



## Consultation Document on Listing Eligibility and Conservation Actions

### *Callocephalon fimbriatum* (Gang-gang Cockatoo)

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

- 1) the eligibility of *Callocephalon fimbriatum* (Gang-gang Cockatoo) for inclusion on the EPBC Act threatened species list in the Endangered 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.

Responses are to be provided in writing either by email to:

[species.consultation@environment.gov.au](mailto:species.consultation@environment.gov.au)

or by mail to:

The Director  
Migratory Species Section  
Biodiversity Conservation Division  
Department of Agriculture, Water and the Environment  
PO Box 858  
Canberra ACT 2601

**Responses are required to be submitted by 27 August 2021.**

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## **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* (Cwth) 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.



# Consultation document for *Callocephalon fimbriatum* (Gang-gang Cockatoo)

## Conservation status

*Callocephalon fimbriatum* is being assessed by the Threatened Species Scientific Committee to be eligible for listing under the EPBC Act. The Committee's preliminary assessment is at Attachment A. The Committee's preliminary assessment of the species' eligibility against each of the listing criteria is:

- Criterion 1: A2bc: Endangered
- Criterion 2: Not eligible
- Criterion 3: Not eligible
- Criterion 4: Not eligible
- Criterion 5: Insufficient data

The main factor that appears to make the species eligible for listing in the Endangered category is that the population has declined by approximately 69 percent in the last three generations (approximately 21 years) (Bird et al. 2020; Cameron et al. forthcoming). In addition to this continuous decline in population numbers, the species also suffered mortality and habitat loss during the 2019/2020 wildfires. Estimates of the distribution impacted by fire range from 28 to 36 percent (Legge et al. 2020; Ward et al. 2020; Legge et al. 2021). The 2019/2020 fires may have reduced the carrying capacity of 40 percent of occupied grid cells by half and resulted in a 10 percent reduction in the overall population size (Cameron et al. forthcoming). An analysis based on expert elicitation estimated an overall population decline at one year post fire of 21 percent, and that three generations post-fire the population could still be 29 percent lower than the pre-fire population size (Legge et al. 2021). These predictions assume no further extreme drought or extensive fire events; however, such events are likely to reoccur over the assessment period, which would worsen the extent of population decline. There are an estimated 25,300 mature individuals in the wild with a declining trend (high reliability) (Cameron et al. forthcoming). The species' extent of occurrence (EOO) and area of occupancy (AOO) is estimated to be stable at 400,000 km<sup>2</sup> and 30,000 km<sup>2</sup>, respectively (Cameron et al. forthcoming).

Species can also be listed as threatened under state and territory legislation. For information on the current listing status of this species under relevant state or territory legislation, see the [Species Profile and Threat Database](#).

## Species information

### Taxonomy

Conventionally accepted as *Callocephalon fimbriatum* (Grant, 1803).

## **Description**

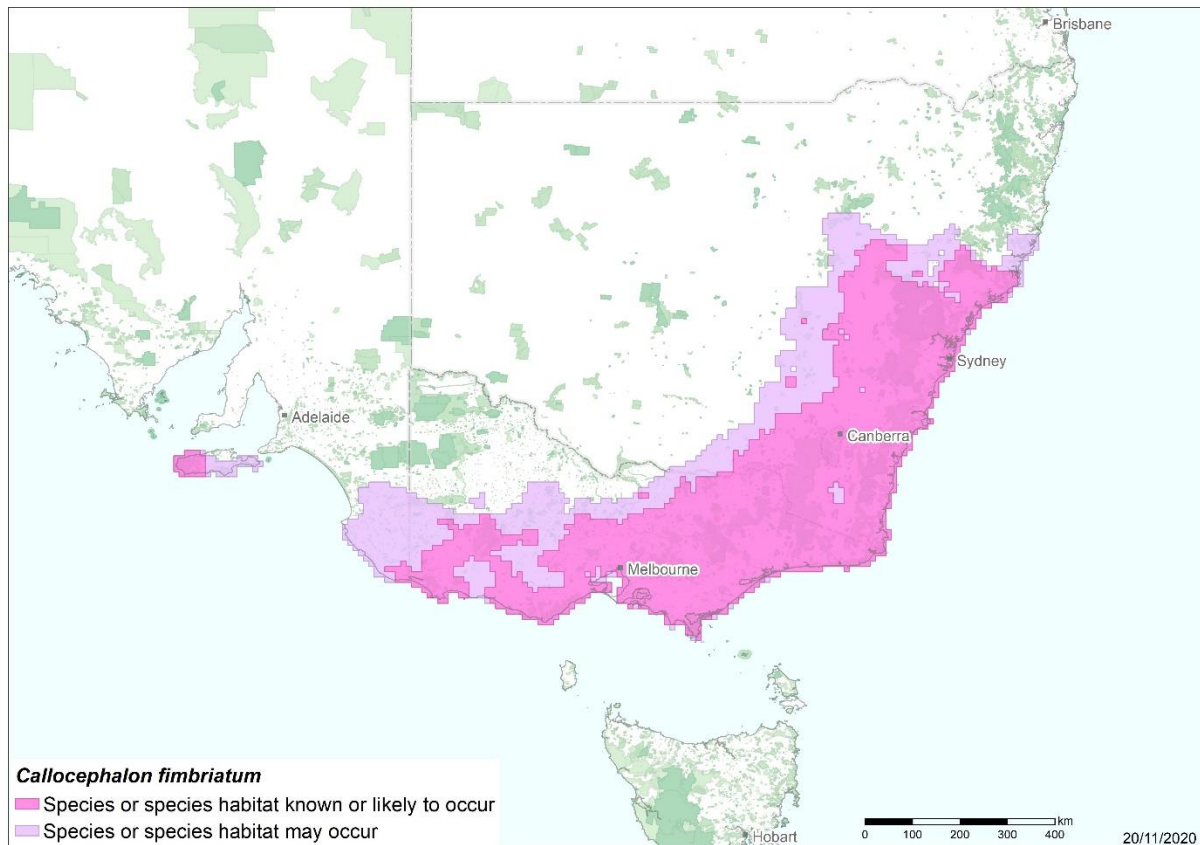
Gang-gang Cockatoos are approximately 32–36 cm in length, 230-334 g in weight and have a wing length of 20 –26 cm (Higgins 1999; Menkhorst et al. 2017). They are a small, stocky cockatoo, primarily slate-grey in colour. Adult males are distinguished by their scarlet-coloured head and wispy, filamentous crest that curls forward (Higgins 1999). The remainder of their plumage is usually mid-grey, with feathers narrowly edged dull-white. Occasionally, male Gang-gang Cockatoos have pale-yellow or dull-orange feathering on their breast or abdomen (Higgins 1999). Adult females have entirely mid-grey plumage, including on their head (Simpson & Day 1996). The feathers of adult females are broadly fringed with yellow-orange, giving a barred effect. This effect is particularly prominent on the underparts of the bird. Secondaries, undertail-coverts, tail, and underwing-coverts are variably barred pale grey-yellow. Both genders have broad wings and short tails (Higgins 1999). Juveniles are similar in appearance to females. However, their crest is rudimentary, and they appear washed green, particularly on their underparts and upper wing (Higgins 1999).

## **Distribution**

Gang-gang Cockatoos are endemic to south-eastern Australia. They are widespread in eastern New South Wales, ranging from the central slopes and tablelands, east to the south coast and central-eastern New South Wales (Shields & Crome 1992). An estimated 54 percent of the species' distribution occurs within NSW National Parks and Wildlife Service estates (NSW OEH 2005). Their distribution continues through Victoria, where they are widespread through north-eastern regions and southern regions, with some records occurring in east Melbourne, Mornington Peninsula, and south-western Gippsland (Higgins 1999; Menkhorst et al. 2017). The species occurs in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee.

Gang-gang Cockatoos have been introduced to Kangaroo Island, South Australia, and are extinct on King Island in Tasmania (Higgins 1999).

**Map 1 Modelled distribution of Gang-gang Cockatoo**



Source: Base map Geoscience Australia; species distribution data [Species of National Environmental Significance](#) database.

### **Cultural and community significance**

The Gang-gang Cockatoo has been the faunal emblem of the Australian Capital Territory since 1997. It is also the faunal emblem of ACT Parks and Conservation Service, and the Canberra Ornithologists Group.

The species is known to occur on the lands of at least the following Indigenous Peoples: Awabakal, Bidawal, Bunurong, Darkinjung, Dharawal, Dharug, Dhudhuroa, Dja Dja Wurrung, Eastern Maar, Gunaikurnai, Gunditjimara, Gundungurra, Jaithmathang, Jerrinja, Ngarigo, Ngunnawal, Nindi-Ngudjam Ngarigu Monero, Taungurun, Wadawurrung, Walgal, Warrabinga, Waveroo, Wiradjuri, Wodi Wodi, Wonnarua, Worimi, Wurundjeri, Yorta and Yuin. Further research into the subject area may benefit the conservation of the species by providing insights about traditional land management.

### **Relevant biology and ecology**

Gang-gang Cockatoos primarily occur within the south-east temperate forests of mainland Australia (Menkhorst et al. 2017). The species is an altitudinal migrant. During summer months, Gang-gang Cockatoos primarily inhabit mature, wet sclerophyll forests, typically dominated by eucalypts (Frith 1969; NSW Scientific Committee 2008). Eucalypt-dominated assemblages with dense, shrubby acacia, wattle and banksia understory support the highest density of birds (Higgins 1999). The species also occurs in more open eucalypt assemblages, subalpine Snow Gum woodland, temperate rainforests, and occasionally regenerating forests (Forshaw 1989; Higgins 1999).

During winter months, Gang-gang Cockatoos tend to range beyond montane forests to inhabit woodland assemblages at lower, drier altitudes. Most birds occur in open eucalypt assemblages during this period (Shields & Crome 1992; Higgins 1999). The species is also often sighted in suburban areas in Canberra, Sydney, and Melbourne, including within parks, gardens, and roadside tree plantations (Morcombe 1986; Higgins 1999). Occasionally, during winter months the species inhabits assemblages of River Red Gum (*Eucalyptus camaldulensis*) woodlands, dense coastal thickets of *Leptospermum* or *Casuarina*, or heathland (Higgins 1999). Overlapping of winter and summer ranges is common, with some individuals choosing to winter at higher altitudes, and others remaining at lower altitudes during summer (Higgins 1999).

Foraging is mainly arboreal, occurring in the canopy of woodland assemblages (particularly within eucalypts) and less often within the understory (more often during *Acacia* seeding) (Higgins 1999). Feeding rarely occurs within shrubs and at ground-level. Gang-gang Cockatoos primarily feed on seeds from eucalypts and acacia, fruits from introduced species such as Hawthorn (*Crataegus monogyna*), Cotoneaster (*Cotoneaster glaucophyllus*) and *Pyracantha* berries, and on insect larvae (Menkhorst et al. 2017). Gang-gang Cockatoos are one of only a few bird species that feed on Sawfly larvae (COG N.D.). When occupying suburban areas, the species often feeds on seeds and berries found within gardens, particularly from ornamental trees, shrubs, and hedges.

Gang-gang Cockatoos favour old growth forest and woodland assemblages for nesting and roosting. The species roosts in the hollows of tree trunks and limbs, or within the dead sprout of large, living eucalypts (Gibbons 1999; Gibbons & Lindenmayer 2000). Roosting sites are often near water (Beruldsen 1980), where larger hollow-bearing trees are more common. Favoured hollows generally have an entrance height of at least 12 cm and entrance width of at least 9 cm (Davey and Mulvaney 2020). The hollow chambers are generally around 20 cm in floor diameter, around 58 cm deep, and occur at least 5 m above the ground (Davey & Mulvaney 2020). Both sexes work to enlarge the hollows by chewing at the sides, and then scraping debris out onto the ground, or using the debris to line the base of the hollow. Individuals use the same roosting and nesting site for multiple years (Higgins 1999).

Gang-gang Cockatoos are monogamous. Breeding usually occurs between October and January (Higgins 1999); however, records exist of breeding events in late August, early September, and March (Higgins 1999). Clutch sizes of two eggs are typical, but occasionally one or three are laid. Both sexes incubate the eggs over a period of 3-4 weeks (Davey & Mulvaney 2020). The fledging period lasts for 7-8 weeks, and the young continue to be fed by parents for 4-6 weeks after fledging (Endersby & Endersby 2001).

## **Habitat critical to the survival**

### **Foraging habitat**

Foraging habitat critical to the survival of the Gang-gang Cockatoo includes all foraging habitat during both breeding and non-breeding season. For the purpose of this document, this does not include exotic feeding grounds such as ornamental trees, shrubs, and hedges within urban and suburban areas.

Within their natural habitat, Gang-gang Cockatoos mostly forage in the canopy of trees at heights >10 m, especially eucalypts within forests and woodlands. Approximately 72 percent of feeding occurs in canopy >10 m height; 21 percent in the subcanopy between 4-10 m; and 7 percent in

the shrub layer between 0.2–4 m. No feeding occurs at ground level (Higgins 1999). The species relies mostly on seeding eucalypts, acacia, and Hawthorn for feeding.

### **Breeding and non-breeding habitat**

In summer months, Gang-gang Cockatoo's typically occur within mature, wet sclerophyll forests, typically dominated by eucalypts with dense, shrubby acacia and banksia understories, often in secluded valleys (Higgins 1999). Additional areas include more open eucalypt assemblages such as subalpine Snow Gum (*Eucalyptus pauciflora*) woodland; temperate rainforests; and regenerating forests. During winter months, Gang-gang Cockatoos rely on woodland assemblages at lower, drier altitudes. Open eucalypt assemblages such as Box-ironbark assemblages make up their habitat during this period. The species also relies on assemblages of River Red Gum (*E. camaldulensis*), dense coastal thickets of *Leptospermum* or *Casuarina*, or heathland. Hollow-bearing trees are a key component of the species' breeding habitat. Favoured hollows generally have an entrance height of at least 12 cm and entrance width of at least 9 cm (Davey and Mulvaney 2020). The hollow chambers are generally around 20 cm in floor diameter, around 58 cm deep, and occur at least 5 m above the ground (Davey & Mulvaney 2020).

### **Key considerations in environmental impact assessments**

Habitat critical to the survival of the Gang-gang Cockatoo occurs across a range of land tenures. Whenever possible, habitat critical to the survival of the species should not be destroyed or modified. Actions that have indirect impacts (e.g., noise and light pollution) on habitat critical to the survival should also be minimised. Actions that compromise adult and juvenile survival, such as the introduction of new diseases, weeds, or predators, should also be avoided.

When considering habitat loss, alteration, or significant impacts to habitat in any part of the Gang-gang Cockatoo's range, including in areas where the species 'may occur', surveys for occupancy at the appropriate times of the year, and identifying preferred foraging species remain an important tool in refining the understanding of an area's relative importance for Gang-gang Cockatoo. In addition, it is also important to note that Gang-gang Cockatoos opportunistically use areas depending on food availability. This means that areas that constitute habitat critical to the survival might not have birds in any one given year. This pattern of habitat use means that both recent survey data and historical records need to be considered when assessing the relative importance of a local area or region for Gang-gang Cockatoos.

Actions that remove habitat critical to the survival of the Gang-gang Cockatoo may include, but are not limited to:

- The felling, ringbarking, or other removal of hollow-bearing trees,
- The felling, ringbarking, or other removal of large trees in good breeding habitat which may provide nesting hollows in the future,
- The removal of critical foraging habitat, or
- The disruption of key ecosystem processes necessary for the development and good health of foraging and breeding habitat critical to the survival of Gang-gang Cockatoo.

Actions that remove habitat critical to the survival would interfere with the recovery of Gang-gang Cockatoos and reduce the area of occupancy of the species. It is important to retain both breeding and foraging habitats described above. If removal of habitat critical to the survival cannot be avoided or mitigated, then an offset should be provided. Actions should not be



assessed in isolation and consideration must be given to existing and future activities that may impact the species to ensure conservation outcomes on a landscape scale are achieved.

Suitable offsets may include:

- Inclusion of unprotected areas of habitat critical to the survival in permanent nature reserves and provision of funding for the management of these areas.
- Restoration of the quality and extent of feeding and breeding habitat.
- Restoration of native forest and woodlands adjacent to habitat critical to the survival to reduce edge effects.
- Management of threats (see *Threats*) in and adjacent to habitat critical to the survival.
- Other compensatory measures that will help address knowledge gaps to improve and maximise efficiency of the recovery of the species.

No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat.

## Threats

The main threat to Gang-gang Cockatoos is the loss and degradation of roosting and nesting sites. In addition, the 2019/20 bushfires were unprecedented in their intensity and extent, and may have had a significant effect on Gang-gang Cockatoo population size. Burnt areas in New South Wales covered 5.4 million hectares (NSW Government 2020), much of which coincided with the species' habitat in the Tablelands and in coastal environments (NSW Government 2020). In total, 28–36 percent of known Gang-gang Cockatoo habitat burnt during this event (Ward et al. 2020; Legge et al. 2021). The resulting loss of breeding and roosting habitat has been exacerbated by the clearance of native vegetation within the species' range by the forestry industry and via urban encroachment (Rose 1993; Nelson & Morris 1994; Cumming 1998; Whitford & Williams 2002). Old hollow-bearing trees are commonly regarded as an impediment to forestry production, or unsightly or dangerous within urban areas. As such, they are often ringbarked, poisoned, or actively removed. Hollow-bearing trees suitable for nesting are now largely restricted to remnant patches of woodland and individual trees within otherwise cleared sites (Saunders & Ingram 1998). Gang-gang Cockatoos are faced with increased intra/interspecies competition for remaining nesting sites. Species which compete with Gang-gang Cockatoos for nesting hollows include feral honeybees, possums, and other bird species such as starlings, Noisy Miners and Common Mynas. It is not yet known which of these species pose the most significant threat to hollow availability.

**Table 1 Threats impacting Gang-gang Cockatoo**

Threat	Status and severity <sup>a</sup>	Evidence
Fire		
Wildfire	<ul style="list-style-type: none"> <li>• Status: current/future</li> <li>• Confidence: known</li> <li>• Consequence: severe</li> <li>• Trend: increasing</li> <li>• Extent: across the entire range</li> </ul>	The 2019/20 bushfires burnt approximately 28–36 percent (approximately 4,700,000 ha) of Gang-gang Cockatoo habitat (Ward et al. 2020; Legge et al. 2021), causing direct loss of habitat and individuals. The 2019/2020 fires may have resulted in direct 10 percent reduction in the overall

Threat	Status and severity <sup>a</sup>	Evidence
		<p>population size (Cameron et al. forthcoming). An analysis based on expert elicitation estimated an overall population decline of 21 percent one year post fire, and that three generations post-fire the population could still be 29 percent lower than the pre-fire population size (Legge et al. 2021).</p>
Climate change		
<p>Increase in frequency, scale, or severity of fire</p>	<ul style="list-style-type: none"> <li>• Status: current/future</li> <li>• Confidence: known</li> <li>• Consequence: severe</li> <li>• Trend: increasing</li> <li>• Extent: across the entire range</li> </ul>	<p>Future climate change is expected to increase wildfire risk through more adverse fire weather, including an expected increase in the number of days of severe fire danger, and a potential lengthening of the fire season over much of the range of the Gang-gang Cockatoo (Clarke 2015). Projected climate change will also lead to changes in fuel dynamics via changes to vegetation composition and structure (Clarke 2015). Fire frequency and severity have strong implications for tree hollow abundance in montane and subalpine eucalypt forests, with stand-level hollow abundance decreasing with more frequent fires (Salmona et al. 2018), hence decreasing nest-hollow availability for Gang-gang Cockatoo.</p>
<p>Warming climate</p>	<ul style="list-style-type: none"> <li>• Status: future</li> <li>• Confidence: suspected</li> <li>• Consequence: severe</li> <li>• Trend: increasing</li> <li>• Extent: across the entire range</li> </ul>	<p>Throughout NSW and the ACT, the temperature is projected to increase by approximately 2.1 degrees Celsius by 2079 (Office of Environment and Heritage 2014). The frequency of hot days is also projected to increase. As a result, the number of severe fire danger days is projected to increase in summer and spring. Hotter temperatures will substantially increase water requirements of Gang-gang Cockatoos and may severely reduce survival rates. Large scale die-offs of several bird species following heatwaves in Australia have been seen in the past (Conradie et al. 2020). These die-offs are likely to influence the stability of populations. Other effects of heatwaves could also include reduced reproductive success (McCreedy &amp; van Riper 2015), potentially resulting in further population declines.</p>

Threat	Status and severity <sup>a</sup>	Evidence
Altered rainfall patterns	<ul style="list-style-type: none"> <li>• Status: future</li> <li>• Confidence: suspected</li> <li>• Consequence: unknown/moderate</li> <li>• Trend: increasing</li> <li>• Extent: across the entire range</li> </ul>	<p>Across NSW and the ACT, spring rainfall is predicted to decrease over the next 100 years (Office of Environment and Heritage 2014).</p> <p>Changes in rainfall patterns have the potential for widespread impacts. Seasonal shifts in rainfall can impact floral productivity i.e., for floral species that are reliant on winter rains for peak growth. Furthermore, changes in rainfall patterns may also affect the post-fire regeneration ability of important foraging and breeding habitat. Changes in foraging and feeding habitat will likely result in increased energy expenditure by the species, likely reducing the survival rate.</p>
<b>Habitat loss and degradation</b>		
Clearing of native vegetation/commercial logging	<ul style="list-style-type: none"> <li>• Status: current</li> <li>• Confidence: known</li> <li>• Consequence: severe</li> <li>• Trend: increasing</li> <li>• Extent: across part of its range</li> </ul>	<p>Clearing of native vegetation and inappropriate forest management may reduce the availability of tree hollows and the abundance of optimum foraging and roosting habitat (Nelson and Morris 1994; Cumming 1998).</p> <p>Large, old, hollow-bearing trees are not suitable for timber production. Therefore, forest managers commonly regard these old trees as an impediment to production. For example, in the 1950s, large areas of old hollow-bearing trees were treated by ringbarking or by injecting poison (Florence et al. 1970). These dead trees had a standing life expectancy of about 50 years, but many fell due to the treatments. Those remaining have a limited lifetime (Ross 1998; Wormington et al. 2002).</p> <p>Hollow-bearing trees suitable for nesting are now largely restricted to remnant patches of woodland and individual trees within cleared sites (e.g., paddock trees) (Saunders &amp; Ingram 1998). Much woodland lacks hollows, and it takes over 100 years for woodland trees to mature and form hollows suitable for nesting (Rose 1993; Whitford &amp; Williams 2002). The replacement of lost hollow-bearing trees is virtually non-existent in many areas, particularly since the introduction of livestock and vermin that trample or graze on young native saplings (del Hoyo et al. 1997).</p>

Threat	Status and severity <sup>a</sup>	Evidence
Predation, competition, and disease		
<p>Competition for nest hollows with other species</p>	<ul style="list-style-type: none"> <li>• Status: current &amp; future</li> <li>• Confidence: known</li> <li>• Consequence: severe</li> <li>• Trend: increasing</li> <li>• Extent: across the entire range</li> </ul>	<p>A shortage of nest hollows due to factors such as wildfire and land clearance can increase competition for nest hollows with other species, reducing the number of hollows available to Gang-gang Cockatoos. Competitors may include feral honeybees, possums, and other bird species such as starlings, Noisy Miners and Common Mynas. Further research is required to better define the species which pose the greatest level of competition for nesting hollows.</p> <p>Colonies of honeybees occupy large hollows in trees. These hollows are completely taken over by honeybees and are removed from the pool of hollows available to native species such as Gang-gang Cockatoos (NSW Government 2019). Due to the long time-periods required for hollow formation and the long residence times of bees, occupation by bees represents a long-term loss of a critical resource (NSW Government 2019). Feral honeybees also invade artificial nest-boxes and have caused the demise of a number of birds' nests.</p> <p>An over-abundance of Noisy Miners (<i>Manorina melanocephala</i>) in some localities can also lead to the aggressive exclusion of Gang-gang Cockatoos from woodland habitat (NSW Government 2017).</p>
<p>Nest predation by Common Brushtail Possum</p>	<ul style="list-style-type: none"> <li>• Status: current</li> <li>• Confidence: known</li> <li>• Consequence: severe</li> <li>• Trend: unknown</li> <li>• Extent: across part of its range</li> </ul>	<p>Invasion of nesting hollows and predation of Gang-gang Cockatoo eggs and young by Common Brushtail Possum (<i>Trichosurus vulpecula</i>) could lead to a decline in population numbers in some parts of their range (Garnett et al. 1999). Possum predation rates are likely elevated from natural predation rates when habitat becomes fragmented following fires and land clearance (Hradsky et al. 2017). Without protection, recruitment of Gang-gang Cockatoos to the adult population may be minimal (Garnett et al. 1999; Garnett et al. 2011).</p> <p>Reproductive success of other cockatoo species (e.g., <i>Calyptorhynchus lathamii</i>) has been improved by prohibiting</p>

Threat	Status and severity <sup>a</sup>	Evidence
		possum entry into nest hollows (Garnett et al. 2011).
Psittacine beak and feather disease	<ul style="list-style-type: none"> <li>• Status: current</li> <li>• Confidence: known</li> <li>• Consequence: severe</li> <li>• Trend: increasing</li> <li>• Extent: across part of its range</li> </ul>	Gang-gang Cockatoos are susceptible to Psittacine beak and feather disease (Sarker et al. 2014). The population of Gang-gang Cockatoos from the Hornsby and Ku-ring-gai local government councils have a high incidence of the disease (DPIE 2019). It is spread through contaminated nest chambers.

Status—identify the temporal nature of the threat;

Confidence—identify the extent to which we have confidence about the impact of the threat on the species;

Consequence—identify the severity of the threat;

Trend—identify the extent to which it will continue to operate on the species;

Extent—identify its spatial content in terms of the range of the species.

Each threat has been described in Table 1 in terms of the extent that it is operating on the species. The risk matrix (Table 3) provides a visual depiction of the level of risk being imposed by a threat and supports the prioritisation of subsequent management and conservation actions. In preparing a risk matrix, several factors have been taken into consideration, they are: the life stage they affect; the duration of the impact; and the efficacy of current management regimes, assuming that management will continue to be applied appropriately (Table 2). The risk matrix (Table 3) and ranking of threats has been developed in consultation with experts, community consultation and by using available literature.

**Table 2 Risk prioritisation**

Likelihood	Consequences				
	Not significant	Minor	Moderate	Major	Catastrophic
Almost certain	Low risk	Moderate risk	Very high risk	Very high risk	Very high risk
Likely	Low risk	Moderate risk	High risk	Very high risk	Very high risk
Possible	Low risk	Moderate risk	High risk	Very high risk	Very high risk
Unlikely	Low risk	Low risk	Moderate risk	High risk	Very high risk
Unknown	Low risk	Low risk	Moderate risk	High risk	Very high risk

**Categories for likelihood are defined as follows:**

Almost certain – expected to occur every year

Likely – expected to occur at least once every five years

Possible – might occur at some time

Unlikely – such events are known to have occurred on a worldwide basis but only a few times

Rare or Unknown – may occur only in exceptional circumstances; OR it is currently unknown how often the incident will occur

**Categories for consequences are defined as follows:**

Not significant – no long-term effect on individuals or populations

Minor – individuals are adversely affected but no effect at population level

Moderate – population recovery stalls or reduces

Major – population decreases

Catastrophic – population extinction

**Table 3 Gang-gang Cockatoo risk matrix**

Likelihood	Consequences				
	Not significant	Minor	Moderate	Major	Catastrophic
Almost certain				Warming climate  Wildfire  Increase in frequency, scale, or intensity of fire	
Likely			Competition for nest hollows with other species  Nest predation by Common Brushtail Possum  Altered rainfall patterns	Clearing of native vegetation / commercial logging	
Possible					
Unlikely				Psittacine beak and feather disease (Pbfd)	
Unknown					

Priority actions have been developed to manage the threat particularly where the risk was deemed to be ‘very high’ or ‘high’. For those threats with an unknown or low risk outcome it may be more appropriate to identify further research or maintain a watching brief.

## Conservation and recovery actions

### Primary conservation outcome

- To prevent further declines and support increases in the population size of the Gang-gang Cockatoo.

### Conservation and management priorities

#### Increase in frequency, scale, or severity of fire

- Actively manage the landscape to minimise the risk of very large wildfires, particularly of very large high-severity wildfires.
- Ensure fire management (both prescribed burning and fire suppression activities) considers impacts on key breeding locations, foraging and nesting habitat for Gang-gang Cockatoo.
- Protect unburnt areas within or adjacent to recently burnt ground that may provide refuge from further damaging fire.

### **Clearing of native vegetation**

- Develop forestry/land clearing policies that promote the retention and recruitment of old hollow-bearing trees which possess potential nesting sites.
- Protect and enhance quality of known habitats (both breeding and foraging) for Gang-gang Cockatoo.
- Establish buffer zones (e.g., 1 km) of native forests or woodlands around important nesting areas to minimise incursions by nest competitors.

### **Competition for nest hollows with other species**

- Monitor nest site competition (behavioural surveys) and monitor nesting outcomes.
- Implement control programs for invasive species identified as significant nest-hollow competitors, such as feral honeybees, possums, starlings, Noisy Miners, and Common Mynas.
- Develop and implement a nest box program to increase the number of nesting sites available to Gang-gang Cockatoos.

### **Common Brushtail nest hollow competition and predation**

- In peri-urban and urban areas with high possum densities, use nest site protection measures to safeguard roosting/nesting sites i.e., protect nests with iron tree collars to prevent possum access.

### **Disease**

- Monitor Gang-gang Cockatoo populations for Psittacine Beak and Feather Disease.

### **Stakeholder engagement/community engagement**

- Develop and implement a broad strategy to raise awareness and educate the public about Gang-gang Cockatoo conservation.
- Develop and implement a targeted strategy to promote the use of citizen science in relation to Gang-gang Cockatoo conservation.

### **Survey and monitoring priorities**

- Conduct long-term, regular, ongoing monitoring to assess population and subpopulation trends.
- Monitor bushfire-affected areas to assess the impact of wildfire on the species and its habitat, and the capacity of the species to recover from such events.
- Identify and map available habitat and assess habitat quality.

### **Information and research priorities**

- Conduct a genetics study to calculate recruitment rate, population size/trajectory, and genetic diversity/structure.
- Undertake further research/surveys to expand on current evidence of the species' ability to re-colonise fire affected areas.

- Identify priority locations for nest tube deployment with consideration of habitat destruction from wildfires.
- Assess the impacts of wildfire and prescribed burning, especially on food resources.
- Assess the availability of suitable nest hollows and consider options to ameliorate limitations if nest site competition or hollow availability is a limiting factor for species' reproductive success.
- Determine the species' susceptibility to heat stress.

### Recovery plan decision

A decision about whether there should be a 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.

### Links to relevant implementation documents

- [Commonwealth of Australia \(2004\) Beak and feather disease \(psittacine circoviral disease\). Department of Environment and Heritage, Canberra.](#)
- [Commonwealth of Australia \(2005\) Threat abatement plan for beak and feather disease affecting endangered psittacine species. Department of Environment and Heritage, Canberra.](#)
- [Commonwealth of Australia \(2015\) Threat abatement plan for predation by feral cats. Department of the Environment, Canberra.](#)

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# THREATENED SPECIES SCIENTIFIC COMMITTEE

Established under the *Environment Protection and Biodiversity Conservation Act 1999*

The Threatened Species Scientific Committee finalised this assessment on DD Month Year.

## Attachment A: Listing Assessment for *Callocephalon fimbriatum*

### Reason for assessment

This assessment follows prioritisation of a nomination from the public/TSSC.

### Assessment of eligibility for listing

This assessment uses the criteria set out in the [EPBC Regulations](#). The thresholds used correspond with those in the [IUCN Red List criteria](#) except where noted in criterion 4, sub-criterion D2. The IUCN criteria are used by Australian jurisdictions to achieve consistent listing assessments through the Common Assessment Method (CAM).

### Key assessment parameters

Table 4 includes the key assessment parameters used in the assessment of eligibility for listing against the criteria.

**Table 4 Key assessment parameters**

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Number of mature individuals	25,300	17,600	35,200	The population estimate of Gang-gang Cockatoos is based on several assumptions: the real AOO is twice that recorded; an average density of 3.1 birds/km <sup>2</sup> exists; the 2019/2020 fire season reduced the carrying capacity of 40 percent of grid cells by half; and the 2019/2020 fire season resulted in 10 percent reduction in the overall population size. In 2019/2020 at least 30 percent of all 1x1 km squares from which birds have been recorded since 1990 were burnt (Cameron et al. forthcoming). Legge et al. (2021) also estimated an overall population decline at one year post fire of 21% (80% confidence limits: 9-38%) but this is not incorporated in the current population estimate provided by Cameron et al. (forthcoming).

<b>Metric</b>	<b>Estimate used in the assessment</b>	<b>Minimum plausible value</b>	<b>Maximum plausible value</b>	<b>Justification</b>
<b>Trend</b>	Decreasing			Reporting rates from 500 m radius area searches (recorded in 20,094/328,201 surveys), arguably the most reliable of the available survey methods for the species, declined by 69 percent from 1999–2019. This follows a significant decline of 22 percent between 1977–1981 and 1998–2001 (Barrett et al. 2002), including a decline of 44 percent in New South Wales (Barrett et al. 2007). However, the decline in 2 ha 20 min surveys from 1999–2019 (recorded 8987/267 885 surveys) was only 15 percent with no clear trend (BirdLife Australia 2020; Cameron et al. forthcoming).
<b>Generation time (years)</b>	6.9	6.2	7.6	Bird et al. (2020)
<b>Extent of occurrence</b>	400,000 km <sup>2</sup>	380,000 km <sup>2</sup>	410,000 km <sup>2</sup>	Gang-Gang Cockatoos occur along the Great Dividing Range from the Hunter Region of the central north coast of New South Wales in a broad arc around south-eastern Australia to the Otway Ranges and inland as far as Wagga Wagga, Albury, Rutherglen, Seymour and Ballarat with largely isolated subpopulations in the Otway Ranges, Grampians and southwestern Victoria to the South Australian border.
<b>Trend</b>	Stable			Cameron et al. (forthcoming)
<b>Area of Occupancy</b>	30,000 km <sup>2</sup>	22,700 km <sup>2</sup>	40,000 km <sup>2</sup>	The minimum AOO is the number of 2x2 km squares within which they have been recorded since 1990 but, given the remoteness of much of the distribution, the real AOO is assumed to be at least twice that and probably substantially greater (Cameron et al. forthcoming). In 2019/2020 at least half of the 30 percent of all 1x1 km squares from which birds have been recorded since 1990 were burnt.
<b>Trend</b>	Stable			Cameron et al. (forthcoming)
<b>Number of subpopulations</b>	1	1	4	Cameron et al. (forthcoming)
<b>Trend</b>	Stable			Cameron et al. (forthcoming)
<b>Basis of assessment of subpopulation number</b>	There could be three discrete subpopulations within south-western Victoria (Otway Ranges, Grampians and the far south-west), which may separate from those further east.			

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
No. locations	Not calculated			The spatial nature of the threats, even though stochastic in space and time, is such that there are >10 geographically or ecologically distinct areas where a single threatening event could affect all individuals of the taxon present within a period of one generation.
Trend	Not calculated			Cameron et al. (forthcoming)
Fragmentation	Not severely fragmented.			
Fluctuations	Not subject to extreme fluctuations in EOO, AOO, number of subpopulations, locations or mature individuals.			

### Criterion 1 Population size reduction

Reduction in total numbers (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%
<p><b>A1</b> Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p><b>A2</b> 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.</p> <p><b>A3</b> Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]</p> <p><b>A4</b> 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.</p>	Based on any of the following		<p>(a) direct observation [except A3]</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</p>

### Criterion 1 evidence

#### Eligible under Criterion 1 A2bc for listing as Endangered

Gang-gang Cockatoos are endemic to south-eastern Australia. The species' habitat was heavily impacted during the 2019/2020 bushfires. Estimates of the percentage of the distribution impacted by fire range from 28 to 36 percent (Legge et al. 2020; Ward et al. 2020; Legge et al. 2021). The 2019/2020 fires may have reduced the carrying capacity of 40 percent of occupied grid cells by half and resulted in a 10 percent reduction in the overall population size. An analysis based on expert elicitation estimated an overall population decline of 21 percent one year post-fire (80 percent confidence limits: 9-38 percent), and that three generations post-fire

the population could still be 29 percent lower than the pre-fire population size (Legge et al. 2021). These predictions assume no further extreme drought or extensive fire events; however, such events are likely to reoccur over the assessment period, which would worsen the extent of population decline.

Reporting rates from 500 m radius area searches (arguably the most reliable of the available survey methods for the species) declined by 69 percent from 1999–2019 (i.e., before the 2019–2020 fires). This follows a significant decline of 22 percent between 1977–1981 and 1998–2001 (Barrett et al. 2002). However, the decline in 2 ha 20 min surveys from 1999–2019 was only 15 percent with no clear trend (BirdLife Australia 2020). Given the evidence of declines before the 2019, followed by substantial mortality caused by the 2019–2020 fires from which the species may struggle to recover, it is plausible that the overall decline in a three generation (21 year) period exceeds 50 percent.

The data presented above appear to demonstrate that the species is **eligible for listing as Endangered** 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
<b>B1.</b> Extent of occurrence (EOO)	< 100 km <sup>2</sup>	< 5,000 km <sup>2</sup>	< 20,000 km <sup>2</sup>
<b>B2.</b> Area of occupancy (AOO)	< 10 km <sup>2</sup>	< 500 km <sup>2</sup>	< 2,000 km <sup>2</sup>
<b>AND at least 2 of the following 3 conditions:</b>			
(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			

**Criterion 2 evidence**  
**Not eligible**

The EOO is estimated at 400,000 km<sup>2</sup> (range 380,000–410,000 km<sup>2</sup>) and the AOO estimated at 30,000 km<sup>2</sup> (range 22,700–40,000 km<sup>2</sup>) (Cameron et al. forthcoming). The EOO is based on all records since 1990. The minimum AOO is the number of 2x2 km squares within which the species has been recorded since 1990 but, given the remoteness of much of the distribution, the



real AOO is assumed to be at least twice that, and probably substantially greater (Cameron et al. forthcoming). The 2019/2020 fire burnt an estimated 30 percent of all 1x1 km squares from which birds have been recorded since 1990 (Legge et al. 2020); however, the decline is not thought to be ongoing. The EOO and AOO for the species is thought to be stable (Cameron et al. forthcoming). The number of locations has not been calculated, but the spatial nature of the threats, even though stochastic in space and time, is such that there are >10 geographically or ecologically distinct areas where a single threatening event could affect all individuals of the taxon present within a period of one generation. The species is not severely fragmented and is not subject to extreme fluctuations in EOO, AOO, number of subpopulations, locations, or mature 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 3 Population size and decline

	<b>Critically Endangered Very low</b>	<b>Endangered Low</b>	<b>Vulnerable Limited</b>
Estimated number of mature individuals	< 250	< 2,500	< 10,000
AND either (C1) or (C2) is true			
<b>C1.</b> An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	<b>Very high rate 25% in 3 years or 1 generation (whichever is longer)</b>	<b>High rate 20% in 5 years or 2 generation (whichever is longer)</b>	<b>Substantial rate 10% in 10 years or 3 generations (whichever is longer)</b>
<b>C2.</b> 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			

### Criterion 3 evidence

#### Not eligible

The species most likely consists of a single population, but there could be three discrete subpopulations within south-western Victoria (Otway Ranges, Grampians and the far south-

west), which may separate from those further east (Cameron et al. forthcoming). The number of mature individuals is estimated to be 25,300 (range 17,600–35,200) (Cameron et al. forthcoming). The population is estimated to have declined by approximately 10 percent due to the 2019/2020 fires and was also likely experiencing ongoing, continuous decline of over 50% before the fires (Cameron et al. forthcoming). The species' geographic distribution is not precarious for its survival and it is not subject to extreme fluctuations (Cameron et al. forthcoming).

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 4 Number of mature individuals

	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
D. Number of mature individuals	< 50	< 250	< 1,000
D2. <sup>1</sup> Only applies to the Vulnerable category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time			D2. Typically: area of occupancy < 20 km <sup>2</sup> or number of locations ≤ 5

<sup>1</sup> The IUCN Red List Criterion D allows for species to be listed as Vulnerable under Criterion D2. The corresponding Criterion 4 in the EPBC Regulations does not currently include the provision for listing a species under D2. As such, a species cannot currently be listed under the EPBC Act under Criterion D2 only. However, assessments may include information relevant to D2. This information will not be considered by the Committee in making its recommendation of the species' eligibility for listing under the EPBC Act, but may assist other jurisdictions to adopt the assessment outcome under the [common assessment method](#).

#### Criterion 4 evidence Not eligible

The total number of mature individuals is estimated to be 25,300 (range 17,600–35,200). This estimate is based on the assumptions that the real AOO is twice that recorded; the birds occur at an average density of 3.1 birds/km<sup>2</sup>; and that the 2019/2020 fire season reduced the carrying capacity of 40 percent of grid cells by half and resulted in 10 percent mortality.

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**

	<b>Critically Endangered Immediate future</b>	<b>Endangered Near future</b>	<b>Vulnerable Medium-term future</b>
<b>Indicating the probability of extinction in the wild to be:</b>	≥ 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

**Criterion 5 evidence**

**Insufficient data**

Population viability analysis has not been undertaken. Therefore, there is insufficient information to determine the eligibility of the species for listing in any category 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.

**Adequacy of survey**

The survey effort has been considered adequate and there is sufficient scientific evidence to support the assessment.

## **CONSULTATION QUESTIONS FOR *Callocephalon fimbriatum* (Gang-gang Cockatoo)**

### **SECTION A - GENERAL**

1. Is the information used to assess the nationally threatened status of the species/subspecies 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/SUBSPECIES? (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 on the ecology or biology of the species/subspecies not in the current advice?

### **SECTION C ARE YOU AWARE OF THE STATUS OF THE TOTAL NATIONAL POPULATION OF THE SPECIES/SUBSPECIES? (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/subspecies? 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/subspecies (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 species/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:

>10,000  10,000 – 15,000  15,001 – 25,000  25,001 – 50,000  >50,000

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/SUBSPECIES? (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 during the late 2000s (*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 species/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:

- >10,000  10,000 – 15,000  15,001 – 25,000  25,001 – 50,000  >50,000

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 13 years (i.e., three generations)? 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/SUBSPECIES? (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:

- <300,000 km<sup>2</sup>  300,000 –400,000 km<sup>2</sup>  400,001 – 500,000 km<sup>2</sup>  >500,000 km<sup>2</sup>

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:

- <20,000 km<sup>2</sup>  20,000 – 40,000 km<sup>2</sup>  40,001 – 60,000 km<sup>2</sup>  >60,000 km<sup>2</sup>

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/SUBSPECIES? (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:

- <300,000 km<sup>2</sup>  300,000 –400,000 km<sup>2</sup>  400,001 – 500,000 km<sup>2</sup>  >500,000 km<sup>2</sup>

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:

- <20,000 km<sup>2</sup>  20,000 – 40,000 km<sup>2</sup>  40,001 – 60,000 km<sup>2</sup>  >60,000 km<sup>2</sup>

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/SUBSPECIES? (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/SUBSPECIES? (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/SUBSPECIES?**

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/subspecies 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/subspecies are land managers where the species/subspecies 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/subspecies?