



Consultation Document on Listing Eligibility and Conservation Actions

Dasyurus maculatus maculatus (Spotted-tailed Quoll, south eastern mainland)

You are invited to provide your views and supporting reasons related to:

- 1) the eligibility of *Dasyurus maculatus maculatus* (Spotted-tailed Quoll, south eastern mainland) for inclusion on the EPBC Act threatened species list in the vulnerable category; and
- 2) the necessary conservation actions for the above species.

Evidence provided by experts, stakeholders and the general public are welcome. Responses can be provided by any interested person.

Anyone may nominate a native species, ecological community or threatening process for listing under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or for a transfer of an item already on the list to a new listing category. The Threatened Species Scientific Committee (the Committee) undertakes the assessment of species to determine eligibility for inclusion in the list of threatened species and provides its recommendation to the Australian Government Minister for the Environment and Energy.

Responses are to be provided in writing either by email to:
species.consultation@environment.gov.au

or by mail to:

The Director
Marine and Freshwater Species Conservation Section
Biodiversity Conservation Division
Department of the Environment and Energy
PO Box 787
Canberra ACT 2601

Responses are required to be submitted by 3 July 2019.

Contents of this information package	Page
General background information about listing threatened species	2
Information about this consultation process	3
Draft information about the common name and its eligibility for listing	4
Conservation actions for the species	10
References cited	18
Collective list of questions – your views	12

General background information about listing threatened species

The Australian Government helps protect species at risk of extinction by listing them as threatened under Part 13 of the EPBC Act. Once listed under the EPBC Act, the species becomes a Matter of National Environmental Significance (MNES) and must be protected from significant impacts through the assessment and approval provisions of the EPBC Act. More information about threatened species is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/index.html>.

Public nominations to list threatened species under the EPBC Act are received annually by the department. In order to determine if a species is eligible for listing as threatened under the EPBC Act, the Threatened Species Scientific Committee (the Committee) undertakes a rigorous scientific assessment of its status to determine if the species is eligible for listing against a set of criteria. These criteria are available on the Department's website at:

<http://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/tssc-guidelines-assessing-species-2018.pdf>.

As part of the assessment process, the Committee consults with the public and stakeholders to obtain specific details about the species, as well as advice on what conservation actions might be appropriate. Information provided through the consultation process is considered by the Committee in its assessment. The Committee provides its advice on the assessment (together with comments received) to the Minister regarding the eligibility of the species for listing under a particular category and what conservation actions might be appropriate. The Minister decides to add, or not to add, the species to the list of threatened species under the EPBC Act. More detailed information about the listing process is at:

<http://www.environment.gov.au/biodiversity/threatened/nominations.html>.

To promote the recovery of listed threatened species and ecological communities, conservation advices and where required, recovery plans are made or adopted in accordance with Part 13 of the EPBC Act. Conservation advices provide guidance at the time of listing on known threats and priority recovery actions that can be undertaken at a local and regional level. Recovery plans describe key threats and identify specific recovery actions that can be undertaken to enable recovery activities to occur within a planned and logical national framework. Information about recovery plans is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/recovery.html>.

Privacy notice

The Department will collect, use, store and disclose the personal information you provide in a manner consistent with the Department's obligations under the Privacy Act 1988 (Cth) and the Department's Privacy Policy.

Any personal information that you provide within, or in addition to, your comments in the threatened species assessment process may be used by the Department for the purposes of its functions relating to threatened species assessments, including contacting you if we have any questions about your comments in the future.

Further, the Commonwealth, State and Territory governments have agreed to share threatened species assessment documentation (including comments) to ensure that all States and Territories have access to the same documentation when making a decision on the status of a potentially threatened species. This is also known as the '[common assessment method](#)'. As a result, any personal information that you have provided in connection with your comments may be shared between Commonwealth, State or Territory government entities to assist with their assessment processes.

The Department's Privacy Policy contains details about how respondents may access and make corrections to personal information that the Department holds about the respondent, how respondents may make a complaint about a breach of an Australian Privacy Principle, and how the Department will deal with that complaint. A copy of the Department's Privacy Policy is available at: <http://environment.gov.au/privacy-policy>.

Information about this consultation process

Responses to this consultation can be provided electronically or in hard copy to the contact addresses provided on Page 1. All responses received will be provided in full to the Committee and then to the Australian Government Minister for the Environment.

In providing comments, please provide references to published data where possible. Should the Committee use the information you provide in formulating its advice, the information will be attributed to you and referenced as a 'personal communication' unless you provide references or otherwise attribute this information (please specify if your organisation requires that this information is attributed to your organisation instead of yourself). The final advice by the Committee will be published on the department's website following the listing decision by the Minister.

Information provided through consultation may be subject to freedom of information legislation and court processes. It is also important to note that under the EPBC Act, the deliberations and recommendations of the Committee are confidential until the Minister has made a final decision on the nomination, unless otherwise determined by the Minister.

Dasyurus maculatus maculatus

Spotted-tailed Quoll, south-eastern mainland

Taxonomy

Conventionally accepted as *Dasyurus maculatus maculatus* (Kerr, 1972).

Sub-species Information

Description

There are two sub-species recognised for the Spotted-tailed Quoll - *Dasyurus maculatus gracilis*, restricted to north-eastern Queensland, and *Dasyurus maculatus maculatus*, that occurs from southern Queensland through to south-western Victoria and Tasmania. While studies have found the Tasmanian populations are distinct from the mainland populations of *Dasyurus maculatus maculatus* to warrant subspecific status, the Tasmanian subspecies has not yet received formal published taxonomic recognition (DELWP 2016). As such, the two southern subspecies are referred to as *Dasyurus maculatus maculatus* (south-eastern mainland population), and *Dasyurus maculatus maculatus* (Tasmanian population).

This Consultation Document relates to the sub-species *Dasyurus maculatus maculatus* from south-eastern mainland Australia.

The Spotted-tailed Quoll is a nocturnal, cat-sized, carnivorous marsupial with reddish-brown fur and distinctive white spots over its back and tail (Cronin 1991; Edgar & Belcher 2008). Males are 380–759 mm in head and body length, and females are 350–450 mm. Tail length is 370–550 mm for males and 340–420 mm for females. Males weigh up to 7 kg and females up to 4 kg (Edgar & Belcher 2008) although the mean weight range for male adults is 2.8–4.6 kg and 1.5–2 kg for females (Belcher 2003; Green & Scarborough 1990; Jones 1997; Körtner et al. 2004).

Distribution

The Spotted-tailed Quoll (south-eastern mainland) occurs in eastern Australia from south-eastern Queensland to western Victoria, but its area of occupancy has contracted by up to 50 percent (Maxwell et al. 1996). Populations are now fragmented and isolated and estimates of the decline range from 50 – 90 percent for the mainland and 25 – 50 percent for the population in NSW (DELWP 2016). It has been extirpated from many parts of its former range, most notably including south-eastern South Australia (Woinarski et al. 2014).

The National Recovery Plan for the Spotted-tailed Quoll lists the following important populations of the Spotted-tailed Quoll (south-eastern mainland):

- Great Otway National Park (VIC)
- Mt Eccles National Park East Gippsland (VIC)
- East Gippsland (VIC)
- Marylands National Park and adjacent areas (NSW)
- Barrington (NSW)
- North Coast (NSW)
- South Coast (NSW)
- Limeburner's Creek Nature Reserve (NSW)
- Northern Tablelands (NSW)
- Greater Blue Mountains (NSW)
- Tallaganda / Badja (NSW)
- Jenolan (NSW)
- Kosciuszko National Park (NSW)

- Stanthorpe to Wallangarra, Granite Belt/New England Tablelands (QLD)
- Cherrabah Homestead (between Warwick and Killarney) (QLD)
- Main Range-McPherson Range west (QLD)
- Lamington Plateau-McPherson Range east (QLD)
- Burnett Range (QLD)
- Dalby region (QLD)

Cultural Significance

The Spotted-tailed Quoll is a culturally and spiritually significant species to Aboriginal people, especially in Queensland. The species is represented in the Dreamtime through totemism, country and story.

Relevant Biology/Ecology

The Spotted-tailed Quoll is carnivorous, feeding on a wide variety of prey such as small-medium sized (less than 5 kg) mammals, birds, reptiles, fish, amphibians, and invertebrates (Belcher 1995; Andrew 2005; Glen and Dickman 2006a; Belcher et al. 2007; Jarman et al. 2007).

The Spotted-tailed Quoll typically occurs at low densities, as adults are solitary and occupy large home ranges of several hundred to several thousand hectares (Woinarski et al. 2014). Males have larger ranges of up to a few thousand hectares in size, while females have smaller ranges of several hundred hectares (Andrew 2005; Claridge et al. 2005; Glen and Dickman 2006b). Home range sizes may vary depending on the quality of habitat – ranges may be smaller in higher quality habitat in northern New South Wales than in southern New South Wales and Victoria (Glen and Dickman 2011).

The Spotted-tailed Quoll is a mainly forest dependent species and occurs in a variety of habitats including closed forests (including temperate and sub-tropical rainforest), tall eucalypt forests, open woodlands, open forests, drier rainshadow woodlands and coastal heathlands (Oakwood et al. 2007). Relatively high densities of the species have been recorded from both wet and dry forest habitats (Watt 1993; Mansergh 1995; Jones & Rose 1996; Belcher 2000; Dawson 2005; Glen & Dickman 2006b). During the day Spotted-tailed Quolls shelter in fallen logs, boulder piles, burrows, tree hollows and occasionally under dwellings (Woinarski et al. 2014).

Breeding occurs annually in winter, with an average litter size of five. A generation length of 2.5 years is derived as the midpoint of age at first breeding (1 year) and longevity (three years) (Woinarski et al. 2014).

Threats

Table 1: Threats impacting the Spotted-tailed Quoll (south eastern mainland) in approximate order of severity of risk, based on available evidence.

Number	Threat factor	Threat type and status	Evidence base
1.0	Habitat loss and fragmentation		
1.1	Habitat loss and modification	severe	Habitat loss and modification likely the greatest threat (DELWP 2016). Demonstrated absence or reduced abundance in cleared areas; large home range size reduces viability in smaller fragments of suitable habitat (Woinarski et al. 2014).
1.2	Timber production	moderate	Timber harvesting occurs through large proportion of the species range (DELWP 2016).

1.3	Mortality associated with road traffic	minor	Susceptible to road mortality due to scavenging of other road-killed fauna. Juvenile males most likely at risk due to extensive ranging behaviour and thus more likely to encounter roads (DELWP 2016).
2.0	Invasive species		
2.1	Red Foxes	severe	Competitive and/or predatory interactions are likely occurring and may be suppressing their populations. (DELWP 2016). There is strong correlative, experimental and modelling evidence of impacts from red foxes (Woinarski et al. 2014).
2.2	Feral Cats	minor	Competitive and/or predatory interactions are likely occurring and may be suppressing their populations (DELWP 2016). There is some correlative, experimental and modelling evidence of impacts from feral cats (Woinarski et al. 2014).
2.3	Wild Dogs	moderate	Competitive and/or predatory interactions are likely occurring and may be suppressing their populations (DELWP 2016). There is some correlative, experimental and modelling evidence of impacts from wild dogs (Woinarski et al. 2014).
2.4	Cane toads	minor	Other species of quolls have deaths attributed to poisoning from cane toads, as such they are likely to be susceptible should their ranges overlap. Climate change may potentially extend the range of cane toads, which may increase the likelihood of future interactions (DELWP 2016),
2.5	Poisoning associated with control of non-native predators	moderate	Poison baits extensively used throughout the range of the species (DELWP 2016). Some low levels of mortality associated with 1080 baiting these impacts may be greater where local population sizes are small or isolated (Woinarski et al. 2014).
3.0	Fire		
3.1	Inappropriate fire regimes	moderate	High frequency fire may reduce the structural complexity of their habitat and some of their preferred prey (Woinarski et al. 2014).

Assessment of available information in relation to the EPBC Act Criteria and Regulations

Criterion 1. Population size reduction (reduction in total numbers) Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered Very severe reduction	Endangered Severe reduction	Vulnerable Substantial reduction
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%
<div> <div> A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased. A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible. A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) <i>cannot be used for A3</i>] A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible. </div> <div> <i>base</i> </div> <div> (a) direct observation [<i>except A3</i>] (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat (d) actual or potential levels of exploitation (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites </div> </div>			

Evidence:

The generation length of the Spotted-tailed Quoll (south-eastern mainland) is estimated to be two and half years (Woinarski et al. 2014), giving a seven and a half year time scale for this criterion (three generations).

Across much of its range, some individual populations have declined or been extirpated. For example, there was a reported seven-fold decline in the Otway ranges from the 1960s to the 1990s, and a six-fold decline from south-western Victoria between the 1970s and 1990s. It has also been extirpated from south-eastern South Australia (Woinarski et al. 2014). Despite these declines, the Spotted-tailed Quoll (south-eastern mainland) remains abundant in areas of north-eastern New South Wales. For example, a study of a population of Spotted-tailed quolls in Marengo and Chaelundi State Forests in northern New South Wales found high local abundance (Glen and Dickman 2011).

In general, there is limited information available on the distribution and abundance of the species throughout much of its range, except for intensively trapped research sites (DELWP 2016). While local declines have been observed or suspected across much of the range, the rate of overall decline is not considered likely to be greater than 30 percent per every three generations (Woinarski et al. 2014).

The data presented above appear to demonstrate the species is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 2. Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
AND at least 2 of the following 3 conditions indicating distribution is precarious for survival:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Evidence:

The extent of occurrence (EOO) is estimated at 596,344 km² and the area of occupancy (AOO) at 2,512 km². These figures are based on the mapping of point records from 1997 to 2017, obtained from state governments, museums and CSIRO. The EOO was calculated using a minimum convex hull, and the AOO calculated using a 2x2 km grid cell method, based on the IUCN Red List Guidelines 2014 (DotE 2015).

The data presented above appear to demonstrate the species is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 3. Population size and decline			
	Critically Endangered Very low	Endangered Low	Vulnerable Limited
Estimated number of mature individuals	< 250	< 2,500	< 10,000
AND either (C1) or (C2) is true			
C1 An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	Very high rate 25% in 3 years or 1 generation (whichever is longer)	High rate 20% in 5 years or 2 generation (whichever is longer)	Substantial rate 10% in 10 years or 3 generations (whichever is longer)
C2 An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(a) (i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(a) (ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b) Extreme fluctuations in the number of mature individuals			

Evidence:

The Spotted-tailed Quoll (south-eastern mainland) is currently listed as Endangered under the EPBC Act, based on eligibility against decline in population size. The EPBC Act listing advice (TSSC 2004) suggested that the population size for this subspecies was between 2000 and 10,000 mature individuals.

There is no reliable estimate of population size for this species. Examinations of populations have found the total population size of the full species is considered to be 'of the order of 20,000 mature individuals' (Burnett and Dickman 2008). The Spotted-tailed Quoll (south-eastern mainland) has an inferred continuing decline in population size, and the largest subpopulation is estimated at fewer than 1000 mature individuals. The population size is estimated to be under 10 000 mature individuals, although this estimate has relatively low reliability (Woinarski et al. 2014).

The data presented above appear to demonstrate the species is **eligible for listing as Vulnerable** under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process

Criterion 4. Number of mature individuals			
	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
Number of mature individuals	< 50	< 250	< 1,000

Evidence:

As described above under Criterion 3, the population of Spotted-tail Quoll is estimated to be fewer than 10 000 individuals.

The data presented above appear to demonstrate the species is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 5. Quantitative Analysis			
	Critically Endangered Immediate future	Endangered Near future	Vulnerable Medium-term future
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Evidence:

Population viability analysis appears not to have been undertaken, there are insufficient data to demonstrate if the species is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Conservation Actions

Recovery Plan

A recovery plan has been developed recently for the full species, it came into effect in 2016.

A decision about whether there should be a new or updated recovery plan for this species has not yet been determined. The purpose of this consultation document is to elicit additional information to help inform this decision.

Primary Conservation Actions

Protection of existing habitat is key for the ongoing recovery of the Spotted-tailed Quoll, and further clearance or fragmentation of habitat of important populations should be avoided.

Determine the distribution and status of populations throughout its range, and investigate key biological and ecological attributes.

Conservation Actions

Conservation and Management priorities

- Habitat loss disturbance and modifications
 - Target landholders in areas where the Spotted-tailed Quoll is known to occur to protect and manage their land in a manner that is compatible with maintenance of Spotted-tailed Quoll habitat through voluntary conservation agreements.
 - Maintain and restore habitat corridors on unprotected freehold land.
 - Develop guidelines on minimum habitat requirements that can be used to direct the formation of habitat retention prescriptions or other requirements in commercially harvested forests.
 - Implement monitoring programs to evaluate the effectiveness of current habitat retention prescriptions at providing habitat for viable populations of the Spotted-tailed Quoll in commercially harvested forests.
- Invasive species (including threats from grazing, trampling, predation)
 - Monitor the abundance of the Spotted-tailed Quoll and introduced predators in areas with and without predator control programs.
 - Conduct population viability analysis to investigate the impact of increased mortality resulting from baiting practices on the long-term viability of Spotted-tailed Quoll populations throughout their range.
 - Assess the potential impact of strychnine use in areas of known or potential Spotted-tailed Quoll habitat.
 - Review existing information on alternative poison delivery or biological control systems to identify systems with high target species specificity that could be applied in areas occupied by the Spotted-tailed Quoll.
 - Map the current distribution of the Spotted-tailed Quoll and the Cane Toad to identify areas of overlap, and determine factors that affect the survival of quolls in these areas.
 - Monitor the survival of Spotted-tailed Quolls in areas newly colonised by Cane Toads.

- If it is considered that Cane Toads are a threat to quoll populations, identify and implement appropriate threat abatement actions.
- Fire
 - Incorporate the need for protection of rocky outcrops and riparian zones into fire planning processes within areas of known Spotted-tailed Quoll habitat.
 - Investigate the impact of bushfires and planned burns on Spotted-tailed Quoll populations and develop prescriptions for planned burns in areas of quoll habitat.

Stakeholder Engagement

- Conduct a survey to determine the target audience and avenues for raising public awareness, and develop a communication and public education strategy based on the findings.
- Prepare education resources and distribute these to the identified target audience.
- Involve the community in survey and monitoring efforts for the species.

Survey and Monitoring priorities

- Conduct further research to determine the distribution and status of Spotted-tailed Quoll populations throughout the range, and develop targeted survey techniques and monitoring protocols.
- Use the results of these surveys to examine population dynamics and determine whether populations persist at low abundance or are becoming locally extinct and re-occupied (metapopulation model).

Information and Research priorities

- Develop targeted survey techniques and monitoring protocols
- Undertake field surveys and mapping in areas where the distribution and status of populations are poorly known.
- Develop and implement a program to monitor Spotted-tailed Quoll population status, determine factors influencing habitat quality, identify threats and implement management actions at representative sites throughout the species' range.

Collective list of questions – your views

SECTION A GENERAL

1. Is the information used to assess the nationally threatened status of the species robust? Have all the underlying assumptions been made explicit? Please provide justification for your response.
2. Can you provide additional data or information relevant to this assessment?
3. Have you been involved in previous state, territory or national assessments of this species/subspecies? If so, in what capacity?

PART 1 – INFORMATION TO ASSIST LISTING ASSESSMENT

SECTION B DO YOU HAVE ADDITIONAL INFORMATION ON THE ECOLOGY OR BIOLOGY OF THE SPECIES? (If no, skip to section C)

Biological information

4. Can you provide any additional or alternative references, information or estimates on longevity, average life span and generation length?
5. Do you have any additional information in the ecology or biology of the species not in the current advice/plan?

SECTION C ARE YOU AWARE OF THE STATUS OF THE TOTAL NATIONAL POPULATION OF THE SPECIES? (If no, skip to section D)

Population size

6. Has the survey effort for this taxon been adequate to determine its national adult population size? If not, please provide justification for your response.
7. Do you consider the way the population size has been derived to be appropriate? Are there any assumptions and unquantified biases in the estimates? Did the estimates measure relative or absolute abundance? Do you accept the estimate of the total population size of the species? If not, please provide justification for your response.
8. If not, can you provide a further estimate of the current population size of mature adults of the species (national extent)? Please provide supporting justification or other information.

If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible subspecies numbers, and also choose the level of confidence you have in this estimate:

Number of mature individuals is estimated to be in the range of:

☐ 1–50 ☐ 51–250 ☐ 251–1000 ☐ >1000 ☐ >10 000

Level of your confidence in this estimate:

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence

- ☐ 51–95% - reasonably certain, information suggests this range
- ☐ 95–100% - high level of certainty, information indicates quantity within this range
- ☐ 99–100% - very high level of certainty, data are accurate within this range

SECTION D ARE YOU AWARE OF TRENDS IN THE OVERALL POPULATION OF THE SPECIES? (If no, skip to section E)

9. Does the current and predicted rate of decline used in the assessment seem reasonable? Do you consider that the way this estimate has been derived is appropriate? If not, please provide justification of your response.

Evidence of total population size change

10. Are you able to provide an estimate of the total population size in 2008-2010 (*at or soon after the start of the most recent three generation period*)? Please provide justification for your response.

If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible subspecies numbers, and also choose the level of confidence you have in this estimate.

Number of mature individuals is estimated to be in the range of:

- ☐ 1–50 ☐ 51–250 ☐ 251–1000 ☐ >1000 ☐ >10 000

Level of your confidence in this estimate:

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, information suggests this range
- ☐ 95–100% - high level of certainty, information indicates quantity within this range
- ☐ 99–100% - very high level of certainty, data are accurate within this range

11. Are you able to comment on the extent of decline in the species/subspecies' total population size over the last approximately 10 years? Please provide justification for your response.

If, because of uncertainty, you are unable to provide an estimate of decline, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of decline, and also choose the level of confidence you have in this estimated range.

Decline estimated to be in the range of:

- ☐ 1–30% ☐ 31–50% ☐ 51–80% ☐ 81–100% ☐ 90–100%

Level of your confidence in this estimated decline:

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on

- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, suggests this range of decline
- ☐ 95–100% - high level of certainty, information indicates a decline within this range
- ☐ 99–100% - very high level of certainty, data are accurate within this range

12. Please provide (if known) any additional evidence which shows the population is stable, increasing or declining.

SECTION E ARE YOU AWARE OF INFORMATION ON THE TOTAL RANGE OF THE SPECIES? (If no, skip to section F)

Current Distribution/range/extent of occurrence, area of occupancy

13. Does the assessment consider the entire geographic extent and national extent of the species/subspecies? If not, please provide justification for your response.
14. Has the survey effort for this species/subspecies been adequate to determine its national distribution? If not, please provide justification for your response.
15. Is the distribution described in the assessment accurate? If not, please provide justification for your response and provide alternate information.
16. Do you agree that the way the current extent of occurrence and/or area of occupancy have been estimated is appropriate? Please provide justification for your response.
17. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the extent of occurrence and/or area of occupancy.

If, because of uncertainty, you are unable to provide an estimate of extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of extent of occurrence, and also choose the level of confidence you have in this estimated range.

Current extent of occurrence is estimated to be in the range of:

- ☐ <100 km² ☐ 100 – 5 000 km² ☐ 5 001 – 20 000 km² ☐ >20 000 km²

Level of your confidence in this estimated extent of occurrence

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, data suggests this range of decline
- ☐ 95–100% - high level of certainty, data indicates a decline within this range
- ☐ 99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of area of occupancy, and also choose the level of confidence you have in this estimated range.

Current area of occupancy is estimated to be in the range of:

☐ <10 km² ☐ 11 – 500 km² ☐ 501 – 2000 km² ☐ >2000 km²

Level of your confidence in this estimated extent of occurrence:

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% - high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

SECTION F ARE YOU AWARE OF TRENDS IN THE TOTAL RANGE OF THE SPECIES? (If no, skip to section G)

Past Distribution/range/extent of occurrence, area of occupancy

18. Do you consider that the way the historic distribution has been estimated is appropriate?
Please provide justification for your response.

19. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the former extent of occurrence and/or area of occupancy.

If, because of uncertainty, you are unable to provide an estimate of past extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past extent of occurrence, and also choose the level of confidence you have in this estimated range.

Past extent of occurrence is estimated to be in the range of:

☐ <100 km² ☐ 100 – 5 000 km² ☐ 5 001 – 20 000 km² ☐ >20 000 km²

Level of your confidence in this estimated extent of occurrence

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% - high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of past area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past area of occupancy, and also choose the level of confidence you have in this estimated range:

Past area of occupancy is estimated to be in the range of:

☐ <10 km² ☐ 11 – 500 km² ☐ 501 – 2000 km² ☐ >2000 km²

Level of your confidence in this estimated extent of occurrence:

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, data suggests this range of decline
- ☐ 95–100% -high level of certainty, data indicates a decline within this range
- ☐ 99–100% - very high level of certainty, data is accurate within this range

PART 2 – INFORMATION FOR CONSERVATION ADVICE ON THREATS AND CONSERVATION ACTIONS

SECTION G DO YOU HAVE INFORMATION ON THREATS TO THE SURVIVAL OF THE SPECIES? (If no, skip to section H)

- 20. Do you consider that all major threats have been identified and described adequately?
- 21. To what degree are the identified threats likely to impact on the species/subspecies in the future?
- 22. Are the threats impacting on different populations equally, or do the threats vary across different populations?
- 23. Can you provide additional or alternative information on past, current or potential threats that may adversely affect the species/subspecies at any stage of its life cycle?
- 24. Can you provide supporting data/justification or other information for your responses to these questions about threats?

SECTION H DO YOU HAVE INFORMATION ON CURRENT OR FUTURE MANAGEMENT FOR THE RECOVERY OF THE SPECIES? (If no, skip to section I)

- 25. What planning, management and recovery actions are currently in place supporting protection and recovery of the species/subspecies? To what extent have they been effective?
- 26. Can you recommend any additional or alternative specific threat abatement or conservation actions that would aid the protection and recovery of the species/subspecies?
- 27. Would you recommend translocation (outside of the species' historic range) as a viable option as a conservation actions for this species/subspecies?

SECTION I DO YOU HAVE INFORMATION ON STAKEHOLDERS IN THE RECOVERY OF THE SPECIES?

- 28. Are you aware of other knowledge (e.g. traditional ecological knowledge) or individuals/groups with knowledge that may help better understand population trends/fluctuations, or critical areas of habitat?
- 29. Are you aware of any cultural or social importance or use that the species has?
- 30. What individuals or organisations are currently, or potentially could be, involved in management and recovery of the species/subspecies?

31. How aware of this species are land managers where the species is found?
32. What level of awareness is there with individuals or organisations around the issues affecting the species/subspecies?
- a. Where there is awareness, what are these interests of these individuals/organisations?
 - b. Are there populations or areas of habitat that are particularly important to the community?

PART 3 – ANY OTHER INFORMATION

33. Do you have comments on any other matters relevant to the assessment of this species?

References cited in the advice

- Andrew DL (2005). Ecology of the tiger quoll *Dasyurus maculatus maculatus* in coastal New South Wales. M.Sc thesis, University of Wollongong, Wollongong.
- Belcher C A (1995). Diet of the Tiger Quoll (*Dasyurus maculatus*) in East Gippsland, Victoria. *Wildlife Research* **22**, 341-357.
- Belcher CA (2000). The ecology of the Tiger Quoll, *Dasyurus maculatus*, in south-eastern Australia. Ph.D thesis, La Trobe University, Bundoora.
- Belcher CA (2003). Demographics of tiger quoll (*Dasyurus maculatus maculatus*) populations in south-eastern Australia. *Australian Journal of Zoology* **51**, 611-626.
- Belcher C (2004). The largest surviving marsupial carnivore on mainland Australia: the Tiger or Spotted-tailed Quoll *Dasyurus maculatus*, a nationally threatened, forest-dependent species. Pp. 612-623 In *Conservation of Australia's Forest Fauna* (second edition). Ed. D. Lunney. Royal Zoological Society of New South Wales, Mosman, NSW.
- Burnett S, and Dickman C (2008). *Dasyurus maculatus*. In 'IUCN red list of threatened species.' Version 2011.2.' <www.iucnredlist.org>. Accessed 6 May 2012.
- Claridge AW, Paull D, Dawson J, Mifsud G, Murray AJ, Poore R. and Saxon MJ (2005). Home range of the spotted-tailed quoll (*Dasyurus maculatus*), a marsupial carnivore, in a rainshadow woodland. *Wildlife Research* **32**, 7-14.
- Cronin L (1991). Key Guide to Australian Mammals. Balgowlah, NSW: Reed Books. [Book; Status=Final; ID=9321].
- Dawson JP (2005). Impact of wildfire on the spotted-tailed quoll *Dasyurus maculatus* in Kosciuszko National Park. M.Sc. thesis, University of New South Wales, Sydney.
- Department of Environment, Land, Water and Planning (DELWP) (2016). National Recovery Plan for the Spotted-tailed Quoll *Dasyurus maculatus*. Australian Government, Canberra.
- Edgar R and C Belcher (2008). Spotted-tailed Quoll, *Dasyurus maculatus* (Kerr, 1792). In: Strahan, R., ed. The Mammals of Australia. Page(s) 61-62. Carlton, Victoria: Reed New Holland. [Book; Status=Final; ID=13927].
- Glen AS and Dickman, CR (2006a). Home range, denning behaviour and microhabitat use of the carnivorous marsupial *Dasyurus maculatus* in eastern Australia. *Journal of Zoology, London* **268**, 347-354.
- Glen AS and Dickman CR (2006b). Home range, denning behavior and microhabitat use of the carnivorous marsupial *Dasyurus maculatus* in eastern Australia. *Journal of Zoology* **268**, 347-354.
- Glen AS and Dickman CR (2011). Why are there so many Spotted-tailed Quolls *Dasyurus maculatus* in parts of north-eastern New South Wales? *Australian Zoologist* **35**, 711-718.

- Green RH and Scarborough TJ (1990). The spotted-tailed quoll *Dasyurus maculatus* (Dasyuridae, Marsupialia) in Tasmania. *The Tasmanian Naturalist* **100**, 1-14.
- Jarman PJ, Allen LR, Boschma DJ and Green SW (2007). Scat contents of the spotted-tailed quoll *Dasyurus maculatus* in the New England gorges, north-eastern New South Wales. *Australian Journal of Zoology* **55**, 63-72.
- Jones M. (1997). Character displacement in Australian dasyurid carnivores: size relationships and prey size patterns. *Ecology* **78**, 2569-2587.
- Jones ME and Rose RK (1996). Preliminary assessment of distribution and habitat associations of the spotted-tailed quoll (*Dasyurus maculatus maculatus*) and eastern quoll (*D. viverrinus*) in Tasmania to determine conservation and reservation status. Nature Conservation Branch, Parks and Wildlife Service. Report to the Tasmanian RFA Environment and Heritage Technical Committee, Hobart, Tasmania.
- Körtner G, Gresser S, Mott B, Tamayo B, Pisanu P, Bayne P and Harden R (2004). Population structure, turnover and movement of spotted-tailed quolls on the New England Tablelands. *Wildlife Research* **31**, 475-484.
- Long K and Nelson K (2012). National recovery plan for the Spotted-tailed quoll *Dasyurus maculatus*. Victorian Department of Sustainability and Environment, Melbourne.
- Mansergh IM (1995). Spot-tailed Quoll, *Dasyurus maculatus*. Pp. 51-52 In *Mammals of Victoria*. Ed. P. W. Menkhorst. Oxford University Press, Melbourne.
- Maxwell S, Burbidge AA and Morris K (1996). Spotted-tailed Quoll (SE mainland and Tas); recovery outline. Pp, 85-87 In *The Action Plan for Australian Marsupials and Monotremes*. Environment Australia, Canberra.
- Oakwood M, Foster P, and Cardoso M (2007). Refining the regional habitat model for the Spotted-tailed Quoll *Dasyurus maculatus*, in the Gosford Local Government Area, New South Wales. Envirotek, Nana Glen.
- Watt A (1993). Conservation status and draft management plan for *Dasyurus maculatus* and *D. hallucatus* in southern Queensland. Department of Environment and Heritage, Queensland.
- Woinarski JCZ, Burbidge AA & Harrison PL (2014). Spotted-tailed Quoll (south-eastern mainland) in *The action plan for Australian Mammals 2012*, CSIRO publishing, Collingwood, 84-87