

CONSERVATION REPORT

Safeguarding a nest of the Critically Endangered Helmeted Hornbill *Rhinoplax vigil* in Kalimantan, Indonesia, with notes on the nesting behaviour

ADAM E. MILLER, RIKARDUS, MAREGA, INDAH SARTIKA SARI, NOVIA SAGITA, DEMI GARY & SADTATA NOOR ADIRAHMANTA

Asia's largest hornbill in crisis

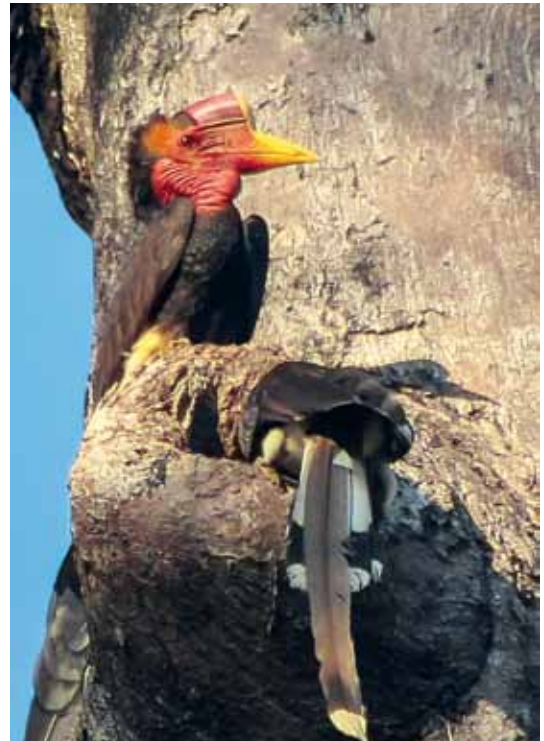
The Helmeted Hornbill *Rhinoplax vigil*, one of the most iconic birds of South-East Asia, inhabits lowland rainforests in Borneo, Sumatra, the Malay Peninsula, southern Myanmar and southern Thailand (Collar 2015). It occurs in low densities across its range, both sexes are long-lived and the rate of reproduction is slow (Bennett *et al.* 1997). To raise a single chick, the female has been known to incarcerate herself inside the nesting cavity for approaching 180 days (Kinnaird & O'Brien 2007). In addition, the species requires large areas of old-growth pristine rainforest for survival and reproduction. Pairs can only nest in large trees with a protruding, upward-facing cavity (typically where a large branch has broken off the main trunk) that can bear the male's weight and does not damage his long central tail-feathers when he is feeding the incarcerated female (Thiensongrusamee *et al.* 2005, Kaur *et al.* 2018).

All hornbill species play a critical role in tropical ecosystems through seed dispersal (Howe 1977, Terborgh 1986). In their turn the plants, which are dependent on the hornbills for their successful propagation, themselves perform a critical function as they are the lifeline to sustain frugivorous animals and communities through periods of resource scarcity. The variety and number of fruit species varies from location to location. For example, in southern Thailand 93 fruit species from 33 families depend on 10 species of hornbill (Kitamura *et al.* 2011), in Bornean forests 123 species from 22 families depend on five hornbill species (Leighton 1982), and 64 species from 15 families depend on four hornbill species in Sumatra (Hadiprakarsa & Kinnaird 2004). Given the large fig intake of hornbills, with relatively long fruit digestion times—an hour or more—and daily flight distances well over several km, hornbills are one of the best groups of fauna at seed dispersal in the tropics (Kitamura 2011). Little data is available but it is fair to assume that the Helmeted Hornbill, the largest Asian hornbill, flies great distances,

occupies a large home range and consumes fruit from a variety of species, which supports the hypothesis that the species is one of the most important seed dispersers in tropical rainforests.

The morphology of the Helmeted Hornbill is unique in that it possesses a thick, dense casque compared with all other hornbills, which have hollow casques. The casque is solid keratin—10% of a bird's body weight (Kemp *et al.* 2019)—and, although extremely dense, is softer than elephant

Plate 1. The pair of Helmeted Hornbill *Rhinoplax vigil* investigating their nest-site in West Kalimantan, Indonesia, early March 2018. Note the typical characteristics of a Helmeted Hornbill nest-site in which the cavity angles outwards, facing upwards, allowing the male to perch on the upper rim and provide food to the female once she is sealed inside.



dentine, making it easier to carve. Demand for the species over the past decade appears to have escalated, with the unique yellow-red carvings from the casque selling for as much as five times the price of elephant ivory on Chinese black markets (Collar 2015). Indonesian authorities became aware of an increasing demand for the casques when they discovered attempts to smuggle hundreds out of the country in 2012 (Bale 2018). Data recorded between 2010 and 2017 showed that a minimum of 2,878 casques and hornbill products had been seized (Jain *et al.* 2018a,b). Beastall *et al.* (2016) reviewed seizure records indicating that between March 2012 and August 2014 no less than 2,170 heads were seized from illegal traders in Indonesia and China alone. This massive increase in trade, combined with the Helmeted Hornbill's dependence on old-growth rainforests for survival, have caused the species to spiral down from Near Threatened in 2012 to Critically Endangered in 2015 (BirdLife International 2019). Despite its Critically Endangered and legally protected status in Indonesian and Malaysian Borneo, the Helmeted Hornbill is still hunted throughout its range.

Breeding habits and attendant risks

There is relatively little data on the breeding biology of the Helmeted Hornbill. Data from Thailand, Peninsular Malaysia and Borneo indicate that the species nests in large trees at altitudes between 300 and 800 m, using cavities between 26 and 70 m high in the tree (Thiensongrusamee *et al.* 2005, Chong 2011, Kaur *et al.* 2018). Chong (2011) noted that nest sealing occupied a 14-day period from late February into early March in Peninsular Malaysia; this nest was visited regularly until 8 August when the nest seal was found to be broken and both the female and juvenile had left. During the previous visit on 25 July, the male was feeding both the female and chick in the nest—roughly 154 days after the initial sealing. Kaur *et al.* (2018) monitored a nest in Sabah, Malaysian Borneo, and found that, as in our study, the nesting cycle appeared to commence in May, with the female exiting the nest in September. Other studies following active nests in Sumatra found that they were generally inhabited between January and August, although some were occupied as early as November. The skimpy data available indicate that there is considerable variation in the timing and length of the breeding season from the initial sealing of the nest to the female departing and the chick fledging (Thiensongrusamee *et al.* 2005, Chong 2011, Kaur *et al.* 2015, 2018).

Helmeted Hornbills are at the highest risk of predation during the nesting period; historically, throughout its range poachers have used the tactic

of locating nesting cavities to successfully hunt the birds (Poonswad *et al.* 2005). During Yayasan Planet Indonesia's (hereafter Planet Indonesia—see below) work with local hunters in West Kalimantan, many of them explained that outside the nesting season the species can be extremely difficult to hunt. However, after a potential cavity is located, poachers will wait either for pairs to visit the site or, if the female is already sealed inside, for visits by the male to feed the female and chick. The male often announces his arrival with a loud, conspicuous call, making an easy target for poachers (Bale 2018).

Helmeted Hornbill nesting behaviour in West Kalimantan (the location of the nest site is withheld for security reasons)

In February 2018, on their last day of fieldwork at the end of a six-month project in West Kalimantan province, the Biodiversity Research Team from Planet Indonesia heard a different variation of the Helmeted Hornbill call. Instead of the typical loud, well-spaced series of quickening *hoop* notes ending with a harsh, cackling manic laugh, this different call was described by the team as more sporadic than the usual call, faster, and increasing in speed and pitch. The team attempted to find the source of the call and at about 10h45 one of them found a large cavity about 34 m up in a 50 m tree. A male Helmeted Hornbill arrived at the cavity, making the usual call; however, he appeared to be summoning the female, as when she arrived she was making the faster, high-pitched, sporadic call. This call was only made as the female approached the nesting cavity and may be a useful tool to help confirm that Helmeted Hornbills are nesting in an

YAYASAN PLANET INDONESIA

Yayasan Planet Indonesia is a grassroots conservation non-profit organisation based in West Kalimantan, Indonesia; it was founded as recently as 2014.

Planet Indonesia's mission statement reads:

We conserve at-risk ecosystems through village-led partnerships. We create shared solutions that catalyse holistic conservation while improving human well-being.

It is immensely encouraging that, ahead of the publication of the Indonesian 10-year plan to save the Helmeted Hornbill, Planet Indonesia had already found a way to protect the species in West Kalimantan. It is also very satisfying to know that Planet Indonesia is happy to share their knowledge with other like-minded organisations. See page 9 for a report on the activities of 'Aceh Birder' members during a visit to Planet Indonesia headquarters in Kalimantan, Indonesia, and visit the Planet Indonesia website at www.planetindonesia.org for more information on the NGO and its work in Indonesia.

area. This unusual call has been heard again at two other sites in the same area in 2019, indicating that the species may be breeding or investigating nesting cavities at several sites within the area.

The site was revisited three times between March and May by both the Planet Indonesia Biodiversity Research Team and their Wildlife Protection Unit. The female was sealed into the nest between 18 May and 3 June. The nest was then observed for six days a month by the Biodiversity Research Team in July and August and for two periods of six days in September, between 04h30 and 16h30 each day. When the Biodiversity Research Team was not on site, Planet Indonesia Wildlife Protection Units patrolled the nest site and surrounding area. Thanks to Planet Indonesia's community-based work, the nest site and surrounding 50 ha were deemed by customary law a 'no-disturbance and harvest zone'—*zona perlindungan khusus*—to provide further protection from possible hunting and disturbance by the inhabitants of the nearest village. Although the nest was located inside a protected area, there were communities living there long before the protected area was established; they have their own laws and regulations related to forest-use. Much of Planet Indonesia's work has been to revitalise these laws, which in many cases had been forgotten or fallen out of use by the early 1990s. One of these laws was utilised to leverage protection of the nesting area by working with village leaders and the customary law leader *Kepala Adat* to provide a declaration to the community about the nesting site and protection relating to it and the surrounding forest. During the same period Planet Indonesia also worked with the West Kalimantan authorities to facilitate conservation agreements and declarations between villages relating to natural resource management, including hornbill conservation, in six villages and sub-villages near the nesting site and between eight villages and sub-villages in the west part of the reserve, where the species appears to be common although nesting sites have yet to be identified.

The average number of visits by the male during the six-day periods decreased as the nesting time progressed, with the male visiting the nest cavity about nine times a day in the early stages, soon after the female was sealed inside, but only about four times a day in the final stages, shortly before the female left the nest and the chick fledged. The team also recorded data on food provision by the male to the female throughout the nesting period. A total of 1,718 fruits and 45 non-vegetative items (snakes, mice, lizards, etc.) were provided over the four sampling periods (Figures 1 & 2). Unfortunately, our team did not

Table 1. Summary of the number and frequency of visits by the male hornbill during the four six-day sampling periods between July and September 2018.

Observation period	Total days	Total male visits
3–8 July 2018	6	53
8–13 August 2018	6	40
8–13 September 2018	6	26
19–24 September 2018	6	26

Table 2. The estimated percentage (by number of items) of non-vegetative food and fruit provided during each observation period.

Observation period	Non-vegetative food	Fruit
July 2018: days 1–6	6.2%	93.8%
August 2018: days 7–12	1.6%	98.4%
September 2018: days 13–18	1.2%	98.8%
September 2018: days 19–24	0.9%	99.1%

have the botanical expertise to identify most fruits to species level.

Throughout the observation periods the amount of fruit provided per day remained relatively constant, with an increase for a short time in August. When looking at protein sources provided to the female (snakes, mice, geckos, lizards, etc.), the overall provision rate decreased with time, with the male providing relatively high levels of protein during the first sampling period and relatively low levels just prior to the chick's fledging.

Unfortunately, we did not observe the chick fledging on 25 September as the chick appears

Plate 2. The male and female Helmeted Hornbill made frequent visits to the site between March and May 2018 prior to nesting, 7 March 2018.



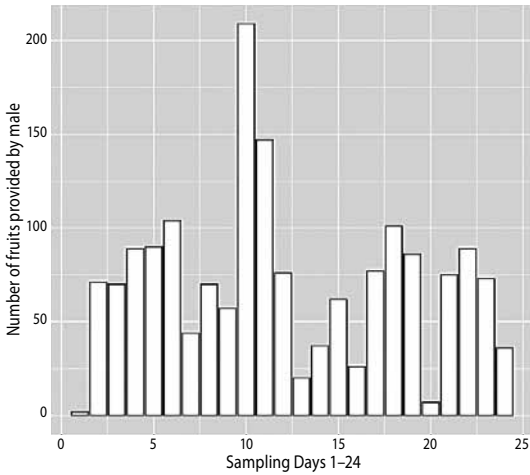


Figure 1. The number of fruit provided each day during four sampling periods, each six days long: a total of 24 days.

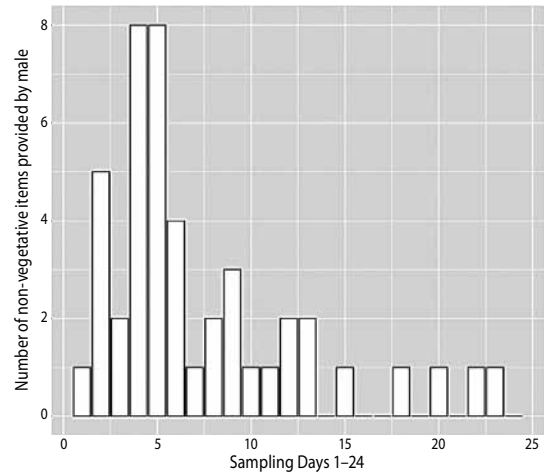


Figure 2. The number of non-vegetative items provided each day during four sampling periods, each six days long: a total of 24 days.

to have left the nest in the late afternoon, during a switch between our teams. The next day, our team observed the pair and the chick together near the nest. This is a novel observation as in other studies, e.g. Kaur *et al.* (2018), the female typically left the nest first and the pair fed the chick for some days before it fledged. In our case, the female and chick both left the nest within a few hours of each other.

Our observations are in no way comprehensive and in many cases our team could not identify the food provided due to lack of botanical knowledge and limitations in equipment. However, they provide basic insights into the nesting behaviour of Helmeted Hornbills and, as far as we are aware,

Plate 3. Between May and September 2018 the female was sealed inside the nesting cavity and the male made daily visits, 9 July 2018.

SHAVEZ CHEEMA, 1 STOP BORNEO WILDLIFE & YAYASAN PLANET INDONESIA



the first data of its kind to be published from West Kalimantan province, Indonesia.

Discussion and conclusions

This study provides basic but in some parts novel insights into Helmeted Hornbill nesting behaviour in Indonesian Borneo. Relatively little data on the species’s breeding behaviour exists, potentially leading to difficulties and shortcomings in habitat management for this Critically Endangered species. Our study suggests that the breeding season in western Kalimantan commences in May, which aligns with observations by Kaur *et al.* (2018) of a Helmeted Hornbill nest site in Sabah, Malaysian Borneo, between 2013 and 2017.

Plate 4. Male with Khao Stick Insect *Phaenopharos khaoyaiensis*, 3 July 2018.



RIKARDUS, YAYASAN PLANET INDONESIA



Plates 5 & 6. Examples of fruits found below or around the nest-site, dropped or disposed of by the male during visits to the nest; most fruits appeared to be *Ficus* spp., 13 August 2018.

The breeding period is a double-edged sword for Helmeted Hornbills: whilst being the crucial time for the propagation of populations, it is also a very vulnerable period for the species due to the high risk of poaching. The species's high dependence on large old-growth trees with cavities having particular characteristics creates very specific habitat criteria. Due to the high levels of disturbance throughout their range it is possible that many populations now occur in disturbed forests with few nest-sites, resulting in a stagnating, ageing population unable to breed. These factors, combined with the high risk of anthropogenic exploitation, are a recipe for continued population decline. A better understanding of Helmeted Hornbill breeding habits will allow for better habitat management, anti-poaching measures and ultimately a more holistic approach to *in situ* conservation of the species.

A 10-year action plan—the output of a meeting of the Helmeted Hornbill Working Group in Sarawak, Malaysia, in May 2017 (Jain *et al.* 2018a,b)—was launched in Bangkok in August 2018, representing a major milestone in the conservation of this species. This international action plan has been distributed to range states as a template and framework for the development of more specific conservation strategies. Indonesia has developed a country-specific 10-year action plan—*Strategi Rencana Aksi Konservasi*—which was launched nationally in October 2018 as well as regionally in Sumatra and Kalimantan. We applaud the government's efforts to push for the conservation of Helmeted Hornbill through a comprehensive plan to combat the illegal trade and protect the species *in situ*. Jain *et al.* (2018b) summarised how Planet Indonesia's site-level activities in the course of executing this project in West Kalimantan province secured this nest-site and the surrounding land and safeguarded it from poaching through the development of village-led patrol and research teams.

We recommend that conservationists and managers assess forest integrity at priority sites to evaluate the potential for a 'safe haven' to support a thriving population of Helmeted Hornbills. Moreover, when potential breeding sites are identified we encourage NGO's, communities and governments to work together to protect these critically important trees and habitats to ensure population persistence. Planet Indonesia took action to protect this single pair by rotating research teams and patrol units for direct nest protection and worked with management authorities and local communities to create land agreements around the nesting tree. We emphasise the importance of breeding sites and the vulnerability of this species in the breeding season. We recommend that protected area managers, private land-owners/companies and NGO's working in areas identified as 'safe havens' should prioritise nest-site identification and protection as this is a critical window for preventing poaching activities.

References

- Bale, R. (2018) Poached for its horn, this rare bird struggles to survive. *National Geographic Magazine*. Pp.112–127. Accessed at <https://www.nationalgeographic.com/magazine/2018/09/helmeted-hornbill-bird-ivory-illegal-wildlife-trade/> on 27/10/2018.
- Beastall, C., Shepherd, C. R., Hadiprakarsa, Y. & Martyr, D. (2016) Trade in the Helmeted Hornbill *Rhinoplax vigil*: the 'ivory hornbill'. *Bird Conserv. Internatn.* 26: 137–146.
- Bennett, E. L., Nyaoi, A. J. & Sompud, J. (1997) Hornbills *Buceros* spp. and culture in northern Borneo: can they continue to co-exist? *Biol. Conserv.* 82: 41–46.
- BirdLife International (2019) Species factsheet: *Rhinoplax vigil*. Accessed at <http://www.birdlife.org> on 03/11/2019.
- Chong, M. H. N. (2011) Observations on the breeding biology of Helmeted Hornbill in Pahang, Peninsular Malaysia. *Raffles Bull. Zool.* 24: 163–165.
- Collar, N. J. (2015) Helmeted Hornbills *Rhinoplax vigil* and the ivory trade: the crisis that came out of nowhere. *BirdingASIA* 24: 12–17.

- Hadiprakarsa, Y.-Y. & Kinnaird, M. F. (2004) Foraging characteristics of an assemblage of four Sumatran hornbill species. *Bird Conserv. Internatn.* 14: 553–562.
- Howe, H. F. (1977) Bird activity and seed dispersal of tropical wet forest trees. *Ecology* 58: 539–550.
- Jain, A., Lee, J. G. H., Chao N., Lees, C., Orenstein, R., Strange, B. C., Chng S. C. L., Marthy, W., Yeap C. A., Hadiprakarsa, Y.-Y. & Rao, M., eds. (2018a) Helmeted Hornbill (*Rhinoplax vigil*): status review, range-wide conservation strategy and action plan (2018–2027). IUCN Species Survival Commission Hornbill Specialist Group.
- Jain, A., Aik, C. A., Miller, A., Kaur, R., Yong D. L., Bidayabha, T., Simbolon, F. H., Thiri Da Wei Aung, Lay Win, Razali, H. & Lee, J. G. H. (2018b) Securing safe havens for the Helmeted Hornbill *Rhinoplax vigil*. *BirdingASIA* 30: 26–32.
- Kaur, R., Singh, S. & Ahmad, A. H. (2015) The nesting biology of the Great Hornbill *Buceros bicornis*, Rhinoceros Hornbill *Buceros rhinoceros* and Helmeted Hornbill *Rhinoplax vigil* in the Temengor Forest Reserve, Perak, Malaysia. *Malayan Nat. J.* 67: 242–259.
- Kaur, R., Singh, S., Ramli, R., Hassan, H., Majinun, A., Ancrenaz, M., Ratag, M., Rauf, H. A., Jamal, J., Rauf, A. S. A., Yunus, M. D. M., Arbani, M. A., Asmar, K. & Amir, M. A. (2018) Observations at a nest of Helmeted Hornbill *Rhinoplax vigil* in Borneo, Malaysia. *Forktail* 34: 68–73.
- Kemp, A. C., Sharpe, C. J. & Boesman, P. (2019) Helmeted Hornbill *Rhinoplax vigil*. *HBW Alive*. Accessed at <https://www.hbw.com/node/55911> on 03/11/2019.
- Kinnaird, M. & O'Brien, T. (2007) *The ecology and conservation of Asian hornbills: farmers of the forest*. Chicago: University of Chicago Press.
- Kitamura, S. (2011) Frugivory and seed dispersal by hornbills (Bucerotidae) in tropical forests. *Acta Oecologica* 37(6): 531–541.
- Kitamura, S., Thong-Aree, S., Madsri, S. & Poonswad, P. (2011) Characteristics of hornbill-dispersed fruits in lowland dipterocarp forests of southern Thailand. *Raffles Bull. Zool.* 24: 137–147.
- Leighton, M. (1982) Fruit resources and patterns of feeding, spacing and grouping among sympatric Bornean hornbills (Bucerotidae). PhD dissertation. University of California, Davis.
- Poonswad, P., Sukkasem, C., Phataramata, S., Hayeemuida, S., Plongmai, K., Chuailua, P., Thiensongrusame, P. & Jirawatkavi, N. (2005) Comparison of cavity modification and community involvement as strategies for hornbill conservation in Thailand. *Biol. Conserv.* 122: 385–393.
- Thiensongrusamee, P., Poonswad, P. & Hayeemuida, S. (2005) Characteristics of Helmeted Hornbill nests in Thailand. Pp.51–54 in S. Lum & P. Poonswad, eds. *The ecology of hornbills: reproduction and populations*. Bangkok: Hornbill Research Foundation, Mahidol University.
- Terborgh, J. (1986) Keystone plant resources in tropical forests. Pp.330–334 in M. E. Soulé, ed. *Conservation biology, the science of scarcity and diversity*. Sunderland MA: Sinauer.

Adam E. MILLER and Demi GARY

Yayasan Planet Indonesia, Jl. Parit Haji Husin 2
Komplek Alex Griya Permai Blok. D 12A
West Kalimantan 78124, Indonesia
and Planet Indonesia – USA, 241 Selma Ave.
Saint Louis Missouri 63119, USA

**RIKARDUS, MAREGA, Indah Sartika SARI
and Novia SAGITA**

Yayasan Planet Indonesia, Jl. Parit Haji Husin 2
Komplek Alex Griya Permai Blok. D 12A
West Kalimantan 78124, Indonesia

Sadtata Noor ADIRAHMANTA

Balai Konservasi Sumber Daya Alam
Kalimantan Barat
Jln. Achmad Yani No. 121 Pontianak
West Kalimantan, Indonesia