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Expert Witness Report for the Spotted-tailed Quoll *Dasyurus maculatus*

In relation to Environment East Gippsland v VicForests

Supreme Court proceeding number 8547 of 2009

December 2009

Dr Chris Belcher
Ecosystems Environmental Consultants

Expert Witness Code of Conduct

Author's Statement

Name and Address:

Dr Chris Belcher

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Qualifications and Experience

Bachelor of Biological Science with a major in Zoology
Masters of Science; Diet of the Tiger Quoll
Doctorate of Philosophy; Ecology of the Tiger Quoll.

I have more than 30 years experience in vertebrate fauna surveys, assessments, threatened species surveys, Environmental Impact Assessment studies and ecological research. I have been an expert witness for Regional Forest Agreements, and a participant in national recovery plan workshops.
I am a member of the Australian Mammal Society and the Royal Zoological Society of NSW.

Area of Expertise:

- Vertebrate fauna surveys
- Threatened species surveys
- Ecological studies of threatened species
- Monitoring and assessment of threatened species
- Environmental Impact studies and assessments

Expertise to make the report:

I have worked in East Gippsland on a number of studies, including:

- Sites of Zoological significance survey in East Gippsland
- Brush-tailed Rock Wallaby surveys
- Spotted-tailed quoll dietary, latrine and bait study (MSc.)

- Spotted-tailed quoll ecological studies, including home range and spatial organisation, habitat use, diet and hunting strategies, baiting, response to wildfire, den use and reproductive success (PhD)
- Post-2003 alpine fires spotted-tailed quoll surveys in the Snowy River and Alpine National Parks
- Remote camera and hairtube spotted-tailed quoll surveys of the Errinundra National Park
- Remote camera spotted-tailed quoll surveys of the Snowy River and Alpine National Parks

I have also undertaken a number of studies and surveys on spotted-tailed quolls in Victoria and New South Wales, including:

- Regional Forest Agreement spotted-tailed quoll survey of the Otway Ranges
- Spotted-tailed quoll trapping survey of Parker River – Blanket Bay section of the Otway National Park
- Remote camera and hairtube survey for Spotted-tailed quolls in the Otway National Park
- Spotted-tailed quoll surveys of Mt Eccles National Park, using hairtubes and remote cameras
- Spotted-tailed quoll surveys of Mt Eccles National Park, Cobbobonee State Forest, Lake Condah and the Aboriginal controlled lands on the Mt Eccles lava flow
- Ecological studies of spotted-tailed quolls in Badja and Tallaganda State Forests in southern NSW, including home range and spatial organisation, habitat use, diet and hunting strategies, impact of aerial baiting, response to selective logging, den use and reproductive success
- Genetic study of Victorian quolls including trapping surveys of Mt Eccles National Park and Mt Pilot State Park
- Spotted-tailed quoll survey of the CSIRO Burrendong Dam study site
- Development and co-author of a population model for the spotted-tailed quoll in Victoria

Relevant publications;

1995. Diet of the Tiger Quoll *Dasyurus maculatus* in East Gippsland, Victoria. *Wildlife Research* 22: 341-357.

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2004. Home Range and Spatial Organisation of the Tiger Quoll, *Dasyurus maculatus*, in southeast Australia. *Journal of Zoology, London* **262**, 271-280.

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The largest surviving marsupial carnivore on mainland Australia: the Tiger or Spotted-tailed Quoll *Dasyurus maculatus*, a nationally threatened, forest-dependent species. Royal Zoological Society of New South Wales, Sydney.

2006. Den use by the spotted-tailed quoll *Dasyurus maculatus* in south-eastern Australia. *Australian Mammalogy* **28**: 59-64.

2006. Habitat use of the tiger quoll *Dasyurus maculatus*, a marsupial carnivore. *Journal of Zoology, London* **269**: 183-190.

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2007. A population viability model for the management of the spotted-tailed quoll, *Dasyurus maculatus maculatus. Department of Sustainability and Environment*, Heidelberg, Victoria.

2008. Spotted-tailed Quoll. Pp 60-62. In *The Mammals of Australia.* Eds. Steve Van Dyck and Ronald Strahan. Reed New Holland, Sydney

2008. Response of the tiger quoll *Dasyurus maculatus* to selective logging in SE NSW. *Australian Forestry.* **71,,** pp. 280-286.

Instructions for preparation of this expert Report

I was commissioned by Bleyer Lawyers on behalf of Environment East Gippsland to prepare an Expert report on the Spotted-tailed Quoll in relation to VicForests proposed logging of four coupes on Brown Mountain in East Gippsland and more specifically requested to;

- Describe the species
- Victorian distribution and habitat
- conservation status at a state and federal level
- presence in East Gippsland
- presence on Brown Mountain
- the Action Statement

- The Precautionary Principle

Facts and Assumptions upon which the report is based

The facts and assumptions are set out in the report. All documents referred to in the report are listed in the reference section at the end of the report.

I agree to abide by the Expert Witness code of conduct.

18/12/2009

Expert Report – Spotted-tailed Quoll

The Species

1 The tiger or spotted-tailed quoll *Dasyurus maculatus* (Kerr 1792) is the largest extant marsupial carnivore on mainland Australia and the sole surviving member of its genus in south-east mainland Australia. *D. maculatus* is a solitary, medium-sized, forest-dependent species and an adept climber (Belcher 1994; 2000; Edgar and Belcher 1995). *D. maculatus* is a forest-dependent species, considered to be dependent on mature or old growth forest (Belcher 2000; Tyndale-Biscoe and Calaby 1975).

The Spotted-tailed Quoll is readily distinguishable from the other quolls by its larger size and spotted tail. Their coat ranges from sandy brown to a rich rufous brown with white spots on the body and tail and a cream coloured belly. They have five toes on both front and back feet and their footpads have well-developed ridges or striations, an adaption for climbing. They have a distinctive bounding gait and are most vocal during the breeding season with a call likened to a 'blast from a circular saw". They are sexually dimorphic for weight with adult females about 60% of the weight of males. Maximum weights recorded are 7 kg for males and 4 kg for females (Settle 1978) Weight ranges for adult animals recorded during a study in south-eastern Australia were: 1.2–2.1 kg (average 1.7 kg) for females and 2.0–4.2 kg (average 2.8 kg) for males (Belcher 2003). Spotted-tailed Quolls use latrines (sites with aggregations of faeces). Peak latrine use occurs during the breeding season, suggesting that latrines are used to enable males to monitor the reproductive status of females. They may also be used to mark territory boundaries, landscape features and to communicate presence without physical contact.

(a)There are two subspecies currently recognised, the northern subspecies *D. m. gracillis* and the southern form, including that found in Tasmania, *D. m. maculatus*. Recent genetic research, however, suggests that the Tasmanian population is phylogenetically distinct from the mainland population of *D. m. maculatus* and should be considered a separate subspecies (Firestone *et al.*1999). The northern subspecies is smaller than the southern subspecies, with average male weight 1.6 kg (Burnett 2000). *D. m. gracillis* is restricted to rainforest in the wet tropics in far north Queensland, from about Townsville to Iron Range in (Watt 1993; Burnett 1993; 2000), and is geographically isolated from the southern subspecies. The southern subspecies is distributed on both sides of the Great Dividing Range, from south-eastern Queensland, through eastern New South Wales, eastern and south-western Victoria, to Tasmania. *D. m. maculatus* is believed to be extinct in South Australia and now has a disjunct distribution throughout much of its present range (Mansergh 1984; Maxwell *et al.* 1996).

2.(a) They have been recorded from a range of habitat types including rainforest, wet sclerophyll forest, dry sclerophyll forest, woodland and heathy woodland (Mansergh 1984; Watt 1993; Belcher 1994; 2000; Edgar and Belcher 1995; Jones and Rose 1996).

Den use and den requirements of *D. maculatus* are poorly known, but destruction of dens has been listed as a threatening process (Mansergh and Belcher 1992; Watt 1993; Maxwell *et al* 1996; Jones *et al.* 2003). Dens have been recorded in caves, rock crevices, boulder tumbles, hollow logs, low tree hollows, burrows and windrows (Edgar and Belcher 1995; Belcher and Darrant 2006).

(b) Most females in a study in SE Australia didn't breed until two years of age (Belcher 2003). *D. maculatus* is a seasonal breeder with an oestrus cycle of 21 days (Settle 1978). They are facultatively monoestrous, able to return to oestrus if conception fails or they lose a litter (Lee *et al.* 1982). Females enter oestrus for three days at a time, mating occurs in winter and in south-eastern Australia occurred between late June and early August with most matings in early to mid-July (Belcher 2003). Gestation is about three weeks and young are born between mid-July to late August with most births from late July to mid-August (Belcher 2003). Average litter size is 5.4 with a range of 4-6 per female (Belcher 2003). The average number weaned is three (range 2-4) (Belcher 2003). The young are carried in the pouch for approximately seven weeks after which they are left in a den until weaning at 18-21 weeks (Fleay 1940; Troughton 1954).

Distribution

3. At the time of European settlement the spotted-tailed quoll occurred throughout southern and eastern Victoria with the 600mm rainfall isohyets forming the inland boundary (Mansergh 1984; 1995). Detailed distributional records and estimates of abundance are generally lacking due to the scale and intensity of surveying required to detect the species across the landscape (Long and Nelson 2007). Reduction in the species range is believed to be 50% or greater (Mansergh 1984; Maxwell *et al.* 1996; Long and Nelson 2007). Populations in previous strongholds such as the Otway Ranges and Mt Eccles have declined substantially (Belcher 1999, 2000; 2002; Nelson 2006; 2008). The majority of recent records (post-1990) are from East Gippsland, particularly the upper Snowy River and tributaries and the Roger River – Errinundra Plateau area which is now most likely the stronghold for the species in Victoria (Long and Nelson 2007).

(a) Yes – Map 1.

(b) Spotted-tailed quolls have been recorded in five broad vegetation alliances in Victoria; Closed forest, Tall open-forest, Open-forest, Low open-forest and Woodland (Mansergh 1984). In a study of habitat use quolls were found to utilize white box *Eucalyptus albens* escarpment woodland in East Gippsland and montane damp forest containing *E. fastigata, E. nitens* and *E. viminalis* in southern NSW (Belcher 2000; Belcher and Darrant 2006). Quolls did not use the available habitat uniformly and the two factors that appeared to influence habitat use were prey densities and preferred den sites (Belcher 2000; Belcher and Darrant 2006). Habitat structural complexity was higher for preferred habitat in both study sites (Belcher 2000; Belcher and Darrant 2006). Arboreal marsupial fauna were a major prey item at both sites (Belcher 1995; Belcher *et al.* 2007).

(c) Most records on the Atlas of Victorian Wildlife are from incidental sightings, road-kills and quolls capture in poultry sheds. The study site at Suggan Buggan has provided a number of records (Belcher 1994; 2000). Systematic surveys have been undertaken in north-east Victoria (Nelson et al. 200), the Errinundra Plateau and Coopracambra (Nelson *et al.* 2007), the Otway Ranges (Belcher 1999; Nelson *et al.* 2007), Cobbobonee State Forest (Belcher 2002),Mt Eccles National Park (Belcher 2002; 2004; Nelson and Belcher 2008), Upper Snowy River (Belcher 1994; 2000; 2007; Nelson *et al.* 2007; In prep).

(d & e) Yes in that the upper Snowy River valley and tributaries and the Roger River – Errinundra Plateau are now the remaining stronghold for the species in Victoria and no, as many records reflect displaced male quolls that are old, injured or roaming looking for females during the breeding season (e.g. Mansergh 1983). Detailed distributional records are lacking due to the scale and intensity of surveying required to detect the species across the landscape (Long and Nelson 2007).

Conservation Status

4. The spotted-tailed quoll is listed under the Flora and Fauna Guarantee Act (1988) and is classified as 'Endangered' in Victoria (DSE 2007).
The current conservation status reflects the continuing decline of the species in Victoria and the urgent need to identify and ameliorate the threatening processes responsible for the decline. The factors that are currently agreed to be largely responsible for the species decline are the loss of suitable habitat and the continuing fragmentation of suitable habitat through clearing and clear-fall logging (Long and Nelson 2007). 1080 baiting is also implicated in the species decline (Belcher 1998; 2000; 2003; 2004; Long and Nelson 2007). Unless current land management practices are altered the species is likely to continue to decline to extinction.

5. The spotted-tailed quoll (mainland) is listed as 'Endangered' nationally (EPBC Act 1999). The national recovery plan urgently needs to be implemented for the above reasons.

6. The conservation status in Victoria is likely to change to 'Critically Endangered' in the short to medium term if the species decline in range and abundance continues. At a federal level the conservation status is unlikely to change in the medium term as there is a relatively large population in NE NSW. The impact of climate change may alter the conservation status at both state and federal levels.

7. Yes, a number of threats are listed in the national recovery plan.

(a) Continued loss and modification of habitat and fragmentation of remaining suitable habitat through silvicultural practices, resulting in smaller genetically isolated fragmented populations, baiting, inappropriate fire regimes, potential competition with and predation by introduced predators, poisoning by eating cane toads, human persecution, road trauma and climate change (Long and Nelson 2007).

i) Most of the above threats exist throughout Victoria, with the exception of poisoning by cane toads, and because of the relatively low numbers of quolls in Victoria, road trauma is less of an issue.

ii). Approximately 50% of the pre-European forest and dense woodland cover in Victoria has been removed (Kile *et al.* 1980). Further clearing for agriculture and ongoing timber harvesting have resulted in fragmentation of the remaining habitat. The dominant silvicultural system used in Victoria for timber harvesting is clear-felling, resulting in even-aged regrowth forest. 1080 poison baiting for a range of introduced species has been implicated in the species decline (Belcher 1998; 2003; 2004). The number of baits deployed and the area baited has increased substantially over the last 20 years. Post-harvest slash burns and fuel reduction burns may further alienate habitat.

(b) No. The existing measures under the Regional Forest Agreements do not address the major threats to the species, i.e. loss, alienation and fragmentation of habitat. Special management areas such as Special Protection Zones (SPZ) are untested as far as being effective conservation measures for spotted-tailed quolls, and the numbers are totally inadequate to conserve a viable population. Fox baiting has become a major conservation strategy e.g. Southern Ark, Gelenelg Ark, with little scientific evidence that it achieves the strategies objectives.

(c) No, for the above reasons. The East Gippsland RFA protects up to 75 sites, which may not be site specific, if there is reserved land within 1.5 kms. Southern Ark operates within a substantial area of the forest estate.

(d) No for the above reasons.

(e) No for the above reasons.

8. Yes current Victorian silvicultural practices have an impact on the spotted-tailed quoll and it's habitat.

(a) Research in Tasmania found that regrowth forest did not support resident quolls, nor breeding females (Long and Nelson 2007).

Research in southern NSW found that quolls avoided selectively logged sawlog only forest for 5-10 years post-logging, where an average of $17m^2\ ha^{-1}$ was removed during harvesting and a minimum basal area of $22m^{2\ ha\text{-}1}$ was retained, resulting in a canopy cover of 40-60% (Belcher 2000; 2008). The forests contained a matrix of selectively logged and unlogged mature forest and quolls used the unlogged forest significantly more than availability (Belcher 2000; 2008). The presence of unlogged mature forest may be a significant factor in enabling quolls to use selectively logged forest once the ground cover and understorey have re-established after logging (Belcher 2000; 2008). Quolls were recorded from structurally more complex habitat with high levels of ground or rock cover, understorey cover and canopy cover in Suggan Buggan, Badja and Tallaganda State Forests (Belcher 2000; Belcher and Darrant 2006). Clear-fell logging removes the structural complexity.

There is currently no evidence that even-age regrowth forest provides suitable habitat for quolls in Victoria. Loyn *et al.*(1980) found that quolls no longer persisted in the Boola Boola State Forest after harvesting.

The greater glider *Petauroides volans* is the spotted-tailed quolls major prey item in tall open forest/damp forest (Belcher 2000; Belcher *et al.*2007; Glen and Dickman 2006). Greater gliders are dependent on the presence of suitable tree hollows and foraging strata (Tyndale-Biscoe and Smith 1969; Recher *et al.* 1980; Ambrose 1982; Lunney 1987; Lindenmayer *et al.* 1991). Greater glider populations can be substantially depleted by clear-felling (Loyn *et al.* 1980), and densities of greater gliders decline in approximate

proportion to the amount of biomass removed during logging, i.e. the density of populations of greater gliders is correlated negatively with logging intensity and positively with standing biomass (Stockwell *et al.* 1990; Davey and Stockwell 1991; Howarth 1992). Clear-fell logging therefore removes the quolls major prey item, rendering the habitat unsuitable.

(b) Clear-fell logging will render the habitat unsuitable by removing the habitat features that spotted-tailed quolls are dependent upon, such as high prey densities, suitable den sites, structural complexity, including high ground, understorey and >40% canopy cover (Belcher 2000; Belcher and Darrant 2006; 2008). Given the rotation period, the clear-felled logged forest is unlikely to redevelop the habitat features quolls are dependent on within the logging cycle.

(c) Breeding female spotted-tailed quolls have not been recorded from clear-felled even-age regrowth forest (e.g. Loyn *et al.* 1980; Long and Nelson 2007; Atlas of Victorian Wildlife). Female quolls are dependent on high prey densities in order to establish a territory, breed and successfully rear young. Young are left in a maternal den at approximately seven weeks of age. Females are then restricted in both the area in which they can hunt and the period of time they can stay away from their young, until weaning. Fragmentation of their habitat and/or reduction in prey densities are likely to render the habitat unsuitable for females to breed successfully.

East Gippsland

9. Yes
(a) The upper Snowy River valley and tributaries, Roger River and Errinundra Plateau are the stronghold for the species in Victoria (Long and Nelson 2007).

10. (a) The only areas where habitat for the spotted-tailed quoll is secure in East Gippsland is in the Alpine, Snowy River and Errinundra National Parks.
(b) Population levels are unknown, but declined after the 2002/03 wildfires in the Alpine and Snowy River National Parks (Belcher 2007)
(c) Ongoing baiting programs throughout the species range may be having an impact on population levels. Fragmentation of habitat through clear-fell logging is likely to be further fragmenting populations, making them more vulnerable to stochastic events (Long and Nelson 2007).

Brown Mountain

11. The area should be surveyed during the species' breeding season, May-August, using hair-tubes at a density of 20/100 ha, or remote cameras with bait stations at a density of 4/100 ha. Quolls are most active during the breeding season, with females actively defending their territory

and males searching for receptive females. Active searches for latrines should also be conducted during this period.

12.

(a) The survey undertaken from10th November to 5th December using four remote cameras did not detect spotted-tailed quolls in the four coupes at Brown Mountain. It must be noted that the survey period was at the least appropriate time as both male and female spotted-tailed quoll activity is at a minimum. Mid-November to early December is during the period when females have their young in a maternal den and are restricted in both their movements, the area they move in and the time they can spend away from their young. Male activity is also at a minimum outside the breeding season (May-August). I therefore cannot determine whether spotted-tailed quolls are present in the four coupes.

(b) The four coupes contain all of the habitat features required by quolls – unlogged mature multi-aged forest, with high ground, understorey and canopy cover, ample potential den sites and high prey densities (Henry and Mitchell 2009). The coupes are still reasonably well connected to adjoining suitable habitat, although some adjoining coupes have been recently logged. The area is subject to ongoing 1080 poison baiting for foxes which may result in some quolls being poisoned, even though the baits are buried below 10 cms, other research has found that an average of > 30% of baits are cached by foxes, suggesting that approximately a third of baits will be accessible to quolls. I woud therefore expect quolls to be present unless other factors such as previous stochastic events such as wildfire or management programs such as baiting have resulted in the loss or extirpation of the local quoll population.

(c) Spotted-tailed quolls have been recorded to the east and west of the coupes (Long and Nelson 2007) so it would be reasonable to expect that quolls would be using the four coupes to move between known populations; for dispersal of young and/or for males seeking females to mate with. All four coupes provide suitable habitat and are connected so they all provide suitable habitat for movement between populations.

13. The four coupes provide suitable habitat for spotted-tailed quolls, particularly for breeding females, so I would expect the species to be present unless previous management has resulted in their extirpation. As discussed earlier, suitable habitat has become fragmented throughout the species range in Victoria resulting in smaller populations that are substantially more prone to extirpation (Long and Nelson 2007). Preliminary population modeling has found that the loss of one female in small populations significantly increases the risk of extinction in the short to medium term (Todd *et al.* 2007). Therefore without a detailed history of the sites and management histories it is not possible to reliably predict that the species still occurs in the four coupes. A systematic survey during the species breeding season would be required in order to provide information on the likelihood of the species being present or absent. A minimum of 40 hair-tubes or 4 remote cameras /100ha would be required to determine the probability of detection (Nelson 2007). Suitable habitat to the east and west should also be surveyed to determine whether the coupes are likely to be used by quolls moving between populations or

females or by dispersing young. Until those surveys are completed I am unable to reliably predict the presence/absence of the species within the four coupes.

14. As above, until appropriate surveys are undertaken during the species breeding season it is not possible to provide a definitive answer at an individual or local population level. At the species level, the loss of suitable habitat for breeding females and the further fragmentation of suitable habitat will contribute to the species ongoing decline, as outlined above and in the national recovery plan (Long and Nelson 2007). It would therefore contribute to the species decline and ultimate extirpation. Extinctions are mostly commonly incremental, and the incremental loss and fragmentation of suitable habitat will therefore logically ultimately result in the species extinction.

15. Indications to date suggest that the spotted-tailed quoll is slow to recolonise after disturbance (Firestone *et al.* 1999; Belcher 2007, Long and Nelson 2007). The proposed silvicultural method for logging the four compartments will result in the loss of suitable habitat for the spotted-tailed quoll through the loss of suitable prey at a density that enables them to exist and breed, loss of suitable dens and structural complexity. The logged areas will then be logged again, before they have developed the habitat features required by quolls, such as suitable tree hollows to support arboreal prey, structural complexity and sufficient suitable potential dens. Therefore the habitat in the four coupes will most likely become permanently alienated, so if quolls are present they are unlikely to recover from logging.

16. No

The Action Statement

17., 18. and 19.

- Protection of remaining suitable habitat, particularly old growth/mature forest with a complex structure, high prey densities ($\geq$ 4/ha) and suitable potential den sites, such as hollow logs, complex rock outcrops and burrows.
- Maintenance of connectivity between suitable habitat i.e. stop further fragmentation of habitat and populations.
- Pre-logging surveys for threatened species, such as spotted-tailed quolls by independent, suitably qualified and experienced scientists.
- Surveys of existing SPZ's and SMZ's to determine whether they achieve the stated objective of conserving the species.
- If SMZ's are to be continued to be used to "protect" quolls, the detection site must be included in the SMZ.
- Setting a realistic population target for the species in Victoria, following population viability analysis (PVA).
- Undertake a demographic and dispersal study in Victoria to provide the basic information required to inform a PVA.
- Review the impact on spotted-tailed quolls and the efficacy of the current broad scale 1080 poison programs in achieving their objectives and undertake the appropriate research.

The Precautionary Principle

20. The precautionary principle is ; that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degredation of the environment where there are threats of serious or irreversible environmental damage (EPBC Act 1991).

21.(a) The precautionary principle is not specifically mentioned in the East Gippsland Forest Management Plan. The precautionary approach, stated on page 29, for spotted-tailed quolls is to protect areas of undisturbed forest as foraging habitat; however the number of sites to be protected and the details of how they will be protected are inadequate to protect a viable population. Once 50 sites have been identified the guidelines will be reviewed. Only 75 sites in state forest and reserves have been protected to date. In areas where the spotted-tailed quoll is known to occur the sivlicultural method for timber harvesting should be selective sawlog only harvesting at an intensity that maintained approximately 50% canopy cover, within a matrix of logged and unlogged forest rather than clear-fell harvesting (Belcher 2008). This would require that mature unlogged forest and forest with high ≥ 4 prey species/ha be reserved and that adequate connectivity through suitable habitat be maintained to limit the impact of fragmentation of habitat and populations.
(b). The revised Action Statement for the Spot-tailed Quoll (2003) also fails to mention or follow the precautionary principle. The Action Statement has been superseded by the national recovery plan (Long and Nelson 2007). The Action Statement does not take a precautionary approach to either 1080 baiting or timber harvesting.
(c). The Scientific Advisory Committee (SAC 1991) recommendation on the nomination of the spotted-tailed Quoll for listing under the FFG Act determined that the species is:

- In a demonstrable state of decline which is likely to result in extinction;
- Significantly prone to future threats which are likely to result in extinction, and
- Is very rare in terms of abundance or distribution.

The species is still declining (Long and Nelson 2007) so clearly current land management practices are not halting the decline and/or are contributing to the decline.
As identified in the national recovery plan, habitat loss and fragmentation of habitat resulting in a disjunct distribution and isolated small populations are the major threats to the species (Long and Nelson 2007). 1080 baiting is likely to also be a contributing factor in the species continuing decline (Belcher 1998; 2000; 2003; 2004). Other factors such as wildfires and inappropriate fire regimes and competition and/or predation by introduced predators are likely to also be contributing to the ongoing decline. Therefore logging suitable habitat with high prey densities, such as the Brown Mountain coupes would be likely to contribute to the species decline and be contrary to the precautionary principle.
(d). Until the Brown Mountain coupes are systematically surveyed during the spotted-tailed quoll's breeding season (May – August), I cannot determine the presence/absence of the species. However given that there are records to the east and west of the compartments in similar habitat, the area is likely to form an important corridor for movement of adults, dispersal of juveniles and for maintenance of geneflow between populations. The Brown Mountain coupes contain suitable habitat with all the habitat features required by the species.

(e). Spotted-tailed quolls are solitary and occupy large home ranges; males average 1755 ha and females 495 ha (Belcher 2000; Belcher and Darrant 2004). They therefore naturally occur at low densities due to their spatial and social organization and viable populations require very large areas (Belcher 2000; Long and Nelson 2007). They are dependent on some habitat features provided by old growth or mature forests, but can tolerate some level of disturbance within a matrix of unlogged/ selectively logged forest. Therefore the conservation of areas of old growth/mature forest is an important component of conservation of the spotted-tailed quoll. The precautionary principle should apply until such time as the level of disturbance tolerated by the species is determined and the decline in range and abundance is halted.

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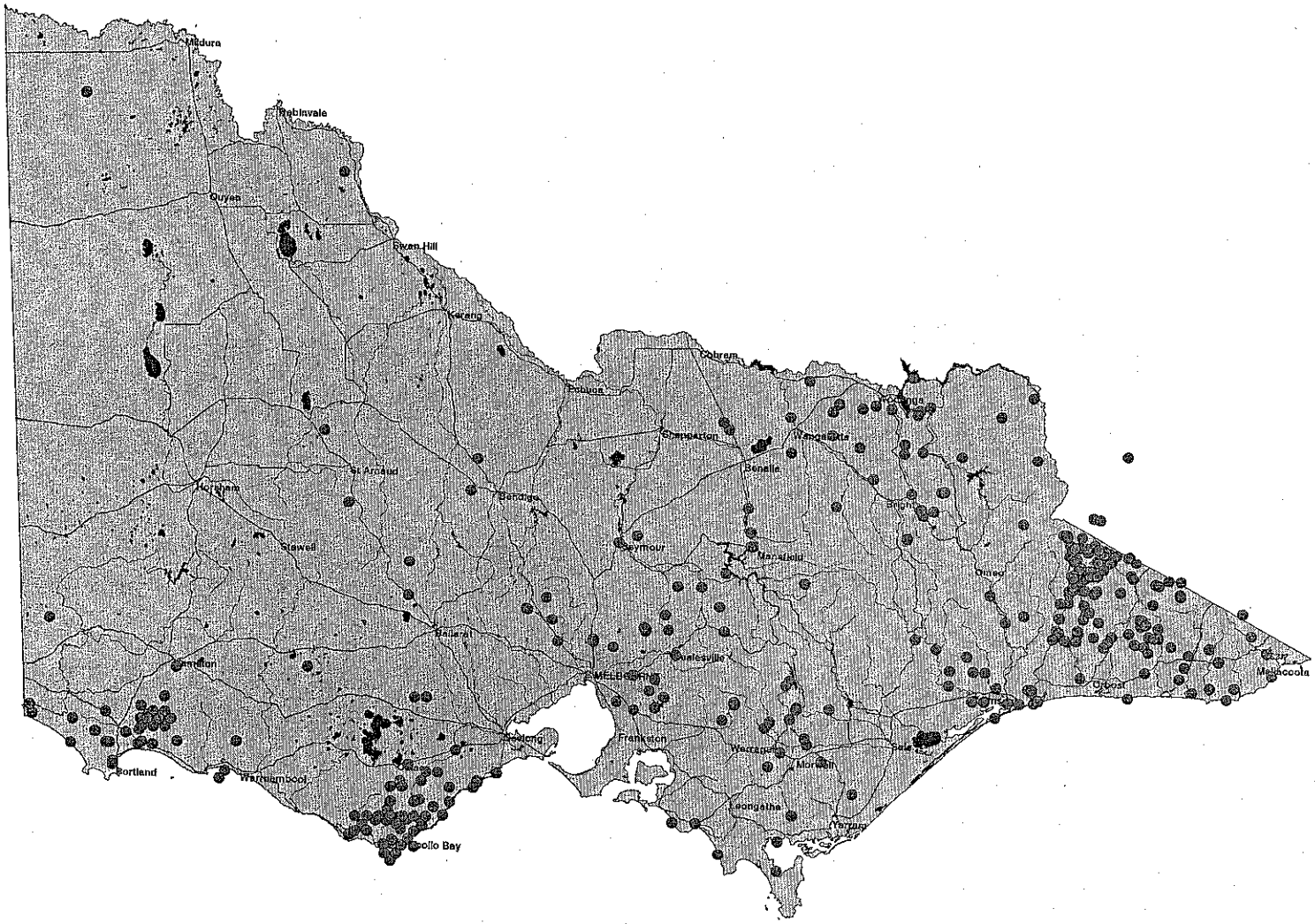
MAP 1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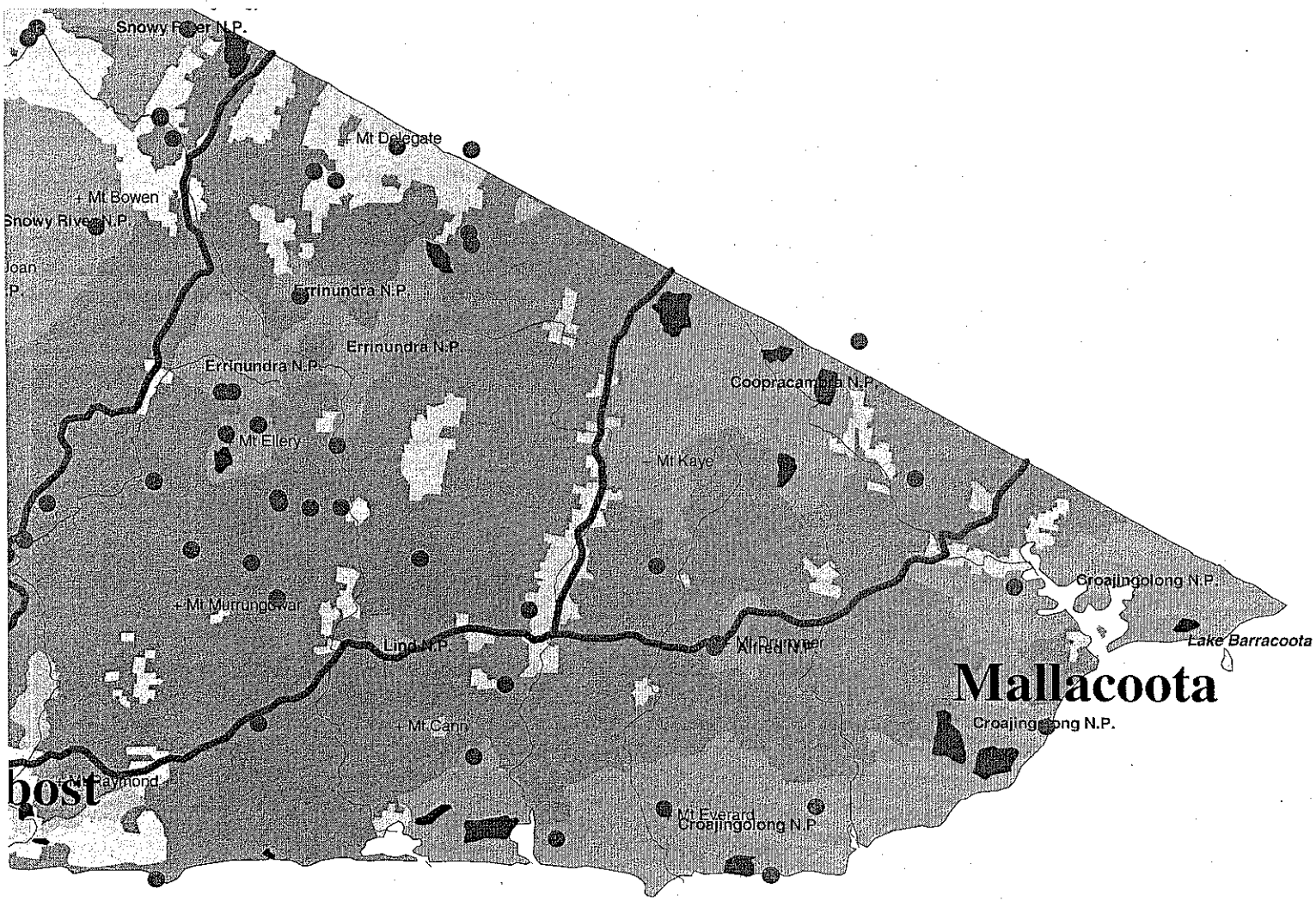
Swan Hill
Kerang
Cobram
Wangaratta
Seymour
Ballarat
Melbourne
Frankston
Warragul
Morwell
Orbost
Mallacoota
Portland
Warrnambool
Apollo Bay

MAP 2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Mt Delegate
Mt Bowen
Snowy River N.P.
Errinundra N.P.
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Mt Ellery
Coopracambra N.P.
Mt Kaye
Croajingolong N.P.
Mt Murrungowar
Lind N.P.
Alfred N.P.
Lake Barracoota
Mallacoota
Croajingolong N.P.
Mt Cann
Mt Raymond
Mt Everard
Croajingolong N.P.