

Mole, who had spent some thirty odd years in the study of the life history and habits of the Trinidad Snakes has left us the only standard work on the subject "The Trinidad Snakes," an abridged version of his more detailed book in manuscript form possessed by a few members of the Club, and an abridged version of what he had published in the Proceedings of the Zoological Society of London on 31st March 1924. Aspiring naturalists in the Society may bear in mind that many gaps are yet to be filled in the knowledge of the habits of our snake fauna, and whilst they may not be capable of such length of devoted application to a single subject, useful work may still be done on a single species at a time among the 43 species indigenous to the island.

P. L. Guppy came from a family of scientists and naturalists. He devoted some 30 years of his life to the study of the fresh water fishes of Trinidad, and his compilation of facts and observations on the subject is still in manuscript form, and is at present in the Library of the Imperial College of Tropical Agriculture at St. Augustine. He also evinced considerable interest in butterflies and marine fishes, and his excellent water colour drawings still adorn the walls of the Royal Victoria Institute Museum.

T. I. Potter was another rare personality. A small man, he was extremely affable and extremely versatile. Under his presidency, I spent my most formative and profitable years. His was not the specialist devotion of Mole, but rather the all-embracing appreciation of Caracciolo. His particular interest, if one might single out something from his wide and varied interests, was orchids, both exotic and indigenous. However, in 1942 he published a work entitled "Fruit—native and introduced—in the Island of Trinidad, B.W.I.", and it is a matter for regret that Broadway, Ulrich and himself did not publish considerably more than they did. Nevertheless, Potter's familiarity with several aspects in the field of natural history, made him a most virile and informed president of the Trinidad Field Naturalists' Club, catering as it did (and does) to the tastes of both scientists and nature lover alike. His intimate knowledge of historical and geographical aspects of the island, spiced with rare anecdotal details on personages and things, made him highly appreciated and dependable at meetings and an intellectually satisfying leader on the Club's biological excursions. It may be conceded that under his long leadership, the Field Naturalists' Club attained its peak of popularity in the colony.

## THE SULPHUR AND WHITE-BREADED TOUCAN

By E. M. CHENERY.

In Trinidad there is only one representative of the sixty odd members of the toucan family, this being the Sulphur and White-breasted Toucan, *Ramphastos vitellinus* Licht., which also occurs on the mainland. Whilst the bird itself is not often seen its raucous cry may be heard throughout the year from the motor roads cut through the primary rain forests of the island. Occasionally a pair may be seen in undulating flight over the roads or hopping in the tree tops; but rarely without the aid of field glasses can a good view be obtained. It is then that their striking coloration can be best appreciated,—the sky blue ring

round the brown eye and the blue at the base of the beak, the orange and white chest merging into a scarlet belt with another scarlet band at the base of the tail, all in marked contrast with the jet black of the rest of the body and beak. Details of the birds' proportions are not less interesting than their colouring. Their huge beaks with serrated edges balanced by their long tails do not appear too ungainly and the birds when seen making their long, effortless hops in the highest branches appear really graceful.

Even since I became converted to bird photography, the camera shooting of such a fascinating subject as the Toucan in its wild state was about the height of my ambition but the chances of achieving it were extremely remote with the only record of eggs being found dating as far back as 1913. My opportunity came, however, in April 1938 when I was lucky enough to be shown a nesting hole with the head of a bird projecting from it. This was sixty-five feet from the ground in a hundred foot tree situated in the heart of the forest but fortunately near a motor road.

The tree was very conveniently forked at about thirty-five feet up, the two limbs being thirty-six inches in girth and only six feet apart at the level of the nest. The hole was roughly circular, four inches in diameter, but its depth and whether it was excavated by the birds are not known. The problem of height was soon solved by nailing rungs to the main trunk and limb until opposite the nest where the camera stand was finally secured.

The first attempt at photography on April 15th 1938 ended in failure for after fixing up the camera, arranging over two hundred feet of string for releasing the shutter and waiting for three hours, the bird proved too shy and only returned at dusk. Next day the camera was rigged up earlier and after leaving it unwatched for three hours I returned to find the parent bird obligingly poking its head out for me to take its portrait. To take the picture of the entire bird proved a much more difficult matter as the old toucan only remained on the edge of the hole for about three seconds before going inside; thus one had to pull the string during this very short interval and be prepared to waste a lot of film. The periods of waiting for the bird to return after setting the camera varied from three hours to ten minutes.

It is seldom, if ever, that ideal conditions for bird photography prevail, especially in the tropics. The drawbacks in this case were bad light, rainy weather and irritation from insects. What can be one of the most pleasurable of occupations too often became an endurance test with the excessive heat, humidity and continuous biting of bloodsucking flies, mosquitoes and ants. The hole was fairly well lighted from three to five-thirty p.m. provided the sun shone but unfortunately the dry season of 1938 was one of the wettest in living memory so that only on very few occasions were conditions really favourable. As much as 19.8 inches of rain fell in April compared with an average of 3.8 for the previous four years.

At the time the bird was first seen it was uncertain whether it was sitting on eggs (a clutch of two white, pointed oval eggs is normally laid) or brooding young. The man who found the nest stated that he had seen the bird in the hole for three weeks prior to April 12th which rather indicates that it was sitting then. A sudden change in this bird's

behaviour took place on May 1st in that it seemed much too nervous to return to the hole after the camera had been fixed up and it left the tree on hearing or seeing something unusual whereas before one could watch indefinitely from the ground without concealment. It is extremely probable that this was due to the hatching out of the young toucans.

Almost a month went by before the presence of young in the nest was confirmed for it was not until May 24th that one of the parents was seen with a berry in its beak. It was apparently able to scream with a fruit the size of a cherry in the tip, swallow it with an upward jerk of the head and regurgitate it with a downward jerk. The actual process of feeding was first seen on May 27th and photographed two days later.

During the next few weeks I spent as much time as possible watching the family life of the toucans. Altogether records were taken for continuous periods longer than three hours over a total of sixty-seven hours of observations.

It must be mentioned here that the two sexes are almost identical in appearance differing only in size, with the female the slightly smaller bird. Distinction from ground level proved very difficult; however in this case one bird, always associated with a higher pitched cry, seemed quicker in movement and showed less hesitation in jumping from the take off branch to the nest. Intensive watching revealed that it was this bird alone that entered the hole after first parting with the food (if any) and came out five to ten seconds later with the excrement of the young ones. To ascribe the respective sexes of the birds could not be done without recourse to the drastic measure of dissection thus throughout this paper specific reference to the sexes has been avoided.

Both parents took part in the feeding of the babies, the food consisting chiefly of berries but the diet may include insects for what appear to be a large winged insect was disclosed in one of the photographs. The actual process of feeding usually took place at the edge of the hole with the parent giving a deliberate peck into the interior, withdrawing the head and by a rapid downward jerk regurgitating another fruit which rolled down to the tip of the bill and was then given to the chicks. On one occasion the old bird was seen to disgorge three complete fruits whilst clinging on to the edge of the hole but more often they flew back to the take off branch nine feet away and coughed up the berries there.

The chief meal seemed to take place early in the morning, consisting of one to three periods of five to twenty minutes each starting at 6 a.m. and ending at about 8 a.m. The parents were kept very busy flying rapidly to and from the nest to satisfy the voracious appetites of the growing chicks. Feeding times during the day were very irregular; once the nest was watched for nine hours continuously with neither of the parents returning. During another long watch from dawn till dusk they made the following visits to the nest: twenty-two for feeding, eight for cleaning, seven for feeding and cleansing on the same visit and nine very short visits when neither operation took place.

I heard the young for the first time on June 1st mewling and gurgling very softly; five days later one was actually seen to poke its head out of the hole. Both chicks were seen together on June 10th and next day one of them had its portrait taken. Its beak was leaden grey in colour, the eye ring very pale blue and the few chest feathers that were visible were pale yellow.

A dramatic end came to this absorbingly interesting and often exciting bird study two months after its commencement. On June 15th at about 5 p.m. a seven foot tree snake known locally as the tigre, wriggling about near the nesting tree in search of a meal must have sensed the presence of the young toucans. It ought to have been pleasantly surprised to find such an easy tree to climb with a ladder already provided. Reaching the camera stand it is quite likely that it made use of this three foot projection on which to anchor itself whilst it bridged the gap to the nest and made short work of the two plump toucan chicks.

On the return journey down the ladder the snake must have had another pleasant surprise for in a hole just where the tree forked were two equally plump babies of the Spix's Scops Owl. At this time the parent toucans probably returned for it was then that the attention of two Forestry Department officials walking nearby was drawn to their frantic screams. They actually saw the birds pecking the snake so much so that it was obliged to drop some thirty-five feet to the ground but only after it had polished off the young owls.

Not until next morning did I realise what I thought at this time was the full story of the tragedy, when I found the toucan's nest silent and deserted for although I arrived on the scene half an hour after the snake had left I thought that only the young owls had been eaten. For two more days the parent toucans were observed hopping about distractedly near the nesting tree before leaving the vicinity for good.

Despite the disaster of 1938, what was probably the same pair of birds nested again in this tree in 1939 and 1940. In 1940 I was able to check up on the data obtained in 1938 but was unsuccessful with my photographic efforts. I am indebted to forest ranger Ifill for keeping a close watch on the birds and recording odd events in their behaviour from which the following conclusions were deduced. The eggs were laid later in the year on May 23rd. (the time at which the birds started being continuously in the hole) instead of early April. Thus the breeding season coincides with the period of greatest activity in the forest so that by the time the young are hatched there will be plenty of food available. Thirty-three to thirty-four days or four and a half weeks elapsed before the eggs hatched (the time when the old birds did not stay in the nest continuously and left at the slightest noise) and it was not until August 10th that the babies left the nest. They were thus at home forty-six days or just over six weeks which fact throws a different light on the 1938 story. It will be remembered that the 1938 babies were in the nest from May 1st to June 18th (the day of the snake episode), this too is forty-six days which rather suggests that the ending might have been quite happy after all. The forest rangers did not actually see the snake eating the birds although they

saw it up the tree being violently attacked by the parent toucans. The young may after all have left the nest on their own accord, under their own steam, so to speak. The young owls were certainly not big enough to fly and the snake may have contented himself with them alone. On the other hand I did not see four toucans around the tree the next day nor at any later period. Young toucans are almost certain to accompany their parents for a considerable time after leaving the nest for it is a general rule in nature that the longer the young are maintained in the nest by the parents the longer they keep company in after life—wasps, ants and even human beings afford good examples of this. Another point is that the nearby feeding grounds of the old birds were probably exhausted and that at this time they were far afield. It would thus be easier for them to look after the fledglings with food close at hand than to stay around the nesting site. Also the fact that the old toucans probably returned to this tree in 1939–1940 indicates a successful brood for 1938. One might say good-bye to the little family by taking the more optimistic view.

A couple weeks after this I consoled myself somewhat by rescuing a baby toucan from the tender mercies of a small boy (it could not possibly have been one of the other brood). It was just able to fly in rather a weak manner and had a terrific appetite for bananas and bread and milk. This bird was kept as a pet for ten months during which time it made quite a name for itself. Although it could fly quite well after about three months I hesitated to return it to the bush for it would never have survived or have known where to look for food. It had one month of happy freedom flying around the Imperial College Laboratories spending most of its time in the saman trees and coming down to its old cage for food when it was hungry. It used to sit about twenty feet above the ground and gaze at every passer by first with one eye then with the other in such a comical way. Then it developed a bad habit of flying into the open laboratory windows and stealing small moveable objects such as students' pencils and rubbers and on one occasion a prepared microscope slide, which it dropped on the concrete outside.

It was most instructive to follow up field observations with a semi-tame bird. The baby call, rather like a crying puppy, was continued for nearly six months before the piercing forest cry developed much to the distraction of certain College lecturers. Also during this time it produced a rattling sound with its beak which, by the way, grew at the rate of a centimetre a month until it reached 12cms, when growth apparently stopped. I was able to test the strength of the beak and it proved far less dangerous than one would imagine the most powerful bite being little more than a nip and on no occasion did it draw blood.

Its sleeping habits were probably the most interesting of all. It invariably went to the perch on the west side of the cage and cocked its tail so high that it turned through 180° and rested on its back then, for the first four months at least, it snuggled its beak over its shoulder between the tail and the back leaving nothing more than a ball of black feathers. Toukie did not enjoy its freedom for long and was killed by a farm boy. It was eventually stuffed and now has a place of honour in the College museum.

In 1941 I had expectations of the original nesting site being used again but the birds after a preliminary occupation of a week or two decided to go elsewhere. My hopes were raised again when two other occupied holes were revealed to me one twenty feet above the ground and the other only nine feet. Such low nesting holes seemed too good to be true after one at sixty-five feet but again the birds used them presumably for roosting or, after a preliminary tryout, discarded them. It has been demonstrated with other species of toucans that they roost in holes at night. This fact is related to the apparent laziness of the birds in getting up in the mornings for they are pretty well the last birds to make their presence felt. The amount of light reaching the bird one or two feet below a hole three inches in diameter at six o'clock in the morning must be equivalent to the light at the very break of day an hour or so earlier.

At this juncture I think it would be interesting to sum up the results of the study of Trinidad's only toucan and then to compare them with those of a much more detailed study of a closely related species made by a professional ornithologist.

The main points revealed so far in this paper are that the toucan feeds on forest fruit and sometimes on large insects. Its breeding season coincides with the onset of the rainy season; it probably uses the same hole year after year and spends a considerable time in occupation before laying; it lays two eggs which take about 4½ weeks to incubate; the young are in the nest the unusually long time of forty-six days which as far as I can ascertain is only surpassed by the Condor vulture chicks which remain fifty-four days in the nest.

The species with which I am going to compare the Sulphur and White-breasted Toucan ranges throughout Central America and was studied intensively by Dr. J. Van Tyne, over a period of three years at Barro Colorado Biological Station, Panama Canal Zone. The work of this station is described in the various books by Dr. Frank Chapman. The bird's scientific name is *Ramphastos brevicarinatus* and its common name is now "Van Tyne's Toucan." This bird is about the same size as our's but is more gaudily coloured. Its beak, besides having the blue base similar to the Trinidad bird, is greenish yellow with a maroon patch at the tip. Its eye ring is yellowish-green but most of its other colouring is similar to our's except for its upper tail-coverts which are white.

The feeding and breeding habits of Van Tyne's Toucan are very similar to the Sulphur and White-breasted but it is interesting to observe that the former species has a great liking for ripe bananas in the field as well as forest fruits and will actually invade plantations for food, skinning the bananas with great dexterity. Our bird is far too shy to come anywhere near a banana field despite its greed for this fruit when in captivity. A notable difference exists in nesting times Van Tyne's Toucan being exclusively a dry-season breeder. Just as in the case of our bird the young Van Tyne's Toucans are fed by both parents with fruit and what is more stay in the nest practically the same length of time. Dr. Van Tyne's pair of birds, on which he made most of his observations, were unfortunate with their young for after thirty-six

days the nest was broken into by some predacious animal and the babies taken. From data obtained on other broods he calculated that the young would normally have remained in the nest forty-five days.

I expect my readers are wondering, for what purpose toucans have such disproportionately large beaks. Dr. Van Tync in his monograph discusses this very fully and I cannot do better than quote an abstract on this subject:—

“The most striking fact about the toucan is the enormous size of its bill. Doubtless among the first natural objects brought back from the tropics of the new world were the bills of toucans. Indeed, the earliest record of the discovery of toucans is a description of the bird and its enormous beak by Oviedo in 1527. From very early times men have wondered why the toucan should have such a bill. Linnaeus and Buffon considered it a grave defect of nature and looked with pity on the poor overburdened creatures but most writers have sought for some adaptive function and have usually found it. The list of conjectures covers most of the possibilities.

Charles Waterton wrote to Traill from Guiana that the toucan's bill “contains a delicate network of bony matter” supporting a “great number of blood vessels.” From this Traill (1815) argued that the toucan bill was “an admirable contrivance of nature to increase the delicacy of the organ of smell.” In this he was followed by Swainson and others. Then Sir Richard Owen studied the anatomy of the toucan bill and published an account in Gould's first monograph (1835) showing that the idea was untenable and advancing the theory that the extraordinary development of the toucan's bill compensated, by its great power of mastication, for the lack of grinding structures in the gizzard. This theory has had its followers ever since, although it seems to have no foundation in fact. Another theory was that of R. P. Stevens (1870) who stated positively that toucans use their great serrated beaks to saw off the deep corollas of flowers in order to obtain the insects therein. Shortly afterwards, Belt (1874) in his famous book on Nicaragua made the much more plausible suggestion that the “principal use of the long sharp bill of the toucan is that of a weapon with which to defend itself against its enemies.”

These are but a few of the ideas which have been put forth to explain the toucan's bill, but they will serve to indicate their range and variety. My own opinions on the subject are not as definite as I could wish, but at least they are based upon a certain amount of actual knowledge of the bird in the field, which most of my predecessors have lacked.

It has always been assumed that the great beak of the toucan must have *some* adaptive significance and that the only problem was to find for what purpose it was adapted. But this seems to me to be an essentially unscientific method. It is surely false to assume that every character of every organism has an adaptive significance. With this in mind, I have endeavoured not only to find the use to which the toucan bill is adapted, but also whether it has any particular adaptive significance. After the most careful study of the living bird in its

natural habitat, and of its anatomy, I cannot believe that the enormous bill has any special adaptive function. I have examined all of the various theories which have been put forth and I find that none of them will stand the test of critical examination. It seems hardly worth while to refute each one in detail for most of them have admittedly been mere guesses and none has received any particular support. It is obvious that hardly a size or shape of bill could be devised which would not have certain useful features in particular situations and in the case of the toucan there seem to me to be two such useful functions. As a means of defence the powerful beak is no mean weapon. I have attempted to pick up a wing-tipped toucan and learned at first hand the damage it can inflict. But nevertheless, it is too much to ask that we believe that the clumsy, slow-flying toucan maintains its great numbers in the face of serious competition from large predacious animals. I saw absolutely no evidence of such enemies and I feel convinced that the toucan population is controlled mainly by parasites, available nesting sites, and similar factors.

A second useful function of the toucan's beak seems to be that it enables the bird to reach with greater ease some of the fruits which form its food, but this again can hardly be a very important factor because of a great abundance of food available without such reaching. It is probably an incidental convenience rather than an important adaptation."

I have four additions of my own to make to these theories; first the bill was undoubtedly useful as a weapon of defence in the case of the 1938 pair; secondly, that when the babies are large there must be very little room in the nest for the mother to clean out the excreta, and a long beak would certainly be useful to delve underneath the baby birds in a congested hole; thirdly, it would be of great use as a lever or hook when clambering out of the nesting and roosting holes. Lastly, I must mention an isolated but very significant incident bearing on this problem. I actually saw a toucan drinking from a vase shaped bromeliad on a high tree. A long beak would surely be a great help in collecting water from such a narrow container. Both Dr. Van Tyne and myself never saw a wild toucan come down to water to drink although captive birds require a large amount. Dr. Wetmore, a distinguished American ornithologist, has recorded that he has seen the large Red-billed Toucan in British Guiana drinking from a forest stream. It is quite conceivable that water in bromelads, such a problem for malarialogist, might serve a useful function after all.

## OBSERVATIONS ON THE LIFE HISTORY OF THE CITRUS KING PAGE

BY V. C. QUESNEL

In Trinidad there are two very similar black and yellow butterflies that are called by the name King Page. Kaye (1) lists only the larger of them, *Papilio thoas neacles* Roths & Jord., whose caterpillars feed on leaves of *Piper emarginatum* and *Piper tuberculatum* (chandelles); the smaller is *Papilio cresphontes* Cram. whose caterpillars feed on the leaves of citrus plants. Kaye (1) states that "at Para *thoas* is found on both bitter and sweet Citrus",