Integrative Conservation

WILEY

INTEGRATIVE CONSERVATION XTBG

NATURAL HISTORY NOTE OPEN ACCESS

First Confirmed Cooperative Breeding of the Brown Hornbill (*Anorrhinus austeni*) in China at the Sino–Lao Frontier

Junsong Li[1] | Aidong Luo[1] | Bo Wang[1] | Yun Yang[1] | Yan Li[1] | Jinhua Li[1] | Jiabin Li[2] | Wendi Yan[1] | Kang Luo[2]

[1]Xishuangbanna National Nature Reserve Management Bureau, Xishuangbanna, China | [2]Southeast Asia Biodiversity Research Institute & Center for Integrative Conservation, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, Mengla, Yunnan, China

Correspondence: Wendi Yan (1064190271@qq.com) | Kang Luo (luokang@xtbg.ac.cn)

Received: 30 September 2025 | **Accepted:** 29 November 2025

Editor-in-Chief & Handling Editor: Binbin Li

Funding: National Natural Science Foundation of China, Grant/Award Number: 42207311

Keywords: *Anorrhinus austeni* | China–Laos border | cooperative breeding | hornbill conservation | nest site

ABSTRACT

The Brown Hornbill (*Anorrhinus austeni*), a Near Threatened frugivore, reaches the northern edge of its distribution in southern Yunnan, China, yet breeding had not been previously documented with site-attributed nests in the country. In April and May 2025, we documented two active nests in the Mengman sector of the Shangyong Protected Area, separated by ~3.5 km. Both involved sealed incubation or brooding by females attended by multiple males, providing the first definitive evidence of cooperative breeding in the species in China. One cavity occurred in a tall *Choerospondias axillaris* tree and was provisioned with *Dysoxylum gotadhora* and *D. binectariferum* fruits, together with insect prey such as mantis and cicadas. The other was in a tall *Terminalia myriocarpa* tree beside a stream gully, with food deliveries including *Ormosia hosiei* and *Pometia tomentosa* fruits. Taken together, these observations establish that *A. austeni* breeds in China, broaden knowledge of nest tree substrates and diet in this frontier population, and confirm that cooperative social systems persist at the species' northern range limit. Alongside recent records of Oriental Pied (*Anthracoceros albirostris*) and Great Hornbills (*Buceros bicornis*), these findings demonstrate that Shangyong sustains a multi-species hornbill guild. Safeguarding cavity-bearing trees, strengthening systematic monitoring, and enhancing transboundary cooperation with Laos are essential to secure these disturbance-sensitive frugivores at the landscape scale.

The Brown Hornbill (*Anorrhinus austeni*), a near-threatened species, is one of the most important large-bodied frugivores in the Indo-Burma biodiversity hotspot. By dispersing seeds of canopy dominants such as *Ficus*, *Dysoxylum*, and *Choerospondias*, it contributes directly to forest regeneration and long-term ecosystem resilience (Kinnaird and O'brien 2007; Kitamura 2011).

The Brown Hornbill (*A. austeni*) was first described by T. C. Jerdon under the original spelling "*Anorhinus austeni*" (Jerdon 1872). It was long treated as a subspecies of Tickell's Brown Hornbill (*Ptilolaemus*/*Anorrhinus tickelli*), but has been widely recognized as a distinct species in *Anorrhinus* since the late 2000s, consistent with molecular phylogeny and modern checklists (Gonzalez et al. 2013; Kemp and Boesman 2020).

Junsong Li and Aidong Luo are co-first authors.

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2026 The Author(s). *Integrative Conservation* published by John Wiley & Sons Australia, Ltd on behalf of Xishuangbanna Tropical Botanical Garden (XTBG).

Summary

In April and May 2025, two active Brown Hornbill (*Anorrhinus austeni*) nests were documented within the Mengman sector of the Shangyong Protected Area, Yunnan, approximately 3.5 km apart. Both involved sealed females provisioned by multiple males, establishing the first definitive breeding evidence of the species in China. The two nests differed in cavity tree species (*Choerospondias axillaris* and *Terminalia myriocarpa*) and in food items delivered (*Dysoxylum*, *Ormosia hosiei*, *Pometia tomentosa*, plus arthropods), demonstrating reliance on large canopy cavities while tracking diverse fruit resources. Although the fate of both nests remains unknown due to the absence of continuous monitoring, these records confirm cooperative male attendance at the northern limit of the species' range. Together with recent records of Oriental Pied and Great Hornbills, these findings highlight Shangyong as a stronghold of hornbill diversity at the Sino–Lao frontier, where strict protection has preserved habitat integrity. Safeguarding cavity-bearing trees, enhancing systematic monitoring, and strengthening bilateral conservation with Laos are priorities to secure this disturbance-sensitive guild.

- **Practitioner Points**
  - Two active nests confirm that *Anorrhinus austeni* breeds in China, establishing a resident population rather than sporadic visitors.
  - Breeding relies on large cavity-bearing trees and diverse fruiting species, underscoring the need to protect mature forest structure.
  - The presence of multiple hornbill species demonstrates Shangyong's role as a guild-level refuge, highlighting the value of strict reserve management.
  - Cross-border coordination with Laos is essential to mitigate hunting pressure and maintain canopy connectivity across the frontier.

The distribution of *A. austeni* extends from northeastern India across northern Myanmar, Thailand, Laos, and Vietnam, reaching only marginally into southern Yunnan, China (Kemp and Boesman 2020). In China, the earliest confirmed record of *A. austeni* dates back to November 4, 1958, with specimens collected from Mengla county of Xishuangbanna (Z. X. Zheng and Zheng 1961). Subsequent faunal syntheses and gazetteers repeatedly list the species as present in Shangyong/Xishuangbanna (Xishuangbanna Nature Reserve Comprehensive Survey, G 1987; Yunnan Provincial Local Gazetteers Editorial, C. 1989; Yang 1993). During the last two decades, all verified Chinese records derive from Shangyong Protected Area within Xishuangbanna National Nature Reserve (G. Zheng 2023), yet until now, no nests have been reported. This absence of breeding evidence left unresolved whether the species maintained a resident population at its northern limit or represented a seasonal visitor from Laos, where hunting and habitat degradation remain severe (Duckworth et al. 1999; Davis and Glikman 2020).

Documenting breeding activity in China is thus of both biogeographic and conservation importance, given that hornbills are sensitive to disturbance, depend on cavity-bearing trees, and in *A. austeni*, multiple males assist in provisioning a sealed female and her brood (Kinnaird et al. 2003; Bora et al. 2023).

The Shangyong Protected Area occupies the southernmost core of Xishuangbanna at ~21°N, immediately bordering northern Laos. The landscape spans ~600–1500 m in elevation. Climatic conditions follow the regional pattern of southern Xishuangbanna, with a humid tropical monsoon regime, mean annual temperatures of 21°C–22°C, and rainfall exceeding 1500 mm concentrated between May and October (Cao and Zhang 1997; Cao et al. 2006). Vegetation is characterized by tropical seasonal evergreen broadleaf forest; representative canopy trees reported from this forest type include *T. myriocarpa*, *Dysoxylum binectariferum*, *Pometia pinnata*, *Choerospondias axillaris*, and multiple *Ficus* spp. (Cao and Zhang 1997; Cao et al. 2006). The forest structure is complex, with abundant lianas and epiphytes typical of Xishuangbanna's tropical seasonal forests. Within this setting, two active hornbill nests were documented in April and May 2025 from the Mengman sector of Shangyong's core zone, providing the first unequivocal evidence of *A. austeni* breeding in China (Figure 1).

We detected active cavities during routine ranger patrols in the Mengman sector. Subsequent stationary watches were conducted from ~50 m to minimize disturbance, with start and end times, visit durations, and the identities and numbers of attending males recorded in field notebooks. Geographic coordinates were logged in WGS84 using a handheld GPS (Garmin eTrex10). Nest-tree height and cavity-entrance height were estimated visually by two observers (independently estimating height multiple times, then averaging) and via proportionate extrapolation (estimating the cavity's position as a fraction of the total tree height). Although these estimates were not precise measurements, they were used to characterize the structural attributes of the nest site. Food items were identified by direct observation through binoculars (DeepForest 8×42 and Bresser Pirsch 8×42) and from remains (e.g., fruit husks) collected beneath the trees. Photographs were taken with a Nikon D500+Sigma 150–600 mm lens for one nest, and with an EOS R6 Mark II+RF200–800 mm F6.3–9 IS USM lens for the other, both serving as vouchers of provisioning events. All observations were conducted with permission of the Xishuangbanna National Nature Reserve Management Bureau.

Nest 1 (April 19–20, 2025). Patrols detected an active cavity on April 19 (~17:00). On April 20, the site was observed for 8 h (09:15–17:30) from ~50 m to minimize disturbance. The cavity was in a tall *C. axillaris* tree (~35 m), with the entrance ~20 m above ground, northwest-facing, at 21°17′ N, 101°25′ E; 811 m a.s.l. The incubating or brooding female was fully sealed, occasionally presenting her bill to accept food. We recorded six provisioning visits. Three adult males repeatedly visited; per visit, one or two perched at the entrance (no instance of three feeding simultaneously). The observed diet comprised fruits and arthropods: *Dysoxylum gotadhora* fruits were directly confirmed; husks of *D. binectariferum* fruits were found beneath the nest; insect prey included mantis and cicadas (Figure 2).

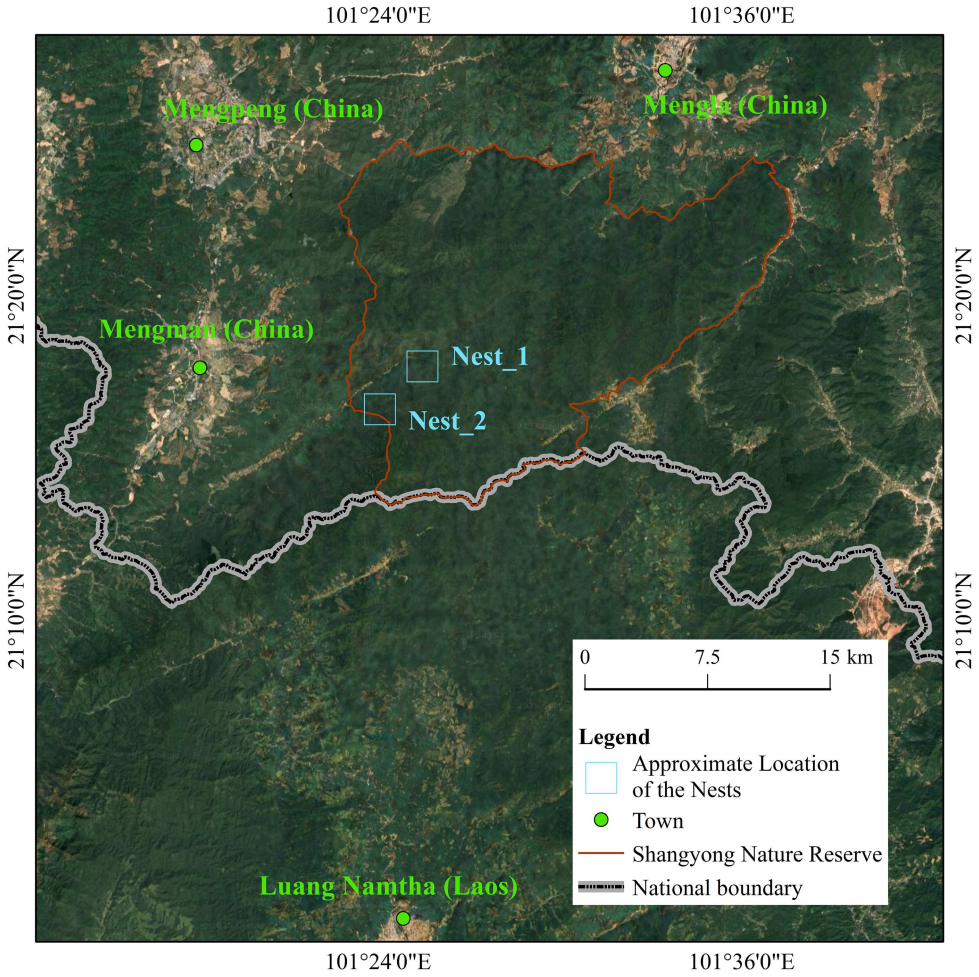


FIGURE 1 | Study area at the China–Laos border showing the Shangyong Nature Reserve and the approximate locations of the two active Brown Hornbill (*Anorrhinus austeni*) nests recorded in April and May 2025. The two nest sites are approximately 3.5 km apart.

Because continuous monitoring was not maintained, the outcome of this nest remains unknown.

Nest 2 (May 15–22, 2025). A second active cavity was found on May 15 at 21°16′ N, 101°24′ E; ~850 m a.s.l., located beside a stream gully in a large *T. myriocarpa* tree (~35 m), with the entrance ~25 m above ground and facing northwest. During a 3-h watch, we recorded three provisioning visits: one primary male fed at all three visits, with two additional males assisting briefly (never all three feeding simultaneously). Identified food items were *Ormosia hosiei* and *Pometia tomentosa* fruits, each delivered singly; visit durations were 3–5 min (Figure 3). On May 22, a revisit detected no attendant adults or chicks; subsequent villager checks likewise noted no return. As continuous monitoring was not conducted, the outcome of this nest also remains unknown.

The two concurrent nesting attempts—differing in nest tree species (*C. axillaris* vs. *T. myriocarpa*) and provisioned fruits (*Dysoxylum* spp. vs. *O. hosiei* and *P. tomentosa*)—jointly confirm *A. austeni* breeding in China. These observations highlight the species' reliance on large cavity-bearing canopy trees and their ability to track diverse fruit resources. Although the fate of both nests is unknown due to the lack of continuous monitoring, their documentation establishes cooperative male attendance in a frontier population at the species' northern range limit.

Independent evidence from the same landscape supports the view that Shangyong functions as a hornbill refuge rather than merely a passage area (Kinnaird and O'brien 2007; Huang et al. 2020). Oriental Pied Hornbills (*Anthracoceros albirostris*) have been repeatedly photographed in the reserve and adjacent forests, with local reports of active nests. Even more notably, on May 25, 2025, two authors (Kang Luo and Jiabin Li) observed a Great Hornbill (*Buceros bicornis*) in a nearby forest, the first unequivocal record for the prefecture in nearly three decades. The coexistence of *A. austeni*, *A. albirostris*, and *B. bicornis* demonstrates persistence of a guild of large frugivores at the Sino–Lao frontier, a pattern increasingly rare elsewhere in tropical Asia where hunting and habitat loss have driven local extirpations (Duckworth et al. 1999; Gray et al. 2018).

The documentation of two active *A. austeni* nests in the Shangyong Protected Area resolves the long-standing uncertainty regarding the species' status in China. Previous Chinese records, all from Shangyong, were based only on field sightings (Kemp and Boesman 2020; G. M. Zheng 2011) and were unable to determine whether the species occurred as a resident or as seasonal visitors from northern Laos, a region where, as noted earlier, hunting pressure and habitat loss are severe (Duckworth et al. 1999; Davis and Glikman 2020). The persistence of cooperative breeding at this distributional edge—where habitat fragmentation and

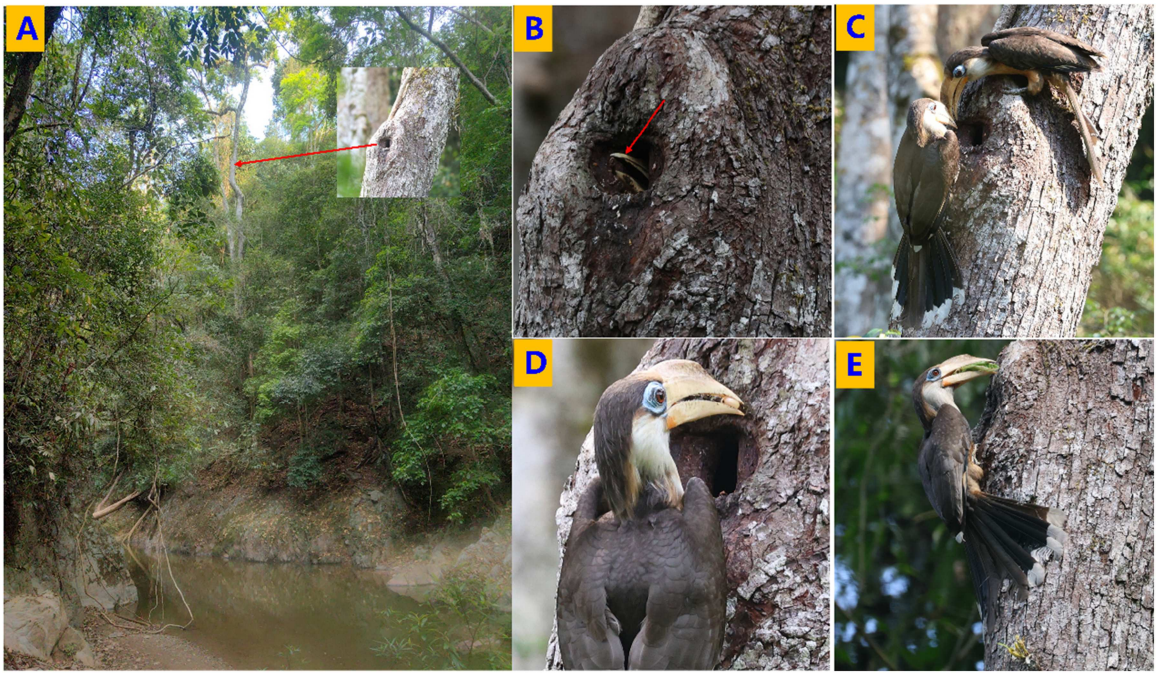


FIGURE 2 | The first Brown Hornbill (*Anorrhinus austeni*) nest in the Shangyong Protected Area. (A) Nest tree (*Choerospondias axillaris*, ~35 m tall) beside a stream gully, with the entrance ~20 m above the ground (arrow). (B) The sealed female showing her bill through the slit (arrow). (C) Two males simultaneously attending the nest entrance. (D) A male delivering a *Dysoxylum gotadhora* fruits. (E) A male delivering a mantis. (Photo credits: Junsong Li.)

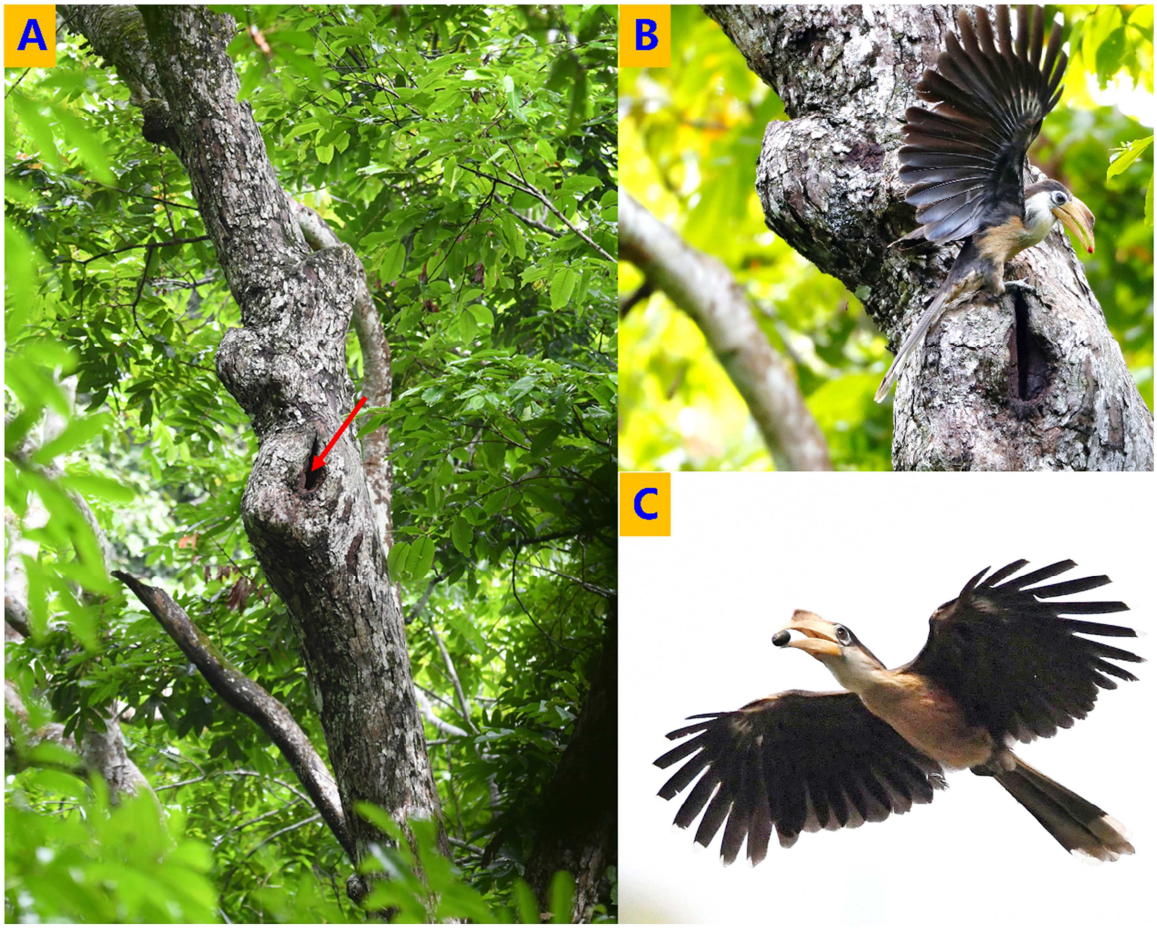


FIGURE 3 | The second Brown Hornbill (*Anorrhinus austeni*) nest in the Shangyong Protected Area. (A) Nest tree (*Terminalia myriocarpa*, ~35 m tall) with the entrance ~25 m above the ground. (B) A male delivering *Ormosia hosiei* fruit to the sealed female. (C) A male in flight returning with *Pometia tomentosa* fruit. (Photo credits: Aidong Luo.)

human disturbance are intensified (Duckworth et al. 1999)—highlights *A. austeni*'s adaptability to marginal habitats. This resilience, in contrast to population declines in northern Laos (Davis and Glikman 2020), underscores the Shangyong Protected Area's role as a transboundary refuge for disturbance-sensitive hornbills.

The observations further underscore the persistence of the species' cooperative breeding system at the edge of its distribution. In both nests, multiple adult males contributed to provisioning, with one acting as a primary feeder and others assisting episodically. Research on the breeding ecology of *A. austeni* remains very limited, with only one systematic study reported from northeast India (Bora et al. 2023; Poonswad and Tsuji 1994). Our records add complementary evidence from the northern limit of the species' range. They show that the basic conditions for cooperative care—including predictable food flow, stable cavity access, and tolerance among attendants—are still present in Shangyong. Future research integrating minimally invasive genetic sampling and repeated observations would help clarify relatedness and role stability of attending individuals across longer time periods, situating Shangyong within broader comparative frameworks on cooperative breeding in birds (Cockburn 2006, 1998).

Nest-site features highlight the species' reliance on large cavity-bearing canopy trees within mature seasonal evergreen forest. The use of *C. axillaris* and *T. myriocarpa* as nest trees demonstrates flexibility in cavity substrates, provided trees reach sufficient height and girth. Identified food items—*D. gotadhora*, *D. binectariferum*, *O. hosiei*, and *P. tomentosa*, supplemented with insects—indicate that breeding groups exploit a diversity of fruit resources from canopy species. These findings corroborate the view that hornbills track fruit availability across heterogeneous forest structure (Kinnaird and O'brien 2007; Kitamura 2011; Naniwadekar et al. 2015). Because such cavity-bearing trees are scarce and vulnerable to selective harvest, their retention is a direct determinant of breeding opportunity.

The persistence of *A. austeni* in Shangyong also reflects the effectiveness of long-term protection. The core zone has been subject to strict access regulations, active ranger patrols, and restrictions on timber harvest, all of which have preserved large trees and maintained relatively undisturbed forest structures. In contrast to many parts of tropical Asia where hornbills have disappeared due to snaring and logging pressure (Duckworth et al. 1999; Gray et al. 2018), Shangyong demonstrates how enforcement and habitat safeguards can maintain disturbance-sensitive frugivores. The discovery of two nests within one sector of the reserve is a tangible outcome of these conservation measures and underscores the value of well-managed frontier reserves as refuges for threatened guilds.

At the community level, the coexistence of *A. austeni*, the Oriental Pied Hornbill (*A. albirostris*), and the recently re-detected Great Hornbill (*B. bicornis*) indicates that Shangyong sustains a functional hornbill assemblage. Hornbills are among the first taxa to decline under hunting and habitat degradation (Kinnaird and O'brien 2007; Kinnaird et al. 2003), and guild-level persistence signals that key ecological processes—including long-distance seed dispersal, canopy fruit tracking, and forest regeneration—remain operational (Kitamura 2011). This elevates Shangyong from a peripheral outpost to a stronghold of hornbill diversity at the Sino–Lao frontier.

Management implications follow this documented breeding activity at multiple scales. Within the reserve, systematic inventories of cavity-bearing trees are needed to quantify nest-site supply and identify recruitment bottlenecks (Pasuwan et al. 2022). Where natural hollows prove limiting, carefully specified artificial cavities and nest-box supplementation—proven effective for Asian hornbills elsewhere—should be trialed with size classes and microclimates appropriate to target species (Pasuwan et al. 2022; James et al. 2011). Autonomous acoustic monitoring and targeted camera-trapping can deliver early, low-disturbance detection of provisioning, extend temporal coverage, and support estimation of nesting success and attendant roles across seasons (Shonfield and Bayne 2017; Wearn and Glover-Kapfer 2017). Because cooperative systems can obscure the true number of simultaneous breeding attempts if groups shuttle among cavities, monitoring designs should explicitly distinguish between concurrent and sequential cavity use. Beyond the reserve boundary, Shangyong's position on the Sino–Lao frontier makes bilateral coordination essential: joint patrols, harmonized protection of cavity trees, and corridor safeguards would help counter hunting pressure and maintain canopy connectivity across the border (Duckworth et al. 1999; Davis and Glikman 2020; Wang et al. 2021).

Finally, the transboundary context is integral. The forests of Shangyong extend seamlessly into northern Laos, where hunting pressure is intense and biodiversity declines have been widely documented (Duckworth et al. 1999; Davis and Glikman 2020). The confirmation of breeding in China strengthens the case for bilateral conservation measures, including joint patrols, protection of cavity-bearing trees, and maintenance of corridor connectivity (Wang et al. 2021). Hornbills are widely recognized as keystone frugivores whose persistence signals forest integrity. By verifying that one of Asia's most disturbance-sensitive frugivores still reproduces in China, these records highlight both the ecological integrity that Shangyong retains and the national and transboundary responsibilities to secure this integrity through coordinated action at the guild level.

Author Contributions

Junsong Li: investigation, data curation, writing – review and editing. **Aidong Luo:** investigation, data curation, writing – review and editing. **Bo Wang:** resources, writing – review and editing. **Yun Yang:** resources, writing – review and editing. **Yan Li:** resources, writing – review and editing. **Jinhua Li:** resources, writing – review and editing. **Jiabin Li:** investigation. **Wendi Yan:** investigation, project administration, writing – review and editing. **Kang Luo:** conceptualization, investigation, writing – original draft, writing – review and editing.

Acknowledgments

We are grateful to the staff and rangers of Shangyong Protected Area (Xiaohai Wang, Shunfu Wu, Fasheng Li, Xiangnuo Yan, Jinpai Zhao, and Jinqing Zhao) for their invaluable assistance with patrols and field logistics. We thank Yun Deng (Xishuangbanna Tropical Botanical Garden) for preparing the map in Figure 1, and Professor Yunhong Tan (Xishuangbanna Tropical Botanical Garden) for his generous support in identifying tree species and fruit items. This study was supported by the National Natural Science Foundation of China (Grant No. 42207311 to K.L.).

Ethics Statement

All field observations were conducted under the regulations of Xishuangbanna National Nature Reserve and with the support of the reserve

management bureau. No animals were captured, handled, or disturbed beyond standard observation protocols.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data supporting the findings of this study (photographs and video evidence) are available upon reasonable request from the corresponding author.

References

Bora, B., D. Sonowal, N. Khakhlari, and A. Datta. 2023. "The Breeding Biology of the Cooperatively Breeding White-Throated Brown Hornbill (*Anorrhinus austeni*)." *Hornbill Natural History and Conservation* 4: 1–19.

Cao, M., and J. Zhang. 1997. "Tree Species Diversity of Tropical Forest Vegetation in Xishuangbanna, SW China." *Biodiversity & Conservation* 6: 995–1006.

Cao, M., X. Zou, M. Warren, and H. Zhu. 2006. "Tropical Forests of Xishuangbanna. China." *Biotropica* 38: 306–309.

Cockburn, A. 1998. "Evolution of Helping Behavior in Cooperatively Breeding Birds." *Annual Review of Ecology and Systematics* 29: 141–177.

Cockburn, A. 2006. "Prevalence of Different Modes of Parental Care in Birds." *Proceedings of the Royal Society B: Biological Sciences* 273: 1375–1383.

Davis, E. O., and J. A. Glikman. 2020. "An Assessment of Wildlife Use by Northern Laos Nationals." *Animals* 10: 685.

Duckworth, W., R. E. Salter, and K. Khounboline. 1999. *Wildlife in Lao PDR: 1999 Status Report*. World Conservation Union Gland.

Gonzalez, J. C. T., B. C. Sheldon, N. J. Collar, and J. A. Tobias. 2013. "A Comprehensive Molecular Phylogeny for the Hornbills (Aves: Bucerotidae)." *Molecular Phylogenetics and Evolution* 67: 468–483.

Gray, T. N. E., A. C. Hughes, W. F. Laurance, et al. 2018. "The Wildlife Snaring Crisis: An Insidious and Pervasive Threat to Biodiversity in Southeast Asia." *Biodiversity and Conservation* 27: 1031–1037.

Huang, Z., Y. Bai, J. M. Alatalo, and Z. Yang. 2020. "Mapping Biodiversity Conservation Priorities for Protected Areas: A Case Study in Xishuangbanna Tropical Area, China." *Biological Conservation* 249: 108741.

James, D. A., A. Bachan, and R. Kannan. 2011. "Installation of Artificial Nest Cavities for the Endangered Great Hornbill: A Pilot Study in Southern India." *Raffles Bulletin of Zoology* 24: 73–76.

Jerdon, T. C. 1872. "Supplementary Notes on the Birds of India." *Ibis (Third Series)* 2: 6.

Kemp, A. C., and P. F. D. Boesman. 2020. "Brown Hornbill (*Anorrhinus austeni*), version 1.0." In *Birds of the World*, edited by J. Del Hoyo, A. Elliott, J. Sargatal, D. A. Christie and E. De Juana, Cornell Lab of Ornithology.

Kinnaird, M. F., and T. G. O'brien. 2007. *The Ecology and Conservation of Asian hornbills: Farmers of the Forest*. University of Chicago Press.

Kinnaird, M. F., E. W. Sanderson, T. G. O'Brien, H. T. Wibisono, and G. Woolmer. 2003. "Deforestation Trends in a Tropical Landscape and Implications for Endangered Large Mammals." *Conservation Biology* 17: 245–257.

Kitamura, S. 2011. "Frugivory and Seed Dispersal by Hornbills (Bucerotidae) in Tropical Forests." *Acta Oecologica* 37: 531–541.

Naniwadekar, R., C. Mishra, and A. Datta. 2015. "Fruit Resource Tracking by Hornbill Species at Multiple Scales in a Tropical Forest in India." *Journal of Tropical Ecology* 31: 477–490.

Pasuwan, C., P. Thiensongrusamee, N. Da-U- re, et al. 2022. "Long-Term Monitoring of Breeding Successes of Great Hornbill (*Buceros bicornis*) and Rhinoceros Hornbill (*Buceros rhinoceros*) Using Artificial Nest Boxes in Budo-Su-Ngai Padi National Park, Thailand." *Avian Conservation and Ecology* 17: art47.

Poonswad, P., and A. Tsuji. 1994. "Ranges of Males of the Great Hornbill *Buceros bicornis*, brown hornbill *Ptilolaemus tickelli* and Wreathed Hornbill *Rhyticeros undulatus* in Khao Yai National Park, Thailand." *Ibis* 136: 79–86.

Shonfield, J., and E. M. Bayne. 2017. "Autonomous Recording Units in Avian Ecological Research: Current Use and Future Applications." *Avian Conservation & Ecology* 12: 14.

Wang, L., B. Yang, Y. Bai, et al. 2021. "Conservation Planning on China's Borders With Myanmar, Laos, and Vietnam." *Conservation Biology* 35: 1797–1808.

Wearn, O. R., and P. Glover-Kapfer. 2017. "Camera-Trapping for Conservation: A Guide to Best-Practices." *WWF Conservation Technology Series* 1: 181.

Xishuangbanna Nature Reserve Comprehensive Survey, G1987. *Comprehensive Survey Report of Xishuangbanna Nature Reserve* [in Chinese]. Yunnan Science and Technology Press.

Yang, D. 1993. *Animals of Xishuangbanna* [in Chinese]. Yunnan University Press.

Yunnan Provincial Local Gazetteers Editorial, C. 1989. *Yunnan Provincial Gazetteer: Animals* [in Chinese]. Yunnan Provincial Local Gazetteers Editorial Committee.

Zheng, G. 2023. *Classification and Distribution of Chinese Birds* [in Chinese]. Science Press.

Zheng, G. M. 2011. *A Checklist on the Classification and Distribution of the Birds of China* [in Chinese], 2nd edn.Science Press.

Zheng, Z. X., and B. X. Zheng. 1961. "A Report on the Bird Species Survey of the Xishuangbanna Region of Southern Yunnan and Its Adjacent Areas" [in Chinese]. *Acta Zoologica Sinica* 13: 1–20.