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THE BUCEROTIDÆ, OR HORNBILLS.

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(With a Coloured Plate.)

THE Zoological Society having recently obtained a living specimen of an adult female hornbill (*Hydrocissa conveza*) from Borneo, furnishes us with the occasion to give some account of these curious birds, which are very seldom to be seen alive in Europe, and are even considered great curiosities by residents in the countries they inhabit.

The hornbills are large and clumsy birds, seldom adorned with bright-coloured plumage, but in many cases bearing a really prodigious bill. In this respect they somewhat resemble the toucans, with which they are often confounded, though they have in fact little or no affinity or true relationship with them. While the toucans are strictly confined to the tropical parts of America, the hornbills inhabit the tropics of the Old World, being found in Africa, India, and the Indian islands. It is in this latter region that the greatest number of large and remarkable species are to be found; and having had frequent opportunities of observing them in their native haunts, I shall endeavour to give a correct idea of their form and habits in the Malay Archipelago, to which will be added a few words on their relationship to other birds and on their geographical distribution.

Form and Structure.—Hornbills are generally characterised by large and heavy bodies, rather long and powerful wings, very short legs, long neck and tail, and enormous bill. The plumage in all the larger species has a ground colour of black, sometimes tinged with bronze, and the tail and lower parts more or less varied with white. The neck is very often of a reddish-brown colour; the plumage is generally loose, and on the head and neck often approaches hair in its appearance. In some species the cheeks and a part of the neck is bare, and



TOUCANS

- 1.—*Toucanus coereba*
- 2.—*Toucanus bicornis*.
- 3.—*Toucanus castaneus*.
- 4.—*Toucanus chrysoloba*.

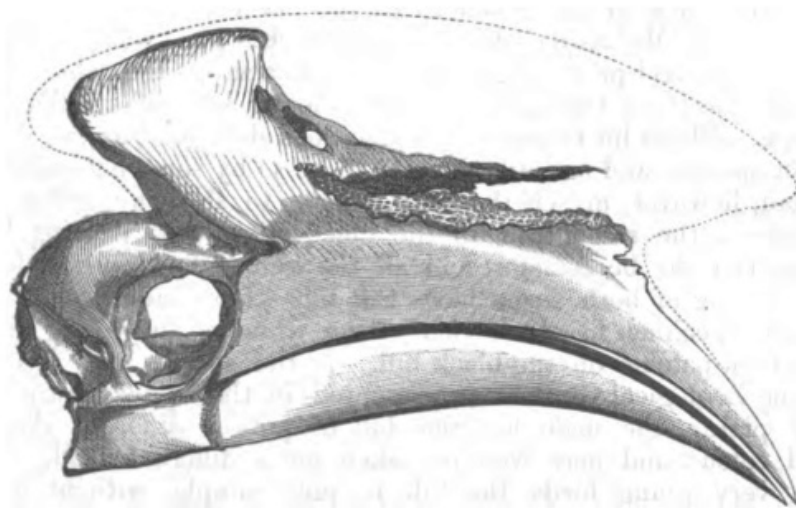
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adorned with brilliant colours. One of this kind, the *Buceros cassidix*, is figured in our plate. The feet are very remarkable, the three toes in front being joined together for some distance from the base, so that they cannot be spread open as in most birds, but form a broad sole to the foot, indicating that the feet are used merely to rest on, and very little for progression. They resemble on a very large scale the feet of a kingfisher, which, as every one knows, rarely or never hops, contenting himself with sitting still, and using his wings when he wants to move.

But the most remarkable feature of the hornbill is that from which they take their name—the bill. The form of this organ varies in every species, varies often in the sexes of the same species, varies even in the same bird from youth to age; yet there is a certain characteristic form, of which all the others seem to be modifications. It is always considerably curved, rather broad and angular at the junction of the two mandibles, and compressed above and below, generally forming a sharp keel along the top. This is the shape in many of the small African and Indian species, forming the genus *Tockus* of naturalists. Other species have the keel raised at the base of the bill, or have ridges on the sides which meet and form rings or crests at the top. In others again the keel is much elevated, swollen, and projecting in a point above the bill itself, till in the larger and more remarkable species a large boss or recurved horn rises up above the crown of the head almost as large as the true bill itself. In some of the African hornbills a curious modification occurs, in a sort of tube or cylinder open at the front, on the top of the bill. In those species which bear ridges on the sides or top of the bill the number of these is supposed to indicate the age of the bird; whence all hornbills are called by the Dutch in the east, and after them by the Malays, "Year-birds." In the *Buceros ruficollis*, figured in our plate, this rule will most likely apply at least for the first seven or eight years, as the young birds have no ridges, and others are found with all intermediate numbers up to about nine, after which the end ridges seem to scale away and become indistinct, so that it is not improbable the bird may live much longer than this would seem to indicate. In the great rhinoceros hornbill (*Buceros rhinoceros* of Linnæus) the bill attains perhaps its greatest size and beauty, the rich hues of orange crimson and ivory white with which it is adorned in the living bird being scarcely capable of imitation. It is this bird which excited the wonder of the early voyagers to Ceylon (where a variety of it exists), who believed it to have two heads—a statement which was long credited in Europe, and which may serve to teach us that the wildest and most improbable fictions of

early ages had probably a foundation in some curious natural phenomenon.

In this immense mouth is situated a very small tongue, so small and capable of so little motion that it may almost be considered rudimentary, and resembling much the tongue of a kingfisher. The bill itself is very light for its size, though containing a tolerably compact core of porous bone to its very extremity. The horn, however, adds scarcely anything to the weight of the bill, being completely hollow, except at the base,



SKULL OF *HYDROCISSA CONVEXA* (MALE).

(The dotted line shows the outline of the bill.)

where it has a bony core. The rest is merely an expansion of the thin horny sheath of the bill. Another remarkable peculiarity is that the upper and lower mandibles seldom meet, except at the base and tip, all the middle portion gaping from an eighth to a quarter of an inch apart. The only use of this anomalous structure which I can conjecture is that it enables the birds to carry a considerable quantity of fruit in the closed bill (the roof of both upper and lower mandibles being hollow), without crushing it, as they would be likely to do during the exertion of flying if they were obliged to hold the fruit by the pressure of the partly separated mandibles. This would render probable the truth of the singular fact stated by the Rev. J. Mason in his work on the "Natural Productions of Burmah," and probably communicated to him by the natives, that when the female of *Buceros bicornis* is sitting on its nest (in the manner to be presently described), the male brings her a continual supply of fruit; "but all must be unbroken, for if a fig or any other fruit is injured, she will not touch it."

A striking peculiarity of some of the Indian hornbills is, the remarkable difference between the two sexes. In birds generally the bill is a very constant organ, and its slightest modifications are often characteristic of distinct genera. The sexes of many birds differ much in plumage, while the bill remains almost always the same. Here, however, the principal differences between the male and female bird are in the bills, the plumage remaining unchanged, or only offering differences in the colours of the head and neck. For example, the *Buceros ruficollis* (see plate) has the neck rich brown in the male, but entirely black in the female. In the black Malayan hornbill (*Hydrocissa Malayana*) the male has the bill pure white, with a very high keel projecting forward in an acute edge, while the female has it jet black, with a much lower keel of a different shape. These birds have of course been described as two distinct species, and are still thought to be so by some naturalists. I had, however, myself the good fortune to shoot a number of them on the same tree, all the black-billed ones proving by dissection to be females, and all the white-billed ones males. The young of both sexes have the bill white, and I have one female specimen in which some of the white of the young bird is left in patches on the black bill. In the species now living in the Zoological Gardens (represented in the upper figure of our plate), the male has the bill of quite a different shape and colour, and may well be taken for a different bird. In the very young birds the bill is quite simple, without any sign of the horns—in some cases resembling that of a young kingfisher, in others that of the small hornbills with a simple curved bill.

Habits of the Hornbills.—Considered as a whole the hornbills seem to be omnivorous, but the Malayan and Indian species are almost always fruit eaters, and I believe all of them prefer that kind of food when it can be obtained. They are seldom to be seen in cultivated districts, inhabiting almost exclusively the primeval forests, where the smaller species are often to be met with in flocks of a dozen or twenty, while the larger ones generally go in pairs. They fly very high, far above the tops of the loftiest trees, with neck stretched out and head bent downwards, progressing rapidly with powerful strokes of the wings, and accompanied by a sound which can be heard at a great distance. The noise produced during flight is in fact so loud and peculiar, that many persons cannot believe it to be produced merely by the mechanical action of the wings on the air. It may sometimes be heard a mile off, and as one of the larger species rushes by overhead it forcibly recalls the old legends of griffins and dragons, the awful sound of whose wings struck terror and dismay into the inhabitants of the country

they came to devastate. The sound which it seems to me most nearly to resemble is, the puffing of a locomotive when starting with a heavy train. There is only one other bird that I have heard produce a sound with its wings at all resembling (though not quite equalling) that of the great hornbills. It is the Muscovy duck (*Cairina moschata*) in its native country, South America. Both these birds have a very heavy body; both have, comparatively speaking, a small area of wing, and must, therefore, to support themselves, beat the air with immense force.

The rhinoceros hornbill sometimes exceeds four feet in length, and exhibits the greatest size reached in the Passerine order of birds. The exertion of flying is so great that it generally rests at intervals of about a mile on some very lofty tree, whence after a few minutes it resumes its flight. In some of the interior villages of Sumatra and Borneo, where a gun is never heard, they will settle upon and even build in trees in the village itself; but in more populous districts, where guns and Europeans abound, they are very shy, and take flight on seeing a man even at a considerable distance.

It is interesting to watch their motions when settled upon a fruit tree. Their weight is so great that they cannot venture out on the smaller branches, nor can they cling to the twigs, or flutter among the foliage like smaller fruit-eating birds. They cannot even hop readily from branch to branch, their short legs only serving to support the massive body. On first alighting they look cautiously round till they discover some spray of fruit hanging within reach of the branch they are upon, when they move sideways towards it by a sort of shuffling hop; and then stretching out their long neck, seize a fruit by the extreme point of the bill. To swallow it now they have got it, is however, no such easy matter; for the tongue not being adapted for deglutition they are obliged to jerk down every mouthful by suddenly throwing back the head, and at the same time opening the bill, by which action the fruit is of course thrown down the throat. This habit has given rise to the statement that this bird as well as the toucan throws its food up in the air before eating it; but a careful observation of the birds feeding in a state of nature, proves that the fruit never leaves the point of the bill except to be jerked down the throat. The action, however, so much resembles that of catching something in the mouth, that the mistake is easily accounted for. Having finished all the fruit within reach of one branch the bird with much deliberation takes flight to the opposite side of the tree, where the same operation is repeated till all the fruit that can be easily reached is exhausted. This is of course soon done, and it therefore happens that hornbills seldom visit a fruit tree more than two or three days consecutively; whereas pigeons,

barbets, bulbuhls, and other fruit-eating birds may be found on the same tree daily for as many weeks. The discovery of a dinner every day in the year must doubtless be sometimes a matter of difficulty to the larger hornbills, and they are often obliged to resort to other kinds of food. From the gullet of the *Buceros cassidia* I have taken the fragments of large long-horned beetles (*Batocera*), and when residing in the forests of Celebes I once had an opportunity of observing from the door of my hut one of these insects captured, beaten repeatedly against the branch, and then swallowed. On another occasion I shot a Moluccan hornbill (*Buceros ruficollis*), to the roof of whose beak was sticking a large lump of bees' comb, showing that he had been making a meal off bees' brood and honey. They are also positively declared by the natives to eat eggs and young birds occasionally. Yet notwithstanding this varied bill of fare there seems little doubt but that periodical scarcity of food is the most efficient check to their increase, as shown by the fact that the larger kinds are always scarce even where the smaller ones abound.

Most of the hornbills make their nests in hollow trees, though some of the African species are said to build rude exposed nests on lofty branches. The larger kinds lay only two eggs, the smaller ones probably a larger number, but all of a white colour. A remarkable habit has been recorded of at least three species, which, like so many of the strange facts in nature, was for a long time considered to be fable. As soon as the female has deposited her eggs the male imprisons her in the tree by closing up the entrance with clay and gummy substances, leaving only a small hole, out of which she puts the tip of her bill to receive the fruits with which he keeps her well supplied. She is kept shut up in this manner, some say, till the young are hatched, others till they are fledged. In the interior of Sumatra in January, 1862, one of my hunters brought me a male concave hornbill (*Buceros bicornis*), which he told me he had shot when in the act of feeding its mate. On going with him to the spot I saw a hole in the trunk of a large tree about twenty feet from the ground, out of which the bill of a hornbill was partially protruding. With great difficulty I persuaded some natives to climb up the tree and bring me the bird, which they did alive; and along with it a young one, apparently not many days old, and a most remarkable object. It was about the size of a half-grown duckling, but so flabby and semi-transparent as to resemble a bladder of jelly, furnished with head, legs, and rudimentary wings, but with not a sign of a feather, except a few lines of points indicating where they would come. A smaller species, inhabiting India and Ceylon (*Buceros monoceros*), is said by Mr. Layard to have a

similar habit. A third species found in Java (*Buceros plicatus*), very similar to the *Buceros ruficollis* of our plate, is said by Dr. Horsfield to be called by the natives "the jealous bird," from its extreme watchfulness over its partner. They assert that if any traces appear of the nest having been visited during the absence of the male bird he will on his return completely close up the opening with mud, and leave his unhappy wife and children to perish.

The voice of these birds is very harsh and grating. It is heard occasionally while they are flying, and also when they are alarmed. When, however, a bird is wounded or captured alive, the horrible noise it makes is perhaps not to be surpassed in the animal world. It is something between a bray and the shriek of a locomotive, and is kept up continuously, so as to be absolutely unbearable. When the female bird I have mentioned was captured on the nest we heard it about a mile off, a horrible noise even at that distance, and the screams continued without ceasing till it reached our boat. It is thought by some persons that the hollow protuberance of the bill may have something to do with the production of such a volume of sound, but besides that there is no communication whatever between the bill and the windpipe, the very large and strongly ringed trachea seems sufficient alone to produce it, especially when we consider the wonderful power and variety of the notes which proceed from the same organ in some of our small singing birds.

Classification.—The relations of the hornbills to other birds are rather obscure. Their large bills and general habits having much similarity to those of the toucans, they have been classed by some authors as the eastern form of that family. A careful comparison, however, shows that this resemblance is only superficial. The toucans have long and powerful legs, and can hop readily and actively about the trees on which they are feeding; but their wings are very small and weak, and their powers of flight are so feeble that in flying across the Amazon, which is three miles wide, they not unfrequently fall into the water from exhaustion. In the hornbills the reverse is the case, the legs being organs of support merely, and the wings the only means of motion. In the toucan's foot the toes are widely separated, the outer one being turned backwards, whereas in the hornbill the three anterior toes are closely joined together. The bill of toucans has no bony core and the tongue is excessively long, by both which characters it is widely removed from the hornbills. The internal structure shows this difference even more clearly, for the sternum or breast bone, which always has a general similarity of form in allied birds, is in this case as different as it well can be in two birds of the same order.

Other authors have placed them near the crows, on account of their conical bill and the semi-terrestrial habits of some of the African species, but almost every detail of structure is equally against this arrangement. The fact seems to be that they are a very peculiar and isolated group, with no immediate relations with any other birds. If we accept the general principle that all apparent isolations in nature are the result of the extinction of intermediate links which have once existed, we must suppose the hornbills, as we see them now, to be but a fragment of a great group of birds, containing many hundreds of genera and species, which once inhabited the great tropical continent, which there are indications of having occupied at a former geological epoch what is now the Indian ocean. Some of these birds would probably have filled up the gap that now exists between the hornbills and the other fissirostral birds, such as the kinghunters (*Dacelo*) of the east, and the puff birds (*Capitonidæ*) of America; for it is to some of these birds, though so much smaller and apparently so different, that the form of the feet, the structure of the skeleton, the shape of the bill in the embryo, and the character of the egg, show the hornbills to be really allied.

As in other families, which seem to be but the surviving remnant of much more extensive groups, there are among the hornbills some peculiar genera which differ much from all the rest. One is a rare Malayan species, the helmeted hornbill (*Buceroturus galeatus*), which, besides having two immense long streaming feathers in its tail, has a short straight pointed bill, with an immense hump on the top of it, which, instead of being hollow and light as in all the other species, is a solid bony mass of such density that the species has received a Malay name signifying "ivory bird." The habits of this rare and curious bird are unknown. The other anomalous form consists of the African genus *Bucorvus*, which has long legs, and habitually runs on the ground, where a true eastern hornbill never ventures. These birds are said to feed on insects, on small reptiles, and also on carrion, taking upon themselves something of the habits and outward appearance of vultures.

Geographical Distribution.—About forty-two species of hornbills are now known, of which eighteen or nineteen occur in Africa, nine or ten in tropical Asia, and seventeen or eighteen in the Malay Archipelago; a few of these being reckoned twice over as they occur on the borders of two of the districts, which however are, on the whole, inhabited by quite distinct species. In Africa they are found in all the country south of the Sahara, the smaller species being more abundant on the West Coast, while the larger semi-terrestrial species inhabit the more arid eastern districts. One or two of the smaller Asiatic species are

found in the mountainous forest country of Nepal, another seems confined to Ceylon; of the others some are confined to the Peninsula, others to Eastern India. How far they extend eastwards into Burmah or China is not at present known; but it is probable they will be found as far as the great forests extend in that direction, and from those regions it seems most probable we may yet receive some additional new species.

In the Malayan Archipelago the species are more numerous in the great islands of Java, Sumatra, and Borneo, in which twelve different sorts occur, ten of which are found in Sumatra, a smaller number in Borneo, and only three or four in Java, one of which is peculiar to it. In the islands farther eastward the species have a more restricted range, two very distinct kinds inhabiting Celebes, and being found nowhere else (the head of one of these, *Buceros cassidix*, is figured in our plate). Three are peculiar to the Philippine Islands, and one (*Buceros ruficollis*), of which the head is also figured, is found in almost every island of the Moluccas, in New Guinea, and in New Ireland, where the eastern range of these birds appears to terminate. They are quite unknown in Australia, and in the Archipelago, the islands of Timor, Flores, Sumbawa, Lombock, and Bouru do not possess them.

These facts agree very well with the supposition before made, that the hornbills were once more numerous and varied, and inhabited a now submerged continent, whence during the slow progress of geographical changes they have spread themselves to the surrounding countries. There is a great deal of independent evidence to show that the islands of Sumatra, Java, and Borneo were at no very distant epoch united with each other and with the continent of Asia, and we therefore find many of the species ranging over all these islands as well as some portion of the adjacent continent; while the islands further eastward, which have remained isolated for a much longer period, contain species which are peculiar to them.

The geographical distribution of the hornbills seems therefore quite in accordance with the almost universal belief of modern naturalists, that the present position of every living thing upon the earth is the result of that long and complicated series of geological changes and organic modification which the globe has ever been and still is undergoing.
