

# The breeding cycle of a pair of Brahminy Kites *Haliastur indus* in New South Wales

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**Abstract.** The breeding cycle of a pair of Brahminy Kites *Haliastur indus* was observed at Port Macquarie, northern coastal New South Wales, by keeping a diary of events from nest-building to independence of the juvenile, from late winter to summer 2012. Nest-building lasted a month, the incubation period ~35 days, the nestling period 52 days, and the post-fledging dependence period ~7 weeks. Adult behaviour, sex-roles, and growth and development of the juvenile are described. The observed breeding diet consisted mostly of fish, although freshwater turtle and crab remains were observed accumulated under the pair's feeding tree. Further breeding attempts by the pair in 2013 (one fledgling) and 2014 (two failures) resulted in 0.67 young per year and 0.5 young per attempt over 3 years.

## Introduction

A recent, but incomplete, study of the breeding behaviour of the Brahminy Kite *Haliastur indus*, which failed at the egg stage (Lutter *et al.* 2006), noted that the Kite is one of the least-studied and least-known of the common raptors in coastal eastern Australia. A study just beyond the Australasian region, in Malaysia (Indrayanto *et al.* 2011), added further information, but was also terminated by nest failure at the hatching stage. Subsequently, some brief casual observations were obtained on the fledgling stage in Darwin, Northern Territory (Riddell 2013).

This paper describes the breeding cycle of a pair of Brahminy Kites from the pre-laying phase to the post-fledging period, on the mid-north coast of New South Wales, mainly in 2012 but with supplementary observations on some aspects of the breeding cycle in 2013 and 2014. As apex predators, the Kites' successful breeding may reflect the health or otherwise of the urban or near-urban environment in the study location.

## Study Area and Methods

### Study area

The observational study (by JR) took place in suburban Port Macquarie (31°26'S, 152°55'E). The nest was located in the front yard of a house near that of JR, and a diary of events was kept from the time the pair of Brahminy Kites was seen nest-building and mating in late August 2012 until the fledgling continued to remain near the nest-site in late December. Additional observations were made on the breeding Kites' behaviour and outcomes in the 2013 and 2014 seasons.

The Kites' 2012–2014 nest was ~2 km inland from the closest ocean beach, ~2.5 km south of the Hastings River Estuary, and ~2 km north of a reservoir. The nest-site was located within a bushland corridor through 'green' suburbia. The nest was in a vertical fork ~27 m above ground in a ~30-m-tall Scribbly Gum *Eucalyptus racemosa*. The nest platform had at least two clear entry points (e.g. for the stick-bearing adult) between the vertical support branches

of the tree. One of the adult Kites, having a distinct golden colour to the head (perhaps blood-staining from fish prey), was identified as likely to be the male and is here so assumed, although with the implicit qualifier 'putative' for male and female.

Skeletal prey remains were observed or collected around the base of the nest-tree and the nearby adults' guard-, feeding and defaecating tree (a tall bloodwood *Corymbia* sp.). This favourite perch-tree (guard-roost) was 35 m from the nest-tree used in 2012 and 2013 and for the first (unsuccessful) breeding attempt in 2014. The second 2014 nest was built ~25m above ground in a lateral fork of a ~37-m-tall Scribbly Gum. This tree was 12 m from the guard-roost and 47 m from the previous nest-tree.

## Results

### Pre-laying phase

In the last week of July 2012, the pair of Brahminy Kites started refurbishing the nest used successfully in 2011 by Forest Ravens *Corvus tasmanicus*. This was the Kites' first nesting event at this site. A local resident (pers. comm.) advised that the Kites had nested ~50 m to the north, in the bushland corridor, in past year(s), but had been driven out by corvids and moved to the 2011 site.

When not on the nest, much of the adults' behaviour was focussed on their guard-roost, where the male often perched and flew to repel Forest Ravens that harassed the female on the nest. The male also guarded the nest by circling high over the site while the female attended the nest.

The male appeared to be the primary collector of nest-material. When nest-building, he typically flew at high speed at a dead branch high up in the tree-canopy and, using his momentum, broke off the branch with his talons. He then carried it to the nest where the female accepted the stick and arranged it. After collecting a stick, the flying male sometimes dropped the stick and then caught it in the air by a short stoop, apparently to rebalance and re-orient the stick (lengthwise rather than crosswise), before

**Table 1.** Chronology of breeding by a pair of Brahminy Kites in Port Macquarie, New South Wales, 2012: nest-building to fledging. M = male, F = female adult.

Date(s)	Comments
Late July	Pair started refurbishing nest.
19 August	Nest-building.
19–25 August	Kite(s) started sitting on nest (laying date uncertain).
24 September	Egg hatched (from behavioural cues only).
24–27 September	Week 1 of nestling period. Feeding of chicks in nest: both adults stood on rim, tearing up fish, their heads dipping down into nest-cup. F left nest for periods of $\leq 5$ minutes. In afternoon of Day 4, M brought large fish and fed on it piece-meal over 20 min., gave tail end to F; his crop was greatly distended.
12 October	Week 3, Day 19. First sighting of chick's downy head above nest-rim.
20 October	Week 4, Day 27. Confirmed only one chick.
28 October	Week 5, Day 35. Chick large and rapidly feathering; first seen wing-flapping.
15 November	Week 8, Day 53. Chick fledged.

completing the flight to the nest. After the male's display flights of soaring in circles about the nest area (up to 10 minutes), with shows of flying prowess (loops, twists, stoops and stalls), the pair mated briefly on the guard-roost, the female having flown there ahead of his arrival. The nest-building phase lasted c. 1 month, until laying in late August.

During this phase, the pair spent little time hunting and feeding. The male spent much time on his guard-roost overlooking the female's stick-arranging at the nest, and this was usually where he fed on a fish each day. At this stage both Kites spent extended periods off the nest, or attended the nest alternately.

Over mid to late June 2014, the Kites built up the nest to an even greater mass after the Forest Ravens had torn it to pieces, having removed about half the nest's depth over the preceding 3 months. In the third week of July 2014, the Kites delivered and arranged soft lining material as well as large sticks.

#### *Incubation period*

Between 19 and 25 August 2012, the adults changed their behaviour from nest-building activity to sitting on the nest (Table 1). The precise laying date was uncertain, but is here assumed to be 22 August  $\pm 2$  days. Either adult (a changeover was observed) incubated on the nest almost constantly. The male brought food to the incubating female throughout the day. They both defaecated and discarded their food scraps from a nearby treetop, possibly to prevent predators from detecting scents below the nest-tree. Typically, the incubating adult was relieved by the other, and flew to the guard-roost to preen, stretch and defaecate, before returning to the nest to recommence incubating.

Hatching is believed to have taken place on 24 September 2012 (Table 1). From the estimated laying date, the incubation period was  $33 \pm 2$  days.

In 2013, incubation appeared to begin on 2 August, after nest repair and rebuilding over ~6 weeks. In 2014, one Kite was sitting low in the nest on 25 July, behaviour associated with incubation in the 2012 and 2013 seasons. On 26 July, the Kite sitting low in the nest was being harassed by four Forest Ravens but, except for a brief flap of the wings when a Raven approached closely, it tenaciously maintained position. Incubation started about a week earlier than in 2013, coinciding with colder weather conditions in 2014.

#### *Nestling period*

In week 1 in 2012, both adults fed the chick, with the female in almost constant attendance (Table 1). During the early nestling phase, the adults took turns to guard the chick. Typically, the foraging adult returned to the guard-roost with a fish, fed on some of the fish, then took it to the nest and the brooding adult fed the chick. By late in Week 5, the female was off the nest and doing much hunting, while the male kept watch from a nearby tree. The chick's downy head was first visible above the nest-rim at 18 days old, and it was first seen wing-flapping at 34 days old (Table 1). The sole chick fledged on 15 November 2012, giving a nestling period of 52 days.

#### *Post-fledging period*

The new fledgling was initially clumsy on branches, but late in Week 1 of the post-fledging period, when it was flying competently, it was fed whilst perched on a branch (Figure 1). The juvenile returned to roost on the nest on many nights until Week 5, by which time it could soar (Figure 2), and used the nest as a feeding platform until late in Week 7. It started to become semi-independent by Week 7, when it was absent from the nest area for 2 days (Table 2). The post-fledging dependence period thus lasted for 7 weeks.

In 2013, a post-fledging dependence of ~6 weeks was recorded for the juvenile.

#### *Nest defence*

Throughout the Kites' breeding cycle in 2012 and 2013, intense aerial skirmishes with the local Forest Ravens were observed (Figure 3). During the nestling period in 2012, these fights occurred daily. During the post-fledging period (Week 7), while the juvenile was feeding on delivered prey in the nest, a further aerial fight took place between an adult Kite and a Raven.

#### *Breeding productivity*

The Kites raised one fledgling in 2012 and one in 2013. The 2014 attempt failed when the chick was ~2.5 weeks old (feeding of the chick had been observed). Thereafter, the adults were not observed together, until in early October a new nest was being built in a fork in a tree closer to the guard-roost than the original nest, and the pair mated on



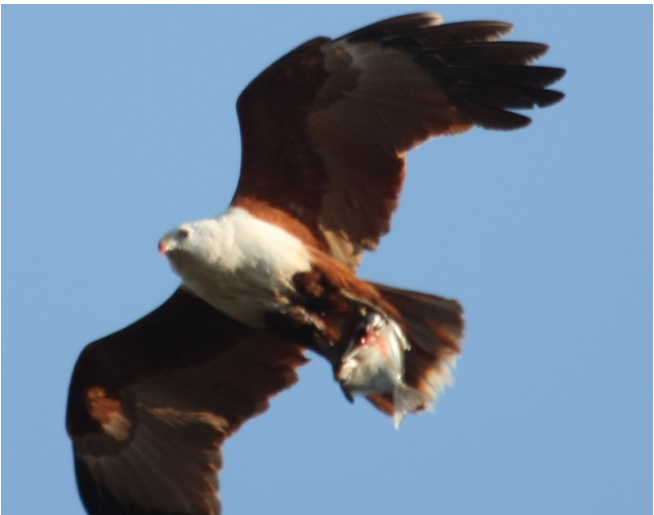
**Figure 1.** Fledgling Brahminy Kite, Port Macquarie, New South Wales, November 2012. Photo: Jeremy Rourke



**Figure 2.** Juvenile Brahminy Kite in flight, Port Macquarie, New South Wales, December 2012. Photo: Jeremy Rourke



**Figure 3.** Aerial conflict between Brahminy Kite and Forest Raven, Port Macquarie, New South Wales, October 2013. Photo: Jeremy Rourke



**Figure 4.** Adult Brahminy Kite bringing fish prey to nest, Port Macquarie, New South Wales. Photo: Jeremy Rourke

**Table 2.** Development of juvenile Brahminy Kite in post-fledging period, Port Macquarie, New South Wales, 2012–2013. J = juvenile

Date(s)	Week	Day(s)	Comments
15–21 November	1	1–7	J lost balance on branches several times; returned to nest on two nights, used it as feeding platform to feed on delivered food. Day 7: flying skills improved, adults delivered food on branch.
9 December	4	25	Adult and J together at feeding time. J had returned to nest many nights since fledging to sleep and/or feed; adults also used nest as feeding platform when J elsewhere. Adult and J shared fish in afternoon, in adults' favourite perch-tree.
21 December	6	37	J returned to nest almost every evening until past few days.
22 December		38	J visited nest twice in evening. Adults still brought food to nest for J, which used it as feeding platform.
25 December		41	J briefly visited nest in evening.
26 December		42	J attempted to fly to nest in high winds, almost succeeded.
27 December	7	43	J on nest in morning, brief visit by one adult. J fed on food in nest.
29–30 December		45–46	J not sighted; both adults waited morning and evening in perch-tree, scanning sky.
31 December		47	J absent in morning, plaintive cries from adult (no response by J). J arrived ~1700 h, scanned sky; ~30 minutes later adult brought food, J used nest as feeding platform while adult defended airspace against Forest Raven.

the guard-roost. Thereafter, the incubating adult sat tight except for the occasional skirmish with Forest Ravens, until the nest was abandoned in late October after severe human disturbance in the adjoining street on Halloween eve. Breeding success was thus two young in 3 years (0.67 per year), or 0.5 young per attempt.

### Prey

One of the food scraps dropped from the perch-tree, during a fight with a Forest Raven, appeared to be the skeleton of a small bird. Throughout the breeding cycle in 2012, the adult Brahminy Kites were often seen feeding on fish (Figure 4), and feeding fish to the young. Fish were the most common food items observed to be consumed by the Kites throughout the observation period. During the post-fledging period (Week 7), the juvenile was feeding on a deep red and very tough item (vertebrate flesh) in the nest. In 2014, the ground beneath the guard-roost was littered with juvenile freshwater turtle carapaces and crab exoskeletons. The neighbour, on whose land the Kites' second 2014 nest was located, advised that she had found various dead fish (one with three fish-hooks embedded in the skeleton) and carapaces of young freshwater turtles on her roof and lawn over the years (J. Metcalfe pers. comm.).

The adult Kites tore off small pieces of flesh to feed the chick, and the food-stripping method appeared to have left the fish skeletons still articulated, thus explaining how the metal hooks were avoided (in that instance).

## Discussion

### Significance of records and possible explanations

Little has been recorded previously on the Brahminy Kite's courtship behaviour, other than soaring and aerobatics by a pair (Marchant & Higgins 1993). The aerial stick-catching activity was hitherto unreported for this species. Copulation took place on the guard-roost, rather than in the nest-tree as found by Lutter *et al.* (2006), although in the study by Lutter *et al.* the guard-roost was also a branch in the nest-tree. Nest-building behaviour was similar to that described by Lutter *et al.* (2006) and Indrayanto *et al.* (2011), although stick-presentation by the male to the female at the nest was hitherto unreported. The nest-building phase (4 weeks, and ~6 weeks for extensive rebuilding after damage) was longer than the 3 weeks reported by Lutter *et al.* (2006).

An incubation period of  $33 \pm 2$  days, probably at the higher end (i.e. ~35 days), is consistent with other data (~35 days: Marchant & Higgins 1993) for the Brahminy Kite, and longer than a previously quoted, improbable figure of 28 days for a hawk of that size (e.g. Whistling Kite *Haliastur sphenurus* 35–38 days; cf. Marchant & Higgins 1993; Ferguson-Lees & Christie 2001). Sex-roles (i.e. incubation changeovers) were also consistent with previous information (Marchant & Higgins 1993; Lutter *et al.* 2006; Indrayanto *et al.* 2011). The male feeding the incubating female on the nest differed somewhat from the observations of Lutter *et al.* (2006), in which the male and female performed incubation changeovers and appeared then to mostly forage for themselves while relieved on the nest by the mate, but is consistent with other data (Marchant & Higgins 1993; Indrayanto *et al.* 2011).

Sex-roles of the adult Brahminy Kites, and growth and development of the chick, are consistent with, and expand on, the previous very limited information on the nestling period (Marchant & Higgins 1993; Hollands 2003). In this respect, the Brahminy Kite resembles the better-known, congeneric Whistling Kite (c.f. Marchant & Higgins 1993). A nestling period of 52 days is consistent with known information (~50–56 days: Marchant & Higgins 1993), and longer than an improbable minimum of 40 days (cf. Ferguson-Lees & Christie 2001).

Intense harassment by, and fighting with, corvids *Corvus* spp. around the Brahminy Kites' nest-site was also a feature of other studies, e.g. attempted egg predation by corvids (Lutter *et al.* 2006; Indrayanto *et al.* 2011), and may be a factor in the Kites' breeding success. Such conflict can extend into the post-fledging period, as revealed by the present study. Intense harassment by over-abundant urban Torresian Crows *C. orru* has been implicated in the death of a fledgling Square-tailed Kite *Lophoictinia isura* in Port Macquarie (Lutter *et al.* 2004).

There is little previous information on the post-fledging period of the Brahminy Kite, other than an inferred duration of ~2 months, as in this study. The duration and developmental stages of the juvenile are similar to those of the Whistling Kite, so far as is known for either species (Marchant & Higgins 1993).

The Brahminy Kites' prey observed delivered to the nest consisted mostly of fish, as found by Hollands (2003), although food remains under their feeding perch were mostly of freshwater turtles and crabs. This difference may reflect differential discarding and/or persistence of fish versus other remains.

The cause of the Brahminy Kites' first nest failure at Port Macquarie in 2014 was undetermined, but failure was followed by a shift in nest-site. The second failure in 2014, at the new nest, followed acute human disturbance around the nest-site. The fortunes of this pair may reflect increasing human activity on the urbanising coast that coincides with a general decline in the local raptor species, other than the Osprey *Pandion haliaetus*, over the past 17 years (T. Bischoff pers. comm.). Most raptor species are declining in New South Wales, including the Whistling Kite and, specifically on the North Coast, the White-bellied Sea-Eagle *Haliaeetus leucogaster* (Cooper *et al.* 2014). Two adult Brahminy Kites in a breeding territory in this region were recently found dead or sick, suspected to have been poisoned by Pindone used to control Rabbits *Oryctolagus cuniculus* (Clancy 2015), as suspected elsewhere for other raptor species (Olsen *et al.* 2013; Olsen 2014). Entanglement in, or ingestion of, lost or discarded fishing gear is another hazard for fish-eating coastal raptors (e.g. Debus *et al.* 2014).

This study has added a little to knowledge of the full breeding cycle of the Brahminy Kite, from courtship and nest-building to independence of the juvenile. However, it remains to conduct a more detailed and quantified account as obtained, for example, by Barnes *et al.* (1999, 2001) and Lutter *et al.* (2004) for the Square-tailed Kite. Other studies could then progress to population and management aspects, such as for the White-bellied Sea-Eagle in human-affected coastal regions (e.g. Dennis *et al.* 2012; O'Donnell & Debus 2012; Debus *et al.* 2014, and references therein).

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