

REPORT ON A SURVEY OF BREEDING ACTIVITY OF THE GANG-GANG COCKATOO WITHIN URBAN CANBERRA 2019-2020

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Abstract. We report on Gang-gang Cockatoo activity (*Callocephalon fimbriatum*) during the 2019-20 breeding season which follows on from a report on the two previous breeding seasons (Davey et al. 2019). A citizen-science led survey conducted through Canberra Nature Map provided information on 149 trees known to have been visited by Gang-gangs during the previous season. We report on young produced from 15 trees. Twenty-two chicks were produced. Of these one died in the nest, and four fell from the nest site with two being successfully returned. Possible reasons for the fatalities are discussed in relation to weather conditions during the latter part of the season.

The Gang-gang Cockatoo is a cool temperate species and may be particularly vulnerable to climate change. As all sites were located on the urban fringe additional observations are required from non-urban areas where water and food may not be so readily available.

1. Background

To celebrate the 50th anniversary of birding activity within the local region the Canberra Ornithologists Group (COG) conducted a citizen science led project on the Gang-gang Cockatoo (*Callocephalon fimbriatum*) from March 2014 to the end of the 2015-16 breeding season. The aim of the project was to find out more about the distribution and abundance of the little-studied cockatoo and in particular to determine whether the Gang-gang breeds within urban Canberra. Although a search of records collected between 1 July 1985 and 31 June 2013 from the COG database provided approximately 255 breeding records, the majority were of birds inspecting hollows or feeding young after they had fledged, none of which indicated that the birds actually breed within urban Canberra.

The 2014-16 survey produced an additional 258 records of birds showing an interest in potential nesting sites but there was only one record of birds nesting and producing young. For a copy of the COG report see <http://canberrabirds.org.au/wp-content/uploads/2015/03/Gang-gang-survey-March-2014-to-February-2015-Final-report.pdf> with a report on community participation at <http://canberrabirds.org.au/wp-content/uploads/2015/03/GG-survey-Community-Engagement-Report-Final.pdf>

In 2017 residents in the suburbs of Hughes and Garran were concerned about a proposed development at the base of Red Hill, since their observations suggested that the Gang-gang was nesting in the area. Subsequent observations in 2017-18 and again in 2018-19 confirmed successful breeding. Meanwhile the general public were encouraged to submit observations with photos to Canberra Nature Map (CNM) of Gang-gangs displaying any breeding behaviour, and over 400 records were submitted (Davey et al. 2019).

For the 2019-20 breeding season the reporting criteria to CNM were refined to capture observations from sites that previously had shown signs of breeding, but none been confirmed.

The aim of this report is to detail findings for the 2019-20 breeding season and to build on observations from previous seasons.

2. Methods

Records obtained from the 2014-16 COG survey and from the CNM survey were coded as follows:

- Breeding possible, one report only, bird/s near hollow (Category 1)
- Breeding possible, one report only, seen entering hollow (Category 2)
- Breeding possible, more than one report of birds at or near hollow (Category 3)
- Very likely breeding, seen on multiple occasions at or near hollow and entering hollow on at least one occasion (Category 4)
- Confirmed breeding, non-flying young seen at entrance (Category 5)

Although category 1 and 2 sites may just as likely have been successful breeding sites as categories 3, 4 or 5, we concentrated survey efforts on those trees with multiple records of Gang-gang interest. Sixty-seven sites categorised as 3 or greater were identified, and those individuals who had contributed observations from those sites were contacted and asked to contribute further sightings during the 2019-20 breeding season.

Instructions and a datasheet specially designated for the survey were posted on CNM. Although images could be posted to CNM, the aim of the datasheet was to record visits to possible nesting sites so that on occasions when there was no activity this could be recorded. From observations obtained the previous year it was realised that early morning or late evening were the most likely times to observe Gang-gangs at a potential nest site. Volunteers were asked to visit their designated site and to:

1. Visit the tree at least twice a month from October to February (i.e. 10 visits)
2. Spend 20 minutes each visit staking out the tree
3. Visit at 7 - 9 am or 6 - 8 pm.

If no Gang-gang activity was observed at the site by the end of November, observations at the site were no longer required.

3. Results

Fifty-seven volunteers or family groups participated in the survey and, with additional information provided by the volunteers, 149 trees were watched, of which 127 were visited on at least two occasions. The field datasheets were returned by about 50% of the volunteers, the remainder providing comments directly via CNM or email. In total there were 864 separate observations.

Of the 149 trees, three had been cut down. Of the remaining 146, 27 had no activity reported. At 57 of the trees, Gang-gangs were seen at or near the site and entered the hollow on at least one occasion. At 46 sites Gang-gangs were observed frequently entering the hollow, and chicks were reported from 15 sites.

Sixty-seven of the 149 sites had reported Gang-gangs visiting them on multiple occasions in previous years. As indicated previously, three of the trees had been cut down, six were not watched, 32 were not seen to be visited by Gang-gangs, two sites were visited by Gang-gangs on a single occasion and 24 were frequently visited, of which three produced young.

3.1 Breeding details

3.1.1. Comparison of sites between years

From records collected during the 2017-18, 2018-19 and 2019-20 breeding seasons we are aware of 22 sites that most likely (code 4) or had definitely (code 5) produced chicks, see Table 1.

Table 1. Breeding categories of 22 Gang-gang hollows during 2017-18, 2018-19 and 2019-20. See text for details of categories.

Site number	Site name	2017-18	2018-19	2019-20
25	Tree 66	5	5	5
28	Long hollow	4	4	NU
29	Small hollow	4	4	5
30	Duck down	5	5	5
133	Mistletoe	3	5	NU
134	Red Box	1	5	5
135	Norm's	NC	5	NU
136	Track hollow	4	4	NU
137	Gully hollow	NC	4	NU
138	Sandy's	4	2	NU
160	Roy's hollow	NC	NC	5
182	Davidson's	NC	NC	5
29	Sandy 2	NC	NC	5
6942	Birch	NC	NC	5
51	Tree 51	NC	NC	5
147	Mt. Ainslie	NC	NC	5
166	Federal Golf Course	NC	NC	5
163	Mugga 1	NC	NC	5
177	Mugga 2	NC	NC	5
183	Bass Gardens	NC	NC	5
Tree 4, ANBG	Tree 4, ANBG	NC	NC	5
Tree 10A, ANBG	Tree 10A, ANBG	NC	NC	4
Tree 2 ANBG	Tree 2 ANBG	NC	NC	4

ANBG: Australian National Botanic Gardens; NC- not checked, NU- Gang-gangs not seen using the site.

3.1.2. Breeding details for 2019-20

During the 2019-20 breeding season 22 chicks were observed from 15 nest sites, see Table 2. The 1.4 chicks per nest was below the average of 2.0 recorded during the 2018-19 breeding season. One of the chicks could not be sexed, leaving a sex ratio of 12 males and 9 females in 2019-20 compared with 8 males and 5 females the previous year.

Table 2 . Number of chicks and fledging dates for 15 category 5 nest sites, 2019-20.

Site number	Site name	Number chicks at hollow	Sex	When first observed	When fledged	Comments
25	Tree 66	2	M, M	28/12/19	9-10/1/20	Male replaced in hollow
29	Small hollow	1	F	31/12/19	16/1/20	
30	Duck down	2	M, M	29/12/19	4-5/1/20	
134	Red Box	2	M, F	24/12/19	30-31/12/19	
160	Roy's hollow	2	F	4/1/20	20/1/20	
			M	4/1/20	24/1/20	
182	Davidson's	1	M	15/1/20	16/1/20	
29	Sandy 2	1	F	4/1/20	22/1/20	
6942	Birch	1	F			Found dead 10/1/20
51	Tree 51	1	F	7/1/20	ca 13/1/20	
147	Mt Ainslie	1	M		ca 2/1/20	Replaced in hollow
166	Federal Golf Course	1	M	4/1/20	6/1/20	
163	Mugga 1	2	M, F	16/1/20	16/1/20	
177	Mugga 2	2	M, F	9/1/20	24/1/20	
183	Bass Gardens	1		31/12/19		Dead in hollow
Tree 4, ANBG	Tree 4, ANBG	2	M	8/12/19		
	Tree 4, ANBG		F	9/1/19		Fell from nest

All of the category 5 sites provided indications of successful hatching and chick production. At all sites chicks were seen at the nest site but not all survived to fledging.

3.1.3. Chick mortality

At site 6942 (Birch) on 10 January 2020 a dead chick, near-ready to fledge, was found under the hollow, having presumably fallen from the nest entrance or been ejected by parents after dying in the nest. The state of decomposition suggested it had died about a week earlier.

At site Tree 4 ANBG a female chick was found on the ground near the nest site on 9 January. The tree was too difficult to climb so the chick could not be replaced. It survived in a nearby bush and continued to be fed by the adults but by the fourth day a pile of feathers indicated that the chick had been predated, possibly by a fox that had been seen in the area. From the development of the wing feathers we calculate that the chick was about a week from fledging. An interesting observation was the difference in the chick feeding behaviour between the

male and female parents. Although the female was relatively gentle in feeding the chick, the male was not, and the feeding session usually ended with the chick falling off its perch. The chick then had to return to the perch with difficulty.

At site 147 (Mt Ainslie) on 2 January a nearly fledged nestling was found on the ground. It was replaced in the hollow and the entrance blocked with a jumper. When the parent birds returned and perched a short distance away, the jumper was removed by pulling the attached string. The parents then returned to the nest site.

At site 25 (Tree 66) breeding occurred in the same tree as last year but in a different hollow. On 9 January around mid-day a male chick was found by a member of the public on the ground near the nest site and taken to the Kent Street Veterinary Clinic in Deakin. The nearly fledged chick was returned to the nest site during the afternoon of the next day. For a detailed account of the rescue see Appendix I.

At site 183 (Bass Gardens) on 31 December 2019 a female adult was observed emerging at the hollow entrance and two photos were taken approximately one minute apart. When the images were displayed on a computer, it was realised that the second image showed the adult clutching a white/creamy-coloured object in its claws. This was not visible in the first image because the adult was still partly hidden. On looking at the images, we concluded that the object was a dead chick that was being removed from the nesting chamber. Subsequently no further breeding behaviour was seen at this site.

An interesting observation occurred during the evening of 31 December at Site 29 (Small hollow); the site identified by the small size of the hollow entrance (7 x 10 cm). The female chick was observed facing outwards and obviously stuck in the entrance. It remained stuck for a couple of hours. Eventually the male arrived, fed it, and managed to push it back into the hollow. Over the next few days the chick was seen to have great difficulty exiting and returning to the nest. It eventually fledged, presumably on 12 Jan.

3.1.4. Tree measurements

Tree species and hollow type (whether on the trunk or a primary or secondary limb) were noted. Measurements for hollow depth were taken from the base of the entrance to the floor of the chamber. There were two measurements for hollow diameter: the width and height of the entrance. In addition, the outside circumference of the spout or trunk at the level of the chamber floor and the maximum diameter of the chamber floor were measured. Finally, the height from the ground to the base of the entrance was measured and the hollow perch length if present was measured (see Appendix II). For additional tree measurements and discussion see Davey *et al.* (2019).

3.2. *Some general observations*

No chicks were observed in trees in urban gardens, small urban parks or road reserves. We watched 27 hollow-bearing trees in these areas. The smallest park in which a hollow was observed to support a Gang-gang chick was the 3 ha Bass Gardens.

Nesting sites tended to be close to each other, and several observers recorded peaceful and what seemed to be helpful interactions between nearby nesting Gang-gang pairs, such as neighbouring Gang-gangs driving off another bird species from an unattended hollow, nesting pairs calling to each other and flying off together, or nesting pairs visiting each

other’s hollows. The nests were clustered at the urban interface in the Hughes-Red Hill area, the O’Malley – southern Red Hill area and the ANU-Botanic Gardens area.

Twenty-one chicks successfully fledged; 12 males and 9 females. One dead young female chick was discovered at the base of the ANU nest tree and one dead chick was observed being removed by a parent from the nest at Bass Gardens. The chicks did not seem to be hurt and we suspect heat exhaustion. Both deaths occurred in planted trees. The hollow formation in these trees is different from that in remnant trees. The hollows start as splits in limbs (or from surgery in the ANU tree), moisture collects in the splits and fungus softens the wood. Parrots then seem to chew out the wood to enlarge a hollow. One hypothesis is that hollows formed in this way are less well insulated than those formed from within by termites. Another “split branch” hollow in a tree in the Hughes area may have resulted in a drowned chick after a heavy spring downpour. A pair nested in a hollow in a 58-year-old planted Brittle Gum and successfully raised a chick, but the hollow in this instance seemed to have been formed by termites.

We observed four chicks leaving or attempting to leave their hollow prematurely. One female chick was stuck halfway in and out of a small entrance and three chicks were found helpless on the ground. Apart from the very young chick at Bass Gardens, all other young were found between 2 and 10 Jan. From around 24 Dec to 9 Jan, apart from a hot spike on 4 Jan of just under 45°C, followed by the passage of a cold front on 5 Jan, the weather in 2019-20 was hotter than the average of the past three seasons (see Fig. 1).

Over the last 80 years the mean annual rainfall at Canberra Airport is 614 mm. The minimum yearly rainfall fell in 1982, with 262 mm, and the maximum was 1062 mm in 1950. The mean annual average over the last three-year period (2017-2019) is 439 mm, the lowest three-year average in the 80 years of recording.

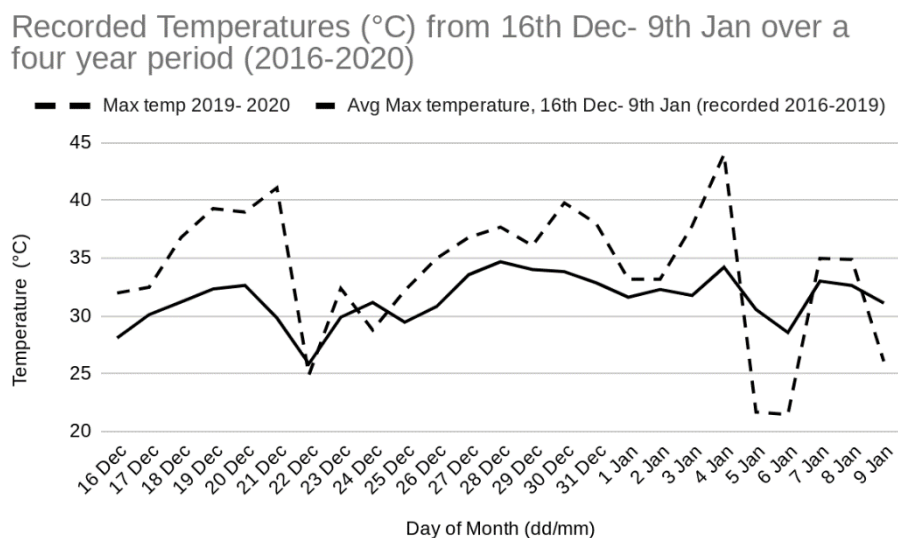


Figure 1. Average maximum temperature between 16 Dec and 9 Jan for years 2016-2019 compared with 2019-20.

Nevertheless, we cannot be sure whether chicks fell from nest sites due to the hot weather (or some other factor), or whether they were found on the ground because we were watching the trees. Our observations have been during a record dry period, and breeding success and

behaviour is likely to be different in wetter years. The Gang-gang is a cool temperate species, unusual among cockatoos, and may well be a species likely to suffer from climate change.

Our observations confirm that when chicks are about to fledge they are fed at the hollow entrance, rather than by the adults entering it. It is possible that certain characteristics of the entrance and the more aggressive feeding behaviour of the adult male make the chicks more susceptible to falling out. This does not have to be fatal for the chick because, as demonstrated at site 4, parents will continue to feed the chick out of the nest.

During 2019-20, virtually all chicks were first seen appearing from the nest hollow between 24 Dec and 16 Jan and fledging occurred between 30 Dec and 24 Jan, that is, over a period of about one month from around the Christmas period. It is of interest that the exception was at ANBG, where one chick was recorded at site 4 on 8 Dec 2019 and young birds were seen at sites 10a and 2 on 19 Nov and 8 Dec respectively. It cannot be confirmed that the young birds were from these sites, but even so there are indications that Gang-gang emergence was earlier than at other sites.

From observations on Red Hill it appears that incubation takes 3-4 weeks and the time from laying to fledging varies from 61 to 79 days (Tom Tyrrell *pers. obs.*). Incubation was judged to have begun when the male or female were seen sitting on the edge of the hollow, looking out. During the incubation period, all was quiet and no birds or change-over were seen during the day. It appears that there are only two change-overs per day, one in the early morning and one at nightfall, with the female incubating during the night. The clutch is incubated continually, apart from the change-over. It was assumed that the eggs had hatched when the change-over started to occur during the day, rather than during the early morning or late evening and this visitation frequently seemed to increase as the chicks grew. As they grew, both parents were seen to leave the hollow together for short periods of time.

Taking the maximum time of 79 days or about 12 weeks from the start of incubation to fledging, these observations agree with those from captive birds (see Higgins 1999).

We acknowledge that it is difficult to assess whether hollows are being used as nesting sites, and most cases require many hours of patient observations or good luck to confirm successful breeding. As with other cockatoo species, Gang-gangs spend much of the year inspecting hollows. This activity is not confined to the breeding season. They will visit nests sites other than their own, and non-breeding birds will apparently also visit nesting sites, but to date we have not observed birds other than the nest owners entering nests, although others may spend much time peering in and head-bobbing. During incubation it would appear that the nesting adults spend very little time around the nest site, with change-over only occurring early morning and late evening.

We obtained hollow measurements after the breeding season and at that time two of them were filled with water. These sites and another are known to be frequented by Gang-gangs coming in to drink, so some trees may be of value providing water during dry periods. Multiple entries into a hollow do not necessarily imply that it is a nesting site.

There is a need in the future to investigate trees visited by Gang-gangs some distance from the urban edge. In the survey reported here, none of the nests were further than 200m from the urban edge but we watched only five trees that were further than 300m: at Callum Brae (3), Mt Majura (1), and the Pinnacle (1). It is possible that the proximity of nests to the urban

edge is related to a preference for sites close to food and water resources provided in the urban environment.

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We also wish to thank Freja Cianchi for compiling the weather observations, the 57 individuals and family groups who contributed 835 observations and to Michael Len and Kevin Windle for editorial comments.

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APPENDIX I.

THE STORY OF A GANG-GANG CHICK BEING RETURNED TO ITS PARENTS

TOM TYRRELL

At 5:45pm on 8 January two male nestlings were seen in the hollow at Site 25 with both Mum and Dad close by. The male could be identified by having much more red on the head. After 20 minutes, both were fed. On returning at 7:00 pm, I thought that the two nestlings were still present

The next day there was no sign of nestlings at 8:30 am or again at 10:30 am. At 6:15 pm and again at 8:00 pm the nestling with less red on the head was seen at the hollow entrance. At about 8:00 pm my son Cameron mentioned that he had seen a picture of a Gang-gang chick on the Facebook site of the Kent Street Veterinary Clinic, Deakin. The chick was uninjured and had been handed over to the carers at ACT Wildlife.



Figure 1 Fallen male chick from nest site #25 (*Photo forwarded from Carla D'Andreti*)

On 10 January I rang the vet to enquire about the chick and was told that the bird had been picked up near Site 25 (at the back of the Kent St Defence building) around mid-day the previous day. It had since been picked up by ACT Wildlife, who sent me a photo of the chick, which looked very much like the chick from Site 25 (see Figure 1). I contacted Don Fletcher, who had rescued a chick from Site 147 (Mt Ainslie) a week earlier. (I had been involved in organising this rescue.) I then contacted the carer (ACT Wildlife had transferred it to a carer) and asked that the chick be given a big feed. My son and I then picked up the bird from its cage at Waramanga and met Don at around 3:15 pm near Site 25. Just after 4:00

pm Don climbed the tree and took measurements of the nesting site after checking that there was no other nestling present.

At around 5:00 pm, with the chick still in the box and becoming distressed, the parents flew in to a nearby tree. The chick called and they responded. The chick was taken out of the box and placed on a low branch near the hollow entrance, but after 30 minutes the parents had not made a move to contact son. Don then decided to place the nestling in the hollow. As this occurred both parents flew to the tree close to Don and after a few minutes flew away again.

When placed deep in the hollow the chick immediately turned around, came to the edge of the hollow and was starting to fall when Don, still up the tree, caught it. It was then placed on the top of the hollow, seemed disorientated and again fell, but Don managed to catch it a second time. When replaced in the hollow, it settled. At 6:51 pm the adult male flew in and fed and preened the chick and the female came in shortly after and did the same. Over the next 90 minutes there was further preening while the parents encouraged their son to fledge. This became quite forceful at one stage when Dad almost knocked his son off the perch. Dad could be seen a few times over this period demonstrating to his son how to get back into the hollow but the chick seemed very reluctant and scared to move from the perch.

After no success and with darkness drawing in, Mum came in at 8:20 pm and virtually pushed her son off his perch. Dad, Mum and son then all flew together to a small tree about 70m away where they spent some minutes. The fledgling, after his maiden flight, seemed very uncoordinated when trying to hold on to a very small branch at the top of the canopy but eventually settled. A happy ending for all.

Special thanks to Don Fletcher, without who's climbing skills the return of this chick to its parents would not have been possible. Thanks to all those who participated in this rescue, which ensured that the chick will have the best possibility of leading a normal Gang-gang life, to Cameron Tyrrell, the Kent Street Vet, Carla D'Andreti from ACT Wildlife, Erica who cared for the chick for 24 hours, and to Michael Mulvaney and Chris Davey for advice, to Michael for running the Gang-gang survey and finally to Jacky Fogerty for advice and monitoring the tree, and to Jenny Tyrrell for support and phone calls to Chris and Michael.

APPENDIX II. Gang-gang breeding hollow measurements

Tree		Hollow					Chamber		Branch Trunk circum.(cm)	Comments	
No.	Species	Location	Type	Height above ground (m)	Entrance		Perch Length (cm)	Depth (cm)			Floor diam (cm)
					Height (cm)	Width (cm)					
25.2	Eb	S	S	8.7	12	--	--	90	--	--	
160	Er	P	H	5.8	30	9	114	44	29 est	178	
182	Er	P	H	5.7	17	14	50 & 200	83	19 est	176	
29	Em	T	H	7.4	26	13	84	46	15	100	P/F
6942	Ee	T	C	5.0	20	11	--	38	18	210	
51	Em	T	H	7.7	16	12	22	66	18	120	
147	Eb	S	H	9.0	24	17	110	78	18	176	
166	Eme	P	H	8.5	14	17	--	52	16	172	
163	Eb	S	H	8.5	35	17	--	22	20 est	80	WDe
177	Eb	P	C	6.9	20	15	100	52	21	166	
183	Ebo	T	H	7.5	42	20	--	35	23	135	Planted. Flooded
4	Er	S	S	9.4	--	--	--	--	--	--	
10A	Emac	T	C	--	--	--	--	--	--	--	
Larissa*	Em	T	H	5.2	35	17	400	65	19	141	P. WDe
Pump*	Eb	P	H	6.0	34	26	--	84	28	129	Possum

Tree species Eb- E. blakelyi, Er- E. rossii, Em- E. mannifera, Ee- E. elata, Eme- E. melliodora, Ebo- E. bicostata, Emac- E. maculata

Hollow location T- Trunk, P- Primary limb, S- Secondary limb

est - estimated

Hollow type H- Hollow in trunk, S- Spout, C- Chimney

* Not used as a nest site

P -Planted

F - Flooded

WDe-Wood Duck with eggs