RECENT OBSERVATIONS ON THE IVORY-BILLED WOODPECKER

BY ARTHUR A. ALLEN AND P. PAUL KELLOGG

Plates 9–15

INTRODUCTION

DURING the spring of 1924 it was the good fortune of the senior author and Mrs. Allen with an able guide, Mr. Morgan Tindle, to discover in Florida a pair of nesting Ivory-billed Woodpeckers, *Campephilus principalis* (Linnaeus). Since it is our belief that more is to be gained from a study of the living bird than from a series of museum specimens, we refrained from collecting the birds and planned our itinerary so as to spend the greater part of the following month studying them. Unfortunately our observations were interrupted by the activities of two local taxidermists who thought 'a bird in hand is worth two in the bush' and collected the birds during our absence. Again, in 1935, the Brand-Cornell University-American Museum Ornithological Expedition was unusually fortunate in Louisiana, with the assistance of Mr. Mason Spencer and Mr. J. J. Kuhn, in locating several nesting pairs of Ivorybills, and we were able to make somewhat more continuous observations on the birds. These observations were interrupted through natural causes which throw some light on the birds' 'struggle for existence' and help to explain their present rarity and gradual disappearance. The habits of the birds studied in Louisiana differed somewhat from those watched in Florida, and some of our observations are at variance with those published by others, so that it seems wise at this time to present the observations and deductions thus far made rather than to wait for an opportunity to complete the life-history study. There are doubtless others more conveniently located or with more time or facilities to carry forward this study, and with the thought of assisting such observers our observations are presented herewith.[1]

DISTRIBUTION

According to the A. O. U. Check-list (1931), the Ivory-billed Woodpecker occurred formerly in "the South Atlantic and Gulf states from Texas to North Carolina, north in the Mississippi Valley to Oklahoma, Missouri, southern Illinois, and southern Indiana; now greatly restricted; reported as occurring locally in small numbers in central Florida, and possibly in

[1] Since this was written the National Association of Audubon Societies has established a fellowship at Cornell University, the recipient of which, Mr. James Tanner, is now undertaking this special study.

southern Missouri, southern Mississippi, and Louisiana." This does not give one very important fact in the distribution, namely, that the birds are non-migratory and moreover they are probably sedentary. It is our belief that most individuals spend their entire lives within a few miles of the place where they are hatched and develop little Ivorybill communities. These, when left to themselves, may develop such local abundance as reported by early observers and give a wrong impression of the general status of the species. On the other hand, one not knowing the exact whereabouts of one of these communities might search for days in suitable forest cover within a few miles of the right spot without discovering the birds.

The birds which we discovered in Florida were within a mile of the place where a hunter reported having seen three and shot one three years before. The birds discovered in Louisiana in 1935 were apparently close to the spot where Beyer (1900) reported collecting seven specimens nearly forty years previously; the place had been known to local residents for fully as long and had been reported by Pearson in 1932. On the other hand, failure to find the birds in a given area is no proof that they are not there, for they are not noisy except when disturbed; their voice does not carry nearly as far as that of the Pileated Woodpecker and in the big trees which they normally frequent they are easily overlooked. We camped for five days within three hundred feet of one nest and, except when the birds were about to change places on the nest or were disturbed, seldom heard them. We had great difficulty in following them through the woods to learn their feeding habits even after becoming very familiar with their notes. The senior author at one time stood under a giant oak and caught in his hand chips of bark and wood that an Ivorybill was scaling from a dead branch high in the tree without either one being able to see the other. We had hunted for three days for this particular pair of birds without ever hearing them, even though we were frequently within three hundred yards of the nest, which we finally found because we happened to be within hearing distance when the birds changed places on the nest. This same sedentary habit, once a community has been located by collectors, has made it possible in the past to exterminate local groups of Ivorybills, and this may well have happened even in the name of science.

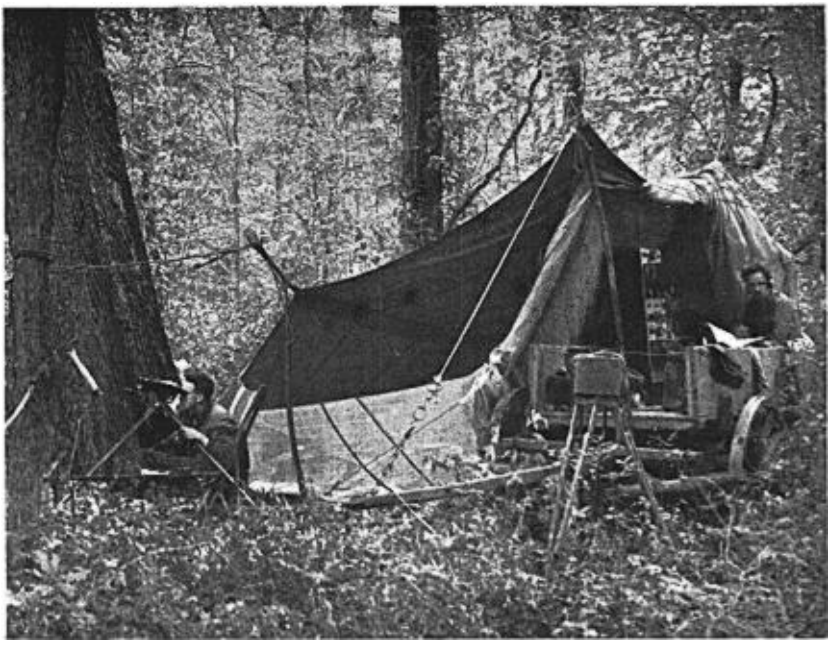
One nest which we found was within one hundred yards of another discovered by our guide the year before, and Maurice Thompson (1885) was shown a pair nesting in the same dead pine stub where they had nested the previous year. Ridgway (1898) reported finding two occupied nests in Florida within two hundred yards of each other. We did not discover nests so close together as this, but three pairs were nesting within a radius of two miles.

FEEDING RANGE AND FOOD

We were never able to follow a bird continuously through the forest of either Louisiana or Florida for more than an hour before it would make a long flight and we would be unable to find it again. Ordinarily upon leaving the nest-tree or its immediate environs the bird would fly at least a hundred yards before stopping. Then it would feed for from a few minutes to as long as half an hour on a dead tree or dead branch before making a short flight to another tree. It might make a dozen such short flights and then, without any warning and for no apparent reason, it would start off on a long flight through the forest that would take it entirely out of sight.

Audubon (1856) states that "it seldom comes near the ground"; but the birds we have watched behave no differently from Pileated Woodpeckers in this respect, sometimes working high up in the trees but at other times within five or ten feet of the ground. The female of the Florida pair which we watched for over an hour on a 'burn' sometimes got down on the ground around the seared, prostrate trunks of the saw palmettos, hopping like a Flicker, while her mate stayed on the trunks of the pines five to ten feet up. We never saw the Louisiana birds on the ground but there was plenty of evidence, both in Florida and Louisiana, that a bird will continue scaling the bark from recently killed trees for the engraver-beetle larvae beneath, clear to the base of the tree, until the tree stands absolutely naked with the bark piled around its base.

Frequently they return again and again to the same tree until they have entirely stripped it. At one time we thought this was their chief method of feeding, but we have since watched them digging for borers exactly like Hairy or Pileated Woodpeckers. At one time we watched the female working at a deep gash in the tall stub of a dead gum, which was apparently a favorite feeding place. She clung to the spot for about five minutes, occasionally picking hard, but never chipping off any large flakes that would account for the depth of the hole which was exactly like that made by Pileated Woodpeckers,—about four inches deep and eighteen inches long. Finally she flew and disappeared in the direction of the nest which was about two hundred yards away. In a few minutes the male Ivorybill came to the same spot where the female had been working and he, too, picked at the hole and stayed there for several minutes. At the time we decided that either the Ivorybills or perhaps the Pileateds had made the gash in the tree for carpenter ants and that the Ivorybills were returning each time for more ants. Since the stub was rather rotten and full of woodpecker drillings, we decided to cut it down the next day and make certain of what the Ivorybills were securing. Upon examining the hole made by the birds there was, however, no evidence of carpenter ants, and the deep gash followed the tunnels of large, wood-boring beetle larvae (Cerambycidae) of which there



"CAMP EPHILUS" WITHIN 300 FEET OF THE IVORY-BILLED WOODPECKERS' NEST

THE SENIOR AUTHOR TAKES HIS TURN AT OBSERVING WITH 24-POWER BINOCULARS

were a great many in the tree; the only other available woodpecker food was termites of which there were comparatively few.

Certainly the Ivorybills did not do enough digging while we were watching them to uncover any additional borers, so they may have been picking up such termites as appeared in the gash. The birds, while we watched them in Louisiana, divided their time between dead branches of live trees and completely dead trees, but more time was spent knocking off the bark for whatever could be found immediately beneath it than was spent digging deeply for borers. The forest was made up primarily of oak, gum and hackberry, and the woodpeckers showed no preference for species so far as we could determine. In Florida, while the nest was located in a cypress swamp in a live cypress tree, the birds apparently did most of their feeding in the dead pines at the edge of the swamp, scaling off the bark of those small and medium-sized pines that had been killed by fire, or actually getting down on the ground like Flickers, as already described.

Audubon (1856) mentions grapes, persimmons and hackberries as food of the Ivorybills in addition to beetles, larvae and large grubs; McIlhenny in his communication to Bendire (1895), mentions their feeding on acorns. Apparently they are fully as adaptable as other woodpeckers in their food and feeding habits, even though Maurice Thompson (1885) asserts that it "is the only Woodpecker which eats insects and larvae (dug out of rotten wood) exclusively," so that we shall have to look in other directions for reasons for their disappearance. Of course, if they do not range far, they might well be restricted to forest of mature trees rather than second growth where there would be plenty of insects in dead timber as well as fruit on which to feed. Lumbering operations might therefore be a prime factor in their disappearance.

COURTSHIP

Nothing seems to have been written concerning the courtship of the Ivorybill and our only observations were made in Florida about 6.00 a. m., on April 13, 1924. We had discovered this pair of Ivorybills at about the same time the preceding morning when they came out of the cypress swamp and preened their feathers and called a few times from the top of a dead pine before going off together to feed. They had made such a long flight the previous day that we were unable to find them again, but that night, still traveling together, they had returned to the same group of medium-sized cypress trees which they had apparently left in the morning and in which there was one fresh hole in addition to four or five other old ones in the near vicinity. On the morning of the 13th, they called as they left these cypress trees and flew to the top of a dead pine at the edge of the swamp where they called and preened. Finally the female climbed up

directly below the male and when she approached him closely he bent his head downward and clasped bills with her. The next instant they both flew out on to the 'burn' where we followed their feeding operations for about an hour.

NESTING

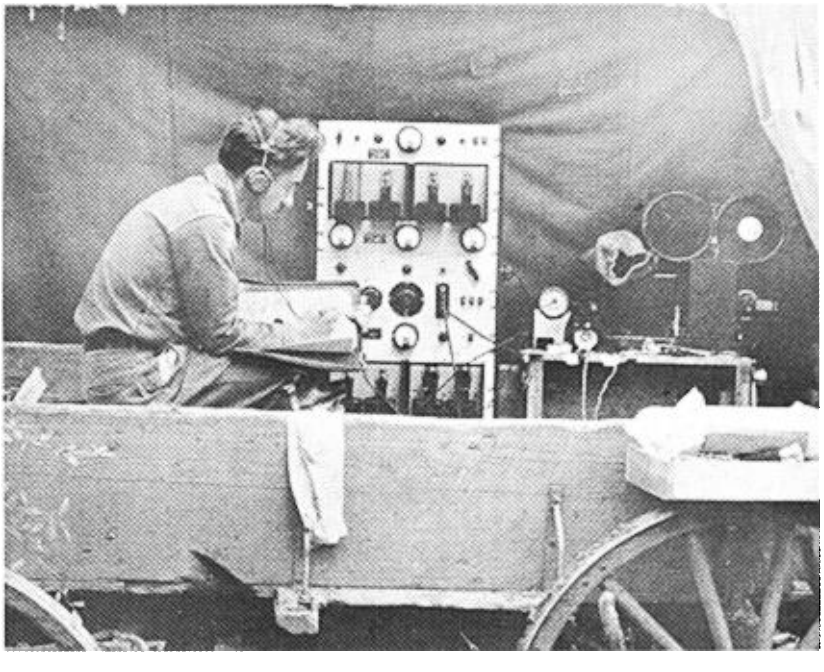
According to Audubon (1856), "The Ivory-billed Woodpecker nestles earlier in the spring than any other species of its tribe. I have observed it boring a hole for that purpose in the beginning of March." The only definite record of a March nesting that we find, however, is that of Scott (1888) of a nest in Florida containing one young female about one-third grown March 17, 1887. Scott (1881) likewise reports taking an incubating female in Florida, January 20, 1880. Ridgway (1898) spoke of shooting a male that left its nest-hole February 15, 1898, but he did not examine the nest, which was 65 or 70 feet up in a cypress, to determine whether eggs had actually been laid. The most definite records, as reported by Bendire (1895) seem to be for April and early May, as follows:

April 6, ——. M. Thompson, Okefinokee Swamp, Ga. Laying
April 9, 1892. E. A. McIlhenny, Avery Id., La. 3 fresh eggs
April 10, ——. Dr. S. W. Wilson, Altamaha Swamp, Ga. 4 eggs
April 15, 1893. A. Wayne, Florida. A young female about 2 weeks out of the nest
April 19, 1893. Ralph Coll., Lafayette Co., Fla. 3 eggs
May 2, 1892. E. A. McIlhenny, Avery Id., La. 3 eggs
May 19, 1892. E. A. McIlhenny, Avery Id., La. 4 eggs, a second laying
May (early) 1894. E. A. McIlhenny, Avery Id., La. 5 young, three days old
May 3, 1885. Capt. B. F. Goss, Jasper Co., Texas. 3 eggs

To these dates we can add, from personal observation:

April 13, 1924. Taylor Creek, Florida. Nest completed. Incubation not yet started
April 6, 1935. Northern Louisiana. Incubating
April 9, 1935. Northern Louisiana. Building
April 25, 1935. Northern Louisiana. Incubating
May 10, 1935. Northern Louisiana. Small young
April (early) 1931. Northern Louisiana (J. J. Kuhn). Incubating
May 13, 1934. Northern Louisiana (J. J. Kuhn). Probably small young

The site of the Ivorybill's nest seems to vary considerably. Audubon (1856) states: "The hole is, I believe, always made in the trunk of a live tree, generally an ash or a hackberry, and is at a great height." There are, however, records of their nesting in live cypress, partially dead oaks, a dead royal-palm stub, "an old and nearly rotten white elm stump," etc., indicating about as great a variety as shown by the Pileated Woodpecker. The lowest authentic nest of which we have found a record, was that described by Beyer (1900) "about 25 feet up in a living over-cup oak," although Scott



THE 'ELECTRIC EAR' AIMED AT THE IVORYBILLS' NEST BY JAMES TANNER, WHILE THE BIRDS' CALLS ARE RECORDED ON FILM BY THE JUNIOR AUTHOR IN THE WAGON-BOX 'LABORATORY' BELOW

(1881) mentions what he considered "an old nest evidently of this species," in a palmetto stub only fifteen feet from the ground. The nest which we discovered in Florida, in 1924, was about thirty feet up in a live cypress and there were other holes in the vicinity in similar trees that had apparently been used in years past. The bark had healed over in some cases and scar tissue was apparently trying to close the wounds. Of the four nests examined in Louisiana, three were in oaks and one in a swamp maple. The maple, seven and a half feet in circumference (breast high), was partially alive, but the top where the nest was located, 43 feet from the ground, was dead and pithy. Of those in oak trees, one was in a dead pin-oak stub about ten feet in circumference and about fifty feet high, standing in more or less of a clearing. The nest was 47 feet 8 inches from the ground. The other two were not measured accurately but were certainly over forty feet from the ground. About the middle of May when it was determined that the first two trees had been deserted, they were cut down, careful measurements taken, and the contents of the holes preserved. The hole in the maple was 5 inches in vertical diameter and 4⅛ inches laterally, and was slightly irregular at the bottom, as shown in the photographs; that in the oak was more symmetrical with a similar vertical diameter of 5 inches and a transverse diameter of 4 inches. The depth of the maple nest from the top of the entrance hole was 19⅛ inches, of which 3 inches was filled with chips and 'sawdust.' This nest cavity was 8⅛ inches in diameter at the egg level, and the tree itself 18½ inches in diameter at the level of the hole. The nest cavity in the oak was 20 inches from top to bottom with a diameter of 8¼ inches at the egg level. The entrance hole went in 3 inches before it turned abruptly downward; the tree at this point was 22 inches in diameter. There was a stub just above the hole in the maple about 4 inches long representing a branch that had apparently died and been broken off years before and started to heal over. The oak was perfectly smooth at the entrance hole, but on either side, slightly above, were the bases of two large branches that could not have given the opening any protection from the weather. The opening in the maple faced north, two of those in the oaks east, and one west. Audubon states: "The birds pay great regard to the particular situation of the tree and the inclination of the trunk; first, because they prefer retirement, and, again, because they are anxious to secure the aperture against the access of water during beating rains. To prevent such a calamity the hole is generally dug immediately under the juncture of a large branch with the trunk." None of the nests examined by us showed this desire for protection from rain, and the chips at the bottom of the cavity were perfectly dry, though we had had some very heavy rains shortly before they were examined.

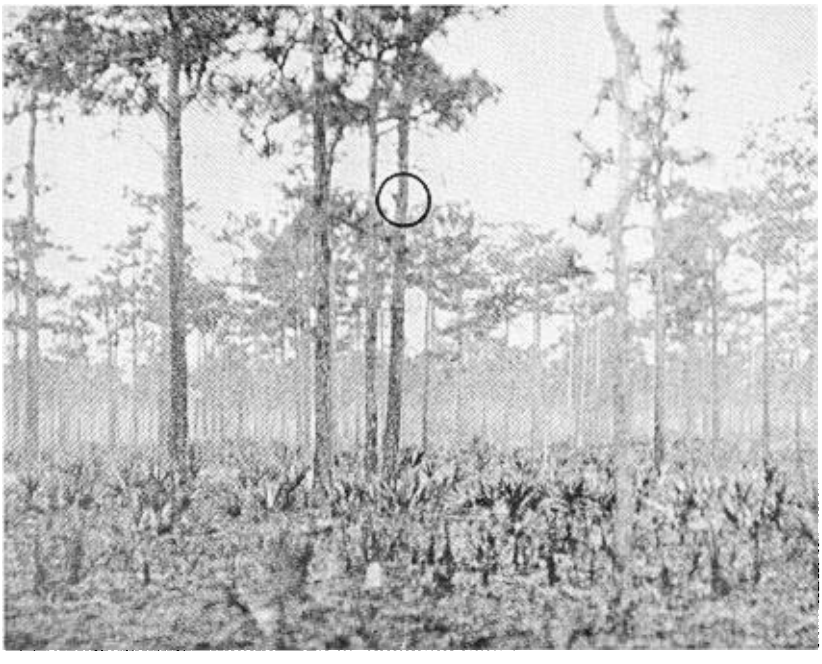
Audubon (1856) further states: "The average diameter of the different

nests which I examined was about 7 inches within, although the entrance, which is perfectly round, is only just large enough to admit the bird." Beyer (1900) says, "The entrance measures exactly 4½ inches in height and 3 7/8 inches in width," and McIlhenny (Bendire, 1895) gives the measurements of a typical hole as "oval and measures 4⅛ by 5¾ inches," and Scott (1888) as "3½ inches wide and 4½ inches high." The corresponding measurements of the nests of Pileated Woodpeckers are given by Bendire (1895) as follows: "The entrance measures from 3 to 3½ inches in diameter, and it often goes 5 inches straight into the trunk before it is worked downward." The additional one to two inches in diameter of the nest hole should be kept in mind when searching for reasons why the Ivorybill has proven less successful than the Pileated Woodpecker in its struggle for existence. Thompson (1885) states: "The depth of the hole varies from three to seven feet, as a rule, but I found one that was nearly nine feet deep and another that was less than two." He also claims that they are always jug-shaped at the lower end.

NEST-BUILDING AND INCUBATION

According to McIlhenny (Bendire, 1895) the female does all the work of excavation, requiring from eight to fourteen days, while the male sits around and chips the bark from neighboring trees. Audubon (1856), however, states that "both birds work most assiduously at this excavation, one waiting outside to encourage the other." Maurice Thompson (1896) likewise reports that both birds work at the excavation. We had no opportunity to check either statement but certainly both birds take part in incubation and feeding the young. The chips are not removed from the vicinity of the nest for each one that we have examined has had piles of chips directly below the opening though, since most of the trees were standing in water, the chips were not very conspicuous.

We camped within three hundred feet of our first Ivorybill nest in Louisiana, in 1935. A pair of 24-power binoculars set on a tripod was trained on the nest-opening, and from daylight, April 10, until 11 a.m., April 14, continuous observations during the hours of daylight were made either by the writers or by James Tanner. The nest had been found the morning of April 6, when the female was incubating, but how far along incubation had proceeded we made no effort to determine for fear of disturbing the birds. Contrary to most published accounts, however, the birds were not particularly wary and soon became so accustomed to our presence that they would enter the nest-hole with one of us standing at the base of the tree and later even when one of us was descending from a blind which we built on April 9 in the top of an adjacent rock elm, twenty feet distant from the nest. On April 9, we located a second pair of Ivorybills in the vicinity of a fresh



FLORIDA FEEDING GROUNDS OF THE IVORYBILL. THE MALE BIRD (ENCIRCLED) CAN BE SEEN BUT THE FEMALE WAS ON THE GROUND WHEN THE PHOTOGRAPH WAS TAKEN

DEAD YOUNG PINES SCALED OF THEIR BARK BY AN IVORYBILL

hole about fifty feet up in a dead oak, some two miles to the south of the nest in the maple. The following morning, however, the nest was occupied by a black squirrel and the birds had disappeared.

Briefly summarizing our five-day vigil at the occupied nest, we learned that the birds took turns sitting on the eggs, working in approximately two-hour shifts when not alarmed, but changing places more frequently when disturbed. Activities usually commenced about six o'clock in the morning, three-quarters of an hour after Cardinals and Carolina Wrens started singing. At this time the female relieved the male after his having spent the night on the eggs. Activities ceased about four o'clock in the afternoon when the male relieved the female on the eggs and went in the nest for the night. This was nearly three hours before dark, which came about seven o'clock.

Because of the rarity of the species and the lack of detailed observations by previous observers, it seems wise to publish the complete journal of activities for the four days that we kept the record from daylight until dark. At times irregularities in behavior may have occurred owing to our disturbance either in adjusting the microphone and sound reflector near the nest-tree or in getting into the blind in the adjacent tree. The birds paid relatively little attention to us, however, and of course we used the utmost care to reduce any disturbance to a minimum. As with other birds, once the blind and the sound mirror had been accepted, their continuous presence apparently disturbed the birds in no way, and activities went on in an apparently normal manner. Copying, then, from our journal the combined observations of the three of us:

April 9, 1935.—We pitched camp about three hundred feet from the nest discovered on April 6, recorded some of the Ivorybill notes, built a blind in a tree about twenty feet from the nest, and about 4 p.m. watched the male take his place for the night.

April 10, 1935.—6.05 a.m. A few conversational clucks heard at the nest.

7.20 a.m. More conversational notes and a few *kents* heard. (Apparently without our realizing just what had happened, the birds changed places on the nest. A screen of leaves, which was later removed, obscured our vision from the camp at this time.)

8.20 a.m. The female looked out of the hole. No sound.

9.45 a.m. The male came into the vicinity and the female put her head out and answered. Her voice was weaker and less harsh. It began to rain hard and we had to cover the 'mike.' This alarmed the birds. The female left and both called. As soon as Jim got back to the tent the male entered the nest with a couple of *yips* and then all was quiet. It was now raining hard.

11.45 a.m. Some heavy chopping near the tent caused the male to look out. No sound, however, and he soon withdrew into the hole.

12.10 p.m. The male was apparently getting nervous. He came out, gave a few *yips*, and then went back in again.

12.35 p.m. The male flew from the nest when we chopped a small tree which obscured the view of the hole from the camp.

12.37 p.m. The female returned and went on the eggs with Kellogg and Kuhn standing near by.

1.05 p.m. The male returned and called several times. The female appeared at the entrance and pecked at the entrance hole, but did not call. He continued to call a dozen times—she flipped out, caught herself for an instant outside and then flew away after he had alighted at one side of the hole. He then entered to take his place on the eggs. It continued to shower.

1.25 p.m. The female called fifteen times (voice weaker), came to hole, looked in; then the male appeared at the hole, pecked lightly at the edge or rubbed his bill, then left and she entered. He made no sound as he left.

1.40 p.m. Male called three times. After a few minutes the female put her head out and pecked at entrance. Male came to the tree. A wren came down the tree to just above the hole when female looked out and the wren flew away. The male came backing down to within two feet above the nest but then flew away. She gave him a parting look and retired.

2.07 p.m. Female put her head out of entrance and looked down.

2.46 p.m. Female put her head out and looked around. Did not peck or call. Two minutes later came out and went up the right fork about ten feet. Gave one double-hammer note; appeared to be looking for food; opened bill wide and swallowed with some difficulty, then backed down tree and disappeared in nest. All this time a squirrel was scolding.

3.15 p.m. Female looked out but no sound was heard from the male or from her. She came out and turned around, climbed around behind the fork, came back, looked in and around several times and then went in.

3.23 p.m. Male called 17 times, flew to tree in front of nest, rested for a few minutes, flew to hole. A little conversation ensued, sounding like the twitter of a nuthatch. She left and he entered. After a few moments she gave a repeated note twice, *yip-yip, yip-yip!*, but more nasal. She then flew to a big oak about fifty feet from the tent and started scaling the bark from a dead branch, giving her *yip-yip-yip* several times. I (senior author) was able to get directly under her and catch one of the last bits she scaled off, then she flew southward, calling several times with her single note, but more prolonged and less sharp, repeating two to four times.

3.45 p.m. Female called her ordinary note one hundred yards to the east of nest twenty to thirty times.

4.00 p.m. Female heard calling to the west a few *kents*.

4.03 p.m. Male looked out of nest for a second or two.

4.50 p.m. Male looked out when I called *kent!* loudly.

6.05 p.m. Paul Kellogg chopped a log and the male looked out twice, then went back. Next he (Paul) walked up to the tree to look at the 'mike' and the camera and the male looked out and watched him for a couple of minutes. No sign of female since four o'clock, and no more activities at the nest before dark at 7.00 p.m.

April 11, 1935.—Cardinals and wrens began singing about 5.10 this morning and by 5.30 all the birds were singing. The sky is overcast, no wind.

5.50 a.m. The male had his head in the entrance, looking all around; backed down occasionally but came right back again until

6.00 a.m. when he left the nest for a tree one hundred feet to the northeast with a half dozen *kents!*

6.03 a.m. The conversational notes of the two birds were heard near the nest and the female flew to the tree ten feet below the hole, the male to the top of the tree. She climbed and entered and the male flew away to the southwest.

A DEAD GUM WITH ITS BARK SCALED OFF BY IVORYBILLS IN LOUISIANA

ENGRAVER-BEETLE TUNNELS EXPOSED BY THE BIRDS

6.30 a.m. After recording the song of a Prothonotary Warbler, we frightened the Ivorybill from the nest to secure some more voice recordings in the quiet morning period. She did not fly back and made no sound until after a few minutes she came back to the nest and called. A few minutes later the male appeared and called loudly. She flew toward him. A little conversation ensued, the male started calling *kent!* loudly and deliberately; the female *yip-yip-yipped!* more rapidly. The male came to the nest and would have gone in but I (senior author) waved my hand. Both birds seemed tame. They got together on a nearby tree but made no sound or display like Flickers. I retired and the female immediately took her place on the eggs.

8.45 a.m. Tanner went up to the blind, fixed it and pulled up the camera. The female once flew to the nest hole but became alarmed and flew away after climbing to the top of the stub. While T. was setting his camera, the male came and entered the nest. The senior author frightened the male from the nest by rubbing the tree. In about twenty minutes it returned, climbed to the hole, looked around and looked in, but after about half a minute or more it became alarmed by the rattle of the camera and flew off. Ten or fifteen minutes later it returned and acted as before, but finally entered the hole.

About 10.15 a.m. Tanner lowered the motion-picture camera and returned to the blind with a still camera. The male returned and entered the hole before he had a chance to open the shutter. In about half an hour Kellogg approached the tree, the male stuck his bill from the hole and in a few seconds flew away only to return a few minutes later. Tanner took several pictures, moving inside the blind and reaching in front to cock the shutter; the bird moved and looked around nervously, calling some, but finally entered the nest.

About 11.30 a.m. The female flew to the tree and backed down to the hole, then looked in. The male stuck his head out and then flew directly away. The female started to enter but took fright at something in the blind and paused. The shutter clicked, she edged away and then flew. A little later she flew to the hole but again flew away.

About 12.50 p.m. Tanner came down and Kellogg went up the tree. The female once came to the nest-hole but climbed up and flew off. The male came but did not enter immediately.

1.00 p.m. Male entered nest.

1.15 p.m. The female called from a big tree southeast of nest, then flew to place above nest. She called and rapped, backed down to the hole and looked in. The male stuck out his head. The female started, probably at the shutter, and soon flew off. The male peered from the nest for a moment, eyes blinking nervously, then withdrew.

1.30–1.45 p.m. The female *kented* occasionally from trees near the nest. Male inactive.

1.55 p.m. The female landed below the nest, called and climbed up. The male stuck his head out, slipped out. There was a little conversation and then the male climbed way up and flew off. The female started to enter, was startled, hesitated a few moments, then left.

1.57 p.m. The female flew to the nest-hole, called some, started to enter, then left. A minute later she was calling a rapid *ki-ent, ki-ent, ki-ent!* from a tree to the west. She then disappeared.

2.08 p.m. The male called from near the top of the stub, backed down with an occasional *kent!*, then, not hesitating, entered the nest. The female *kented* from nearby.

2.30 p.m. The female landed below the hole, called and rapped, then climbed up to hole. The male stuck out his head and flew straight away. The female started in, hesitated, and then sidled away. She made two more false starts and then went in.

2.35 p.m. She must have left in a moment for by 2.45 she climbed up a small tree north of the nest, then flew west and called both a rapid *ki-ent, ki-ent!* and a slow *kent!*

2.38 p.m. The female flew to a big tree south of the nest, called, then flew to nest. She looked in a few times, then entered.

3.00 p.m. The male entered the nest after giving a few calls. The female had just left.

3.15 p.m. The female called, then flew to the tree. The male came out and flew away. The female started in, then turned, and followed the male to a tree north of the nest. A moment later she returned and entered the nest.

3.20 p.m. The female came from the hole, called a few times, then re-entered.

3.40 p.m. The female came from the hole, then re-entered without calling.

3.45 p.m. The female stuck her head from the hole, then flew thirty feet to a tree. She called some, then in a minute flew back to the nest and entered the hole.

4.00 p.m. The female came out and went back without calling.

4.10 p.m. The female stuck her head from the hole but soon withdrew it.

4.30 p.m. The male *kented* from nearby. The female stuck out her head and answered. The male flew nearer and then away. The female called and then flew out of the hole. She gave a few rapid taps on the edge of the hole, climbed up a bit, gave a solid rap, then climbed higher. The male pounded irregularly on a nearby stub.

4.35 p.m. The female returned into the hole silently.

4.45 p.m. The male alighted beside the hole and *kented.* The female projected her head and a talk followed. She stepped out and climbed up the stub, then flew. The male yapped a few times, jumped as the camera shutter clicked and then entered the hole. The female *kented* repeatedly south of the nest.

5.00 p.m. Kellogg started the camera down and the male flew from the nest. He was halfway down when the male returned and entered the nest. The female came to a sapling nearby and *kented.* She called for several minutes and then came to the nest-tree and the male came out. The female, disturbed by Kellogg's motions, flew off. The male circled around the tree and re-entered the hole.

5.30 p.m. The female called and the male came out for a minute and then re-entered the hole. The female flew and then scolded several hundred times.

(Judging from later actions, the birds were somewhat disturbed by our close proximity on this day and called and changed places on the nest more frequently than normal.)

April 12, 1935.—7.15 a.m. No sounds so far. Went up and tapped on the tree and the male stuck his head out and then withdrew. The female had not yet appeared. Broke the tripod in adjusting the 'mike' and went for a screw. When I returned the female was in the tree twenty feet above the 'mike.' She *yipped* once and the male stuck his head out and called softly, then left the nest. The female entered as soon as I withdrew at 7.30.

9.00 a.m. The female left for a few minutes, gave a few *kents* and then went back again.

9.30 a.m. The male returned, gave only a few *kents* and exchanged places.

9.50 a.m. The female returned with a few *kents* and exchanged places.

12.15 p.m. The male returned, *kented* a dozen times, came to the top of the tree

and backed down. The female stuck her head out, held still, and then drew back. The male came to the hole and the female came out, was quiet for a moment and then flew away and the male took his place. The female *yipped* around in the vicinity for a few minutes.

12.35 p.m. The female returned without a sound and the male left when she came. She took her place and he flew off with no sound uttered. He flew to a tree about fifty feet toward our tent where we got a splendid view of him through our glasses (24×) for twenty-five minutes. He moved only a few feet and spent the entire time scratching and adjusting his feathers, yawning and stretching. He acted as though he were lousy.

1.00 p.m. The male flew to the tree with no sound. The female left with no sound but called a few times several minutes later.

4.15 p.m. The female relieved the male after a little conversation. Then the male climbed the stub and flew away.

5.45 p.m. The male called a couple of times. The female stuck her head out but he did not come immediately and she retired. After a few minutes she came out and climbed up the tree and he flew down to her, exchanging a few weak *yip-yip-yips*. She then left and the male took his place for the night.

April 13, 1935.—5.35 a.m. The male left and the female entered with a few *kents* and a few *yips*.

7.25 a.m. Exchange took place again with a few *kents*.

8.00 a.m. Allen climbed into the tree blind and Kellogg scared the bird from the nest. Birds somewhat disturbed and changed places every fifteen to twenty minutes. Whenever the female returned the male rapped on the inside of the nest before showing his head.

10.50 a.m. Allen lowered the cameras, dismantled the blind and descended the tree, having exposed two hundred feet of motion-picture film and taken twelve stills of the birds.

11.00 a.m. The female came to relieve the male.

12.40 p.m. Exchange.

1.55 p.m. The female went on the nest. The only noise was *yan-yan-yan!*

2.30 p.m. A Red-bellied Woodpecker climbed up past the nest and the female stuck her head out.

5.00 p.m. The male returned. A couple of *kents* and a little conversation and they exchanged places.

At 1.40 p.m. the senior author left camp, going west, and found the female chopping in a dead tree, much like a Pileated, though the gouge she was working on was more irregular. After a few minutes, she flew to another tree and then directly toward the nest. Five minutes later the male was on the same tree chopping at the same hole. He continued thus for twenty minutes before moving on. "I then followed him for an hour, until 3.00 p.m., when he made a longer flight westward and was lost. Sometimes he fed high, sometimes within fifteen feet of the ground, and he was not very wild as I often got within forty or fifty feet of him. His flight was much more direct than a Pileated's—usually sloping downward with a final swoop upward as he landed. Sometimes he chopped for ten or fifteen minutes on one tree, sometimes only two or three. Sometimes he merely

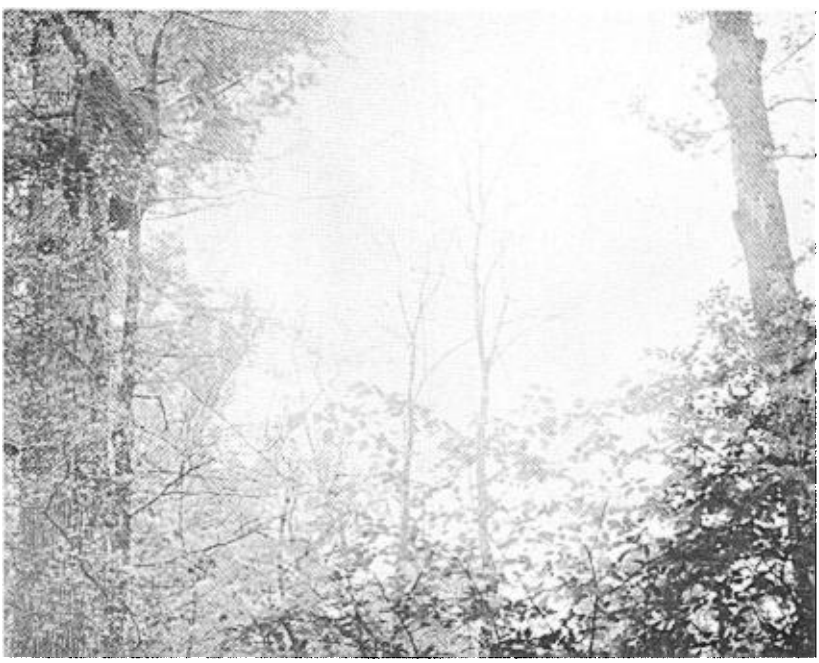
chopped off the bark, but nearly as often he went to old cuttings and enlarged them for whatever was inside—perhaps carpenter ants or termites. Some of the chips he knocked out were two inches long and an inch wide, but mostly smaller. His *kenting* varied a great deal, perhaps depending on whether he noticed me. Most of the time he was silent. His tail was always closed and pointed in flight, his head and bill straight out; his wings looked much more pointed than a Pileated's, and narrower, but this might be an illusion on account of the large amount of white."

April 14, 1936.—While we were getting ready to break camp, Tanner brought Professor Roberts and Mr. Lowery of Louisiana State College from our base camp to see the Ivorybills, and the birds continued to behave normally even under the scrutiny of these additional pairs of eyes.

At noon our driver returned for the wagon with four mules, and since there seemed little further to be learned at this stage of the Ivorybill reproductive cycle, we broke camp, planning to return in two or three weeks when the eggs should have hatched and the parents would be engaged in feeding the young. Mr. Kuhn offered to visit the nest from time to time and report to us as to its progress so far as he could tell from the actions of the birds. Accordingly, we traveled south to Avery Island and thence west to Oklahoma to make studies of the Lesser Prairie Chicken, and did not get back to Louisiana until May 5. During our absence Mr. Kuhn had found another Ivorybill's nest about a mile to the northwest of our first nest and had heard of another pair of birds about seven miles south. He had visited our nest in the maple on April 29 and had found the birds behaving rather strangely. The male came flying toward him as he approached but soon paid no attention to him; then the two birds took turns looking into the hole, remaining inside for a few minutes and then flying to another tree about fifty feet away and there spending a great deal of time preening themselves, but they were apparently not feeding any young.

On May 9, the senior author visited the nest with Mr. Kuhn and Dr. L. M. Dickerson, who was on a tour of inspection for the National Park Service, and found it deserted and the birds nowhere to be seen or heard. We spent most of the day waiting for these birds and hunting for the nest which Kuhn had found on April 29 a mile to the northwest, but since he had not marked it and the jungle was so thick and the birds so quiet, we were unable to relocate it. Toward evening we returned to our first nest. Mr. Kuhn and Dr. Dickerson heard the birds about a quarter of a mile to the north, but since the birds did not come any nearer to the nest, about 6 p.m. we cut down the tree, which we were unable to climb, and examined the contents of the nest-cavity, preserving everything in a paper bag. At the time, by the dim light, all we could find in the dry chips at the bottom of the hole were tiny fragments of egg-shells, and no sign of blood or albumen or even

THE IVORYBILLS EXCHANGING PLACES ON THE NEST



THE IVORYBILLS' NEST IN THE SWAMP MAPLE AT THE RIGHT AND OUR OBSERVATION BLIND IN THE TREE AT THE LEFT

moisture. The next morning, however, under a desk lamp at the hotel, as the heat of the lamp warmed up the 'sawdust,' the material gradually came to life and swarmed with innumerable tiny mites and we soon felt them crawling all over our hands. We quickly bagged the entire contents again, trying to return as many of the creatures from our hands as possible. The bag was mailed to Professor C. R. Crosby at Cornell University; he referred the material to a mite specialist, Dr. Arthur Jacot, who has given us the following report:

Appalachian Forest Experiment Station
Asheville, N. C.
August 23, 1935

Dear Dr. Allen:

The mites from the sawdust of the Ivorybill nest-cavity are now mounted up and I determine them as follows:

Oribatidae

1 = *Galumna curvum* (Ewing)
1 = *Carabodes*
1 = *Platynothrus*
1 = *Suctobelba*

} Eaters of wood, fungi and algae

Predaceous

1 = *Cheyletus*
1 = Uropodid
1 = Gamasid

Parasitic?

3 = Of the group Anachotricha
Family?

As already stated, this is but a meager sample of what must have been in the sawdust but I got it too much dried out to secure the rest of the fauna.

Yours sincerely,
(*signed*) ARTHUR JACOT

When the mites began crawling on our hands that morning in the hotel, we were reminded of the actions of the birds at the nest and how nervous they sometimes seemed after incubating for a short time and of how much time they sometimes spent preening when they came out of the hole in the maple. Knowing from experience of mites having killed young House Wrens, Redstarts, Louisiana Water-Thrushes, Phoebes and other birds, we wondered if they could not have been responsible for the destruction of the young Ivory-bills, either by killing the young outright or by causing so much nervousness on the part of the parents that the eggs failed to hatch or the young to be properly brooded. The small fragments of egg-shells left in the nest favor the belief that the young hatched as the shell fragments were about the size that one normally finds in a woodpecker's nest after the larger pieces have been carried away by the parent birds. What became of the dead young remains a mystery, though with some birds it is a common practice to remove dead young from the nest if they die during the period

that they are being brooded. We have known Flickers to leave one or more dead young in the bottom of the hole while they continued to feed the others, but in such cases the young were so large that they were no longer being brooded and the parents doubtless did not know what had occurred. Without knowing definitely what actually happened to this nest, we are probably safe in concluding that the eggs hatched and the young disappeared from some natural cause when they were small and probably less than a week old.

The following day we rode southward through the woods seven miles to the area from which the fourth pair of Ivorybills had been reported. We arrived just in time to catch the distant exchange of calls when the birds exchanged places at the nest, and, while the senior author marked the general direction, Kuhn advanced and soon his sharp eye marked the male bird near a hole 47 feet up in a dead pin oak which stood at the edge of a small, more or less natural clearing. Here the visibility was very good, and it was not difficult to conceal oneself in the luxuriant tangle of poison ivy and cat briars that covered the lower vegetation. The female was inside, brooding, but did not come out when we pounded on the tree. A little later, however, when Kuhn had gone after Dickerson, and the senior author was moving to get a better point of observation, the female put her head out, discovered him, left the nest and started calling in characteristic manner. Almost immediately the male appeared and added his notes to the commotion. About this time Kuhn and Dickerson returned, and the birds transferred their attention to them. Very shortly, however, they forgot us and went about their normal activities, which we proceeded to record for the next hour and a half as follows, watching the birds through 24-power binoculars:—

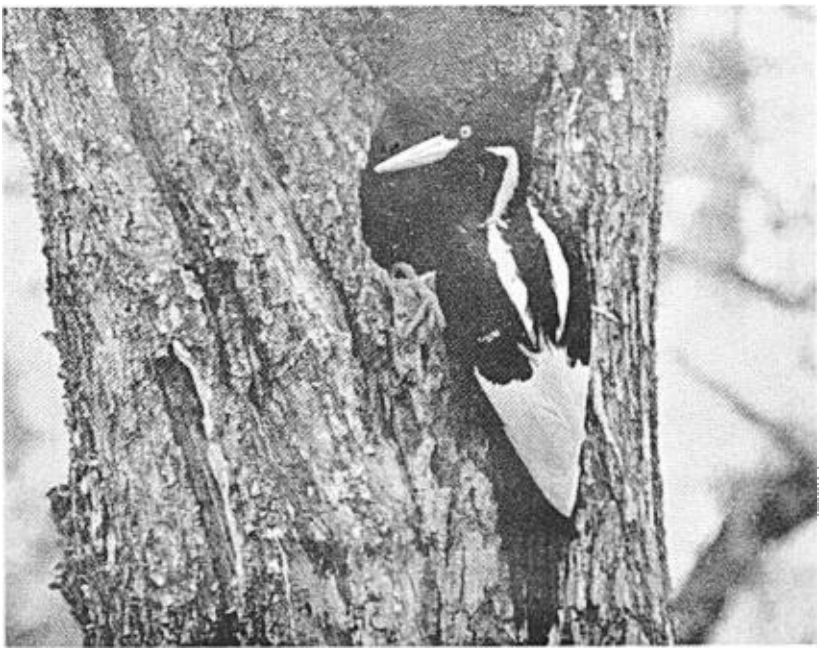
May 10, 1935.—10.46 a.m. The female entered the hole with her bill slightly open.

10.53 a.m. The female looked out with bill open as though she were hot. She came out and climbed the stub with bill agape. The male came to the snag, calling as he hit it, and stood at the entrance calling for some time and after making several starts entered the hole at 10.56, but immediately put his bill out and soon came all the way out, when the tip of his bill looked wet. He called upon leaving as though perhaps he saw one of us batting mosquitoes or raising the glasses. He then sat on the dead stub between us and the nest, interspersing *kents*, with double whacks of his bill.

11.10 a.m. The female returned and entered the hole with bill agape, leaving almost immediately. The male, about fifteen feet away, continued to scold.

11.16 a.m. The female returned with bill agape. Was in the nest about thirty seconds. Her bill seemed moist when leaving. The tip was discolored,—brownish,—as was also the male's, either from the dead wood or berries.

11.36 a.m. The female returned slightly below the nest, climbed to it and entered. Her bill was not agape this time but the tip was discolored.



THE FEMALE IVORYBILL RETURNS TO THE NEST 43 FEET FROM THE GROUND; THE TREE IS 18½ INCHES IN DIAMETER AT THIS POINT

THE MALE AT THE NEST ENTRANCE WHICH MEASURES 4⅛ BY 5 INCHES

11.39 a.m. The female put her head out and held her bill open as though hot. She put her head in and out several times but finally got down out of sight until

11.40 a.m., she came out and climbed the snag with bill open and preened near the top. The male had stopped calling but could be heard two hundred feet away digging.

11.42 a.m. The male called three times and the female answered with *yip-yip-yip!* and soon flew toward him when he called *kent!* several times, but kept on digging.

11.52 a.m. The male flew to the nest but did not enter. Called, looked in, and then flew toward us and called some more continuously. When he alighted his bill was agape and I could see him protrude his tongue. He apparently considered himself guardian.

11.55 a.m. The male ceased calling and apparently left for food.

12.00 m. I walked toward the nest and remained about forty feet from the tree behind a gum.

12.05 p.m. The male returned with a big borer grub held lengthwise in his bill. He did not come to the nest immediately, however.

12.10 p.m. The female came and fed.

12.12 p.m. The male came and entered with his grub. He remained inside a couple of minutes and I could hear a weak buzzing from the young. Apparently they were too small to swallow the grub for he left with it to a tree one hundred feet away and apparently swallowed it himself.

When we left at 12.30 p.m., the birds had apparently accepted us and paid no attention to our going. We returned to our base camp intending to move down to the vicinity of this nest so as to make more conveniently, continuous observations on the care of the young. They were obviously very young, and so we delayed our return until May 14, when, to our dismay, we discovered that this nest also had been rifled. When we were thoroughly satisfied that the birds were nowhere around we secured a crosscut saw and an axe and cut the tree down. Since it was fairly solid at the base and about ten feet in circumference, this was 'quite a job.' Once again the only evidence of the hole having been occupied by woodpeckers was the tiny fragments of shell similar to those in the swamp-maple nest. There was no sign of young birds having been in the nest, nor was there any evidence of blood or of spilled food or excreta, and in this nest there were no signs of mites. The young birds had just mysteriously disappeared, and the old birds had deserted the area, though Kuhn thought he heard them half a mile to the north when we were leaving.

The unfortunate history of these two nests which we had hoped to study was exactly paralleled by that of a third nest which Kuhn had discovered on May 13, 1933, forty-five feet up in a black oak. The nest was located within one hundred yards of the nest just described. Kuhn visited the nest on May 16 and again on May 23 and May 27. Activities about the nest seemed to him normal except that the birds were rather wild (more so than the pairs we have been describing), and during the three hours he watched them, they changed places on the nest every eleven to twenty

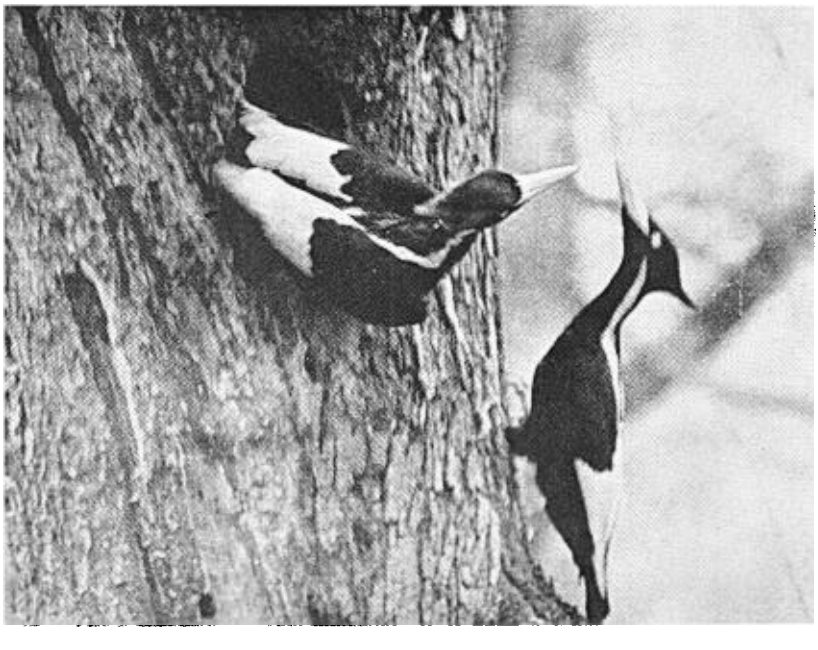
minutes, indicating that they were probably feeding young. He sent a telegram to Dr. T. Gilbert Pearson, President of the National Association of Audubon Societies, and Dr. Frank Oastler came down on June 7 to verify the discovery and secure some motion pictures. When he and Kuhn arrived at the nest-tree, however, they found it deserted, and Kuhn was very disconsolate for having brought Dr. Oastler so far on a 'wild-goose chase.' Having determined that the birds had in truth deserted the tree, they cut it down and, just as in both of our nests, the only evidence of its ever having been occupied by Ivorybills or any other birds was the tiny fragments of egg-shells.

The histories of these three nests, therefore, were almost identical, with the Ivorybills managing to hatch their eggs successfully but losing their young for some cause during their early life. At this time it is appropriate to call attention to the fact that in the literature there are relatively few references to young Ivorybills and there is no complete description of an immature bird, that of Scott (1888) being the only one we have found.[1] Even Ridgway (1914), in his 'Birds of North and Middle America,' omits the juvenal plumage from his consideration, describing only the adult male and female. Scott (1888) and Beyer (1900) both speak of nests with only one young, and in the type set of eggs from the Ralph Collection, two were infertile and only one contained an embryo. Our guide, J. J. Kuhn, in all his experience with Ivorybills, had seen young, to recognize them as such, only twice. He described them as resembling the female, but not so black, and with apparently more white in the plumage.

With these facts in mind it seems safe to conclude that a critical period in the life of an Ivory-billed Woodpecker is during the early life of the young. Whether this is due to predators or to innate weakness in the stock has not, of course, been determined, and there are arguments to be advanced on both sides. If predators are important, we would have to explain an apparent discrimination in favor of the Pileated Woodpeckers which nest practically side by side with the Ivorybills but which are apparently much more successful in rearing young. In this connection there is apparently one real difference in the nesting of the two species: the size of the nest hole, which is over an inch greater in diameter in the case of the Ivorybill. This might admit certain enemies such as raccoons, opossums, and Horned and Barred Owls that cannot enter the smaller hole of the Pileated Woodpeckers. On the other hand, we found no signs of conflict in the nest-cavities which we examined that might indicate that some marauder had entered. The second nest which we discovered was occupied the next morning by a black

[1] "The young bird in the nest was a female, and though one-third grown had not yet opened its eyes. The feathers of the first plumage were apparently beginning to cover the down, and were the same in coloration as those of the adult female bird."

THE MALE IVORYBILL RETURNS TO RELIEVE THE FEMALE



THE MALE IVORYBILL LEAVES AS THE FEMALE ARRIVES

squirrel but at this date (April 9) there could not have been young in the nest, and we have no way of knowing that there were even eggs.

The mites may well have caused the destruction of one of our nests, but the two others showed no indication of nest parasites, and many young birds of other species manage to survive even when heavily infested with mites. This leaves us with the theory of inherent weakness due to inbreeding, and that of lack of synchronization in the reproductive cycles due to the birds' scarcity and resulting lack of choice in selecting mates. Inbreeding in other birds and animals frequently results in a high infant mortality; lack of 'sex rhythm' (Allen, 1934), in infertile eggs.

Even at a time when the birds were apparently numerous, 'inbreeding' might have become of importance owing to the sedentary nature of the birds; and with the increasing isolation of these family groups from others of their kind through the activities of man (including the primeval Indians), any weakness of the stock may have become still further emphasized and resulted in still greater infant mortality. The destruction of Ivorybills by the Indians in the early days is mentioned even by Catesby, in 1731. In his original description of the bird, "*Picus maximus rostro albo*," he says, "The bills of these Birds are much valued by the *Canada Indians*, who made coronets of 'em for their Princes and Great Warriors by fixing them round a wreath with the points outward. The *Northern Indians*, having none of these Birds in their cold country, purchase them of the *Southern People* at the price of two, and sometimes three, Buckskins a Bill." Thus early did commercialization of the Ivorybill start, and the price on its head has continued to the present day. Indeed, the publicity which a certain group of Ivorybills received a few years ago by the local press in which the statement appeared that they were worth a thousand dollars apiece, caused the death of one bird (and possibly others) at the hands of an impressionable youth who hoped to find a market for his specimens. But this commercialization, we believe, has been only an indirect cause of the near extinction of the bird, and while we should do everything humanly possible to give the present stock complete protection from man, we should likewise bend our efforts toward a more nearly complete study of the living birds than has thus far been possible, in an effort to determine definitely whether there is always this high infant mortality and whether inbreeding is the cause.

Difference of sex rhythm is always important when a species is so scarce that the individuals have little or no choice in the selection of mates. It expresses itself usually in the production of infertile eggs rather than in weak young, though weak germs and infant mortality are possible results also. Scarcity of young might be due to either cause. The 'introduction of new blood,' as is sometimes practiced in game coverts, will not necessarily strengthen the present stock unless the new birds happen to be synchronized

with the old. Just what controls the variations in the sex cycles of individual birds living apparently under identical environmental conditions is not always explicable, but the problem becomes increasingly important as the number of individuals involved decreases. The type set of Ivorybill eggs already mentioned, of which two of the three were infertile, might well be an indication of this lack of synchronization. One would expect considerable irregularity in this respect in different Ivorybill communities entirely dependent on whether or not the birds happen to be synchronized.

Before concluding this discussion it might be advisable to mention a few other observations which have no bearing on the disappearance of the birds but in which the observations of the writers vary somewhat from those of previous writers.

VOICE

There seems to be some confusion as to the different notes of this bird and their carrying power. Audubon states: "Its notes are clear, loud, and yet rather plaintive. They are heard at a considerable distance, perhaps half a mile, and resemble the false, high note of a clarionet." This description fits very well the common note of the bird, and anyone can produce the sound very accurately by using only the mouthpiece of a clarionet. It is doubtful, however, if the loudest calls can be heard, under normal conditions, for a quarter of a mile, and some of the weaker ones are scarcely audible at 300 yards. However, when we tested the carrying power of one of our recordings of the common alarm note, *kent*, amplified until it sounded to our ears normal at about one hundred feet, the call was distinctly recognizable at a distance of 2500 feet directly in front of the amplifier with no trees or buildings intervening. At a 45-degree angle the sound was not recognizable at half this distance. The birds are so often quiet for such long periods that we can scarcely agree with Audubon's statement that "the bird spends few minutes of the day without uttering them." They seem much more likely to call when they are alarmed, as when they discover an intruder in their haunts. Both birds give the call, but that of the female is somewhat weaker. In addition to this *kent* note, as it is called by the natives of Louisiana, and because of which they call the birds 'Kents,' they have a variety of low conversational notes when they exchange places at the nest, which are suggestive of similar notes of the Flicker; but they never, so far as we know, give a call at all similar to the *pup-pup-pup!* of the Pileated, nor have we ever heard them sound a real tatoo like other woodpeckers, such as described by Thompson (1885), and which McIlhenny (Bendire, 1895) compares to the "roll of a snare drum." The birds in Florida and all those in Louisiana telegraphed to each other by single or double resounding whacks on the trunk or dead branches. Mr. Kuhn who has had years of experience with them, likewise has never heard any notes

or tatoos that were comparable with those of the Pileated. Our observations agree with Audubon's, rather than with those of some others, in that "it never utters any sound while on the wing."

FLIGHT

Audubon's (1856) description of the flight of the Ivorybill was quite misleading to us: "The flight of this bird is graceful in the extreme, although seldom prolonged to more than a few hundred yards at a time, unless when it has to cross a large river, which it does in deep undulations, opening its wings at first to their full extent and nearly closing them to resemble propelling impulse. The transit from one tree to another, even should the distance be as much as a hundred yards, is performed by a single sweep, and the bird appears as if merely swinging itself from the top of one tree to that of the other, forming an elegantly curved line."

In Florida and again in Louisiana we observed the birds making long as well as short flights, and we were impressed by the similarity of the flight to that of a Red-headed Woodpecker rather than of a Pileated, because of its directness. In going from tree to tree there is usually an upward swing as the bird alights, but this is the nearest to an undulation observed. The tail is kept closed in flight, and owing to the large amount of white in the wings they appear much narrower than the Pileated's. The head is carried straight forward so that the impression given by the bird at a distance is much more that of a duck than of a large woodpecker. In fact, one local hunter told us that he had sometimes been deceived by them even to the extent of shooting at them, thinking that they were ducks. This is not so impossible as it at first seems.

SUMMARY

1. Nesting Ivory-billed Woodpeckers were studied in Florida in 1924 and in Louisiana in 1935.

2. Photographs, motion pictures and records of their calls on film were made in Louisiana.

3. Observations are presented on their sedentary habits, their feeding range, their food, methods of securing it, their calls, their courtship, dates of nesting, choice of nesting sites, measurements of nest-cavities, incubation and feeding of the young, and their nest parasites.

4. A record of all observations made at one nest from daylight until dark for four days during incubation is presented, as well as of similar observations at another nest for an hour and a half during the early life of the young.

5. The unfortunate ending of three nests is described and analyzed in the light of published data on other nests and the following theories (worthy of

further investigation) are offered as plausible explanations for the near extinction of the species: (a) sedentary habits resulting in inbreeding and weak young as soon as the colonies became isolated through commercialization and deforestation; (b) lack of 'sex rhythm' for the same reason, resulting in infertile eggs; (c) predation by such enemies as raccoons, opossums and owls admitted to the nests because of the large size of the openings, whereas the smaller openings of the more successful Pileated Woodpecker's nests prevent such admittance.

LITERATURE CITED

A. O. U. Check-list of North American Birds, fourth edition, p. 201, 1931.

AUDUBON, J. J.
1856 (1835). The birds of America, vol. 4, pp. 214–226.

ALLEN, A. A.
1934. Sex rhythm in the Ruffed Grouse (*Bonasa umbellus* Linn.) and other birds. Auk, vol. 51, pp. 180–199, pls. 8–11.

BENDIRE, CHARLES
1895. Life histories of North American birds. Special Bull. no. 3, U. S. Nat. Mus., pp. 42–45.

BEYER, GEORGE C.
1900. The Ivory-billed Woodpecker in Louisiana. Auk, vol. 17, pp. 97–99.

CATESBY, MARK
1731. Natural history of Carolina, Florida, and the Bahama Islands, p. 16.

PEARSON, T. G.
1932. Bird-Lore, vol. 34, p. 300.

RIDGWAY, ROBERT
1898. The home of the Ivory-bill. Osprey, vol. 3, pp. 35–36.
1914. Birds of North and Middle America. Bull. U. S. Nat. Mus., no. 50, part 6, pp. 167–169.

SCOTT, W. E. D.
1881. On birds observed in Sumpter, Levy and Hillsboro Counties. Bull. Nuttall Ornith. Club, vol. 6, pp. 14–21.
1888. Supplementary notes from the Gulf Coast of Florida. Auk, vol. 5, p. 186.

THOMPSON, MAURICE
1885. Byways and bird notes—A red-headed family, pp. 23–39.
1896. An archer's sojurn in the Okefinokee. Atlantic Monthly, April.

Cornell University,
Ithaca, N. Y.