

PAIR FORMATION, MUTUAL TAPPING AND NEST HOLE
SELECTION OF RED-BELLIED WOODPECKERS

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This paper describes pair formation, nest hole selection and the early breeding cycle of the Red-bellied Woodpecker (*Centurus carolinus*) as observed in the vicinity of Seneca, Maryland, beginning with the first signs of breeding behavior in January until the actual nesting in April. Features such as reverse mounting, a hitherto undescribed performance here called mutual tapping, vocalizations and drumming are also discussed. I did most of my observations in bottomlands along the Potomac River, when the woods were bare of foliage, in 1956, 1957, 1958.

ONSET OF BREEDING BEHAVIOR

Families of Red-bellied Woodpeckers break up in late summer and individuals become distributed singly over the countryside. It is rare to find a male and female together between September and January. The birds are relatively quiet during the autumn. In September and October, 1956 I heard no drumming from Red-bellies, and the vocalization "kwirr" on only two days when males were apparently in conflict over roost holes. During the late fall I watched several roost holes at dawn. The males invariably left their roosts without pausing, and flew off with little noise. The females had their own roost holes.

In 1956 signs of an autumnal recrudescence of breeding behavior (if such it was) were limited to one observation. On a warm day, November 9, a male flew to a dead stub and gave three sets of slow, rhythmical taps. A female appeared, gave a "chrr" note, joined briefly in the tapping and was gone. The loud "kwirr" so characteristic of the male during the breeding season was not uttered. The stub where this incident occurred had a small hole apparently owned by a Downy Woodpecker (*Dendrocopos pubescens*), which after the tapping drove the male Red-belly away.

The onset of the breeding cycle seems to be signaled by the loud persistent "kwirr" of the males, which rings out at dawn on the coldest days after the middle of January. In 1955, 1956 and 1957 this call was first heard in mid-January. At about the same time the male starts to drum. A male will generally call from his roost hole or from a potential nest hole. A female may fly to him from her separate roost hole. In 1957 I did not notice males taking an interest in potential nest holes until January 26.

During the severe winter of 1957-58, especially when mid-December snow storms broke a long period of mild weather, Red-bellied Woodpeckers deviated somewhat

from patterns of behavior which I had observed the previous year. Though the male Red-bellies had been relatively quiet all fall, they began calling after the snowfall as ardently as in spring. On December 15, when I walked into Seneca Swamp over snow and ice in the early morning sun, I heard almost frantic "kwirr, kwirr, kwirr" calls from many directions. The sound of mutual tapping (Figs. 1 and 2; see p. 320) came clearly on two occasions. The sound appeared to come from a willow stub with a hole in it. A male drummed a number of times on a nearby pole, where a nesting male had drummed during the previous spring. A neighboring male called "kwirr" and drummed from a succession of dead stubs and branches. Two other males were starting excavations, which, as far as I could observe, were completed over the next four to six weeks. The intensity of this mid-December activity greatly subsided within a week. After a short spell of mild weather, January 1958 was unusually cold and windy and I heard almost no "kwirrs" until February.

SEPARATE ASPECTS OF BEHAVIOR IN EARLY PAIR FORMATION

Drumming. When drumming, male Red-bellied Woodpeckers give a roll, lasting close to a second, which is so rapid that one has difficulty determining the number of individual blows—possibly about six a second. An unmated male drummed every 5 to 10 seconds for a few minutes. Pauses between drums, however, can be irregular and interrupted with "kwirrs." In 1957, males began drumming in January, at the time of their first "kwirrs." Drumming might be occasioned by a variety of circumstances. Thus, with the Pennifield pair (*infra* p. 324), the female flew to the male on three different days when he was drumming and coition or reverse mounting soon followed. Lone male Red-bellies might drum and "kwirr" alternately in an apparent effort to attract a mate. Males scattered over the countryside often seemed to drum in response to other males and they continued to do so while nesting was in progress. Drumming went on occasionally during the summer. However, I heard none from Red-bellies during the fall when the drumming of Pileated Woodpeckers (*Dryocopus pileatus*) or of Flickers (*Colaptes auratus*) could be heard on any early morning. Female Red-bellied Woodpeckers drum infrequently. I saw a female drum only once, on April 20, 1957, when a pair was much excited over Starlings, which were trying to take over their nest. The pair called and gave mutual taps also. This could have represented "displacement" activity.

Mutual Tapping. Tapping consists of blows given at a rate of about three per second. The beats in tapping are countable and slow. Tapping is readily distinguished from drumming, which is a much more rapid, blurred roll. Males, apparently trying to attract a female to an excavation or potential excavation, may tap alone many times, in addition to calling "kwirr" and occasionally drumming. If attracted, the female

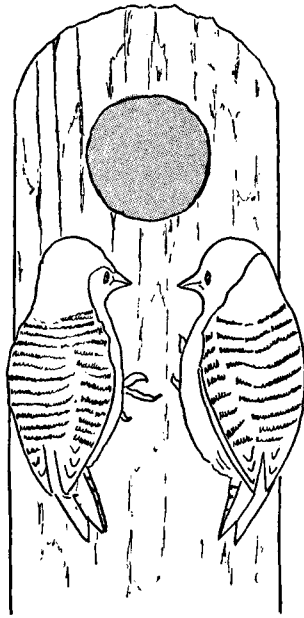


FIGURE 1. When starting a new excavation, the pair of Red-bellied Woodpeckers tap together outside of the hole.

may go to the same tree as the male and, alighting beside him, join in mutual tapping (Fig. 1). Sometimes the male may tap within the excavation and the female outside it (Fig. 2B). Mutual tapping lasts on the average for about two seconds, but its duration is somewhat variable, and it may be repeated. The tapping is essentially synchronous, but not perfectly so. This performance was observed 30 times in the spring of 1957—often when a pair was selecting or excavating a potential nest hole. Mutual tapping may occur early in the season. On February 23, 1958 I heard a pair repeatedly engage in bouts of mutual tapping. I never noted it once actual nesting had started within an excavation.

Examples: A pair of Red-bellies began an excavation on the under side of a dead limb of a pin oak (*Quercus palustris*) where they were molested both by Starlings and a Red-headed Woodpecker (*Melanerpes erythrocephalus*). On March 24, 1957 the pair seemed to have moved about 40 feet away. At 6:45 a.m. I saw the female giving strong, rhythmical taps alone. In the next 15 minutes I heard mutual tapping three times in the same vicinity. I could find no excavation. Possibly I had not been quick enough, for it is difficult to spot a situation through intervening trees. On the next week-end, however, I found the male where I had heard the tapping; he was excavating a new hole in a dead maple. Next morning

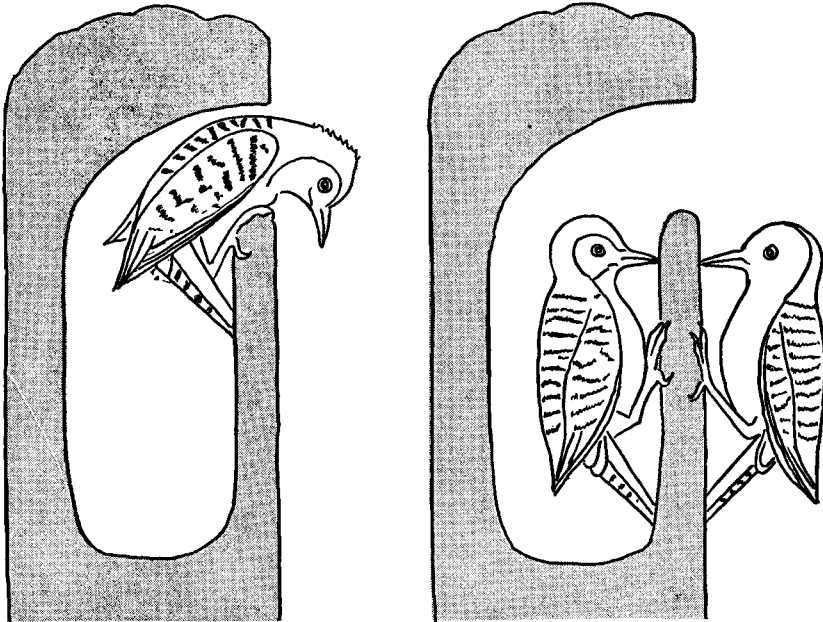


FIGURE 2. Mutual tapping of Red-bellied Woodpeckers. (A) Male calls "kwirr" from entrance of his roost hole at dawn, raising crest and pointing bill toward ground. (B) Male starts to tap inside as his mate alights and joins in the tapping.

mutual tapping took place twice on this stub. As usual in such excavations, the female excavated once the male had the hole well started.

On February 23, 1958 I located on a dead elm stub a pair which had been engaged in mutual tapping. By this time a second male had appeared and tapping ceased. Twenty minutes later the first male was alone on the stub. He tapped several bursts, then "kwirred" with some intensity, and drummed. Within a few minutes a female alit at his level, which was by a new, shallow excavation. Both birds rested in the same positions for the next 20 minutes, motionless except for occasional bursts of mutual tapping.

On March 30, 1958, I observed a male Red-bellied Woodpecker clinging to a dead elm eight inches below an abortive excavation of Pileated Woodpeckers. When close, I heard the Red-belly give nine bursts of tapping, interspersed with "kwirrs." The bursts included from 4 to 12 taps. After the nine bursts, the male called "kwirr" over and over, stretching head and bill upward as he did so. Then the female suddenly alit close to him and about five mutual taps followed. She flew away shortly afterward. The male, however, remained motionless and quiet in the same place where I had first observed him, for the next ten minutes. On the basis of this and similar episodes, I believed that the birds were performing at a potential nest site.

I sometimes noticed Red-bellies pecking here and there on bark below an excavation. Possibly they were percussing to ascertain the degree

of soundness of the underlying wood. One may speculate that mutual tapping evolved as an amplification of this procedure. Presumably both members of a pair must agree on the site of their prospective nest hole. Mutual tapping may, among other things, register and express this agreement. It thus stimulates the pair to work in unison. Once excavation has begun, continued mutual tapping may reinforce the cooperative spirit which, in final stages, enables the two birds to work in turn at creating a nest.

Mutual tapping is a dramatic performance. I have not observed it among other species of woodpecker, nor found mention of it in the literature.

Comparison with other Species

Intercommunication among woodpeckers by means other than calls and regular drumming is not unknown. Thus de Villiers (1957), writing of an experience in East Transvaal, states that "on June 1, I witnessed an intercommunication of two Cardinal Woodpeckers (*Dendropicos fuscescens*) by means of drumming on the bark of trees. The male beat a rapid tattoo on the bark of a dead tree, the female answering almost immediately with an identical tattoo * * *." Tanner (1942), in his report on the Ivory-billed Woodpecker (*Campephilus principalis*), wrote that "Ivory-bills * * * signal by pounding with the bills on limbs and stubs, sometimes a single hard blow, but more often a hard, double rap, *bam bam* * * *. They frequently double rap when disturbed * * * or when one of the pair is absent." When members of a pair changed places at a nest "One would * * * signal the other by calling or pounding. We occasionally heard the setting bird answer by pounding on the inside of the cavity."

Coition and Reverse Mounting. During winter and spring of 1957 I observed what appeared to be coition 11 times. Mounting by males was noted as early as February 7, which was two months before eggs were laid in my area. The early mounting by the male is probably only pseudo-coition. In full coition, as seen prior to egg-laying, the male starts well-mounted, then gradually falls off to the left side and somewhat backward, the whole process being notably longer than the abortive type.

Reverse mounting, in which the female fluttered on the male's back, I saw on nine occasions in 1957. It was noted as early as February 23 (see p. 326); on five occasions later in the year reverse mounting immediately preceded coition.

Coition and reverse mounting might be preceded by drumming or mutual tapping. In my experience a constant feature preceding reverse mounting was that the female flew to the male. She usually came as he called at a nest excavation, but in a few instances, as in the Pennifield pair discussed later (p. 324), she came to a drumming tree.

Example: On April 27, at 6:40 a.m. a male Red-belly was calling "kwirr," at the nest hole in a willow stub. The female flew to him and coition took place.

From 7:22 to 7:30 she flew to him three more times and on each occasion fluttered on his back in reverse mounting just prior to real coition.

Reverse mounting takes place among other birds. I have observed it in a pair of hand-raised hornbills (*Bycamistes subcylindricus*). Glick (1954) has described it prior to coition in Starlings (*Sturnus vulgaris*). He observed reverse mounting several times a day for four days, and concluded that "the female of this pair solicited copulation by imitating the treading of the male." Beach (1948: 65-67) states that mounting by the female of the male has been reported in the courtship of the Great Crested Grebe, *Podiceps cristatus*, the Water-Hen (Common Gallinule), *Gallinula chloropus*, the Common Tern, *Sterna hirundo*, and less frequently in the Domestic Pigeon, *Columba livia*; as well as in certain mammals. I have not found a description of reverse mounting in woodpeckers.

Behavior of unmated males. To attract a female an unmated male calls from a potential nest hole, as observed for two males in the winter and spring of 1957. The first of these woodpeckers had begun an excavation in a sycamore (*Platanus occidentalis*) by February 10. He became the noisiest Red-belly in the area, calling "kwirr, kwirr, kwirr" every 10 to 20 seconds. A female suddenly appeared on the morning of February 24. He gave excited "kew, kew" notes and flew to meet her in mid-air. She soon flew away. By March 4 the male had still made little progress either on the excavation or, as I thought, on the attraction of a mate. That morning he called "kwirr" 60 times in a row. A female then alit on a neighboring limb and called "quer." The male immediately started to tap, but she failed to join in. Affairs had apparently progressed by the following morning, for at 7 A.M. I saw mutual tapping on the sycamore, after which the female flew to a nearby limb. He immediately followed and coition took place. Five minutes later the pair had another episode of mutual tapping. Successful nesting was prevented when Starlings took over the excavation a few weeks later.

A second unmated male called repeatedly from the beginnings of an excavation in a willow stub. On April 20, he got two replies in one morning. First, a female came from the east, joined in mutual tapping, then flew back the way she had come. The male continued to call. Then another female approached, from a westerly direction. He flew to her, his plumage fluffed out in excitement, but she returned the way she had come. Two weeks later the male was still alone and his excavation unfinished.

I suspect that this second male had called up two already mated

females on April 20. I had been observing two pairs of Red-bellies which were his immediate neighbors on the east and west. Both of these pairs were disturbed by Starling interference on April 20 and the males comparatively subdued. Thus it is possible that their mates, due to these disturbances, were attracted momentarily by the loud, persistent "kwirrs" of the neighboring unmated male.

Display. Male Red-bellies commonly erect the red-feathers on their crowns when excited in the breeding season. On a single occasion I saw an unmated male float down to a drumming limb, with wings held stiffly at a 45 degree angle. The most striking displays were threatening in nature and arose when a third Red-belly intruded on a pair already formed. Thus on April 27 I was watching a pair of Red-bellies which were obviously mated, as indicated by repeated coition and mutual tapping. A second female suddenly alit by the male. The male froze in awkward posture with tail fanned and bill pointed upward. His mate now flew near and he immediately raised his wings, fully outstretched, over his back. This was a beautiful display. I witnessed a similar performance on two other occasions when an intruder came to a mated pair.

A chance observer, seeing a male woodpecker in full display before two females, might easily call the performance courtship. Prolonged observations on Red-bellies, however, gave background for a different interpretation. Threat display may be more spectacular among woodpeckers than pair formation. I have observed this among Downy Woodpeckers, and Noble (1936) found a similar situation in his study of courtship in the Flicker. He states that the so-called "dance" of these birds, in which they call "we-cup," wave bills in the air, and spread their uptilted tails, is "obviously intimidatory."

NEST HOLE SELECTION AND EARLY BREEDING BEHAVIOR OF A SINGLE PAIR

The interplay of the various aspects of breeding behavior is best shown by following the activities of a single pair. On February 3, 1957 I began a special study of a male calling repeatedly "kwirr" from a hole 60 feet up in a dead stub of a living silver maple (*Acer saccharinum*), near the Pennfield Locks on the Chesapeake and Ohio Canal (Fig. 3). Thereafter and until April 13 I came at dawn on many days to watch this male and his mate. Their behavior during the period of observation fell into three phases.

Phase 1. Behavior at winter roost hole. On February 3 I heard "kwirrs" and drumming in the direction of the silver maple. The male Red-belly flew into the hole at 7:40 A.M., rested with head looking out,

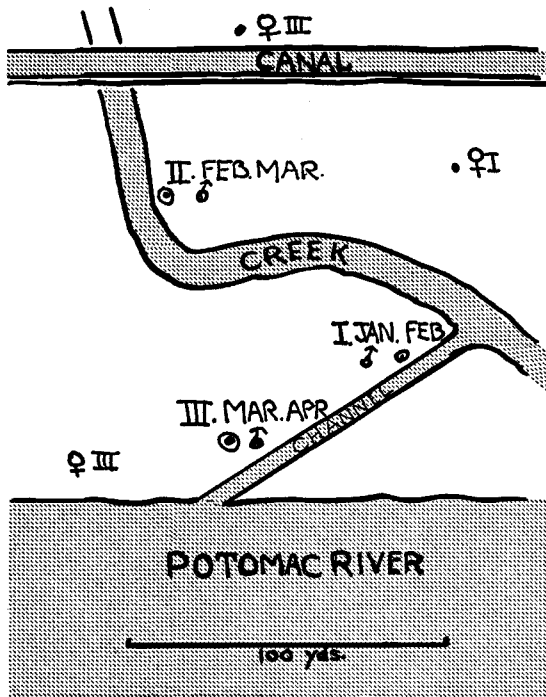


FIGURE 3. Area occupied by a pair of Red-bellied Woodpeckers early in the breeding season. Roman numerals show how the male (δ) moved from his original roost hole (I) to two successive excavations (II and III) in the months indicated. The female (♀) changed her roost hole also, each time preceding the male to a new vicinity (II and III).

called "kwirr" twice, then suddenly dropped from sight. To my surprise, he gave a slow, clear tapping from the inside. A female Red-belly appeared immediately as if on signal, and, alighting below the entrance, tapped simultaneously (see Fig. 2B). The female flew away after a few moments. Her mate reappeared within the entrance and called "kwirr" 8 times, each time pointing his bill toward the ground and raising the feathers of his crown (Fig. 2A). This posture exposed the red of head and nape to its full extent. The male disappeared from sight for a second time and the female flew in as before to join in mutual tapping. This rhythmical tapping was so distinctive that I later learned to recognize it at a hundred or more yards.

On February 7, the hole in the silver maple was dark and empty before dawn. At 7 A.M., the male looked out and gave a rapid "chaa-aa-aa" followed by a few "kwirrs." His mate replied with a flat "quer" from her roost hole across the creek (Fig. 3) and within a few minutes

she flew directly toward the silver maple. Her mate had been looking in her direction. He dropped from sight at her approach and mutual tapping took place when she lit on the outside of the cavity. It lasted about ten seconds. By 7:20 A.M. I had walked around to the canal. Here a loud "chee-wuck, chee-wuck" attracted my attention to the Red-bellies, which had flown to a dead locust stub. The male was inching up the stub followed by his mate. He had his tail spread and, on reaching the top, he lit on her back in what appeared to be coition. (I cannot say whether there was actually cloacal contact.) This was over two months before I found any indication of actual egg-laying among 11 pairs of Red-bellies under observation during the spring.

Mutual tapping took place at the male's roost hole on February 10 and 13. Something, however, had gone wrong by February 16th. The male, for example, gave his "kwirr" at 6:50 A.M. but his mate answered only "cha" and then only at 7 A.M. From what I could discover, she had already moved to a new roost hole by the canal (Fig. 3). He tried to attract her by continued "kwirrs," and he even dropped from sight to tap alone four different times. She never came to the silver maple until after he had flown. By 7:20 I was watching him on the dead locust. In silhouette, I could see that his bill opened slightly and that his whole body puffed out each time he called "kwirr." The female now responded by flying to him. He spread his tail feathers and attempted coition.

The female called "quers" from her new direction on February 20 and 22, but did not fly to her mate's roost hole. A final dawn performance took place on the following day. After mutual tapping the pair inched to the top of stub in the silver maple and she fluttered on his back in reverse mounting.

Phase 2. First Excavation. On February 24 I discovered that the male was excavating a new hole. It was in the direction in which his mate had moved a week previously and was located fifty feet up near the top of a dead birch stub (Fig. 3). He paused to call "kwirr," moving ten feet away as he did so. The female suddenly flew to the new hole to tap at the entrance alone. I returned at dawn on the next morning. At 6:40 A.M. the male put his head out from the hole and gave a low "kwirr." She immediately replied with several "quers," then flew directly to him as he disappeared from sight. I could see her tapping when she alit below the entrance, but I heard no tapping from the male. Possibly the new hole was not large enough for him to maneuver. Similar events took place on March 2 and 3. On March 4, however, I heard mutual tapping full and clear when the female flew from her roost hole to the male's at 6:30 A.M. The male afterward flew

to his dead locust and drummed ten times in five minutes. Then, as on other days, his mate flew to join him. Moving up from behind, she fluttered on his back in reverse mounting.

The newly excavated hole was well established when I left for an absence of three weeks. Starlings had taken over by the time I returned and the Red-bellies were on a third cycle of behavior.

Phase 3. Second Excavation. After being driven from his excavation the male had returned to his winter roost hole in the silver maple. On March 24, he emerged at 6 A.M., "kwirred," then dropped back inside to tap alone. His mate did not come. Nor did she appear when I watched again two days later. On April 6 breeding behavior was on the upswing once more and I found the male calling "kwirr," while clinging to the bark by his roost hole, at about 6 A.M. His mate answered from down by the Potomac (Fig. 3). She "quered" four or five times and did most of the calling in the next ten minutes. The male meanwhile drummed half-heartedly and finally flew away. I now went to the other side of the creek to discover, if possible, where the female had called. I not only found a fresh excavation but also the male. He started to tap as his mate lit close by to join in the first mutual tapping which I had witnessed for some weeks (Fig. 1). The male then started excavating with head and shoulders in the new hole. Next morning there was little light when I arrived. At dawn I watched the male emerge from the same winter roost hole where I had first observed mutual tapping, sixty-five days before. His mate started the day by flying, not to him, but directly to the new hole. He came to work on the excavation only after twenty minutes of preening and drumming. He paused while excavating to call "kwirr." She was some distance away, but she answered "quer" immediately and flew to him. Both birds now joined in mutual tapping, just below the hole (Fig. 4). He tapped twice as long as she did. The female then took a turn at excavating.

By April 10 the male was roosting in the excavation. He called eagerly at dawn, came out to drum, then returned inside to look out expectantly. Four Starlings were clinging on the top of his stub. His mate appeared disturbed and would not come close. Three days later I saw the pair of Red-bellies tapping together for the last time. They had deserted their hole by the following day. The Starlings had displayed their usual strategy of waiting until an excavation was complete before beginning active interference.

The pair of Red-bellied Woodpeckers had gone through three cycles of behavior in association with three potential nest holes. In each cycle breeding behavior would reach a crescendo, as marked by the intensity

of their calls and mutual tapping. Starlings twice interfered at this stage. When the Red-bellies began to lose interest and their ceremonies diminished in intensity, it appeared as if the female wanted to move. She seemed to transfer her attention to a new site. The male would continue to stay by the old hole, calling to her in vain. The gamut of breeding behavior began to rise in intensity once he had begun excavating at the new site.

Skutch (1943), writing of the related (Wagler's) Red-crowned Woodpecker, *Centurus subelegans* (= *rubricapillus*), states that the male's winter roost is usually sounder than that of the female and that "it was natural that when the birds began to breed in February it should be chosen for the nest in preference to the female's. Now the female upon leaving her own dormitory in the morning would come to visit her mate's . . ." Skutch does not mention anything resembling mutual tapping.

It is too early to reach definite conclusions, but my present impression is that calling, drumming, and mutual tapping may be used in various situations. Drumming, for example, may serve an unmated male to attract a mate, a paired male to strengthen the pair bond, any male to advertise his nesting area, or an over-excited bird of either sex as a displacement activity. All of these situations may also bring forth calls and sometimes tapping.

SUMMARY

Observations made on the early breeding cycle and related behavior of Red-bellied Woodpeckers may be summarized as follows:

1. Onset of the breeding cycle in winter was signaled by males calling "kwirr."
2. A female might fly from her roost hole to that of her mate, in response to his calling at dawn.
3. In mutual tapping, a ceremony which may strengthen the pair bond and register agreement on the site of a nest hole, both members of a pair give slow, rhythmical taps. This performance was observed a) with the male inside his roost hole and the female outside, at dawn, and b) with both birds on bark outside of a hole about to be or being excavated.
4. Mutual tapping was not encountered during actual nesting.
5. Coition a) was apparently solicited by the female, b) was not infrequently preceded by reverse mounting and c) seemingly took place several months before the onset of actual nesting.
6. Unmated males drummed and called "kwirr" in a persistent fashion from incomplete excavations.

7. Paired males started excavations and their mates joined in the work only when the hole was well begun.

8. Females drum rarely in comparison with males.

9. Starlings were severe competitors of Red-bellied Woodpeckers and frequently forced them to abandon excavations at the time of their completion.

10. Red-bellied Woodpeckers were relatively quiet and solitary during the fall. A dramatic but transient outburst of "breeding" behavior took place in mid-December, 1957, following the first snow-storm of the winter.

LITERATURE CITED

- BEACH, F. A. 1948. *Hormones and Behavior*. (Paul B. Hoeber, Inc., New York) 368 pp.
- GLICK, B. 1954. Reverse mounting in the Starling (*Sturnus vulgaris*). *Auk*, **71**: 204.
- NOBLE, G. K. 1936. Courtship and sexual selection of the Flicker (*Colaptes auratus luteus*). *Auk*, **53**: 269-282.
- SKUTCH, A. F. 1943. The family life of Central American Woodpeckers. *Scientific Month.*, **56**: 358-364.
- TANNER, J. T. 1942. *The Ivory-billed Woodpecker*. Nat. Audubon Soc., New York.
- DE VILLIERS, J. 1957. Intercommunication of Woodpeckers. *Bokmakierie*, **9**: 45.

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