

Survey Standards: Spot-tailed Quoll, *Dasyurus maculatus maculatus*

1 Purpose

This document outlines the standards required for surveying fauna species listed under the *Flora and Fauna Guarantee Act 1988* (FFG Act). These standards detail acceptable survey methods and the minimum survey effort to determine the likelihood of the species' presence or absence at a site. They also detail appropriate record keeping and reporting standards.

There are two main purposes of these standards.

1. To document the information required to determine if a record is valid – i.e. determining presence only. The standards provide the information that is required to enable an assessment to be made as to whether a record can be accepted as a valid record. All records, irrespective of how they are obtained, need to adhere to these standards.
2. To document the information required for surveys that aim to determine both presence and absence – i.e. outlining the acceptable level of survey effort required to provisionally infer absence if a species is not detected during a survey. These minimum standards are required to be met by any organisation/group undertaking a presence/absence survey.

Executing and reporting a survey to these standards will support the Department of Sustainability and Environment (DSE) to make an assessment of the validity of a claim to species presence or absence at a site. Subject to DSE approval, alternative survey methods may be applied where the proponent provides an evidence-based rationale for the approach and a detailed description of the survey technique(s) and where the standards are considered to exceed those set out below.

These standards should be read in conjunction with the Action Statement for this species. In the context of timber harvesting operations they should be read in conjunction with the Code of Practice for Timber Harvesting and Forest Management Plans. As further information about the species and survey techniques becomes available, these standards will be reviewed and updated.

2 Introduction

The Spot-tailed Quoll is listed under the FFG Act, and categorised as Endangered in Victoria (DSE 2007). An action statement was published in 2003 (Backhouse 2003) and is currently being reviewed (2011). Nationally, the species is listed as Endangered under the *Environmental Protection and Biodiversity Conservation Act 1999*. A national recovery plan is currently under development (Long and Nelson 2008). There are forest management prescriptions for this species under the Central Highlands, Central Gippsland, East Gippsland, North East, Mid-Murray, Otway and Portland Forest Management Plans.

The Spot-tailed Quoll occurs in many forest types, ranging from lowland forest to sub-alpine woodland. Key habitat features in areas preferentially used by quolls that are correlated with the availability of their preferred prey and dens in which quolls shelter and rear their young include: structurally complex habitat containing dense overstorey and understorey vegetation, abundant large hollow-bearing trees, large logs and rock outcrops

and / or escarpments (Jones and Barmuta 2000, Andrew 2005, Belcher and Darrant 2006, Glen and Dickman 2006).

Spot-tailed Quolls are solitary animals that occur naturally at low densities and occupy large home ranges of several hundred to several thousand hectares (Belcher and Darrant 2004, Andrew 2005, Claridge *et al.* 2005, Glen and Dickman 2006). Breeding is seasonal (May-August) and is a time of peak activity, particularly by males, which make movements well outside the areas they occupy at other times of the year as they seek to maximise their number of potential mates (Belcher 2003, Glen 2008). The activity on 'latrines', which are communal defecation sites thought to be used by quolls to communicate reproductive status, also increases at this time, particularly during May and June (Belcher 1994, Dawson 2005, Ruibal *et al.* 2009).

The majority of recent records of Spot-tailed Quolls (since 1990) originate from East Gippsland, particularly the upper Snowy River and tributaries and the Errinundra Plateau area, which is the stronghold of the species in Victoria (Victorian Fauna Database DSE 2007, Mansergh 1995, Nelson 2007a).

3 Requirements to demonstrate presence

Spot-tailed Quolls have been detected by using a range of mammal survey techniques. The most commonly used techniques are camera trapping, hair-tube surveys, scat searches and live capture in cage traps. Of these techniques, camera trapping is the most efficient and cost-effective method of detecting Spot-tailed Quolls in Victoria.

3.1 Acceptable records

1. Camera trapping – photographs of Spot-tailed Quolls obtained from remote cameras deployed at survey sites. Photographs must be retained to allow independent confirmation.
2. Hair-tubing – identification of Spot-tailed Quoll hair samples by an experienced mammal hair analyst. Where doubt exists as to the identity of the species from which the hair was obtained, hair records should not be accepted as evidence of occurrence of the species at a site. Hair samples should be archived, to enable independent confirmation of identifications.
3. Scats – when fresh, Spot-tailed Quoll scats have a strong and distinctive odour, and when deposited in a latrine, can be readily identified by experienced field biologists. Such records should be evidenced by photographs and the latrine's GPS coordinates documented to allow independent verification. When single scats are located, definitive identification requires the identification of Spot-tailed Quoll grooming hair within the scat, by an experienced mammal hair analyst. DNA retrieved from scats can also provide definitive evidence of quoll presence.
4. Cage trapping – observation of captured Spot-tailed Quolls in cage traps. Such records should be evidenced by photographs to enable independent confirmation.
5. Road-killed Spot-tailed Quolls with photographic evidence of the animal and the location to enable independent confirmation.

6. Footprints – footprints can only be used as evidence of the presence of Spot-tailed Quolls if identified by a recognised quoll expert. Photographic evidence would be required.

3.2 Non-acceptable records

Unconfirmed sightings will not be accepted as definite records, however, they can be used to focus subsequent survey effort using methods that enable confirmation (such as remote cameras). Spot-tailed Quoll remains obtained from predator (dog or fox) scats are not accepted as evidence of presence, as the location where the quoll was consumed may be some distance from the site where the remains were found.

3.3 Reporting standards to show presence

The following data are required to support a ‘presence’ record:

- name and contact details of the observer (including indicating that they will make themselves available to escort an independent validator to the site if required);
- permit details of the surveyors where required (i.e. if undertaking trapping or hair-tubing, a research permit under the Wildlife Act is required, as well as a research permit under the National Parks Act if working within a Park and consent from DSE Land and Fire Division if working in State Forest);
- details of the species present, number of individuals detected or number of observations;
- date and time of record;
- precise geographic location of sighting (written location and GPS coordinates);
- photographic evidence of the location with a fixed relocatable feature in the frame to enable validation if required;
- method of observation, including the sampling effort (e.g. number of camera trap-nights, number of hair-tube nights);
- supporting evidence: Spot-tailed Quolls are distinctive animals that can be readily identified. Photographs obtained by remote cameras, of animals captured in cage traps or of the remains of road-killed animals allow independent confirmation of the identification;
- for hair-tube records the name and expertise of the person identifying the hair is required;

This is the core information required for records to be entered onto the Victorian Wildlife Atlas. Records of all other species observed at the site should also be submitted to the Atlas of Victorian Wildlife.

4 Requirements to demonstrate presence/absence

While it is relatively straightforward to document if a species is present, it is more difficult to determine if a species is truly absent if it was not recorded during a survey, or if the survey was not adequate to reliably record the species if it was present. The following section outlines the survey requirements for there to be confidence that if a species is not recorded it is absent. While there can never be complete certainty that a species is absent, DSE will accept, for planning purposes, that the species is effectively absent if surveys are undertaken to the following specifications.

4.1 Survey effort

Due to the low densities at which Spot-tailed Quolls occur, and their large area requirements, surveys must be conducted at a broad-scale in order to detect them; an area of 1,000 ha may only support one or two resident female quolls and form part of a larger area used by several males. Surveys conducted at small scales, such as the coupe-level, are therefore unlikely to detect quolls as only a very small proportion of the potential home range of an individual animal will be sampled.

Camera traps

Nelson *et al.* (2010) estimated the probability of detecting Spot-tailed Quolls in the Snowy River and Alpine National Parks in East Gippsland using four different densities of remote cameras deployed in 100 ha sampling units. After three weeks of sampling with 1-4 cameras per 100 ha site, detection probabilities were uniformly high at > 0.8, regardless of the density of cameras. This estimate was substantially higher than a previous estimate from data collected in several other areas of Victoria, where the probability of detecting quolls with two cameras per 100 ha survey site after three weeks of sampling was 0.34 (Nelson *et al.* 2008). This difference in detectability was attributed to the different densities of quolls in these areas; quolls are more detectable in the Snowy River and Alpine National Parks where they occur at higher densities than elsewhere in Victoria. The probability of detection also varied depending on the model of camera used (Nelson *et al.* 2010). This is consistent with the results of another study in which the probability of detecting a target species (feral cat) using camera traps also varied with camera model (Robley *et al.* 2010).

Nelson *et al.* (2010) recommended that when surveying for Spot-tailed Quolls, two widely spaced cameras (e.g. 500 m apart) are deployed within 100 ha sampling units for at least three weeks. Cameras should be set for 24 hour operation as quolls may be active during the day as well as at night. It is also recommended that surveys aim to cover as many 100 ha sites as possible within the designated survey area (e.g. 40 - 50 % of the 100 ha sites present) to maximise the likelihood of detecting this wide-ranging thinly distributed species. Nelson *et al.* (2010) recommend that surveys done in other areas of Victoria, where quolls occur at lower densities, or using different camera equipment, estimate detection probabilities specific to their own situation as part of their sampling strategy, or collect this information so that it can be analysed by DSE. This will allow an assessment of the likelihood that quolls are present on some sites but are not detected during the survey.

Hair-tubes

Nelson (2007b) estimated the probability of detecting Spot-tailed Quolls using grids of hair-tubes (Faunatech hair funnels, Faunatech/Austbat, Bairnsdale, Victoria) at a study site in south-eastern New South Wales. High probabilities of detection (i.e. > 0.9) were achieved when 100 ha survey sites were surveyed with at least 30 widely spaced hair-tubes (i.e. each hair-tube separated by at least 100 m) (Table 1). Hair-tubes are generally left on site for at least 2 weeks.

Table 1. The probability of detecting Spot-tailed Quolls in 100 ha survey sites with four densities of hair-tubes. Based on data collected from a single population in south-eastern New South Wales (Nelson 2007b).

No. of hair-tubes / 100 ha site	5	10	20	30	40
Probability of detection	0.34	0.56	0.81	0.91	0.96

As a 100 ha survey site only samples a proportion of any resident quoll's home range, to be confident of detection requires that multiple 100 ha sites are surveyed. The results of computer-based simulated surveys conducted by Nelson (2007b) provide a guide to the level of sampling required in survey areas of 2,000 – 10,000 ha to be confident of detecting quolls if one 400 ha home range (i.e. the average home range size of females in this study area) is occupied (i.e. 4 x 100 ha survey sites,) using a grid of 40 hair-tubes (probability of detection 0.96) (Table 2). If fewer hair-tubes are deployed at each site (e.g. 20 hair-tubes, probability of detection 0.81) then more sites are required for 80% and 95% confidence of detection (Table 3).

Table 2. Results of computer-based simulated surveys indicating the number of survey sites required to be 80% and 95% confident of detecting Spot-tailed Quolls using a grid of 40 hair-tubes (probability of detection 0.96) when four 100 ha survey sites are occupied.

Survey area (ha)	No. of 100 ha survey sites	No. of survey sites for 80% confidence of detection	No. of survey sites for 95% confidence of detection
2,000	20	6	10
4,000	40	13	22
6,000	60	20	32
8,000	80	27	42
10,000	100	34	52

Table 3. Results of computer-based simulated surveys indicating the number of survey sites required to be 80% and 95% confident of detecting Spot-tailed Quolls using a grid of 20 hair-tubes (probability of detection 0.81) when four 100 ha survey sites are occupied.

Survey area (ha)	No. of 100 ha survey sites	No. of survey sites for 80% confidence of detection	No. of survey sites for 95% confidence of detection
2,000	20	8	13
4,000	40	17	27
6,000	60	25	39
8,000	80	32	50
10,000	100	41	64

It must be noted that the probability of detection estimates and survey simulations outlined above are based on data collected from a single site in south-eastern NSW where a population of quolls was present. In Victoria, where quolls occur at lower densities, detection probabilities will most likely be lower. Despite these differences, the results of Nelson (2007b) provide a guide to the survey effort required for a high probability of detecting quolls using hair-tubes.

Cage traps

Although Spot-tailed Quolls can be readily captured in large wire cage traps, unless traps are set at active latrines the probability of detecting quolls in Victoria using this technique is extremely low. For example, daily detection probabilities for single cage traps deployed at sites occupied by quolls in the Snowy River and Alpine National Parks have been estimated at 0.003 (95% credible interval 0.001, 0.010) (J. Nelson unpublished data). The survey effort generally applied when trapping involves setting approximately 40 traps near the sides of forest tracks at 500 m intervals. Traps may target rock outcrops, gullies and saddles as these landscape features are known to be preferentially used by quolls in some areas (Belcher and Darrant 2006). Trapping is generally conducted in Victoria for a minimum of seven nights. Trapping is not recommended for surveys aimed at reliably detecting Spot-tailed Quolls, or when trying to establish that the species is absent from a site.

Scat searches

No information is available for assessing the probability of detecting Spot-tailed Quolls by searching for latrines. This technique is only used in areas where there are rocky habitats which can be targeted for searching. It should not be used as the sole survey method for determining if quolls are present or absent in an area, but can be used in conjunction with one of the techniques outlined above.

4.2 Timing considerations

The optimal time for conducting surveys for Spot-tailed Quolls is from May to August to coincide with a peak of activity by quolls associated with the breeding season. Spot-tailed Quolls are most likely least detectable during Spring and early Summer, prior to the dispersal of young.

4.3 Reporting standards for presence/absence surveys

In order to assess the adequacy of surveys conducted for Spot-tailed Quolls, proper documentation of survey effort is essential. This is particularly the case for survey methods where reliable quantitative assessments of survey effort can be made (i.e. camera trap and hair-tube surveys), where data concerning survey effort (number of survey devices and survey duration) is essential for assessing survey adequacy.

The core data required for the presence only reporting also needs to be provided for the presence/absence surveys (refer section 3.3). Additional data required to document presence/absence surveys is outlined below. This information needs to be provided for all surveys, including those that did not detect the species.

Camera surveys:

- documentation of the size of the survey area, the number of sites surveyed, the number of camera traps deployed at each site and distance between them;
- the type of camera used and the camera settings;
- GPS coordinates of each camera location;
- type of bait used; and
- the length of time the cameras remained operational (which may be less than the full duration of the deployment in cases of camera malfunction, battery exhaustion or camera storage media exhaustion).

Hair-tubing:

- documentation of the size of the survey area, the number of sites surveyed, the number of hair-tubes deployed at each site and distance between them;
- type of hair-tube;
- type of bait used; and
- duration for which hair-tubes were deployed;

Cage trapping:

- number, type and location of the traps deployed and distance between them;
- duration of the deployment; and
- frequency of checking of traps.

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