

# IDENTIFICATION OF FLEDGLING AND JUVENILE KAKA (*Nestor meridionalis*)

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## ABSTRACT

Kaka (*Nestor meridionalis*) less than one year old can be distinguished from older birds by a pale ring of skin around the eye (periophalmonic ring). In birds less than five months old this has a yellow tinge, as does the cere, gape and the soles of the feet. A further distinguishing feature of Kaka between three and six months of age are protruding rachides (feather quills) on the tips of the tail feathers. On Kapiti and Little Barrier Islands, most Kaka nestlings fledge in February and receive food from their parents until June or July. Fledglings can often be detected during this period by their conspicuous and frequent food-begging behaviour. Juvenile characteristics in the Kaka persist for a much shorter period than in the Kea (*N. notabilis*), its sole extant congener. The loss of juvenile characteristics prior to sexual maturity suggests that juvenile Kaka becomes socially independent of adults earlier than Kea, presumably because of more readily obtainable food sources in their environment.

KEYWORDS: Kaka, *Nestor meridionalis*, juvenile identification, growth

## INTRODUCTION

The ability to distinguish juveniles from adults is of considerable benefit to many aspects of ornithology and conservation. In demographic research, identification of juveniles in the field can be the most practical means of quantifying successful breeding - particularly in long-lived species with low productivity. In morphometric studies, identification of juveniles can improve the reliability of data by reducing age-related variance in the sample. This is particularly important in the development of mensural sexing criteria for plumage monomorphic species.

Like most large parrots (Forshaw 1989), the Kaka (*Nestor meridionalis*) seems to be long-lived. A female Kaka is known to have lived for at least 27 years on Kapiti Island (P. W. Daniel pers. comm.) and there are presently five Kaka of at least 25 years of age in captivity (M. J. Sibley pers. comm.). The few available studies of Kaka productivity in the wild (Beggs & Wilson 1991, Moorhouse 1991) suggest that this is low compared to that of similar sized Australian parrots (Saunders 1982, Smith & Saunders 1986). In a population of South Island Kaka (*N. m. meridionalis*), only one successful nest was found, and only four of 31 radio-tagged birds attempted to breed

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within a six year period (Beggs & Wilson 1991). As Kaka probably live to at least twenty years in the wild, and may nest very infrequently, the ability to identify juveniles in the field is useful for assessing the status of populations.

The Kaka is monomorphic in plumage (Forshaw 1989) and therefore cannot be readily sexed by appearance. It can, however, be reliably sexed by culmen length so long as juvenile males can be distinguished from adult and sub-adult females (Moorhouse *et al.* in press., P. R. Wilson unpubl. data). In this paper we describe diagnostic morphological and behavioural features that distinguish fledgling and juvenile Kaka from adults and sub-adults (observations on both captive [M.J. Sibley pers. comm.] and wild Kaka [pers. obs.] indicate that sexual maturity is usually reached after four years). We define these age-classes as follows: fledglings are less than five months old at which age they are still dependent on adults for food; juveniles are five months to one year old and are largely independent of adults; sub-adults are one to four years old, completely independent but not sexually mature; adults are over four years old. Although our ageing criteria are based entirely on the North Island subspecies (*N. m. septentrionalis*), they are consistent with observations on juvenile South Island Kaka (P.R. Wilson pers. comm.). We also discuss the biological significance of juvenile characteristics in the Kaka and its closest extant relative, the Kea (*Nestor notabilis*).

## METHODS

The morphological development of 21 Kaka nestlings on Kapiti Island in 1988 and 1991 was regularly (every one to two days) monitored until the week before fledging at which time they were approximately 9 weeks old (mean = 66 days, n = 10, range = 61-74 days). Nine birds were observed for a week after fledging. These observations identified morphological features that were unique to fledgling and juvenile Kaka. It was not practical to regularly weigh nestlings as most were in deep cavities in trees from which they could not easily be extracted. Weight was, however, recorded daily from a single nestling in a more accessible site on Little Barrier Island. The weights of nine nestlings on Kapiti Island were also recorded the week before they fledged. Our description of fledgling/juvenile development and behaviour are based on this sample of nine known-age birds, all of which were banded as nestlings and all of which were observed at least once a month over a two year period. Four of these fledglings had been radio-tagged before they left the nest so that their subsequent development could be monitored more frequently. Radio-tagged fledglings were located in each of the first four days after fledging and their activity recorded at one minute intervals for a minimum of thirty minutes. The observation period was curtailed if the presence of the observer alarmed attendant adults, and/or there was a risk of attracting Weka (*Gallirallus australis*) to fledglings that were on the ground.



FIGURE 1 – Kaka fledgling showing pale ring skin around the eye which persists until birds are approximately one year old.

Photo: P. Daniel.



FIGURE 2 – Adult male Kaka showing dark skin around the eye.

Photo: R.J. Moorhouse.

## RESULTS & DISCUSSION

### **Distinguishing morphological features of fledglings and juveniles**

The most reliable distinguishing feature of fledglings and juveniles was a pale periophthalmic (eye) ring (visible with the naked eye at up to 10 m) which developed during the nestling period (Table 1) and persisted until they were one year old (Figure 1). In contrast, adult and sub-adult birds had a darker, grey-black eye-ring (Figure 2). One of us (T.C.G.) recently saw a nesting female with a pale eye-ring which suggests that the persistence of this feature in female birds is variable, or that females can attain sexual maturity at only 12 months of age. Fledglings less than four months old were the most distinct in appearance from adults, as at this age the eye-ring, cere and gape were a pale yellow colour. Fledglings this age also had a yellow tinge to the undersides of the feet but this was normally visible only in birds in the hand (this feature is retained into adulthood in South Island Kaka [P. R. Wilson pers. comm.]).

The obvious yellow colouration of the eye-ring had disappeared by the time most birds had reached six months of age, leaving only a vestigial, much narrower ring of pale yellow skin immediately surrounding the eye. Although this was visible only in birds in the hand, the rest of the eye-ring remained discernably paler than that of sub-adults and adults. As some nesting females also had this vestigial yellow eye-ring, it may be retained by females after sexual maturity and lost with age. No breeding males were found to have this feature. As it could only be seen in birds in the hand, our information on its persistence in juvenile males is scant. One known-age male still had a vestigial yellow eye-ring at 22 months of age while another had lost all trace of yellow from the periophthalmic ring by 34 months.

Another distinguishing feature of fledglings and juveniles was protruding rachides ("tail-spines") at the tips of the tail feathers (Figure 3). These protruded approximately 15 mm from the end of each tail feather and had developed by the time fledglings were three months of age, remaining prominent on all nine known-age birds up to the age of six months. The tails of fledglings less than three months of age were not fully grown and were frayed at the tip, presumably due to abrasion in the nest cavity. The "spines" presumably develop as the tail grows to full length, perhaps because of loss of the vanes at the tip through wear in the nest cavity. Although the rachides also protruded from the tips of new tail feathers in adult and sub-adult birds, as these age-classes did not replace their tail feathers simultaneously, these were present on only a few tail feathers, rather than all, or most, as in fledglings and juveniles. Moreover, at the time of year when tail-spines were most prominent on fledglings and juveniles (March-May), adults and sub-adults had not yet moulted and consequently had worn, frayed tail-tips.

Juveniles could also be distinguished from adults and sub-adults by an absence of moult between the months of May to August. All six adult/ sub-adult Kaka captured on Kapiti Island between May and August were in obvious moult as opposed to none of ten juveniles examined within the same period. From September to December all nine known-age juveniles had noticeably faded plumage and worn and frayed tails compared to adult and sub-adult birds.

TABLE 1 – Developmental chronology of 22 Kaka nestlings on Kapiti Island and Little Barrier Island. Body masses shown are of a single nestling recorded at the end of the stated time interval, except for the period of 55-60 days which is a mean body mass of 10 nestlings.

Period (days)	Body mass, (g)	Principal identification features of nestlings
1-3	-	Pale grey down, skin pink, eyes closed, beak pale with dark tip, prostrate in nest
3-7	-	Beak becomes entirely black, skin of gape enlarges forming fleshy yellow 'wattles'
7-9	-	Eyes open
9-11	296	Skin darkens but prominent pink strip remains along spine
11-15	383	Pin feather tips emerge on wings, crown and tail. Chicks now usually sitting up
15-17	452	Pin feathers fully emerged
17-22	527	Feathers erupt from sheaths on wing, crown and tail
22-26	562	Feathers appear on tarsi
26-34	587	Orange feathers appear on belly, back, cheeks fully feathered but breast and flanks still covered in down
34-55	-	Become fully feathered except for flanks and shoulders. 'Wattles' begin to disappear but gape remains yellow. Periophthalmic ring becomes tinged with yellow
55-60	540*	Loose all remaining exposed down, gape remains yellow, yellowish cere, periophthalmic ring and soles of feet. Tail not fully grown, tip frayed.

\*95% confidence limits = 517 - 562 g.

### Distinguishing behavioural features of fledglings

The most conspicuous behaviour of fledgling Kaka on Kapiti and Little Barrier Islands was food-begging which often persisted, with only infrequent pauses, for over an hour at a time. The food-begging posture is very distinctive; the begging bird crouches with head and body plumage erect and tail feathers spread, making it appear larger than normal. The head is drawn in and the wings are slightly lowered and held a short distance out from the body. Calling in this posture was often accompanied by head-bobbing and wing-fluttering. Food-begging birds emitted a sustained high pitched, screeching or squealing, interspersed with guttural "coughing" or "choking" sounds, that was very distinct from the typical calls of the Kaka. As nesting females also perform this display when soliciting food from their mates, this behaviour in itself is not sufficient to reliably identify fledgling Kaka.

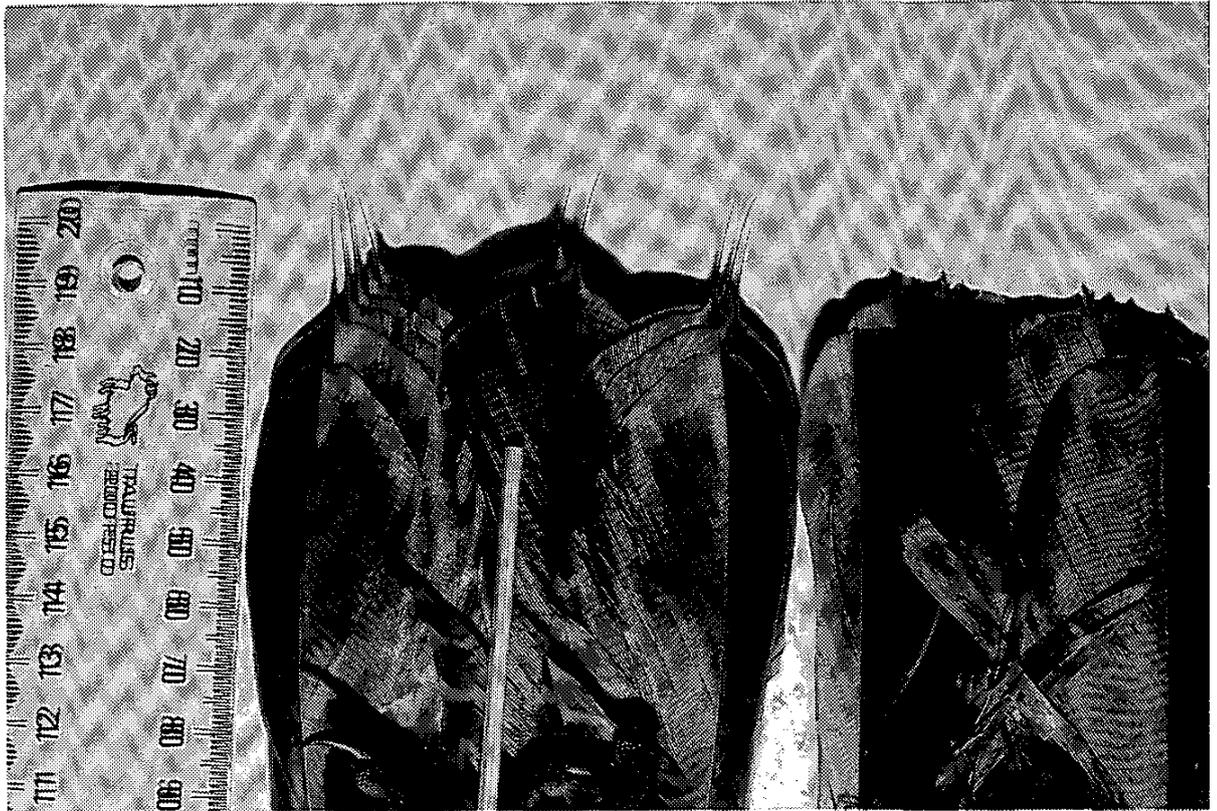


FIGURE 3 - Protruding rachides on the tail of a juvenile Kaka (left) collected between March and June and a worn tail (right) typical of an adult or sub-adult at the same time of year.

Photo: T.C. Greene.

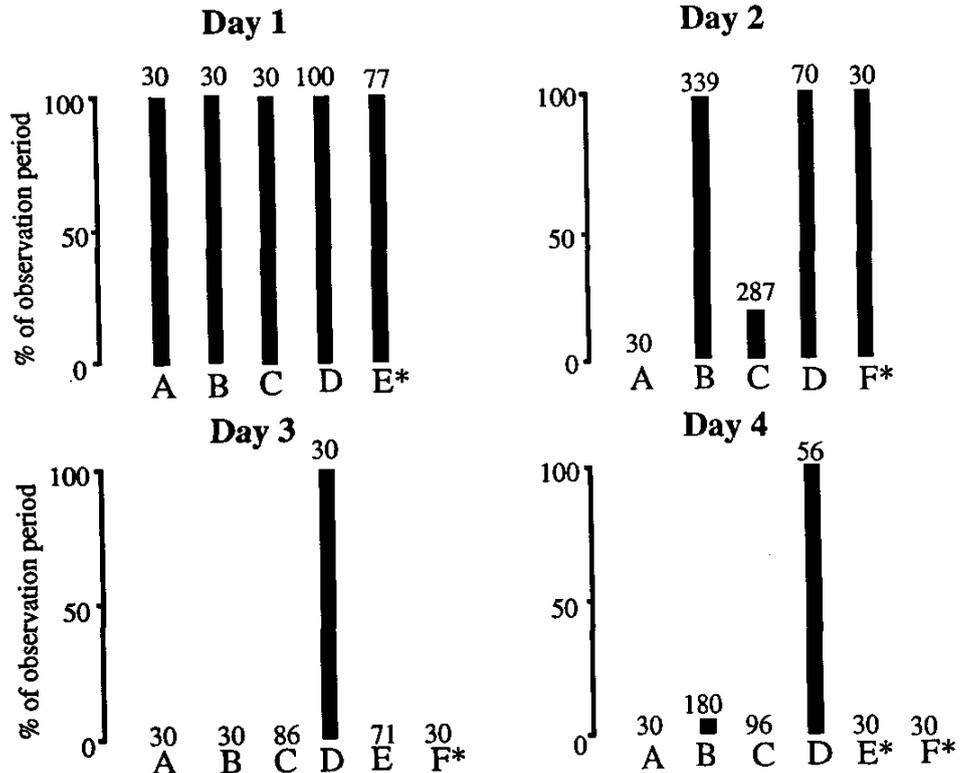


FIGURE 4 - Proportion of time spent on the ground by juvenile Kaka in the first four days after fledging. Letters below bars identify individual fledglings, those marked with an asterisk were not radio-tagged. Numerals at top of bars indicate duration of observation period in minutes.

The food-begging display of the Kaka is analagous to the "hunch" display of Kea (described in Diamond & Bond 1991). While the primary function of the "hunch" display in fledgling and juvenile Kea appears to be the appeasement of adult aggression in competitive interactions over food (Diamond & Bond 1991), in Kaka it is the soliciting of food directly from adults (which is provided by regurgitation). For this reason, this behaviour in fledglings and adult female Kaka is best described as food-begging. Although adult and sub-adult Kaka also "hunch" in apparent appeasement of aggression (pers. obs.) this behaviour differs from the food-begging of fledglings and nesting females in that the body posture is upright and it is not accompanied by loud calling.

Observations on four radio-tagged and two non-radio-tagged fledglings suggest that most juvenile Kaka spent the first two days out of the nest predominantly on the ground (Figure 4). During this period fledglings were very inconspicuous, often hiding in dense vegetation or under large rocks and logs. Although they attempted to climb shrubs and trees, most lacked sufficient coordination to do so until the third day (Figure 4). By day four most fledglings had managed to perch in the canopy or sub-canopy but the one observed for the longest period (fledgling "B") still spent 7% of its time on the ground as the result of falls while attempting to climb (Figure 4). Not until the fifth day were all six fledglings perching in the canopy or sub-canopy. Although one radio-tagged fledgling was first seen to fly on only its second day out of the nest, the others, including the two non-radio-tagged fledglings, were not seen flying until three to eight days after leaving the nest. One fledgling was clearly incapable of flight at least five days after fledging as it could be caught by hand. As this individual was not radio-tagged, and the two that were the most precocious were, we consider it unlikely that transmitters retarded the development of the fledglings' flying or climbing ability.

#### **Generalised chronology of fledgling and juvenile development**

Most Kaka nestlings on Kapiti Island fledge in February (15/20 broods) although young (<13 month old) fledglings have been observed as late as August, and on Little Barrier Island, as early as December (M. Thorson pers. comm.). Fledglings appeared to be entirely dependent on adults for food in their first month out of the nest after which they progressively obtained a greater proportion of their food, eventually becoming self-sufficient after another two to three months (in May or June). Fledglings are therefore most likely to be detected between the months of March and June because of their frequent food-begging behaviour at this time of year (Figure 5). As previously mentioned, although adult females employ the same behaviour when soliciting food from their mates, they do not do so as frequently, or persistently, as fledglings. Also, if adult females on Kapiti Island were seen food-begging between March and May they were usually feeding fledglings which were likely to be nearby.

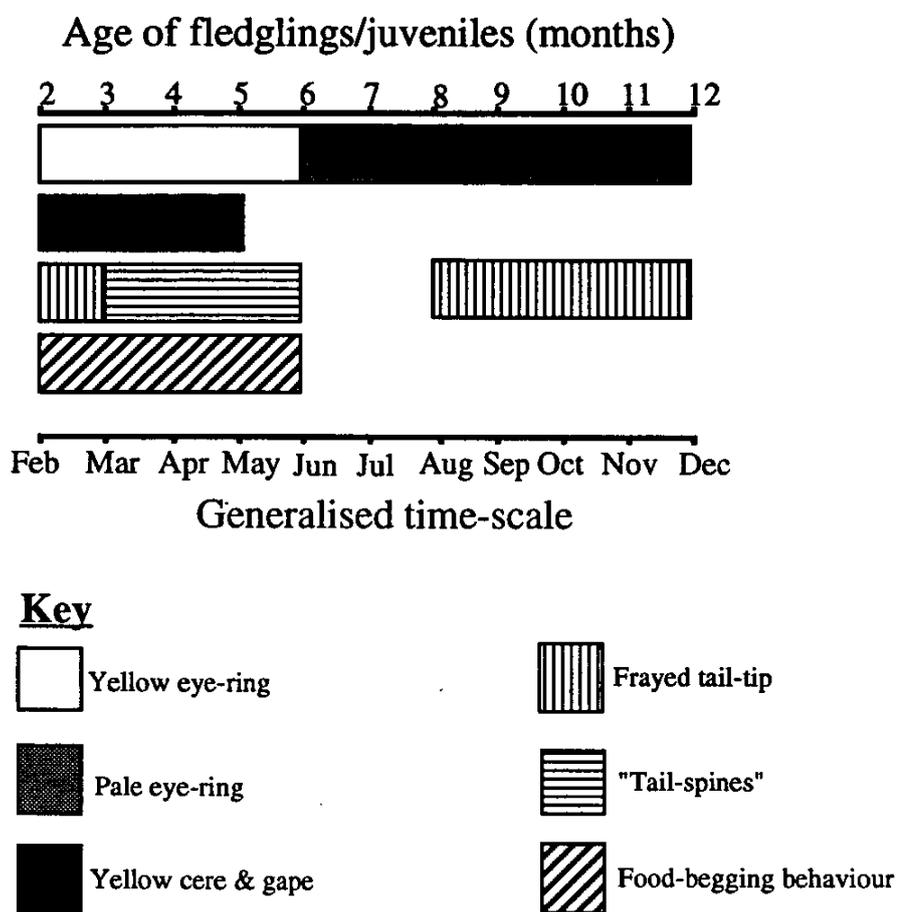


FIGURE 5 – Generalised chronology of fledgling juvenile Kaka development on Kapiti Island. Duration of characters shown represents their duration in the majority of known-age fledglings under observation (N = 9).

Fledglings between three and five months of age are most distinct in appearance from adults and sub-adults due to their yellow eye-ring, cere and gape and protruding tail-spines (Figure 5). In view of this and the duration of food-begging behaviour in fledglings, juvenile Kaka, at least on the North Island mainland, are most likely to be detected during March and April (Figure 5). While it is now evident that juvenile Kaka can disperse long distances (a juvenile banded on Little Barrier Island flew as far as Gisborne, approximately 400 km [B.D. Lloyd pers. comm.]), detection of fledglings (which are still dependent on adults for food) is definite evidence of successful local breeding. Failure to detect fledglings in a particular year, however, does not necessarily indicate that a population is in decline as even Kaka populations which are apparently increasing may produce very few fledglings in some years (Moorhouse 1991).

### Comparison of fledgling and juvenile characteristics in Kaka and Kea

Juvenile characteristics in the Kea, the Kaka's closest living relative, are both more pronounced and persistent than in the Kaka (Lindt 1958, Schmidt 1971, Keller 1972, Mallet 1973). In summary, Kea less than one year old have a bright yellow-orange eye-ring, cere and base of the bill, and yellowish crown feathers. Birds in their second year lose the yellow cast to the crown feathers but retain a pale yellow eye-ring, cere and lower mandible. Sub-adult birds of three to four years of age have a dark cere and bill as do adults, but retain an incomplete yellow eye-ring. Thus, in contrast to juvenile Kaka, which are indistinguishable from adults at one year of age, Kea of two, three or four years old are readily distinguishable from adults. As Kaka reach sexual maturity only a year earlier than Kea (M.J. Sibley, T. Pullar pers. comm.) the much shorter persistence of juvenile characteristics in the Kaka presumably reflects differences in the social status of juveniles and sub-adults in each species.

Diamond & Bond (1991) found that juvenile and sub-adult Kea obtained the majority of their food either by usurping, or stealing it from adults. While sub-adults were usually repulsed by adults, the more pronounced yellow colouration and "hunch" behaviour of juveniles appeared to inhibit adult aggression, allowing them to usurp food sources with relative impunity (*op. cit.*). Diamond & Bond (1991) suggest that juvenile and sub-adult Kea lack sufficient foraging skills to be self-sufficient and must, therefore, rely on adults to locate food. Although their observations were made on Kea that habitually foraged at a rubbish-dump, they are not necessarily an inaccurate reflection of the foraging interactions between juveniles, sub-adults and adults in natural situations.

This interpretation of the function of juvenile characteristics could explain their differing persistence in Kea and Kaka. The sub-alpine environment of the Kea would be expected to be less productive than the forest habitats of the Kaka, and may contain fewer food sources which juveniles can exploit with little or no experience. As juvenile and sub-adult Kea consequently are likely to depend on adults for food to a greater degree than Kaka of the same age, they would benefit by maintaining juvenile characteristics which inhibit adult aggression. In contrast, as (at least on Kapiti Island) juvenile Kaka can forage independently of adults at only six months of age, such prolonged advertisement of their immature status may be unnecessary.

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