

The Breeding Cycle of a Pair of Pacific Bazas *Aviceda subcristata* in South-eastern Queensland

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Summary

A family of Pacific Bazas *Aviceda subcristata* was observed from nest-building to independence of the juvenile over the period 19 December 2002 to 31 March 2003. The nest-building and pre-laying phase took 16 days, the incubation period 29 days, the nestling period 35 days, and the post-fledging dependence period at least 22 days, of which the juvenile was fully dependent on parental feeding for 15 days. Parental roles, and the nestling's diet, growth and development, are described.

Introduction

The Pacific Baza *Aviceda subcristata* is one of Australia's least-known raptors, despite its ready accessibility to ornithologists in Sydney, Brisbane and other coastal cities on the populous subtropical eastern coast, where it nests in suburban parks and gardens. The little information on its natural history was summarised by Czechura (1993) and Marchant & Higgins (1993). Otherwise, there have been brief accounts providing minimal information on nesting and associated behaviour (Carpenter 1992, Mallen & Mallen 2003, Wilson 2003, Ashton 2004, Roberts 2004). Sex roles through the breeding cycle are known in general terms; the incubation period is 29 days in captivity and estimated as 30–33 days in the wild; and the nestling period is 32–35 days. There is little information on growth and development of nestlings, and the post-fledging dependence period is essentially unknown.

This paper describes the breeding cycle of a family of Bazas from nest-building to independence of the juvenile, based on an almost daily observation diary at a nest in south-eastern Queensland, in summer 2002–03.

Study area and methods

The nest-site was located in the backyard of a house in Karana Downs (27°33'S, 152°47'E), an outer south-western suburb of Brisbane. The nest was situated about 30 m above ground in a large Forest Red Gum *Eucalyptus tereticornis* on the bank of the Brisbane River. The well-treed suburban area is bordered on the north by a golf course and to the south, across the river, by paddocks. There are large tracts of forest to the west, north and east of the Bazas' nest, within a few minutes' flight, and a 60-m-wide strip of shrubs, casuarinas, thick undergrowth and vines on the riverbank under the eucalypt canopy. The Bazas' nest-tree had many hollows, which were used by several bird species including Nankeen Kestrels *Falco cenchroides* in the previous summer.

The Bazas' nest was observed from a position upslope, level with the nest so that the contents were visible, for up to several hours per day in each phase of the cycle (10 days in the building phase, 12 days during incubation, 14 days in the nestling phase, 16 days in the post-fledging period). Observations were made using $\times 7$ binoculars from a distance of 30 m. The sexes were distinguished when perched together by relative size and behaviour, the female being slightly the larger; no plumage differences were noted.

Results

Nest-building

The adults were first seen on 14 December when they reconnoitred the future nest-site. At that stage they were harassed by Torresian Crows *Corvus orru* and Sulphur-crested Cockatoos *Cacatua galerita* that had fledglings in the same tree. On 19 December the Baza started building, and were harassed by Black-faced Cuckoo-shrikes *Coracina novaehollandiae* and Noisy Miners *Manorina melanocephala*. By 25 December they had essentially completed the structure, mainly of dry eucalypt sticks and twigs, with few leaves. Observations then lapsed for 6 days. On 2–3 January one Baza (sex unknown) added a lining of leaves, which was completed on 4 January by the male while the female stood on the edge of the nest; she then occupied the nest. The building phase thus took 16 days.

The Baza gathered dry sticks by hanging from small branches of eucalypts and breaking off terminal sections, in the vicinity of the nest-tree. In the nest-lining stage one Baza collected sprays of eucalypt foliage, by hanging onto and breaking off live branchlets within 30 m of the nest; this activity proceeded for about an hour each morning.

Incubation

On 6 January incubation was in progress. Laying therefore probably took place over 4–5 January. One egg was seen on 30 January (taken as day 26 of incubation), and hatching appeared to take place on 3 February (the next observation day) when the sitting bird was restless, shuffling on the nest more than usual. One chick was seen on 5 February when it was active, though not vocal, and still had the appearance of having recently hatched. Incubation therefore took about 29 days.

In weeks 1 and 2 (days 5–11) of incubation the female sat on the nest; on day 5 she preened on the nest between 1815 and 1830 h. During that stage of the cycle the male was not seen, although occasional nest maintenance occurred in the form of addition of green foliage. For example, early on day 6 the female left the nest for 3 minutes and returned with a sprig of eucalypt leaves which she placed in the nest. During weeks 2–4 (days 12–26) both sexes shared incubation.

Changeover of nest duties occurred in the mornings between 0700 and 0830 h. As the adults never perched side by side at this stage, the sexes could not be distinguished. Usually, the incoming bird called and perched prominently about 15–30 m from the nest, attracting harassment from Noisy Miners and alarm calls from Cockatoos and Crows. After the Miners lost interest, the incoming Baza then perched 3–6 m from the nest and its sitting mate departed silently, whereupon the relieving bird flew to the nest and settled to incubate. The whole procedure usually took about 10 minutes. For example, on one morning the Baza calls started at 0630 h and the incoming bird arrived 15 m from the nest at 0705 h, mobbed by Cuckoo-shrikes. Within 30 seconds it landed <2 m along the nest-branch, and the sitting bird immediately left and flew in the opposite direction. The relieving bird occupied the nest within 90 seconds. A variation occurred on a subsequent morning, when the incoming Baza remained 15 m away until the relieved bird had departed; the arriving bird then gave about six *wee-choo* calls and occupied the nest. Changeovers were usually rather stealthy, giving the impression that a single Baza had arrived in the tree and then departed on the same course.

On the afternoon of day 26, Baza calls were heard at 1415 h while the nest was not occupied. A Baza arrived at 1430 h and stood on the edge of the nest for 4 minutes before incubating; it was uncertain whether a changeover occurred or the sitting bird had briefly vacated the nest and returned.

Nestling period

The nestling period lasted about 35 days from presumed hatching on 3 February to fledging on 10 March. Until day 11, both parents took turns to feed and brood the chick. From day 13 the chick was not brooded by day, but one of the parents remained nearby while the other foraged. From day 17 the chick was often unattended by day while both adults foraged. Until day 29 it was brooded at night, but thereafter it was unattended at night (Table 1, which also summarises the nestling's growth and development). Early in the nestling period, the usual pattern was for the incoming, food-bearing parent to feed the chick then brood while the relieved bird foraged. From day 29 only one parent was present at a time: apparently always the same bird, from its behaviour and flight paths, although this could not be confirmed and both could have attended alternately. From this day the adults were not seen together or simultaneously.

On the presumed hatching day the parental changeover routine continued, with no observation of the chick being fed. On day 3 changeover of brooding duty in late afternoon (1805 h) was different from the morning pattern during incubation. However, the presence of a White-bellied Sea-Eagle *Haliaeetus leucogaster* on the opposite riverbank may have caused the adult Bazas to be more silent and cautious than usual. Before the changeover, the brooding Baza constantly watched the perched Sea-Eagle. It was not until the Eagle departed that the incoming Baza arrived silently, <30 cm from the nest, and the brooding bird then departed. The incoming bird stood on the side of the nest and fed the chick for about 2 minutes before brooding; there had been no prior indication of its presence near the nest.

On day 4 the chick was fed at 0645 h, when the incoming parent again arrived silently. Feeding took no more than 60 seconds.

On day 11, parental feeding/brooding changeovers took about 5 minutes in the early morning. After a rapid feeding session, the brooding parent covered the chick, which kept its head out in front of the parent's breast. The chick squirmed before sleeping.

On day 15 the parents were vocal, giving *wee-choo* calls, early in the morning (0530–0630 h), but called less frequently later in the day. Feeding frequency was as often as 2 minutes early in the morning, and up to hourly later in the day when the chick slept between feeds. On day 17 feeding visits occurred every 10 minutes or so, with one parent always close by; both adults fed and guarded alternately. On day 23 feeding visits were short, to deliver whole insects, after which the parent perched 50 cm away for a few seconds before departing. On day 29 a food transfer to the nestling took 2 seconds, and the adult immediately departed.

On day 17 the nest and chick survived a violent thunderstorm with gale-force winds and heavy rain during which the parent fully covered the chick; in the ensuing light rain the chick had its head out, observing.

On day 17 a Brahminy Kite *Haliastur indus* tried to rob an adult Baza that was carrying prey in its foot. During the tussle there was much spiralling and evasive

Table 1

Behaviour of adult Pacific Bazas and growth of juvenile during the nestling period, Karana Downs, Queensland, 3 February–10 March 2003. Week, day = stage of nestling period.

<i>Week</i>	<i>Day</i>	<i>Comments</i>
1	1–3	Parental brooding changeover between 0600 and 0700 h.
1–2	4–9	Food primarily shredded stick insects; fleshy parts stripped off and fed to chick.
2	10	Chick left alone for first time, for 5 min. though adult perched 100 m then 15 m away.
2	11	Intense feeding of chick in early morning; long larvae (?) shredded as for stick insects. Chick entirely downy; held its head steady and could squat on its tarsi without wavering. Brooded by day.
2	13	Chick about 15 cm long, left alone by day; one parent nearby while other foraged. First signs of feathers and colour: dark area below eyes, along crest and on upperwings; slight tufting at crest. Stubby wings used for balance; unstable when moving in nest. Preened and stretched, rotated in nest by shuffling 360° to look about.
3	15	Intense feeding of chick by parents early in morning then hourly for remainder of day; chick fed whole insects, able to quickly swallow dragonfly. Nest maintained by addition of eucalypt foliage.
3	16	Frequent parental feeding visits; adults perched in nearby trees.
3	17	Chick not brooded by parents by day during hot weather; left alone for extended periods. Brooded during heavy rain. Large prey (stick insects) torn up by parent.
4	23	Nestling about 22 cm high with wingspan of about 40 cm; preened and stretched wings frequently, perched on side of nest, stable when standing. Cocked its head to observe other birds as they called. Wing-feathers well developed; crown-feathers showing; crest evident; some feathering visible on neck, breast and top of shoulders. Flapped wings when begging to parent. Not brooded during light rain; mostly unattended during day. No nest maintenance.
5	29	Nestling's wings fully feathered; crest and full juvenile colouring evident; patch of down on throat. Sides of breast feathered, barring almost complete across breast. Nest deteriorated to a platform; no maintenance by parents. Nestling stood on nest all day, without calling except immediately after being fed; beat wings slightly when calling. Adult stayed within 50 m of nest in morning, absent after 1500 h; nestling unattended overnight.
5	30–31	From this stage only one parent at a time fed nestling. Adult within 50 m of nest in morning, calling frequently and catching prey. Nestling not fed between 1530 h and dusk, while parents absent. Nestling faced into breeze and flapped wings, practising flight; backed to edge of nest to defaecate over rim.
5	32	Parent fed nestling, after 0800 h. Parent calling and flying in nest area, catching prey. Nestling's tail about 8 cm long.
6	36	Fledged. Fully feathered, with complete barring across breast; some down around crest and on throat. Tail-feathers not developed sufficiently to control flight.

action by the Baza away from its nest, until the Baza eventually arrived with intact prey to feed to the chick. On day 29 an adult Baza gave agitated *wee-choo* calls frequently over a period of 40 minutes, while soaring and perching prominently 120 m from the nest, as a pair of Brahminy Kites circled about 700 m away; the calling ceased when the Kites soared out of sight.

On the nestling's last few days in the nest, the attending adult (sex unknown) performed what appeared to be enticement behaviour. On days 30–31 the adult called frequently within 50 m of the nest and repeatedly dived into bushes to catch insects; about 60% of attempts were unsuccessful. On day 32 at 0745 h the parent initially called at a distance from the nest, then at 0815 h closer to the nest it began diving into bushes for insects and calling *wee-choo* frequently. It fed the nestling then remained in the area, calling. Until this stage, the parents were not seen feeding in the nest area.

Fledging

On 10 March at 0800 h a flock of Sulphur-crested Cockatoos drove off the parent Baza then approached the nest, flapping their wings and breaking off branches, appearing to intimidate the juvenile which called in distress. The harassment continued for about 10 minutes, then some Cockatoos approached to within 50 cm of the nest as the juvenile became more agitated. After the Cockatoos departed, the juvenile preened and stretched for 10 minutes then moved to the edge of the nest, away from obstructing twigs and branches, to flap its wings. It overbalanced and fell 1 m to a lower branch, where it recovered by using bill, claws and flapping wings. After hanging precariously for about 1 minute, it perched in a twiggy section.

After 10 minutes the parent arrived at the empty nest with prey, peered at the calling juvenile for 30 seconds then flew to it to attempt a food transfer. After several unsuccessful attempts, with the juvenile overbalancing, the transfer was made, but the juvenile dropped the food and kept begging as the adult departed. The juvenile flapped down to a stronger branch, quickly improving in balance by using its wings and short tail. The adult returned and gave the juvenile an insect, which it swallowed. After perching 100 m away and sunning for 10 minutes, the parent then called *wee-choo* continuously while moving constantly among branches 30 m above the juvenile, which watched with cocked head. For the remainder of the day the parent continued to feed the juvenile about every 30 minutes; the parent always gave an approach call when 300 m away, and paused en route at about 75-m intervals. The juvenile did not move from its perch in full sun, but rotated its body to receive food. It warily watched all local birds, and cocked its head to listen to their calls until it apparently perceived them as non-threatening.

Post-fledging period

The juvenile remained overnight on its new perch, and was fed there from first light on day 2. Later that day, on its first true flight away from the nest, the nestling flapped (without gliding) on a descending course for 25 m to a she-oak *Allocasuarina*. It landed in dense foliage, flapping its wings to maintain balance, then clambered to a larger branch and quickly settled amid sheltering foliage about 17 m above ground, where it was fed several times. It was able to actively flap along the branch by using its wings for balance and as props against the foliage. It practised this activity for 10 minutes then preened vigorously, shedding down as it

did so. The food-bearing parent gave a short *wee-choo* call from about 150 m, then approached the juvenile in one or two stages. At this stage the juvenile's wings were about 1.5 times the length of its body, and it frequently quivered its tail with the characteristic lateral movement of the adult upon alighting.

The juvenile's flight from the nest-tree was precipitated by harassment from Cockatoos and Noisy Miners when the parent tried to feed it. The Cockatoos broke off and dropped branches up to 75 cm long onto the juvenile from 10 m above. It gave frequent *wee-choo* distress calls, until a large branch fell on and trapped it for about 5 minutes before it struggled free and launched towards the she-oak. Meanwhile, the parent was calling from a perched position 30 m away, in what appeared to be distraction behaviour towards the Cockatoos.

On days 3–4, in rainy weather, the parent continued to deliver food to the juvenile without harassment from other birds. The juvenile gradually moved higher in the she-oak to a more open section.

On day 5 the parent fed the juvenile frequently between 0700 and 0845 h, with some deliveries 5 minutes apart. A Crow once swooped at the adult, but none of the usual mobbing birds harassed the juvenile at its new, low perch away from the Bazas' nesting tree. At this stage the juvenile still had down in front of its crest and under the wings, and appeared about three-quarters adult size. It tentatively used a foot to hold prey against its perch while stripping it with the bill, and competently jumped 50 cm between branches.

Early on day 6 the juvenile flew 100 m to a taller eucalypt, landing clumsily in thick foliage. After 10 minutes spent disentangling itself, it moved to another tree. The food-bearing parent flew over the she-oak then continued towards the begging juvenile, which flew 15 m to take the food at a perch. Later feeds took place in the same area.

On days 7–8 the juvenile stayed in the area, with frequent feeding by the attending parent between 0700 and 0830 h and periodically thereafter. It flew from tree to tree, begging, and practised gliding between trees within a 300-m radius.

On days 9–15 the juvenile was fed infrequently. It called often and remained close to a particular eucalypt.

On day 16 (25 March) the juvenile begged continually from its favoured tree from 0700 to 1100 h as if hungry, behaviour that suggested curtailment of parental feeding. To this date, it was not seen to perform foraging behaviour. It was not seen again, although it was heard for a further week. The post-fledging period of dependence on parental feeding thus appeared to last for 15 days, with residence in the nest area for at least a further 7 days, giving a likely post-fledging period of >22 days.

Juvenile vocalisations

The nestling Baza gave peeping or cheeping begging calls that developed, by day 29, into a repeated disyllabic call *piee-piee-piee...* which was given through the post-fledging period. From the fledging day, the juvenile also gave rapid *wee-choo* calls when in distress. From day 8 post-fledging it also gave the *wee-choo* call apparently in other contexts; this call was readily distinguished from that of the parent, being more rapid and strident than the equivalent adult call.

Prey

Prey brought to the nestling Baza included many stick insects (Phasmatidae), two dragonflies (Odonata), long grub-like or worm-like items that may have been larvae or perhaps the abdomens of stick insects, one tree-frog *Litoria* sp., and unidentified insects. The nestling was given some whole insects from day 15, but the parent tore up large items until day 17; from day 23 all prey was provided whole. Prey brought to the fledgling included a large grasshopper (Orthoptera, probably Hedge Grasshopper *Valanga irregularis*), a long mantis (Mantidae, probably *Archimantis* sp.), and a fat green insect about 5 cm long. By comparison with the adult's foot, in which prey was always carried, all insect prey was >3 cm long.

Discussion

There is no previous record of the time taken by Bazas to build the nest, but an interval of 8–9 days between completion of the structure and laying is consistent with previous records of 4–9 days (Marchant & Higgins 1993). Building behaviour, and sex roles in building and lining, were also much as previously recorded by Marchant & Higgins (1993).

An incubation period of about 29 days is consistent with a previous record of 29 days in captivity, and shorter than an unsubstantiated claim of 33 days quoted by Marchant & Higgins (1993), though similar to an estimate of 30 days by Ashton (2004). The value of 33 days may refer to the interval from first-laid to last-hatched egg in a clutch of two or three, rather than per egg. The nestling period of 35 days is also consistent with previously recorded values of 32–35 days (Marchant & Higgins 1993) and about 31–34 days (inferred from Ashton 2004).

Sex roles during incubation and nestling periods were much as previously described by Marchant & Higgins (1993), with both sexes taking turns to incubate or to brood small chicks. Feeding behaviour, rates and times, diet, and food preparation for the young were consistent with previous information (Ley 1990, Carpenter 1992, Czechura 1993, Marchant & Higgins 1993, Mallen & Mallen 2003, Wilson 2003, Ashton 2004, Roberts 2004). Ashton (2004) observed one prey item inferred to be a dark-fleshed vertebrate (i.e. possibly a small bird).

The tendency for juveniles to vacate the nest area soon after fledging has been noted previously (Carpenter 1992, Marchant & Higgins 1993, Ashton 2004). The length of the post-fledging period, as indicated by dependence on parental food for 15 days and vocal persistence in the nest area for at least 22 days post-fledging, is similar to apparent dependence periods of about 14 days (Carpenter 1992) and about 3 weeks (Mallen & Mallen 2003) respectively. Ashton (2004) found complete dependence on parental feeding for 9 days after fledging, then departure from the nest area. In south-eastern Queensland two juveniles were dependent on parental feeding in late January, when their wings and tails appeared fully grown and they could fly well (S. Debus pers. comm.). As juveniles can associate with their parents for months after independence (Czechura 1993, Marchant & Higgins 1993), the duration of the post-fledging dependence period remains to be determined precisely, although 3–4 weeks may be realistic for an insectivorous raptor in summer.

This study confirms and enlarges on previous knowledge of the Baza, and adds some data on hitherto undescribed aspects of its breeding cycle. Further detailed

and quantified studies are required, for example, of the sort conducted by teams of amateur observers on Square-tailed Kites *Lophoictinia isura* breeding in coastal New South Wales and south-eastern Queensland (Lutter *et al.* 2004 and studies cited therein).

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