

BREEDING OF THE WHITE-RUMPED PYGMY FALCON

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ABSTRACT.—A nest of the White-rumped Pygmy Falcon, *Polihierax insignis*, was observed in Thailand for five days during the incubation period. The nest site in a woodpecker hole and the white eggs are described for the first time. Observations on diet, hunting and breeding behavior are also described. The systematic position of the species is discussed. Received 8 May 1997, accepted 4 Oct. 1997.

The breeding biology of only one species of pygmy falcon, the African Pygmy Falcon (*Polihierax semitorquatus*), has been studied in any detail (Maclean 1970). We report on five days of observation at a nest of its congener, the White-rumped Pygmy Falcon (*P. insignis*). The six other very small falcons, falconets in the genera *Spiziapteryx* and *Microhierax*, are also relatively little known (Bierregaard 1994, Clark 1994, Kemp and Crowe 1994).

We watched White-rumped Pygmy Falcons near the headquarters of the Huay Kha Khaeng Wildlife Sanctuary, western Thailand, during 28 March to 1 April 1996. A nest of *P. insignis* had been photographed nearby seven years earlier, at about the same time of year (Pilai Poonswad, pers. comm.). Nakhasathien and Stewart-Cox (1990) describe the sanctuary in detail.

METHODS

We discovered an active nest about 1 km south of the headquarters, close to the start of the Khao Hin Dhaeng Nature Trail, at 15° 36' 10.9" N, 99° 19' 1.5" E and an altitude of 210 m a.s.l. The nest was discovered at 12:50 on 28 March after watching for a pair of pygmy falcons that had been seen copulating in the area several weeks before (Thannyalax Suntaramat, pers. comm.).

The nest area was watched from 12:00 to 19:00 on 28 March (except when erecting a blind at 14:00–15:00), dawn (06:00, local sunrise 06:25) to dusk (19:00, local sunset 18:25) on 29 March, 06:00–12:00 and 14:00–19:00 on 30 March (for photography) and on 31 March, and 06:00–11:00 on 1 April. Three man-days also were spent searching the surrounding area for neighboring pairs, including the use of playback of the

distinctive male song. At the end of the study, the nest tree was climbed and the cavity inspected.

Observations were made at the peak of the hot dry season, with daily temperatures exceeding 40° C and only brief drizzle falling from the afternoon build-up of clouds. The pair were quite approachable and observations were made either on foot or from a ground hide of saplings and foliage erected 20 m south of the nest tree. A pair of 10 × 40 binoculars and a 15–60× telescope facilitated observation. Vocalizations were recorded with an ECM-K100 microphone to a Sony WM-D3 cassette recorder and were analyzed with AVISOFT-SONOGRAPH PRO Windows version 2.5 software.

RESULTS

Nest site.—The nest tree was an emergent 24 m-tall *Shorea obtusa* tree with a dbh of about 90 cm, one of several larger trees along the crest of a low ridge in dry deciduous dipterocarp forest. Trees in the forest were about 15–20 m high, with some larger emergents, and the overall impression of the vegetation was a dense 2 m-high scrub layer, with numerous bare tree trunks up to about 10 m, topped by an uneven and partly open canopy. The ridge with the nest tree was about 1 km east of the foothills of the Thanon Thongchai mountains, which run north-south down the Thailand-Myanmar border. The foothills were covered in denser, taller bamboo and evergreen forest.

The nest was in an old woodpecker hole on the north-east side of the trunk, the entrance being 12 m above ground and 2 m below where the first branches emerged. Below and on the same side as the falcon nest, at between 7–10 m, were two old overgrown and four new holes in which three (two males and a female) Greater Flameback (*Chrysocolaptes lucidus*) woodpeckers returned to roost each evening. The tree, which appeared healthy up to the lowest hole, had growths on the trunk

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TABLE 1. Hourly rates in *Polihierax insignis* of prey delivery to the female by the male and of hunting from the nest by the female, during three days of observation within the incubation period.

Sex	Delivery or hunting rates per hour, starting at:													Number of events
	06	07	08	09	10	11	12	13	14	15	16	17	18	
Male	0.7	0.7	1.3	0.7	0.0	0.0	1.0	1.0	0.5	1.3	0.3	0.7	0.0	22
Female	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	3.5	1.3	1.7	0.3	0.0	19
Days observed	3	3	3	3	3	1	2	2	2	3	3	3	3	

above, sparse foliage and a large dead limb above the canopy.

The oval nest entrance was 9 cm high by 8 cm wide and the nest floor was 9 cm below the lower lip of the entrance. The nest cavity, which had a diameter of about 32 cm, was lined with fine wood chips. Overall, the nest hole was similar to the woodpecker roost holes below. On the afternoon of 1 April, the nest contained two plain white, rounded-oval eggs that measured 35.4×25.6 mm and 32.5×24.7 mm.

Incubation behavior.—The female incubated during the day, although the male sometimes entered the cavity briefly during or after delivering food. The male roosted in the nest with the female, entering at 18:45 on 28 March, leaving again at 06:09 on 29 March and returning to sleep at 18:47 that evening. Both entered the nest at 18:55 on 1 April as soon as the nest inspection was completed.

The female spent most of the time in the nest cavity, only coming to the entrance when hearing the male or other birds nearby (see below). During the heat of the day she also perched at the nest entrance, from which she sometimes pursued nearby prey. Rates of prey delivery and capture (Table 1) indicate that, except for a late morning break, the male provisioned the nest throughout the day and that the female hunted from the nest in the heat of the afternoon.

Hunting behavior and diet.—We never saw the male hunt, despite numerous attempts to follow him as he left the nest area. His small size made it difficult to detect him as he seemed to hunt from low perches or from deep within the foliage. Judging from where he disappeared and then re-appeared with prey, the male appeared to hunt within about 400–600 m of the nest. Prey delivered to the nest by the male included eight lizards, a cicada, an unidentified insect and 12 unidenti-

fied items. Most of the lizards appeared to be *Draco* flying lizards (or at least slender agamids with long tails, large hind legs and, in two individuals, expandable throat flaps). Unidentified items were small and were probably insects. The male of a neighboring territory was seen to catch a *Draco* lizard at 13:20 on 1 April, darting 25 m from a perch 3 m up to snatch the lizard from 2 m above the ground off a 6 cm diameter branch of a small tree.

The female confined her hunting to within 50 m of the nest tree, striking either from the nest entrance or from a nearby perch after a previous attempt. Most prey ($N = 17$) were not identified because they were consumed where captured, usually behind foliage, or were carried rapidly to the nest. A cicada and a grasshopper were identified and probably most prey was of this size, given that consumption time was usually less than a minute and no large prey, such as lizards, was seen being carried to the nest.

We saw the female attempt to capture prey 13 times. Six attempts were to the ground, four into foliage, and three to a branch or twig. Strike distances estimated to the nearest 10 m were 40 m (1), 30 m (1), 20 m (2), 10 m (6) and 0 m (vertical, 1). Four of these strikes, one to the ground among dry leaves and three into foliage (31%), were successful. Two of the successful strikes were upwards from the perch, at the underside of the foliage, and one downwards.

Calls and displays.—The male repeated a shrill flight call *chwirr chur chur* (Fig. 1a), singly or in series, when flying to the nest with food. The female responded with a monotonously repeated and less harsh *cheep* call (Fig. 1b). This call was also used when the male was absent. It appeared to be a food solicitation call since it was often given for long periods when the female perched at the nest entrance and hunted for herself in the after-

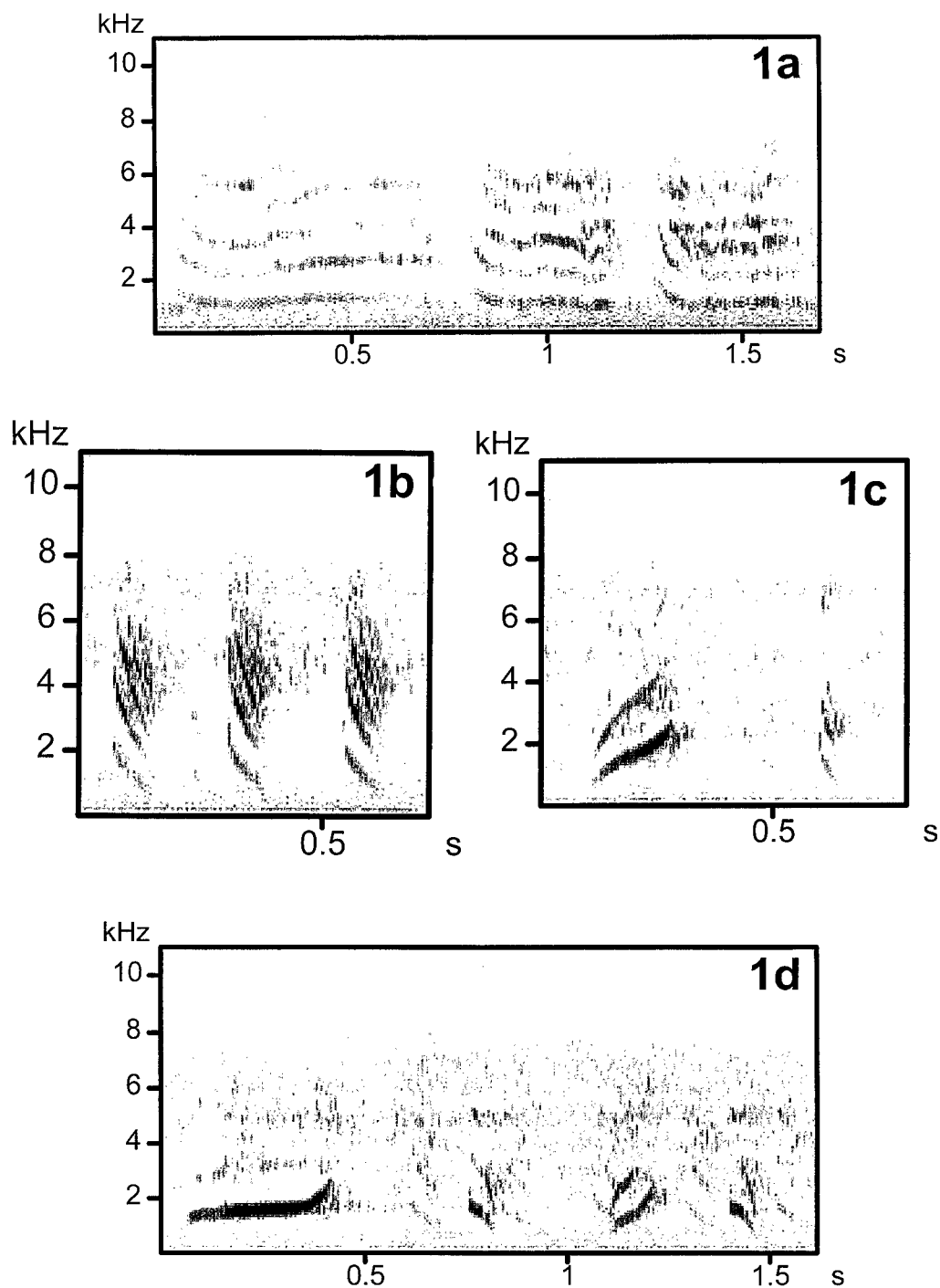


FIG. 1. Sonograms of the main calls of *Polihierax insignis*. Male flight call (1a), female food solicitation call (1b) and male song at low (1c) and high (1d) intensity. See text for further details.

noon. The intensity of the call was a soft purr when the female was alone (Fig. 1b), accelerating to a harsh screech when the female was perched next to the male carrying food. The female sometimes flew calling up to 200 m from the nest to meet the male and solicit prey.

After the flight call, and especially after presenting prey, the male often uttered a short musical song. This was delivered either in abbreviated form as a simple whistle-like phrase *wee-you* (Fig. 1c) or as a more developed series *wee-you-pity-you* (Fig. 1d). The latter somewhat resembles the *twee twee twip* song of the African *P. semitorquatus* (Maclean 1970; sonagram in Maclean 1993). The song was given either in the nest, if prey was presented there, or after returning to a nearby perch. The song was repeated, sometimes several times, especially if the female was out of the nest and perched nearby. The male also uttered a harsh insistent *sheer*, either as a single note in alarm or rapidly repeated if nervous. This was often given as he hung at the nest entrance and once when he was dived at by an Indian Cuckoo (*Cuculus micropterus*) away from the nest area.

The male carried prey in his feet until near the nest and then, at a perch or in flight, transferred it to his bill. This enabled him to land at the nest entrance or on a perch with the food ready to pass to the female. Several times the male refused initially to pass prey to the female. Sometimes he ate some himself and at least twice he eventually consumed the whole lizard without feeding the female. Once the male appeared to threaten the female, mantling with wings drooped and three-quarters open, after which he flew off to eat the prey. Such encounters were noisy, accompanied by loud soliciting (female) and singing or alarm calls (male).

The pair clung at the nest almost like a woodpecker or parrot, braced on their tails, and they were also able to run up the trunk without opening their wings. Twice the male landed lower down on the nest trunk without food and scuttled between the woodpecker roost holes, entering one or other for a brief period and even calling from within. Their antics on the nest trunk or when trying to snatch prey from branches indicated unusual flexibility of their leg and toe joints.

Both birds performed exaggerated head bobbing when examining potential prey. Apart from mantling prey, no other display postures were recorded under natural conditions. However, playback of selected calls were performed once each on the male when he was about 200 m away from the nest. Playback of the male flight call and female solicitation call produced no visible reaction. Playback of the male song caused the male to fly towards the nest, stopping several times en route to sing in reply and once, during an intense period of 6–8 songs, to pump his tail up and down five times through about 45°; the effect, with the wings drooped, was to flash the white rump and display the white-spotted tail.

One evening, at 17:41, the female emerged from the nest to perch with her plumage fluffed. She then preened vigorously before flying east towards a sandy track. After 15 min she returned to the nest without food and when the track was examined later, signs on the sand suggested recent dust bathing. A pair of pygmy falcons had been sketched one evening a few months earlier while dust bathing together on a sandy track just north of the headquarters (Thannyalax Suntaramat, pers. comm.).

Presence of and reaction to neighbors.—No neighboring pairs of pygmy falcons were found by searching. However, on 1 April at 13:20 we were called to see a male in the grounds of the headquarters. We watched it catch a lizard, consume the forequarters and then carry the hindquarters off in a north-easterly direction. Although no nest was located, the behavior suggested a second breeding pair, probably neighbors, with a nest at least 1.5 km north of the study nest.

The falcons at the nest were especially aggressive to a pair of Hill Mynahs (*Gracula religiosa*) that visited the nest tree as many as five times a day. The female always came to the nest entrance when she heard the mynahs call upon landing in the nest tree and once, when she had hunted away from the nest, she dived at the mynahs on her way back to the nest entrance. The female also came to the entrance on hearing a Shikra (*Accipiter badius*) calling overhead, or when Hair-crested Drongos (*Dicrurus hottentottus*), themselves building a nest 50 m away, uttered alarm calls.

At least three pairs of Shikra had nests

within earshot of the falcon nest, the nearest about 400 m away, and the area was also visited several times by Collared Falconets (*Microrhierax caerulescens*) and Black Baza (*Aviceda leuphotes*). At least five other species of large woodpeckers also visited the falcon nest area and could have provided alternate nest sites: Common Flameback (*D. javanense*), Greater Yellownape (*Picus flavinucha*), Lesser Yellownape (*P. chlorolophus*), White-bellied Woodpecker (*Dryocopus javensis*) and Black-headed Woodpecker (*P. erythropylus*).

DISCUSSION

Our observations corroborate most aspects of a recent summary of the biology of the White-rumped Pygmy Falcon (Clark 1994). They emphasize the importance of lizards in the diet, especially as large prey items delivered to the nest when breeding. Specialization for hunting on trunks and foliage may explain the limited overall range of this species in dry deciduous forests. Such arboreal and terrestrial hunting differs notably from the more aerial hunting above the canopy of sympatric *Microrhierax* falconets (Kemp and Crowe 1994).

However, previous reports of the White-rumped Pygmy Falcon nesting in old stick nests and laying off-white eggs (Swann 1933, Clark 1994) appear erroneous; the white eggs placed in a cavity nest, as described here, are typical of all other Old World falconets.

Phylogenies of the 60 species of Falconidae suggests three phylogenetic and ecological clades: (1) caracaras (polybori, 8 species), (2) forest and laughing falcons (micrasturi, 6 species) and (3) true falcons (falconi, 46 species) [Amadon and Bull 1988, Kemp and Crowe 1990, Griffiths 1994 (who includes the laughing falcon with the true falcons)]. The first two clades are Neotropical in distribution, but the true falcons are cosmopolitan. The true falcons include the three genera and eight species of pygmy falcons and falconets, which are scattered across the Neotropical, Afrotropical and Indomalayan biogeographic realms (Amadon and Bull 1988). Phylogenetically, these diminutive species represent basal clades to the 38 species of larger falcons and kestrels in the genus *Falco* (Kemp and Crowe 1990, Griffiths 1994).

The two species in the genus *Polihierax* occur on different continents (Africa, Kemp

1994, and Asia, Clark 1994). Both have marked sexual dimorphism, the male with more gray and the female with more rufous markings. Both pump the tail in display, the African species more frequently (Maclean 1970), but so do some true falcons in the Americas and on some Indian Ocean islands (Kemp and Crowe 1994), including the Madagascar Kestrel (*F. newtoni*, Siegfried and Frost 1970). Males of both *Polihierax* species also utter a distinct song of similar structure. *Polihierax insignis* has been separated previously, on tail and primary dimensions, into the genus *Neohierax* (Swann 1922). This separation is supported by a phylogenetic study of syringeal morphology (Griffiths 1994). In a further distinction, the African *P. semitorquatus* nests in cavities within the nest structure of other birds, in the same way as the South American Spot-winged Falconet (*Spizapteryx circumcinctus*; Bierregaard 1994), while the Asian *P. insignis* is now known to nest in tree holes excavated by other birds, like the five species of Asian *Microrhierax* falconets (Clark 1994).

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