



# Threatened Species Nomination Form — For adding or changing the category of a native species in the list of threatened species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

### Nominator details

Note: Nominator details are subject to the provision of the *Privacy Act 1988* and will not be divulged to third parties if advice regarding the nomination is sought from such parties.

#### 1. Full name

Deborah Tabart OAM

#### 2. Body, organisation or company name (if applicable)

Australian Koala Foundation

#### 3. Contact details

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Phone: (07) 3229 7233

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Postal address:  
GPO Box 2659,  
Brisbane 4001 QLD

#### 4. Declaration: I declare that the information in this nomination and its attachments is true and correct to the best of my knowledge.

Signed (If available, please attach an electronic signature when submitting by email):

5. Date signed: 09/12/2008

### Nominated species — summary of eligibility

#### 1. Name of species (or subspecies)

*Phascolarctos cinereus* (within the Koala Coast)

#### 2. Category for which the species is nominated under the EPBC Act

Current listing category

- Extinct
- Extinct in the wild
- Critically Endangered
- Endangered
- Vulnerable
- Conservation dependent
- Unlisted

Proposed listing category

- Extinct
- Extinct in the wild
- Critically Endangered
- Endangered
- Vulnerable
- Conservation dependent

#### 3. Criteria under which the species is eligible for listing

For a species nominated as critically endangered, endangered or vulnerable, identify which of the eligibility criteria it meets (one or more) from the list below. Please note that the information you provide in this nomination form should support the criteria you select.

For further details on the criteria, please refer to the Threatened Species Scientific Committee [guidelines](#) attached to this form.

- Criterion 1 — It has undergone, is suspected to have undergone or is likely to undergo in the immediate future a very severe, severe or substantial reduction in numbers.
- Criterion 2 — Its geographic distribution is precarious for the survival of the species and is very restricted, restricted or limited.
- Criterion 3 — The estimated total number of mature individuals is limited to a particular degree and:
  - (a) evidence suggests that the number will continue to decline at a particular rate; or
  - (b) the number is likely to continue to decline and its geographic distribution is precarious for its survival.
- Criterion 4 — The estimated total number of mature individuals is extremely low, very low or low.
- Criterion 5 — Probability of extinction in the wild.

For species nominated as conservation dependent, identify which criterion the species meets (either criterion 1 or criterion 2).

- Criterion 1 — The species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or
- Criterion 2:
  - The species is a species of fish; and
  - The species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; and
  - The plan of management is in force under a law of the Commonwealth or of a State or Territory; and
  - Cessation of the plan of management would adversely affect the conservation status of the species.

#### Important notes for completing this form

- Complete the form as far as possible. It is important for the Threatened Species Scientific Committee to have comprehensive information and the best case on which to judge a species' eligibility against the EPBC Act criteria for listing (Attachment A).
- To ensure you have the most up to date information, it is recommended that you contact the relevant Natural Resource Management authority. For details see: [www.nrm.gov.au](http://www.nrm.gov.au).
- Nominations that do not meet the EPBC Regulations will not proceed. Division 7.2 of the EPBC Regulations 2000 ([www.environment.gov.au/epbc/about/index.html](http://www.environment.gov.au/epbc/about/index.html)) specifies the required information. Note that, if after a search, relevant information is not available, please state this under the relevant question in the nomination form (as noted under sub-regulation 7.04(3)).
- Keep in mind that the purpose of the questions is to help identify why the species is eligible for listing in the nominated conservation category.
- Subspecies (or other taxa lower than the species level) may be nominated, but it is important to provide information on the full national range of the species to support the claims.
- The questions are separated into themes, which indirectly or directly relate to the criteria for listing. The Committee provides the following general description of what kind of information informs its judgements against the EPBC Act criteria for listing (Attachment A).
- For all facts and all information presented — identify your references and sources of information. Document the reasons and supportive data. Indicate the quality of facts/information and any uncertainty in the information. For example was it based on a peer-reviewed research publication or anecdote; or on observed data, an inference/extrapolation from the data, or a reasonable premise not yet supported by hard data.
- Personal communications — The opinion of appropriate scientific experts may also be cited (with their approval) in support of a nomination. If this is done the names of the experts, their qualifications and full contact details must also be provided at the end of this nomination.
- Confidential material — Identify any confidential material and explain the sensitivity.
- Tables — Can be included at the end of the form or prepared as separate electronic documents included as appendixes or attachments. Refer to tables in the relevant area of the text.
- Maps — If maps cannot be supplied electronically, please provide them in hardcopy.
- Cross-reference relevant areas of the nomination form where needed.

## How to lodge your nomination

Completed nominations may be lodged either:

1. by email to: [epbc.nominations@environment.gov.au](mailto:epbc.nominations@environment.gov.au), or
2. by mail to: The Director  
Species Listing Section  
Department of the Environment and Water Resources  
GPO Box 787  
Canberra ACT 2601

## Further information

The Threatened Species Scientific Committee has developed guidelines to assist nominators. The guidelines are attached to this form. They include the statutory criteria for the 'critically endangered', 'endangered' and 'vulnerable' categories at [Part A](#). Indicative thresholds, which may be used by the Committee to assess whether a species is eligible for listing against the criteria prescribed by the EPBC Regulations, are at [Part B](#). It should be noted that the Committee does not apply these thresholds strictly, but has regard to them when making judgments about species in terms of their biological contexts, and on a case-by-case basis.

More detailed information on all categories for threatened species can be found in Section 179 of the EPBC Act and the statutory criteria can be found in Division 7.1 of the EPBC Regulations 2000. These are available at: [www.environment.gov.au/epbc/about/index.html](http://www.environment.gov.au/epbc/about/index.html)

For questions regarding nominations contact:

The Director  
Species Listing Section  
Department of the Environment and Water Resources  
GPO Box 787  
Canberra ACT 2601  
Telephone (02) 6274 2238  
Fax (02) 6274 2214

## Section 1 — Legal Status, Distribution, Biological, Ecological

### Conservation Theme

1. How does this nomination relate to the **conservation theme**? (If applicable.)

[The previous conservation theme closed on 31 March 2008. The next theme is yet to be announced. Any nominations made at present are likely to be considered for the 2009 assessment period.]

### Taxonomy

2. What are the **currently accepted scientific and common name/s** for the species?

Note any other scientific names that have been used recently. Note the species authority and the Order and Family to which the species belongs (Family name alone is sufficient for plants, however, both Order and Family name are required for insects).

*Phascolarctos cinereus* / Koala  
(within the Koala Coast)

Goldfuss, 1817

Order: Diprotodontia  
Family: Phascolarctidae

3. Is this **species conventionally accepted**? If not, explain why. Is there any controversy about the taxonomy?

Yes

4. If **the species is NOT conventionally accepted**, please provide:

(i) a taxonomic description of the species in a form suitable for publication in conventional scientific literature; **OR**  
(ii) evidence that a scientific institution has a specimen of the species and a written statement signed by a person who has relevant taxonomic expertise (has worked, or is a published author, on the class of species nominated), that the person thinks the species is a new species.

Not Applicable

5. Is this species **taxonomically distinct** (Taxonomic distinctiveness — a measure of how unique a species is relative to other species)?

Yes

## Legal Status

<p><b>6.</b> What is the species' <b>current conservation status</b> under Australian and State/Territory Government legislation?</p>	<p>The koala is not listed at a federal level. Koalas in the South East bioregion in Qld are listed as 'vulnerable' under the <i>Nature Conservation Act 1992</i>. The species in general is listed as 'vulnerable' in NSW under the <i>Threatened Species Conservation Act 1995</i>, with two populations listed as endangered. In Victoria, the koala is not listed under the <i>Victorian Flora and Fauna Guarantee Act 1988</i>. In South Australia, the koala is not listed under the <i>National Parks and Wildlife Act 1972</i>.</p>
<p><b>7.</b> Does the species <b>have specific protection</b> (e.g. listed on an annex or appendix) under other legislation or intergovernmental arrangements, e.g. Convention on International Trade in Endangered Fauna and Flora (CITES), Convention on Migratory Species (CMS).</p>	<p>The species is listed as 'threatened' under the United States Endangered Species Act by the US Fish &amp; Wildlife Service. Koalas are classed as 'near threatened' in the <i>National Action Plan for Monotremes and Marsupials 1996</i>. The IUCN lists the species as 'least concern'.</p>

## Description

<p><b>8.</b> Give a brief description of the species' <b>appearance</b>, including size and/or weight, and sex and age variation if appropriate; social structure and dispersion (e.g. solitary/clumped/flocks).</p>	<p>The koala <i>Phascolarctos cinereus</i> is the sole member of the family Phascolarctidae. It is an arboreal marsupial with large furry ears and a vestigial tail. Its fur colour varies from pale grey in the northern parts of its range to grey-brown in the south. The koala also varies in size across its latitudinal range, from an average 6.5 kg in Queensland to 12 kg in Victoria. Male koalas can weigh up to 50% more than females. Detailed accounts of the koala can be found in Phillips (1990), Martin and Handasyde (1999), and Moyal (2007).</p>
<p><b>9.</b> Give a brief description of the species' <b>ecological role</b> (for example, is it a 'keystone' or 'foundation' species, does it play a role in processes such as seed dispersal or pollination).</p>	<p>The koala attracts considerable public attention as an Australian icon and, through its appeal to international visitors, contributes significantly to Australia's tourism industry. The koala is also an important component of Australia's biodiversity, and its unique habitat supports a variety of other native species.</p>

## Australian Distribution

<p><b>10.</b> Describe the species' <b>current and past distribution in Australia</b> and, if available, attach a map.</p>	<p>It is difficult to know the distribution of koalas prior to the time of European settlement. The fossil record provides evidence of koala fossil remains from published deposits across Australia (Price, 2008). It is known that prior to European settlement, eucalypt forests covered much of the east coast of Australia and they would have provided a large habitat resource for koalas. While present knowledge of the koala's ranging behaviour tells us that they would not have been evenly distributed over that range, their potential distribution was far greater than that of today.</p> <p>Continued clearing and fragmentation of woodland and forest has significantly reduced the current distribution of koala populations. In Queensland, they occur throughout</p>
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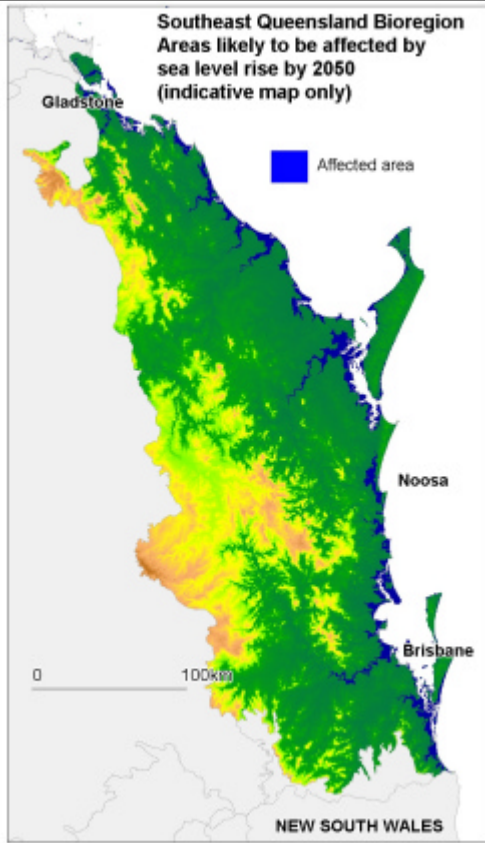
	<p>most of their natural range, although the overall koala population is declining mostly due to continued clearing and fragmentation of woodland and forest. In New South Wales, trends across the state are mixed – some populations on the New South Wales coast are declining, whilst some populations west of the Great Dividing Range have expanded. There are generally only transient animals occurring in the ACT, with very little of the area within the territory containing forest vegetation that is considered to be koala habitat. Koalas in Victoria occur over much of the southern and eastern lowlands. Densities are lower in the dry forests and woodlands in northern parts of Victoria where the habitat is of lower quality. However much of the habitat remaining in the state is fragmented and many populations are isolated. In South Australia, because of introductions to areas where it did not occur since European colonisation, the koala is now found over a greater range and abundance than at the time of European settlement.</p>
<p><b>11. What is the extent of occurrence</b> (in km<sup>2</sup>) for the species (described in Attachment A); explain how it was calculated and datasets used.</p>	
<p>a. What is the <b>current</b> extent of occurrence?</p>	<p>The Koala Coast covers an area of approximately 375km<sup>2</sup>.</p>
<p>b. What data are there to indicate <b>past declines</b> in extent of occurrence (if available, include data that indicates the percentage decline over the past 10 years or 3 generations whichever is longer)?</p>	
<p>c. What data are there to indicate <b>future changes</b> in extent of occurrence (if available, include data that indicates the percentage decline over 10 years or 3 generations whichever is longer (up to a maximum of 100 years in the future) where the time period is a continuous period that may include a component of the past)?</p>	
<p><b>12. What is the area of occupancy</b> (in km<sup>2</sup>) for the species (described in Attachment A); explain how calculated and datasets that are used.</p>	
<p>a. What is the <b>current</b> area of occupancy?</p>	<p>The QLD Environmental Protection Agency calculates the current area of occupancy as 350km<sup>2</sup>, including ~155km<sup>2</sup> of bushland, ~31km<sup>2</sup> of remnant vegetation, ~78km<sup>2</sup> of urban koala habitat, and, ~111km<sup>2</sup> of other koala habitat (refer to Environmental Protection Agency 2007).</p>
<p>b. What data are there to indicate <b>past declines</b> in area of occupancy (if available, include data that indicates the percentage decline over the past 10 years or 3 generations</p>	<p>There was a 17% decrease in remnant bushland (~ 650 ha), and an 11% decrease in urban habitat (~ 1000 ha) from 1997 to 2005; there is also evidence of a small increase in the amount of forest in the Koala Coast (refer</p>

<p>whichever is longer)?</p>	<p>to Environmental Protection Agency 2007).</p>
<p>c. What data are there to indicate <b>future changes</b> in area of occupancy (if available, include data that indicates the percentage decline over 10 years or 3 generations whichever is longer (up to a maximum of 100 years in the future) where the time period is a continuous period that may include a component of the past)?</p>	<p>40% (2498) of koalas are not within designated koala habitat under the Koala Plan (<i>Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016</i>). As such, any proposed developments in these areas do <b>not</b> require assessment under the provisions of the Koala Plan. Development of these areas will reduce the koala's area of occupancy.</p>
<p><b>13. How many <i>natural locations</i> do you consider the species occurs in and why? Where are these located?</b> The term 'location' defines a geographically or ecologically distinct area.</p>	<p>The Koala Coast koala population is delineated by Manly Road and Lota Creek to the north; the Gateway and Pacific Motorways to the west; Logan River to the south; and Morton Bay to the east – effectively isolating the resident koala population as a geographically disjunct group (QLD Environmental Protection Agency 2007).</p> <p>The Koala Coast population is the highest density urban koala population in Australia and among the highest densities of natural koala populations (including rural populations). It is therefore of national significance to the conservation of the species</p> <p>Genetic analysis has confirmed koalas for the Koala Coast region are reproductively isolated and genetically distinct (Seddon et al. 2008; Seddon et al. <i>in prep.</i>).</p>
<p><b>14. Give <i>locations of other populations</i>: captive/propagated populations; populations recently re-introduced to the wild; and sites for proposed population re-introductions. Note if these sites have been identified in recovery plans.</b></p>	<p>The Australian Koala Foundation estimates approximately 600-1000 koalas are currently held in captivity in Australia. Further koalas are held in captivity at zoos around the world.</p>
<p><b>15. Is the species' <i>distribution severely fragmented</i>? What is the cause of this fragmentation? Describe any biological, geographic, human-induced or other barriers causing this species' populations to be fragmented.</b> Severely fragmented refers to the situation in which increased extinction risk to the taxon results from most individuals being found in small and relatively isolated subpopulations (in certain circumstances this may be inferred from habitat information). These small subpopulations may go extinct, with a reduced probability of recolonisation.</p>	<p>The distribution of koalas within SE Queensland is severely fragmented. The Koala Coast population is effectively isolated as a geographically and genetically distinct group by Manly Road and Lota Creek to the north; the Gateway and Pacific Motorways to the west; Logan River to the south; and Morton Bay to the east (QLD Environmental Protection Agency 2007; Seddon et al. 2008; Seddon et al. <i>in prep.</i>).</p> <p>Urban development within the Koala Coast has led to an increasingly hostile urban matrix, with decreasing landscape permeability (Environmental Protection Agency 2007). Habitat loss within the koala coast is continuing, resulting in an increasingly fragmented distribution.</p>
<p><b>16. Departmental Use Only:</b></p>	

## Global Distribution

<p><b>17. Describe the species' global distribution.</b></p>	<p>The koala is only found in the wild in Australia.</p>
<p><b>18. Give an overview of the global population's size, trends, threats and security of the species outside Australia.</b></p>	<p>Not applicable, the species is only found in the wild in Australia.</p>
<p><b>19. Explain the relationship between the Australian population and the global population, including:</b></p>	
<p>a. What <b>percentage</b> of the global population occurs <b>in Australia</b>;</p> <p>b. Is the Australian population <b>distinct</b>, geographically <b>separate</b> or does part or all of the population move in/out of Australia's jurisdiction (give an overview; details in Movements section);</p>	<p>100</p> <p>The koala is only found in Australia, and as such, the Australian population is distinct.</p> <p>The Koala Coast koala population is delineated by Manly Road and Lota Creek to the north; the Gateway and Pacific Motorways to the west; Logan River to the south; and Morton Bay to the east – effectively isolating the resident koala population as a geographically disjunct population (QLD Environmental Protection Agency 2007).</p> <p>Genetic analysis has confirmed koalas from the Koala Coast region are genetically distinct from all other sampled regions in SE Queensland on Bayesian cluster analysis indicating a high degree of reproductive isolation; MtDNA control region haplotype distribution indicates that koalas along the coast were connected historically, were distinct from western koalas and that genetic isolation of the Koala Coast is likely to be a recent event (Seddon et al. 2008; Seddon et al. <i>in prep.</i>).</p>
<p>c. Do <b>global threats</b> affect the Australian population?</p>	<p>Climate change has the potential to have a significant impact on koala populations. Global climate change is likely to affect koalas and the other eucalypt specialists by changing the species composition within forests and by exacerbating the low ratios of nutrients to anti-nutrients in eucalypt foliage (Hume 2008; refer to <a href="http://www.science.org.au/sats2008/nfs-hume.htm">http://www.science.org.au/sats2008/nfs-hume.htm</a>).</p> <p>One additional impact of climate change is the projected rise in sea level of 50 cm by 2050 (refer to map: <i>Southeast Queensland Bioregion Areas likely to be affected by sea level rise 2050</i>), which will cause salinity in near-coastal water tables and lead to degradation of Koala Habitats composed primarily of Swamp Mahogany (<i>Eucalyptus robusta</i>). This species prefers sandier soils which will in addition suffer from erosion by the increased storminess predicted to occur with climate change, especially if/when coastal dune systems are breached. As Swamp Mahogany gets affected by salt and starts to die off these coastal Koalas will be forced further inland to higher ground; areas that are currently/will soon be affected by coastal housing development.</p>





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## Surveys and Monitoring

<p><b>20. Has the species been reasonably well surveyed?</b> Provide an overview of surveys to date and the likelihood of its current known distribution and/or population size being its actual distribution and/or population size.</p>	<p>The Koala Coast koala population was the subject of an initial five-year research program conducted from 1996-2000. A subsequent survey was conducted in 2005-2006.</p>
<p><b>21. For species nominated as extinct or extinct in the wild, please provide details of the most recent known collection, or authenticated sighting of the species and whether additional populations are likely to exist.</b></p>	<p>Not applicable</p>
<p><b>22. Is there an ongoing monitoring program? If so, please describe the extent and length of the program.</b></p>	<p>The <i>Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016</i> calls for a monitoring program, but to our knowledge no formal process has been announced.</p>

## Life Cycle and Population

<p><b>23. What is the species' total population size in terms of number of mature individuals? How were population estimates derived and are they reliable? Are there other useful measures of population size and what are they?</b> In the absence of figures, terms such as common, abundant, scarce can be of value.</p>	<p>Deriving reliable koala population estimates remains very difficult so the national population of the koala remains unclear at this stage. At a national level, estimation of the extent of habitat loss, fragmentation and modification, and declines in distribution are more appropriate indicators of koala population declines rather than population size <i>per se</i>.</p>
<p><b>24. Does the species occur in a number of smaller populations? How many? For each population give the locality, numbers and trends in numbers and tenure of land (include extinct populations). Can these be considered to be subpopulations and why?</b> <b>Subpopulations</b> are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange.</p>	<p>Within the Koala Coast, the most recent survey estimated the total population at 4611 animals in 2005 (Environmental Protection Agency 2007). Please note that the survey methodology did not appear to differentiate between juveniles and mature individuals, and no confidence limits are reported for this estimate. 40% of these animals occur within urban land use areas.</p> <p>Unpublished results of a further EPA survey in 2008 suggest the current abundance of koalas in the Koala Coast is now approaching/less than 3800 individuals.</p>
<p><b>25. Provide details on ages of the following:</b></p>	<p>For further information, please refer to: <a href="https://www.savethekoala.com/koalas.html">https://www.savethekoala.com/koalas.html</a></p>
<p><b>a. sexual maturity;</b></p>	<p>Female koalas are fully mature by about 2 years of age and males by their third or fourth year.</p>
<p><b>b. life expectancy;</b></p>	<p>Koalas living in an undisturbed habitat would have a greater life expectancy than those living in suburbia. Some estimates for the average life-span of an adult wild male koala are ten years, but the average survival rate for a dispersing sub-adult male living near a highway or a housing estate is closer to two or three years.</p>
<p><b>c. natural mortality.</b></p>	<p>In the wild in undamaged habitat, the average life span of a koala is about 10 years.</p>

<p><b>26. Reproduction</b></p> <p><b>For plants:</b> When does the species flower and set fruit? What conditions are needed for this? What is the pollinating mechanism? If the species is capable of vegetative reproduction, a description of how this occurs, the conditions needed and when. Does the species require a disturbance regime (e.g. fire, cleared ground) in order to reproduce?</p>	<p>Not applicable</p>
<p><b>For animals:</b> provide overview of breeding system and of breeding success, including: when does it breed; what conditions are needed for breeding; are there any breeding behaviours that may make it vulnerable to a threatening process?</p>	<p>The breeding season for koalas runs roughly from August to February. This is also when juveniles from the previous year disperse from their mothers. Where koalas live near urban areas and major roads, dispersing koalas are particularly exposed to threats such as cars and dogs, and accompanying stress levels mean a higher incidence of sickness. The average survival rate for a dispersing sub-adult male living near a highway or a housing estate is estimated as only two or three years.</p> <p>Females usually produce only one offspring each year. However, not all females in a wild population will breed each year. Some produce offspring only every two or three years, depending on factors such as the age of the female, quality of the habitat and the presence or otherwise of <i>Chlamydia</i> (McLean &amp; Handasyde 2006). In the average female's life span of about twelve years, this means that one female may produce only 5 or 6 offspring over her lifetime.</p>
<p><b>27. What is the <b>population trend</b> for the entire species?</b></p>	<p>Nationally, the koala population is declining.</p>
<p>a. What data are there to indicate <b>past decline</b> in size (if available, include data on rate of decline over past 10 years or 3 generations whichever is longer)?</p>	<p>No population data is available to indicate declines over the last 18 years (3 generations). However, surveys have shown the Koala Coast koala population exhibited a 26% decline in abundance between 1995-1999 and 2005-2006 (~10 years; Environmental Protection Agency 2007). Results of the 2005-2006 survey show the annual anthropogenic mortality rate for "urban" koalas in the region was in excess of 19% per annum (Environmental Protection Agency 2007). The causes of this past decline have not ceased, and we therefore expect koalas to already show declines in excess of 30% in 18 years; declines could be as high as 50-80% within 18 years.</p>
<p>b. What data are there to indicate <b>future changes</b> in size (if available, include data which will indicate the percentage of decline over 10 years or 3 generations whichever is longer (up to a maximum of 100 years in the future) where the time period is a continuous period that may include a component of the past)?</p>	<p>Unpublished results of a further EPA survey in 2008 suggest the population has experienced a further 17.6% reduction since 2005-2006.</p> <p>40% (2498) of existing koalas are not within designated koala habitat under the Koala Plan, and thus are poorly protected from threats including habitat loss, roads and dogs. Annual anthropogenic mortality rate for "urban" koalas in the region is estimated in excess of 19% per</p>

	<p>annum (Environmental Protection Agency 2007).</p> <p>The largest proportion of koalas inhabit bushland areas. Secure bushland areas rely on high immigration rates from urban areas (urban habitats occur mainly on fertile soils and have a higher habitat quality) to maintain population levels (Thompson, 2006); bushland habitat, which occurs mainly on red-yellow podzolic and Wallum soils (Beckmann 1967), is not sufficient to maintain the Koala Coast koala population. The high level of anthropogenic mortality caused by vehicles, dogs and disease in urban areas has reduced the availability of immigrants and therefore the probability of new immigrants rescuing declining populations, or recolonising empty patches. "It appears that the importance of the urban koala population in bolstering the bushland population has previously been underestimated" (Environmental Protection Agency 2007).</p> <p>Studies conducted by McAlpine et al. (2006) and Rhodes et al. (2008) have demonstrated that koala occurrence is related to forest area, forest patch size and the proportion of primary Eucalyptus tree species; occurrence decreased with distance between forest patches, density of forest patches and the density of sealed roads. The high density of urban development in the Koala Coast area will continue to reduce koala abundance within the Koala Coast.</p>
<p><b>28. Does the species undergo extreme natural fluctuations in population numbers, extent of occurrence or area of occupancy? To what extent and why?</b>  <b>Extreme fluctuations</b> can be said to occur in a number of taxa when population size or distribution area varies widely, rapidly and frequently, typically with a variation greater than one order of magnitude (i.e. a tenfold increase or decrease).</p>	<p>No</p>
<p><b>29. What is the generation length and how it is calculated?</b>  <b>Generation length</b> is the average age of parents of the current cohort (i.e. newborn individuals in the population). Generation length therefore reflects the turnover rate of breeding individuals in a population. Generation length is greater than the age at first breeding and less than the age of the oldest breeding individual, except in taxa that breed only once. Where generation length varies under threat, the more natural, i.e. pre-disturbance, generation length should be used.</p>	<p>Based on data from a free-ranging, <i>Chlamydia</i>-positive population in northeastern New South Wales an estimated generation time of 6.02 years has been calculated for koalas (Phillips 2000). This estimate was determined by taking the mean of the midpoint values of age classes determined for individual animals by the tooth wear criteria of Gordon (1991) and by excluding midpoint values of &lt;4 years in the case of male koalas, and &lt;2 years in the case of females.</p> <p>High mortality among dispersing sub-adults may skew the age-structure of the population; it is possible that this could result in a longer generation time within the Koala Coast. Also, based on the work of Martin and Handasyde (1990), a longer generation time would be conceivable for <i>Chlamydia</i>-negative populations, given the greater longevity and fecundity of females.</p>
<p><b>30. Identify important populations necessary for the species' long-term survival and</b></p>	<p>The Koala Coast koala population is recognised as one of the most significant natural koala populations in Australia, due to the relatively large numbers of koalas and the high</p>

<p>recovery? This may include: key breeding populations, those near the edge of the species' range or those needed to maintain genetic diversity.</p>	<p>density of animals (Environmental Protection Agency 2007).</p> <p>Genetic analysis has confirmed koalas from the Koala Coast region are reproductively isolated, and genetically distinct from all other sampled regions in SE Queensland on Bayesian cluster analysis indicating a high degree of reproductive isolation; MtDNA control region haplotype distribution indicates that koalas along the coast were connected historically, were distinct from western koalas and that genetic isolation of the Koala Coast is likely to be a recent event (Seddon et al. 2008; Seddon et al. <i>in press</i>).</p>
<p><b>31.</b> Describe any <b>cross-breeding</b> with other species in the wild, indicating how frequently and where this occurs.</p>	<p>Not applicable</p>
<p><b>32.</b> Departmental Use only:</p>	

### Populations In Reserve

<p><b>33.</b> Which <b>populations</b> are <b>in reserve systems</b>? Which of these are actively managed for this species? Give details.</p>	<p>In general, koala habitat is poorly protected because the majority of koala habitat occurs on freehold land (ANZECC 1998, Reed and Lunney 1990) with only small populations of koalas represented in Queensland's conservation reserves (Environmental Protection Agency 2007). Conservation reserves within the Koala Coast include the Daisy Hill Forest Reserve, and the Brisbane Koala Bushlands.</p>
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## Habitat

<p><b>34. Describe the <i>species' habitat</i></b> (e.g. aspect, topography, substrate, climate, forest type, associated species, sympatric species). If the species uses different habitats for different activities (e.g. breeding, feeding, roosting, dispersing, basking), then describe each habitat.</p>	<p>The Koala Coast koala population is associated with eucalypt forests, and within urban environments will also make use of individual trees.</p>
<p><b>35. Does the species use <i>refuge habitat</i></b>, e.g. in times of fire, drought or flood? Describe this habitat.</p>	<p>No</p>
<p><b>36. Is the <i>extent or quality</i> of the species' habitat <i>in decline</i></b>? If the species uses different habitats, specify which of these are in decline.</p>	<p>The extent and quality of koala habitat within the Koala Coast is declining.</p> <p>Urban habitat loss is attributable to both the loss of koala food trees and a decline in urban matrix permeability associated with the elimination of scattered trees and tree clumps, open space, grass, unfenced areas, and other vegetation. The cumulative effect of losing individual trees in residential lots, the removal of roadside vegetation for road upgrades or the development of remnant patches of bushland for housing estates and commercial precincts has severely impacted on both the quantity and quality of available urban habitat. Tree removal over time has led to further fragmentation of habitat, a reduction in habitat linkages, and an increased exposure of koalas to threats in the landscape: vehicles, dogs and disease - compounded by the stress of living in an urbanising area (Environmental Protection Agency 2007).</p>
<p><b>37. Is the species part of, or does it rely on, a <i>listed threatened ecological community</i></b>? Is it associated with any other <b><i>listed threatened species</i></b>?</p>	<p>The koala is associated with, and utilises a number of endangered regional ecosystems (listed under the <i>Vegetation Management Act 1999</i> - less than 10% of pre-clearing extent remaining)</p> <p>Regional Ecosystems listed as 'endangered' under the <i>Vegetation Management Regulations 2000</i> (highly preferred Koala species shown):  12.3.2 and 12.5.2 (<i>E. tereticornis</i> dominant)  12.5.6 (<i>E. siderophloia</i>, <i>E. propinqua</i>, <i>E. microcorys</i> dominant)  12.3.1 (<i>E. populnea</i> dominant)  12.5.3 (<i>E. racemosa</i>)</p> <p>Plus many other communities with "Of concern" status, including:  12.3.5 (<i>M. quinquinervia</i>/<i>E. robusta</i>)  12.3.11 (<i>E. siderophloia</i>, <i>E. tereticornis</i>)  12.5.12 (<i>E. racemosa</i>, <i>E. bancroftii</i>)  12.8.20 (<i>E. racemosa</i>)  12.8.26 (<i>E. major</i>)  12.9-10.1 (<i>E. resinifera</i>)  12.11.9, 12.11.14, 12.12.12 (<i>E. tereticornis</i>).</p> <p>The area covered by the koala's current geographical range</p>

also provides habitats for an additional 1500 listed threatened species.

## Feeding

**38.** Summarize the species' **food** items or sources and timing/seasonality.

The koala is an animal which feeds primarily, but not exclusively, on leaves of the genus *Eucalyptus*. Throughout their range in eastern Australia, koalas have been recorded as using a wide variety of eucalypt species. This information can be misleading because it portrays koalas not as the ecological specialists they are, but as opportunistic feeders who drift aimlessly across the landscape munching on "gum leaves". In reality, this is not the case and within a particular area, only a few species of eucalypt will be preferentially used by koalas. Such species, where they occur, are vitally important to the distribution, abundance and well being of contemporary koala populations. In the koala coast, preferred species include Queensland Blue Gum (*E. tereticornis*), Tallowwood (*E. microcorys*) and Swamp Mahogany (*E. robusta*).

A variety of other trees, including many non-eucalypts, are also used by koalas for feeding and shelter, or other behavioural purposes. On their own, however, these trees are not capable of sustaining koalas long term. They are used primarily because they are growing in association with or in close proximity to the key food tree species.

With respect to seasonality, Ellis et al. (1995) found a distinct variation in seasonal tree use in central Queensland populations, with winter food trees providing more energy, and summer food trees providing more moisture, a finding backed by laboratory analysis of collected leaves. In the west Moreton region of southeast Queensland, female access to *E. tereticornis* (Queensland Blue Gum) appeared to be an important requirement during the breeding season, at other times of the year they preferred *E. crebra* (Narrow-leaved Ironbark), in part due to males denying access to *E. tereticornis* (White 1999).

**39.** Briefly describe the species' **feeding behaviours**, including those that may make the species vulnerable to a threatening process.

The koala *Phascolarctos cinereus* is an animal which feeds primarily, but not exclusively, on leaves of the genus *Eucalyptus*. Within a particular area, as few as one, and generally no more than two or three species of eucalypt will be regularly browsed (primary browse trees) while a variety of other species, including some non-eucalypts, appear to be browsed occasionally or used for rest and shelter.

In addition to being threatened by the destruction of suitable habitat for urban development, koalas are exposed to threats including cars and dogs as they move between trees. Clearing of koala habitat exposes animals to these threats and substantially increases the risk of mortality.

## Movement Patterns (fauna species only)

<p><b>40.</b> Describe any relevant <b>daily and seasonal pattern of movement</b> for the species, or other irregular patterns of movement, including relevant arrival/departure dates if migratory.</p>	<p>Day-to-day, koalas are exposed to threats including cars and dogs as they move between trees.</p> <p>From August to February, juvenile dispersal exposes individuals to threats such as cars and dogs, and accompanying stress levels mean a higher incidence of sickness. The average survival rate for a dispersing sub-adult male living near a highway or a housing estate is estimated as only two or three years.</p>
<p><b>41.</b> Give details of the species' <b>home ranges/territories</b>.</p>	<p>Home range size is variable, and depends on the quality of the habitat (Rhodes et al. 2005). Studies in rural south-east Queensland estimated average home range size as 34.4 ha and 15.0 ha for males and females respectively (White 1999), while studies in central Queensland found local koalas occupy home ranges of 135 and 101 ha respectively (Ellis et al. 2002).</p>

## Survey Guidelines

<p><b>42.</b> Give details of the <b>distinctiveness and detectability</b> of the species.</p>	<p>Koalas are an arboreal species that occurs at low densities. They are often cryptic, and the probability of detection declines with the density of forest habitat, and the height of the individual within the canopy.</p>
<p><b>43.</b> Describe <b>methods for detecting species</b> including when to conduct surveys (e.g. season, time of day, weather conditions); length, intensity and pattern of search effort; and limitations and expert acceptance; recommended methods; survey-effort guide.</p>	<p>Survey methods include visual surveys of abundance (Dique et al. 2004), and surveys of the presence/absence of koala, through the detection of koala faecal pellets (Phillips and Callaghan <i>submitted</i>; Callaghan et al. <i>in review</i>).</p> <p>While visual survey methods can estimate abundance, the error associated with such methods is high, due to the cryptic, arboreal nature of the species, and the low densities at which it occurs. Faecal pellet surveys provide a more accurate prediction of habitat use, but further research is required to use this methodology to predict abundance.</p>



## Section 2 – Threats and Threat Abatement

### Threats

**44.** Identify *past, current and future threats*, to the species indicating whether they are *actual or potential*. For each threat, describe:

- 1) **Habitat loss, fragmentation and degradation** - Loss of habitat is the major threat to the koala in the Koala Coast and is the primary factor responsible for declining populations in those states. This is a continuing problem, resulting mainly from clearing or fragmentation of forest and woodland associated with urban development. Post-mortem examination of koalas admitted to hospitals within SE Queensland reveal high levels of malnutrition (many individuals reported to be wasting). 40% (2498) of koalas are not within designated koala habitat under the Koala Plan (*Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016*); any proposed developments in these areas do not require assessment under the provisions of the Koala Plan, and are therefore unprotected. These populations in particular are expected to experience further declines.
- 2) **Roads** - Injury and death of koalas due to road vehicle collisions is a threat, particularly in urbanised areas where roads intersect koala habitat. The problem of vehicle collisions is usually a result of poor planning and road design (e.g. placing new roads too close to koala habitat).
- 3) **Dogs** - Dog attacks occur where koalas use habitat in urban areas, on small rural holdings close to urban centres and in semi-urban and rapidly urbanising areas. The problem is exacerbated when dogs have the opportunity to form pairs or packs (even small dogs can be a threat to koalas), when dogs can roam widely outside their home properties and where large and aggressive breeds are common. Dog attacks commonly result in stress, injury or death to koalas.
- 4) **Disease** - Eye or urinary tract infections due to *Chlamydia* may become apparent as overt diseases when an animal is subject to additional stress such as nutritional deficiency following habitat loss or loss of territory. Infection of the reproductive tract by *Chlamydia* may lead to female infertility, which may reach sufficiently high levels to cause a marked depression of the reproductive rate in the population.
- 5) **Climate Change** - Climate change has the potential to have a significant impact on koala populations. Global climate change is likely to affect koalas and the other eucalypt specialists by changing the species composition within forests and by exacerbating the low ratios of nutrients to anti-nutrients in eucalypt foliage (Hume 2008).

- a. **how and where** it impacts on this species;
- b. what its **effect** has been **so far** (indicate whether it is known or suspected; present supporting information/research; does it

See above

See above. Habitat loss, roads, dogs and disease have contributed to observed declines in koala abundance within the Koala Coast. Koala abundance fell by 26% in ~ 10

<p>only affect certain populations);</p>	<p>years, between surveys conducted in 1995-1999 and 2005-2006.</p>
<p>c. what is its <b>expected effect in the future</b> (is there supporting research/information; is the threat only suspected; does it only affect certain populations);</p>	<p>See above. Habitat loss, roads, dogs and disease are expected to continue to cause declines in koala abundance.</p>
<p>d. what is the <b>relative importance or magnitude of the threat to the species.</b></p>	<p>See above. Loss of habitat is the major threat to the koala in the Koala Coast. Dogs and Roads are major threatening processes.</p>
<p><b>45.</b> If not included above, identify <b>catastrophic threats</b>, i.e. threats with a low predictability that are likely to severely affect the species. Identify the threat, explain its likely impact and indicate the likelihood of it occurring (e.g. a drought/cyclone in the area every 100 years).</p>	<p>Natural disasters such as fire and drought affect koala populations both directly and indirectly. Hot crown fires can cause high numbers of koala mortalities as well as destroy habitat or reduce it to remnant patches. Droughts can also cause high rates of mortality and may have a greater impact on young koalas, especially in semi-arid and arid regions. If a natural disaster such as a drought occurs over an extended time the impact on the population will be even greater. The impact of natural disasters such as fire and drought is exacerbated by fragmentation of habitat and may also be influenced by climate change.</p>
<p><b>46.</b> Identify and explain any <b>additional biological characteristics</b> particular to the species that are threatening to its survival (e.g. low genetic diversity)?</p>	<p>Koalas are specialist herbivores. As such, they are entirely dependent on the presence and availability of quality eucalyptus forage.</p>
<p><b>47.</b> Identify and explain any <b>quantitative measures or models</b> that address the probability of the species' extinction in the wild over a particular timeframe.</p>	<p>No recent quantitative analysis has been conducted. Please refer to the nomination for listing the koala as 'vulnerable' throughout Australia (2004). This nomination contains a preliminary Population Viability Analysis for the Koala Coast and surrounding area.</p>
<p><b>48.</b> Is there <b>other information</b> that relates to the survival of this species that you would like to address?</p>	<p>The Koala Coast koala population is recognised as one of the most significant natural koala populations in Australia, due to the relatively large numbers of koalas and the high density of animals (Environmental Protection Agency 2007).</p> <p>The AKF and others consider that anthropomorphic impacts have geographically isolated this population between Manly Road and Lota Creek to the north, the Gateway and Pacific Motorways to the west, Logan River to the south, and Morton Bay to the east. Recent (currently unpublished) genetic analysis has confirmed koalas from the Koala Coast region are reproductively isolated, and genetically distinct from all other sampled regions in SE Queensland on Bayesian cluster analysis indicating a high degree of reproductive isolation. This is crucial evidence for the Minister to evaluate whether the koala population is distinct and therefore meeting the EPBC Act criteria.</p> <p>Under the <i>International Union for Conservation of Nature</i> Red List criteria, a <i>vulnerable</i> listing requires evidence of 'an observed, estimated, inferred or suspected population size reduction of = 30% over any 10 year or three generation period, whichever is the longer, where the</p>

	<p>reduction or its causes may not have ceased.’ Queensland Government data have shown a decline of 26% between surveys conducted in 1995-1999 and 2005-2006. Given the generation period of the koala as 6 years, the observed declines in abundance certainly fulfil the Red List criteria for listing the Koala Coast koala population as <i>vulnerable</i>.</p> <p>Threats including habitat loss, roads, dogs and disease are expected to continue into the future. Current threat abatement measures are not protecting koalas, and as such declines are expected to continue.</p> <p>The AKF is also aware of Queensland Government data that is currently unavailable due to the caretaker mode of the Parliament. Once the election is concluded, we would continue to urge you to obtain the results of the most recent surveys conducted by the Queensland Environmental Protection Agency; reports suggest that observed declines have intensified, and that the Koala Coast population now satisfies the criteria for listing as <i>Endangered</i>, or even <i>Critically Endangered</i>. If and when these documents come to light, we would be anxious to assist you in amending our nomination to reflect a more appropriate category.</p>
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### Threat Abatement and Recovery

<p><b>49.</b> Give an overview of how broad-scale <b>threats</b> are <b>being abated</b>/could be abated and <b>other recovery actions</b> underway/proposed. Identify who is undertaking these activities and how successful the activities have been to date.</p>	<p>The Queensland state government enacted the <i>Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016</i> in 2006. However, 40% (2498) of koalas are not within designated koala habitat under the Koala Plan (<i>Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016</i>); any proposed developments in these areas do <b>not</b> require assessment under the provisions of the Koala Plan, and are therefore unprotected. Additionally, the plan was not retrospective, and as such, has no effect on existing development applications.</p>
<p><b>50.</b> For species nominated as extinct in the wild, provide details of the locations in which the <b>species</b> occurs <b>in captivity</b> and the level of human intervention required to sustain the species.</p>	<p>Not applicable</p>

## Mitigation Approach

**51.** Describe any **mitigation measures or approaches** that have been developed specifically for the species at identified locations. Identify who is undertaking these activities and how successful the activities have been to date.

The Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016 is the principle legislative tool to protect koalas and koala habitat; the plan has not been successful in halting loss and fragmentation of habitat, and the plan has not prevented further reductions in Koala numbers.

**52. Departmental use only:**

## Major Studies

**53.** Identify major studies on the species that might relate to its taxonomy or management.

ARC SPIRT grant was awarded to the University of Queensland, NSW DECC and the Australian Koala Foundation to fund four year's research into the conservation and restoration of koala populations in fragmented landscapes of eastern Australia. This research culminated in the publication of over 10 peer-reviewed articles, and of particular relevance for the management of koala populations, *Planning guidelines for koala conservation and recovery* (McAlpine et al. 2007).

## Management Documentation

**54.** Identify **key management documentation** available for the species, e.g. recovery plans, conservation plans, threat abatement plans.

1. *Planning guidelines for koala conservation and recovery* (McAlpine et al. 2007).
2. *The Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016* (QLD).

**55. Departmental use only:**

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## Section 3 — References and Reviewers

### Notes:

- The opinion of appropriate scientific experts may be cited (with their approval) in support of a nomination. If this is done the names of the experts, their qualifications and full contact details must also be provided in the reference list below.
- Please provide copies of key documentation/references used in the nomination

### 56. Reference list

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whom (including current professional position).

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Guidelines for Assessing the Conservation Status  
of Native Species according to the *Environment  
Protection and Biodiversity Conservation Act  
1999* (the EPBC Act) and *EPBC Regulations 2000*

Threatened Species Scientific Committee (TSSC)

Part A	Criteria for listing species under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> and <i>Environment Protection and Biodiversity Conservation Regulations 2000</i>
Part B	Indicative thresholds that may be used by the Committee to judge the subjective terms provided by the criteria for listing
Part C	Area of occupancy and extent of occurrence



## Part A — Criteria for listing species under the *Environment Protection and Biodiversity Conservation Act 1999* and *Environment Protection and Biodiversity Conservation Regulations 2000*

For section 179 of the EPBC Act (which provides general eligibility for inclusion in a category of the list of threatened species), a native species is in the critically endangered, endangered or vulnerable category if it meets any of the criteria for the category mentioned in the following table:

Criterion	Critically Endangered	Category Endangered	Vulnerable
1 It has undergone, is suspected to have undergone or is likely to undergo in the immediate future:	a <a href="#">very severe</a> reduction in numbers	a <a href="#">severe</a> reduction in numbers	a <a href="#">substantial</a> reduction in numbers
2 Its <a href="#">geographic distribution is precarious</a> for the survival of the species and is:	<a href="#">very restricted</a>	<a href="#">restricted</a>	<a href="#">limited</a>
3 The estimated total number of mature individuals is: and either of (a) or (b) is true: (a) evidence suggests that the number will continue to decline at: or (b) the number is likely to continue to decline and its geographic distribution is:	<a href="#">very low</a> a <a href="#">very high</a> rate <a href="#">precarious</a> for its survival	<a href="#">low</a> a <a href="#">high</a> rate <a href="#">precarious</a> for its survival	<a href="#">limited</a> a <a href="#">substantial</a> rate <a href="#">precarious</a> for its survival
4 The estimated total number of mature individuals is:	<a href="#">extremely low</a>	<a href="#">very low</a>	<a href="#">low</a>
5 The probability of its extinction in the wild is at least:	50% in the <a href="#">immediate</a> future	20% in the <a href="#">near</a> future	10% in the <a href="#">medium-term</a> future

These criteria define situations in which a risk of extinction in the wild, some time in the future, is deemed to exist for a species (for the purposes of section 179 of the EPBC Act). It is not necessary to identify a quantitative risk of extinction, but it is important to ensure that judgements about the criteria (for example, whether a reduction in numbers represents a severe decline), are made in the context of risk of extinction. For example, the Committee’s consideration of whether a reduction in numbers of a species is ‘severe’ takes into account the relationship between the reduction in numbers and the biological and other factors that are relevant to the species’ risk of extinction in the wild (or, alternatively, the factors relevant to the species’ prospects of survival in the wild).

The table above includes hyperlinks that, when clicked, will take you to indicative thresholds ([Part B](#)) that may be used by the Committee to judge the subjective terms given above. While these are modified from the “IUCN Red List Categories and Criteria Version 3.1, 2001”, it should be noted that the Committee does not strictly apply these, but has regard to them when making judgments about species in terms of their biological contexts, and on a case-by-case basis.

**Part B — Indicative thresholds that may be used by the Committee to judge the subjective terms provided by the criteria for listing (as presented at Part A of these guidelines)**

When assessing a species’ eligibility against the listing criteria (see [Part A](#)), the Committee exercises its judgement to give practical meaning to the subjective terms of the criteria. The Committee does this by considering the information provided to it via the nomination form in the context of the species’ biology and relevant ecological factors, and having regard to the degree of complexity and uncertainty associated with that context and the information provided.

The Committee is also informed by, but not bound by, indicative thresholds, which have been adapted from “IUCN Red List Categories and Criteria Version 3.1, 2001”. When considering whether to use these thresholds, the Committee judges whether they are appropriate to the species in question. For example, a relatively long-lived species with slow reproduction and relative population stability (such as most mammals) might be more impacted by, for example, a 30% decline in numbers than might a relatively short-lived species with fast reproduction and naturally fluctuating populations (such as most insects). This consideration of biological attributes is placed in the context of matters such as the relative population size so as to judge whether, for the species in question, a decline is substantial, severe or very severe, for the purposes of the criteria for listing.

EPBC Matters considered		Indicative Thresholds		
Reduction in numbers (based on any of A1–A4)		Very severe	Severe	Substantial
Criterion One	A1. An observed, estimated, inferred or suspected population size reduction over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following: (a) direct observation (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.	≥90%	≥70%	≥50%
	A2. An observed, estimated, inferred or suspected population size reduction over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.	³80%	³50%	≥30%
	A3. A population size reduction, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.	³80%	³50%	³30%
	A4. An observed, estimated, inferred, projected or suspected population size reduction over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.	³80%	³50%	³30%

<b>Criterion Two</b>	<p><b>Geographic distribution</b> (based on either of B1 or B2)</p> <p>B1. Extent of occurrence estimated to be less than</p> <p>B2. Area of occupancy estimated to be less than</p>	<p><b>Very restricted</b></p> <p>100 km<sup>2</sup></p> <p>10 km<sup>2</sup></p>	<p><b>Restricted</b></p> <p>5,000 km<sup>2</sup></p> <p>500 km<sup>2</sup></p>	<p><b>Limited</b></p> <p>20,000 km<sup>2</sup></p> <p>2,000 km<sup>2</sup></p>
	<p><b>Geographic distribution is precarious</b> for the survival of the species, (based on at least two of a–c)</p> <p>a. Severely fragmented or known to exist at a limited location.</p> <p>b. Continuing decline, observed, inferred or projected, in any of the following:</p> <ul style="list-style-type: none"> <li>(i) extent of occurrence</li> <li>(ii) area of occupancy</li> <li>(iii) area, extent and/or quality of habitat</li> <li>(iv) number of locations or subpopulations</li> <li>(v) number of mature individuals.</li> </ul> <p>c. Extreme fluctuations in any of the following:</p> <ul style="list-style-type: none"> <li>(i) extent of occurrence</li> <li>(ii) area of occupancy</li> <li>(iii) number of locations or subpopulations</li> <li>(iv) number of mature individuals</li> </ul>	<p><b>Precariousness</b> is judged on a case-by-case basis, having regard to the degree of threat operating on the species</p>		
<b>Criterion Three</b>	<p>Estimated <b>total number</b> of mature individuals</p> <p><i>And either of (A) or (B) is true</i></p> <p>(A) <b>Rate</b> of continued decline</p>	<p><b>Very low</b></p> <p>&lt;250</p> <p><b>Very high</b></p> <p>25% in 3 years or 1 generation (up to 100 years), whichever is longer</p>	<p><b>Low</b></p> <p>&lt;2,500</p> <p><b>High</b></p> <p>20% in 5 years or 2 generations (up to 100 years), whichever is longer</p>	<p><b>Limited</b></p> <p>&lt;10,000</p> <p><b>Substantial</b></p> <p>10% in 10 years or 3 generations (up to 100 years), whichever is longer</p>
	<p><i>OR</i></p> <p>(B) <b>Continued decline</b> and <b>geographic distribution is precarious</b> (based on at least two of a–c):</p> <p>a. Severely fragmented or known to exist at a limited location.</p> <p>b. Continuing decline, observed, inferred or projected, in any of the following:</p> <ul style="list-style-type: none"> <li>(i) extent of occurrence</li> <li>(ii) area of occupancy</li> <li>(iii) area, extent and/or quality of habitat</li> <li>(iv) number of locations or subpopulations</li> <li>(v) number of mature individuals.</li> </ul> <p>c. Extreme fluctuations in any of the following:</p> <ul style="list-style-type: none"> <li>(i) extent of occurrence</li> <li>(ii) area of occupancy</li> <li>(iii) number of locations or subpopulations</li> <li>(iv) number of mature individuals</li> </ul>	<p><b>Precariousness</b> is judged on a case-by-case basis, having regard to the degree of threat operating on the species</p>		

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<b>Criterion Four</b>	<p>Estimated <b>total number of mature individuals</b>, based on the following:</p> <p>a. Number of mature individuals only</p>	<b>Extremely low</b> < 50	<b>Very low</b> < 250	<b>Low</b> < 1,000
<b>Criterion Five</b>	<p><b>Probability of extinction</b> in the wild within a period, based on the following:</p> <p>a. Quantitative analysis</p> <p>(Note: probability must be at least 50% for critically endangered, 20% for endangered, 10% for vulnerable)</p>	<b>Immediate future</b> 10 years or three generations, whichever is the longer (up to a maximum of 100 years)	<b>Near future</b> 20 years or five generations, whichever is the longer (up to a maximum of 100 years)	<b>Medium-term future</b> Within 100 years

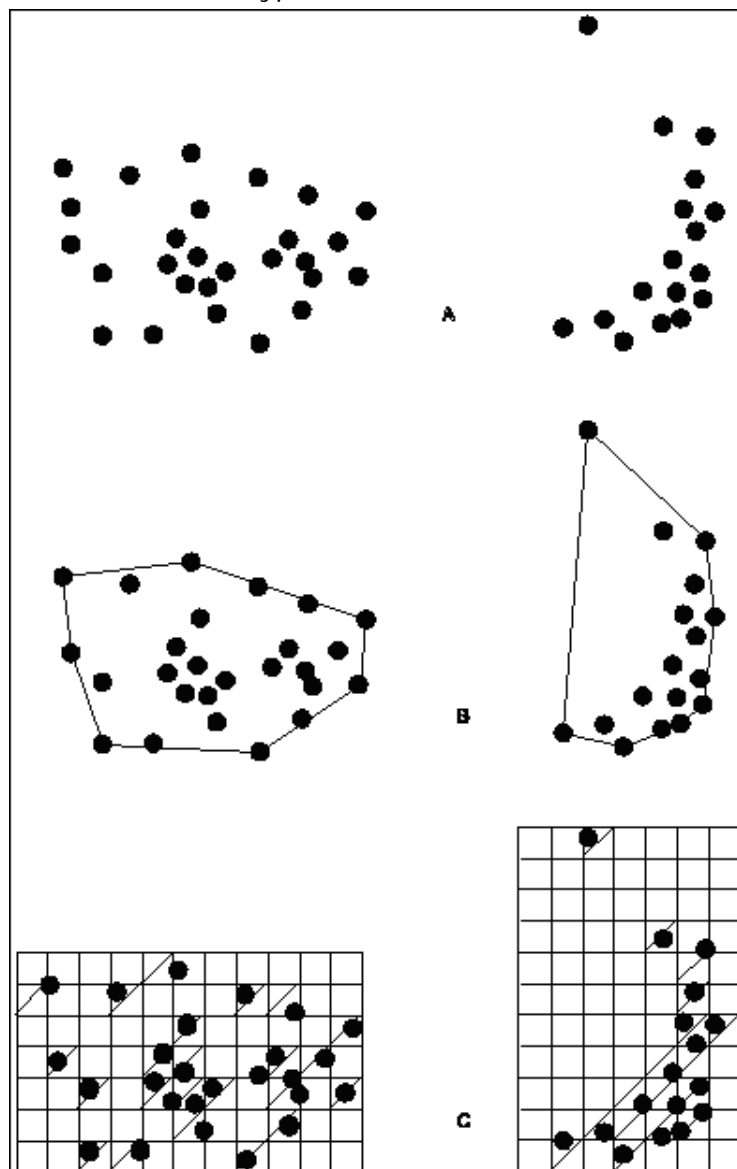
## Part C — Area of occupancy and extent of occurrence

### Extent of occurrence

Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy (see Figure 1). This measure may exclude discontinuities or disjunctions within the overall distributions of taxa (e.g. large areas of obviously unsuitable habitat) (but see 'area of occupancy', point 10 below). Extent of occurrence can often be measured by a minimum convex polygon (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence).

### Area of occupancy

Area of occupancy is defined as the area within its 'extent of occurrence' (see point 9 above) which is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats. In some cases (e.g. irreplaceable colonial nesting sites, crucial feeding sites for migratory taxa) the area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon. The size of the area of occupancy will be a function of the scale at which it is measured, and should be at a scale appropriate to relevant biological aspects of the taxon, the nature of threats and the available data (see point 7 in the Preamble). To avoid inconsistencies and bias in assessments caused by estimating area of occupancy at different scales, it may be necessary to standardize estimates by applying a scale-correction factor. It is difficult to give strict guidance on how standardization should be done because different types of taxa have different scale-area relationships.



**Figure 1.** Two examples of the distinction between extent of occurrence and area of occupancy. (A) is the spatial distribution of known, inferred or projected sites of present occurrence. (B) shows one possible boundary to the extent of occurrence, which is the measured area within this boundary. (C) shows one measure of area of occupancy which can be achieved by the sum of the occupied grid squares.