

# Nature Watch

## Hornbills – Giants Among the Forest Birds

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Fascinating and grand, with curious beaks and breeding habits, hornbills are a naturalist's delight. In forest types ranging from open savannah to rainforest across Africa and Asia, they occupy the pride of place among birds and play a pivotal role as mutualistic frugivores and seed dispersers of various trees. Due to the impact of humans on hornbills and their habitats, most species are now endangered. Fortunately, there has been some success in recent conservation efforts to save these magnificent forest flagships.

### Introduction

Among the surest contenders for the title of most spectacular, even bizarre, birds of Indian forests are hornbills. Contrasted against our familiar house sparrow, for instance, the great pied hornbill – full four feet in length with striking black, white, and yellow hues, and a beak as large as a crow – appears as different as a giraffe from a rat. The natural history of hornbills and their unique traits and habits, such as the incarceration of the female in a tree cavity during nesting, include some of the most curious tales to be told from the world of birds. To become irresistibly captivated by these birds, all that one requires is to encounter a hornbill in its forest habitat.

Imagine yourself in a luxuriant tropical rainforest, walking silently along a trail. From the distance, over the towering tree canopy you suddenly hear a deep, persistent *woosh, woosh* noise. As it approaches, the sound grows louder and louder, almost as if one of Gulliver's brobdingnagian giants is bearing down upon you, gasping. In fact, it is a giant – a giant among birds and the largest of the hornbills, the great pied hornbill, and the noise is that

**Box 1. Hornbills: Diversity and Biogeography**

Hornbills are today considered taxonomically unique enough to be placed in two separate families, Bucerotidae (savannah and forest hornbills) and Bucorvidae (ground hornbills), under the order Bucerotiformes. Earlier they were placed along with birds such as kingfishers, bee-eaters, rollers, trogons, and hoopoes in the order Coraciiformes. They are most closely related to hoopoes, which also lack pigments besides melanin, in contrast to other colourful coracids.

Of 54 species of hornbills, 23 occur in Africa. Only 12 of those occur in forests and the rest are savannah birds, due to the large spread of savannah habitats in the region. The Oriental region (south and south-east Asia) has 30 species and one species is found in the Australasian region (Papua New Guinea). These regions are dominated by forest habitats, which have left a biogeographic imprint on the hornbills' habitat preferences – only a single species occurs in wooded savannahs, while the rest are moist forest birds.

Birds remarkably similar to the hornbills are the toucans – large-billed frugivorous birds found in the neotropical forests of the Americas. Evolved independently and placed in a different family (Ramphastidae), these birds are an example of convergent evolution.

produced by its wings in flight. If you are lucky, you will get an awe-inspiring glimpse, like most others do, of a pair flying majestically over the rainforest. One of the first things likely to strike you about its appearance is its huge, grotesquely caparisoned beak.

**An Avian Rhinoceros**

Atop the large, curved beak of hornbills is a horny protuberance or ridge called the casque. The casque is a unique feature of hornbills and the various eccentric or exaggerated shapes and colours it takes gives several species their names: helmeted hornbill, red-knobbed hornbill, even rhinoceros hornbill. The casque is not as heavy as its size would suggest since it is hollow in all species except the helmeted hornbill. In this species, the casque is solid and the skull thus forms nearly ten percent of its body weight.

The uses of the enlarged beak and casque are many. The beak is used to procure various, often large, food items including fruits (such as figs which are a hornbill delicacy, and nutmegs), arthropods, lizards, snakes, even the occasional flying squirrel.

**Figure 1. A captive female rhinoceros hornbill (*Buceros rhinoceros*), with its unmistakable casque, is a species that occurs in south-east Asia. The male differs in having a red eye. (Photo Credit: M D Madhusudan)**



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During nesting, the female uses its beak to plaster the nest cavity opening with a 'cement' made from its droppings. In the helmeted hornbill and the great pied hornbill, the beaks are used in a rare and spectacular form of aggressive interaction called aerial casque-butting where the males clash their beaks in mid-air flight. Males usually have a larger, differently coloured bill and casque than females and the colours may play a role in their displays.

Although most hornbills are strikingly coloured, by avian standards they are quite poorly endowed. Their feathers lack any pigment besides melanin – offering a circumscribed range of possibilities from white, greys and browns to black. This is, however, offset by a couple of hornbill adaptations. A gland on the bird's rump, which normally secretes an oil useful in preening, has been modified to secrete a cosmetic colouring substance. The great pied hornbills, for instance, smear their bills, casques, and white feathers with this substance during the breeding season, turning them a bright yellow or orange. Several species have also developed bare patches of skin – the wreathed hornbills occurring in north-east India have a bright yellow or blue throat pouch. Differences in the colouration of the bill, casque, feathers, or eyes, besides size dimorphism, help distinguish males from females and adults from young in most species.

### Hole Sweet Home

Hornbill nest cavities are large, commensurate with their large body size. Each species prefers, however, cavities that are just the right size for a female to squeeze into.

Besides their striking appearance, hornbills are also noteworthy for their peculiar breeding habits. Hornbills nest in cavities or hollows in trees or rotting branches, barring two species of African ground hornbills that tunnel into the earth. The arboreal species are called secondary cavity nesters since they only use pre-existing cavities. These cavities may be natural ones or enlarged nests excavated and used earlier by primary cavity nesters such as woodpeckers.

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thirty metres high on trees of large girth and height.

Nest-site selection has been studied in two species in India – the smallest, malabar grey hornbill (*Ocyceros griseus*) by Divya Mudappa, and the largest, great pied hornbill (*Buceros bicornis*) by Ragupathy Kannan. The research of these ecologists in the rainforests of the Anamalai Hills in south-west India has shown that the choice of nest trees is not random and hornbills select trees that are much larger than expected by chance. There are also clear differences between the species. The great pied hornbill prefers trees that are more than one meter in diameter at breast height and that achieve an average height of 44 m. The malabar grey hornbill mostly selects smaller trees of about 0.6 to 0.9 m in diameter at breast height and with an average height of 28 m. Studies on hornbills in south-east Asian rainforests also report that some species of dipterocarps and eugenias, which form large emergent trees, are preferred for nesting.

### Sealing Their Own Fate

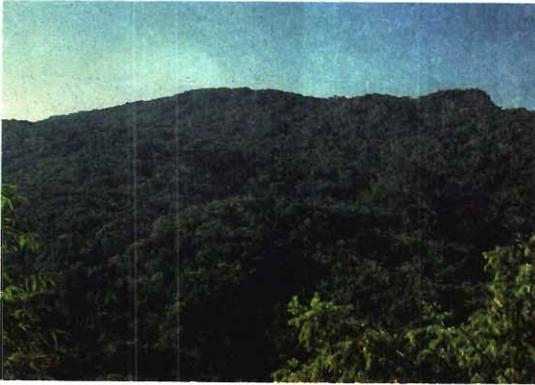
The most peculiar aspect of hornbill breeding begins after nest selection and preparation are complete. The female occupies the nest to lay her clutch of eggs and then, intriguingly, she commences the apparently masochistic act of sealing herself in within the cavity. Using her beak as a trowel, she ‘cements’ the nest opening with her own droppings, which consist of a sticky paste with fig seeds and other waste. Finally, only a thin slit is left through which she can extrude her bill-tip. For weeks she will remain incarcerated thus, fed regularly by the dotting male who brings and regurgitates one to several dozen fruits and animal prey.

Immobilised and cooped-up, the female moults her flight feathers and sometimes her tail feathers too. To maintain nest sanitation she twists around each time to forcibly eject, like a bazooka blast, her droppings through the narrow slit of the nest cavity. When the young hatch, they emulate the female in this eminently sensible practice for the duration of their incarceration. In the larger hornbill species, only one chick is raised in a nest, whereas



*Figure 2. The striking male white-crowned hornbill (Berenicornis comatus), another south-east Asian species, differs from the female which has a black throat and neck. (Photo Credit: M D Madhusudan)*





*Figure 3(left). A hornbill's eye-view of a rainforest in north-east India. (Photo Credit: T R Shankar Raman)*



*Figure 4 (right). The male malabar grey hornbill perched on a ledge just above its nest with a fruit for the incarcerated female. (Photo Credit: V Santharam)*

in some species there may be up to four chicks.

In south-west India, the breeding season of the great pied and malabar grey hornbills begins in February. The eggs of the former hatch after nearly two months, while those of the latter smaller species take about 40 days. The female great pied hornbill stays with the chick for over a month. Then she emerges from the nest to help the male feed the young in the final phase of nesting. The chick reseals the nest in the same manner as the female and remains incarcerated for another fortnight. Four months after the female first occupied the nest, the chick breaks out fully fledged. As opposed to this, in the malabar grey hornbill, the female and fledged young break out of the nest at the end of the twelve week nesting period. Unusually, the brown hornbill found in north-east India and south-east Asia has a cooperative breeding system. From one to several 'helper' individuals, usually young male offspring of previous years, assist the male in feeding the incarcerated female and young.

Why do hornbills have such peculiar nesting and breeding habits? Since hornbills, like other large-bodied birds have long incubation and fledging periods, low fecundity and breeding rates, they are particularly susceptible during the nesting phase of the life cycle. Adaptations, even seemingly strange ones, that enhanced their nesting success and survival would have evolved by natural selection. By nesting high up in trees and sealing the nest entrance, the chances of predation by carnivores such as the



*Figure 5. A great pied hornbill photographed in the possession of a hunter in north-east India. (Photo Credit: Shekar Dattatri)*

yellow-throated martin and King Cobra and nest usurpation by other hornbills are reduced. High nesting success of 75 percent or more may be achieved under natural conditions.

### **Passion for Fruit**

While the male hornbills do bring invertebrates and animal prey to feed the nest inmates, the bulk of their diet comprises fruit. The male perches at the edge of the nest or on a nearby branch and regurgitates up to several dozen fruits one by one – a process that takes a few minutes. Depending on species and locality, about one-fourth to three-fourths of their diet during the breeding season comprises figs. The hornbills' predilection for fruit is accentuated during the non-breeding season when various other fruits are also consumed.

Figs are notoriously aseasonal in fruiting unlike many other fruit-bearing trees. The super-abundant fruit crops on fig trees are a major resource for a variety of birds and mammals during annual periods of fruit scarcity. They have therefore been labelled 'keystone resources' in many tropical forests (see *Resonance*, Vol. 2, No. 7, 67–74, July 1997). With the onset of the rains, more seasonal fruits of trees in families such as Myristicaceae (nutmegs) and Lauraceae become available. In contrast to figs which have tiny seeds and are rich in sugars, these fruits have one seed and are rich in lipids.

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## For Mutual Benefit

In return for the nutriment the fruits provide, the hornbills disperse their seeds far and wide. With home ranges as large as 4 to 30 square kilometres or more in area, the great pied and wreathed hornbills often fly effortlessly several kilometres in a day transporting their gut-cargo of seeds. Dispersal is also effected through the piles of dropped and defaecated seeds, called middens, that accumulate at the base of the nest trees. Some tree species with large fruits, such as *Myristica* and *Beilschmedia*, appear to depend exclusively on large frugivores such as hornbills and imperial pigeons for dispersal. Dispersal may benefit trees in different ways. For some, it would enable seeds to reach favourable germination sites away from the parent tree. For others which have a hard seed coat which is whittled down during its passage through the hornbill's gut, germination and viability may be improved.

Such reciprocally beneficial relationships have been termed mutualisms by biologists. Hornbills have been called 'mobile links' and 'keystone mutualists' because of their wide-ranging habits and role in seed dispersal as well as regeneration of rainforest trees. The functional role of hornbills in maintaining tree populations and regeneration makes them a critical component of tropical forest ecosystems.

## Vanishing Giants

Although hornbills stand tall among birds in terms of their importance in tropical forest ecosystems, several species are highly threatened and endangered today due to human impacts on hornbill populations and their habitats. India has nine species of hornbills of which two, the malabar grey and narcondam hornbills, are endemic and not found anywhere else in the world. All species are considered endangered and receive protection under the Indian Wildlife Protection Act of 1972, although at least one species, the common grey hornbill, is relatively common and widespread over its range. The status of the narcondam



*Figure 6. Hunting poses a threat to survival of hornbills—head and casque of a poached great pied hornbill photographed in the possession of a hunter in north-east India. (Photo Credit: T R Shankar Raman)*

hornbill is most precarious as there exists only a single population of less than four hundred individuals. This population is restricted to the Narcondam island in the Andamans. To understand the causes that have led to the endangerment of hornbills and to devise effective conservation measures, several aspects of hornbill natural history and ecology are relevant.

The hornbills' preferences for particular types of nest trees is of great significance for their survival. When nest trees are logged or trees with cavities removed as part of silvicultural operations, these actions can trigger declines in breeding populations. Another vital factor is nest-site fidelity – pairs use the same nest every year. Identifying and protecting these trees will go a long way in maintaining hornbill populations.

Poaching is another threat to hornbills. Often it is for the meat of adults or unfledged squabs in the nest. Since the hornbills have low breeding rates, poaching at the nest hits the population where it hurts most. In many tribal societies of north-east India and south-east Asia, hornbill casques and feathers are valued as ornaments or symbols of hunting prowess. In the past, when forest cover was extensive and human populations low, traditional hunting for subsistence or ornaments may have had little impact. Today, elders and local hunters in many parts of south-west and north-east India themselves give testimony to local extinctions of

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*Figure 7. Short-cycle slash-and-burn agriculture in rainforest areas results in dense bamboo forests – unsuitable habitat for hornbills. (Photo Credit: T R ShankarRaman)*

hornbills due to hunting in otherwise undisturbed forest areas in the vicinity of their villages.

The destruction, conversion, and fragmentation of mature tropical forests due to logging, plantations, or slash-and-burn agriculture, are other inexorable forces affecting hornbills. In the rainforests of Arunachal Pradesh; a study by Aparajita Datta, a field biologist with the Wildlife Institute of India, showed that plantations and commercial logging for timber particularly affected large species such as the great pied and wreathed hornbills. Hornbills have become locally extinct or very rare in large areas of north-east India covered by dense bamboo forests resulting from slash-and-burn agriculture with short fallow periods. Fragmentation of rainforests is proceeding apace in tropical forests of south and south-east Asia. When the size of forest patches falls below a threshold, it may become woefully inadequate to meet the year-round habitat, nesting, and food requirements of the hornbills. Where hornbills are left unmolested because of legal protection or local taboos, a pair may cling like vestiges to a small forest patch that contains their traditional nest-site – as in Puthuthottam in the Anamalai Hills. Their survival here is, at best, tenuous.

### A Silver Lining

It is ironical, but fortunate, that some of the modern conservation success stories involve the endangered hornbills. Using hornbills as flagships for their forest habitats, many countries including India have protected them and their habitats under wildlife laws. Appreciating the monogamous fidelity of breeding pairs, people in a part of Sumba island in Indonesia have stopped hunting the sumba hornbill for meat and have instead made it a mascot. Two other hornbill species have also been adopted as state birds in Indonesia. Researchers in Mahidol University of Thailand have also successfully used hornbills as flagships for environmental awareness and conservation efforts.

In the Anamalai Hills of south-west India, following the studies of researchers, several management measures were launched.

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The forest department today employs several local tribals who, along with researchers, monitor several dozen hornbill nests every year during the breeding season. The cutting of fig trees and saplings to provide fodder for camp elephants was also stopped after their importance for hornbills and other frugivores was highlighted to the authorities. In the rainforests on the Karumalai Gopuram hills of Parambikulam Wildlife Sanctuary, great pied hornbills had suffered a brief period (three years) of local extinction. Due to protection by the Kerala Forest Department and the awareness and cooperation of local tribals, the species appears to be staging a comeback and has resumed nesting in the area.

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There is much that remains to be done to conserve hornbills and their forest habitats. Let us hope that the efforts of local people, researchers, forest staff, and conservationists alike will continue, like fig trees, to bear copious fruit. The sight of hornbills in majestic flight over lofty rainforests will then continue to inspire awe in the future.

### Suggested Reading

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