

THE AUK

A QUARTERLY JOURNAL OF
ORNITHOLOGY

VOL. 81

JULY, 1964

No. 3

NOTES ON THE HARPY EAGLE IN BRITISH GUIANA

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ALTHOUGH the Harpy Eagle (*Harpia harpyja*) is the heaviest and most powerful of all eagles, a truly dramatic bird, little has been published concerning its life history. Most accounts appeared prior to 1900 and are largely anecdotal. The species has a wide range extending throughout tropical America from southern Mexico to northern Argentina but is nowhere numerous. Chubb (1916) quotes from the works of Schomburgk (1848), Quelch (1890), Lloyd (1897), and Brown (1876), in briefly describing its habits and general distribution in British Guiana. Bond (1927) observed a nest in northeastern Brazil and took from it two eggs, 12 days apart, the second perhaps a replacement.

In British Guiana, from December, 1959, to May, 1960, we made many observations at the nest sites of two families of Harpy Eagles, either from a blind or from other concealment in the immediate vicinity of their nest trees. We took precaution at all times to keep the eagles from being aware of our presence. We think these are among the first detailed observations of Harpy Eagles in their native habitat.

Eventually a juvenile male (Figure 1) was trapped at one nest site and an adult female (Figure 2) and a juvenile female at the other. Both juvenile birds were in identical plumage and were judged to be between 8 and 10 months old when trapped. All three eagles were subsequently trained to have little fear of humans, and thus they could be studied at close range. As of May, 1963, they were still being maintained successfully in captivity and observations on plumage and food requirements were continuing. Although much of the behavior of a trained eagle closely approximates the behavior of a wild eagle, behavior of captive birds is designated as such in the text.

Additional observations were made at these same nest sites by Fowler in March, 1961.



Figure 1. Male Harpy Eagle in third subadult plumage (juvenal = first). This bird was captured 5 April 1960 in British Guiana.

DESCRIPTION OF THE NEST SITES

Both nest sites were in the northwest section of the Kanaku mountain range of southwestern British Guiana. These mountains extend approximately 35 miles from north to south and 75 miles from east to west. The western half of the range is surrounded by the Rupununi savannas with a strip of forest 3 to 5 miles wide separating the densely forested moun-



Figure 2. Adult female Harpy Eagle, captured 13 January 1960 in British Guiana.

tains from the flat, open grassland. To the east, these mountains extend into a vast area of uninhabited rain forest. According to British Guiana Geological Survey maps, the highest peak in the range has an elevation of 3,400 feet (1,036 m) above sea level, while the relatively flat savannas are about 300 feet (91 m) above sea level. Rainfall along the northern slopes and forested flats is estimated to be at least 100 inches (254 cm) a year, and is concentrated between April and September and between December and February. From January through April, temperature in the

area varied from a nightly low of 72° F (22.4° C) to a daytime high of 92° F (33.6° C), and the mean humidity was about 85 per cent. Animal life is relatively abundant in the area, where human molestation is slight.

The first nest site was found on 9 January 1960 in heavy rain forest along Nappi Creek, one and one-half miles (2.4 km) north of the north-western edge of the range and three miles south of the open savanna, in a giant silk-cotton tree (*Ceiba pentandra*).

At 0830 hours a juvenile eagle was seen sitting in dense foliage near the top of a mora tree (*Mora excelsa*) approximately 75 yards (69 m) from the nest tree. Its presence was indicated by frequent, high-pitched screams (*whce-e-e-e-e*, *whce-e-e-e-e*) repeated 10 to 12 times. When aware of our presence, it flew to the top of the nest tree carrying in its talons what appeared to be the thigh of a monkey. Considering the bird's size, we judged it to be a female (females are about one-third larger than males) and from the obviously worn condition of her primaries we assumed that she had been able to fly for several months. Two rectrices and two primaries on each wing were only three-quarters grown out and quite different in pattern from the other feathers, indicating that she was beginning to molt.

The nest tree was easily the tallest tree in the area, approximately 190 feet tall (about 60 m), and its first limb measured 110 feet from the ground. Its trunk, at least 7 feet (2 m) in diameter, was supported by huge buttresses extending 20 feet in all directions from the base. The upper canopy of the surrounding forest was approximately 120 feet above the ground.

The nest was built in one of the tree's main crotches, 130 feet from the ground, just above the canopy of the forest. The nest measured four feet in diameter and two feet in depth, and was relatively flat on top. Sticks up to one and one-half inches (3.8 cm) in diameter had been used as construction material. The presence of accumulated organic matter and old bones, and the compacted condition of the nest indicated that it had been used for several years.

Activity at the Nappi Creek nest site was recorded from daylight to dark every day from 9 January to the morning of 16 January, at which time the juvenile eagle was trapped. Observations at this site totalled 96 hours.

The second nest (Figure 3, A and B) was also situated in a silk-cotton tree growing near a creek. It was 12 miles south of the nest at Nappi on a small terrace 100 feet from the north branch of Moco-Moco Creek, at a point three and one-half miles northeast of the creek's meander onto the open savanna. This creek flows through heavy forest from Nappi Mountain, westwardly down a moderately steep valley surrounded on three sides by 1,000- to 1,500-foot peaks. The altitude at this nest site was about 450 feet.

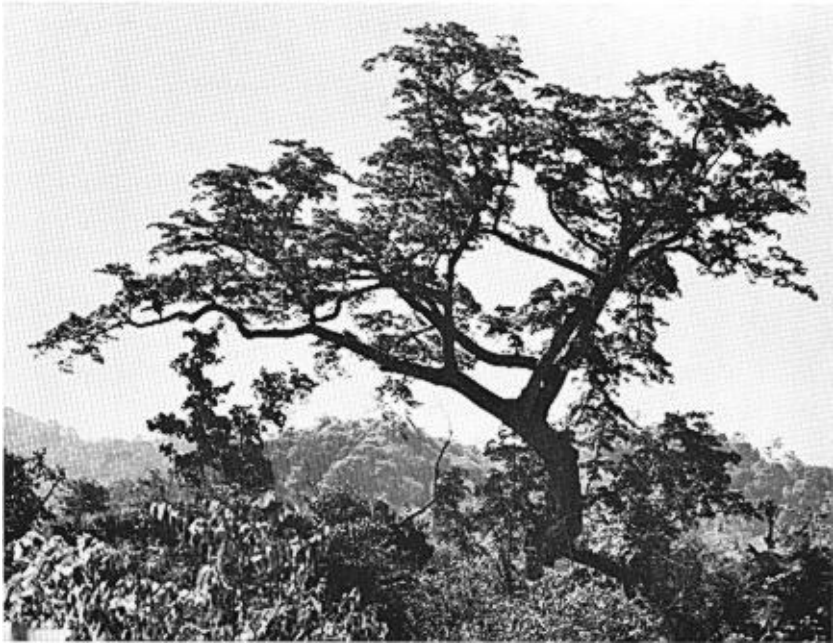


Figure 3. A. Harpy Eagle nest tree at the Moco-Moco Creek site. The nest is in the main fork of the tree. The tree, a silk-cotton, is 190 to 200 feet in height; the upper canopy of the forest is about 120 feet. B. Rebuilt nest in the same tree. Photograph taken on 20 March 1961.

Just west of the nest tree a one-acre (4 hectare) patch of forest had been cleared and planted with cassava and tobacco by Amerindians the preceding March, so the tree was much more easily viewed from the ground than was the one at Nappi. It was larger than the latter and extended farther above the upper canopy of the forest. The nest, located in the main fork of the tree 135 feet from the ground, was approximately the same size, shape, and construction, and in similar condition, as the one at Nappi.

The Moco-Moco nest tree was first visited on 5 January 1960. No eagles were seen, but fresh bones and other animal remains under the tree indicated that harpies had fed in it. On 5 February, on our second visit, a juvenile eagle, appearing to be in exactly the same plumage as the one trapped at Nappi, was spotted perching on one of the upper branches. The Amerindians said that the parent bird had been in the tree when they cleared the field and that the young bird was seen in the nest in June when they transplanted their tobacco. Thus the Moco-Moco juvenile was approximately 10 months old on 20 March 1960, when continuous observation began. Activity was recorded daily until 5 April (a total of 150 hours of observation) at which time this bird was also trapped.

The silk-cotton seems to be ideal as a nest tree for the harpy. Not only does it have many large horizontal limbs on which the young eagle can move about, but the trunk in most cases splits to form a "T" just above the upper canopy of the forest. This makes a good support for a large nest, conceals it from the ground, and permits easy approach by the parents. The silk-cotton is one of the few trees in the rain forest that drops its leaves; the tree at Nappi was completely bare when we saw it in January, and could easily have been thought dead. It was mid-February before the tree began to leaf out. Four other harpy nests reported to us from other parts of British Guiana were all located in silk-cotton trees. Lloyd (1897) stated that the silk-cotton was the favorite tree of the harpy in British Guiana, but the nest that Bond (1927: 562) saw in northeastern Brazil was in a mahogany tree. These reports all indicate that the harpy usually builds its nest in the tallest tree in a forest.

BEHAVIOR OF THE JUVENILE EAGLES

Detailed notes on behavior were taken at the Nappi nest site, but only general observations were made at Moco-Moco. However, the juvenile birds exhibited almost identical behavior. It was not very difficult to follow the movements of the birds, since their calls are easily audible from a distance of 100 yards or more. The activity of both birds centered around their nest trees; each followed what seemed to be a daily pattern of movement within a radius of 100 yards from the tree. Both birds had equally well-developed flying and landing abilities.

In the daytime, the juveniles spent 40 per cent of the time perched in their nest trees; 5 per cent of that time they stood on the nest, where they sometimes went to eat a carcass. The rest of the time they spent on four or five favorite perches in neighboring trees. At midday, especially when the temperature reached 85° F (29.7° C) or above, they regularly sought shade in the dense tops of mora trees, well above the lower limbs of the silk-cottons. On cloudy days and cooler periods of the day they usually perched high on exposed branches of the silk-cottons or on the top of nearby dead snags. The white and gray plumage of the juvenile harpies blended in well with the mottled gray limbs of the silk-cottons and the usual background of clouds, so that it was hard to locate an eagle unless it was calling or moving. Whether from necessity or not, the plumage of the juvenile serves well as camouflage.

At night, the juvenile eagles usually roosted on the uppermost branches of the silk-cottons, especially if they had not eaten that day. About 25 per cent of the nights, however, they roosted on the lower but more densely foliated tops of nearby trees. When we climbed the silk-cottons to set a trap, we did so at night to minimize the possibility of frightening the eagles. However, one night at Nappi, the juvenile flew 50 yards to the top of a mora tree where it made a "crash landing." At Moco-Moco, the juvenile showed much less alarm and always remained in the tree, although sometimes the climber was only 50 to 60 feet below. Once, when it was necessary to climb the tree at Nappi in the daytime, the juvenile flew to within 60 feet of the climber. Neither juvenile showed much fear when a person occasionally passed by beneath its perch.

The juveniles began calling about one-half hour after sunrise. If a bird had not roosted in its silk-cotton, it soon flew noisily over to it, always landing on one of the larger limbs. The eagles may prefer to land on the larger limbs because the upper surfaces of the smaller limbs and branches of the silk-cotton are densely covered with large cone-shaped spikes up to two inches long. These spikes become relatively scarce and small on limbs over 10 inches in diameter.

When the juvenile eagles were hungry they perched on the higher branches, well exposed to view from all directions, and called frequently. With each call they flashed the white under wing coverts with a forward flapping motion of their "wrists." This flashing of white can easily be seen from a distance and probably serves as a display to stimulate the parent to bring food. As the eagle's hunger increased, the calling became more frequent. On one occasion, when the Moco-Moco juvenile had gone 10 days without eating (we had noted no defecation for three days), his call changed into the combination of a "scream" and a pathetic "whine." It was not hard for the observer to interpret this anthropomorphically and imagine

how a parent eagle might be motivated to bring food. In the case of the Nappi juvenile, these screaming sessions averaged 10 per hour with each session consisting of from 10 to 20 successive calls. The Moco-Moco juvenile was just as noisy. Both eagles called more in the early morning and mid-afternoon than they did in the middle of the day. In spite of this frequent begging display, food was brought to the Nappi juvenile only once in 5 days and to the Moco-Moco juvenile only once in 14 days (on the tenth day of observation).

On both occasions when a parent brought food, the juvenile bird became excited and increased the frequency of its calling long before the parent reached the nest tree. By the time the parent had arrived, the juvenile was calling almost continuously. At Nappi, the parent flew directly to the nest with her kill but scarcely had time to drop it before the juvenile rushed over and chased the parent away. At Moco-Moco, the parent landed on one of the larger limbs of the nest tree, 40 feet from the nest, and sat for one minute before the juvenile finally rushed her aggressively and, with much screaming, mewing, and croaking, chased the parent out of the tree. The prey brought in at Nappi was part of a monkey (*Cebus* sp.) and that at Moco-Moco a coati mundi (*Nasua rufus*).

Once a juvenile had food in its possession it spread its wings in a protective fashion over the prey and screamed until the adult left the area. The Moco-Moco juvenile seemed to try to "kill" the dead coati mundi several times, shortly after he had taken it from his parent, by gripping it repeatedly with his talons. Both birds seemed to feed unhurriedly and quietly after the animal's fur had been carefully removed with a sideways pulling action of the beak and discarded. The Moco-Moco bird stayed at his meal until sundown, at which time he left the kill on the limb and went to roost high in the silk-cotton. At 0730 the next morning, he flew back to the carcass and stayed near it most of the day. After having been fed on for three consecutive days the carcass was carried to the nest and finished. The Nappi juvenile left its meal in the nest also, after having fed on it and carried it around for five hours on the day it was brought in.

We made additional observations on the juveniles' feeding habits when we attempted to trap them. Even though both birds could fly well, neither showed any sign of being able to capture its own prey. We made no attempt to lure the juvenile to the ground with bait at Nappi, because of the ground cover and dense surrounding vegetation. However, at Moco-Moco, where the cleared field offered the young eagle a good view of the ground, several different kinds of bait were used in attempts to lure him down to a trap. First, a live chicken was so arranged as to look wounded, and was rigged so that it could be made to flap its wings and move about within a circle of open ground. Although the eagle flew down to within

60 feet of the chicken, he showed no real indication of making a kill. The fresh carcass of a red howler monkey (*Mycetes semiculus*) elicited a little more reaction from the eagle but again no attempt was made to feed on it. The trap and the observer were well-hidden at all times and the juvenile seemed to be hungry as indicated by lack of defecation and continuous screaming. Although the bird had no trouble landing on familiar perches, he neither went to unfamiliar perches nearer the ground nor landed on the ground.

When bait was placed in one of the nest trees neither juvenile bird hesitated to go to it. The Nappi bird went directly to the carcass of a chicken the first time one was placed in the tree, and later also fed on the carcass of a red howler. The bait on which this eagle was finally trapped was the three-day-old carcass of a capuchin monkey (*Cebus capucinus*), already badly decayed and full of maggots. The Moco-Moco bird readily took a squirrel monkey (*Chrysothrix sciureus*) and a part of a chicken which had been nailed on one of the tree's larger limbs, as well as the carcass of an agouti (*Dasyprocta aguti*) with which he was eventually trapped. The squirrel monkey was pulled loose and carried around the area by the eagle for two days before finally being finished in the nest. On this occasion he carried his meal around several hours before beginning to eat it, and screamed "possessively" throughout the first day.

When the juveniles had satisfied their appetites they became inactive and settled down for long periods of time, usually in the shade of a tree top, although they responded to each movement or sound within their immediate vicinity. Birds and insects that came by were viewed with a cocking and twisting of the eagle's head and neck. Attention to sounds, especially during this period of digestion, indicates an acute sense of hearing. Several times, when a tribe of monkeys called at a distance or a flock of parrots began chattering, the eagle quickly looked toward the direction of the noise. When a hawk or vulture soared within view the juveniles looked at them but showed no sign of alarm.

Other than the calls associated with their begging display, the juveniles produced at least three vocalizations: a croaking noise that was used when a parent was near; a shorter single scream used just after a kill had been seized or just after the parent had gone; and a combination of quacks and whistles when a person walked under the perching bird. In captivity, both juveniles beg to the adult female or trainer when hungry, especially when only one of the two birds is fed. When handled or spoken to, the juveniles respond with short whistles, quacks, and croaks similar to those notes delivered when in the proximity of a parent in the wild.

BEHAVIOR OF THE ADULT EAGLES

At Nappi an adult visited the nest tree three times in the first five days of observation. It appeared to be the same adult female each time. The first two times she came on the same day (10 January) but brought food only the first time. On the third visit (0900, 13 January) she was again without food and was caught in a net which had been placed in the tree to trap the juvenile.

Twice, just before the adult flew to the tree, she gave a scream similar to that of the juvenile's but pitched lower. It was almost inaudible above the screams of the juvenile and the constant *pi-pi-y-o*'s of the numerous Gray Screaming Pihás (*Lipaugus cineraceus*) that were always present. At least once, just after the adult had arrived in the tree, she emitted a croaking noise combined with a short scream—this when the juvenile was near and begging. Otherwise, even if the juvenile screamed and called excitedly, the adult stood quietly and made no response.

On the second day of observation (10 January), after she had come to the tree for the first time and had been chased away from the nest by the juvenile, the adult perched on a nearby limb for 10 minutes and surveyed the tree. Then she suddenly rushed to the top of a mora tree, 100 feet directly above the observer, and began to attack its bushy top with spectacular intensity. Branches and leaves fell on the blind and it seemed that the eagle would come down too! For three minutes she was either fighting the branches, upside-down with her legs drawn tightly to her body, or was holding on to the top of the mora with her wings outspread. Then, just as suddenly, she flew back to her previous perch, stood there for 15 minutes, and, with a few quick flaps of her wings, disappeared into the forest. She did not return to the tree for three days.

If this action was motivated by an object, the latter could have been a ten-foot length of one-inch manila rope attached to the first big limb of the nest tree near the top of the mora. Possibly the behavior was caused by the presence of the blind, directly below the mora. This, although well camouflaged, was probably visible to the adult. Our only other speculation is that the adult eagle was going after a small piece of meat that had lodged in the top limbs of the mora tree. The juvenile eagle remained in the nest tree unaffected by this action.

At Moco-Moco, an adult eagle, apparently a female, was seen once. She slipped into the tree on the northeast side before the observer was aware of her presence. In her talons was a *coati mundi*. She sat for one minute, croaking, as had the adult at Nappi, while the juvenile screamed continuously 60 feet away. Finally, when the juvenile flew towards her aggressively, she dropped the prey on the limb and retreated without hesita-

tion, uttering some quacks and short screams while flying off in the same direction from which she apparently had come.

The adult eagles flew quickly with fast wing beats followed by gliding, reminiscent of the flight pattern of hawks of the genus *Accipiter*. They were never seen flying above the forest, but always came into the nest trees from below the uppermost canopy level. Both adults showed remarkable visual perception. Although the blinds were well camouflaged and there were several canopies of vegetation between the observer and the bird, the slightest movement by the observer inside the blind caused the adult to look down toward the blind with much head bobbing. The Indians at Moco-Moco reported that the adult often flew over their heads and screamed at them, especially when they were burning fallen brush.

BEHAVIOR OF CAPTIVE EAGLES

The captive adult harpy showed little fear of humans. Even the first day, she was relaxed and seemed to be unafraid on the trainer's gloved fist. On the second day, she ate freely from the carcass of a red howler monkey while on the fist again. All three of the eagles were trained and handled while being restrained by a four-foot leash fastened to two leather straps around the tarsometatarsi.

In one week the adult was jumping to the trainer's fist from the perch. In two weeks she was flying free in the same general territory in which she was trapped and could be called down from a tree for a reward of meat. We closely observed her ability to fly through thick forest. Her flight was powerful and she maneuvered skillfully, moving almost vertically through the trees. While hunting, she moved short distances from tree to tree and spent much time listening and watching. She paid close attention to animal sounds, especially those made by monkeys. When the bird was perched in dense foliage the erected crest of feathers on her head blended in well with the background of leaves, and she was very difficult to see. On one occasion when she chased a capuchin monkey, her speed and maneuverability were astonishing. She moved through the trees at an estimated 40 to 50 miles per hour.

The juvenile eagles did not respond as rapidly to the training routine. They were excitable on the fist for the first week and fought the glove with powerful grips of their talons. When carried on the fist, they gripped the glove hard and found it difficult to keep their balance. The adult did not grip the glove hard enough and lost her balance occasionally because she was too relaxed. Throughout training the adult was consistent in her reactions to the trainer. The juveniles were excitable and generally inconsistent.

All three eagles used their feet as defensive weapons. The beak was used

TABLE 1
PREY REMAINS AT THE NAPPI CREEK NEST SITE

<i>Prey species</i>	<i>Number of bones collected</i>	<i>Minimum number of individuals represented</i>	<i>Elements</i>
Monkey (<i>Cebus</i> sp.)	26	7	Mostly femora; also pelvic bones and one skull
Two-toed sloth (<i>Choloepus didactylus</i>)	28	3	3 skulls
Agouti (<i>Dasyprocta aguti</i>)	1	1	1 pelvic bone
Total		11	

only to "bluff" with, when the bird was aggravated or threatened at close range. When the trainer or another eagle approached a feeding harpy, it spread its wings ("mantled") over and around its meal and erected the feathers on its head, neck, and back. If approached too closely while feeding, the adult eagle would suddenly flap her wings and thrust her open beak at the offender.

When an eagle is given an entire carcass the bird holds or closely guards the food until it is eventually consumed. Left-over meat not having fur or feathers is never guarded as closely as is a complete carcass. When hungry, the eagles show interest in almost any kind of small animal up to the size of a small dog.

FEEDING HABITS

Food records (Tables 1 and 2) at both nest sites were compiled from the remains of prey animals found in the nests and on the ground under the nest trees, and from the two sight records of adults bringing kills to the juveniles. Because of the rapidity of decay in the rain forest it was difficult to determine how recently the bones had been dropped. However, most of them were found lying on top of the litter on the forest floor, an indication that they probably were not there during the previous rainy season (April-September, 1959).

Bones on the ground within a radius of 100 feet of the nest trees were collected; 75 per cent of them were found directly beneath the nests. The rest were beneath four or five of the larger limbs.

A captive harpy requires approximately eight ounces of meat a day to maintain its weight in a climate similar to that of British Guiana. Its weight can also be maintained if the eagle is allowed to feed freely once every three days on enough meat to fill its crop completely. If an eagle is molting it may require a little more than this. Considering these food

TABLE 2
PREY REMAINS AT THE MOCO-MOCO NEST SITE

<i>Prey species</i>	<i>Number of bones collected</i>	<i>Minimum number of individuals represented</i>	<i>Elements</i>
Monkey (<i>Cebus</i> sp.)	33	8	8 pairs of pelvic bones
Two-toed sloth (<i>Choloepus didactylus</i>)	28	3	2 skulls, 3 pairs of femora
Prehensile-tailed porcupine (<i>Coendou prehensilis</i>)	1	1	1 skull
Opossum (<i>Didelphis marsupialis</i>)	3	1	1 skull
Agouti (<i>Dasyprocta aguti</i>)	9	2	2 femora
Coati mundi (<i>Nasua rufus</i>)	1	1	[sight record]
Total		16	

requirements in captivity and the observed frequency with which the juvenile eagles fed in their natural habitat, it seems reasonable to estimate that a wild harpy might feed normally on the average of twice a week, but if necessary, could fast 10 to 14 or more days.

MEASUREMENTS

Measurements (Table 3) were taken from the three Harpy Eagles in December, 1961. Discrepancies between these measurements and those taken from study skins by other investigators may be due to the difficulty of measuring live birds. The weights are the heaviest of several recorded in December, 1961.

The harpy has relatively short, broad wings and a long tail, apparently adapted to life in heavy forest. The grip of a harpy's talons, even through the protection of a heavy leather glove, is of impressive strength and there is no doubt as to its effectiveness in killing prey species of considerable size.

TABLE 3
MEASUREMENTS OF THREE LIVING HARPY EAGLES

<i>Measurement</i>	<i>Juvenile male</i>	<i>Juvenile female</i>	<i>Adult female</i>
Wing (chord in mm)	520	570	580
Tail (mm)	360	375	400
Culmen (mm)	48	52	52
Tarsus (mm)	119	140	145
Middle toe (mm)	72	83	97
Hallux claw (mm)	57	65	64
Diameter of tarsus (at feather line) (mm)	28	39	34
Weight (g)	4,819	7,541	7,598
	(10 lb., 10 oz.)	(16 lb., 10 oz.)	(16 lb., 12 oz.)

PLUMAGE

The young Harpy Eagles at the age of approximately 50 months have worn three plumages since that (presumably juvenal) worn when we got them, but as yet have not assumed adult plumage. In general, they have become darker in color and more like the adult each year.

The most distinct plumage change was in the rectrices and primary remiges. These feathers were collected as they dropped. Although a report at this time is necessarily incomplete, there are differences between the plumage changes of these birds and those described by Friedmann (1950: 433-434).

Juvenal plumage.—This was as described by Friedmann, except that the primaries of our harpies were almost wholly black above with 4 or 5 very wide indistinct black bands below. This was quite different from that of their second subadult plumage. The rectrices were distinctly barred with 10 or 11 narrow black bands on the lower as well as the upper surfaces of the tail.

There was some difference in plumage between the sexes. The male had very little mottling of black on his back whereas the female was heavily mottled with black. Also, the greater secondary wing coverts of the male were much whiter than the adjacent feathers, giving the effect of a white wing bar, a characteristic totally lacking in the female.

Second subadult plumage.—Replacement of the two middle rectrices began when the eagles were approximately 17 months old.

The plumage of the male was as described by Friedmann, except that the rectrices had one to three thin, triangular-shaped, subterminal, black bands. The rectrices of the female were distinctly marked with 6 or 7 thin, triangular-shaped, black bands on both surfaces. The primaries of both eagles were dark above but had 6 or 7 narrow black bands below. All head feathers were, for the most part, still white and underparts were white. The male, however, showed indistinct black marks on his thighs, and some gray in his crest.

Third subadult plumage.—Replacement of the two middle rectrices began when the eagles were approximately 26 months old. Plumages of the male (see Figure 1) and female were essentially alike.

Rectrices were barred with 5 or 6 black bands, much broader and less triangular-shaped than the second subadult plumage, but closer together and not as broad as that of the fourth subadult plumage. Remiges had fewer but broader black bands. Scapulars and other back feathers were darker and more completely banded with black. The head was smoke gray, as in the adult, with some black feathers in the crest. The neck was gray with black feathers, as in the adult, coming in. The thighs were faintly

barred with black bands, and under wing coverts were partly barred with more black as in the adult.

Fourth subadult plumage.—Replacement of the two middle rectrices began when the eagles were approximately 38 months old.

These rectrices are barred with only 4 or 5 black bands, which are broader than those of the third subadult plumage but still not as broad as those in the adult. Scapulars and other back feathers are darker but not as dark as in the adult. Some gray feathers still remain. The head and crest are as in the adult. The neck and wings are still flaked with some gray feathers; the thighs are as in the adult.

Although it takes approximately one year for an eagle's flight feathers to be replaced, the rate of replacement is irregular. This may be due to variations in food and environmental conditions in captivity.

The iris of the adult eagle is light brown, flecked with gray streaks radiating out from the pupil. The younger eagles, at 50 months of age, still had dark brown irides without gray flecks, the same as when they were juveniles.

OBSERVATIONS AT THE NEST SITES IN MARCH, 1961

Both the Nappi nest site and the Moco-Moco nest site were revisited by Fowler from 20 to 31 March 1961. There was no sign of activity at the Nappi site where the juvenile and the adult female had been trapped. There were no new bones beneath the tree and the nest appeared to be in the same condition as when last seen in April, 1960. At Moco-Moco, where only a juvenile male had been trapped, there had been additional activity.

When the Moco-Moco nest had last been seen it was compacted with old bones and organic matter and was in bad repair. On 16 May 1960, an Indian reported that an adult eagle had returned to the site and often sat in the tree and screamed. In August, 1960, this same Indian reported that the nest had been rebuilt. However, apparently no attempt had been made by the eagle to rear young from that time to 20 March 1961. The nest had been completely rebuilt, but there was no sign that it had been used. It was five feet across, four feet high, with a bowl six inches deep; approximately two feet of new material (sticks and branches up to one and one-half inches in diameter) had been added on top of the old nest. A lining of green leaves (unidentified) and five large ($7 \times 2\frac{3}{4}$ inches) leguminous seed pods (unidentified) had been placed around the bowl of the nest. The nest site was observed for two days but no eagles were seen.

Nothing more was learned concerning the Moco-Moco nest site until September, 1961, when it was reported to us that the nest contained a young eagle similar in color to the one we had trapped there. Considering

these nesting records and the length of time that the young eagle relies on its parents for food, it is probable that the harpy nests only once and rears only one young every two years.

SUMMARY

Observations were made in British Guiana from December, 1959, to May, 1960, at two nest sites of Harpy Eagles. An adult female and a juvenile male and female were trapped and trained.

The two nests were similar in construction and size (approximately four feet in diameter and two feet deep) and both were in silk-cotton trees (*Ceiba pentandra*).

The juvenile birds were both approximately eight months old when first seen. In the daytime they spent 40 per cent of the time in their nest trees. They usually roosted in the uppermost branches of the nest trees. They began calling about one-half hour after sunrise. When hungry, they perched on high branches, well-exposed to view, where they called frequently and flashed the white under wing-coverts. These sessions averaged about 10 per hour, each consisting of 10 to 20 successive calls. Food was brought by the adults (apparently the female) to one juvenile bird only once in 5 days, and to the other only once in 14 days (the tenth day of observation). Neither juvenile bird attempted to capture its own prey, although both could fly well.

The adults (apparently always the females) visited the nest trees three times at one nest and once at the other.

The behavior of the birds in captivity closely approximated that of wild birds.

Records of food were compiled from the remains of prey in and around the nests and from sight records. In captivity the harpies require approximately eight ounces of meat a day to maintain their weight in a climate similar to that of British Guiana. We estimated that a wild harpy might normally feed on the average of twice a week, but if necessary, could fast for 10 to 14 days or longer.

Plumage changes were observed in the captive juvenile birds. In some instances, their plumages differed from those described by Friedmann (1950).

The nest sites were revisited in March, 1961. There was no sign of additional activity at the site where an adult was trapped, but at the one where only a juvenile had been trapped, the nest had been completely rebuilt, although apparently it was not used. No eagles were seen. Later reports (September, 1961) indicated that the nest contained a young eagle.

It seems probable that the harpy raises only one young every two years.

ACKNOWLEDGMENTS

We are most grateful to Mrs. George H. Willis, for financial assistance; to Dr. Emmet R. Blake, whose knowledge of British Guiana was a great help in planning the trip; to the late Dr. James P. Chapin, for encouragement; and to the many people in British Guiana who gave assistance and hospitality, including Mr. Vincent Roth and Mr. Ram Singh of the British Guiana Museum, and the ranchers of the Rupununi district. We also thank Mr. Edward McGuire, for identifying mammal bones; Dr. Charles Wharton, for reviewing the manuscript; and Dr. Dean Amadon, for reviewing the manuscript, and for assistance and encouragement in the writing and processing of this paper.

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