

A Nest Record of the Bat Hawk *Macheiramphus alcinus* in Southern Thailand

Chanatip Ummee¹ and Chaiyan Kasorndorkbua^{1}*

The Bat Hawk *Macheiramphus alcinus* is an old-world sedentary raptor with three subspecies: *M. a. alcinus* in the Thai Malay Peninsula (extreme Myanmar, southern Thailand and peninsular Malaysia), Sumatra and Borneo; *M. a. anderssoni* in sub-Saharan Africa and Madagascar; and *M. a. papuanus* in Papua New Guinea (VAN BALEN *ET AL.*, 2003; CHRISTIE & FERGUSON-LEES, 2010). It is local and uncommon throughout its Southeast Asian range (EATON *ET AL.*, 2016; WELLS, 1999) although its global conservation status is Least Concern (BIRDLIFE INTERNATIONAL, 2023). It is the only crepuscular-diurnal bird that preys primarily on bats (MIKILA *ET AL.*, 2016). Bat Hawks have a direct relationship with the behavior and evolution of their prey, resulting in the unique morphology and biology, along with the limitations of weather and day-length (FENTON *ET AL.*, 1977; HARTLEY & HUSTLER, 1993; JONES *ET AL.*, 2012; MIKILA *ET AL.*, 2016). Long, slender wings adapt them for swift flight in chasing bats. Their wide gape allows them to swallow bats whole (JONES *ET AL.*, 2012). The Bat Hawk is the only diurnal bird of prey whose main prey is bats (MIKILA *ET AL.*, 2016). Bat Hawks are mainly active during the evening hours for a short period of the day, coinciding with the activity of bats (ECCLES *ET AL.*, 1969; BLACK *ET AL.*, 1979; HUSTLER, 1983). The breeding season of the Bat Hawk accords with the lactation period of tropical insectivorous bat, allowing them to obtain more food (RACEY, 1982; MCWILLIAM, 1987; RAUTENBACH *ET AL.*, 1988; LIM *ET AL.*, 2018). Information on the breeding biology of the species in Thailand is scant. A nest with a single chick was reported in the vicinity of the Hala-Bala Research Station (S. Tantitadapitak, cited in ROUND & JUKMONGKOL, 2002). That particular nest-tree was a tualang tree, *Koompassia excelsa*, which fell in 2023 (S. Thong-aree, in litt. 2024) (not the nest-tree of the present study). There is no detailed description of the eggs and brood of the Bat Hawk in peninsular Malaysia, though nest-building has been observed at one nest site near Kuala Lumpur in December, display and copulation at the end of May, active nests during July to September, and the fledging of a single young on 25 October (WELLS, 1999). The purpose of this study is to report in detail the nesting behavior of *M. a. alcinus* in Narathiwat Province, southern Thailand.

A nest of the Bat Hawk was observed in the rainy season of 2019, during July to October, in Hala-Bala Wildlife Sanctuary (5°47'N, 101°49'E), Waeng District, Narathiwat Province, southern Thailand (Fig. 1). Nest observation was performed between 9 August and 16 October. An observation hide was built on a hill to record brooding and prey delivery behaviors, approximately 100 m from the nest. The nest was closely observed throughout the daytime but mainly during afternoon and dusk. The total observation time was 293 hours and 50 minutes, using a 10×42 binocular, a 20–60× spotting scope and a digital camera. The nest was

¹ Laboratory of Raptor Research and Conservation Medicine, Faculty of Veterinary Medicine, Kasetsart University, Chatuchak, Bangkok, 10900 Thailand.

* Corresponding author. E-mail: chaiyan.k@ku.th

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built on a tualang tree, ~40 m high, with a diameter at breast height of ~190 cm, and a crown diameter of ~10 m. The nest was situated about 20 m from the ground. The tree was situated in tropical rain forest at an elevation of 76 m above sea level, and located within about 100 m of a stream, orchards, and rubber plantations of local people.

The beginning of the breeding season was assumed to be in July 2019 when a local person reported seeing the pair vocalizing around the nest. The nest was composed mainly of dry sticks and twigs (Fig. 2), with an external diameter of ~80 cm and a height of ~50 cm. Even after the brood had hatched, the birds still brought sticks to reinforce the nest: this was observed on three occasions (0942 h on 25 August, 1641 h on 14 September, and 1039 h on 26 September).

Hatching occurred on 9 August with one single white-downed nestling seen, which fledged on 16 October, giving a nestling period of 68 days. However, the clutch size was unknown. The parent birds had slight sexual dimorphism, with the slightly smaller male showing a thinner black mesial stripe than the female (Figs. 3 and 4). They shared brooding duty. When not brooding, the parent birds perched on the nest-tree close to the nest. Hunting started between 1725 and 1804 h, before nightfall. This corresponds with the study of Bat Hawks in Africa which also hunted at approximately the same time (HUSTLER, 1983). The median duration of each hunting bout was 4.62 min (10 sec–14 min; $n = 87$). The median number of hunting bouts per evening session was 4.21 (1–8 times; $n = 27$). On a single occasion, late morning feeding behavior was observed, at 1110 h, 11 September 2019. This was probably the result of insufficient feeding the previous day due to the weather (heavy rain).

The adult birds shared brooding and feeding the nestling. They spent an average of 1.89 ± 2.56 (SD) min (5 sec–12 min; $n = 100$) feeding the young which had an ingestion time average of 19.35 ± 48.66 (SD) sec (3 sec–5 min; $n = 82$). During the first two weeks, the nestling could not swallow the prey whole and an adult dismembered the prey into smaller pieces, feeding it to the young; this resulted in longer feeding times. By the start of week 3, the young could swallow prey whole within just a few seconds. The nestling began to develop pin feathers of the upper wing coverts during week 4, and primaries and secondaries in week 5. During week 4, the nestling began to stand erect and practiced wing flapping.

The average number of prey consumed per day was 4.04 ± 1.45 (SD) bats (1–8 bats; $n = 27$), similar to that found by HUSTLER (1983) in Zimbabwe. In the present study, the prey were almost entirely bats: 103 small- and six medium-sized. This differed from the studies of FENTON *ET AL.* (1977) and GOODMAN *ET AL.* (2016), both of which found that although bats constituted the main diet, the Bat Hawk also preyed on reptiles, birds, and insects. In the present study, only a single bird prey item (species uncertain) was delivered at 1818 h on 2 September. According to GOODMAN *ET AL.* (2016), bird-hunting behavior may be opportunistic, taking place when the number of bats caught is insufficient.

The average time between the onset of hunting by the adult to the last feeding of the nestling of the day was 31.2 ± 15.8 (SD) min (1–68 min; $n = 23$), and the average time from the first to the last provisioning of young per day was 25.5 ± 11.0 (SD) min (3–41 min; $n = 26$). After the 3rd week after hatching, the nestling was able to consume up to eight prey items within 29 min. This compares with seven bats within 20 min reported by ECCLES *ET AL.* (1969). BLACK *ET AL.* (1979) found that the hawks fed on seven insectivorous bats within 18.3 min, and the Bat Hawk had an average kill-to-ingestion rate of 6 sec.

The parent birds showed nest protection behavior against fly-bys by Crested Serpent Eagle *Spilornis cheela*, Bushy-crested Hornbill *Anorrhinus galeritus*, and Rhinoceros Hornbill

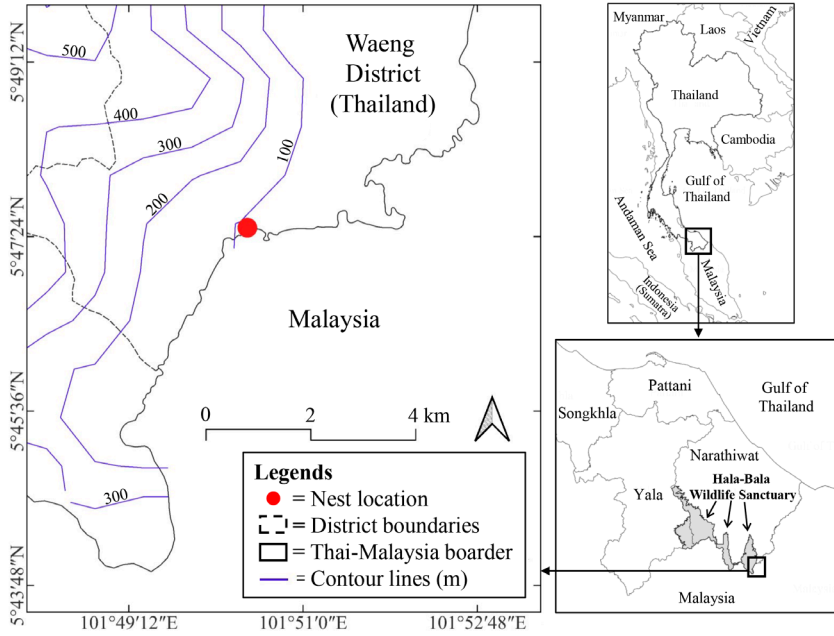


Figure 1. The location of the study site in Hala-Bala Wildlife Sanctuary, Waeng District, Narathiwat Province, southern Thailand.

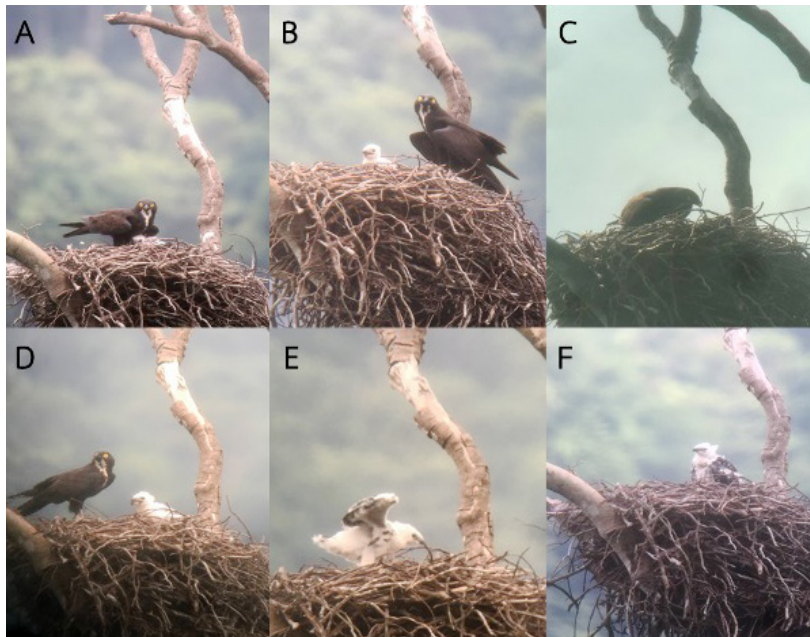


Figure 2. Parent birds and the nestling on the nest (A & B). A parent bird moving a stick on the nest in the morning (C). The nestling swallowing prey (D). The nestling flapping its wings (E). The nestling at 4 weeks and 4 days old after hatching (F). Photographs by Chanatip Ummee.



Figure 3. Parent birds in the nest. Photograph by Sumate Thitiphuree.



Figure 4. Parent birds. Photograph by Chaiyan Kasorndorkbua.

Buceros rhinoceros. On a single occasion one of the adults chased off a Rhinoceros Hornbill that came to perch on the nest at 1720 h on 14 September. The nestling also crouched down inside the nest when seeing or hearing large birds of other species in the vicinity.

Fledging by October may be beneficial, and perhaps coincide with peak prey abundance, since tropical insectivorous bats tend to increase in number during the rainy season when their insect prey is also at a peak (RACEY, 1982; McWILLIAM, 1987; RAUTENBACH *ET AL.*, 1988; LIM *ET AL.*, 2018). This also accords with the study of HARTLEY & HUSTLER (1993) in which the African Bat Hawk *M. a. anderssoni* benefited from the reproductive seasonality of bats. Because the species' breeding season during September and October occurs when female bats are pregnant, this would likely increase the chances of successful hunting.

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