

## THE COWBIRDS OF PRESTON FRITH

BY RUSSELL T. NORRIS

THE Preston Laboratory Grounds, comprising about 90 acres, and lying three miles due west of the city of Butler, Pennsylvania, are surrounded by a high fence intended to keep out dogs, grazing animals, and the like, for which reason the area is referred to briefly as "the Frith" or "Preston Frith." \*

The bird population has been under observation, so far as wartime conditions permitted, for some years past, but information prior to 1943 is fragmentary and—so far as Cowbirds are concerned—negligible before 1944. Our principal interest in the bird population as a whole concerned the effects of encroaching civilization on a rural environment (Norris and Preston, MSS), and the effects of protecting the area by the fence. Although there was originally no intention to study in detail any particular species, it seemed desirable to take especial note of the Cowbird, since it stands in a category of its own by reason of its parasitic habits and may thereby affect other species in a particularly direct and determinable manner.

Nearly all the observations before sunrise I made jointly with Hal H. Harrison; most of the other field observations I made alone, though some nests with Cowbird eggs were found by Harrison, Dr. F. W. Preston, and Miss Janet Mathison. The investigation was supervised and financed by Dr. Preston of the Preston Laboratories. His suggestions and criticisms, both in the field work and in preparing the manuscript, were most helpful. Most of the observations were made in the Frith itself, only a few outside it.

About half (43 acres) of the Frith is wooded, a large part of the forest area being second-growth oak-hickory. There are smaller areas of recent cuttings, bottomland hardwoods, and aspen. There are 27 acres of old fields rapidly going back to bush, and 12 acres of grassland, all planted to rye grass. The remaining acreage is made up of fencerows, roads, parking areas, lawns, and water areas. A stream divides the Frith into two unequal portions, and a spring run has been dammed to create a small pond of about one half acre. There is a great deal of edge created by the many roads and pathways through the Frith (Figure 1).

Most of the area is part of a farm which has been very little cultivated since 1900. Since 1939 the Frith has been surrounded by a nine-foot fence which excludes dogs, domestic stock, and deer, but

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\* *Frith*—"Peace, freedom from molestation, protection. . . . A game preserve, deer park. . . . A wood of some kind, or wooded country collectively. . . . A piece of land grown sparsely with trees or with underwood only. . . . A space between woods; unused pasture land."—Oxford English Dictionary.

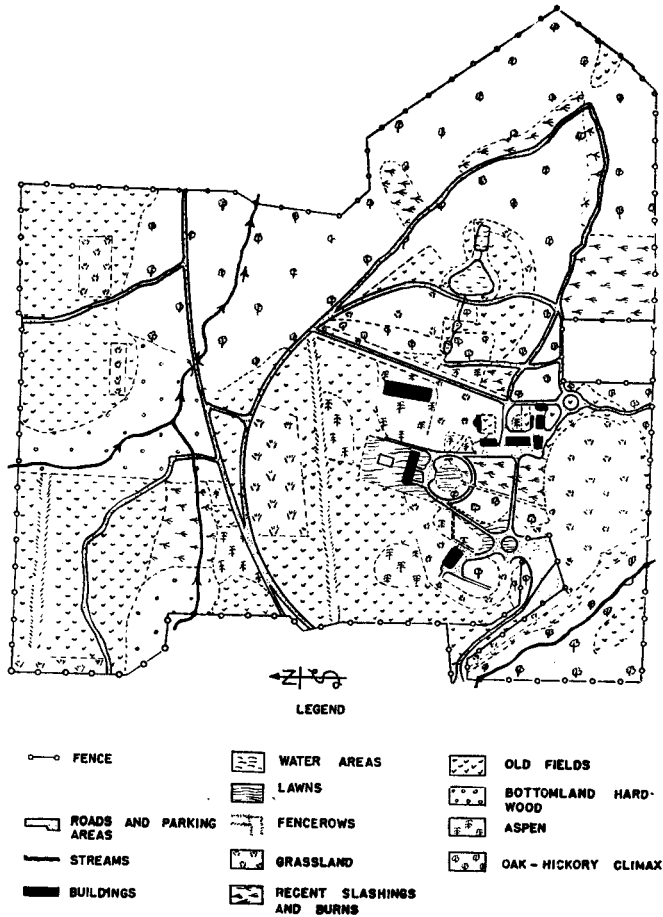


Figure 1. Cover-type map of Preston Frith. Type-boundaries are indicated with dotted lines.

does not exclude feral house cats or wild predators such as raccoons and skunks; house cats were eliminated when possible, but no effort was made to control the natural predators of bird life.

#### COWBIRD POPULATION

The breeding bird population of the Frith, which will be discussed more fully in another paper, was very high—probably greater than that of any similar area reported in the literature, and certainly denser than that of the surrounding countryside. The population of Cowbirds (*Molothrus ater*) also seemed definitely higher than in most of western Pennsylvania.

The Cowbirds usually arrived at the Frith during the last week of March, the males preceding the females by a few days. The month of March 1945 was unseasonably warm, and most of the migrants arrived early; male Cowbirds arrived March 15, females March 24. The following week, Cowbirds were conspicuous everywhere. The males were chasing and courting the females continually.

During the breeding season in the Frith the male Cowbirds probably outnumbered the females but not by a large margin. On June 14, 1944, at 7:00 p.m., I noticed a flock of Cowbirds feeding in a newly harrowed and sown buckwheat field about a mile from the Frith, and I counted them with the aid of field glasses. There were slightly more than 100 adult birds in the flock, of which only 4 were females. This is the only time I have seen a flock in the breeding season composed largely of one sex. At the Frith, a mile away, egg-laying was still going on, and the birds were in small groups. Since Cowbirds have not readily entered my banding traps, no exact indication of their numbers in the Frith is available. In 1944 three females were banded, two on April 28, one on May 3. (Their weights were 36.6, 39.6, and 40.6 grams respectively.) In 1945 one male (April 24) and two females (April 28) were trapped, one of which was a return. (Their weights were 45.8, 39.0, and 38.4 grams respectively.) None of these banded individuals was ever observed in the field. From the egg-laying dates and continual observation it appears that there were about 6 female Cowbirds active in the Frith in 1944 and about 10 in 1945. These estimates are conservative, and more definite data might raise them slightly.

During March, April, and the early part of May, Cowbirds were never seen in the wooded areas of the Frith. They confined their activities to the fields and open country, where they became a serious factor in the economy of the Song Sparrow (*Melospiza melodia*), Red-eyed Towhee (*Pipilo erythrophthalmus*), Cardinal (*Richmondia cardinalis*) and (to a lesser extent) of the Field Sparrow (*Spizella pusilla*). About May 15, when the Oven-bird (*Seiurus aurocapillus*), Red-eyed Vireo (*Vireo olivaceus*), Veery (*Hylocichla fuscescens*), Scarlet Tanager (*Piranga olivacea*), and Wood Thrush (*Hylocichla mustelina*) began to build their nests, the Cowbirds seemed to move into the wooded areas. They continued to parasitize some nests in the fields, but most of the late eggs, from May 15 to the end of the laying season, were deposited in nests of woodland birds. In addition to the birds just mentioned, the following were also parasitized in the Frith: Brown Thrasher (*Toxostoma rufum*), Catbird (*Dumetella carolinensis*), Yellow-throat (*Geothlypis trichas*), Chestnut-sided Warbler (*Dendroica pensylvanica*), Indigo Bunting (*Passerina cyanea*), and Chipping Sparrow (*Spizella passerina*).

Cowbirds were seen frequently from the time of their vernal appearance until June 15. During the latter half of June their number

gradually dwindled, but they were observed in the Frith for another month; in fact, egg-laying continued, though at a reduced rate, until almost mid-July. After July 10, Cowbirds were not seen in the Frith until the last half of September or early October; nor did they become common even then. On October 6, 1944, a lone female was observed in the Frith, and on September 24, 1945, I noticed a small flock of Cowbirds near the Frith. There were about a dozen birds, roughly two-thirds males. The males seemed to be chasing the females much as they do shortly after they arrive in spring. They would fly from one tree-top to another, the males giving the flight whistle and the females rattling as they do while courting. I have not observed this in the fall on any other occasion.

TABLE 1  
COWBIRD EGG-LAYING AND HATCHING DATES, PRESTON FRITH

Laying		Hatching		Laying		Hatching	
1944	1945	1944	1945	1944	1945	1944	1945
April 10	1			May 26	3		
11	1			27	2		
16	1			28	1		
17	1			29	1		
18	1			30	2		
19	1			31	2		
20	1			June 1	3	1	1
21	3			2	4		1
22	1			3	2		1
24			1	4	1		4
27	1	1		6		1	
May 1	2		1	7		1	1
2	1		1	8	2		3
4	1		1	9	2	1	2
5	1			10	3		1
7	2	1		11	2		
8	1			12	1		
9	2	1		14	1		
10		1		17		1	1
11	1			18	1		
12		1		21			1
13	1	1	1	23			1
14		2		24	1		
15			3	25	1		
17	1			26	2		1
18	1	1		27			1
19	1	2		28	1		
20	1	2	1	29	1		
21		1		30	2		
22	2	2	2	July 1	1		
23	1	2		11	1	1	1
24		3	2	12	1		
25	1	2	2				

Totals: Eggs laid in 1944, 21\*; in 1945, 81. Eggs hatched in 1944, 12; in 1945, 30.

\* Six 1944 egg-laying dates unknown.

EGG-LAYING HABITS OF THE COWBIRD

The laying season of the Cowbird in the Frith extended from the middle of April to the middle of July, about three months. Table 1 lists the egg-laying dates, and Figure 2 shows graphically their distribution. The crest of the laying season comes late in May.

The exceptionally long laying season suggests that Cowbird eggs are laid in clutches. Friedmann (1929:182) had some evidence that clutches consist of four or five eggs laid on successive days, but Rand's observation (Friedmann, 1929:184) of the captive female that laid 13 eggs in 14 successive days does not agree with this. Nice (1937:155, 163) believed that the Cowbirds in her study area in Columbus, Ohio, laid three or four "sets" of eggs with intervals of 6 to perhaps 12 days between them. She also made a guess that Cowbirds and Song Sparrows laid about the same number of eggs each. In a recent letter she expressed a belief that Cowbirds probably lay 16 eggs in a season.

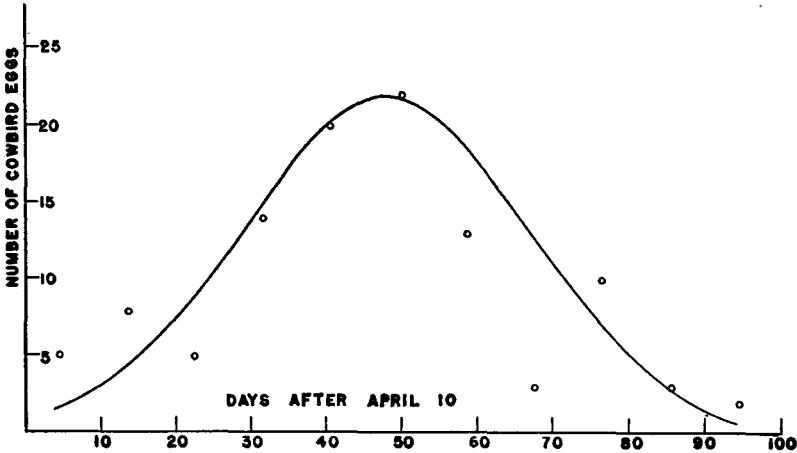


Figure 2. The Cowbird's laying season, Preston Frith, 1944-1945.

Hann (1937:207) believed from his studies of Cowbird parasitism at Oven-bird nests in Michigan that each female laid about 8 eggs, but he reported Hicks' opinion that the female Cowbird lays as many as 16 eggs in a season. Very rough estimates based on our observations in the Frith during 1944 and 1945 led me to believe that the Cowbird lays at least 14 eggs in a season.

Hann (1937:201) stated that the female Cowbird finds Oven-birds' nests by watching the females build. On several occasions I have seen female Cowbirds perched motionless and watching nest-building intently, but I did not later find Cowbird eggs in the nests which I thought were being observed. (It is possible that the bird in each instance was watching another nest near by.) Apparently Cowbirds

spend considerable time inspecting and visiting nests for reasons difficult or impossible to determine. While watching a Robin (*Turdus migratorius*) building on April 13, 1945, I saw a female Cowbird alight in the nest tree, hop down to within six inches of the nest and peer into it. Then the female Robin returned, and the Cowbird flew away. The Robin did not seem perturbed at the presence of the parasite. This occurred at 6:00 a.m.; about a half hour later, three female Cowbirds alighted in the nest tree while the female Robin was moulding the nest. The Robin paid no attention to them. At 8:10 a.m., a female Cowbird again alighted in the nest tree. The female Robin was away from the nest gathering material. The Cowbird deliberately walked to the nest, hopped in, and settled down. She turned her head in every direction, and then the female Robin arrived. The Cowbird left hurriedly, but the Robin did not chase her or seem disturbed at her presence. The nest was well formed at this time, but the inside was not lined and the mud was very wet.

This same nest was the scene of another Cowbird observation on May 2. On May 1, I had noticed that three of the four Robin eggs, which had been incubated about a week, had tiny holes in the shell resembling pin pricks. They would not have been noticed except for a whitish area around them. The holes occurred in irregular numbers and positions on the eggs and hence did not look like claw marks. Under a hand lens, the holes appeared to be crescent-shaped; they could have been caused by taps of a bird's mandibles. Within a few days of this date, holes of this type appeared in the eggs of three near-by Robin's nests. Early on May 2 the three eggs that had been punctured in the first-mentioned nest were gone, but the Robin continued to incubate the remaining egg. At 9:00 a.m., while the Robin was off the nest feeding, a pair of Cowbirds flew into the nest tree. The male perched about 20 feet from the nest while the female walked directly down a limb to the nest and looked inside. At that moment both birds were accidentally frightened off by a workman. On May 3 the last egg was gone from the nest. House Wrens (*Troglodytes aëdon*) had not yet arrived in the Frith, so the tiny holes cannot be blamed on this species. When Blue Jays (*Cyanocitta cristata*) destroy Robin's nests, they leave large holes in the eggs or carry them away completely. Two female Cowbirds that were held captive in the Frith were each given on the second day a Robin's nest containing two eggs. On the third day all four eggs had been punctured, but the holes were large (the eggs were left in the nests and the contents not eaten). The interest that Cowbirds showed in the Robin's nest mentioned above suggests that they may have been responsible for the tiny holes in the Robins' eggs in that vicinity, but there seems no good reason for this type of destruction. The eggs were not eaten, and the nests were not parasitized (so far as we know) after the damage was done.

On June 14, 1945, I watched the nest of a Cerulean Warbler (*Dendroica cerulea*) for more than 10 minutes, and the female, who had been incubating for about 10 days and rarely left the nest for more than a few minutes, did not return. The male was singing near the nest, which was 45 feet above the ground near the end of a limb. At 9:55 a.m., a female Cowbird flew swiftly down the valley and went directly to the nest tree. She immediately walked up the limb to the nest as if she had been there before. She hopped onto the rim of the nest, stepped in, and settled down. In a few seconds she flew away sputtering. Neither male nor female Warbler seemed perturbed at this, and I decided to investigate. Upon climbing the tree, I found that only one egg of the Warblers remained, and this had been punctured, apparently by a bird's mandibles.

During 1944 and 1945 in the Frith, 45 parasitized nests contained but a single Cowbird egg each, 21 contained two Cowbird eggs, and 7 contained three (Table 2). Hann (1941:220) believed that the Cowbird laid but one egg in a nest unless nests were scarce. However, certainly nests were not scarce in the Frith, and 38 per cent of the parasitized nests contained more than one Cowbird egg (for an extreme example, see Figure 3). When nests were found that contained two or three Cowbird eggs, an effort was made to determine whether they were the product of one or several females. If we may judge from egg type, two nests that each contained three Cowbird eggs were each parasitized by three females; one nest that contained three Cowbird eggs was parasitized by two; three nests that each contained two Cowbird eggs were each parasitized by two females.

The measurements of 17 Cowbird eggs in the Frith ranged from 24.5 x 17.3 mm. and 23.2 x 18.3 mm. to 21.1 x 16.0 mm., averaging 22.5 x 17.1 mm. Weights of the 17 eggs ranged from 3.50 to 2.00 grams, averaging 2.95 grams.

#### THE COWBIRD AT THE NEST

In attempting to photograph the Cowbird at the nest, we found it necessary to acquaint ourselves with the routine of Cowbird egg-laying. Hann (1941:220) found that Cowbirds usually lay their eggs at dawn; that they usually lay during the egg-laying period of the host; and that parasitized nests regularly have one or more eggs removed by the Cowbird; but we found that the behavior of the female Cowbird was different at the nests of different species.

Our five observations of the Cowbird at the nest for the purpose of laying were all at dawn, or at any rate before sunrise. They are given in Table 3 with the times of sunrise, weather conditions, and the dates. The times given in each case are in Eastern Standard Time, and they refer to the exact moment the Cowbird was first seen about the nest.

From the figures in Table 3, the differences in time of arrival at the nests in open fields and at those in the woodland appear to be

TABLE 2  
THE COWBIRD IN RELATION TO ITS HOSTS, PRESTON FRITH, 1944-45

Species	Total nests	Parasitized nests	Nests with			Cowbird eggs laid	Cowbird eggs hatched	Cowbird young fledged
			1	2	3			
Catbird	47	1(2.1%)	1	—	—	1	0	—
Brown Thrasher	14	1(7.1%)	—	1	—	2	0	—
Wood Thrush	11	2(18.2%)	2	—	—	2	1(50.0%)	1(50.0%)
Veery	11	7(63.6%)	6	1	—	8	8(100.0%)	4(50.0%)
Red-eyed Vireo	14	12(85.8%)	7	4	1	18	2(11.1%)	0
Chestnut-sided Warbler	2	1(50.0%)	—	—	1	3	0	—
Oven-bird	7	6(85.7%)	2	2	2	12	7(58.3%)	3(25.0%)
Yellow-throat	2	2(100.0%)	1	—	1	4	0	—
Scarlet Tanager	4	4(100.0%)	3	1	—	5	2(40.0%)	2(40.0%)
Cardinal	8	3(37.5%)	2	1	—	4	2(50.0%)	2(50.0%)
Red-eyed Towhee	24	13(54.2%)	6	5	2	22	15(68.2%)	12(54.5%)
Chipping Sparrow	9	1(11.1%)	1	—	—	1	0	—
Field Sparrow	57	9(15.8%)	5	4	—	13	2(15.4%)	1(7.7%)
Song Sparrow	27	11(40.7%)	9	2	—	13	7(53.8%)	4(30.8%)
Totals	237	73(30.8%)*	45	21	7	108	46(42.6%)	29(26.8%)

\* Excluding the Brown Thrasher, Catbird, and Chipping Sparrow, this figure is 41.9%.



significant. On the two clear mornings in the fields the Cowbird came to the nest much earlier than on the three mornings in the woods, so that the time of laying seems to be correlated with light intensity. The observation on June 1 lends strength to this theory. It was a cloudy morning and very dark in the deep woods; we had nearly given up our vigil when the Cowbird appeared. It began to rain a few minutes later. The observations on June 9 and 11 were made in the woods but near a clearing.

The laying of the Cowbird at dawn seems strange in view of the fact that this species is one of the last birds to be heard in the morning. Nice (letter) has expressed her belief that the Cowbird is a late riser. At the Song Sparrow nest in 1944 (Norris, 1944), we heard a female Cowbird call just before she alighted on the camera at the nest, but at other nests no Cowbird note was heard until after the egg-laying. In April 1945, the average time of Cowbird notes was about six minutes before sunrise. It seems probable that Cowbirds are quiet until the eggs are laid,—when they become noisy, as they do each morning, the eggs are already deposited.

TABLE 3  
TIMES OF COWBIRD LAYING IN RELATION TO SUNRISE

Date	Cowbird's arrival (a.m.)	Sunrise	Minutes before sunrise	Weather	Host	Location of nest
1944						
May 29	4:30	4:52	22	Clear	Song Sparrow	Field
1945						
May 30	4:30	4:53	23	Clear	Indigo Bunting	Field
June 1	4:50	4:53	3	Heavily overcast	Oven-bird	Woods
June 9	4:42	4:51	9	Clear	Red-eyed Vireo	Woods
June 11	4:36	4:50	14	Overcast	Red-eyed Vireo	Woods

In Hann's (1937:204) study, the loss of 34 Oven-bird eggs (85 per cent of the number of Cowbird eggs laid) was attributed to the female Cowbird; 10 eggs disappeared on the day before the Cowbird's egg was laid, 10 on the same day, and 3 on the following day. Nice (1937:158) found that eggs of the host disappeared 37.2 per cent of the times Cowbird eggs were laid in Song Sparrow nests.

My data on egg removal are quite fragmentary, but in 11 instances I am quite sure the loss of eggs from nests was caused by Cowbirds. Once a single egg was removed (from a Field Sparrow's nest), seven times an egg was removed when two were in the nest, once when the nest contained three eggs, once when the nest contained three eggs of

the host and one of the Cowbird; once two eggs were removed from a nest containing three eggs that had been incubated for five days. Burroughs (1887:24) and Hann (1941:212) noted that the removal of eggs was confined to nests with two or more eggs.

I have notes on the exact conditions under which 32 eggs were laid. In only seven instances did the Cowbird lay the day after she had removed an egg from a nest of two eggs—which was the pattern we had been depending on. It soon became evident that the Cowbird usually laid in Red-eyed Vireo's nests *before* the Vireo began to lay. This may be due to the coordination of the Cowbird's egg-laying with nest building: Hann (1941: 220) believed that the sight of a bird building its nest served as a stimulus to the Cowbird and that an egg would be laid four or five days later. The Red-eyed Vireo takes several days to complete its nest and then sometimes waits several more before laying its first egg. When a female Cowbird is stimulated by the sight of the Vireo's building, her egg is ready to be laid before the Vireo has started to lay. In 6 of the 10 Vireo nests in 1945 the Cowbird laid prematurely; in 2 she laid after removing an egg the day before, and in one nest she laid when one Vireo egg was there and none had been removed. In the remaining nest, the Cowbird laid five days after incubation started. In one of the 6 nests where the Cowbird laid prematurely, the egg appeared eight days after the nest was started. The Vireo then deserted. This lack of synchronization seems to occur occasionally in nests of other species; I have found several nests containing one Cowbird egg and none of the host species.

After our success in photographing the female Cowbird laying her egg in the nest of a Song Sparrow (Norris, 1944), Harrison and I hoped to photograph the Cowbird on many nests and anxiously awaited the laying season in 1945. Early in the season our efforts were without result. To give one example: An Indigo Bunting (*Passerina cyanea*) nest had been under observation, and when the nest was completed on May 27 we decided to check it several times daily for signs of Cowbird activity. One Bunting egg was laid on May 28 and a second on May 29, before 8:00 a.m. By 11:00 a.m. on that day, only one egg remained. The nest was intact, and no sign of predation could be seen. We decided to attempt a photograph the next morning. We arrived at the nest at 3:45 a.m. and prepared the equipment. Our truck was used as a blind about 25 feet from the nest, and we were ready to go inside at 4:00 a.m. We watched the nest intently but saw nothing until 4:30 a.m., just 23 minutes before sunrise. We then heard a whir of wings and saw a female Cowbird speeding away from the nest. We then found a warm Cowbird egg beside the single egg of the Bunting. The nest was surrounded by tall grass, with only the front in clear view. The Cowbird had apparently entered the nest from the dense cover behind and deposited her egg without making a sound.

On May 26, I had found an Oven-bird's nest nearly complete in the Frith. I watched it closely because we knew that this was a favored host of the Cowbird. Hann (1941) had already twice photographed a Cowbird at an Oven-bird nest in black and white, but we wanted to try it in color. On May 29, the first Oven-bird egg was laid, and the second was there on May 30. I was unable to check the nest until late in the day on May 31, and to my surprise I found it still contained only two eggs. Since the Oven-bird usually lays an egg a day until her clutch is complete, we assumed that the Oven-bird had laid her third egg and that the Cowbird had removed one sometime before I checked the nest. This was only a guess, but we decided to attempt the picture.

We were in the blind ready for the Cowbird at 4:05 a.m. on June 1. It was a heavily overcast morning, and occasionally a drop of rain would hit the blind. At 4:50 a.m., just three minutes before sunrise, we heard a rustle in the leaves beside the blind. Finally, at 4:58 a.m., a female Cowbird appeared at the edge of the nest and entered. Harrison pressed the button on the batteries, and the color picture was taken (shown in black and white, Figure 4). The Cowbird immediately flew from the nest and did not lay her egg. We waited until 5:15 a.m., when the Oven-bird arrived to lay, but the Cowbird did not return.

We watched two Red-eyed Vireo nests, waiting for the Vireo to begin to lay, but in both nests the Cowbird laid first. Then on June 5 Harrison found a Red-eyed Vireo building about eight feet up in a maple tree. The nest progressed rapidly, and on June 6 it was complete except for the lining. We decided to set up our equipment at this nest every morning; since this Vireo is one of the favored hosts, we felt that sooner or later a Cowbird would attempt to lay her egg in the nest.

The previous photographs had been taken at ground nests, and Harrison had merely placed his camera on a tripod in front of the nest. This nest was eight feet from the ground on the end of a maple limb. Harrison carried with him a series of ladders of several heights, and these were fitted for an extension on the top step with a tripod screw on the end which can be locked at any desired height. On the evening of June 6 we went to the nest just before dusk to arrange the equipment. The camera was temporarily placed on top of the ladder to focus for distance, and then it occurred to us that if a Cowbird should walk out on this frail limb, the nest would dip completely out of sight. By placing a 40-gram weight in the nest and watching it dip about a foot, we realized that it would be necessary to secure the branch both vertically and horizontally. I cut a forked stick about eight feet long, pushed it into the ground and placed the fork against the branch that supported the nest. Then with fine copper wire I lashed the two together, making it impossible for the Cowbird to move

the nest vertically. This forked stick was held in position and horizontal movement prevented by taut wires strung from it to trunks of near-by trees. After placing our blind a few feet away, we were ready for the Cowbird. We left the nest wondering if all our paraphernalia would frighten the Cowbird away if she should come to deposit an egg.

The next morning (June 7) we were at the nest long before day-break, but saw nothing of the Cowbird or the Vireo. The nest was lined during the day, however, and the fact that our apparatus, which we did not remove, did not keep the Vireo from completing her nest encouraged us greatly. We were at the nest on June 8, but the Cowbird did not appear. On the morning of June 9 we again set up the camera, and at 4:15 a.m. were in the blind watching the nest intently. It was dark enough to make vision quite difficult, especially from our tiny peepholes in the blind. At 4:42 a.m., 9 minutes before sunrise, a female Cowbird alighted on the top step of the ladder about two feet from the nest. For a few seconds she seemed poised to fly away, but at 4:43 a.m. she flew to the limb supporting the nest and alighted about 5 inches from the nest rim. One minute later she hopped to the rim, looked in, then settled on the nest. She looked away from the camera, then turned in profile. Harrison pressed the button, and our long-awaited picture was taken in natural color. The Cowbird remained motionless after the flash went off but did not lay her egg. At 4:45 a. m. Harrison left the blind, and she flew from the nest. From the photograph it is easy to see that the Cowbird made no attempt to get into the tiny nest; she merely stretched out along the limb and across the top of the nest.

The Vireo laid her first egg before 9:30 a.m. June 9, and her second was in the nest by 9:30 a.m. June 10. When I checked the nest at 1:00 p.m. that day, only one egg remained. On June 11 we were in the blind at 4:15 a.m., and the sky was heavily overcast. At 4:36 a.m., 14 minutes before sunrise, a female Cowbird flew rapidly down the valley toward the blind. She headed directly for the nest tree, but when a short distance away, she apparently noticed the camera and other equipment. She veered from her course and alighted in the nest tree about three feet from the nest. In a series of hops she began to approach the nest, and 57 seconds later, as she hesitated on the limb near the nest, Harrison pressed the button (Figure 5). She immediately flew away, and Harrison went out to change the film from color to black-and-white. In a short while he was back in the blind. At 4:41 a.m. the Cowbird appeared in the nest tree again, this time six feet above and five feet at the side of the nest. She very cautiously approached the nest, one hop at a time. Two minutes and 28 seconds later she finally settled herself on the nest. Harrison again pressed the button (Figure 6), and she flew from the nest after the flash went off. She did not lay her egg and did not return.



Figure 3. Chestnut-sided Warbler nest with three eggs of the host and three of the Cowbird, June 21, 1945. Photo by Hal H. Harrison.



Figure 4. Cowbird on Oven-bird's nest, 4:58 a.m., June 1, 1945. Photo by Hal H. Harrison.



Figure 5. Cowbird approaching Red-eyed Vireo's nest, 4:37 a.m., June 11, 1945. Photo by Hal H. Harrison.



Figure 6. Cowbird on Red-eyed Vireo's nest, 4:43 a.m., June 11, 1945. Photo by Hal H. Harrison.

THE YOUNG COWBIRD

The hatching dates of young Cowbirds for 1944 and 1945 in the Frith are given in Table 1. Friedmann (1929:187) gave the incubation period as 10 days, and it has long been a common belief that the young Cowbird always hatched two or three days before the host young. Nice (1937:153) found that with the Song Sparrow as host the Cowbird egg never hatched two or three days early, and sometimes hatched after the host young; normally it hatched in 11 or 12 days. Hann (1937:204) found the incubation period of the Cowbird averaged 11.6 days. I have recorded the incubation period accurately for only 10 eggs, but none of these hatched in 10 days. Five hatched in 11 days, one in 11.5 days, one in 12 days, two in 12.5 days, and one in 13 days. This gives an average of 11.6 days, exactly Hann's figure. I have recorded the hatching of 19 Cowbird eggs in relation to the hatching of the host's eggs. One Cowbird hatched four days before the host; 4 hatched one day before; 10 hatched the same day as the host; 3 hatched one day later than the host; and one hatched five days later than the host. The Cowbird egg that hatched four days early

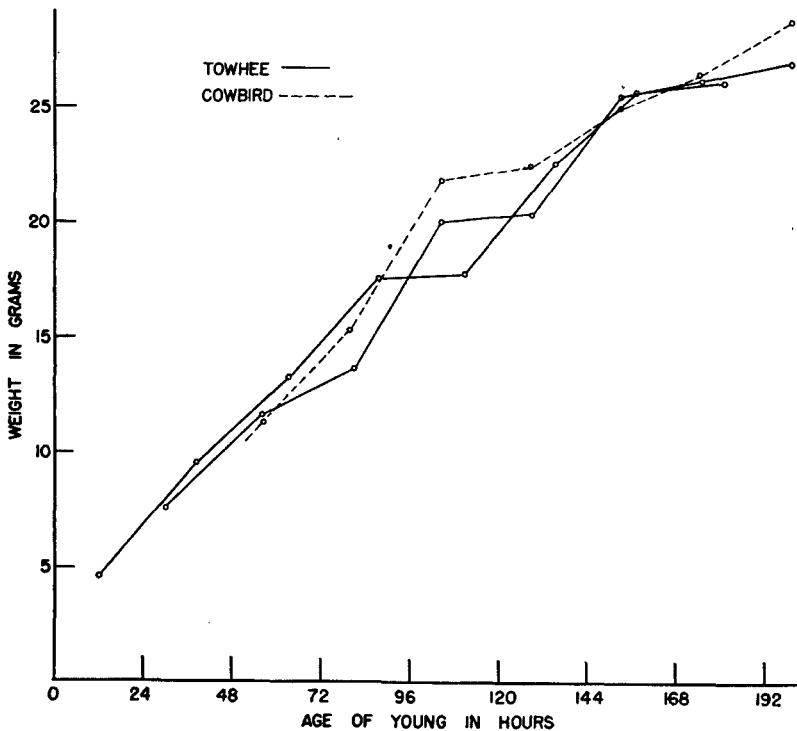


Figure 7. Daily growth rate of young Cowbird and two young of Towhee host.

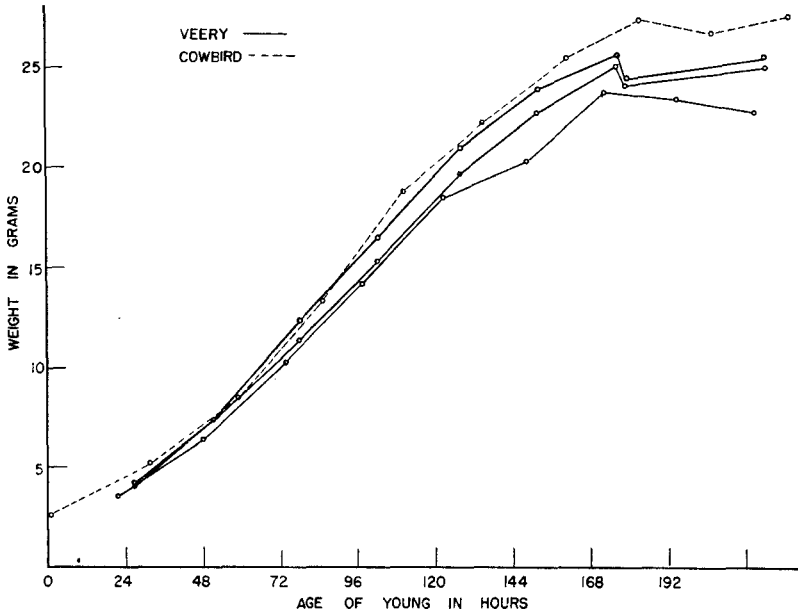


Figure 8. Daily growth rate of young Cowbird and three young of Veery host.

was in an Alder Flycatcher's (*Empidonax traillii*) nest. The egg that hatched five days after the host's egg hatched was in the nest of a Red-eyed Vireo. (Four days after incubation started on the three Vireo eggs, two of them disappeared; the next day the Cowbird egg was in the nest.)

The weights of three young Cowbirds at hatching were 2.33, 1.77, 2.70 grams respectively. Another weighed 2.60 grams when it was 6 hours old. The daily rate of growth of the young Cowbird and the host young is shown graphically for the nests of the Oven-bird, Veery, Wood Thrush, Cardinal, and Towhee in Figures 7 to 11. A daily photographic record was kept of the Cowbird and host young at several nests. The records for the Wood Thrush and Oven-bird accompany this paper (Figures 12 and 13; Tables 4 and 5).

Young Cowbirds in the Frith usually left the nests of their hosts at 8 to 10 days of age. Eleven records of the exact age of nest-leaving averaged 8.7 days.

#### THE SUCCESS OF THE COWBIRD IN THE FRITH

Most host species would accept a single Cowbird egg when it was not laid prematurely with reference to the host's clutch. But nests in which a Cowbird egg was laid before the host's clutch was begun and nests in which more than one Cowbird egg was laid were usually deserted.



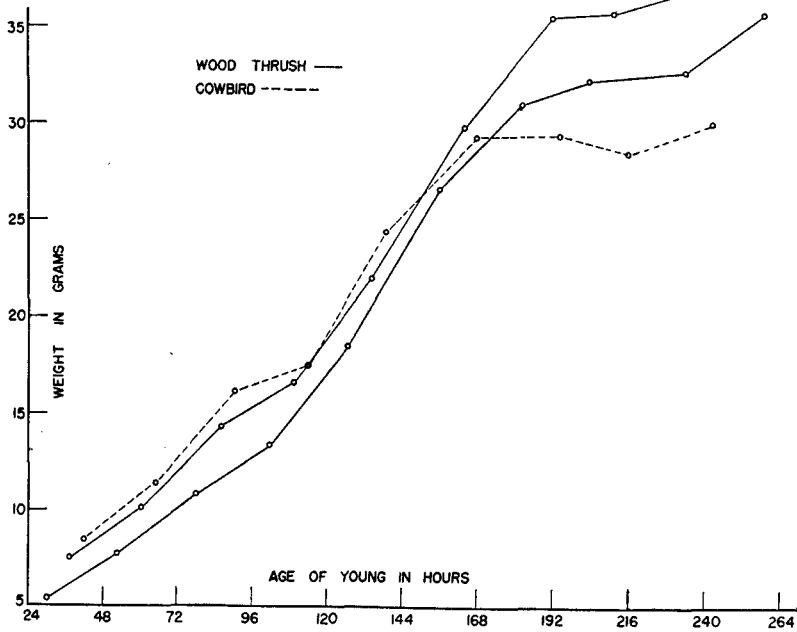


Figure 9. Daily growth rate of young Cowbird and two young of Wood Thrush host.

Of the 45 nests in which one Cowbird egg was laid, 8 were deserted apparently because the Cowbird laid prematurely; 1 was deserted even though the Cowbird's laying synchronized with the host's; 17 were destroyed; 19 produced fledglings. Of the 21 nests in which two Cowbird eggs were found, 9 were deserted; 6 were destroyed; 6 produced fledglings. Of the 8 nests in which three Cowbird eggs were deposited, 4 were deserted and 4 were destroyed; one (not included in the table) was a Chestnut-sided Warbler's (*Dendroica pensylvanica*), containing three eggs of the host as well as the three Cowbird eggs (Figure 3). Because we were anxious to obtain a series of weights of the young Warblers and a Cowbird, we removed two of the Cowbird eggs. But, as we later discovered, incubation had started a week before, and the embryos in the three Warbler eggs were dead. The one young Cowbird hatched, however, and left the nest weighing 29 grams (as compared with the weight of the adult male Warbler—9 grams). (This is the only instance in which we deliberately interfered with the natural outcome of a nest.) One Red-eyed Vireo's nest contained three Cowbird eggs and none of its own. The Cowbird eggs completely filled the nest, but the Vireo incubated them until the nest was destroyed (by unknown agency). In 1945, we found two Oven-bird nests in which three Cowbird eggs had been deposited. In one, there were three host eggs as well; it also was destroyed by unknown agency. The

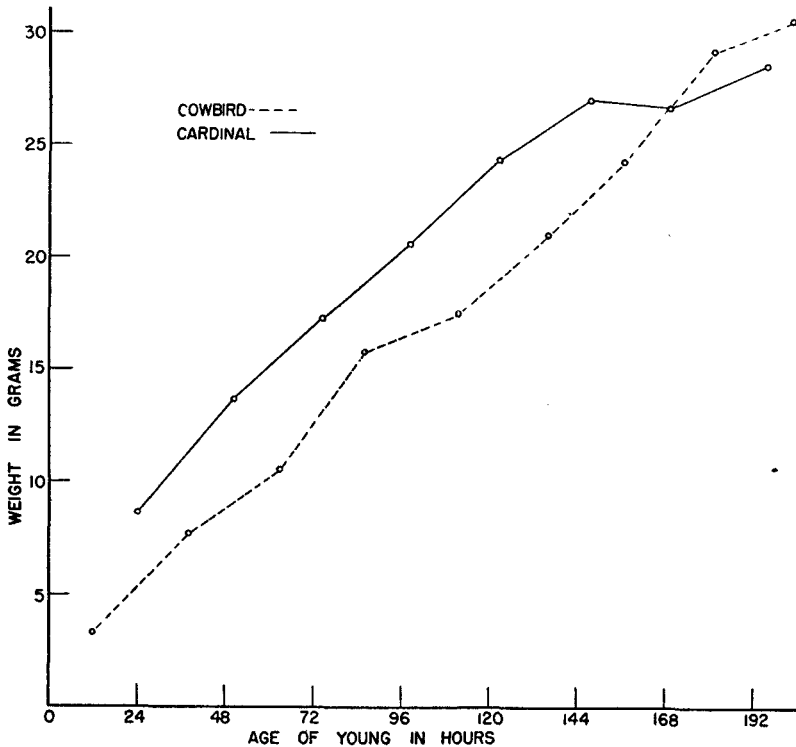


Figure 10. Daily growth rate of young Cowbird and one young of Cardinal host.

other contained three Cowbird young, two Oven-bird young, and two Oven-bird eggs (Figure 14). The birds were between one and two days old. One Oven-bird was able to maintain normal growth, but the other lost weight steadily and died two days later.

In the Alder Flycatcher nest mentioned above, in which the Cowbird hatched four days before the host young, one host young died when one day old. The remaining host young then weighed 1.59 grams, as compared with the 14.6 grams of the five-day-old Cowbird. Figure 15 shows the young Cowbird with the young Red-eyed Vireo in the nest mentioned above in which the Cowbird hatched five days after the host young. When the young Cowbird was 6 hours old, it weighed 2.60 grams, as compared with the Vireo's weight of 11.8 grams. The Vireo was 130 hours old at this time. (This nest was later destroyed.)

During 1944 and 1945, in the 237 observed nests, the hosts laid 668 eggs, of which 383 (57.3 per cent) hatched. Only 46 (42.6 per cent) of the 108 Cowbird eggs hatched. Nice (1937:163) had a much higher hatching percentage for Cowbirds (63.7 per cent, as compared with 60.7 per cent hatching in her Song Sparrow population). In the Frith, 29 (26.8 per cent) of the Cowbird eggs produced fledglings, as compared with 252 (37.7 per cent) of the eggs of the host population.

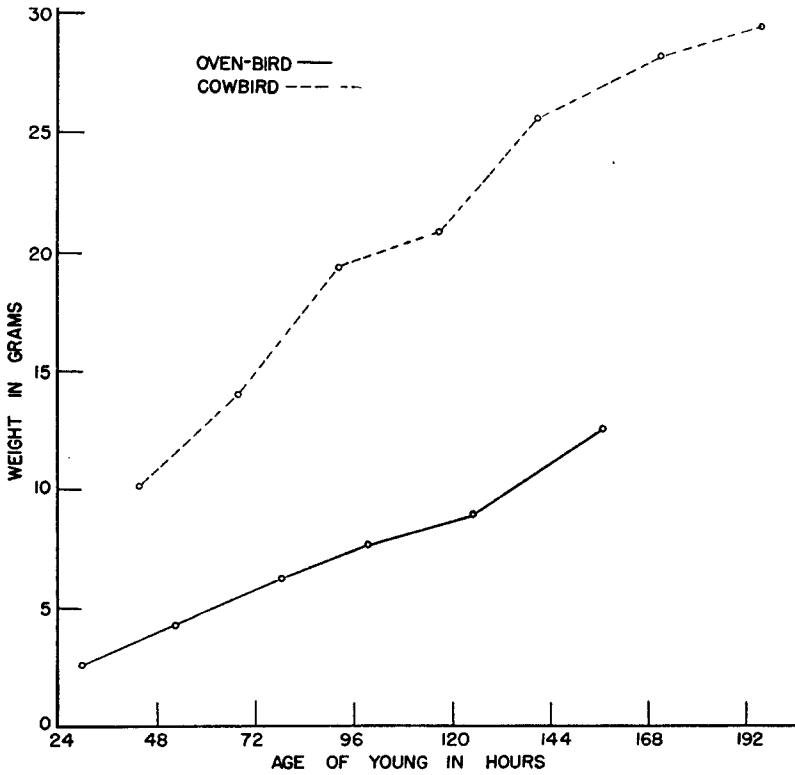


Figure 11. Daily growth rate of young Cowbird and one young of Oven-bird host.

TABLE 4

DAILY GROWTH OF YOUNG OVEN-BIRD AND COWBIRD

Date (1945)	Age and weight	
	Oven-bird	Cowbird
June 3	30 hrs (2.67 grams)	44 hrs (10.01 grams)
June 4	53 hrs (4.10 grams)	67 hrs (13.99 grams)
June 5	78 hrs (6.07 grams)	92 hrs (19.37 grams)
June 6	101 hrs (7.70 grams)	115 hrs (21.98 grams)
June 7	125 hrs (8.98 grams)	139 hrs (25.77 grams)
June 8	156 hrs (12.83 grams)	170 hrs (28.14 grams)
June 9	[Gone]	195 hrs (29.31 grams)

TABLE 5  
DAILY GROWTH OF YOUNG WOOD THRUSH AND COWBIRD

Date (1945)	Age and weight	
	Wood Thrush	Cowbird
June 3	38 hrs (7.30 grams)	42 hrs (8.44 grams)
June 4	60 hrs (10.00 grams)	64 hrs (11.39 grams)
June 5	86 hrs (14.09 grams)	90 hrs (16.08 grams)
June 6	109 hrs (16.53 grams)	113 hrs (17.39 grams)
June 7	134 hrs (22.00 grams)	138 hrs (24.27 grams)
June 8	163 hrs (29.91 grams)	167 hrs (29.12 grams)
June 9	190 hrs (35.59 grams)	194 hrs (29.38 grams)
June 10	210 hrs (35.73 grams)	214 hrs (28.54 grams)
June 11	240 hrs (37.40 grams)	244 hrs (30.00 grams)
June 12	265 hrs (37.79 grams)	[Gone]

Since many Cowbird eggs are never incubated at all or are laid too long after the host's incubation period has begun, the low percentage of eggs that hatch and produce fledglings, as compared with the figures for the hosts, is not surprising. But when Cowbirds were once successfully hatched, the rates of success were more comparable. Of the Cowbird eggs hatched in the Frith, 63 per cent produced fledglings; of the hosts' eggs hatched, 64 per cent produced fledglings.

I have complete records on 21 nests that fledged at least one Cowbird young. No more than two Cowbirds were fledged in a single nest, and this occurred only five times. Twice in Towhee nests, two young Cowbirds were fledged and none of the host's young. In one instance, a young Cowbird was the sole fledgling of a pair of Song Sparrows and once of an Alder Flycatcher. In every other case, at least one host young survived. In Table 6, I have shown the comparative success of parasitized and non-parasitized nests that raised at least one host young in the Frith in 1944 and 1945. Nice (1937:160) found that each Cowbird seemed to be raised at the expense of one Song Sparrow; non-parasitized (successful) nests fledged an average of 3.4 young per nest, while parasitized (successful) nests fledged an average of 2.4 young per nest. My figures for the Frith, while less extensive, show a similar situation in relation to a group of host species. In the 35 non-parasitized (successful) nests, there were 2.94 fledglings per nest; the 19 parasitized (successful) nests fledged 2.05 host young per nest.

#### SUMMARY

In 1944 and 1945 Cowbird parasitism was studied in "Preston Frith," a 90-acre protected area near Butler, Pennsylvania.

By estimate, 6 female Cowbirds were active in the Frith in 1944, 10 in 1945.

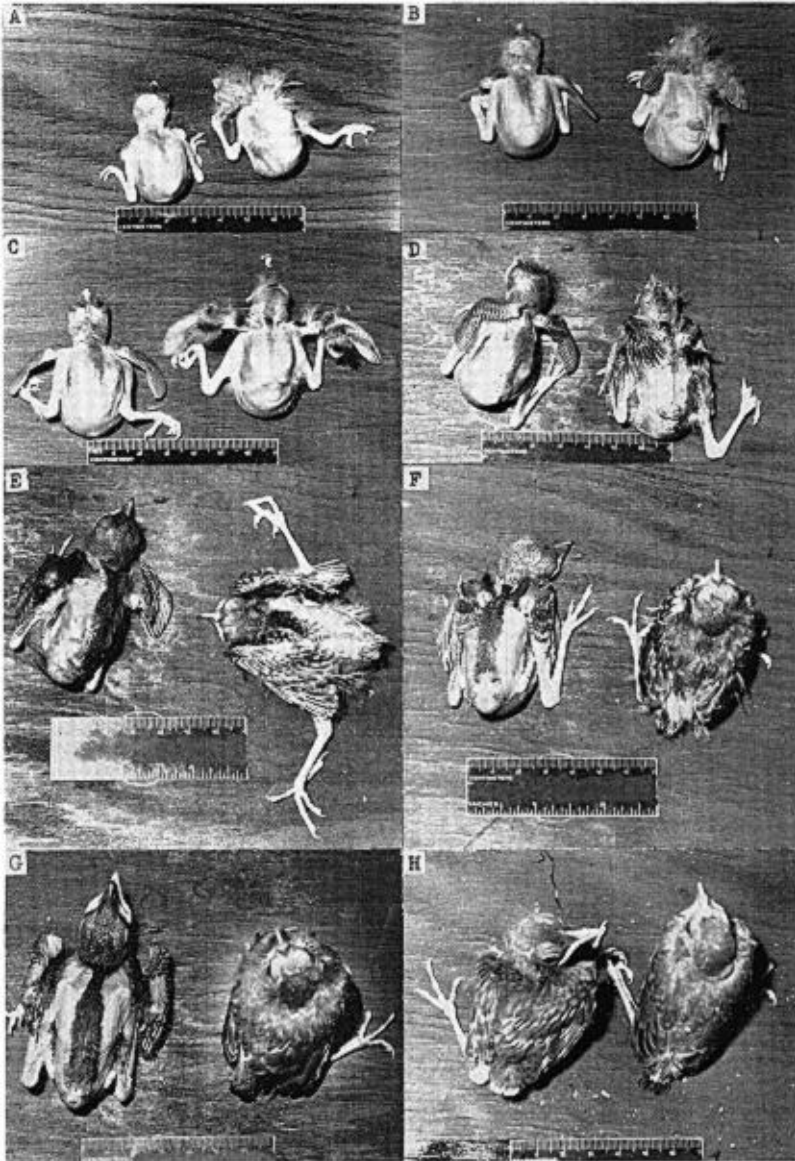


Figure 12. Daily growth of Cowbird (at right in each photo from A to H) and Wood Thrush (at left), June 4-11, 1945. See Table 5 for weights.  
 Photos by Hal H. Harrison.

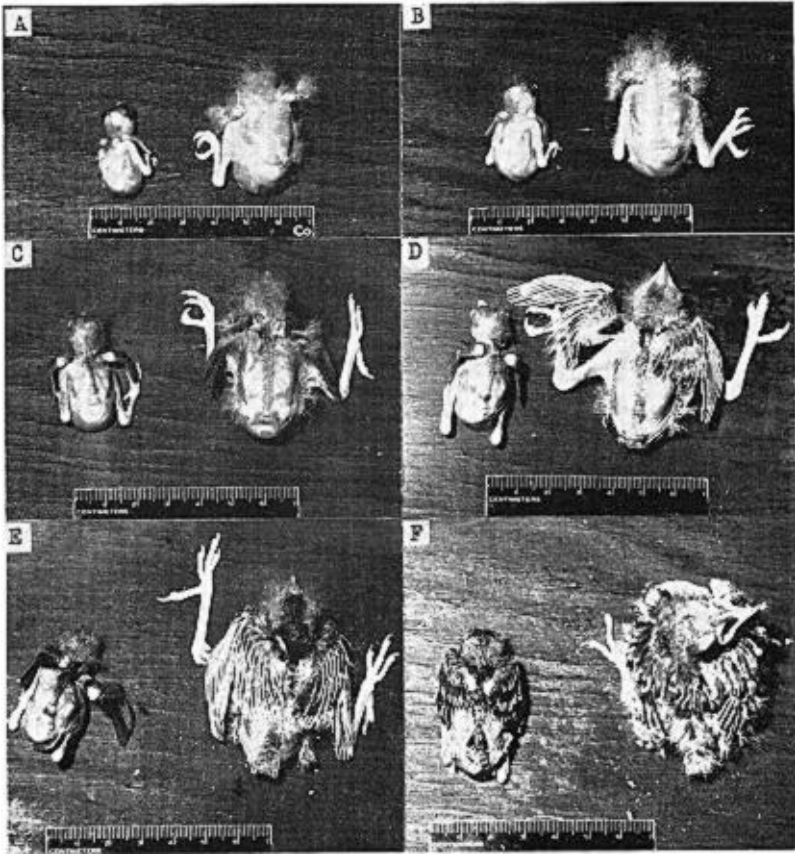


Figure 13. Daily growth of Cowbird (at right in each photo from A to F) and Oven-bird (at left), June 3-8, 1945. See Table 4 for weights.  
Photos by Hal H. Harrison.



Figure 14. Two Oven-bird eggs; two young Oven-birds (left), aged 24 hours (2.11 grams) and 30 hours (3.10 grams); three young Cowbirds (right), aged 42 hours (7.48 grams), 30 hours (5.20 grams), and 30 hours (5.00 grams). Age and weight given from left to right, June 9, 1945. Photo by Hal H. Harrison.



Figure 15. Young Red-eyed Vireo on left, aged 130 hours (11.8 grams); young Cowbird on right, aged 6 hours (2.60 grams); July 11, 1945. Photo by Hal H. Harrison.

TABLE 6  
SUCCESS OF NESTS WITH AND WITHOUT COWBIRD EGGS, 1944-45

Species	Non-parasitized nests			Parasitized nests		
	No. nests	No. young fledged	Av. fledged per nest	No. nests	No. young fledged*	Av. fledged per nest
Catbird	25	73	2.92	0	—	—
Brown Thrasher	4	10	2.5	0	—	—
Wood Thrush	3	10	3.33	1	2	2.0
Veery	2	5	2.5	4	8	2.0
Red-eyed Vireo	1	4	4.0	0	—	—
Chestnut-sided Warbler	1	2	2.0	0	—	—
Oven-bird	0	—	—	2	3	1.5
Yellow-throat	0	—	—	0	—	—
Scarlet Tanager	0	—	—	1	1	1.0
Cardinal	1	3	3.0	2	3	1.5
Red-eyed Towhee	2	7	3.5	7	15	2.14
Chipping Sparrow	2	5	2.5	0	—	—
Field Sparrow	21	58	2.76	2	5	2.5
Song Sparrow	6	20	3.33	3	6	2.0
Totals†	35	103	2.94	19	39	2.05

\* Host young only.

† For comparison, all species parasitized in the Frith are included in the table, but only nests of species that raised at least one Cowbird young and one host young are included in the totals.



The Cowbird laying season extended from mid April to mid July, with its peak in May. Until mid May most Cowbird eggs were laid in the nests of birds of field and open country, after mid May in nests of woodland birds.

A total of 73 parasitized nests were found, each of 45 containing one Cowbird egg, of 21 containing two, of 7 containing three.

Judged by egg type, two nests that each contained three Cowbird eggs were each parasitized by three females; one nest that contained three Cowbird eggs was parasitized by two; three nests that contained two Cowbird eggs were each parasitized by two females.

The time of egg laying seemed to be correlated with light intensity.

In 11 instances, Cowbirds removed eggs from hosts' nests, 7 times when two host eggs were in the nest, once when a single egg was there, once when the nest contained three host eggs, and once when the nest contained three eggs of the host and one of the Cowbird; once two eggs were removed from a nest of three, five days after incubation started.

For 32 Cowbird eggs, exact conditions of laying were known. In only 7 instances did the Cowbird lay in a nest on the day after she had removed an egg.

The Cowbird was photographed at the nests of the Oven-bird and Red-eyed Vireo.

The Cowbirds, though early risers, were usually quiet until after the eggs were laid.

The incubation period (10 eggs) ranged from 11 to 13 days and averaged 11.6 days.

Of 19 Cowbird eggs, one hatched four days before the host; 4 hatched one day before; 10 hatched the same day as the host; 3 hatched one day later than the host; and one hatched five days later than the host.

The weights of three young Cowbirds at hatching were 2.33, 1.77, and 2.70 grams respectively.

The daily rate of growth of the young Cowbird and the host young was recorded for the nest of the Oven-bird, Veery, Wood Thrush, Cardinal, and Towhee.

Records (11) of the Cowbird's age at nest-leaving averaged 8.7 days (extremes: 8 and 10 days).

Of the 45 nests in which one Cowbird egg was laid, 8 were deserted, apparently because the Cowbird laid prematurely; one was deserted even though the Cowbird's laying synchronized with the host's; 17 were destroyed; 19 produced fledglings. Of the 21 nests in which two Cowbird eggs were found, 9 were deserted, 6 were destroyed, 6 produced fledglings. Of the 8 nests in which three Cowbird eggs were found, 4 were deserted and 4 destroyed.

One Oven-bird nest was found containing three Cowbird young, two Oven-bird young, and two Oven-bird eggs.

In the 237 observed nests, the hosts laid 668 eggs, of which 383 (57.3 per cent) hatched; the Cowbirds laid 108 eggs, of which 46 (42.6 per cent) hatched; 37.7 per cent of the host eggs, 26.8 per cent of the Cowbird eggs produced fledglings. Of the host eggs that hatched, 64 per cent produced fledglings; of the Cowbird eggs that hatched, 63 per cent produced fledglings.

With four exceptions all parasitized nests that produced young produced at least one host young.

The 35 non-parasitized (successful) nests produced 2.94 fledglings per nest; 19 parasitized (successful) nests fledged 2.05 host young per nest, indicating that each parasite was raised at the expense of about one host young.

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