

## NESTING AND FORAGING BEHAVIOUR OF BREEDING RED-BACKED KINGFISHERS *Halcyon pyrrhopygia*

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### INTRODUCTION

The Red-backed Kingfisher *Halcyon pyrrhopygia* occurs widely but erratically as a breeding species in arid and semi-arid habitats of southern and central Australia. Although it is a dry-land predator, many other members of this widespread genus are aquatic foragers. The species is thought to have evolved from forms in the rainforests of New Guinea (Fry 1980). Its nest, a tunnel in a stream bank, contrasts with the more characteristic arboreal nests of the *Halcyon* species (Fry 1980).

On 20 December 1984 a pair of nesting birds was found at Fowlers Gap, (31°08'S., 14°40'E.) 110km north of Broken Hill, New South Wales. For 26 hours spread over the following 8 days systematic observations of adult foraging behaviour were conducted in the vicinity of the nest and data on adult visits to the nest were recorded. There was no free water in the vicinity of the nest.

The young fledged on 28 December. The nestling period of these kingfishers is 23 to 26 days (Courtney 1971), so the young were approximately 16 to 19 days old when the observations were begun.

### METHODS

Adults were observed for 3 to 6 hours each day, mostly in the early morning and late evening. The time of each visit to the nest, the type of food carried, and its approximate length were recorded. Initially these lengths were described in numbers or fractions of bill lengths (exposed culmen) to the nearest  $\frac{1}{4}$  bill length. These were

later converted to mm on the basis of measurements of bills of seven male and seven female specimens in the Australian Museum ( $\bar{x}$  = 36.2 mm for males,  $\bar{x}$  = 34.9 mm for females; Table 1). After the adults were captured in a mist net near the nest and banded on the third day of observation, the sex of individuals for each visit was recorded.

As much of the foraging was done within sight of the nest, a large portion of the adult foraging behaviour was observed. The adults typically forage from a perch by diving for prey on the ground or a tree trunk. The nine most commonly used perches within sight of the nest were frequently scanned. Time was recorded whenever a bird was located, when it moved to a new perch, when the bird dived for prey, or when it moved away from the perch. Success of the dive was evident from the behaviour of the adult after diving, as it would beat the prey against its next perch in a characteristic fashion. The success of a dive and whether the parent ate the prey or delivered it to the nest were recorded. Perching substrate was categorized by height and type.

### RESULTS

#### *The nest*

The nest was located in the bank of a small dry stream-bed that was lined with scattered River Red Gum *Eucalyptus camaldulensis*. The entrance was 150cm above the stream bed, 27cm above the nearest ledge, and 33cm below the top of the bank. The nest chamber was located 6cm above the nest entrance and was reached by an upward sloping 17cm long tunnel. The chamber

itself was 18cm long, 13cm wide and 10cm high. A constriction comprising a hardened plug of dirt and saliva was located 10cm into the tunnel, so that the 5cm diameter opening was reduced at this point to a 4.5 x 2cm opening. The adults therefore, could not enter the chamber to feed the young, but instead brought food to this plugged opening. The plug probably served both for concealment and for protection from predators.

#### *Parental morphology*

The female of the pair was heavier, weighing 54.9g as opposed to 47.0g for the male. This is consistent with the weights of a female (53.8g) and male (48.0g) obtained from two specimens at The Australian Museum. Morphological measurements of seven male and seven female specimens (Table 1) indicated that the females' bill are slightly shorter and deeper but similar in width to that of the male and that females have slightly longer tarsi, although wing lengths of the sexes are identical.

#### *Parental foraging behaviour*

The mean time between arrival or sighting of a bird at a perch and its diving for prey was 4 minutes, 33 seconds (SD=3:33, n=33), while the mean time birds spent on a perch until leaving without diving was 4 minutes, 44 seconds (SD=4:43, n=17). Although these times were quite variable, the similarity of the mean values suggests that the birds may operate within a certain 'time window' within which they either detect prey or decide to move elsewhere. The distributions of leaving and diving times also appear similar; 14 out of 16 diving times and 24 out of 35 leaving times were under 9 minutes.

TABLE 1

	Male		Female	
	≅	SD	≅	SD
Wing length	99.8	2.86	99.9	2.52
Tarsus length	11.2	0.94	11.7	0.29
Bill length	36.2	2.96	34.9	1.88
Bill width	11.7	0.56	11.7	0.24
Bill depth	10.9	0.58	11.1	0.52
Tail length	66.5	2.50	67.5	2.20

Means (≅) and standard deviations (SD) of morphological measurements (mm) of seven male and seven female specimens from The Australian Museum, Sydney.

The height of dives varied from 3 to 40m, with a horizontal distance ranging from 0 to 30m. Of the 43 dives observed, 20 (47%) were successful. Four dives were made to the trunk of a Red Gum or *acacia* spp and the remainder to the ground. On seven occasions following successful dives the parent ate the prey; in the 13 remaining instances the prey was delivered to the nest.

Eight commonly used foraging perches were observed from the customary observation post. An additional perch was generally used prior to and following nest visits. Sites within about a 5m radius in a gum tree or along a telephone wire were considered to be a single perch. Perches ranged from 20 to 70m from the nest. Height was about 20m for the three telephone wire perches, 20 to 30m for the three gum tree perches and 2 to 3m for the acacia perches. The ratio of successful to unsuccessful dives was 13/15 for the wire perches, 6/9 for gum trees, and 1/0 for acacia trees.

#### *Nest visits*

The adults visited the nest an average of 4.8 times per hour and the male visit rate (2.3) was similar to that of the female (2.6). Examination of average temperatures for each hour (recorded from a shaded thermograph located 3km from the nest in similar habitat) suggested no relationship between temperature and the rate of nest visitation. Visits occurred between 0500h and 2000h and the average hourly temperature ranged from 20 to 39°C. The number of nest visits was tremendously variable, however; in one 2 hour period on 26 December (1000-1200h; 31-26°C) 21 visits were observed, while later that day (1800-2000h; 23-26°C) no visits were observed.

Deliveries were usually made from a perch located about 7m from the nest entrance. Sometimes the adult waited on the perch until there was an audible cry from the young. At times the young made calling sounds periodically, even if the parents were not nearby. Often, and especially when the young were silent, the parent would make three or four repeated flights to the nest entrance over a several minute period before delivering the prey. It is suspected that these false deliveries stimulated the young to get into position on the inside of the plug and the number of false deliveries may have been an inverse function of the hunger level of the nestlings. On one occasion the male was observed to repeatedly

present a large orthopteran to the nestlings over a 90 minute period but after no apparent response the male ate the prey item. This was the only case in which a parent ate the prey following attempted deliveries.

Of the 71 deliveries in which the prey could be identified, 6 (8.4%) were lizards or lizard parts (mostly Skincidae and Gekkonidae), 64 (90.1%) were arthropods and 1 (1.4%) was a rodent. Most of the arthropods were acridids (Orthoptera), although arachnids and centipedes were also captured. Both adults were carrying prey when netted for banding; one was a mantid (1.00g wet weight) and the second an acridid (0.87g). Average approximate length of the prey items was 31mm for the female kingfisher ( $SD=12.3$ ,  $n=17$ ) and was not significantly different from the mean of 52mm for prey delivered by the male kingfisher ( $SD=36.6$   $n=17$ ).

Throughout the observation period large numbers of ants were noted entering and leaving the nest and carrying off organic material from the nest entrance. The parent birds were observed to remove material from the nest only once, yet the nest was quite clean inside when excavated 2 days after the young fledged. This is in contrast to the typically fouled conditions of nests characteristic of the family Alcedinidae (Fry 1980). Upon excavation of the nest, ants were observed to be using a crack in the dirt at the rear of the nesting chamber as an alternative entrance. The ants apparently carry off fecal material and other organic waste, while not bothering the young birds. Lord (1935) reported that ants had been seen cleaning the excreta from the entrance to a Red-backed Kingfisher nest.

#### *Removal of the nest plug and fledging*

Between 1100 and 1200h on 26 December the female was observed making return trips to the nest after delivery of a food item. On these visits she pecked repeatedly at the plug in the nest entrance. At 0630h on 27 December the young began tapping on the plug from within the nest. By 1330h the plug had been completely removed. By 1600h it had been replaced by a mound of loose dirt that filled approximately half the opening. On the following day the first food delivery was made at 0603h. All three young then fledged, at 0611, 0623 and 0746h. They were immediately capable of flying at least 10m horizontally and landing on a branch.

The young first landed on the perch 7m from the nest entrance, then moved about 10m further away to two separate perches. When the parents made alarm calls the young usually adopted a cryptic pose by pointing their bills upward, closing their eyes, and holding very still, such that the dark eyestripe formed a line with the dark wings and back and looked very much like a tree limb (Figure 1). After the young fledged, the adults became very aggressive toward nearby birds, including Australian Magpies *Gymnorhina tibicen*, Little Crows *Corvus bennetti*, and Grey Falcons *Falco hypoleucos*, when they were less than about 150m from the fledglings. At some point during the first 2 hours following emergence each fledgling flew down to a bare dirt area and made some practice dives by hopping up and pouncing bill first into the dirt. The parents continued to feed the fledglings and the group was observed within 200m of the nest the following day. By this time the young were observed diving from low perches ( $<5m$ ).



Figure 1. Cryptic pose of a juvenile Red-backed Kingfisher in response to disturbance on the morning it fledged. The bird remained quite still for several minutes and appeared to mimic the light/dark pattern of surrounding branches.

## DISCUSSION

The male and female behaved similarly in the number of feeding trips made and the type of prey brought to the young. The capture of prey by these kingfishers is probably largely opportunistic; Hobbs (1976) reported that *H. pyrrhopygia* fed extensively on rodents during a mouse plague at Ivanhoe, New South Wales. The role of ants in keeping the nest clean could be extremely important as insect larvae could otherwise breed in the nest and parasitize the young. Fry (1980) reported that dipterous and coleopterous larvae typically inhabit the debris left inside kingfisher nests. It is evident from the mode of nest construction and from fledgling and parental behaviour that predation has been a major influence on the observed behaviour patterns.

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# RECOVERY ROUND-UP

*This section is prepared with the co-operation of the Secretary, Australian Bird and Bat Banding Schemes, Australian National Parks and Wildlife Service. The recoveries are only a selection of the thousands received each year; they are not a complete list and should not be analysed in full or in part without the prior consent of the banders concerned. Longevity and distance records refer to the ABBBS unless otherwise stated. The distance is the shortest distance in kilometres along the direct line joining the place of banding and recovery; the compass direction refers to the same direct line. (There is no implication regarding the distance flown or the route followed by the bird.)*

*Recovery or longevity items may be submitted directly to me whereupon their merits for inclusion will be considered.*

—Hon. Editor.

The following abbreviations appear in this issue:

- ANARE — Australian National Antarctic Research Expeditions.  
 ANPWS — Australian National Parks and Wildlife Service.  
 AWSG — Australasian Wader Studies Group.  
 NPWS, SA — South Australian National Parks and Wildlife Service.  
 PSG — Penguin Study Group.  
 SSG (BOAT) — Shorebird Study Group of the Bird Observers Association of Tasmania.  
 VWSG — Victorian Wader Study Group.  
 WAWSG — Western Australian Wader Study Group.

### Little Penguin *Eudyptula minor*

190-26143. Nestling banded by PSG on Phillip Island, Vic. on 29 Jan. 86. Found dead at Knights Beach, Port Elliot, SA on 13 Apr. 86. 662 km NW.

### Black-browed Albatross *Diomedea melanophrys*

CF7949\* Banded on Kerguelen Island, Antarctica (49°20'S., 70°15'E.) on 13 Feb. 71. "Found as skeleton" at Elliston, SA (33°37'S., 134°54'E.) in Aug. 85, over 14 years 5 months after banding. 5 492 km NE.  
 \*CRBPO (French Banding Scheme) band.

### Shy Albatross *Diomedea cauta*

280-07620. Nestling banded by N. P. Brothers at Mewstone, Tas., (43°44'S., 146°22'E.) on 24 Apr. 85. "Entangled in fishing gear" (dead) off West Coast of South Africa (31°00'S., 15°36'E.) on 8 Oct. 86. 10 338 km SW.

### Southern Giant-petrel *Macronectes giganteus*

- (a) 130-50628. Banded by A. F. C. Lashmar at Eastern Cove, Kangaroo Island, SA on 24 June 86. Found exhausted (later died) at Pottsville Beach, NSW on 2 Aug. 86. 1 692 km ENE.  
 (b) 131-52111. Nestling banded by ANARE on Frazier Islands, near Casey Antarctica (66°14'S., 110°11'E.) on 14 Feb. 86. "Entangled in fishing gear" (later died) at Western Cook Strait, New Zealand (41°05'S., 174°28'E.) on 1 Oct. 86. 4 775 km ENE.