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## Breeding the Great Indian hornbill

*Buceros bicornis*

### at the Cotswold Wild Life Park

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The Cotswold Wild Life Park purchased a pair of Great Indian hornbills *Buceros bicornis* in 1970. The aviary in which the birds have been maintained since then has an outside flight measuring *c.* 27 × 5 × 3.5 m high and a completely enclosed and covered shelter measuring 3.5 × 1.5 × 3.5 m high which is attached at right angles to the back of the flight. One long and one short side are formed by a 3.5 m high brick wall which also extends along the back of the shelter (Fig. 1). The other two sides and the top consist of black plastic-covered chainlink fencing wire, with a 5 cm mesh, supported by a timber frame. The flight is furnished with shrubs, climbing plants and cut branches and the floor supports a natural growth of grasses and other low-growing plants; there is also a shallow sunken concrete-lined pool. The shelter is constructed from cement blocks and timber, roofed with translucent corrugated roofing sheets and furnished with a number of wooden perches. A glass panel in one wall of the shelter gives a view of the interior from the viewing path which runs past both parts of the aviary (Fig. 1). The hornbills are allowed freedom of movement between the flight and the shelter throughout the year. When necessary heat is supplied to the interior of the shelter by means of a single 275 W infra-red heating lamp and reflector suspended above the main perch.

Two ♀ Black storks *Ciconia nigra* have also occupied the flight for most of the period since the hornbills arrived, including 1983 when they bred successfully.

In 1971 two wooden barrels, 0.6 m in diameter and 0.9 m high with an 0.25 m aperture cut in one side towards the upper end, were fixed to the back wall of the flight at a height of approximately 2 m. In 1978, following an unsuccessful breeding attempt when eggs had been laid in the barrel, a partially hollow log 0.8 m in diameter and 2.7 m high was positioned opposite the shelter within the 90° angle of the brick wall (Fig. 1); the internal chamber, which occupied the upper half of the log, was *c.* 0.45 m in diameter. A piece of felted timber was fixed to the top where it provided protection by means of an overlap and also formed a roof to the chamber. A perch was positioned on the outside of the log close to the aperture.

#### BREEDING

The hornbills made several attempts to breed, with a single clutch being laid every year from 1977–1983. Breeding behaviour commenced in February or early March on each occasion when the birds began showing an interest in the nestbox (or in earlier years the barrel) and started 'mudding up' the aperture. Mating was observed once in 1982 and once in 1983. Eggs were laid a few weeks after the birds first showed an interest in the nestbox. In 1977 and 1978 the eggs were laid in one of the barrels but in subsequent years they were laid in the log. Although it was not possible to be sure of the number of eggs on each occasion it was thought that two eggs were laid in five of the clutches and one egg in the remaining two. The first hatching,

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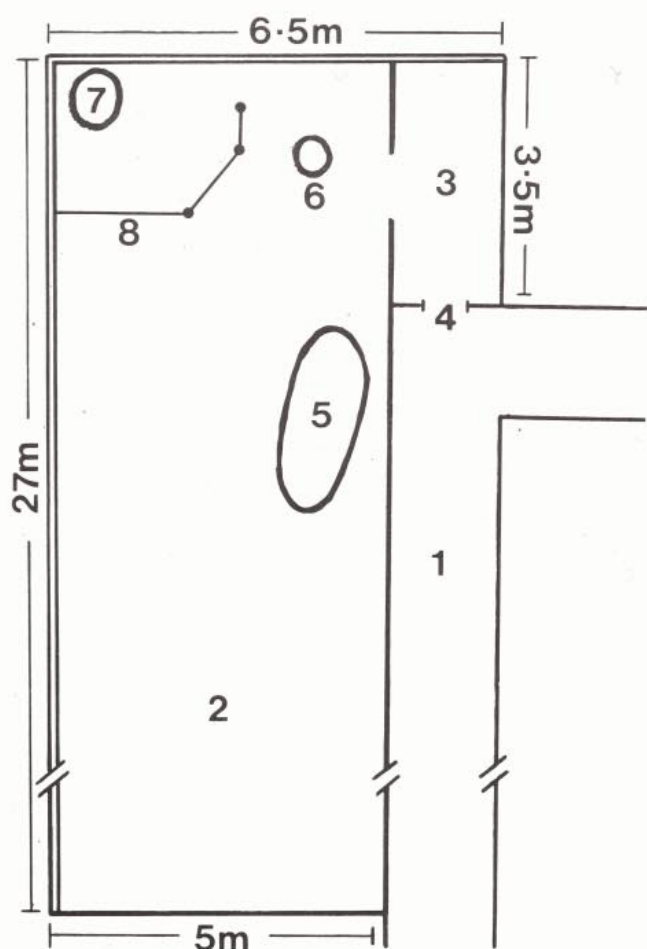


Fig. 1. The aviary for the Great Indian hornbills *Buceros bicornis* at the Cotswold Wild Life Park. 1. public pathway; 2. outdoor flight (bounded by a 3.5 m high brick wall at one end and the side opposite the public path); 3. indoor, totally enclosed shelter; 4. viewing window; 5. pond; 6. feed table; 7. nest log; 8. hessian screen erected in 1983 (see text).

apparently of a single chick, occurred in 1980 but the chick died when it was approximately three weeks old. The second hatching occurred in 1982 but the single chick died after about 24 hours.

Efforts were made to improve breeding conditions for the hornbills in 1982 and 1983. Since it was thought possible that the death of the chick in 1980 might have been partly due to low outside temperatures, a small 30 W electric blanket of the type used to ease rheumatic pains in human patients was placed at the bottom of the chamber inside the log before the commencement of the 1982 breeding season. The blanket was covered by a 5 cm deep layer of peat and wood shavings within which, for protective purposes, a sheet

of fine wiremesh was buried and fixed. Trials undertaken at the time of installation indicated a rise in temperature of c. 5°C on the surface of the covering layer when the blanket was switched on. A switch positioned inside the shelter, well away from the nest log, operated the blanket.

At the same time a small, baby-alarm-type, microphone was fixed within the upper part of the nesting chamber and protected by a wiremesh cover. The microphone was wired to a loudspeaker and a control switch in the animal food preparation room, thus enabling staff at any time to hear the sounds coming from within or immediately around the nest log.

Early in 1983, again before the commencement of the breeding season, a screen of hessian sheeting fixed to a timber frame was erected within the flight thus forming a visual barrier between the nest log and all external viewing areas (Fig. 1).

On 2 January 1983 both hornbills spent some time at the nest log and made desultory attempts at mudding up the entrance hole. The expression mudding up is somewhat misleading because our Great Indian hornbills have never been observed to use soil or mud to reduce the size of the entrance hole to the nest when breeding. Instead the birds use their own faeces, banana or other pulpy or sticky food items which they plaster around the sides of the hole by sideways tappings of the bill. The activity had not previously been observed so early in the year and was possibly associated with the mild winter of 1982–1983; it was not seen again during January.

On 9 February the ♂ was observed at the nest log tapping at the sides of the entrance hole with the tip of his bill although not apparently mudding up. Between 6 and 13 March the ♀ spent several short periods inside the nest log each day although she was seen to roost with the ♂ in the shelter at night. On 14 March she spent the entire day alone in the nest log and almost certainly remained there during the following night although this was not verified for fear of disturbing the birds. The next day the ♀ was in the nest log when staff commenced work at 0800 hours and both birds were vigorously



engaged in mudding up the aperture, the ♂ working from outside the log and the ♀ from within. The ♂ began carrying food to the ♀ in the nest log during the morning.

Mudding up, with a consequent narrowing of the entrance hole, was continued by both birds during the subsequent incubation period although the rate of activity decreased as time passed with the ♂ ceasing altogether a day or two before the chick hatched. The ♀, however, continued to mud up during the entire period that she was in the nest log but the quantity of material used became very small during the two to three weeks before she emerged from the log. It is possible that the sounds produced by the sideways tappings of her bill against the sides of the entrance hole had other functions, such as communication with the ♂.

The microphone inside the log was switched on for the first time on 10 April for short periods throughout the day, particularly at feeding times (0830 and 1600 hours). On 23 April, at c. 0800 hours the calls of a single chick were clearly heard.

#### CHANGES TO THE FEEDING REGIME

Under normal circumstances the hornbills are fed twice a day, at 0830 and 1600 hours, when a shallow tray containing coarsely chopped tomatoes, bananas and apples, brown bread, grapes, Vionate, calcium lactate, a small quantity of chopped raw meat and a mixture containing barley meal, shrimp meal, soya meal, grass meal, fish meal, meat meal, honey and calcium lactate, is placed on a low tree stump within the flight. In addition whole mice and pieces of cheese are given two or three times a week. Prior to 1983 the only change made to the standard feeding regime was an increase in the raw meat provided as soon as it was known that a chick had hatched. In 1983, however, major revisions were planned and implemented immediately after the sounds of the chick were heard.

Raw minced meat, minced whole adult mice, chopped boiled eggs, pieces of cheese and brown bread soaked in milk were given in three daily feeds in addition to the standard food items. Since a post-mortem examination of the 1980 chick had revealed undigested

tomato skins in the crop, all tomatoes and grapes were skinned. In addition between 20 and 30 fifth instar locusts *Locusta migratoria*, c. 50 adult crickets *Acheta domestica* and a handful of mealworm *Tenebrio molitor* larvae were added to each feed. This last change was perhaps the most important since upon being given the first modified feed at 0830 hours the ♂ hornbill immediately selected locusts, crickets and mealworms only, ignoring all other items. After tossing between 20 and 25 of these insects into the back of his throat he flew to the perch outside the entrance hole to the nest where he regurgitated the insects one by one and fed them to the ♀. Only when all visible insects (some buried beneath other food items) had been collected were other food items taken and given to the ♀ until the next feed was given three or four hours later. When collecting items from the food tray the ♂ appeared to retain these in the throat region as a visible bolus before taking them to his mate. Locusts were almost invariably taken first, followed closely by crickets; mealworms were taken only sparingly. Broadly speaking this feed regime was continued until the ♀ emerged some weeks later.

#### REARING

Frequent use was made of the microphone and the sounds of the chick were recorded on tape almost daily until it left the nest log. All three birds vocalised a good deal, especially when the ♂ was feeding the ♀, and although it was not always possible to differentiate between the two adults at these times the calls of the young were easily distinguished. Once the chick had started to vocalise it continued to do so for several minutes during which time changes in its calls gave an indication of when it was accepting and swallowing food. Eventually it appeared to become satiated and ceased to vocalise.

When the chick was six days old a handful of locusts and crickets was thrown onto the floor of the flight at about 0700 and 1900 hours; these were immediately collected by the ♂ and given to the ♀. The following day all locusts given with the 0830 feed were smeared lightly with a mixture of codliver



oil and Abidec and then dusted lightly with a mixture of calcium lactate and Vionate. These supplements, and the additional feed of insects, were continued until the chick was about six weeks old when the adults began feeding it fruits instead of insects.

When the chick was eight days old the ♂ was seen to capture and kill a newly fledged wild Blackbird *Turdus merula* which had entered the flight through the wiremesh. After alternately crushing the young bird in its bill and battering it against a perch, the normal treatment for large food items, the ♂ fed it to the ♀. Other wild birds were captured occasionally and given to the ♀ while she was inside the nest log. After such an event there were occasions when the chick did not vocalise during feeding periods and it was assumed that it had been fed with large portions of the wild bird.

Ten days after the first fledgling Blackbird had been eaten the ♂ took a dead day-old chick (a food item previously ignored) from the Black storks' feed tray and, after crushing and battering it, fed it to the ♀. This behaviour was observed on several subsequent occasions.

On the morning of 30 May, just over five weeks after the chick had hatched, the ♀ was seen to have emerged from the nest log and, unusually, was moving around on the floor of the flight where she remained until the first feed was provided at about 0830. Her plumage was soiled, the flight feathers were in a dishevelled condition and a vertical band of hard brownish material, similar to the deposit around the entrance hole, was present about halfway along the bill, obviously the result of her regular mudding-up activities. The nest aperture had, however, permitted the exit of the ♀ without requiring enlargement. Later examination of the nest chamber confirmed that the ♀ had not moulted while inside the log although three or four flight and tail feathers had been lost.

At 0900 hours the ♀ joined the ♂ in collecting food and feeding the young hornbill inside the nest log. On 3 June both adults suddenly switched priority from insects to fruits when selecting food for the chick. This change of emphasis was consolidated over the

following four days and subsequently insects were fed only occasionally.

At the time the ♀ emerged the weather became colder so the small electric blanket buried at the bottom of the nest chamber was switched on at 1700 hours and turned off again in the morning. The blanket was left on during the coldest nights, but switched off on warm days, until 7 June when it was judged to be no longer required. Every attempt was made to avoid frequent or sudden temperature fluctuations. Although there is no way of knowing whether the provision of extra warmth was beneficial, at least there appeared to be no disadvantageous effects from using the blanket as described. Later examination of the nest chamber showed that the layer of peat and wood shavings above the blanket was still c. 5 cm deep although this may have fluctuated during the rearing period.

The young bird was observed briefly through the entrance hole on 12 June as it moved around inside the log. The next day it commenced mudding up the entrance hole and continued doing so until the day it emerged. The activity was accompanied, as in the case of the adult ♀, by light, fairly rapid tapping sounds as the bill came into contact with the sides of the aperture, and the terminal third of the bill could sometimes be seen protruding from the log.

In order to guard against potential accidents, should the young bird emerge from the log in the absence of staff, the water level in the pool in the flight was reduced and hessian sheets were fixed over the interior of the glass observation window of the shelter. At 0830 on 3 July the young hornbill was seen to be pecking lightly at the mud around the entrance hole with the tip of its bill. Upon arrival of the staff the next day the young bird had emerged and was moving around the floor of the flight; it was just over ten weeks old. During the next two-and-a-half hours it moved, by a combination of hops and wing beats, to a succession of higher perches and finally came to rest on a perch near the top of the flight. It appeared to have some difficulty in maintaining its balance at first, but by about 1500 hours it was sufficiently confident to fly in a rather laboured fashion to a perch at





Plate 1. Great Indian hornbill *Buceros bicornis* young, bred at the Cotswold Wild Life Park, on the day it emerged from the nestbox aged 73 days. Colin Fountain.

the far end of the flight. On several subsequent occasions during the afternoon it flew from one end of the flight to the other. Although the body size of the young hornbill appeared to be almost that of its parents the bill and tail feathers were noticeably shorter. The upper mandible was smooth dorsally, with no trace of a casque, and the iris was a pale blue. The plumage was in excellent condition and the bird appeared to be healthy and normal in every way.

The parent birds reacted to the presence of the fledgling with loud and frequent vocalisations; both continued to feed it for some weeks. It was seen to take food from the tray for the first time on 27 July, about three weeks after it had emerged. The first indi-

cations of the development of a casque were observed on 11 August by which time the young bird was almost independent of the parents although they were still seen to feed it occasionally.

#### CONCLUSIONS

The Great Indian hornbill is not uncommon in captivity but it breeds only rarely under captive conditions. If, however, a pair is provided with the necessary materials for nesting, including a hollowed-out log placed in an undisturbed and relatively secluded area, breeding success can be greatly improved. In addition an immediate increase in the amount and variety of food provided when the chick has hatched, with a particular emphasis on live insects, is essential to ensure that it receives the correct diet in adequate amounts for healthy development. The ♀ remains with the young for about five weeks, depending entirely on the ♂ for food, and the fledgling emerges at the age of about ten weeks but is not independent of the parents for about another five weeks.

The young at the Cotswold Wild Life Park represent the first captive breeding of the species in Great Britain, and for this the park was presented with a Group 1 Award by the National Federation of Zoological Gardens of Great Britain and Ireland.

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#### PRODUCTS MENTIONED IN THE TEXT

**Abidec:** liquid multivitamin supplement, manufactured by Parke-Davis, Usk Road, Pontypool NP4 8YH, Great Britain.

**Vionate:** powder multivitamin supplement, manufactured by E. R. Squibb & Sons Ltd, Animal Health Division, Regal House, Twickenham, Middlesex, Great Britain.

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