AUSTRALIAN FIELD ORNITHOLOGY 2006, **23**, 177–183

Observations on Nesting Brahminy Kites *Haliastur indus* in Northern New South Wales

H. LUTTER[1], M.B. McGRATH[2], M.A. McGRATH[2] and S.J.S. DEBUS[3]

[1]Unit 45/77 Pearces Creek Road, Alstonville, New South Wales 2477
[2]7 Marumba Place, Port Macquarie, New South Wales 2444
[3]Division of Zoology, University of New England, Armidale, New South Wales 2351 (Corresponding author: sdebus@une.edu.au)

Summary

The breeding behaviour of a pair of Brahminy Kites *Haliastur indus* was studied at Laurieton, northern coastal New South Wales, by observation (62 h) at a nest in the pre-incubation and incubation phases in June–August 2005. For the duration of the expected incubation period, the adults covered the eggs for 95% of total observation time; the presumed female incubated for 78% and the male for 19%. After hatching failure, incubation of infertile or addled egg(s) continued for a further 2 months (3 months in total), though the male increased his share (36%, vs female 57%; eggs uncovered for 7%), until the attempt was abandoned. Observed food items brought to the nest area included an insect, crabs, fish and a bird.

Introduction

Although common on the tropical and subtropical coasts, and readily observable in coastal towns and cities in eastern Australia northwards from the Mid-north Coast of New South Wales (NSW), the Brahminy Kite *Haliastur indus* is one of Australia's least-known and least-studied raptors. Since the summary by Marchant & Higgins (1993), concurrent with an unpublished study (Smith 1992), there has been a brief note on feeding behaviour and an account of one day's observation at a nest with chicks (Wren 2000; Hollands 2003). There are also brief notes on the species extralimitally, in New Guinea (van Balen & Rombang 1999) and the Solomon Islands (Olsen 1997; Hadden 2004). Sex-roles in the breeding cycle are known in general terms, and the duration of the incubation, nestling and post-fledging periods are known, but otherwise most aspects of the Kite's breeding biology and behaviour are poorly known.

This paper describes aspects of nesting behaviour, early in the breeding cycle, by a pair of Brahminy Kites in northern coastal NSW. Although the attempt ultimately failed, apparently because the egg(s) did not hatch, our observations may facilitate the interpretation of aspects of the Kite's breeding behaviour in future studies.

Study area and methods

The nest of a pair of Brahminy Kites was located in North Haven (31°38′S, 152°49′E) at Laurieton, south of Port Macquarie on the Mid-north Coast of NSW, on 21 May 2005. From that date, nest activity was checked briefly or observed for varying periods of up to 3 h (usually 0.5–1.5 h) almost daily, by rotating teams of observers using binoculars and telescopes, until 15 October 2005. There were occasional repeat sessions within a day or lapses of a few days; the observation schedule included a dawn-to-dusk watch (11.3 h, 0605–1725 h) on 29 July during the incubation period (total 62 h of observation). After a lapse of a week, the nest area was revisited on 22, 25 and 28 October: the breeding attempt was found to have failed, and the nest was deserted. The contents of the nest were not examined.

Most observation sessions were conducted between late morning and early to mid afternoon, although a few were conducted in early or mid morning, or late afternoon. Parental time-budgets were determined by continuous focal-animal sampling, i.e. recording the start and finish time (duration) of each behaviour sequence.

The focal pair of Kites was initially difficult to sex, but when the birds were together (e.g. copulating, and at incubation changeovers) it was apparent that the presumed female was slightly the larger of the two. Throughout this paper, assigned sexes are qualified by 'putative', except for the all-day watch when there was greater certainty.

Results

Nest-sites

The focal Kites' nest-site was located in a reserve 10 m from a busy thoroughfare in a residential area, and adjacent to an estuary. The nest was high (2 m from the top) in a large, live 25-m Blackbutt *Eucalyptus pilularis* of 82 cm diameter at breast height, and situated in the leafy canopy in the centre of the tree. The adults had a favoured perch (a truncated dead branch) in the nest-tree.

Another pair of Kites had a nest 5 km west of the focal pair, at the entrance to a sailing club situated on a lake. The nest was in a fork in the main trunk of a large Blackbutt, about halfway up the tree, and easily visible from the road. These Kites bred in this nest in 2004; in 2005 both adults were on the nest on 12 July.

A third pair of Kites had a nest 2 km south of the focal (North Haven) pair. On 19 August and 2 September 2005 an immature Kite was seen with an adult; on the latter occasion the young bird's head colour had changed from brown to mainly white, though it was otherwise still in brown plumage. On 11 September two adults were together in a large eucalypt in a paddock, collecting sticks and taking them into a large fig *Ficus* sp. tree within view of a bridge over a river estuary. By this stage the immature Kite was not seen with the adults.

Nest-building to incubation

When first observed on 21 May 2005, the focal nest was attended by both adult Kites. On the following days one or both birds attended the nest or nest-tree, but the first renovation activity was seen on 8 June when one adult was in the nest-cup, moving around and apparently arranging nest-material. This pattern of attendance and occasional arrangement of material was repeated until 17 June, the first day when collection of material was seen. On 13 June, at dusk, the Kites did not roost in or near the nest-tree.

Over a period of 20 days, 17 June to 6 July inclusive, both Kites were observed collecting material: two sticks, one strip of soft bark, and one item that was either a stick or bark strip, at a rate of 0.4 item/h in late morning to early or mid afternoon (10.3 h over nine observation days). On 17 June, after a building session, one Kite apparently fed the other. On 18 June the female sat in the nest for 10 minutes, then the pair copulated at 1515 h for ~30 seconds, on the favoured branch in the nest-tree, and perched side by side (= 0.1 copulation/h during the building phase). On 22 June both were in the nest-cup, arranging material. From 29 June to 6 July one Kite mostly sat on the nest, on one occasion while the other also visited the nest; on 3 July one collected lining (bark) and arranged it, and on 5 July both ate food in the nest-tree.

On 7 July, around sunset, one Kite sat on the nest, arranged material then

settled lower into the cup apparently for the night, while the other flew to the foliage canopy of another tree, apparently to roost. Over the next three observation days between 8 and 11 July, one Kite sat on the nest; on one occasion the other brought food to the nest. On 12 July in the evening, one Kite sat on the nest until dark and the other departed at sunset. Thus, laying may have occurred by 12 July, but could not be confirmed.

Incubation

Incubation appeared to be in progress by 13 July, when a changeover took place. On that day, in late morning, one Kite was sitting on the nest and the other arrived with a stick, gave it to its partner which placed it in the structure, then the relieving bird sat on the nest. The change in shift was interrupted by combined defence against two Whistling Kites *Haliastur sphenurus* (see Nest-defence, below), then one Brahminy Kite returned and appeared to settle on eggs.

Over the next seven observation days (between 14 and 24 July), five changeovers were observed on three days. During the other watches, when one bird was incubating, the non-incubating bird variously perched in the nest-tree; made a food drop to the nest, then departed; briefly visited the nest; or brought and ate food in the nest-tree. After one changeover the relieving bird briefly (< 1 min.) moved around the nearby tree-canopy and returned to the nest with an object (nest-lining?) in its bill and incubated.

At dawn on the all-day watch (29 July) the male perched atop a vertical bare branch 3 m above the nest, in the first rays of the rising sun, then departed. He returned with a small prey item and gave it to the incubating female bill to bill, resumed a perch in the sun, and left. Subsequently, from 0800 h to dusk, there were eight changeovers of incubation duty, at varying intervals of 16 to 160 minutes (mean 66 min.). On the final change of shifts for the day the male covered the eggs while the female ate prey, which he had brought, in the nest-tree, then she returned to incubate overnight while he roosted nearby in dense foliage. Otherwise, either parent foraged for itself while the other incubated, and both brought food back to eat in the nest-tree. Four times, the male brought a stick to the nest and gave it to the incubating female or placed it in the structure before departing, and once the female broke an incubation stint to collect a stick and place it, then resume incubating. On six occasions the female (five times) or male (once) appeared to roll the egg(s) before settling or resettling to incubate.

Incubation from (or before) 13 July would have placed likely hatching around 17–19 August, depending on clutch-size, given that asynchronous hatching would take place over several days (from incubation periods of 5 weeks for the Brahminy Kite and 35–38 days for the Whistling Kite: Marchant & Higgins 1993). Over six observation days from 3 to 21 August the previously observed behavioural pattern continued, with four changeovers seen on three days and both sexes apparently turning eggs once each; the male also briefly visited the nest while the female incubated, and at one changeover both arranged sticks together on the nest. Although by then hatching was overdue, the pattern continued over five further observation days from 23 to 31 August: six changeovers on three days, and the male (?) also visited the nest once and arranged sticks while the female (?) incubated.

To 27 August five of 23 changeovers were accompanied by the incoming bird presenting nest-material, bill to bill, to the incubating bird (three sticks and one bark strip by the male; one stick by the female). The relieving female brought another stick, but dropped it before she reached the nest. Both sexes seemed anxious to incubate. On five occasions the male nudged the incubating female off the nest, once pushing under her when she stood up to take the stick, and on one occasion the female nudged the incubating male off the nest. Twice, the incoming male brought a stick but eventually left when the female did not relinquish her position; on both occasions he arranged sticks for several minutes, and once he also stood on her back for 2 minutes, apparently to induce her to leave, before giving up his attempt at a changeover. During changeovers they sometimes called or touched bills.

On 2 September there were possible signs of a chick, or perhaps a broken egg: the female relieved the sitting male then stood in the nest, reaching her head down into it; five minutes later the male delivered a small item (food or nest-lining) in his bill and perched in the nest-tree, while the female moved around the nest and then settled on it. Thereafter, the incubation routine continued and there was no sign of nestling(s) or parental feeding. Over 11 observation days, from 4 September to 15 October, there were nine incubation changeovers on six days; on one of these the male brought food to the female and she ate in the nest-tree while he covered the nest. He retrieved some of the food and ate it on the nest-rim before settling on the nest. Behaviour was as earlier in the incubation phase, except that no sticks were presented at changeovers. It thus appeared that the egg(s) were infertile or addled, and that the adults continued incubating for 2 months beyond the expected hatching date (or >90 days in total) before abandoning the nest.

The presumed 'normal' incubation phase was taken as 13 July to 27 August, when the behaviour as described above was consistent (i.e. up to the last observation of ritualised stick-presentation at incubation changeovers). Through this stage the eggs were covered for 95% of observation time (33.7 h); the nest was unattended for periods of 1–35 minutes (usually 2–6 min.) or 4% of observation time (though a parent was circling near the nest-tree for 3 min.), and otherwise the female stood on the nest (<1%) or a parent perched in the nest-tree (<1%). For observation time (23.9 h) when the gender of the incubating parent was reasonably certain, the female incubated for 78% and the male for 19%. For the all-day watch (11.3 h) when the sexes were readily distinguishable, these proportions were the same (female 78%, male 19%). The female incubated for stints of 20–171 minutes (mean 79 min., n = 7), and the male incubated for stints of 5–71 minutes (mean 29 min., n = 9). The female also incubated for three stints of >30 minutes, three of >50 minutes, two of >60 minutes and one of >85 minutes (all extending beyond watch times). During the incubation phase, the male was observed to bring five sticks and one piece of nest-lining (= 0.2 item/h) and the female brought one stick (<0.1/h) and collected but dropped another. The male made three food deliveries to the female (two at the nest and one in the nest-tree; 0.1/h).

From 29 August to 15 October, when there should have been nestlings, parental behaviour typical of the incubation period was repeated: eggs covered for 96% of observation time (15 h), unattended for 2%, and female standing on the nest for 2%. However, for observation time (6.5 h) after the all-day watch when the gender of the incubating parent was reasonably certain, the female sat for 57% and the male for 36%, suggesting that she was losing interest; his stints were now longer

(e.g. >20 min., >35 min. and >40 min., extending beyond watch times). There was no decline in nest attendance (i.e. nest unattended for periods of only 1–5 min.), with a parent usually sitting for an entire watch. There were only one or two food deliveries (one delivery may have been of nest-lining) by the male (0.1–0.2/h).

Vocalisations

Calls uttered by the adult Kites were variously noted as a low, plaintive single note, repeated (by the female just before copulation); a soft call similar to that of a Whistling Kite, but much softer and shorter (as the two adults arrived together on a perch); and 4–5 high-pitched single-note calls by the male as he arrived in the nest-tree (female incubating). In October the Kites were sometimes heard calling near the nest at 0500 h (C. Green pers. comm.).

Nest-defence

In the pre-incubation phase (6, 10 and 11 July) and early incubation phase (13 July) both adults defended the nest area, together, against a pair of Whistling Kites; the latter initiated these aerial skirmishes by circling the Brahminy Kites' nest-tree and calling. Aggression was mutual until the Brahminy Kites prevailed and the Whistling Kites retreated. The incubating female also left the nest and gave chase when three Australian Magpies *Gymnorhina tibicen* approached; the male (perched in the nest-tree) did not join in, or cover the nest. However, after she had returned he flew off to repel a Whistling Kite, then he perched 5 m from the nest.

Late in the incubation phase (18 August), when a White-bellied Sea-Eagle *Haliaeetus leucogaster* flew over the nest-tree, the female Kite sat lower in the nest. Around the anticipated hatching date, while the female was incubating, the male (which had been perched in the nest-tree) chased away a Pied Currawong *Strepera graculina* that approached; the same applied (though Kite sex-roles uncertain) to a Torresian Crow *Corvus orru*. There was no visible reaction to an Osprey *Pandion haliaetus* flying over the nest-tree (male Kite incubating, female absent).

In the incubation phase, linesmen from the electricity authority were working in a cherry-picker, trimming trees around the Kites' nest-tree. The incubating Kite appeared to ignore the activity. (The workmen were aware of the Kites, and the nest-tree was not marked for trimming.)

Food and hunting

During the incubation phase (29 July) the male gave the incubating female a food item that appeared to be a large insect. When subsequently perching in the nest-tree, he changed perches, peered down intently, then swooped and seized a Noisy Miner *Manorina melanocephala* from a shrub; he took it to a perch and started to eat, but then carried the prey out of the nest area to finish elsewhere. He later returned without the remains.

Other food items observed were one live crab (~10 cm in diameter including legs and claws) brought by the male and shared by the pair in the nest-tree; scraps of fish (apparently scavenged bait rather than live-caught), independently brought and eaten in the nest-tree by both adults; and a slightly larger live crab that the

male brought and ate in the nest-tree while the female incubated. Later (3 October), fish bones and fins were found under the nest-tree. Apart from these, and a carapace dropped from a crab, no other remains or pellets were found under the nest-tree. The crabs were brought in the afternoon (1615 and 1700 h).

Discussion

Our observations on the pre-incubation phase are consistent with, and extend, previous information on the Brahminy Kite; courtship (or supplementary) feeding in the pre-incubation phase was previously unreported, but might be expected (cf. Marchant & Higgins 1993). Our observations were biased towards early afternoon, but building and copulation rates may have been higher in the mornings. For instance, up to 14 July (i.e. pre-incubation to start of incubation) a Kite was on the nest every morning at 0730 h (C. Jordan pers. comm.). Although laying dates were not determined, it appeared that the female sometimes sat on the nest, including overnight, several days before laying.

Our observations on the 'normal' incubation phase are also consistent with, and extend, previous information, with quantification of sex-roles, although in this study sexing of the adults was sometimes tentative. Certainly, both incubated. The male is known to incubate (Marchant & Higgins 1993), but males may take a greater share than previously suspected, owing to the difficulty in distinguishing the sexes. In this study the male seemed anxious to take a greater role than just covering the eggs while the female ate his catch. Rather, the sexes alternated in shifts and the female mostly foraged for herself. Aspects of breeding behaviour, until the incubation phase, appear similar to those of the Whistling Kite (cf. Marchant & Higgins 1993).

Hollands (2003) similarly recorded incubation of an infertile clutch for >80 days. In this study the male assumed an increasing share of incubation after hatching was overdue, and he may have been responsible for the attempt lasting as long as it did before desertion.

Diet and foraging behaviour are also consistent with previous information: the Brahminy Kite takes a range of live and scavenged, mainly aquatic and tideline small items, but also catches small birds and large insects (especially the Hedge Grasshopper *Valanga irregularis*) in or on the outer edge of the vegetation canopy (Marchant & Higgins 1993; G. Czechura pers. comm.). Among a wide range of molluscs, crustaceans, insects, fish, birds, mammals and carrion taken in south-eastern Queensland, the dominant prey items were Pippis *Plebidonax deltoides* (a bivalve mollusc), Ghost Crabs *Ocypode cordimana*, catfish *Arius*, mullet (Mugilidae) and Yellow-finned Bream *Acanthopagrus australis*, with substantial numbers also of Pilchards *Sardinops neopilchardus*, Jewfish *Johnius vogleri* and whiting *Sillago* (i.e. mainly estuarine and inshore molluscs and fish: Smith 1992).

This study was incomplete, terminated by extended incubation on apparently non-viable egg(s) and abandonment of the attempt. Nevertheless, some insights were gained on the pre-incubation and incubation phases. Further detailed study is required on successful nests, from nest-building to independence of juveniles, in order to describe the Brahminy Kite's breeding cycle comprehensively. As the Kite's eggshell thickness was adversely affected during the DDT era (Olsen *et al.* 1993), and it breeds in areas subject to increasing development and human population pressure with their attendant pollution and disturbance, further study and monitoring might usefully include population aspects such as nesting density

and breeding success over time. For instance, the Kites have been unusually absent in parts of south-eastern Queensland in recent months, and disturbance such as jet-skis near nests may be an issue (G. Czechura pers. comm.).

Acknowledgements

This paper is dedicated to the memory of the late Marj Lutter, who assisted with the observations. We thank members of the Hastings Birdwatchers (Tony Bischoff, Bob Dinnie, Flora McDowell, Jill McGregor, Anne Pears, Jan & Bryce Taylor, Steve Vine and Dave Whitfield) and the Camden Haven Birdwatchers (Carol Jordan, Diana Lock, Noel Sparks) for taking observation shifts and supplying their notes. We also thank Penny Olsen and Greg Czechura for comments on a draft, and Andrew Ley for editing.

References

Hadden, D. (2004), *Birds and Bird Lore of Bougainville and the North Solomons*, Dove, Brisbane.
Hollands, D. (2003), *Eagles, Hawks and Falcons of Australia*, 2nd edn, Bloomings Books, Melbourne.
Marchant, S. & Higgins, P.J. (Eds) (1993), *Handbook of Australian, New Zealand and Antarctic Birds*, vol. 2, Oxford University Press, Melbourne.
Olsen, J. (1997), 'Notes on Sanford's Sea-Eagle *Haliaeetus sanfordi* and other raptors in the Solomon Islands', *Australian Bird Watcher* **17**, 81–86.
Olsen, P.D., Fuller, P. & Marples, T.G. (1993), 'Pesticide-related eggshell thinning in Australian raptors', *Emu* **93**, 1–11.
Smith, J.I.D. (1992), The Feeding Ecology of Brahminy Kites, *Haliastur indus* (Boddaert, 1783), from South-east Queensland, BSc Hons thesis, University of Queensland, Brisbane.
van Balen, B. & Rombang, W.S. (1999), 'Nocturnal feeding by Brahminy Kites', *Australian Bird Watcher* **18**, 126.
Wren, J. (2000), 'Brahminy Kites and Cane Toads (Qld)', *Boobook* **20**, 19.

Received 7 May 2006 ■