

# First record of Carnaby's Cockatoo raising two broods in one season

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Here we report on a female Carnaby's Cockatoo *Calyptorhynchus latirostris* (subgenus *Zanda*) that successfully bred twice in the 2022–2023 breeding season at Cataby, Western Australia. This is the first record of a cockatoo raising two broods in the one season.

**Keywords:** Carnaby's Cockatoo; double breeding; Western Australia

## INTRODUCTION

The number of breeding attempts per breeding season is closely related to the length of the breeding cycle and the length of time breeding is possible during the year. With many passerine birds, including fairywrens and flycatchers, if conditions are good females will often nest again, relinquishing her brood a few weeks after they fledge. Many passerine species, such as the Willie Wagtail *Rhipidura leucophrys*, are able to make two, three or even four successful breeding attempts in a year when conditions are favourable and food is abundant, Johnstone and Storr (2004). This is mainly due to the fact that the fledglings are independent soon after leaving the nest.

Generally larger birds take longer to prepare for breeding and have long incubation, nestling and dependency periods. Rarely can they attempt a second clutch after successfully rearing one brood. In what is our most studied cockatoo, the Galah *Eolophus roseicapilla*, Rowley (1990) recorded them re-laying after failure. These replacement clutches were laid after the first nesting had failed at the egg stage and a small number after nestlings had died (some as old as three weeks). Rowley (1990) noted that it was extremely unlikely that any pair of Galahs could raise two broods in one season and we could find no account of any cockatoo, even aviary birds, ever attempting to raise two broods in one season.

In our breeding biology study of the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksia naso* in the south-west of Western Australia (Johnstone et al. 2013), we found that this population laid only a single egg, the female incubates for 29–31 days, there is a prolonged nestling period, young are fully feathered in 48 days and fledge at 78–80 days, and juveniles depend on the adults for 18 months to 2 years after fledging. This is in contrast to the mid-west population of Red-tailed Black Cockatoos *C. b. escondidus* in which individuals have been recorded breeding twice in the one year Saunders (1977). Another interesting case of a non-passerine with a similar nesting regime to the latter is the Silver Gull *Larus novaehollandiae* population on Carnac Island, off Fremantle, Western Australia, in which the same individuals bred in the autumn and spring of the same year (i.e. were double brooded) Nicholls (1974). No other species of gull is known to be double brooded and this phenomenon in the Silver Gull is known only in Western Australia.

## METHODS

Over the past 25 years we have been studying the breeding biology of Baudin's Cockatoo *Calyptorhynchus baudinii*, Carnaby's Cockatoo *C. latirostris* and the Forest Red-tailed Black Cockatoo *C. banksia naso*, all endemic to the south-west of Western Australia. One of our monitoring sites for Carnaby's Cockatoo is at Cataby in Shire of Dandaragan, 164 km north of Perth. In 2004 we began to trial a small number of artificial nest hollows to determine which designs would be suitable for Carnaby's Cockatoos but generally unsuitable for other competitor superabundant species, namely the Galah, Butler's Corella *Cacatua pastinator* and feral European Honeybees *Apis mellifera*.

Each breeding season we monitor all nests of Carnaby's Cockatoos (natural and artificial hollows) to gain information on breeding success. Chicks are banded with special stainless-steel bands provided by the Australian Bird and Bat Banding Scheme (ABBBS), weighed and measured, and DNA feather samples taken. Also in the 2021–2022 and 2022–2023 breeding seasons we helped the Murdoch University Black Cockatoo Conservation Management Project team with a movement ecology study of Carnaby's Cockatoo in the Cataby region to help determine movements and habitat use of birds in this area. Part of this study involved the attachment of two tags to breeding adult birds that had nestlings that were a minimum of three weeks old. A Telonics (TAV 2617) Argos Platform Terminal Transmitter (PTT) satellite tag and an accelerometer capable UvA-BiTS GPS tag (Bouten et al., 2013) were attached in order to obtain movement, behavioural and ecological data as per methods described in Yeap et al. (2017). Additionally, tagged adults and their nestlings were fitted with stainless steel ABBBS bands and colour bands for identification in the field.

## RESULTS

On 29 August 2022 a female was flushed from a PE (polyethylene) nest pipe or Cockatube, number 1375 (Fig. 1), which had been erected in a Wandoo in 2019. The tube was checked with a pole camera and contained a clutch of two eggs. By 19 September 2022 the tube contained a hatchling, two days old, and one egg and on 15 October it contained a feathered





**Figure 1.** Artificial nest tube 1375, Cataby.

Photo: T. Kirkby



**Figure 2.** Adult female with band number 320-02106 (purple/yellow colour bands) with male.

Photo: Z. Kissane



**Figure 3.** Close up of female with purple/yellow colour bands.

Photo: Z. Kissane



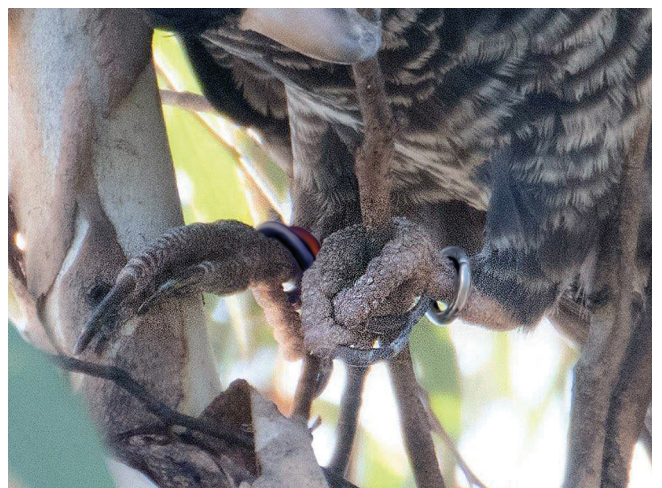
**Figure 4.** Nestling 320-02107 in nest.

Photo: T. Kirkby



**Figure 5.** Juvenile with silver band number 320-02107 and with red/purple colour bands.

Photo: Z. Kissane



**Figure 6.** Close up of juvenile with silver and red/purple colour bands.

Photo: Z. Kissane





**Figure 7.** Three-day old hatchling 320-02120 in nest 1375 and one addled egg. Photo: T. Kirkby

nestling at a good stage for the Murdoch University team to trap and band both the female and chick.

On 8 November 2022 the brooding female was trapped and banded with ABBBS band number 320-02106 and with purple/yellow colour bands (Fig. 2 and 3). The nestling was banded with ABBBS number 320-02107 and with red/purple colour bands (Fig. 4).

On 25 November 2022 nest tube 1375 was checked with a pole camera and the nestling had fledged (Fig. 5 and 6).

On 10 February 2023 a female was flushed from nest tube 1375, which contained a hatchling about three days old and one addled egg (Fig. 7). This was of great interest as a pair had fledged a chick from this tube around 24 November 2022 (from eggs laid in August and nestling banded in this tube on 8 November). We presumed that the current pair were different birds and late breeders (eggs would have been laid around 4–6 January and this nestling would fledge in April); however, banding details from later photographs showed that this was the same female that had bred previously.

On 3 March we observed three birds (pair and a juvenile) fly into nest tree 1375. The juvenile had colour bands (red/purple), indicating that it was from the previous breeding event in this tube and had fledged by 24 November 2022. The female began to walk along branches towards the tube but then all three birds left shortly afterwards and were not seen to visit the nest tube on this occasion. The tube contained a healthy pin-feathered nestling, which was banded, number 320-02120, and photographed.

During our visit on 22 March 2023, three birds were again observed at nest tube 1375. The male entered the tube and fed the nestling. The juvenile had the colour bands red/purple and the female had colour bands purple/yellow, confirming that these were the same birds that had previously fledged a chick from this tube in the 2022–2023 breeding season (colour bands confirmed with photographs).

The nest tube was re-checked on 21 April 2023, by which time the chick had fledged successfully.

## DISCUSSION

This is the first confirmed record of double breeding by female Carnaby's Cockatoo. It is of interest that her mate was able to feed two chicks (one fledged and one in the nest) as well as the female during incubation and brooding of the second nestling. Also noteworthy here is the physiological state of the female after the first brood. She was obviously carrying enough reserves to form a second clutch of eggs and one would assume that this second brood would, or could, have endangered the life of the first fledgling and possibly that of the female and the second nestling.

Courtship feeding of the female by the male occurs prior to egg laying but is most important when the female is incubating as she relies completely on the male at this time. It would seem to be a disadvantage to have the young present and receiving regurgitated food from the male at a period when the female, having already produced and assisted in the rearing of one clutch, was preparing for a second clutch and also requiring the male's feeding attention. The success of this pair to rear a second chick in a single season was no doubt partly due to the maintenance of the pair bond and partly because they had bred successfully earlier.

Individual Carnaby's Cockatoos differ in the date of laying in different habitats. For example, at Cataby, breeding begins usually in early July–August and continues until mid-December; however, at another of our study sites in Great Southern, near Hyden, egg laying has been recorded in late May and early June and birds continue to breed at that site through spring into summer and early autumn. This extended breeding period may well occur at other breeding sites in the Great Southern. Timing of breeding events and breeding success appear to depend on climatic factors and available foraging habitat. Birds are obviously responding to factors that are different in the two habitats, possibly the timing of the food supplies for the breeding pairs. Breeding success is largely dependent on suitable feeding habitat adjacent to the nest site to provide the necessary food for the survival of the chick. The autumn of 2022 was one of the wettest on record and this may have contributed to the timing and length of the breeding season.

Although foraging habitat at Cataby is small, restricted and unevenly distributed, the second breeding may have been due to the availability of food resources that facilitated and possibly accelerated this pair to breed again after a successful breeding experience. Pairs that breed successfully in a particular nest hollow often return to the same hollow the following breeding season and if unsuccessful, prospect for a new hollow. Additionally, other contributing factors include age of the pair, individual ability to find food, a strong pair bond and the fact that they bred early in the first instance and late in the second, hence both age (or experience) and date of laying appear to affect the breeding success.

Migration and movements of populations following breeding also differs in various parts of the State and some populations are becoming more sedentary, no doubt an impact of climate change and changing landscapes. As the climate warms and rainfall declines in the south-west, species such as Carnaby's Cockatoo that undergo extensive movements may either shorten their migration distance or even stop migrating and remain year-round in certain rainfall zones.

Most breeding in the central and northern wheatbelt is completed by the end of January or early February and family groups begin to move west towards the coast and amalgamate into larger foraging flocks on the northern section of the Swan Coastal Plain (Wanneroo to Lancelin). During February, March, April and occasionally lingering into May-June, large transit flocks forage at major food sources including *Banksia* or Kwongan heaths and *Pinus* plantations in the Jurien Bay area and on the northern Swan Coastal Plain between Lancelin and Perth. On the northern Swan Coastal Plain, the reverse movement of transient birds returning back to their wheatbelt breeding quarters is evident in July, August and September.

There are, however, some exceptions to this westward and southward yearly movement. For example, tracking data from Murdoch University has shown post-breeding movement from Cataby to as far north as Dongara and the Chapman Valley (approximately 290 km), in late March-April. Additionally, a flock of over 300 (including adult and juvenile birds) remains during the autumn-winter period in the Eneabba area. These birds roost in tall river gums in and around the township and forage in both remnant native vegetation and adjacent farmlands.

In November and December 2003, seven Carnaby's Cockatoo chicks from Cataby had the ventral surface of the white undertail panels painted with bright red with a lanolin-based spray paint. This study was part of a trial in conjunction with Birds Australia and Department of Conservation and Land Management (different colours used at different breeding sites). The aim was to test tail marking as a tracking method for birds from different populations. A campaign was conducted to encourage members of the public to report sightings of marked birds and searches were conducted by Birds Australia, volunteers and WA Museum personnel. Three confirmed or highly likely sightings of birds with red-painted tails were made, one at the Gngangara pine plantation (in March 2005) and two in the Perth metropolitan area (Wanneroo and Cottesloe in April 2004). These birds had travelled approximately 160 km SSW from their fledging site.

Although only a small number of birds were marked, the study provided valuable information on the migration pathway of birds from the central wheatbelt west and south onto the Swan Coastal Plain.

Judging from our historical monitoring (banding recoveries and tail marking) at Cataby, virtually all birds, at least up until very recently, departed from the breeding site and migrated west and south onto the Swan Coastal Plain to forage in *Banksia* woodlands and pine plantations; however, GPS-telemetry and ARGOS tracking data over the past two years has shown some birds to have remained in the vicinity of Cataby throughout the non-breeding period before some relocated further north along the Geraldton Sandplains. Whilst in the Cataby region during the post-breeding period, birds were observed foraging in adjacent remnant vegetation, nature reserves, roadside verges and in a maturing pine plantation. Having a suitable food supply during late summer would be crucial for the survival of the second chick this late in the breeding season. At that time most foraging was in roadside verges, highlighting the importance of these small patches of remnant vegetation. The new monitoring results indicate that a small proportion of populations in the mid-west are becoming more sedentary, and remaining in the breeding area post breeding, and this could well be an important factor in the second clutch at the Cataby site.

Over the past 50 years there has been dynamic changes in the migration and movements of Carnaby's Cockatoo in the south-west. The impacts of climate change, alterations in the landscape (clearing, fire regimes, salinity etc.), changing forest structure and the expansion of some native and exotic species that compete with this cockatoo. The lack of food resources along migration pathways has no doubt had a major impact on some populations.

Lastly this record shows the value of colour banding and collaborative field work and long-term monitoring. Certainly, as one of the reviewers to this paper pointed out, that without the luck of having the female and the first juvenile colour-banded, we would have been hard pressed to demonstrate this rare event.

## PERMITS

All telemetry tracking took place with approval of the Western Australian Department of Biodiversity Conservation and Attractions under permit number TFA 2020-0043, and Murdoch University Animal Ethics Permit No. RW3232/20.

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