

A Failed Breeding Attempt by the Grey Falcon *Falco hypoleucos* near Alice Springs, Northern Territory

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Summary

A breeding attempt by a pair of Grey Falcons *Falco hypoleucos* was observed for ~23.5 hours spread over 9 days of the incubation period at a site 40 km north-west of Alice Springs, in the south of the Northern Territory. The birds were discovered during the incubation phase on 19 September 2010, and nest watches of 1.7–7.5 h per day, covering all daylight hours, were conducted until the breeding attempt failed (owing to storm damage) and the nest was abandoned on 6 October. Observations continued until 12 October, but the nest was no longer attended. The behaviour and vocalisations of the adults are described; the active nest was attended for 93% of observation time. Four regurgitated pellets contained many feathers of Budgerigars *Melopsittacus undulatus*.

Introduction

The endemic Grey Falcon *Falco hypoleucos*, of the arid and semi-arid zones, is one of the least-known of Australia's birds of prey. Several recent studies have added to knowledge of its biology and ecology (Aumann 2001a,b; Falkenberg 2011; Schoenjahn 2011a; Sutton 2011), and several anecdotal reports have appeared since Sutton's review (Schoenjahn 2011b,c,d). A study of its breeding, movements, diet and morphology is currently being conducted (Schoenjahn 2010a,b). However, there has been little study of its breeding behaviour, with one anecdotal description of nest-selection behaviour (Jackson 1919) and anecdotal (unquantified) descriptions of aspects of the breeding cycle, e.g. sex-roles, parental behaviour and vocalisations during the incubation and nestling periods (Cupper & Cupper 1980, 1981; Hollands 1984; Falkenberg 2011; Schoenjahn 2011a,c).

A Grey Falcon was discovered on a property north-west of Alice Springs, in the south of the Northern Territory, on 19 September 2010. After sightings of a single Falcon over several days, two Falcons were found to be present, one sitting on a nest, on 28 September. The nest was therefore monitored over the ensuing week, until a storm damaged the nest and it failed, almost at the hatching stage, on 6 October; observations continued on a further four days until 12 October. Primarily, this paper (1) provides some environmental context for one more among the very few nests documented; (2) describes the behavioural and vocal interactions between the two Falcons that, on strong circumstantial evidence, were a breeding pair with egg(s) in the nest; and (3) describes other behavioural observations relating to this event.

Study area and methods

The study site is an operational cattle property with 100 cattle and some horses grazing in the general area. This area received ~650 mm of rain from the beginning of 2010 until the time these observations were made, and was well vegetated and green.

The area immediately east and west of the nest is an open plain dominated by Button Grass *Dactyloctenium radulans*, Billy Buttons *Calocephalus platycephalus*, grasses *Enneapogon* and *Eragrostis* sp., foxtail *Ptilotus* sp., nightshade *Solanum* sp., and cassia *Senna* sp., with

swampy areas thickly grown with Wire Bush *Lechenaultia divaricata* and Native Oatgrass *Themeda avenacea*. Small stands of Mulga *Acacia aneura*, Witchetty Bush *A. kempeana* and needlewood *Hakea* sp. dominate the fringes of the plains. The nest was located on a dry watercourse lined by River Red Gums *Eucalyptus camaldulensis*. The watercourse was densely populated by Budgerigars *Melopsittacus undulatus* and other parrots, and there was open water (a stock dam) nearby.

The Falcons were observed almost daily, from the time the nest was discovered until the date on which they were last seen in the vicinity of the nest (Table 1). Observations were made using 8 × 42 binoculars from a makeshift hide ~150 m from the nest-tree, or from locations in the open plains adjacent to the river bed but at a similar distance. Approach to the nest any closer than this was considered too disruptive, as the nesting Grey Falcons, and many other raptors in the vicinity, flushed from their nests. The area was very open, with little vegetation large enough to conceal approach. My presence was quickly discovered, and communicated by the alarm calls of numerous other nesting species in the area, particularly Yellow-throated Miner *Manorina flavigula*, Spotted Harrier *Circus assimilis* and Nankeen Kestrel *Falco cenchroides*.

The Grey Falcons were observed on 11 days, with additional observations provided by Anthony Molyneux and John Rogers, on one morning in the incubation period and one day after the nest failed, respectively (Table 1). The Falcons were observed in blocks averaging ~3 hours, mostly in the early morning or through the afternoon; during the Falcons' incubation period, observation sessions collectively covered all times of day (Table 1). The total time of observation was ~43 hours, spread over 13 days, of which ~34 hours over 9 days occurred during the incubation period (~23.5 h over 6 days at the known nest). No observations of the interior of the nest were made, before or after it failed (such interference, apart from being potentially too disturbing to a rare species, may have raised permission and animal-ethics issues with the authorities).

On the few occasions when the two Falcons were seen perched together, the incubating bird seemed slightly larger and more robust (deeper in the body), and was therefore probably the female. When seen together in flight, the female (which was initially on the nest) appeared larger and bulkier than the male (C. Pavey pers. comm.; see Table 1). From photographs (Plate 38), the incubating bird had a robust bill shape suggesting a female, an opinion shared by S. Debus and J. Schoenjahn (pers. comm.; e.g. see photographs of male and female in Cupper & Cupper 1981 and Hollands 1984), and she also had large feet (Plate 38). In Grey and other falcons, the female is larger than the male, and performs most of the incubation (Cupper & Cupper 1980, 1981; Hollands 1984; Falkenberg 2011; Schoenjahn 2011a). The sexes are so assigned herein, though always with the qualifier 'presumed'. Photographs obtained (Plate 38) confirmed that the moulting presumed female was in adult plumage except for juvenile feathers remaining on the upper edge and underneath of the carpal joints (S. Debus pers. comm.). This bird was thus apparently a yearling, or had retained traces of juvenile plumage until 2 years old (S. Debus, J. Schoenjahn pers. comm.). The presumed male's plumage resembled that of the adults photographed by Cupper & Cupper (1981). Incubation is assumed herein, from the presumed female sitting on the nest in the incubation posture for extended periods (Table 1), and a broken falcon egg, near hatching, subsequently found among nest debris directly below the storm-damaged nest (further details in Results).

One pellet seen to be ejected by the female Falcon on 26 September, and three other pellets found directly under the nest by Chris Pavey on 10 October, were examined in the field by the respective finders, and feathers therein identified *in situ*.

Results

It is conceded that interpretation of the behaviour observed is based on circumstantial evidence, that is: only two Grey Falcons seen together or distinguished; one (the larger, presumed female) performed incubation-type behaviour; and the presence of egg(s) was inferred from a broken falcon egg found directly below the damaged nest after the storm. It is noteworthy that the incubating female was either a yearling or still had traces of juvenile plumage at 2 years old.

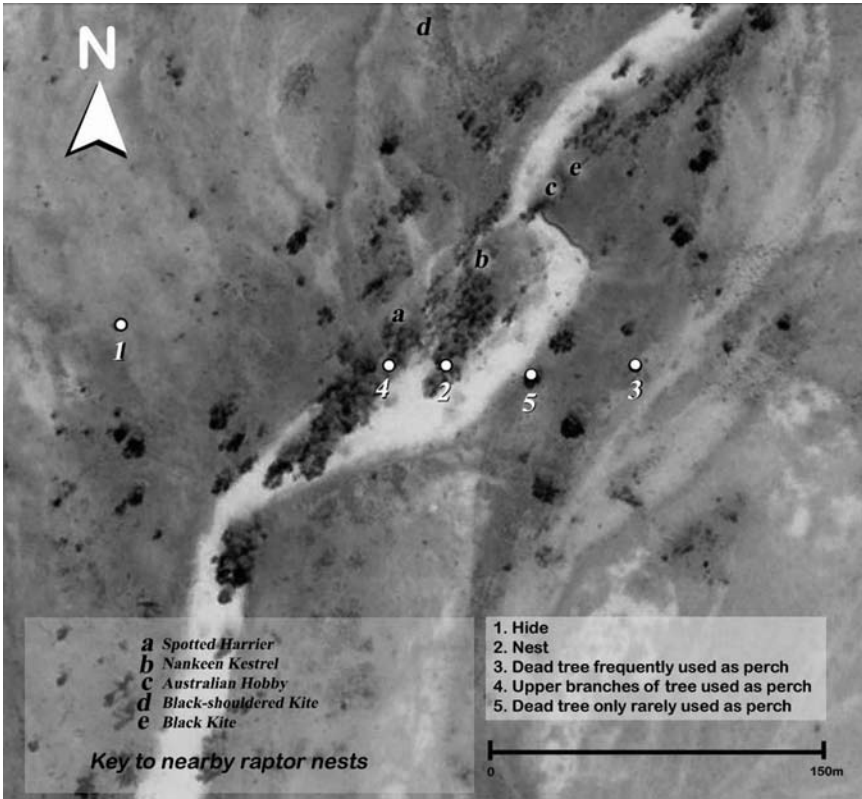


Figure 1. Map of study area showing location of observation hide (1), Grey Falcon nest and perch trees (2–5), and nests of other raptor species.

Map source: Google Earth

Nest-site

The Falcons’ nest was a stick nest estimated to be 10–12 m above ground, in the crown of a live River Red Gum in the river channel. The nest was most likely the vacant nest of a Torresian Crow *Corvus orru*, the only corvid observed in the area and a pair of which had an active nest >500 m from the Falcons. It was a solid nest in the uppermost branches, rather exposed, and was too small to be that of a Black Kite *Milvus migrans* or Whistling Kite *Haliastur sphenurus* (both kite species’ nests being familiar to the observer). From one side (western side of the river; Figure 1), the Grey Falcons’ nest was obscured by foliage and easily overlooked unless one knew exactly where to look.

Seven other pairs of raptors had nests in the area: Black-shouldered Kite *Elanus axillaris*, Black Kite, Collared Sparrowhawk *Accipiter cirrocephalus*, Spotted Harrier, Nankeen Kestrel (two pairs, in tree-hollows) and Australian Hobby *Falco longipennis*. The closest of these were a Spotted Harrier nest ~30 m away, and a Kestrel nest ~40 m away, from the Falcons’ nest; that of the Hobby was ~90 m away (Figure 1).

Table 1

Observation schedule and table of events in Grey Falcon nest area, Alice Springs, NT, during the incubation period September–October 2010. F = presumed female; M = presumed male. For perch-tree codes, see text and Figure 1.

<i>Date (day, month)</i>	<i>Time of day</i>	<i>Observation time (h)</i>	<i>Comments</i>
19.09	1420–1830 (sunset 1830)	4.17	Single Falcon (F?) flushed from low (5 m) in nest-tree, went to dead tree (3) then left nest area (but could have returned to nest unobserved); no further sightings for 3 h until a Falcon flew high over nest area, calling.
20.09	1440–1820	3.67	No action for 1 h, then a Falcon intermittently (every ~1 h) perched in nest area, or flew or called in nest area, until 1700 h.
26.09	0600–0830 (sunrise 0621)	2.5	F was perched on tree 3 (0642 h); changed perches several times then ejected pellet in tree 4; flew low to east (i.e. towards nest-tree), lost to view (0702 h). Over next 10 min., a Falcon circled high over, calling, then departed high to east; no further action over next h.
28.09	~0800	~0.3	Nest found by Chris Pavey and Peter Nunn. M perching in tree 4 (?); after ~15 min., F flushed from nest (possibly because inadvertently approached too closely), M also flew; observers left (C. Pavey pers. comm.).
	1440–1820 (sunset 1832)	3.67	Nest found by CW. No action until 1635 h, when M seen in tree 3 and F in tree 4; F went to tree 3 then to nest, settled low in incubation posture (1644 h) and remained so for ~1.5 h until end of watch. M visited nest-tree (3 m below nest, 1650 h), retreated to tree 4 when mobbed, then to tree 3; departed from nest area at 1658 h.
29.09	1410–1900 (sunset 1833)	4.83	Apart from flushing episode (see text), when F off nest (1642 h) for 3 min., she incubated low in nest for most of watch (>4.5 h); she went to tree 4 (1738 h) to preen for 13 min. and once (1828 h) stretched and stood for 2 min. M variously perched in nest area, departed for ~1.5 h, and visited nest momentarily (1835 h, while F sitting).
30.09 ^a	0800–1000	~0.5?	F incubating (15 min.), left to perch beside M when he arrived on tree (4?); then both circled (F calling), landed together on tree 3 (5 min.), then interacted in flight (see text).

Table 1 continued

<i>Date (day, month)</i>	<i>Time of day</i>	<i>Observation time (h)</i>	<i>Comments</i>
03.10	0612–1130 (sunrise 0613)	5.3	F incubated low for >2 h; M visited nest-side branch (<1 m away, 0707 h) for 2 min. while F sitting, then departed. F left to perch in tree 3 (0836 h, 10 min.) and tree 4 (12 min.), then stood on nest (3 min.) and incubated (1.3 h), rousing twice to stretch, stand and preen (0912 h, 6 min.; 0940 h, 5 min.). F left to perch beside M in tree 3 when he arrived (1022 h, 8 min.), then incubated for remaining 1 h of watch while M absent.
04.10	0530–1300 (sunrise 0612)	7.5	F incubated low for ~2 h; once stood and stretched momentarily (0655 h). M left foliage roost near nest (0652 h), preened in tree 4, landed momentarily and precariously on nest-rim (0656 h), then in nest-tree (F incubating). M then landed on nest-rim, F remained sitting but called at M (cluck; see text). M otherwise perched in nest area (trees 3, 4 and 5), intermittently absent, interacted with F on tree 3 (see text), and visited nest-rim again (0746 h, F sitting). F left to perch near M in tree 3 (0726 h, 12 min.); perched in tree 4 (0837 h, 6 min.; 1052 h, 2 min.), defended nest area against Sparrowhawk (1152 h, 1 min.; see text). F otherwise incubated for entire watch (stood twice, momentarily, 0843 h and 1222 h).
05.10	1150–1330	1.7	F incubated for entire watch. M arrived momentarily in tree 3 (1212 h, 1 min.), departed. Last day nest seen attended.
Subtotal		~23.5	Since nest found (28.09–05.10)
06.10			Storm damaged nest (see text).
07.10	0640–1050 (sunrise 0610)	4.17	Nest debris and broken falcon egg below nest (see text). Nest unattended, no Falcons seen.
08.10 ^b	~0800	?	Nest unattended. Single Falcon in flight away from nest area.
09.10	1410–1540	1.5	Nest unattended for 1.5 h. Single Falcon perched 500 m away, departed from area.
12.10	1520–1900 (sunset 1838)	3.3	Nest unattended. Single Falcon >3 km away.

^aObservation by Anthony Molyneux^bObservation by John Rogers

Behaviour and routines

Observations established that the Grey Falcons had a favourite dead tree ~90 m east of the nest (tree 3: Figure 1), used for perching and preening, and they also perched in the upper branches of a live tree ~25 m west of the nest (tree 4: Figure 1). A Grey Falcon (presumed female, from a photograph: Plate 38) was first detected on 19 September when she flushed from a low perch (5 m above ground) in what was later found to be the nest-tree, and landed on the dead tree (tree 3) for several minutes before departing. She was not seen to return while the area was under observation (~4 h), raising the possibility that the male was incubating, or she returned secretively, unobserved, to the then unknown nest. Despite a morning and an afternoon observing session on two subsequent days, the nest or incubating bird were not detected by the author until a third observation day.

Before the nest was discovered, a single Grey Falcon was observed on each observation day, flying or circling and sometimes calling in the nest area, and perching on the dead tree (tree 3), visiting tree 4 and occasionally perching on a less-favoured dead tree (tree 5: Figure 1) ~40 m east of the nest. When in tree 4, one Falcon (identified from photographs as the presumed female) ejected a pellet (which was promptly collected, still warm). After the nest was found, only two individual Falcons were observed together in the area, and there did not appear to be (for instance) a third Falcon that might suggest the presence of an adult pair and a yearling offspring remaining in the nest area.

Incubation, i.e. presence of egg(s) in the nest, was inferred from the finding of a broken falcon egg, referable to the Grey Falcon, amid nest debris directly below the storm-damaged nest (see p. 174). During the incubation period, after the nest was found, the presumed male sometimes flew in, occasionally calling, to perch in the favoured dead tree (3) or tree 4, or to visit the nest (perching beside it or even on the rim, while the presumed female continued to incubate). Occasionally, the incubating, presumed female flew out to meet the other Falcon on tree 3 or, once, in flight, but no food deliveries were observed and she then returned to incubate while he sometimes followed her to tree 4. No changeovers of incubation were observed. These routines continued until the day before the storm (i.e. 5 October), and lapsed after the storm damaged the nest (Table 1).

During these interactions, the presumed female sometimes flew from the nest, calling, to perch beside the other Falcon and he then left while she returned to the nest. On one occasion, she approached him in circling flight, calling, and they interacted briefly, as if she was attempting to obtain food from him (but he was not carrying prey). On one other occasion, she flew from the nest to perch beside him and they touched bills briefly, before she returned to the nest and he followed her to tree 4, then departed (foraging?). Once, the presumed male arrived on the nest-rim, without food, the incubating female called harshly at him (double cluck; see p. 175) and he left for other perches in the nest area, via a brief drop to the ground, then departed, flying low to the ground out of sight.

The female ejected a pellet, and photographs of her in a perch-tree and in the incubation posture on the nest show a scrap of food on her bill, so she must have been feeding during the observation period. Feeds and changeovers could have been missed by the observation schedule, i.e. watches were conducted on only some days and for only part of the day (Table 1).

At varying intervals, the incubating Falcon (in the other's absence) stood, stretched and sometimes preened for a few minutes, then resettled, on two



Presumed female Grey Falcon, Alice Springs, NT, September 2011

such occasions bill-digging in the nest-cup or arranging sticks before settling. Occasionally, she flew briefly to one of the nearby perch-trees to preen, before returning to incubate. A Falcon was incubating for a total of 93% of observation time ($n = 23.5$ h). Nine absences (total 7% of observation time) ranged from 1 to 25 minutes. On one such occasion, the incubating Falcon flew, calling (wailing call; see p. 175) to displace a Collared Sparrowhawk that had arrived in the Falcons' live perch-tree (tree 4) near their nest-tree.

Interactions with other species

On two occasions, the non-incubating, flying Grey Falcon was harassed or chased by an Australian Hobby; on one of these, the Falcon perched and threatened the Hobby with open bill, and it desisted. On several occasions, a Kestrel perched above the Falcon(s) and called, but did not attack. The Falcons were also frequently mobbed by Yellow-throated Miners and once harassed by a Pied Butcherbird *Cracticus nigrogularis*. When a Butcherbird landed beside the Falcons' nest, the incubating Falcon stood up, and the Butcherbird fled with alarm calls. The incubating Falcon also defended the nest area against a Sparrowhawk (see above).

Reaction to disturbance

On one observation day, a car was driven up and parked ~300 m from the Falcons' nest, and two birdwatchers walked towards the nest; as they arrived below it, the incubating Falcon flushed and flew to tree 4. After 3 minutes the Falcon returned to incubate, while the people continued walking along the river bed, having failed to detect the Falcon. Meanwhile, the non-incubating Falcon flew in low (also undetected by the birdwatchers) and perched in tree 4. Later on that day, a station vehicle passed within 50 m of the Falcons' nest-tree; the incubating Falcon turned its head to watch the vehicle, but remained incubating.

The quiet and very cryptic nature of the Falcons around their nest was noteworthy. In the nest or in a nearby tree they permitted very close approach before flushing, and when flushing were stealthy.

Nesting outcome and chronology

On 6 October a storm, with winds up to 120 km/h and 28 mm of rain, passed through the nest area. Next day, the nest was found to be damaged, with ~25% of its sticks on the ground below; directly beneath the nest-site was found, on the ground, one broken egg which closely matched descriptions and photographs in the literature of Grey Falcon eggs (e.g. Cupper & Cupper 1981). The location of the egg among debris from the damaged nest (1 m from the tree-trunk), and the timing of its discovery, suggested that it was likely to have come from the nest of the Grey Falcons. Furthermore, the other (intact) falcon nests in the area were 40 m away (Kestrel) to 90 m away (Hobby), all of which fledged young, and no nests of the Brown *Falco berigora* or Black *F. subniger* Falcon (which have similar eggs to the Grey) were detected in the area. There were no other raptor nests in the Grey Falcons' nest-tree or within 30 m, and Spotted Harriers (the closest nest) have eggs unlike those of falcons (Marchant & Higgins 1993). The embryo within the broken egg was well developed, having visible feather tracts, and had a falcon bill structure. Given the degree of development of the embryo within the broken egg (which could not be retained), the egg would have been within 3–6 days

of hatching. If hatching was thus likely to have occurred in mid October, laying would have been in early September, given the 35-day incubation period (from Marchant & Higgins 1993; Sutton 2011).

From 7 to 12 October (after the storm), the nest and nest area were not seen to be attended by the Falcons in 9 hours of observation (Table 1). A single Grey Falcon was seen occasionally in the wider area, 0.5–3 km from the nest, over this period, until observations ceased at 1900 h on 12 October. The Falcons were also not seen in the area during occasional further checks until April 2011 (C. Pavey pers. comm.).

Vocalisations

The Grey Falcons gave several types of call, described here using the standard terms for the calls of large falcons such as the Peregrine Falcon *Falco peregrinus* (cackle, guttural double cluck [= *ee-chip*], wail: Cade 1982; Marchant & Higgins 1993; Debus & Tsang 2011; Falkenberg 2011). The non-incubating (presumed male) Falcon, when approaching or departing from the nest area in direct flight, or when circling high over, gave the cackle. This was the most commonly heard call, usually given in flight, and sometimes heralded the male Falcon's approach. When perched in the nest area, he also gave two weak calls: an abrupt *kek* note, descending in pitch and slightly squeaky (possibly a 'chirrup' type of call).

The incubating Falcon (presumed female) gave several types of call, according to context. When flying out to meet the incoming, non-incubating Falcon on the dead tree (3), she gave a clucking call. When interacting with the male in flight, as if to obtain food, she gave the cackle. When apparently dismissing the male from the nest-rim when he did not bring food, the incubating female gave a guttural double cluck, noted at the time as a 'harsh, scolding, coughing noise'. When defending the nest area against the Sparrowhawk, the incubating Falcon gave a wailing type of call.

On one occasion, when the presumed male Falcon was harassed in flight by a Hobby, he called with a 'whinnying' type of call (distress chitter).

Hunting and prey

All four pellets contained many Budgerigar feathers. The presumed male Grey Falcon was seen apparently hunting in the nest area on two occasions: (1) a direct flight at canopy height towards the riparian trees, then a sweeping pass over the treetops, before being interrupted by a harassing Hobby; and (2) from a perch, an apparently opportunistic pounce to the river bed directly below for a few seconds (apparently unsuccessful, perched again without prey). When departing from the nest area (e.g. when dismissed by the incubating female), apparently on foraging (searching) flights, the presumed male variously (a) flew low (sometimes near the ground) and directly, perpendicular to the river channel, out of sight (5 times); (b) circled high, then left on a direct course, out of sight (twice); and (c) flew above tree level, along the river channel, out of sight (once).

No prey deliveries were seen in 23.5 hours of observation during the incubation period, collectively across all times of day. However, the observation schedule, covering only part of the day on only some days between discovery and nest failure, may have missed any deliveries.

Discussion

The Grey Falcons' nest-site was typical for this species, i.e. a vacant corvid stick nest in the crown of a riparian eucalypt, sometimes among other nesting raptor species (e.g. Olsen & Olsen 1986; Marchant & Higgins 1993; Aumann 2001a; Falkenberg 2011; Sutton 2011). The estimated laying date is consistent with known information, though towards the late end of the known laying season (which peaks in mid August: Marchant & Higgins 1993). The breeding attempt and local conditions (e.g. lush vegetation, abundant prey) are consistent with known Grey Falcon breeding events in relation to rainfall (e.g. Aumann 2001a; Falkenberg 2011; Sutton 2011).

The Falcons' behaviour and routines (e.g. sex-roles) were typical of this species during the incubation period (e.g. Cupper & Cupper 1980, 1981; Hollands 1984; Falkenberg 2011), but no prey deliveries were observed, and hence no changeovers of incubation duty. The lack of prey deliveries in ~24 hours is a mystery, when they might be expected, but may be partly explained by the intermittent, incomplete observation schedule (Table 1). It is likely that, during some initial observation sessions, the female returned to the nest secretly and unobserved, as incubating female falcons can be highly cryptic (Falkenberg 2011; P. McDonald pers. comm.).

It is likely that sexing of the members of the subject pair, and interpretation of sex-roles, were correct, in the light of previous studies on this and other falcon species (e.g. Marchant & Higgins 1993). The immaturity, and hence inexperience, of the female may have contributed to the late laying date and ultimate nest failure (J. Schoenjahn pers. comm.), including perhaps the poor choice of nest-site in relation to weather. The age of the female is also of note, as in fast, bird-catching falcons such as the Peregrine, age at first breeding is usually 2 years for females (Marchant & Higgins 1993). However, it is conceded that other interpretations of the event are possible, e.g. the young female was occupying an empty nest (but the egg below it then becomes difficult to explain). Australian Peregrine Falcons begin post-juvenile moult during their first year (wing- and tail-feathers at 1 year), and complete it 'by end of second year' (Marchant & Higgins 1993), thus implying that some juvenile plumage can be retained well into the second year.

Grey Falcon nests are susceptible to storm damage (e.g. Cupper & Cupper 1980, 1981), and inclement weather is critical in disrupting the breeding cycle of falcons (e.g. Olsen & Olsen 1989; McDonald *et al.* 2004). The frequent use of year-old (or older) corvid nests (mostly Torresian Crow or Little Crow *Corvus bennetti* in the arid zone) may be a factor in this susceptibility, and in the apparently common practice of Grey Falcons using nests for only a single season (e.g. Falkenberg 2011; Schoenjahn 2011a).

Some interspecific conflict was observed, especially with other falcon species, as previously recorded for the Grey and other Australian falcons (e.g. Marchant & Higgins 1993; Falkenberg 2011). Competition for vacant stick nests, as well as defence of eggs or young, may be a factor in these conflicts. One could speculate that the high density of breeding raptors in the present study area relegated the Grey Falcons to a substandard nest-site. Notably, the seven other nesting pairs of raptors, subjected to the same high winds and heavy rainfall, all proceeded to successful fledging of offspring in the weeks following the Grey Falcons' nest failure. However, the hawk species would have built or renovated their nests afresh for the season, whereas the Grey Falcons used an older, and probably already weather-beaten, nest. The Sparrowhawks had chicks in the nest ~2 weeks after

the Grey Falcons' failure, and the other stick-nesting raptors appeared not to have chicks during the Falcons' incubation period; that is, those species did not necessarily start (and thus occupy available nests) earlier than the Grey Falcons.

The adult Grey Falcons' calls, and their contexts, during the incubation period were apparently typical of this species during the relevant stage of its breeding cycle (e.g. Cupper & Cupper 1980, 1981; Hollands 1984; Falkenberg 2011), and consisted of a Peregrine-like cackle, a double cluck (*ee-chip*), a wail, an apparent chirrup call, and a distress chitter. The presumed male gave the cackle, as did the female when attempting to obtain food from him in flight, and the presumed female gave the double cluck and a wail. However, some caution is required, given the female's apparent immaturity and the circumstantial evidence concerning nest contents.

This and other recent studies (e.g. Cupper & Cupper 1980, 1981; Hollands 1984; Falkenberg 2011) suggest that some elaboration or reinterpretation of the earlier literature is required. Like the Black Falcon (Debus & Tsang 2011), it is apparent that the disyllabic cluck (*ee-chip*) is used by the female Grey Falcon when selecting and testing a nest-site (see Jackson 1919); i.e. it has specific contexts. An alleged 'cluck-cluck-cluck' was thereafter, for decades, adopted as the supposedly typical Grey Falcon call (e.g. Cayley 1965 and even later field guides, into the 1980s), until recent field guides and other work (e.g. Slater 1970; Marchant & Higgins 1993; Falkenberg 2011) determined the Peregrine-like cackle as the most typical call. A sharp, disyllabic *kitt-kit* by an aerially displaying, apparently male Grey Falcon (Hall 1974, overlooked by Marchant & Higgins 1993) is evidently the male version of *ee-chip*. An alleged 'plaintive whistle' when circling (but not defending) a nest with eggs, being climbed by a human (McGilp 1934, cited by Marchant & Higgins 1993), has not been reported by recent observers familiar with the species (e.g. Cupper & Cupper 1980, 1981; Hollands 1984; Falkenberg 2011). Recent observers have reported the defensive cackle given by Grey Falcons defending (i.e. swooping) nests with eggs or nestlings against a human climber (Cupper & Cupper 1980, 1981; Olsen & Olsen 1980; Falkenberg 2011), which suggests that McGilp's birds may have been Black-shouldered Kites, which *do* utter plaintive whistles (e.g. Marchant & Higgins 1993).

There is little previous information on the Grey Falcon's foraging (searching) behaviour (Marchant & Higgins 1993). Observations at Alice Springs suggest that searching flights are initiated variously from near ground level (commonly), at treetop level, or high in the air. These observations support the view that the Grey Falcon performs fast contour-hunting, transect-hunting, and soaring and prospecting to search for prey (Marchant & Higgins 1993; Harrison 2000), the last possibly to commute long distances to hunting grounds. The small dietary sample in this study was entirely small parrots, consistent with recent quantified information (Aumann 2001b; Falkenberg 2011; Sutton 2011). The Grey Falcon is a highly specialised bird-hunter; e.g., it had the lowest dietary diversity index among a community of 11 raptor species, <300 km west of the present study site (Aumann 2001b).

The present attempt to quantify the Grey Falcon's breeding cycle was terminated by nest failure, before incubation sex-roles and time-budgets could be established by observation of food deliveries. Thus, although there are general (unquantified) accounts of the Grey Falcon's parental behaviour, sex-roles and vocalisations during the incubation and nestling stages (Cupper & Cupper 1980, 1981; Hollands 1984; Falkenberg 2011), there is still scope for a fully quantified

(time-budgetted) account of an entire breeding cycle from nest-selection and prelaying behaviour, through incubation and the nestling period, to the post-fledging period and independence of the young. There is also scope for a more in-depth study of vocalisations (ideally with sound-recordings) and their contexts, and comparison with better-known falcons, in order to develop an objective method of describing and cataloguing the various calls.

Observations suggest that incubating Grey Falcons are tolerant of close human approach, but frequent flushing may encourage nest failure because the nest contents are then vulnerable to weather or predation (e.g. Falkenberg 2011). Breeding Grey Falcons are cryptic and may avoid detection by humans, even if flushed from the nest, as found by Falkenberg (2011). The present study suggests that repeated 'ticking' attempts by inexperienced observers may be detrimental to the Falcons' breeding attempts, e.g. the flushing episode and birdwatchers driving right up to the river bed. The Falcons could have been observed without disturbance by approaching carefully from >200 m away on foot, noting their alert distance (pre-flush attention to the observer), and retreating outside that distance to watch by telescope; and by refraining from walking in the river channel among the various occupied raptor nests.

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Editor's note:

Following the critique by Schoenjahn (2010, *AFO* **27**, 49–58) of the many erroneous literature claims of Grey Falcons, another example has come to light, discussed here using Schoenjahn's format.

Barrett (1994), at Blue Water Forest Reserve, near Townsville (coastal Qld): a grey raptor observed at close range in rugged forest terrain (i.e. in classic Grey Goshawk range and habitat); no description provided. Undoubtedly Grey Goshawk.

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