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## BEHAVIOR AND METHODS OF COMMUNICATION OF PILEATED WOODPECKERS

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The present study deals with displays, drumming and vocalizations of Pileated Woodpeckers (*Dryocopus pileatus*) together with descriptions of courtship, copulation, conflicts, territoriality and other situations with which these actions were associated. Much of this material has not been described previously as far as I am aware. Pileated Woodpeckers are not easy birds to observe the year around and this may explain why knowledge of their life history remains incomplete in spite of general accounts such as those of Bent (1939), Conway (1957) and Hoyt (1957).

Three situations have aided my investigations. First I had available a study area in a swamp by the Potomac River, near Seneca, Maryland, where, with the exception of two years, I could study the comparative behavior of woodpeckers since 1951. Second, these woodpeckers could be watched in an area in Florida where woods and swamps were free of undergrowth due to pasturage of cattle. I found that Pileated Woodpeckers were easy to approach in this pasture which I visited from February to May in 1958 and 1959 while studying at the Archbold Biological Station at Lake Placid in Highlands County. Finally, a hand-raised female Pileated Woodpecker enabled me to observe a number of aspects of behavior at close range.

### METHODS OF COMMUNICATION

#### INSTRUMENTAL EXPRESSIONS

*Drumming.*—Pileated Woodpeckers drum in bursts which last for about 3 seconds and fall off toward the end. Bursts are commonly delivered at intervals of 40 to 60 seconds, 4 to 7 times in a row. The woodpeckers drum every month of the year in Maryland, but their drumming may consist of no more than a single burst in the late fall, given as a male happens to pass a drum tree. I have seen females drumming. They appear, however, to drum far less than the males. The drumming of Pileated Woodpeckers is frequently associated with preening and moments of excitement, as when the birds are about to roost for the night.

*Drum-tapping.*—Many species of woodpecker tap at a regular and countable rate in relation to courtship and the location of a nest hole (Blume, 1958; Kilham, 1958*b*, 1959*a*). Pileated Woodpeckers may tap in the manner of other woodpeckers at the time of nest relief. Members of a pair resort to a modified form of drumming when in apparent agreement on the site of a potential nest cavity earlier in the breeding season. This drum-tapping is a rapid roll which lasts for about a second. It may be repeated immediately. The head of the performing woodpecker appears to vibrate much as it does when pumping food into the throats of well-developed young. The drum-tapping may sound like a low *brr* if the wood of the nest site is soft. Descriptions of situations involving this performance are given in the section on behavior.

The European Black Woodpecker (*Dryocopus martius*) is the only generic relative of the Pileated Woodpecker on which information on behavior is available. Sielmann

(1958) has given excellent descriptions of the tapping of *D. martius* both at the time of nest excavation and at the time of relief on the nest. Eygenraam (1947) gives an exact description of what I have observed. He has used an old Dutch word "tockelen," which means strumming, for what I have termed "drum-tapping." Eygenraam, freely translated, states that Black Woodpeckers strum only against the edge of the nest hole or against the nest wall. Compared with pecking, the blows are weaker and the tempo is faster. A striking feature is the tense attitude of the bird while strumming. The neck is pulled in and the head is directed upward at an angle. The bill is lifted only slightly above the wood. Strumming occurs only during the nest building period. Eygenraam quotes Tinbergen as having made similar observations.

*Rapping*.—Pileated Woodpeckers strike a sharp rap with their bills against any surface they happen to be on, when nervous or excited. They frequently rap when approaching a roost hole in the presence of an observer. My captive bird would rap whenever I upset the aviary by dragging in fresh logs. Blume (1958) has described the rapping of *D. martius* and Tanner (1942) reported that the Ivory-billed Woodpecker (*Campephilus principalis*) gave a double rap—*bam, bam*—when disturbed.

#### VOCALIZATIONS

*Random cuks*.—These are the most frequent vocalizations of Pileated Woodpeckers. They can be given at a rate of four *cuks* a minute for some minutes, but they are usually delivered in a slower, more irregular manner. Variations can make it possible for a single bird to sound like a pair of woodpeckers or even a domestic fowl. Random *cuks* appear to have a number of functions. They may serve to maintain the pair bond the year around and to register excitement in addition to location. A lone, unmated male in Seneca Swamp resembled my captive female in giving almost no random *cuks*.

*High call*.—This vocalization has a regular pattern of 6 to 8 high-pitched *cuks* with a terminal one of lower pitch. High calls are the main breeding notes of Pileated Woodpeckers and they also appear to express dominance within an area. My captive female gave almost no high calls until placed in an outdoor cage in New Hampshire where she could hear wild Pileated Woodpeckers in the adjacent woods.

*Woick, woick*.—These are intimate notes exchanged by members of a pair in the breeding season and I have heard them as late as mid-September. *Woicks* almost invariably accompany the bill-waving dance described later.

*G-waick, g-waick*.—These were loud, shrill vocalizations which I have heard most frequently when a pair of Pileated Woodpeckers encounters a rival individual or another pair. Courtship and conflict seem to elicit somewhat similar expressions, for *g-waicks* may be exchanged when a pair appears to be alone. It is possible that *g-waicks* represent *woicks* given at a high intensity. Situations attending both vocalizations are illustrated in figure 4.

*hn, hn*.—These low, grunting noises are intimate notes made during the breeding season. I am not sure whether these notes are exchanged since it is difficult to determine which bird is making vocalizations when a pair is close together. The note is definitely made by females and is identical with the begging call of well-developed young. These vocalizations are sometimes drawn out into a *hn-waan*, which is suggestive of a gray squirrel (*Sciurus carolinensis*).

*Notes of nestlings*.—Nestling Pileated Woodpeckers have vocalizations which have no obvious relation to anything expressed by adults. On April 30, 1958, for example, I heard soft *churr, churr* notes when I stood below a nest in Florida. The vocalizations were given intermittently. I removed the young from the nest on the same day, estimating that they were from 11 to 12 days of age. The two nestlings lived in an artificial

hollow for the next eight days. They would crawl to the top when hungry, feed from my fingers, then drop to the bottom to make a variety of soft jabber noises. They also made *peep, peep, peep* vocalizations when settling for the night.

#### DISPLAYS

*Full-wing threat display.*—A Pileated Woodpecker may face an adversary with wings stretched out sideways (fig. 4), a performance which flashes the white of the under wings in contrast with the black of the body.



Fig. 1. Pine pasture habitat of Pileated Woodpeckers in Florida.

*Bill-waving dance.*—In this display a Pileated Woodpecker points its head and bill straight upward and even backward, while jerking them about, swaying the body and making intention motions with its wings. I have never seen this dance without hearing the *woick, woick* vocalization at the same time.

It would appear from the sketches and descriptions of Blume (1956) that the European Black Woodpecker has a bill-waving dance similar to that of *D. pileatus*, the difference being that the accompanying vocalization is *urr* instead of *woick*. The flicker (*Colaptes auratus*) and the Hairy (*Dendrocopos villosus*) and Downy (*D. pubescens*) woodpeckers also have bill-waving dances, as mentioned by Bent (1939) and as I have observed in field and aviary studies.

*Raising of crest.*—Pileated Woodpeckers raise the long, red feathers of their crests straight upward when excited. This action usually accompanies the other types of display.

#### BEHAVIOR

##### EARLY BREEDING SEASON

I observed the courtship, copulation, drum-tapping, and conflicts with rivals of one pair of Pileated Woodpeckers in Florida between March 1 and 5, 1959. This was at a time when the birds were leaving one nest excavation to select a site for a new one.

*Copulation.*—The four occasions on which copulation was observed in Florida were as follows: (1) Male A had drummed 7 times in 5 minutes at 4 p.m. on March 3, when his mate flew to him giving random *cuks* on the way. She alighted crosswise on a dead limb. The male did a bill-waving dance calling *woick, woick*. I also heard *hn, hn* vocalizations. The male mounted the female and copulation took place; after he had left, his mate remained, preening her spread and uptilted tail. (2) The male returned to the same pine a half hour later and drummed 6 or 7 bursts. When his mate flew toward him, he flew out as if to meet her, then passed over my head. She alighted on the dead pine and drummed one burst. He returned immediately. There was an exchange of *woicks* as the female moved out onto a limb. The male mounted but I could not determine whether copulation had taken place. (3) At 8:40 a.m. on the following day I had a more complete view of copulation when the female alighted near the male. An exchange of *woicks* followed. She was again crouching crosswise on a limb when he flew over and mounted her back firmly. He then fell backward and over to the left in a gradual and awkward fashion in what appeared to be close cloacal contact. This process took an appreciable time. The female

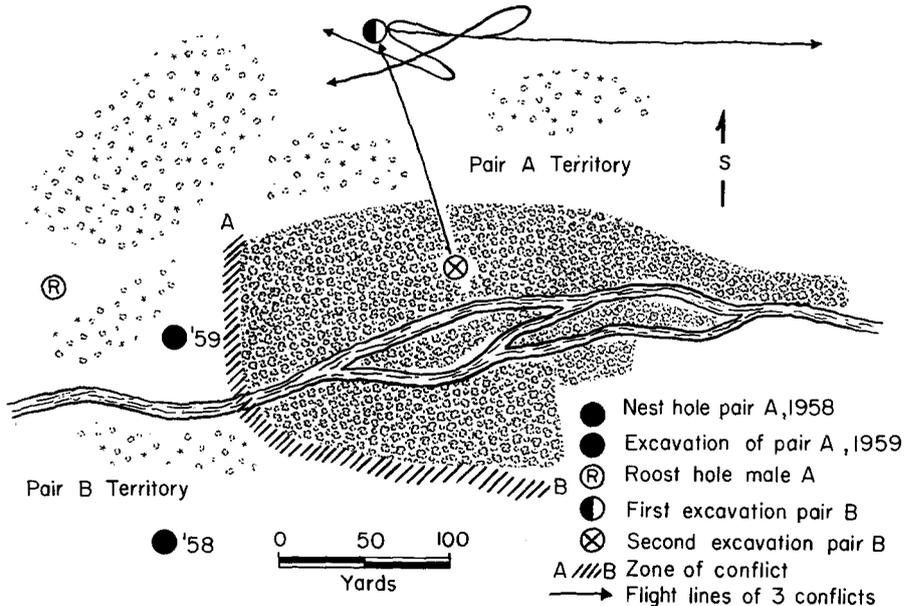


Fig. 2. Territories of two pairs of Pileated Woodpeckers in Florida. Boundaries indicated by zones of conflict.

presented an odd spectacle after he had left, for her head and tail were drooping limply over either side of the limb and her body was flattened closely against it. (4) An hour later pair A had just driven away a rival pair and were flying back when the female alighted crosswise on a dead pine limb. Her mate mounted but came off right away in what might be termed pseudo-copulation.

I have also observed copulation of Pileated Woodpeckers in Maryland. All three occasions were in March; one on March 22, 1957, at 7:15 a.m. and the other two on the evenings of March 25 and 31, 1959, at a time when a pair had just completed their nest excavation. No references known to me give any description of copulation among Pileated Woodpeckers.

*Beginning of excavations and drum-taps.*—On March 1 and 2 I watched the male and female of pair A excavating at separate times in a pine stub located on the periphery of their territory (fig. 2). The stub was remarkable. It was 70 feet tall and contained 11 holes, of which the top 5 were obviously old. The most dilapidated of these was the roost hole of female A. There were 6 fresh excavations within a length of 15 feet in the lower part of the stub (fig. 3). As far as I could determine the Pileated Woodpeckers had made successful entrances to these 6 fresh holes but had been stopped, on each attempt, by the hard inner core of the pine. This was the reason, I presumed, for their seeking another site for locating a nest hole.

After copulation by pair A on March 3 the male flew into the adjacent swamp followed by his mate. I was unable to keep them in view. I did, however, hear *hn, hn* vocalizations and a series of double drum-taps which, although delivered on a resonant spot, were unlike the lengthy roll of a regular drumming. Subsequent events suggested that pair A was starting a new excavation at about this time. Thus at 9:40 a.m. on the following day I located male A as he was excavating a hole  $1\frac{1}{2}$  inches wide and equally deep, 40 feet up in a dead stub arising from the swamp water. This stub was in the same area where I had heard drum-tapping the day before. The female arrived with some *hn, hn* noises and I saw the male give three bursts of drum-taps, all delivered at the edge of the excavation. Both sexes excavated. The hole enlarged rapidly during the day, for when I returned at 2:40 p.m. the entrance was already of full size. A little later female A made a series of random *cuks* as she flew to the excavation. Her mate immediately put his head inside the hole and I could see that he was drum-tapping by the vibration of his crest as well as by the peculiar position of his head. She then drum-tapped on the outside. The male flew away. His mate excavated for 3 minutes and when he reappeared, she drum-tapped inside the hole just as he had done on the previous change-over. Each of the birds did a half-hour stretch of excavating during the afternoon. The male was getting much of his body into the excavation by 4:15 p.m., but there were indications that he was losing enthusiasm. For example, he had not drum-tapped during the afternoon change-overs although his mate had done so on each occasion. This loss of interest became obvious over the next two days. On March 6, male A rested at the hole for 20 minutes but excavated for only 30 seconds. His mate arrived, drum-tapped, then worked at the hole for 50 minutes.

I observed pair B, which occupied a territory adjacent to that of pair A in Florida, excavating in February, 1958, and in March, 1959. In each year the nest cavity was in the rotted tops of pine stubs. One or the other of the pair might excavate, but at well separated intervals; there were no direct change-overs, no drum-tappings, and the male did most of the excavating in both years.

#### TERRITORIALITY

Pairs of Pileated Woodpeckers appear to occupy the same areas year after year. One can hardly refer to such areas as territories when distances in swampy and wooded country, such as those in my study area in Maryland, make it difficult to follow a Pileated Woodpecker in a regular manner. The drumming territory of an unmated male in Seneca Swamp was an exception which is described in the following section. The situation in Florida was different, for I was able to follow the activities of Pileated Woodpeckers for hours at a time. The pasture where observations were made consisted of two zones well demarcated from each other: one of pine glades with patches of grass and saw palmetto, the other of dark wooded swamp along a winding creek. The juncture of swamp and pine glades was the boundary between the territories of pairs A and B (fig. 2) as was apparent from five encounters which I witnessed in this area as well as from the fact

that neither pair fed in the territory of the other. The encounters were mild and took place late in afternoons. Thus on 4 out of 7 evenings between February 1 and 7, 1958, both pairs approached the border zone making shrill *g-waick*, *g-waick* vocalizations which I did not hear from either pair at other times of day. On March 4, 1959, I had an especially close view of what took place on these occasions. At 5 p.m. female A gave a high call in response to one from her mate and flew to him at the edge of the swamp. Pair B, possibly hearing these calls, flew to the same area. I now saw one or the other bird of opposite pairs flying toward each other over an open space, alighting on separate trees as they made *g-waick* vocalizations. These calls ceased when pair A flew back into the swamp.



Fig. 3. Pine stub with many holes excavated by Pileated Woodpeckers in Florida.

Intrusions of a third pair of Pileated Woodpeckers and conflicts which they had with pair A indicated that these latter birds were also defending a territorial boundary to the south (fig. 2). The intrusions probably originated because of a scarcity of suitable nest trees, for all of the three conflicts observed were related to the many-holed pine stub described previously. The following details were among those observed: (1) The intruding male had excavated at the pine stub for 10 minutes on the afternoon of March 2, 1959, when male A swooped down on him from the top of the stub and the two grappled in the air. Male A excavated briefly. He then flew at the intruder which was resting 60 feet away but now took a long flight away from the area. (2) Both members of pair A were on the pine stub at 8:30 on the following morning when the intruding male gave a high call 250 yards to the east. Male A immediately flew toward the intruder, followed by his mate. One male pursued the other several times in a circuit up a dead pine and the two grappled in the air before the intruding male took a long flight in the same direction as on the previous day. (3) The four members of the two pairs of Pileated Woodpeckers had a conflict on March 4. Pair A was at its new excavation in the swamp when an

intruding Pileated Woodpecker drummed one burst near the south boundary (fig. 2). Female A flew toward the sound immediately, followed by her mate, and the two were by their many-holed pine stub before I was able to view them again. From this resting place female A, and then her mate, drove away a female rival from trees 50 feet away. All the conflicts described above were direct attacks, unaccompanied by displays or vocalizations.

#### ACTIONS OF AN UNMATED MALE

The behavior of a lone male (LM) in Seneca Swamp, Maryland, illustrated a different type of territoriality from that just described, for it was associated with efforts of an unmated Pileated Woodpecker to attract a mate. I came to this interpretation after eleven mornings of observation between December 25, 1957, and March 2, 1958. In this period I never saw LM in association with any other Pileated Woodpecker and his behavior in regard to drumming and vocalizations was markedly different from that of a mated male in an adjacent area.

LM made rounds of the same drumming trees on successive days. It was not difficult to follow him over the frozen swamp when trees were bare of leaves, especially since his long flights were usually above the treetops and his persistent drumming made him easy to locate. The distance between the extremes of his drumming trees was 700 yards. His drumming territory remained the same for more than two months. Irregularities of terrain prevented any significant determination of its width.

There was a marked increase in the drumming of Pileated Woodpeckers in Seneca Swamp at the end of December. Most of this drumming was done by LM. On January 12 this male drummed continuously for 3 hours from the time I first heard him at 7:20 a.m. At 8:30 he was drumming, at his usual rate of one burst every 25 seconds, on an oak stub where an old woodpecker cavity gave added resonance. LM took a long flight to the other end of his territory. He soon returned, giving high calls on the way, and from 8:50 until 9:30 he drummed, almost without interruption, on three different trees. The neighboring male, a mated Pileated Woodpecker, drummed for 5 minutes at about 8 a.m. and did no further drumming as far as I was aware. His rate was one burst every 40 to 60 seconds.

LM gave many high calls but infrequent random *cuks* were heard in comparison with the situation in the neighboring male. LM gave his high calls, in most instances, when about to fly from one drum tree to another or when on a long flight across his territory. The only other vocalizations were shrill *g-waicks*. They all came from the lower end of LM's territory which was the one place where he would have been most likely to have encountered the neighboring pair of Pileated Woodpeckers. Unfortunately I could never get a good view of the actual situation because of intervening trees.

#### ACTIONS ASSOCIATED WITH ROOSTING

A pair of Pileated Woodpeckers had roost holes 80 yards apart by the Potomac. The male's hollow was freshly excavated in October, 1958, and he continued to occupy it until the next spring when he took to roosting in a new nest excavation which the pair had made in the vicinity of their winter roost holes. An extra male Pileated Woodpecker roosted in the same area.

I had evidence that conflicts took place between the two males on at least nine evenings between September 24 and March 31. One of the more spectacular conflicts occurred at about 4:20 p.m. on December 13, 1958, when the Pileated Woodpeckers flew to the base of a tree 30 paces from where I stood. They shifted around the trunk as one tried to strike down at the other. The male on the defensive raised his wings in full threat display. This silent conflict was interrupted when a female (F1) flew to the base of the tree

making shrill *g-waick* vocalizations as she did so. One of the males made the same noises. The three Pileated Woodpeckers were now close together and the male and female on either side were engaging in a bill-waving dance, accompanied by *woicks*, when the male in the middle suddenly raised his wings in a full threat display (fig. 4). There was a flurry of wings, the female departed and the males resumed their silent conflict.

A different type of conflict took place at dawn on January 10, 1959. Male M1 flew from his roost hole at 7:21 a.m. Within a few minutes female F1 and male M2 had come to a tree behind me and M1 immediately flew toward them and over my head, calling *woick, woick, woick* as he flew. One of the woodpeckers on the tree did a bill-waving

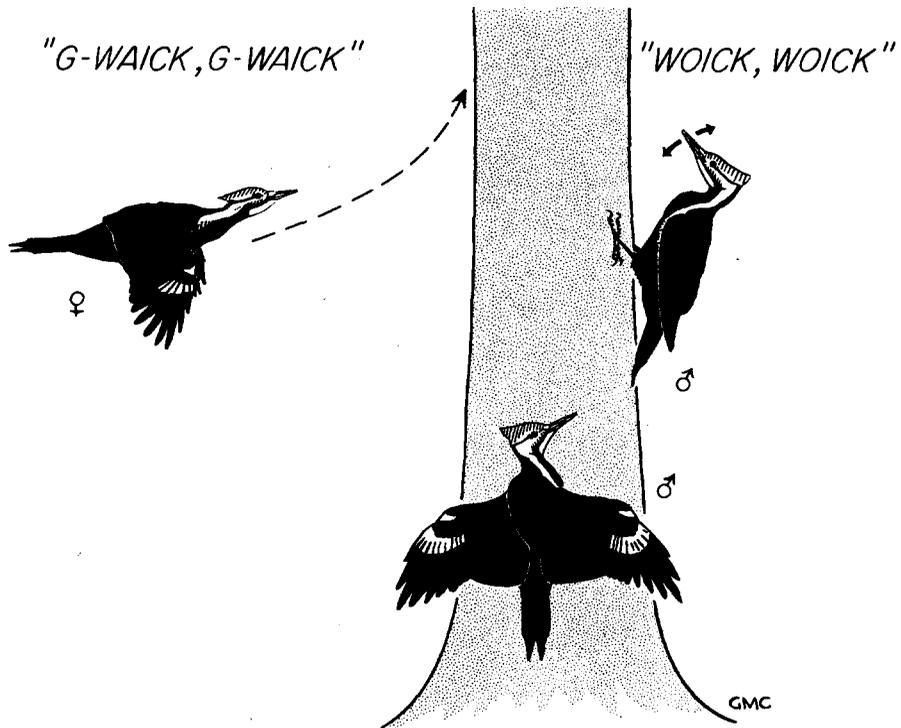


Fig. 4. Conflict between two male Pileated Woodpeckers observed on December 13, 1958.

Male in center performed a full wing threat display and male to right did a bill-waving dance when his mate flew in from left.

dance. The three birds now flew away, F1 to feed on a stump with seeming indifference while the two males fought for the next 20 minutes in her vicinity. One male would alight below his rival, then chase him up the tree trunk to the upper branches. The fleeing male flapped his wings as if to speed his ascent. He would then take flight and a pursuit would follow, round about through the woods until the two males had alighted on another tree. The male being pursued took rest in a curious way on several occasions. He would alight on small branches of low trees, clinging upside down as I have seen Pileated Woodpeckers do when feeding on poison ivy berries, but this male was not feeding. He preened in a nervous fashion but was not attacked until he flew to a tree trunk.

The Pileated Woodpeckers roosting by the Potomac sometimes flew down to the water to drink before entering their holes for the night. I had close views of this drinking

on four occasions. On March 22, F1 flew to the base of a sycamore at 6 p.m., then moved along its roots to the edge of a creek where she dipped her bill in the water, then raised her head nine times. The male behaved in similar fashion three days later, dipping his bill into the water 14 times before flying to his roost hole.

On February 25 I witnessed the beginning of some interesting competition between the woodpeckers and a pair of nesting Wood Ducks (*Aix sponsa*). It was evening when I noticed that female F1 was behaving in a singular fashion. She kept peering into her roost hole, then drew back and flew to a neighboring branchlet where she would hang upside down and sway momentarily before returning to peer again. She repeated these performances five times before flying away to roost elsewhere. F1 behaved in an identical manner on the evening of March 22. It was at this time that I discovered that a female Wood Duck was entering the same hollow sycamore by an entrance three feet below the hole used by the woodpecker. As in encounters which I have observed between Pileated Woodpeckers and other animals (Kilham, 1958*a* and 1959*b*), the woodpecker remained almost completely silent.

#### CAPTIVE FEMALE

A hand-raised female Pileated Woodpecker (fig. 5) was kept in an indoor garage which had been converted into an aviary 10½ feet square by 7½ feet high. Five other woodpeckers lived in the same aviary. These other hand-raised species included a pair of Yellow-shafted Flickers (*Colaptes auratus*), two female Red-bellied Woodpeckers (*Centurus carolinus*) and a female Yellow-bellied Sapsucker (*Sphyrapicus varius*). The Pileated Woodpecker responded to these associates in various ways, partly, one may presume, through lack of any companion of her own species. Her displays in relation to the sapsucker were of particular interest. They consisted of bill-waving dances accompanied by *woicks* and these took place many times a day when the sapsucker happened to fly near to the Pileated Woodpecker and *vice versa*. The Pileated Woodpecker did not perform in this fashion to any of the other birds in the aviary. The dances had been going on for nearly two months when I removed the sapsucker, by way of an experiment, on October 15. The Pileated Woodpecker came to the wire closest to the cage containing the sapsucker and did a *woick* dance. I then removed the cage to another room for three days. There were no bill-waving dances in this period, but when I returned the sapsucker to the aviary on October 18, the Pileated Woodpecker immediately followed it about and at the same time performed the longest series of bill-waving dances which I had observed. The sapsucker never responded in any way on this or on other occasions. One can only conjecture why the Pileated Woodpecker sought out this particular companion from among the woodpeckers present. Female Yellow-bellied Sapsuckers, however, do resemble miniature male Pileated Woodpeckers in having a red frontal patch which can be raised into a crest, a white throat ending in black on the breast and a number of black and white lines radiating backward from the base of the bill. This combination of markings may have served as releasers. Pileated Woodpeckers are closely paired the year around and my lone female probably felt the lack of a mate, a lack which found expression in her displays to the one bird which most resembled a male of her own species.

The Pileated Woodpecker resorted to full-wing threat displays on only a few occasions, one of which was in November when she began to spend her first nights in a roost box and became aggressive toward one of the Red-bellied Woodpeckers. She pursued the smaller bird about the aviary in a most persistent fashion. The Pileated would raise her crest and spread her wings whenever able to get at all close and at one time, when the Red-bellied Woodpecker was feeding from my fingers, she flew up and gave a full threat display within a few feet of my face.

The Pileated Woodpecker had a form of play which took place over many months when I turned on the aviary lights in the morning. She would cling to the under side of a slanting log, her crest raised and bill pointed upward as she made intention motions with her wings; she then shifted nimbly from one side of the log to the other as if dodging an imaginary assailant.



Fig. 5. The hand-raised female Pileated Woodpecker when six months of age.

#### SUMMARY AND CONCLUSIONS

Pileated Woodpeckers (*Dryocopus pileatus*) were found to drum throughout the year. The females drum but do so infrequently in comparison with males. Drumming serves various purposes, of which advertisement of dominance within a territory and attraction of a mate are of particular importance. The breeding or high call is used in somewhat the same manner as drumming and also has great carrying power.

These woodpeckers have a peculiar method of drumming which serves to register agreement between members of a pair on the location of a nest site. It is thus analogous to the tapping of some other species of woodpeckers.

An unmated male drummed persistently for over two months in mid-winter, using the same round of drum trees. His drumming territory was 700 yards long.

Pileated Woodpeckers also rap with their bills, making a sharp *bam*, when nervous.

Random *cuks* are the most frequent vocalizations and serve as location notes in keeping members of a pair together. They may also act as alarm calls when given at high intensity.

Pileated Woodpeckers have intimate vocalizations which serve to maintain the pair bond and are heard most frequently in winter and spring. One of them, a *hn, hn* note, is identical with the begging call of fully fledged young.

Pileated Woodpeckers may extend their wings sideways in a threat display when facing an adversary of their own or of unrelated species.

A bill-waving dance is an expression of intimacy between members of a pair. It is accompanied by a *woick, woick* vocalization.

The Pileated and the related Black Woodpecker share many similar habits which include tapping, drum-tapping, rapping, and the bill-waving dance.

The female may invite copulation by flying to the male and squatting crosswise on a limb. Seven instances of copulation were observed in March.

The roosting habits of one pair of Pileated Woodpeckers were followed from September until March, when a nest hole was completed. An extra male roosted in the same vicinity and conflicts between the two males took place intermittently over a 6-month period. The woodpeckers often flew down to a river bank to drink in the evening, just before flying to their roost holes. A female Wood Duck disturbed the female woodpecker by occupying a cavity three feet below her roost.

Territoriality, as evidenced by conflicts along boundaries, was observed in two pairs of Pileated Woodpeckers in Florida.

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