing the applicability of a GIS habitat model to assist searches for target species.

# Background

In January 2006, a severe, landscape-scale wildfire burnt approximately 80,000 ha (47%) of the Grampians National Park (GNP). The initial impact of this wildfire on the Grampians fauna assemblages is currently subject to a Parks Victoria research partners project with Deakin University (Stevens 2008, DeBondi 2009, Vinicombe 2009). The impacts of the fire to flora are currently poorly understood yet existing monitoring on priority flora indicate that some (not all) conservation significant species such as the Grampians Bitter Pea (*Davisea laevis)* and Grampians rice-flower (*Pimelia pagophila*) have displayed positive life history response.

Current research into the recovery of small mammal assemblages post-2006 is ongoing however, it is assumed that due to the size and severity of the wildfire event there has been a loss of extent and diversity of species within the 2006 fire area with significant disruption to landscape processes.

Since 2006 there has been increased community awareness and participation in fire planning processes. Wide ranging views have been presented from the public concerned with management of the Grampians National Park primarily divided between increasing planned burning to the preservation of remaining small mammal populations.

A number of concerns have been raised as to the potential impact continued prescribed burning may have on remaining populations of small mammals in the Grampians. In particular concerns that the burning program may lead to the local extinction of certain species was raised. The habitat for two species in particular, Long-nosed potoroo (LNP) and Southern-brown bandicoot (SBB), was thought to be heavily impacted by the 2006 wildfire and the remaining habitat was at risk from inappropriate planned burning.

Staff have highlighted the difficulty and high resource input required to conduct traditional survey techniques such as live trapping for SBB and LNP with a need for more time and cost effective protocols such as remote camera that have recently gained momentum as a preferred monitoring technique (Scroggie 2008). Additionally, a knowledge gap into the current status of these populations were highlighted during the planning of prescribed burning programs through a lack of contemporary sightings or species records being available.

As such, this study is primarily focussed on conducting a pilot investigation into the application of remote digital cameras in the Grampians to detect and develop a monitoring protocol for SBB and LNP. A specific monitoring protocol is required for these species to provide staff with a level of confidence around their detection probabilities so that false absences are minimised or appropriately understood and acknowledged when conducting future planned burning monitoring.

# Method

### *Habitat Model*

A search of historic records for LNP and SBB from the Parks Victoria Environmental Information System (EIS) revealed 87 and 193 records respectively for spanning 109 years. These data were selected for post 1980 records as it was believed that the mapping and survey techniques would have improved and the changing environmental conditions would better reflect the habitat that the animals are using now.

The post 1980 data showed 43 records for LNP and 113 records for SBB in the Greater Grampians Area. To rationalise potential search locations for the pilot study a habitat model was developed using the historic records overlayed with Ecological Vegetation Class (EVC) data to find areas of likely habitat. The habitat model was developed using MapInfo as follows:

1. Buffer all post 1980 records for 125m radius (estimated 5Ha home range of animals).
2. Query the % of each EVC within each record buffer to determine the preferred EVC's that fall within the home ranges of the post 1980 records.
3. Assign the top four EVC's for both LNP and SBB represented in over 75% of the historic sightings home ranges.
4. Rank EVC's from 1 to 4 based on the percentage of historic LNP and SBB records that occurred within each EVC.
5. For ease of explanation, this step has been simplified. A complex GIS analysis utilising MapInfo was conducted for the entire Greater Grampians region by determining where the four priority EVC's coincided within 300m of the existing road and track network (for project efficacy).
6. All potential search locations were cropped outside of the 2006 wildfire affected area to target unburnt vegetation.
7. Point locations were created in MapInfo for areas of 'priority EVC hot-spots' and an index ranking score applied to determine priority survey locations.
8. Point locations were uploaded to handheld Garmin GPS units.

### *Camera Setup and Lures*

HuntingCamOnline™, Scoutguard series SG550 cameras with specifications of 5 megapixel, colour SMOS sensor with 2560x1920 resolution, focal lens of F=3.1mm, trigger time of 1.2 seconds and a field of view of 40º were used with 2GB SD cards. Two cameras, 50m apart were established at each site.

Cameras were mounted on, and protected from inclement weather by a plastic lunch box attached to a plastic steel post cap and mounted onto a galvanised star post, 1.3 metres from the ground (figure 3 and 4). One layer of beige masking tape was placed over the 22 long range infrared emitters to prevent incidences of over-exposure as cameras have not been specifically designed to monitor species at close range (i.e. at 1.3m). Cameras were activated on the following specifications of 'normal' PIR sensitivity, '3 photo' consecutive capture mode with '1 second' delay between consecutive photos and '30 second' delay between successive captures to prevent multiple triggers of 'trap happy' animals.

An area of one metre square was cleared of vegetation and a scent lure (non-food reward) as an attractant was placed 20cm from the base of the star post in the centre of the field of view (see figure 5). The placement of the lure was to encourage animals to enter the field of view, thus triggering the infrared camera sensor to take photos whilst the animals 'pose' in the centre of the field of view at the lure. The scent lure was an absorbent material (3cm x 6cm) soaked in a mixture per batch of 300ml raw linseed oil, 50ml truffle infused olive oil and 20ml vanilla extract then placed in a specimen jar (LabServ 94mm length x 44mm diameter).

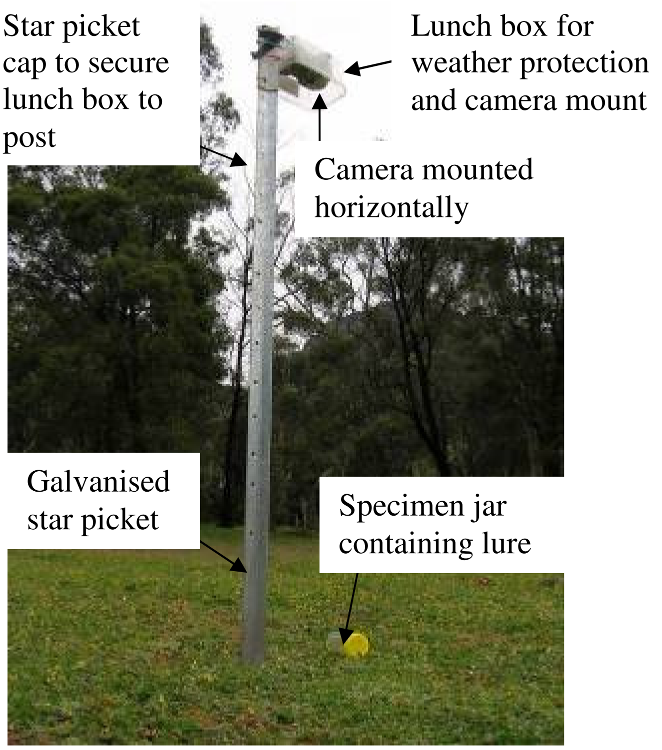


Figure 3. Description of materials used to mount remote digital cameras horizontally in thick Heathland habitats in the Grampians National Park.

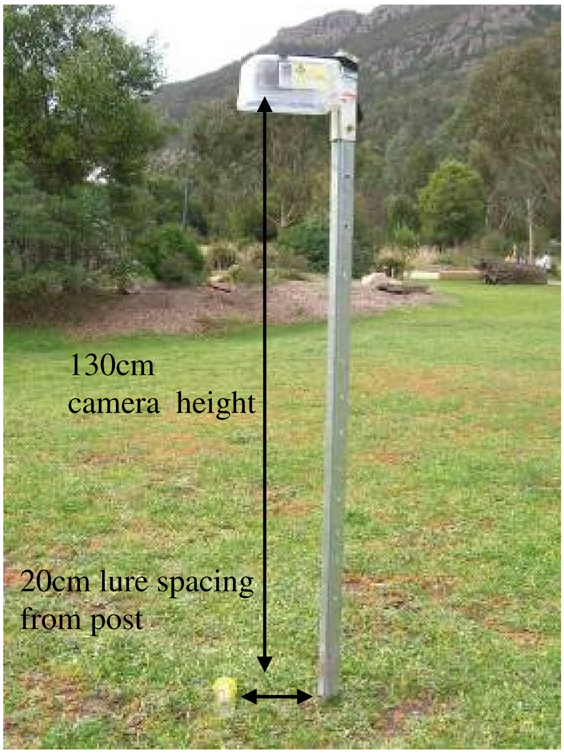


Figure 4. Spacing distance of remote digital camera to ground and lure to base of mounting pole when mounting in thick Heathland habitats in the Grampians National Park.

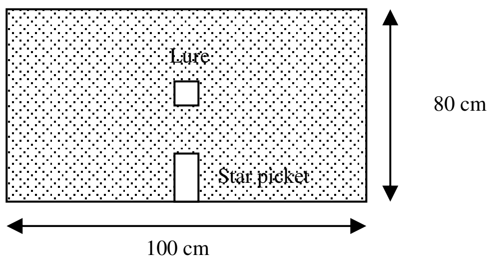


Figure 5. Remote digital camera field of view (shaded area) when mounting horizontally in thick Heathland habitats in the Grampians National Park.

37 study sites were targeted in off-track areas of dense vegetation specifically for LNP and SBB (figure 6). The horizontal mounting technique was developed to reduce the need to clear large paths of vegetation to minimize false triggering events caused by moving vegetation. Additionally, it was anticipated that horizontal mounting of cameras would provide a greater field of view targeting small mammals and allow for more accurate identification of species as the lure would provide a scale measure, with small mammals not being able to 'sneak' below the cameras field of view or be obscured by vegetation when mounted in the traditional vertical manner.

After each period of trapping, camera memory cards were downloaded and the photos analysed for detection of target species. The presence of both target and non-target animals were recorded, for addition into the Victorian wildlife database. It was assumed that multiple photos of the same species taken in a short period would be the same animal visiting the site and were classed as a single detection event.

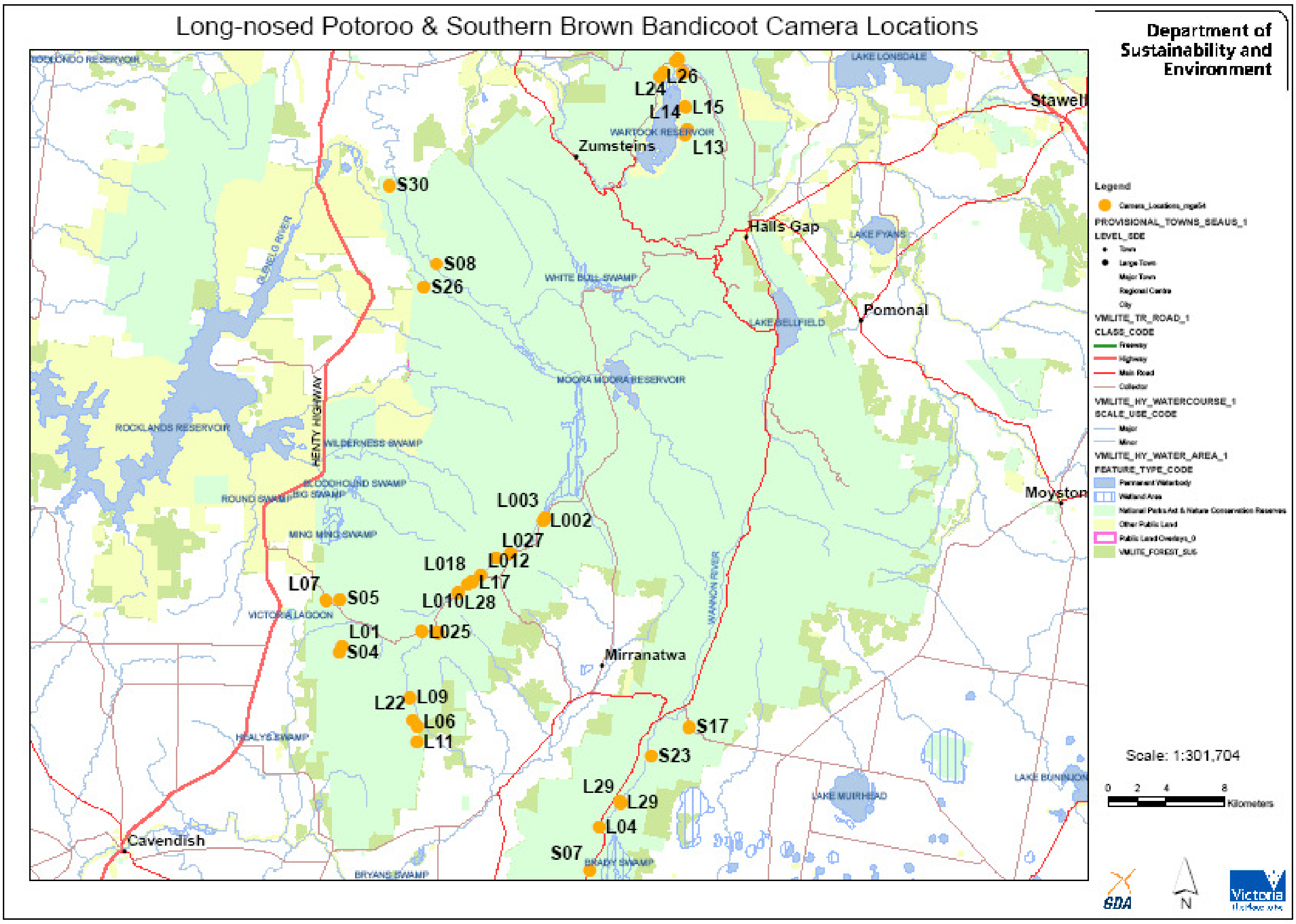


**Figure 6**. Pilot camera trapping locations in the Grampians National Park. L denotes LNP GIS habitat model sites, S denotes SBB GIS habitat model sites.

***Detection Probabilities***

From the detections recorded at each site a daily detection probability (p) was calculated by dividing the numbers of days the cameras at each site were in place by the number of detections, then averaged across sites. These probabilities were calculated using Microsoft Excel to obtain a standard deviation and then a 95% confidence calculated.

A cumulative probability curve (Kéry, 2002 in Nelson *et al.*, 2008), was then calculated using the equation for geometric probability distribution where:

$$P_n = 1-(1-p)^N$$

Where $P_n$ is the cumulative probability of detection after N days, and p is the daily probability of detection (p = number of detections / days camera in action). The standard deviation was established, and then a confidence interval calculated.

# Results

EVC's present in the estimated 5Ha estimated home range for SBB were Heathy Woodland (58.6%), Sand Heathland (16.4%), Riparian Scrub (6.3%), and Shrubby Woodland (6.1%). The results of the landscape scale GIS assessment determined 722 potential SBB search sites of which 8 were surveyed in this study.

EVC's present in the estimated 5Ha home range for LNP were Wet Heathland (42.5%), Heathy Woodland / Heathy Dry Forest Complex (21.4%), Sedgy Riparian Woodland (13.7%) and Lowland Forest (4.74%). The landscape scale GIS assessment determined 143 potential LNP search sites of which 29 were surveyed in this study.

A greater emphasis was placed on survey of LNP suitable sites in this pilot study based on local knowledge that GIS habitat model LNP sites were areas where SBB had recently been captured through live trapping and had more appropriate EVC's to target both species based on field knowledge.

Thirty seven sites were camera trapped with two cameras per site over an eight week period from the 5th of February 2009 to the 2nd of April 2009. This effort resulted in 926 camera trapping nights for an average of 12.5 survey nights (±0.046 S.E) or 25.03 camera trapping nights (±0.065 S.E) per site. The minimum survey night effort for any site was 7, with a maximum of 20 for any individual site. A summary of the sites, length of trapping and number of detections of target species is presented in table 1.

Of the 37 sites sampled, detections of LNP occurred at 5% (two sites) and SBB at 13.5% (five sites) of monitoring sites (table 2, figure 7). Interestingly, SBB did not occur at any of the predicted habitat model sites for SBB but only at predicted LNP sites.

SBB were detected by survey night 9 (±0.323 S.E) with LNP all detected by night 4.

Three cameras out of the total of 74 cameras employed were unusable due to memory card errors and poor image quality resulting in 34 of the 37 sites being used in analysis.

A total of 11 other species were detected, with 18 unknown rodents and marsupials at 35 sites.

Based on the above results the daily detection probability (p) for SBB and LNP were calculated at p 0.082 ± 0.021 (95% Confidence interval) and p 0.132 ± 0.042 95% CI respectively. Inputting p into the equation for cumulative probability curve (Kéry, 2002 in Nelson *et al.*, 2008), a probability of detection of 1 with 95% confidence was 62 days (min 49, max 79) for SBB and 38 days (min 28, max 57) for LNP (figure 8).

Results from the cumulative probability calculations suggest less effort is required to detect LNP than SBB. The respective number of days required to reach a detection probability of 1 for each of the species is impractical for cameras to remain in the field due to lure longevity, battery life, memory card capacity and the need for resource efficacy by surveying as many sites as quickly as possible.

As such, a detection probability of 0.8 has been nominated as a practicable measure for leaving cameras in situ whilst providing field staff with a level of confidence to minimise false absences of target species. Using this revised detection probability measure, results indicate that 19 days is required to obtain a detection probability of 0.8 for SBB and 11 days for LNP (figure 8) using two remote digital cameras per site in the Grampians National Park.

**Table 1**: Summary of camera trapping results for surveyed sites in the Grampians National Park

| Site ID | Survey nights | Camera trapping nights | Number of Detections |
|---|---|---|---|
| L01 | 12 | 24 | 0 |
| L002 | 7 | 14 | 0 |
| L003 | 7 | 14 | 0 |
| L04 | 13 | 26 | 0 |
| L006 | 12 | 24 | 0 |
| L09 | 12 | 24 | 0 |
| L010 | 9 | 18 | 0 |
| L11 | 12 | 24 | 0 |
| L012 | 13 | 26 | 0 |
| L15 | 16 | 32 | 0 |
| L017 | 9 | 18 | 0 |
| L018 | 9 | 18 | 1 (LNP) |
| L020 | 7 | 14 | 0 |
| L22 | 12 | 24 | 0 |
| L025 | 9 | 18 | 0 |
| L027 | 13 | 26 | 2 (LNP) |
| L028 | 20 | 40 | 0 |
| L29 | 13 | 26 | 1 (SBB) |
| L030 | 9 | 18 | 0 |
| L031 | 9 | 18 | 0 |
| L07 | 13 | 26 | 1 (SBB) |
| L13 | 16 | 32 | 0 |
| L14 | 16 | 32 | 0 |
| L19 | 15 | 30 | 1 (SBB) |
| L21 | 15 | 30 | 1 (SBB) |
| L23 | 16 | 32 | 2 (SBB) |
| L24 | 15 | 30 | 0 |
| L26 | 15 | 30 | 0 |
| L29 | 15 | 30 | 0 |
| S07 | 13 | 26 | 0 |
| S17 | 13 | 26 | 0 |
| S23 | 13 | 26 | 0 |
| S04 | 13 | 26 | 0 |
| S05 | 13 | 26 | 0 |
| S08 | 13 | 26 | 0 |
| S26 | 13 | 26 | 0 |
| S30 | 13 | 26 | 0 |
| | | Total 926 | |

**Table 2.** Site specific records for LNP and SBB captured on camera in the Grampians National Park

| Species | Site ID | Camera | Date | Night of Detection | Time | EVC |
|---|---|---|---|---|---|---|
| Southern Brown Bandicoot | L19 | 6.1 | 14/04/2009 | 14 | 9:55 PM | Wet Heathland |
| Southern Brown Bandicoot | L23 | 11.1 | 12/04/2009 | 13 | 8:54 PM | Damp Heath Scrub |
| Southern Brown Bandicoot | L23 | 12.1 | 9/04/2009 | 10 | 4:30 PM | Damp Heath Scrub |
| Southern Brown Bandicoot | L027 | 12.1 | 18/03/2009 | 7 | 2:00 AM | Wet Heathland |
| Southern Brown Bandicoot | L21 | 7.1 | 7/04/2009 | 5 | 1.19 AM | Wet Heathland |
| Southern Brown Bandicoot | L07 | 20.1 | 8/04/2009 | 6 | 12.57 AM | Sand Heathland |
| Long-nosed Potoroo | L027 | 13.1 | 10/02/2009 | 4 | 2.20 AM | Heathy Dry Forest |
| Long-nosed Potoroo | L027 | 12.1 | 10/02/2009 | 4 | 12.25 AM | Wet Heathland |
| Long-nosed Potoroo | L018 | 19.1 | 1/03/2009 | 4 | 10.36 PM | Wet Heathland |

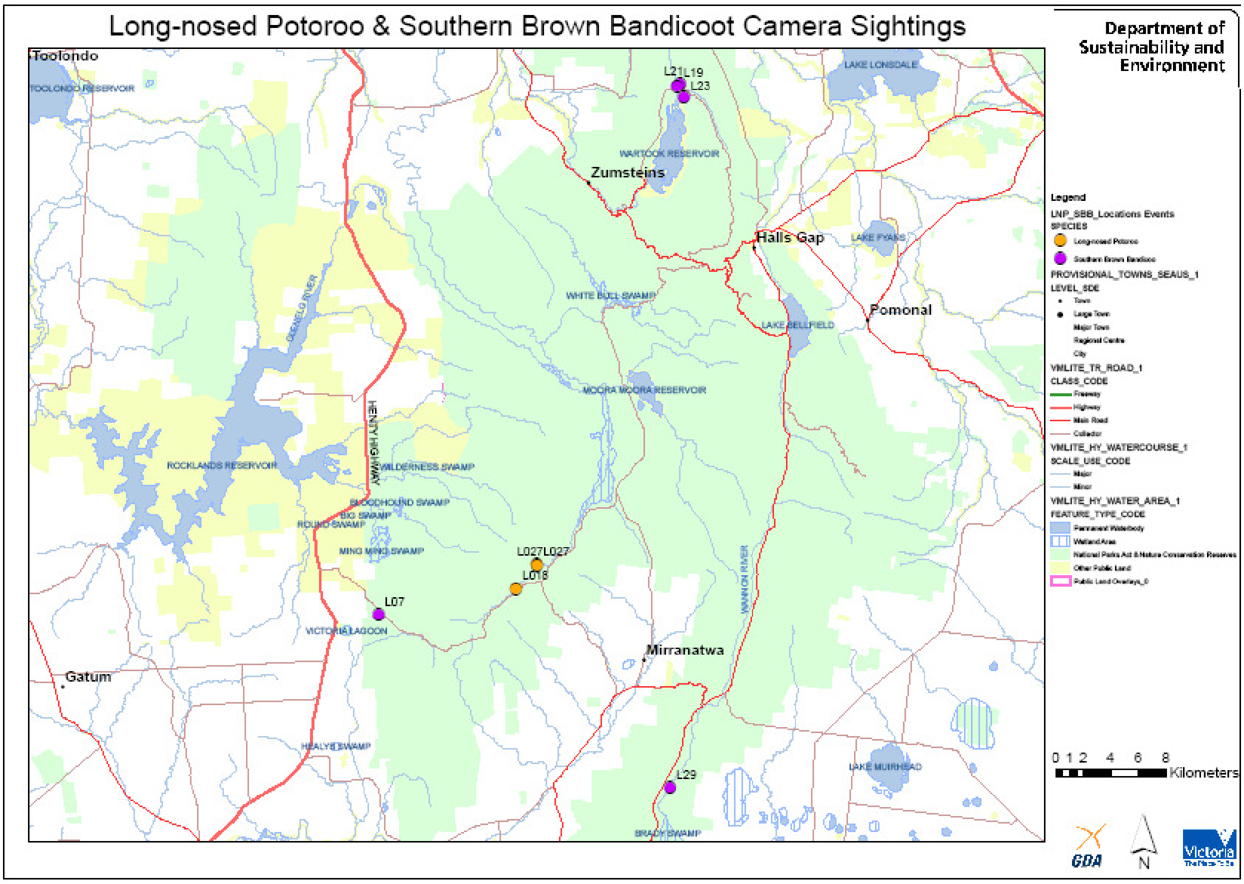


**Figure 7.** Location map of two LNP and five SBB sites confirmed through use of remote digital camera in the Grampians National Park during the pilot study.

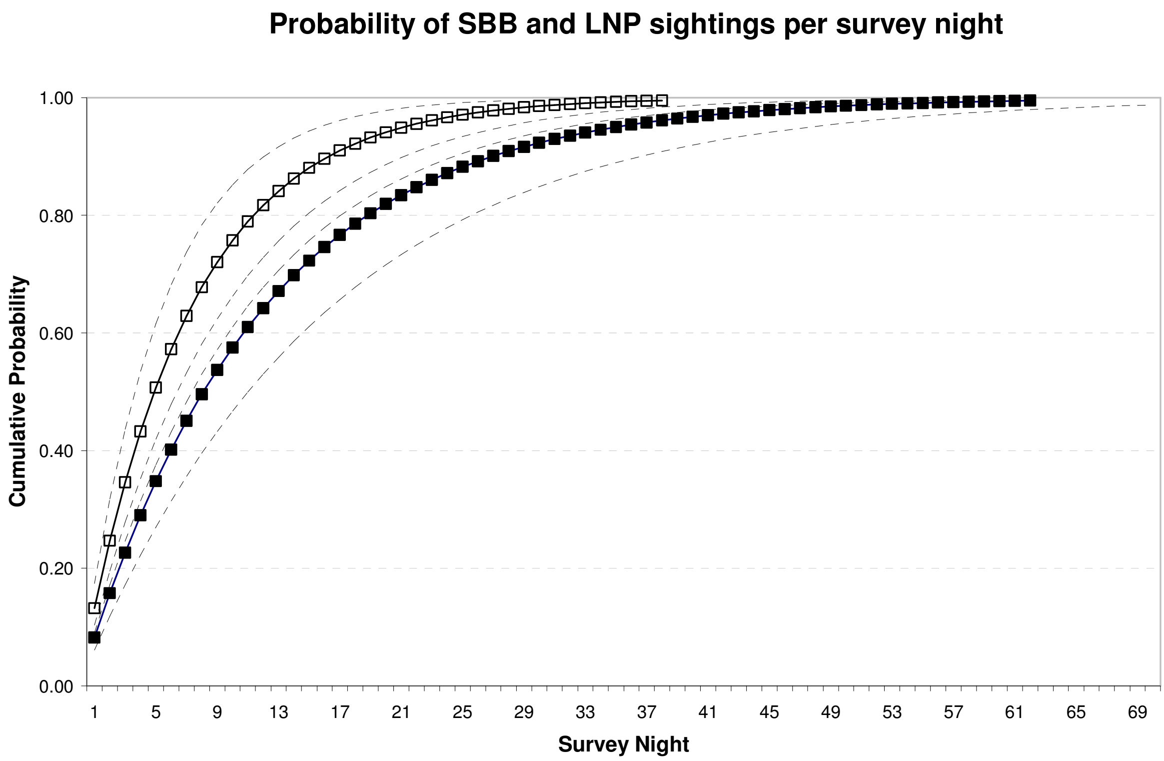


**Figure 8.** Cumulative probability of detection for SBB (enclosed squares) and LNP (open squares) in the Grampians National Park after N days ( $P_N=1-(1-p)^N$ ) with dashed lines representing 95% confidence intervals.  Where $P_N$ = probability of detection after N days and p = daily detection probability.

# Discussion

The horizontal mounting technique is appropriate for the use of remote digital camera surveillance for small terrestrial mammals in thick vegetation. The benefit the technique provided is that it reduced the amount of vegetation to be cleared, minimised false triggers due to moving vegetation at distance, and enables quick and efficient camera set up in remote and thick habitat areas.

Results in this study of SBB detection probability of 0.8 at 19 nights is similar to Scroggie (2008) who found probability of detection of approximately 0.8 after 21 monitoring nights. However, Scroggie (2008) data was based on 1 camera at 1 site in comparison to two cameras at one site presented here. This comparison has significant limitations in this study of low amounts of species detection and few sites surveyed (n=37).

In addition, sites with no detections were not included in the calculation of detection probability which may lead to the exclusion of sites which had target species present but were not detected. There is a high possibility this is the case as the probabilities suggest many of the cameras were not set long enough to detect animals.

Nelson *et al.* (2008) found LNP at two of 51 surveyed sites in the Otway Ranges with similar results to detection of LNP at sites found in this study of 5% (two of 37 sites). These data highlight the need to use resources appropriately by developing targeted monitoring protocols for these rare and elusive species.

It is important to note that the number of detections were low in this study (6 SBB and 3 LNP) however, Scroggie (2008) notes that it is important not to infer that the detection probabilities represent occupancy of sites across the Grampians landscape, only of the detection probability at sites where animals were detected.

While these data need to be treated with caution, they do form a sound basis for further monitoring work. From these figures a period of three weeks, (21 days) is recommended for future surveys to give at least 80% probability that target species will be detected. Further surveys using this technique will undoubtedly improve the statistical rigor of these figures.

# Future considerations

As remote digital cameras are a developing technique for land managers, some field observations from this study are worthy of specific mention to assist others in conducting similar monitoring.

While effort was made to prevent miss-fires of cameras by clearing "loose" vegetation from the camera field of view there were still numerous shots of moving vegetation. A general observation was that these false triggers occurred during temperatures above 35 degrees Celsius from ambient heat interference with the infrared detection sensor. This resulted in some of the memory cards filling prior to the conclusion of the monitoring session resulting in reduced survey effort and lower probability of detecting an animal.

Field observations also detected that cameras placed in full sun to prevent moving shadows were also subject to false triggers, assumed to be the result of radiant heat from the ground triggering the infrared sensor.

Faulty memory cards also caused some cameras to record no pictures. It was vital to check memory cards prior to use to make sure they were empty and working ok.

When conducting surveys in the peak of summer or hot weather with infrared triggered cameras, based on observations in this study, researchers are encouraged to consider the following:

- adequately clear "loose" vegetation within the field of view,
- reducing survey effort during hotter months by considering the time of year to conduct surveys,
- place cameras in full shade (hard to achieve practically when surveying open heath areas)
- program cameras to automatically turn off during the day when detection of target species is unlikely during high temperatures (all detections in this study were between 4:00pm to 3:00am).

# Conclusion

Although data in this pilot study is limited, they will assist in developing rigorous monitoring protocols when employing remote digital cameras for surveying of LNP and SBB in the Grampians.  As a starting point to establish a monitoring protocol to confidently detect presence / absence, it is suggested that at least two cameras per site for at least 14 survey nights (28 camera trapping nights) could provide an 80% and 100% detection probability for LNP and SBB respectively.  However, it is recommended further study be conducted for at least 21 survey nights per site to increase the data set and seek more rigorous data analysis before any further development of monitoring protocols for LNP and SBB in the Grampians.

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**Appendix 1.** Sample photos of horizontally mounted remote digital cameras in the Grampians National Park


*Southern Brown Bandicoot*


*Southern Brown Bandicoot*


*Long-nosed Potoroo*


*Ring-tailed Possums*


*Ring-tailed Possums*


*Tiger Snake*


*Blotched Blue-tongued Lizard*