

Age-related Colour Changes and Behaviour in the Northern Funereal Black-Cockatoo *Calyptorhynchus funereus funereus*

By JOHN COURTNEY, 'Ashgrove', Swan Vale, via Glen Innes,
N.S.W. 2370

Summary

The development of colour changes and behaviour from chick to adult in two captive males of the northern race of the Funereal Black-Cockatoo *Calyptorhynchus funereus funereus* is described for the first time. These males had female-type characters (pale bill, dark orbital skin) until 1 year 10 months, but differed in having duller ear coverts. The upper mandible was dark by 2 years of age, and the orbital skin was pale within 3 years of fledging. Adult plumage (brown instead of black) was attained in two years and a dark lower mandible was attained at 4 years. Courtship displays were first performed at 22½ months. There were slight differences in the quality, length and rate of utterance of juvenile begging and food-swallowing vocalisations when compared with the western race *C. f. latirostris*. It is concluded that *funereus* may be specifically distinct from southern *C. f. xanthonotus* and western *latirostris*.

Introduction

Two distinct forms of yellow-tailed black-cockatoo occur in south-eastern Australia; these are currently regarded as subspecies of the Funereal Black-Cockatoo *Calyptorhynchus funereus*. *C. f. funereus* ranges from central-eastern Queensland to the eastern extremity of Victoria, while the smaller *C. f. xanthonotus* occurs westwards of the Great Dividing Range in southern Victoria to south-eastern South Australia and Tasmania (Saunders 1979a). These two forms are separate taxonomic entities which come into contact in the Gippsland area of eastern Victoria (Saunders 1979a), but data are insufficient to determine whether they intergrade. Data in Saunders (1979a) and Blakers et al. (1984) indicate some overlap in the distribution of the two forms, but there is no evidence of hybridisation.

Adults of all forms within the *funereus* superspecies (*baudinii*, *latirostris*, *xanthonotus* and *funereus*) are sexually dimorphic to the same pattern: males have a dark beak, pale eye-skin (periophthalmic ring) and dull ear coverts; females have a pale beak, dark eye-skin and bright ear coverts (Lendon 1973). Against the above background, data on age-related colour changes and behaviour from chick to adult in two males of northern *C. f. funereus*, previously unrecorded in the literature, are presented.

In 1961 and 1962, the two unrelated nestlings were reared as part of an ongoing project designed to place on record the juvenile food-begging calls and related behaviour of all possible species of Australian parrot. The aim is two-fold, first to add this basic information to the life history of each species, and second, to compare the calls of each species in order to draw taxonomic conclusions (juvenile food-begging calls are often closely similar in closely related species, and bear little or no resemblance in distantly or unrelated species: pers. obs.).

Materials and methods

Young birds were mostly obtained on loan from avicultural sources, and retained only until reared, except for some cockatoos which have been the subject of a special study (for further details see Courtney 1974). The first *C. f. funereus* reared, designated no. 1 male, was estimated to have hatched in early May 1961. The second reared, designated no. 2 male, was known to have hatched on 26 March 1962 \pm 1 day and rearing began on 13 May 1962 at seven weeks (48 days). As rearing *Calyptrorhynchus* cockatoos to adulthood spans several years, the opportunity was taken to note data on age-related development over this period. The procedure for rearing the two birds was the same in each case.

Tail measurement was undertaken on no. 2 male because he was of known age, having first been observed on 1 April 1962 at an estimated age of 6-7 days, taken here to be one week. He was covered in dense yellow down and was still quite helpless (and therefore not more than a week old, cf. Saunders 1979b). The method was to gently lift the quite flexible tail upwards until a slight angle was formed with the spine, against which was placed the tip of a ruler, which in turn rested along the tail. An exact measurement was thus possible, made from the same point each week. The growth rate of no. 2 male (Figure 1) was then applied to no. 1 male, the hatching date of which was not known, but which had a tail 62.5 mm long when hand-rearing began and was therefore judged to be about five weeks old. This seems a reasonable assumption in view of the close agreement between the growth rate of no. 2 male's tail and that obtained by Saunders (1982) for *C. f. latirostris* (see below). The application of Saunders' growth curve gives the same projected age for no. 1 male (i.e. about five weeks for a tail 62.5 mm).

The begging calls were recorded while the fledglings were being spoon-fed, but only after several months in captivity had elapsed and the young were calling without constraint. The sound recordings were made in 1963 and 1964 using a Philips Continental EL 3546 open-reel tape recorder with a frequency range of 80-13000 Hz, and Philips dynamic microphone EL 3756/00. Tape speed was 9.5 cm per second. The sonagrams were made on a Kay Spectrum Analyser 7030A using the 300 Hz filter and the FL-1 selector.

Results

Plumage development

When they were nestlings and recently fledged, both young males had jet-black plumage with yellow natal down attached to the tip of some feathers, and dull yellow ear coverts. The breast feathers were quite dark when they were chicks, and the plumage changed to brown within two years. No. 1 male started to develop yellow tipping on the breast feathers at c. 34 weeks, which was complete by c. 40 weeks at which stage he began hulling seed sufficiently well to be weaned. No. 2 male was recorded as having 'distinct' yellow tipping at 35 weeks, and 'very distinct' at 36 weeks by which time he too was hulling seed. At c. 60 weeks, no. 1 male was discovered to have strikingly distinctive bicoloured under-tail coverts (black with yellow patches). Previously, the nestling under-tail coverts were plain black. No. 2 eventually developed bicoloured under-tail coverts at 92½ weeks.

Figure 1 shows the growth rate of no. 2 male's tail from seven weeks old (125 mm; body weight 737 g) to 15 weeks old (339.5 mm) when it ceased growing. This bird first flew at 12½ weeks (tail 290.6 mm; body weight 709 g), after

which the rate of tail growth slowed noticeably (4.5 mm per day to 12 weeks, 19 mm per week after 12 weeks). Most feathers of the first tail of no. 2 male were kept as specimen material, and the final feather was shed at 1 year 15 days old. In colour, the nestling tail was a deeper yellow and more heavily marked than second and subsequent tail feathers (Plate 35). The feathers of the second tail were 20 mm longer than the first tail, being about 360 mm long. In turn, feathers from the adult tail (sampled 1985) were another 15 mm longer, making his tail some 375 mm long.

The twelve rectrices comprising the tail of *Calyptorhynchus* cockatoos consist of five on either side with a band of colour, and two central ones which are usually plain black. In this resume of moult of the tail of no. 2 male,

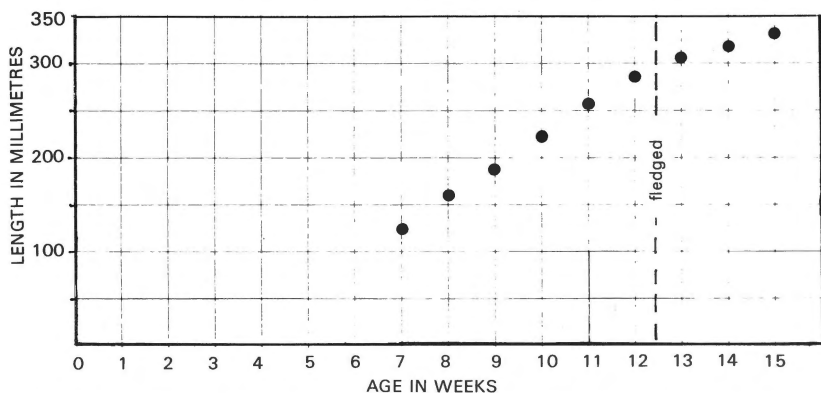
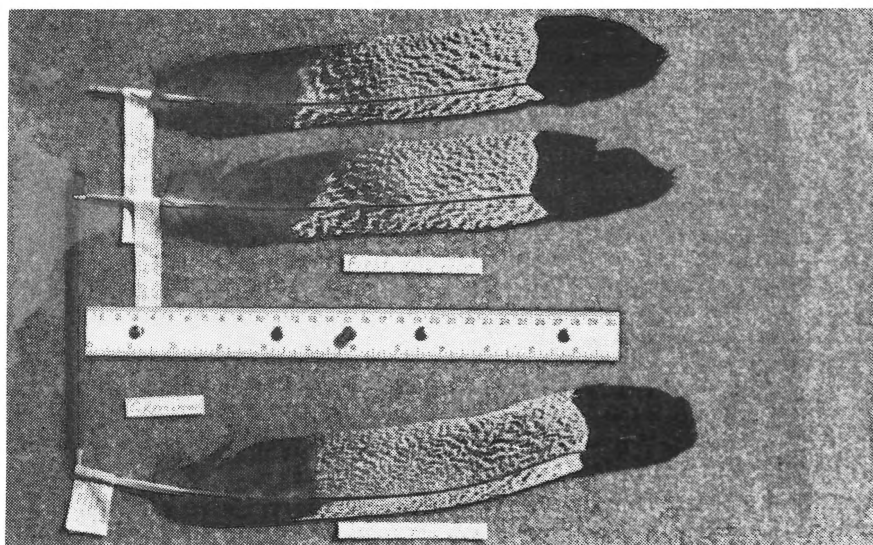


Figure 1. Growth of tail of nestling *C. f. funereus* (no. 2 male: see text).



Feathers from first (upper) and second (lower) tail of young male *C. f. funereus*, 1962 and 1963 respectively (no. 2 male: see text). Note heavy markings on juvenile feathers (upper).

the feathers are numbered from outside to inside, thus L1 is the outside left rectrix, while L6 is the left black central one. L5 was removed for a specimen on 22 June 1962 and the date of natural moult cannot be estimated. L3 and R6 were moulted on 21 December 1962, and an examination of the tail was then made. R1 was missing and a pinfeather was already growing in its place. R2 was a broken-off stub, moult not subsequently recorded. L1 was a new feather and thus would have been the first moulted, well prior to 21 December 1962. The others moulted in early 1963: R3 on 31 January, R4 on 1 February, L6 on 7 February, L4 on 24 February and R5 on 10 April being the last to moult, for the rest were new. It was not recorded when L2 was lost, but it was a broken-off stub in November 1962.

Vocalisations

When hungry, chicks of *C. f. funereus* utter a monotonous, repetitive, harsh rasping sound for long periods (the 'begging grate' described and illustrated for *C. f. latirostris* by Saunders 1983). In common with all cockatoos except the Glossy Black-Cockatoo *Calyptorhynchus lathami* and probably the Red-tailed

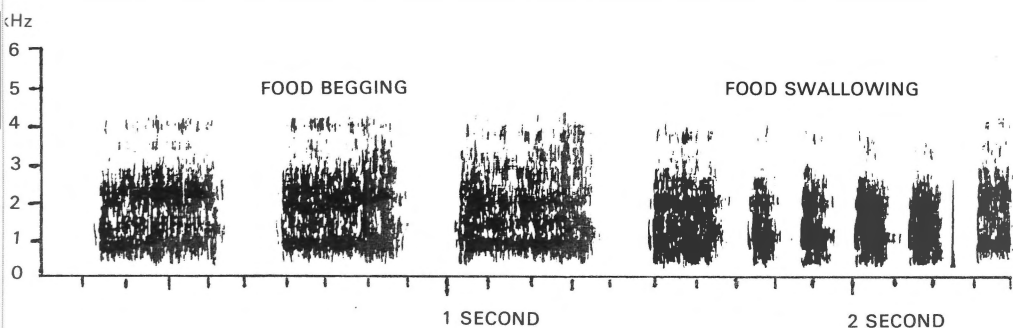


Figure 2. Sonagram of begging and food-swallowing calls of fledgling *C. f. funereus* (see text for explanation).

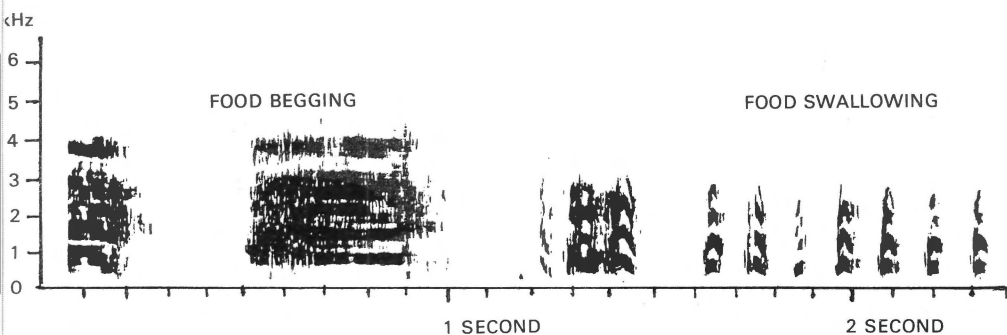


Figure 3. Sonagram of begging and food-swallowing calls of fledgling *C. f. latirostris* (see text for explanation).

Black-Cockatoo *C. magnificus*, chicks of the *C. funereus* superspecies utter a food-swallowing vocalisation with jerking movements of the head while being fed by the parents (the 'feeding A...A...A...' described and illustrated for *C. f. latirostris* by Saunders 1983). This call is apparently unique to the cockatoos and not found in any other parrot. When sated, chicks make head-averting movements accompanied by a soft growling sound.

The food-begging and swallowing calls of *C. f. funereus* are hoarser and more rasping than those of *C. f. latirostris*, the short-billed form of the White-tailed Black-Cockatoo. Consequently, the sonagrams of *C. f. funereus* show an unstructured band of noise from 0.5 kHz to 4.0 kHz whereas those of the more pure-sounding *C. f. latirostris* have the same frequency range but at least six bands of harmonics visible (Figures 2 and 3). The food-swallowing calls of the latter are quite pure-sounding with all the energy confined to four chevron-shaped harmonics, in contrast to the unstructured band of noise produced by the calls of *C. f. funereus*. The begging calls of *C. f. funereus* are shorter (about 390 ms) and have a higher repetition rate (2.1 calls per second cf. 1.8). Conversely, the pure-sounding food-swallowing calls of *C. f. latirostris* are only half (35 ms) the length of *C. f. funereus* and are given at a faster rate (8.6 calls per second cf. 6.4).

Colour of bill and orbital skin

Both nestlings first flew at 12½ weeks (no. 2 on 20 June 1962 at 86 days; no. 1 on 2 August 1961 at an estimated age of 88 days). Up to this age, they had milky-white eye-skin which then began to turn brown, becoming a deep blackish brown by about 16 weeks. At c. 89 weeks, the brown eye-skin of no. 1 male began to turn paler, with a pink tinge. At c. 139 weeks, almost a year later, his eye-skin had reverted to milky white with a pink tinge. At c. 140 weeks, his eye-skin was seen to flush deep pink during courtship display. No. 2 male also reverted from brown to pink-white orbital skin, beginning at 92½ weeks, but took longer, being four years old before he was recorded as having flesh-coloured eye-skin.

Both young birds had white beaks, no. 2 however possessed a faint dark 'wash'. At c. 89 weeks, the white upper mandible of no. 1 male developed a dark base, and became completely dark by c. 99 weeks old. At 111½ weeks no. 2 male had most, but not all, of the upper mandible dark. Thus, about two years (104 weeks) would seem an average age to attain an all-dark upper mandible. Nine months later, the lower mandible of no. 1 male developed the dark base at 138-139 weeks, and a further one year and five months elapsed before the lower mandible was all dark at four years old.

Displays

At c. 89 weeks, no. 1 male performed his first epigamic display, which consisted of bowing, tail-fanning and vocalising. This coincided with the beginning of the paling of his brown eye-skin, and the beginning of the darkening of his white upper mandible. At 121½ weeks no. 2 uttered a bubbling epigamic display call, the first such activity that he was observed to make. As no. 2 became older, he seemed to lag behind no. 1 in general development at comparable ages, perhaps because no. 1 was dominant and shared the same aviary. The epigamic display vocalisations of these two males range from squeaks and bubbling trills to two variants of the 'Ah ah' call described and illustrated by Saunders (1974, 1983) for the Western

Australian *latirostris*. The one most frequently uttered is obviously homologous with the 'Ah ah' call, but lacks the distinctive high-pitched, brief squeak in between the 'Ah ah' components typical of both *latirostris* and *xanthanotus*, and sounds like 'Ow ow'. Indeed, this call of the northern Funereal sounds more akin to the shrill 'At at' of the Red-tailed Black-Cockatoo or the 'Eep eep' of the Glossy Black-Cockatoo.

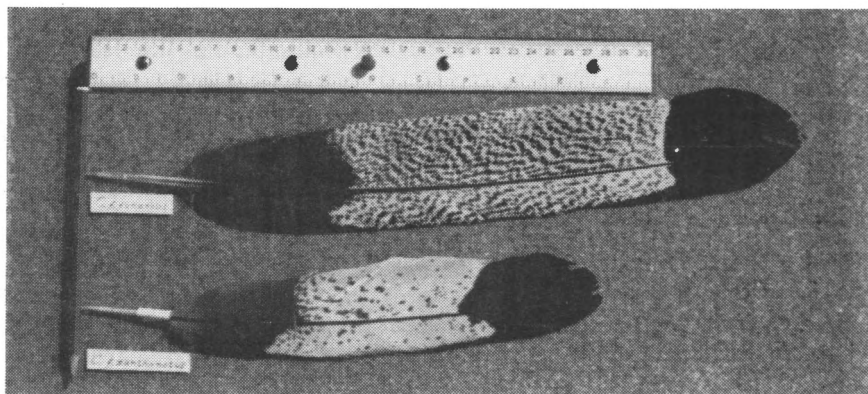
Discussion and conclusions

In summary, two young male *C. f. funereus* displayed female characters, i.e. having a pale bill and dark skin around the eye, until 1 year and 10 months of age, differing in having duller ear coverts. By 2 years of age, their upper mandible had darkened. Within 3 years of fledging, the skin around the eye had paled, but the lower mandible did not darken until 4 years of age at which time they had reached full adult colouration. There was some individual variation in the rate at which these changes took place. The sample size (two birds) is small, and further data on a large number of birds are needed before firm conclusions can be drawn on age criteria in *C. f. funereus*.

A puzzling feature arising from this study is the gradual acquisition of yellow tipping to once-dark breast feathers in male fledglings, almost certainly without moult. Such changes of colour are caused by the abrading of tips or by bleaching (Welty 1964), or by a shift in the distribution of feather pigments under the influence of gonadal hormones (Silver et al. 1979). The last explanation would seem the most likely in the case of these fledglings. Pale tipping to the feathers is so universal in all adults of the superspecies, and in three nestlings of *latirostris* that I have seen, that its very lack in these nestling northern males is puzzling. Unfortunately data are lacking not only for nestling northern females, but for nestlings of both sexes of southern *xanthanotus* as well.

The actual mechanism by which the deep blackish-brown eye-skin reverts to pinkish white warrants further study, but hormonal change seems the likely cause. As young males presumably remain with their parents for more than a year before independence (McInnes & Carne 1978), the function of acquisition of 'female-coloured' eye-skin in juvenile males may be to inhibit aggression towards them by the male parent. (Squabbling adult males flush the eye-skin a bright pink in aggression as well as in courtship: pers. obs.).

The tail measurement of 125 mm at seven weeks for no. 2 male *funereus* compares exactly with the tail measurements plotted by Saunders (1982) for a number of seven-week-old nestlings of the short-billed form of the White-tailed Black-Cockatoo (*latirostris*). His measurements ceased at about 11 weeks (77 days), presumably because the young then fledged, but at that age the close comparison still held, with the most advanced young having a tail approximately 251 mm long, the same measurement as no. 2 male *funereus* at the same age. A tail growth rate of 4.4 mm per day for *latirostris* (calculated from Saunders 1982) also compares very well with the growth rate of no. 2 male *funereus* (4.5 mm per day). Saunders did not give an indication of completed length in the first (fledgling) tail, but it is likely to be shorter than the 280 mm of fully adult *latirostris* observed by me. As the tail of no. 2 male *funereus* was 339.5 mm long when growth ceased at 15 weeks, one must assume that the considerably shorter tail of *latirostris* is the result of growth ceasing long before that of *funereus*. As no. 2 male *funereus* went on to grow a



Long tail feather of *C. f. funereus* (upper) compared with short tail feather of *C. f. xanthonotus* (lower).

Plate 36

Photo: J. Courtney

second tail 360 mm long and to finally attain a tail length of 375 mm as an old individual, and as some tail feathers of no. 1 male reach 390 mm, the tail of *latirostris* is only little more than two-thirds as long as that of *funereus*. Much the same applies to the southern *xanthonotus* (see Plate 36), many individuals of which have a tail only very slightly longer than *latirostris*. These differences are consistent with the larger body size of *C. f. funereus* (900 g cf. 650 g: D. Saunders in litt.). Ideally, a larger sample of *C. f. funereus* is required before tail measurement can be used as a method for estimating the age of nestlings, but nests are difficult to find. Among a sample of 3407 Australian parrot eggs from 68 subspecies, Saunders et al. (1984) were able to obtain only five from *C. f. funereus*.

It is of interest that in the one male observed, all nestling tail feathers had been lost when just over one year old, in contrast to four Glossy Black-Cockatoos studied, which moulted only half of the total number of tail feathers each year from nestling to fully adult, and were over two years old before the last half of the first tail moulted. This one male *funereus* studied may have been atypical in tail moult.

The presence or lack of striking bicolouration in under-tail coverts is a puzzling feature that remains unresolved in the two male *funereus* studied. Sometimes virtually all these feathers are bicoloured and at other times, a year or so later, are noted as all black. This feature is erratic in these two birds, and is therefore an unreliable indicator of age in adults. This feature also occurs in some *C. f. latirostris*, and was therefore a feature of the ancestral form of the four-member superspecies. An examination of 15 skins in the Museum of Victoria by A.R. McEvey (in litt. 7 September 1962) showed that specimens from Queensland to Tasmania (n=5, all female) had bicoloured under-tail coverts, while those with plain black under-tail coverts (n=9, both sexes) came from New South Wales (3), Victoria (2), South Australia (1) and Tasmania (3). Wholly black feathers from Queensland were not represented, while a single male specimen from Kangaroo Island, South Australia, was intermediate with the largest coverts showing a tendency towards a yellow

patch on either side of the feather shaft. Geographical variation therefore does not seem to be a factor in the occurrence or lack of this feature.

The interrelationships of the four components of the *funereus* superspecies comprising two white-tailed populations in the west and two yellow-tailed populations in the east, are somewhat confused. Saunders (1979a) departed from the old concept of a single white-tailed species in the west and a yellow-tailed species in the east, by giving full specific status to the specialised long-billed *baudinii* of the far south-western heavy forest, and merged the short-billed white-tailed *latirostris* with the two eastern yellow-tailed *xanthanotus* and *funereus*. There are problems with this arrangement however, for although southern *xanthanotus* does seem intermediate geographically and physically between the very different *latirostris* and *funereus*, evidence is mounting that questions the view that *xanthanotus* and *funereus* are merely intergrading geographical races. Indeed, *latirostris* and *xanthanotus* seem to have much in common including short tails, an apparently identical male epigamic display vocalisation, occurrence in more open habitat, a tendency to nest in loose colonies, and the formation of very large post-breeding flocks; whereas *funereus* is much larger, has a different male epigamic call, occurrence mainly in tall heavy forest, shy solitary nesting habits, and rarely occurs in large flocks (pers. obs.). The apparent overlap in distribution without an obvious merging of the breeding populations of *xanthanotus* and *funereus* seems significant. As regards differences between *latirostris* and *funereus*, these are quite marked in the young. Nestling *latirostris* that I have observed had clear, unbarred and unmarked subterminal colour bands in the tail exactly the same as adults, whereas the subterminal bands in the tail of nestling *funereus* were quite heavily barred with wave-like markings. In the juvenile food-begging calls and food-swallowing vocalisations, the similarities and differences have already been described in this paper. The remarkable similarity in pitch and shape of the rasping begging call between both kinds is indicative of a common ancestor, while the differences in the tone and in the timing of both begging call and swallowing vocalisation are more consistent with those of sibling species rather than recently derived geographical races, for begging calls seem very conservative. A possibility is emerging that *latirostris* may prove to be a subspecies of *xanthanotus*, while the latter and *funereus* may be closely related sibling species, as are *baudinii* and *latirostris*. That would involve two species, one each in the far east and far west of the continent, and a third species in the south consisting of distinct subspecies each side of the Great Australian Bight. This would introduce yet again another 'worse possible case scenario' as regards the common names of the various species. With the reshuffle by Saunders (1979a), it became inappropriate to refer to a white-tailed race as the Yellow-tailed Black-Cockatoo, hence the use of Funereal Black-Cockatoo. Should the above taxonomic forecast eventuate, it would be equally ludicrous to refer to *latirostris* as the 'Yellow-eared Black-Cockatoo' (the meaning of 'xanthanotus'). This presents a good case for Australians to 'fall into line' in following the use by overseas ornithologists of separate common names for well-defined subspecies. In the present case, Long-billed Black-Cockatoo exists for *C. baudinii* (Saunders 1979a); an alternative is Baudin's Black-Cockatoo (the French 'au' pronounced 'o'). White-tailed Black-Cockatoo seems suitable for the more numerous and conspicuous *C. x. latirostris*, and Southern Yellow-

tailed Black-Cockatoo for *C. x. xanthonotus*. Funereal Black-Cockatoo exists for *C. funereus*, the nominate species of the *funereus* superspecies (Saunders 1979a); an alternative is Northern Yellow-tailed Black-Cockatoo. Quite regardless of the ebb and flow of scientific opinion regarding their status as species, semispecies or subspecies, the four populations are very distinct and ought to receive recognition by separate common names. This would greatly aid popular concern for their protection and conservation, a matter of paramount importance, for all except perhaps *funereus* are gravely threatened by loss of habitat, and *baudinii* and *latirostris* by shooting on apple and pear orchards and pine plantations.

Acknowledgements

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Chestnut-rumped Thornbill *Acanthiza uropygialis*

Previously recorded at The Humps. On 28 April 1975 I obtained good views of individuals in the forest by the lake to the north of Hyden, and on 9 October 1977 confirmed the presence of the species at Gibb Rock when I watched a single bird in mallee-sandplain interface.

Crimson Chat *Epthianura tricolor*

Previously recorded in the spring and summer of 1970-71. On 4 and 7 October 1977 I located 10-15 birds in a wheat crop adjacent to a mallee shelter belt. On both occasions Black-faced Woodswallows *Artamus cinereus* appeared to be loosely associated. On 27 October 1977 a few Chats were in roadside vegetation adjacent to a property boundary c. 6 km from the above location.

Little Crow *Corvus bennetti*

Suspected to occur (Sedgwick 1974); subsequently confirmed by remains of a dead bird and by positive field identification.

Discussion

I suppose that the ideal method of carrying out this project would have been to make an intensive survey of the avifauna of the location while it was in its primitive state, to completely clear the blocks – and the adjacent properties – and then carry out another survey of the modified area. Even if practicable, this would hardly have been desirable.

As the matter stands, we have a much less clear-cut situation: not only is part of the farm uncleared, but despite extensive clearing in the neighbourhood there are still uncleared areas contiguous with the farm boundaries and these, together with the road reserves, provide reservoirs of sandplain-mallee birds and corridors which enable them to move freely about the area. This should be borne in mind when interpreting Tables 1-5: the uncleared portion of the farm and the shelter belts on the developed portion are not isolated but, for the present, are part of an extensive unmodified area. As this area is reduced and fragmented, some impoverishment of the fauna of the remaining pockets of vegetation is almost certain to occur. I have classified all the honeyeaters recorded on the property as 'surviving': I suspect that the nomadic species flow through the area from time to time, but this situation could change with further clearing.

Reference

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**Corrigendum–**

Vol. 11 no. 5 pp. 137-145 'Age-related colour changes and behaviour in the northern Funereal Black-Cockatoo *Calyptrorhynchus funereus funereus*': in several places in this paper *xanthonotus* should read *xanthanotus*. Our apologies to the author.