

MISCELLANEOUS PUBLICATIONS  
MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN, NO. 74

STUDIES OF THE NESTING BIRDS  
OF THE EDWIN S. GEORGE  
RESERVE. PART I.  
THE VIREOS

BY

GEORGE MIKSCH SUTTON

ANN ARBOR  
UNIVERSITY OF MICHIGAN PRESS

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### PLATE

- I. Young Yellow-throated Vireo just after leaving the nest.  
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- II. Yellow-throated Vireo and nest containing a young Cowbird.
- III. Yellow-throated Vireo about to feed young.
- IV. Oak-hickory woodland on the Edwin S. George Reserve.
- V. Aerial photograph of the Edwin S. George Reserve.



## STUDIES OF THE NESTING BIRDS OF THE EDWIN S. GEORGE RESERVE. PART I. THE VIREOS

THREE species of a distinctively New World family of passeriform birds, the Vireonidae, summer on the Edwin S. George Reserve, in Livingston County, Michigan. These are the Yellow-throated Vireo (*Vireo flavifrons*), the Red-eyed Vireo (*Vireo olivaceus*), and the Warbling Vireo (*Vireo gilvus*). In all of these species the male and female are alike in shape and color, the male being slightly the larger and brighter. All three vireos are distinctly arboreal, although the Red-eyed frequently, and the Yellow-throated occasionally, nests only a few feet from the ground. The males of all three species are loud and persistent songsters, with a penchant for singing during the hottest parts of the day, when most birds are still. The females do not sing. The males sometimes assist in nest building, regularly assist in incubation and brooding, and frequently sing on the nest. The nests are beautiful pensive cups, attached along the rims to forked twigs. So similar in general appearance are the nests of the three species that not even an expert can always distinguish them with certainty in the winter woods. The eggs of all three species are white (creamy white in the Yellow-throated Vireo), rather sparsely spotted with dark brown, chiefly at the larger end.

Morphologically, the Red-eyed Vireo and Warbling Vireo resemble each other much more closely than either species resembles the Yellow-throated Vireo. The Yellow-throated is the only one of the three which has wing bars and a brightly colored throat and breast. The eye (cornea) is considerably larger, the bill is shorter and heavier, the head broader, and the general appearance somewhat stockier than in the other two. Any well-made skin shows the Yellow-throated Vireo's actual as well as proportional largeness of eye. To ascertain the proportional broadness of head, however, I measured the skulls of all adult specimens of *Vireo flavifrons*, *Vireo olivaceus*, and *Vireo gilvus* in the University of Michigan Museum of Zoology osteological collection. The comparative results are given in Table I.

Most present-day ornithologists place all three of these vireos in the genus *Vireo*. Owing to certain recognized structural differences within this group, the Red-eyed and Warbling Vireos are assigned to the subgenus *Vireosylva*, and the Yellow-throated Vireo and Solitary Vireo (*Vireo solitarius*) are placed in the separate subgenus *Lanivireo* (A.O.U. Committee, 1931: 276-77). Ridgway (1904: 129) gave both *Lanivireo* and *Vireosylva* full generic rank. A point of dissimilarity between *Lanivireo* and *Vireosylva* which I think has not been sufficiently stressed in the literature is that in *Lanivireo* the juvenal plumage resembles the adult plumage rather

closely, whereas in *Vireosylva* it does not. A young Yellow-throated Vireo may be recognized at the time it leaves the nest from the clear yellow throat, superciliary line, and partial eye ring, and from the white wing bars. Young Warbling and Red-eyed Vireos at the same plumage stage are so unlike their parents that a good ornithologist might despair of identifying them without seeing the old birds bringing food.

Similar as the Warbling and Red-eyed Vireos are morphologically (the young Red-eye and young Warbling are almost equally brown-eyed), there

TABLE I  
MEASUREMENTS IN MILLIMETERS OF *Vireo* SKULLS\*

U.M.M.Z. No.	Sex	Greatest Width (Interparietal)	Least Width (Interorbital)
<i>flavifrons</i>			
74645	Male	15.2	3.2
85402	Male	15.5	3.3
73590	Female	15.4	3.2
<i>olivaceus</i>			
85377	Male	14.5	4.0
73663	Male	14.6	3.9
107117	Male	14.6	4.1
71987	Female	14.8	4.1
99449	Female	14.2	3.8
99505	Female	14.4	3.2
107122	Female	14.4	3.4
<i>gilvus</i>			
85094	Male	14.0	3.6
99256	Male	13.2	3.1

\* The skull-breadth measurements of *Vireo flavifrons* and *V. olivaceus* given have been analyzed statistically by my friend Andrew J. Berger. Since few skulls were available, the analysis is merely indicative; but the standard error of difference between the means of the two groups (difference =  $.867 \pm .1141$ ;  $t = 7.597$ ), when referred to probability tables, reveals a higher than 99 per cent chance that the two groups are separate and distinct—in other words, a difference exists more fundamental than casual inspection of the measurements suggests. Further measurements on a larger number of vireo skulls, including those of *V. solitarius*, need to be made and statistically analyzed before the results can be regarded as conclusive.

are striking habitat and behavior differences between the two species. The songs are quite unlike, that of the Red-eye resembling the Yellow-throated's only to the extent that it is made up of distinctly separated phrases. The habitats are unlike. The Warbling Vireo likes shade trees, but it does not often nest in a shady spot, whereas the Red-eye lives in a shady place the summer through and places its nest so that the sun virtually never strikes it. Roberts (1932) stated that the Warbling Vireo nests from "15 to 35 feet up" (p. 183) and that the Red-eye nests "2 to 5 feet up, rarely 10 to 20 feet" (p. 178). Trautman (1940) reported Red-eyed Vireo nests "8 to 80

feet above the ground" (p. 343) and Warbling Vireo nests "10 to 50 feet above the ground" (p. 344). Williams (1936) reported one Red-eyed Vireo nest 6 feet above ground with another nest 64 feet directly above it (p. 379). Red-eyed Vireo nests which I have examined on the Reserve were, respectively, 4, 5, 10, 12½, 18, 18, and 40-50 feet above the ground. All Red-eyed Vireo nests that I have examined, either on the Reserve or elsewhere, have invariably been in shady places, but several Warbling Vireo nests to which I have climbed have been well out on branches which were not shaded at all.

Newly hatched Red-eyed, Warbling, and Yellow-throated Vireos all have yellow mouth lining. Dwight (1900) described the natal down of the Red-eyed Vireo as "pale drab gray" (p. 235), that of the Warbling Vireo as "pale wood-brown" (p. 237), and that of the Yellow-throated Vireo as "drab" (p. 238). I have not collected nor painted from life newly hatched specimens, and have no comment on the color or pterylography of the natal down, but I believe, from what I have seen of young birds in or recently out of the nest, that the postnatal and postjuvinal molts proceed in about the same manner in all three species.

### *Vireo flavifrons* Vieillot

#### YELLOW-THROATED VIREO

Although the Yellow-throated Vireo is considered an "uncommon summer resident" in Michigan, with "few actual nest records" (Van Tyne, 1938: 31), it is probably the most common of the three vireos which nest on the George Reserve. It is less numerous than the Red-eyed Vireo in parts of the Big Woods, but anyone counting vireos needs to bear in mind that singing Red-eyed Vireos often stay lower in the trees than do the Yellow-throated Vireos, hence their songs frequently drown out those of the other species. A person who stands outside the wooded tract, listening from afar, has a better chance of counting all the singing vireos than does one who remains within the woodland. A song census made from the open fields in midsummer revealed that Yellow-throated Vireos were singing in several smaller wooded tracts, such as those to the north and south of Crane Pond (Tracts 19 and 20, Pl. V), in which there were no Red-eyed Vireos singing.

The Yellow-throated Vireo breeding population on the Reserve has not fluctuated noticeably during the fourteen-year period covered by my observations. Like the Wood Pewee (*Contopus virens*), it prefers the open parts of the upland woods and is particularly numerous among the larger oaks and hickories. Here the male sings at all hours the summer through, frequently singing while on the nest (Campbell, 1940: 133; Todd, 1940: 477). Presumably, the male shares the duties of incubation about equally

with the female, but I believe it is the female which regularly spends the night on the nest, for I have yet to see a singing bird go to the nest in late evening.

I have not recorded the hour of the earliest morning and latest evening songs, but have repeatedly observed that the Yellow-throated Vireo was one of the "noontide singers" during the hottest, driest weather in 1936 and 1946. In August and September of 1942 and 1946 I noted that it was one of the few species which continued to sing throughout the period of the post-nuptial molt. The late summer and fall songs of the Yellow-throated Vireo are a noticeable Reserve phenomenon. Young males try out their voices early in life, and many of them learn to sing well before leaving for the south. On bright warm mornings in late August or early September I have heard six to eight Yellow-throated Vireos singing on several occasions. Some of these songs have but a single phrase—a mere snatch of the "Mary! Mary! Come here!" song of June and July. They are rich and full-throated nevertheless and occasionally are prolonged into a complete song and repeated over and over. Molting birds probably do not sing much, but at no time during the extended molting period do all the birds lose their vigor simultaneously, and the singing continues. On September 4, 1940, I collected a singing bird near the Camburn Laboratory. It proved to be an immature male in beautiful first-winter feather.

On August 30, 1946, I spent half an hour watching two Yellow-throated Vireos in Tract 19 (Plate V). One of the birds was a young male in complete first-winter plumage, the other an adult in the midst of the post-nuptial molt. The young bird kept trying snatches of song. Rough scolding phrases became a rolling chatter and then suddenly a clear rich "dearie" or slowly descending "gleer," followed by other notes, all of them possessed of that rich quality which makes the Yellow-throated's song instantly recognizable.

Counts of singing birds made in July, 1942, from June 24 to July 1, 1944, from May 26 to about the end of July, 1946, and from July 14 to 19, 1947, indicate that nesting pairs were distributed about as follows in the four seasons: one to two in Southwest Swamp, one in Tract 19, one to two in Southwest Woods (Tract 2), three to five in the West Woods (Tract 5), two to three in the Northwest Woods (Tract 8), one on Fawn Hill (Tract 7), three in the North Woods (Tract 10), one in the South Woods (Tract 16), one in the small wooded tract lying along the west side of the Big Cattail Marsh (Tract 15), two to three on Big Island (Tract 14), one in the Kelly Woods (Tract 18), one in the large poplars along the east fence near the extreme southeast corner, and five to seven (possibly more) in the main body of the Big Woods (Tract 11). This makes a total of

twenty-three to thirty-one pairs. From time to time I heard birds singing in the Burt Woods (Tract 20) and on various islands in the Big Swamp, but as I never observed pairs nor found nests in these places, I suspect that the singing birds represented nests on Big Island or along parts of the Big Woods lying close to the tamarack swamplands. Never have I heard singing which I felt represented a nest territory wholly in the tamaracks. Birds which sang along the edge of Dollar Tamarack Swamp (Tract 4) in the West Woods spent most of their time among the oaks and hickories rather than among the tamaracks.

Fluctuation of the breeding population in Southwest Swamp (Tract 1) has been interesting to observe. In 1934, 1935, 1936, 1940, and 1942, I noted one pair nesting either in or very close to a large elm which stands on the east edge of the swamp not far from the present laboratory site. In the first four of these seasons this pair was the only pair within that area, so far as I could determine. In 1942 there were two pairs, the "Lab elm" pair and another pair on the west side of the swamp. In 1944 I heard one singing male from time to time (especially on June 27) on the west side and believe that the one nesting pair of the swamp had a territory there. In 1946 one of the first sounds I heard upon arriving at the laboratory was a Yellow-throated Vireo call note from the "Lab elm." Thinking this must surely mean that the birds had re-established themselves there, I investigated and found a Warbling Vireo nest and a Baltimore Oriole (*Icterus galbula*) nest on opposite sides of the tree. These "owners" of the elm permitted the Yellow-throated Vireo to enter and sing in the tree occasionally on May 26, but from May 27 on I noticed that no Yellow-throated Vireo ever sang a full song there. What I heard instead was fervent singing from one Warbling Vireo and occasional scolding from Warbling and Yellow-throated Vireos. Two pairs of Yellow-throated Vireos did nest in Southwest Swamp in 1946, one among the few living maples, elms, and ashes toward the north end of the middle part, the other at the extreme south end. The north end pair I watched as they gathered nest material on May 27. I saw them fly with this into the middle part of the tract, but I never found the nest. I was scolded by the birds occasionally, especially when I climbed to Warbling Vireos' nests along the edge of the swamp. The Warbling Vireos' cries of anger seemed to attract the Yellow-throated Vireos.

Yellow-throated Vireo nest territories which I have studied on the Reserve have been of two wholly different sorts; some are close to, and include, the ground, others are high in the tallest trees and wholly above ground. I cannot explain this apparent inconsistency. So far as I have been able to ascertain, it is not a matter of year-to-year variation in habitat—that is to say, I have never known the species as a whole to nest high during certain

years and low during others. One pair nests high, another low. One 1946 territory which I visited several times in the Big Woods east of Buck Hollow (Tract 12) was a very low one; a contemporaneous one to the west of Buck Hollow, in what appeared to be exactly the same sort of woodland, was a high one. High-nesting pairs stay so high and low-nesting pairs are so low that I should not be greatly surprised at discovering one territory partly above another. This sounds absurd, but it is not unthinkable (see Williams, 1936: 379). Three high territories which I studied in 1946 were so definitely among the treetops that the parent birds never once scolded me as I passed under them, nor did they seem at all perturbed when I propped dead branches as markers against their nest trees, shouted at them, and even tossed sticks toward them in an attempt to attract their attention. It was as if they were living on a wholly different planet from mine.

A fairly dependable index to the high territories in such forest tracts as the Big Woods is the scoldings Yellow-throated Vireos are wont to give all Wood Pewees (*Contopus virens*), Scarlet Tanagers (*Piranga olivacea*), Crested Flycatchers (*Myiarchus crinitus*), and especially Blue Jays (*Cyanocitta cristata*) which pass through or close to the nest trees. I well remember the noisy outcry two vireos directed toward a Blue Jay which foraged through their nest tree, just west of Buck Hollow, on June 25, 1946. I would never have found the vireo nest had it not been for their scolding. Looking upward through my binocular, I saw the jay hopping from branch to branch, avoiding the vireos as best it could but determinedly holding its ground, until at last it found the nest. The vireos hurled themselves at the jay with doubled fury as it took a nestling in its beak, but their efforts were to no avail. Off the jay flew, high in air, with its victim dangling. The squealing vireos followed the jay almost, if not quite, across Buck Hollow, a distance of a hundred yards or more, attacking it fiercely the whole way.

On June 21, 1946, at the south end of Southwest Swamp, I noticed that when a pair of Baltimore Orioles flew through certain treetops directly above me on their way to their nest with food, they were savagely scolded and attacked by two Yellow-throated Vireos.

Another incident is worth mentioning in connection with vireos' defense of treetop territories. On the evening of July 12, 1946, I helped the Hamerstroms catch a brood of young Cooper's Hawks (*Accipiter cooperii*) which they wished to tether. The young hawks flew directly from their nest tree, one of them off through the woods well out of sight. We probably never would have found it had it not been for the persistent scolding of the Yellow-throated Vireos in whose territory it happened to alight. The vireos stayed by it until we got there.

I have information concerning several nests. The first observed was an

almost finished one found by Milton B. Trautman and George Moore on May 22, 1938, in the southeast corner of Southwest Woods about forty feet above the ground in a large hickory which stood several rods in from the edge of the tract. The two bird owners stayed close together as they journeyed to and from the nest, but only the nonsinging bird (the female) gathered material and worked at the nest.

Another nest, which was found by the Hamerstoms on June 22, 1942, contained two small young on that date. It was in a fourteen-inch (d.b.h.) white oak about eight feet above water eight inches deep, along the west side of Southwest Swamp. The tree stood ten paces out from shore, among mixed oaks, maples, ashes, and elms, some of which were dying as a result of the water. The nest was on a downward-sloping branch about fifteen feet out from the main trunk and about four feet from the end of the branch. Since there was no underbrush in that part of the swamp, the nest site was strikingly exposed. To the nest's rim clung conspicuous wads of white, cottony material, which became stringlike where it entered and was woven into the nest wall. When the Hamerstoms visited the nest on June 27 to band the young, it was empty.

In 1946, I made observations at six nests. The first nest was about sixty feet from the ground in a tall, fourteen-inch (d.b.h.) white oak growing in the middle of the wooded peninsula which extends from the west edge of the West Woods out into the adjacent swampland. I found it on May 27, when the oak leaves were still very small throughout the woods. That day I chanced to see the two vireos hunting nest material close to the ground at the edge of the wet swampland. When they flew up, heading straight for the upper part of the nest tree, I clearly saw white material, probably spider egg cases, in their bills. I did not find the nest until one of the vireos darted directly from it toward a Wood Pewee about fifteen feet away. At the nest the female did most of the building and decorating, but the male continued to assist in gathering and carrying in material. I enjoyed watching the two birds as they came and went. They kept close together and called to each other in low, rich tones almost constantly. Most of the nest material they obtained on or near the ground. The nest was near the end of a slender two-foot-long twig which extended directly out from the main trunk of the tree. After the birds had made four trips together, the female stayed on the nest for ten to fifteen minutes, while the male sang loudly in the crown of a tree close by. I did not climb to this nest, but the young birds which I saw in the vicinity about a month later were probably reared in it.

The second nest, in 1946, was discovered by F. N. Hamerstrom, Jr., who watched two birds, at least one of them with nest material, go to it on May

28. It was in the Big Woods, sixty to sixty-five feet above steeply sloping ground just south of the main hogback road. The nest was hung from a crotch of two half-inch-diameter twigs within the flat and rather irregular crown of an oak. Hamerstrom saw one bird working at the nest, but was not sure that the other actually helped. I did not see this nest until June 8. I did not climb to it and do not know whether it was successful or not.

On June 3, 1946, I saw a male and female Yellow-throated Vireo going about together near the ground at the edge of the Big Tamarack Swamp just west of Hidden Lake. The female was hunting nest material. Dry grasses seemed to interest her in particular, and these she tested with her bill one after another, presumably for their flexibility. During the ten-minute period in which I watched the birds the male did not pick up anything, though he stayed very close to the female. Eventually, the female flew back into the woods with a long dry grass blade in her beak. The male followed her closely.

The third nest, located by Frances Hamerstrom on June 1, 1946, has an extremely interesting history from the standpoint of the Yellow-throated Vireo's relationship with the Cowbird (*Molothrus ater*). The nest was only ten feet from the ground, and four feet out from the main trunk on a six-foot-long branch (the lowest in the tree) in a ten-inch (d.b.h.) oak. The tree stood in open woods about sixty yards from the north edge of the Big Cassandra Bog. The nest was not hidden by leafage and was sheltered but little by twigs or leaves from above. With the glass I could see it clearly from points seventy to eighty paces away to the east and west.

On June 1, two birds were at the nest, one on it, the other close by. There were three eggs, one of them a Cowbird's egg. The two vireo eggs looked fresh.

On June 2, at 11 A.M., there were two Cowbird eggs and one vireo egg in the nest. The female Cowbird presumably had removed one vireo egg before laying her own.

On June 6 (I did not visit the nest June 3-5) there were two vireo eggs and one Cowbird egg in the nest. The vireo presumably had removed one Cowbird egg before laying her own. A vireo was incubating closely. It did not leave the nest until I started to climb the tree. No egg remains were on the ground.

On June 10, a vireo was sitting deep in the nest at 7:30 A.M. It did not leave when I stood directly beneath the tree, nor did the other vireo appear.

On June 13, a vireo was on the nest at 5:30 P.M. As I approached, the mate flew down from overhead, the incubating bird left the nest, and both birds scolded me harshly from branches a few yards away.

On June 16, Eliot Porter and Harold Wing took several photographs

of the nest. In it were two vireo eggs, and a newly hatched Cowbird (Pl. II). The parent vireos scolded a great deal.

On June 22 (I did not go to the nest June 17-21), the nest was deserted. In it were a dead Cowbird weighing twenty-three grams, possibly six days old (see Norris, 1947: 96-97), a Cowbird egg, and about two dozen medium-sized ants which were devouring the dead Cowbird.

The fourth nest was the one west of Buck Hollow from which the Blue Jay took a young bird. It was about sixty feet from the ground in the crown of an oak. I looked at it with the glass on June 25, at which time I think the young birds were not very well developed.

The fifth nest I discovered on June 27 by watching the parent birds carrying food and by listening for the calls of the young, which were just leaving the nest. The nest was about fifty-five feet from the ground in a tall oak southeast of Buck Hollow not far from the hogback road. There were three or four young birds, which I did not see very clearly.

The sixth nest, first seen by Alfred Brandt and myself on June 29, held four well-developed young. It was the lowest Yellow-throated Vireo nest that I had ever seen. It was only five-and-one-half feet from the ground, and was six feet out from the main trunk of a leaning five-inch (d.b.h.) white oak growing on sloping ground between Buck Hollow and the main hogback road. The woods there were open. A Scarlet Tanager's nest, from which the young had departed a day or so previously, was about forty yards to the southeast. The parent vireos were extremely tame. Brandt spent several hours photographing them and their brood. Sitting on a low stepladder without a blind of any sort, he held the camera three feet from the nest. The birds came and went fearlessly, fluttering about him, frequently almost alighting on him. Once he touched one of them without even putting it to flight. As a rule the male and female came and went together. Often they announced their return with food by a duet of various cries, notably a rapidly chattered "chee-tee-tee-tee" which never failed to rouse the young birds. The older two of the brood frequently stood high in the nest, stretched their wings, and looked about with what appeared to be an active interest in their surroundings. While being fed, all four young birds vibrated their heads back and forth rapidly with a curious wobbling motion.

The larger and brighter parent, presumably the male, although we did not see it singing, was somewhat the tamer. The female was recognizable at any distance by her mannerisms. She fluttered her wings a great deal, especially just after alighting. Occasionally, her behavior suggested that of a young bird begging for food. The male always fed the young directly, however, without passing the food to the female.

Between 9 and 11 A.M. on June 29, we saw the vireos bring food to the

nest about thirty times. We occasionally recognized what they brought to be a caterpillar or moth, but a longish, rather hard-looking item of almost twiglike appearance, which they brought in repeatedly and which the young birds swallowed with difficulty, continued to puzzle us. Curious, we pulled a protruding "twig" from the mouth of one of the young birds and discovered it to be the crushed and battered thorax and abdomen of a large dragonfly. The head, wings, and legs of the insect all had been removed with a good deal of care. How and where the vireos obtained these insects we failed to learn. Possibly they captured them in mid-air, for by that time of day many dragonflies would certainly be on the move. If the insects had only recently emerged as adults and were not able to fly very strongly, the birds may have caught them without difficulty in the grass or shrubbery along the edge of Buck Hollow. Theodore Hubbell, who examined a specimen which we retrieved from the gullet of one of the young birds, identified it as an adult female of the genus *Aeschna*, probably *A. constricta* Say, a form known to alight on leaves and twigs in the forest and to be common on the Reserve (Pl. III).

After feeding the young, the parent bird either ate the fecal sac or flew off with it, dropping it downslope twenty-five yards or more from the nest. On June 30, I painted one of the young birds from this nest direct from life. I was astonished at the resemblance certain of its cries bore to those of the adults. Its vireo-like manner was evident in everything it did, the way it turned its head, the slow lifting of its crown feathers, the clinging, climbing action of its feet (Pl. I).

The three remaining young birds left the nest between 5:45 P.M. on July 1 and noon on July 2. During the afternoon of July 1, one of them spent a good deal of time on the nest rim or on a twig four to fifteen inches from the nest. In the bottom of the nest was a considerable quantity, possibly a tablespoonful, of bits of feather sheath.

A seventh 1946 nest I never actually saw. It must have been fifty to sixty feet above ground near the top of an oak on Big Island, fifty yards northwest of a Cerulean Warbler (*Dendroica cerulea*) nest at which I made observations late in June. On June 28, while seated on the ground under the warblers' nest, I saw a pair of Yellow-throated Vireos flying in and out of the oak. With the glass I finally located two stub-tailed young vireos. Their call notes were very much like those of the adults, and they could not have been out of the nest more than a few hours. The parents obtained food high in the trees along the edge of the island, usually about thirty to seventy-five yards to the east and southeast of the nest. With the glass I could follow their comings and goings, because they moved deliberately and kept in the open much of the time.

Yellow-throated Vireos may rear two broods a season on the Reserve as a rule. My earliest date for young not long out of the nest is June 24, 1944, at which time I saw one family group (the young all short-tailed) in oaks near the north gate and another (adults and three stub-tailed young) in a large poplar tree near the east fence in the extreme southeast corner. Young birds still being cared for by their parents I have observed on the following comparatively late dates: July 13, 1946; July 23, 1934; July 24, 1936; July 25, 1942; August 3, 1934; and August 7, 1942.

Young Yellow-throated Vireos usually keep together as broods until they leave for the south. On several occasions I have "squeaked up" two or three of them and I could tell from the way they appeared simultaneously, as well as from their being at about the same stage of the postjuvinal molt, that they were probably siblings. Two such birds seen in a hickory overhead on August 5, 1946, amused me with their sluggishness. Both were ratty in appearance, and both were more interested at the moment in resting than in doing anything else. I watched one of them closely as it responded to the warmth of the sun, opened up the bare spaces between its shoulder and back feathers, turned its head to one side, spread its wings and tail, and actually lay across a forked twig, taking a sun bath among the leaves about thirty feet above ground.

The postjuvinal molt begins soon after the young have left the nest, long before the flight feathers are full length, but I have not collected specimens which show the various stages of this molt. Molting young birds are not always easily recognizable, for the juvenal plumage is much like that of the adult: the yellow of the throat and white of the wing bars is distinct even in young birds barely out of the nest. The fledgling male which I painted direct from life on June 30, 1946, was in typical juvenal plumage. The stubby tail was about 12 mm. long. Its weight was 13 grams. The bill was pale olive-gray, feet pale blue-gray, and eyes very dark brown, almost black (Pl. I). An immature male (U.M.M.Z. No. 106515), already referred to, which I collected on September 4, 1940, had completed the molt, although the skull was not fully ossified. It weighed 20.3 grams.

The postnuptial molt begins when brood rearing is over. An adult male which I collected for the skeleton on July 24, 1934, had not yet started to molt. It weighed 16.9 grams. An adult male which I saw clearly on July 27, 1940, was "in very bad plumage," but I am not certain that it was molting. An adult which I saw at close range on July 31, 1936, probably had molted its greater coverts, for it seemed to have but one bar on each wing. An adult female which I caught in a net and banded on August 8, 1934—and which bit me savagely, in a manner strongly reminiscent of a shrike—was in much worn plumage but had not, so far as I could tell, started to molt. The molting adult bird which I watched on August 30, 1946, I already have described.

One instance of Cowbird parasitism is discussed above in connection with a nest observed in 1946. On July 3, 1934, I watched a singing male Yellow-throated Vireo gathering food for a full-fledged young Cowbird at the edge of the Big Woods. Evidently the Yellow-throated Vireo is not often parasitized on the Reserve, although Friedmann considers it "a common victim" (1929:236). A comparative study of the much-parasitized Red-eyed Vireo and the little-parasitized Yellow-throated Vireo might lead to some interesting discoveries.

The heaviness (20.3 grams) of the young male Yellow-throated Vireo which I collected on September 4, 1940, seems to bear out Wolfson's (1945:125) belief that "maximum body weight is diagnostic of a readiness to migrate." This statement was based on observations of adult birds in spring, but the need for fat may be equally great among birds which are preparing for migration in the fall. The adult male which I collected on July 24, 1934, weighed only 16.9 grams. Two males in the University of Michigan Museum of Zoology (Nos. 93989 and 109630) taken in early summer, weighed 17.8 grams and 16.1 grams, respectively.

### *Vireo olivaceus* (Linnaeus)

#### RED-EYED VIREO

Of the three species of vireos which summer on the George Reserve, the Red-eyed Vireo is probably the best known, for it breeds widely throughout the eastern United States and eastern Canada and is very abundant in some deciduous woodlands (Kendeigh, 1945:423). Throughout Michigan it is a "common summer resident" (Van Tyne, 1938:31). The nest is often placed low and, consequently, is frequently noticed, observed, and photographed. Old nests are a familiar sight to all who walk through the woods in winter. The Red-eyed is not as likely to inhabit shade trees along village streets as is the Warbling Vireo, but that species usually keeps high and is little seen. The Yellow-throated Vireo also is usually a creature of the treetops. Many Red-eyed Vireos spend much of their time in the foliage of the lower half of the forest and often feed at little more than eye level.

The Red-eyed Vireo sings almost incessantly throughout the daylight hours during the whole of the nesting season. Molting adult males and young males in full first-winter plumage sing occasionally in late summer, not only from the depths of the forest but from scattered willows, elms, maples, and poplars which are far removed from the recently abandoned nest territories. The song is easily recognized, with its hurried, not very musical phrases, some of which can be imitated fairly well by spoken words or syllables. I have no recorded data as to the hour at which the Red-eye awakens and begins to sing, but on June 23, 1946, when making

observations at the nest of a Cerulean Warbler near Buck Hollow, I heard the chorus of Red-eyed Vireos in the Big Woods in full swing at 4:40 A.M. (Light from the rising sun was not strong in the forest that morning before 5:20 A.M.) Observations on late summer songs are: Throughout July, in 1942 and 1946, and from July 14 to August 4, 1947, I heard Red-eyed Vireos singing daily; on August 12, and again on August 20, 1942, I heard what I believed to be adult males "singing well"; on August 17, 1946, I heard "one singing gently" along the edge of Fishhook Marsh; on September 7, 1940, young birds with brown eyes, seen at close range, were singing disconnected snatches of song.

The Red-eye's noontide singing and its singing on the nest have frequently been mentioned in the literature (Roberts, 1932: 180; Allen, 1939: 70). On the Reserve I have noticed that all three vireos share this enthusiasm for singing during the hottest, brightest part of the day. On more than one occasion I have been convinced, however, possibly by the rapidity with which the phrases were uttered, that the most strenuous singing of all was being done by the Red-eye. The Red-eye's song contrasts rather sharply with that of the Yellow-throated Vireo in this respect.

Another reason that the Red-eyed Vireo's presence is so well known is that it responds readily to "squeaking." Often it is the first bird—sometimes the only one—to appear when one "squeaks" in imitation of a young or crippled bird. Not uncommonly both the male and female fly up, alight not far overhead, peer downward through the leaves, and lift their gray crown feathers inquiringly as they give their harsh, scolding, "nasal ye-an" (Allen, 1939: 69). Their manner on such occasions is characteristic; they usually crouch, spread their tails somewhat more widely than usual, and hold their beaks slightly open while investigating this puzzling and disturbing noise.

Counts of the Red-eyed Vireo are somewhat more difficult to make than are those of the Yellow-throated Vireo for two reasons: (1) The singing of an individual male Red-eye is less likely to be recognizable, for the phrases of the song are more rapidly given and less distinctly enunciated. The Yellow-throated Vireo's deliberate "Dearie! Weary? Come 'ere!" may be so sharply inflected and so clearly given as to be individually identifiable even at great distance. But all Red-eyed Vireo songs seem to sound alike, as if the birds were imitating each other's phrases and tempo. (2) Red-eyed Vireo nest territories are more likely to adjoin than are those of the Yellow-throated Vireo, so that the voices of the singing males of adjacent territories often overlap and mingle. On the Reserve, a requirement of the Red-eyed Vireo appears to be that the whole nest territory lie within a uniform forest area (see also Kendeigh, 1944: 93). The nest itself may be

built on the forest's edge, but a contiguous feeding area, either surrounding it or immediately to one side, is a necessity. In this area the parent vireos may obtain food, and into it young vireos are able to move the instant they leave the nest, without having to fly across or around an open space. The Yellow-throated Vireo occasionally nests high in a large tree which stands wholly apart from the forest. The parent birds then have to fly conspicuously across an open space in carrying food. Such a procedure is virtually unheard of among Red-eyed Vireos. As for the Warbling Vireo, it is not really a forest bird at all. Its nest territory is usually well above ground in a row of trees along a road or at the edge of a stream, lake, or swamp. The nest usually is placed so as to permit the brooding bird to look out in all directions. The Warbling Vireo does not demand the shade which seems to be all-important to the Red-eye.

My records indicate that the Red-eyed Vireo population on the Reserve has not fluctuated much during the fourteen-year period covered by my observations. Each summer the species has nested in all of the major upland wooded tracts. I have never observed it nesting among tamaracks, nor have I so much as seen or heard it in midsummer in the several old apple orchards within the fence.

The only area in which there has been a really notable change in the breeding population is Southwest Swamp. Here two or three pairs nested in 1934, 1935, and 1936. In 1938 the water level was raised, and the trees in the middle part of the swamp began to die. By 1942 the Red-eyed Vireo had withdrawn completely from that tract.

I made no careful counts of Red-eyed Vireos throughout the Reserve before 1942. In 1942, 1944, 1946, and 1947, I found pairs as follows: two to four in Southwest Woods; three to five in the West Woods; one in the Kirtland Woods (Tract 6); two to three on Fawn Hill and in the Northwest Woods; two to three in the North Woods; six to nine in various parts of the Big Woods; two to three on Big Island, other islands in the Big Swamp, and Juniper Hill; one in the Kelly Woods; and one in Tract 15 (just west of the Big Cattail Marsh). This makes a total of twenty to thirty singing males heard or pairs "squeaked up" and observed. I am not certain that all singing males were paired, but I believe that most of them were. I saw very few nests, and I observed nothing that indicated a nest territory including tamaracks.

In 1942, 1946, and 1947, I encountered Red-eyed Vireos (both adults and young) in late summer in the South Woods, but I am not convinced that they actually nested there, for I have never seen a nest, either in summer or winter, anywhere in that tract. I am inclined to believe that the birds' presence was rather the result of late summer crowding in other feeding grounds close by.

Small oak-hickory tracts such as Tracts 19 and 20 and those on slopes in the southeast corner of the Reserve either are not extensive enough or are too open and dry for the Red-eyed Vireo. The Yellow-throated Vireo apparently finds some of them adequate, but the Red-eye seems to need woodland with a leaf canopy sufficiently dense to furnish a considerable amount of shade, yet sufficiently open to permit the growth of a healthy understory of oak and hickory saplings, sassafras, and witch hazel. The somewhat thicketed parts of the Big Woods are much to the Red-eyed Vireo's liking. Once the undergrowth has died out or been cleared away from such a woodland, once the aspect becomes at all open and parklike, the Red-eye withdraws. •The Yellow-throated Vireo is apparently more adaptable. Although it usually nests high, it sometimes nests low and obtains its food low. Low-placed Yellow-throated Vireo nests which I have seen on the Reserve have invariably been in woodland too open for the Red-eye. Whether this is the result of an active species rivalry between the two—the Red-eye pushing the Yellow-throated out of the lower, shadier, shrub-filled parts of the woods, or the Yellow-throated forcing the Red-eye down from the treetops—or whether it is the result of a traditional nest-site choice which happens to be convenient to all concerned, I cannot say. Of this much I am certain: I have never seen a member of either of these two species chasing one of the other as if from a nest territory. From what I have observed I should say that each species instinctively selects a nest site and nest territory unsuitable to the other, though precisely what the determining factor is I do not know (see Lack, 1944).

Each summer that I have visited the Reserve, I have happened upon several dark-colored, old Red-eyed Vireo nests (see Allen, 1939: 69), most of them five to ten feet from the ground, suspended from witch hazel, oak, or hickory branches. Freshly built Red-eyed Vireo nests are usually distinguishable from Yellow-throated Vireo nests by their freedom from ornamentation outside (Todd, 1940: 481). On the Reserve some Yellow-throated Vireos nest very low, however, and some of the old nests which I have examined have not been in good enough condition to determine to which species they belonged. On June 13, 1935, I found in the Big Woods two freshly built but empty Red-eyed Vireo nests each about six feet above ground, under each of which were the fresh remains of vireo eggs. There was no evidence that Cowbirds had been responsible, or that predators had attempted to eat the eggs. The brooding vireos may have been frightened suddenly, or even snatched from the nest by some predator; or, possibly, the nests were shaken violently by passing deer. Where deer are numerous, as they are on the Reserve, accidental destruction of birds' nests by them is, perhaps, more frequent than is usually supposed.

The only active nests of the Red-eyed Vireo that I have information

about were observed by various persons in 1946 and 1947. In 1946 I started field work early enough to see something of the building of the first Red-eyed Vireo nests, but I almost wholly missed that lively part of the reproductive cycle in which various associated woodland species settle their territorial disputes before starting to build nests. According to the Hamerstroms' field notes, territorial disputes among Red-eyed Vireos were almost incessant in the Big Woods on May 20 and 21, 1946. These included chasing, bill snapping, and various cries of anger, intimidation, and alarm. All the disputes were similar enough to suggest that the nest territories occupied almost (if not quite) the same stratum of leafage. Least Flycatchers (*Empidonax minimus*) and Ovenbirds (*Seiurus aurocapillus*) were also fighting among themselves over nest territories all through the Big Woods at that time.

On May 27, 1946, when I began field work that year, the Red-eyed Vireo had reached the nest-building stage of the reproductive cycle throughout the Reserve. Most of my observations were made in Southwest Woods and West Woods. I found three pairs in the former tract and four or five pairs in the latter. Every one of these birds appeared to have definitely appropriated a territory. The males sang volubly as they accompanied (apparently followed) their nonsinging mates. The pairs moved slowly about, rarely ascending to points higher in the trees than twenty to twenty-five feet, often descending almost to the ground. As far as I observed they paid little attention to other species of birds. Interspecific territorial disputes had probably been settled.

In a comparatively open part of the Southwest Woods, several rods in from the northeast corner, on a slope just above a little-used road, I noticed that a female Red-eyed Vireo made her way repeatedly to a fork near the end of an upward-sloping, thinly leafed bough about eighteen feet from the ground and seven feet out from the main trunk of a large oak about seventy feet high. The bird lingered at this spot, inspected the twigs minutely, swung from each, and moved gracefully in and out between them several times. The male, which sang almost incessantly, accompanied her on each visit, but did not inspect the fork nor move in and out among the twigs. The fork was so exposed to view that at first I thought the bird was merely hunting food there, but presently she brought a beakful of some white substance, probably spider's webbing, and started building the nest. She wound the webbing round and round the twigs at the very base of the fork—not with a series of jabs, releasing the material on one side of a twig and taking it up again on the other—but holding it constantly and moving with it round and round the twigs. The male continued to sing four to fifteen feet away while she worked, and accompanied her as she gathered material.

In hunting for this she stayed close to the ground much of the time, occasionally flying to natural cavities in the larger trees.

On May 27 the Hamerstoms found an unfinished nest in an open part of the Big Woods northeast of Hidden Lake, about forty-five feet from the edge of the Yellow Birch Swamp. It was twelve and one-half feet from the ground in a fourteen-foot-high witch hazel plant, about a foot from the tip of the branch. What there was of the nest was composed of soft, somewhat rotted large-toothed aspen wood fiber (not bark) bound together by webbing.

Both of these nests were deserted before they were finished. I visited the Southwest Woods nest early on the morning of May 28, and after a brief wait I saw a Red-eyed Vireo bring in one mouthful of material. I saw only the one bird and heard no singing close by. I visited the nest again on May 30, June 2, and June 3 and saw no Red-eyed Vireo in the vicinity. The nest may have been deserted because of its exposed position or the male may have been destroyed by a predator. As for the nest in the Big Woods, I can only guess that it was deserted because of its exposed position, though to my way of thinking it was much more concealed than that in Southwest Woods. The season was very late, however, and the witch hazel leaves were not fully opened by June 1.

On May 31 the Hamerstoms reported a partly finished nest on a witch hazel growing on a gentle slope twenty feet from the gravel pit road near the east end of the Big Woods. This one was four feet from the ground and eighteen inches from the end of an eight-foot-long branch. Here the female did all the carrying of material and building, but the male accompanied her almost constantly, singing fervently. The nest was composed of "shredded bark-strips, pieces of partly rotted leaves, bits of white cottony material and bits . . . of white rotted wood (probably *Populus grandidentata*)" (quoted from nest card). On June 4 this nest held four Cowbird eggs, and it may well have been deserted before the Hamerstoms' visit on that date. As late as June 15 and 25, when the Hamerstoms last visited it, it still held three of the Cowbird eggs unbroken.

On June 3 I tried to locate the Red-eyed Vireos which had the nest at the northeast corner of Southwest Woods; the birds were not there. At the extreme southeast corner of the woods, however, a male was singing with more than ordinary insistence. I watched the bird for a quarter of an hour, eventually being led by it straight to a nest about eighteen feet from the ground in a four-inch (d.b.h.) hickory sapling which grew not far from the water's edge (Southwest Swamp) in a spot heavily shaded, except early in the morning. The male, singing loudly, moved slowly to the edge of the nest. The female sat deep in the nest and, so far as I could

see, did not budge. I did not climb up, because I could not examine the nest without shaking the whole sapling and bending the branches down perilously. On June 4, when I reached the nest with the help of a ladder, I was surprised that no vireos protested. The nest was empty; the territory abandoned.

On June 4, the Hamerstoms found a high nest, forty to fifty feet from the ground, twelve feet out from the main trunk, and about eighteen inches from the end of the branch, in a white oak which stood in an open part of the Big Woods about thirty feet from the edge of the swamp just northeast of Hidden Lake. The branch to which the nest was attached was the lowest major branch on that side of the tree. Almost directly below the nest, twelve feet from the ground, was another vireo nest which appeared to be about a year old. The Hamerstoms located the high nest while witnessing a spirited quarrel among three Red-eyed Vireos. The wrangle terminated with one bird flying almost directly to the nest as the other two darted off. There is no further information as to this particular nest, but I wish to record my belief that the Red-eyed Vireo nests high more frequently than has been supposed. High nests are rarely seen save in winter, so the low nests found in summer claim most of the attention. All high vireo nests in the winter woods are usually considered to be Yellow-throated Vireo nests, but some which I have examined certainly looked more like Red-eyed Vireo nests. In any event, the Red-eyed Vireos on the Reserve should be studied further in this respect. Males which sing from high places and do not stop to scold a man walking beneath them may possibly be singing in high nests.

On June 7 I found a nest ten feet from the ground near the end of a six-foot-long branch, one of the lowest branches in a ten-inch (d.b.h.) hickory growing in open woodland on a low ridge between kettle holes just southwest of Buck Hollow. The nest was beautifully sheltered by large leaves and contained three fresh vireo eggs. The female flew from the nest as I walked directly beneath it. On June 8, the brooding parent (the female?) flew from the nest when I walked under the tree. On June 22, I saw both parents fly to the nest with food and heard them scolding loudly when a Cooper's Hawk perched momentarily high in a tree about sixty yards away. On June 27, I noted that as I approached the nest tree I was not scolded until I was within fourteen yards. That day I saw the bill of a young bird protruding above the nest rim. On June 28, I climbed up to find that the only occupant of the nest was a well-developed Cowbird, which fluttered off when I touched it. The nest was lop-sided and all but torn from its mooring on one side. No trace of vireo eggs or young was on the ground beneath the nest. A male vireo that sang as I approached the nest was fully fifty to sixty feet above ground and almost directly above

the nest. Since this male did not stop singing while I was being scolded by two adult vireos at the nest, I could not help thinking that I was below another Red-eyed Vireo nest territory (see Williams, 1936: 379).

A new nest which I found at the edge of the Big Woods west of Big Island on June 20 probably had been deserted. I never saw adult birds near it, and there was no evidence, such as particles of feather sheath or droppings, that young had been reared in it. This nest was six feet from the ground in a small oak sapling.

The only occupied nest of the Red-eyed Vireo which I observed in 1947 was one first found by Andrew J. Berger on June 21. At that time it held four vireo eggs and one Cowbird egg. The nest was about five feet from the ground on a horizontal branch in a ten-foot-high white oak sapling at the edge of a road in the middle of Southwest Woods. I discovered it independently, on June 24, when the brooding vireo slipped quietly off the nest as I passed about six feet from it on the road. Neither parent vireo scolded very loudly while I was in the vicinity.

The fortunes of this nest have been described by Kenneth W. Prescott (1947). Briefly, they are as follows: On June 21 and June 24, the nest held four vireo eggs and one Cowbird egg. On June 27, it held four vireo eggs and two Cowbird eggs. Early in the morning (between 4:55 and about 5:00 o'clock) on June 28, Prescott saw a female Cowbird go to the nest. A male Scarlet Tanager joined the two vireos in driving the Cowbird off, but not before she had "made a distinct pecking motion at the nest," presumably throwing out a vireo egg, and "settled on, or over, the nest," presumably depositing an egg of her own. "After this occurrence, the nest contained six eggs," perhaps three Cowbird and three vireo eggs, rather than four vireo and two Cowbird eggs.

On June 30, between 11:15 A. M. and 2:26 P. M., a Cowbird egg hatched (nest contents at that moment: one young Cowbird, one Cowbird egg, and two vireo eggs). At 7:35 A. M. on July 2, the nest held one young Cowbird, two Cowbird eggs, and one vireo egg (a female Cowbird presumably had tossed out a vireo egg before depositing one of her own). Between 7:35 A. M. and 1:00 P. M. that day the vireo egg hatched. On July 3, at 3:30 P. M., the nest contents were: one young Cowbird, one young vireo, and two Cowbird eggs. The young birds were easily distinguishable because the mouth lining of the Cowbird was light red, whereas that of the young vireo was yellow. They were not strikingly different in size. On July 7 and 8, the nest contained the two nestlings and one Cowbird egg. On July 10, it contained only the two nestlings. That day "the Cowbird (aged ten days) was able to fly a few feet; the vireo nestling (aged eight days) was quiet, seemed weak, and kept its eyes closed most of the time." On July 14, the nest was empty. Whether both the young Cowbird and the young vireo

survived no one knows. I suspect that the Cowbird did and that the vireo did not.

In 1948 Andrew J. Berger found a nest on a steep slope in the Big Woods just east of Buck Hollow. It was about four feet from the ground near the end of a much bent-over oak sapling in a well-shaded place. On June 20, when found, it contained one young vireo, one vireo egg, and one young Cowbird. On June 26, it held two vireos and one Cowbird. On June 28 it was empty. The brood was probably destroyed by a predator.

A brief analysis of the eight nests of the Red-eyed Vireo is as follows:

Two were deserted before being finished, possibly because of exposed position resulting in part from lateness of the spring and retarded growth of leaves.

One was deserted after four Cowbird eggs had been laid. How many vireo eggs were removed by the Cowbird I do not know.

One was deserted just after being finished or after one or more eggs had been destroyed by a predator.

One was an exceptionally high nest (forty to fifty feet), the contents of which I never ascertained.

Three were more or less "successful." Total broods therefrom were: (a) one Cowbird; (b) one Cowbird (probably) and one vireo (possibly); and (c) one Cowbird (possibly) and two vireos (possibly).

Kendeigh (1942: 21) considered that the Red-eyed Vireos of Hillcrest Farm (a fifteen-acre tract near Cleveland, Ohio) were "70-60 per cent" successful in their nesting from 1921 to 1939. The data summarized here clearly show that eight nestings of the Red-eyed Vireos on the George Reserve were far less than "70-60 per cent" successful.

The Cowbird frequently parasitizes the Red-eyed Vireo on the Reserve. In addition to the instances reported above, I mention briefly the following: (1) On July 11, 1934, I collected a young Cowbird, which was being fed by a Red-eyed Vireo. (2) On July 14, 1934, I followed a pair of Red-eyed Vireos about the Big Woods for some time, before I finally ascertained that the only young bird they were caring for was a Cowbird. (3) On July 10, 1935, I found an empty and deserted Red-eyed Vireo's nest in a witch hazel plant in the Big Woods. On the ground almost directly beneath the nest was an unincubated Cowbird's egg with an irregular hole in the side. (4) On August 3, 1935, I observed a Red-eyed Vireo feeding a young Cowbird about thirty feet above ground in a large oak in the Big Woods. (5) On July 22, 1936, I saw a Red-eyed Vireo feeding a young Cowbird. (6) On July 27, 1942, I followed a pair of Red-eyed Vireos about the Northwest Woods, finally learning that their brood consisted of at least one Cowbird and one vireo. So far as I could tell both parent vireos were feeding the two young birds.

It is significant that I have on only five occasions during eight periods of summer work observed a parent Red-eyed Vireo feeding one or more young vireos and not at the same time caring for a young Cowbird. These five occasions were as follows: (1) On July 14, 1942, in Tract 15, I watched one adult vireo feeding two young vireos not long out of the nest. (2) On July 24, 1942, on Big Island, I saw one adult vireo caring for two young vireos. (3) August 5, 1942, in the Big Woods, I saw one adult vireo being followed by one young vireo. (4) On June 24, 1944, along the edge of Big Island, I saw an adult vireo and one young vireo just out of the nest. (5) On July 5, 1946, in the North Woods, I saw one adult vireo feeding one young vireo which had just left the nest. I realize that these data are not very satisfactory. In no instance did I see both adult vireos or what I knew to be the whole brood of young. Since Red-eyed Vireo broods probably split up shortly after leaving the nest, as warbler broods usually do, some of the young vireos just mentioned may possibly have had Cowbirds as nest mates. Young Cowbirds are much noisier than young Red-eyed Vireos when begging for food, however, and they beg insistently for days after they have left the nest. After years of experience in bird observing, I cannot believe that in the five instances just mentioned the observed parent vireo was also caring for a young Cowbird. As for what the other parent vireo was doing, I cannot say.

I have yet to sketch from life a nestling Red-eyed Vireo. Indeed, I have never handled a living one in a plumage stage quite comparable to that of the young Warbling Vireo and young Yellow-throated Vireo which I painted direct from life in the summer of 1946. The juvenal Red-eye is much browner than the adult on the crown as well as throughout the back, wings, and tail.

I have no data concerning the postjuvinal molt aside from the following: (1) On August 5, 1934, I saw two molting young birds at the edge of the Big Tamarack Swamp near Big Island. They were brown-eyed. (2) On September 14, 1940, an immature female specimen which I collected was in complete first-winter plumage. It was not very fat and weighed 18.7 grams. Its eyes were "dark brown." The back, wings, tail, sides, flanks, and under tail coverts were considerably brighter in general tone than those of an adult male taken July 15, 1934 (see below).

In regard to the postnuptial molt, I offer the following data: (1) On July 15, 1934, I collected an adult male (with greatly enlarged testes) which had not yet started to molt. It was thin, weighing only 15.4 grams. (2) On each of the following dates I caught in a net and banded a single nonmolting adult bird: July 15, 1934 (male, breeding plumage soiled but not badly worn), July 23, 1934 (probably a male), July 26, 1940 (sex ?),

July 30, 1936 (sex ?), August 3, 1936 (sex ?). (3) On July 29, 1942, in the North Woods, I saw an adult (red-eyed) bird which was obviously molting. (4) On August 5, 1942, in the South Woods, I saw an adult (red-eyed) bird which appeared to be in complete plumage, but whether it had molted or not I did not know. (5) On August 29, 1946, I "squeaked up" an adult (red-eyed) bird, which certainly did not appear to be molting. It might have been in complete winter plumage since it was bright in tone.

*Vireo gilvus gilvus* (Vieillot)

EASTERN WARBLING VIREO

The Warbling Vireo is considered a common summer resident in southern Michigan (Van Tyne, 1938: 31), but is neither common nor widely distributed on the George Reserve proper, presumably because only a small part of the woodland there meets its nesting requirements. Even after the young have left the nests and the whole population has spread out, it does not ordinarily feed in, or even along the edges of, the oak-hickory forest, nor in the tamarack swamplands, nor among such shrubs as the poison sumac and dwarf birch. Throughout the summer it shows a strong preference for scattered maples, elms, ashes, and various poplars. At this season it customarily keeps well above ground, often in the very tops of the trees, and though not a particularly shy bird it is not conspicuous.

The singing of this vireo is a good index to its breeding habitat, nest territories, and feeding grounds; the males continue to sing throughout the summer. Their singing is most fervent during the earlier part of the season (June and July), but adult males sing occasionally while they are molting, and young males learn to sing fairly well before they leave for the south in late September and early October (see Wood and Tinker, 1934: 38). In 1946 I made a point of observing the young birds which frequented the trees along the east side of Southwest Swamp, and I noted that some of them sang "more or less full songs" from August 17 to mid-September.

The singing is a surprisingly good guide to the nest itself, for the male often sings near by or on it. This is true during the entire period of nidification, for he gathers at least some of the nest material, stays with the female almost constantly while she builds the nest, occasionally visits the nest during the three or four days on which eggs are laid, and assumes a considerable share of the incubating. I had opportunity to check this repeatedly in 1946, for that year one pair nested in a large elm near the laboratory, and I made observations at four other nests in the southwest corner of the Reserve.

It might appear from what I have written so far that I have seen much of the Warbling Vireo in the course of this study. Such is not the case. In 1934, I recorded the species only three times: two singing males on August 5; one singing male, August 11; and one singing male, August 12. In 1935 I recorded it once, on July 24, when I collected a molting immature female (weight, 14.7 grams) which was begging food from a parent among the aspens at the north end of Southwest Swamp. In 1936 I saw a pair in small elms near the south gate on July 23, collected a female in complete first winter plumage two miles south of Gregory on July 28, noted "a few" on the Reserve on July 31, saw a family group in the Camburn yard on August 3, and saw two along Doyle Road east of the Camburn house on August 16. One of these, an adult male in fresh winter feather, I collected. The plumage of the hind neck and upper back was badly matted with caterpillar silk. It weighed 14.1 grams.

In 1940 I saw an adult bird and two young in what appeared to be complete first-winter plumage, in a fallen apple tree in the Camburn yard on July 17, heard an adult male singing along Doyle Road east of the Camburn house on July 18, and encountered a family group (two adults and two to four young) in aspens near the north end of Southwest Swamp on July 19. The young birds were as large as their parents, but were still begging for food.

Whether or not the raising of the water level in Southwest Swamp and Fishhook Marsh in 1938 has had a direct bearing upon the breeding population, the Warbling Vireo has certainly become more common there since 1940, whereas the Red-eyed Vireo has grown less common or has disappeared. From July 10 to 22, 1942, I recorded the Warbling Vireo repeatedly, principally in Southwest Swamp and at the south end of Fishhook Marsh, but also in mixed woods along the fence west of West Marsh (one singing male, July 17), and in willows and a large poplar at the extreme southeast corner of the Reserve (one singing male probably with a female, July 18).

On May 27, 1943, the Hamerstroms found an unfinished nest about thirty feet from the ground in an eight-inch (d.b.h.) large-toothed aspen on the east side of Fishhook Marsh. Both birds were seen that day going to the nest with fine materials, which were probably intended for the lining. From the ground the structure appeared to be finished.

From June 24 to July 3, 1944, I heard two males singing repeatedly in and about Southwest Swamp, one at the north end, June 24; two along the "borders," June 25; two "in maples, etc. along western shore," June 27. Two pairs, possibly three, nested in the general vicinity of the laboratory that year. Just west of the Big Cattail Marsh I heard two singing males June 27 to 30, and on June 27 found the nest of one pair forty feet

from the ground in a tall oak standing not far from the water's edge. The young were being fed insects gathered chiefly within ten yards of the nest approximately at nest level. They must have been small, for I could not see even their heads above the nest's rim with the glass. The parent birds were scolding a good deal while I was under the nest tree, especially when agitated Redwings (*Agelaius phoeniceus*) alighted in aspens close by. On July 3 I heard one male singing in trees along Kelly Road just outside the fence east of East Marsh. The total breeding population of Warbling Vireos on the Reserve in that summer probably was five or six pairs.

In 1946 I spent a good deal of time watching the Warbling Vireos of Southwest Swamp and Fishhook Marsh. The day of my arrival, May 26, three males were singing persistently in this area. Hoping there was a nest near the laboratory, I spent two hours (5 to 7 P.M.) observing the birds. During this period two males sang on the east side of Southwest Swamp and one male on the west side. The two on the east side were widely separated most of the time; the nearer one sang in the tops of the aspens, maples, elms, and ashes which line the margin from the large elm just southwest of the laboratory to a clump of tall aspens one hundred and ninety paces to the southwestward; the farther one sang from these aspens on to the southernmost tip of the swamp. When the two males met in the borderline aspens, there was a dispute which usually wound up in the return of the birds to points several rods to the northeast and southwest, respectively. The more I saw of the nearer bird, the more convinced I was that he had a mate. Several times during the two-hour period I saw near or with him a nonsinging bird which crouched and fluttered its wings in the manner of a young bird begging food. This bird joined him in scolding the Bronzed Grackles (*Quiscalus quiscula versicolor*) which flew from the swamp through certain trees to feeding grounds south of the fence. This scolding of the grackles, I realized, centered in the "Lab elm," the tree which seemed to mark the northern limit of the male's singing. Shortly before seven o'clock I saw a male Baltimore Oriole and a Warbling Vireo chasing a grackle fiercely from this elm. As the oriole had a nest on the east side of the tree, I understood its animosity. Suddenly, I saw that there were two vireos rather than one. One of these flew to a maple top about fifteen yards away and started to sing. The other stopped scolding, began to flutter its wings as if in a sort of ecstasy at hearing the song, flew across to the tree where the male was, and then returned to the elm, straight to a beautiful nest. I now knew that the nonsinging, wing-fluttering bird was the female of the pair. Twenty minutes earlier I had seen the male capture a big green caterpillar which I had fondly hoped he would take to his mate at the nest, but which he had proceeded to swallow. The nest (No. 1) appeared to be finished and was about thirty-five feet from the

ground near the end of a long slender branch directly opposite from, but several feet higher than, the orioles' nest. It was surrounded by leafage and was wholly invisible from directly below. To see it I had to step well out from under the tree.

The following day (May 27) I went to look at the nest at 6 A.M. and discovered that it was not quite finished. The female bird was busy gathering caterpillar webbing and other materials in the upper third of a forty-foot-high wild cherry at the swamp edge about fifteen yards away. Occasionally, she gave a sputtering call—a harsh though not very noticeable “teh, teh, teh,” or “ch eh, ch eh, ch eh.” The male, which continued to sing from a favorite aspen, did not join her while I watched. Nest building continued until about 10 A.M.

That afternoon, with the help of two friends, Lawrence Camburn fastened an extension ladder to a truck placed under the tree, guying the ladder securely in such a way as to permit me to climb straight to the nest without propping the ladder against the slender branches. This operation required about an hour. I was afraid that the conspicuous paraphernalia and disturbance might cause the birds to desert, especially if I remained long, so I promptly withdrew and gave my attention first to the male which had been singing at the south end of the swamp, then to the male on the west side. The male at the south end wandered about a good deal and kept high in the trees which stood close to the water's edge. I am not sure that he had a mate. In any event I saw no nonsinging bird with him and found no nest there.

I found the male on the west side and his mate without difficulty. While the male sang, the female sometimes scolded, sometimes spread and fluttered her wings just as the female at Nest 1 had. Following her closely and heeding especially the intensity of her scolding, I soon found the nest (No. 2); it was in a leaning, thirty-foot-high silver maple, at the tip of a long, slender, horizontal branch, eighteen feet above water fifteen inches deep and about thirty-five yards out from shore. To reach the nest I had to climb an ash which grew close by, lean out from one of the main trunks, grasp a branch of the maple, and pull the whole tree toward me. The nest was fully finished but empty.

At the extreme north end of Southwest Swamp, in a clump of aspens along the road between the swamp and Fishhook Marsh, I observed two Warbling Vireos which behaved as if paired. One of them obviously was a male, for it continued to sing fervently; the other probably was a female, although it gave once what sounded like an abbreviated song. These birds flitted from tree to tree, did not seem to be closely attached to one spot, and eventually flew northeastward across Fishhook Marsh to another group of aspens.

On May 28, I went up the ladder to Nest 1 in the "Lab elm," finding it to be empty. From a position twelve yards south of the tree, I made observations from 2:10 to 3:40 P.M. From 2:10 to 2:24, the male sang at the rate of five or six songs a minute, each song lasting three to three-and-one-half seconds. During this period I did not know where the female was. She certainly was not on or very near the nest. At 2:25, there was a break in the male's singing as the female appeared at the nest and stood in it. The male resumed his singing. Until 2:33, the female continued to stand in the nest; she then left the tree. At 2:41, she returned and settled in the nest as the male continued his singing. At 2:45, the male began to scold loudly. The female stood up, listening, and darted from the tree. Following her, I found both vireos scolding a Bronzed Grackle, which was about fifteen yards from the vireos' nest, and which flew off on seeing me. The male vireo now returned to his favorite aspen to resume his singing, and the female flew straight to the nest and settled down. At 2:48, the male came to the nest tree and sang about three feet directly above the nest. At 2:50, the female left the nest and flew off with her mate. At 3:07, a vireo whose behavior did not seem like that of the female bird under observation came to the nest. Since no male bird was singing anywhere close by I decided this must be the male. At any rate it perched on and stood in the nest. At 3:08, there was a brief song from the nest; at 3:11, a full-length song; at 3:11½, another full-length song; and at 3:16, another full-length song. At 3:28, I heard a loud "chit, chit" from the female high in a tree to the southwest. The male at once flew from the nest to join her. At 3:33 both birds returned to the nest tree, one chasing the other briskly through the upper branches.

On the west side of Southwest Swamp I had some trouble relocating Nest 2. The male, to my surprise, was not singing much. Finally I saw the two birds and followed them about until one of them went to the nest. As the female settled down, the male began to sing volubly.

While at Nest 2 I heard a Warbling Vireo singing well to the south on the west side of the swamp. Since I heard no singing at the south end on the east side I suspected that the male there had moved westward.

On May 29, I listened carefully to the singing and decided that five males were established along the borders of Southwest Swamp: one at Nest 1, one at Nest 2, one to the south of Nest 2 near the westernmost arm of the tract, one at the extreme south end, and one at the extreme north end. I heard an occasional song from Fishhook Marsh to the north, but could not be sure that this was from an additional bird. I climbed to Nests 1 and 2 that day in the early afternoon, finding both of them empty. At Nest 2 the birds paid little attention to me as I started up the ash near the nest tree; but they dived at me, snapping their bills and scolding sharply, when I pulled

the nest over for examination. As I was leaving, the male broke into song when I was about fifteen paces from the nest tree.

On May 30 I saw no bird at or near Nest 1 when I inspected it from the ground at 11 A.M., but I found one egg in it when I climbed up at 1:30 that afternoon. The bird which went to the nest shortly after I descended was the male; it sang a full song a few minutes after settling down. The birds did not scold me that day as I walked toward the nest tree. They scolded mildly as I started up the ladder. They did not dive at me, even when my hand was on the nest. At 2 P.M. I examined Nest 2, finding it empty.

On May 31, at 1:05 P.M. (after a light rain lasting ten minutes), I climbed to Nest 1 and found two eggs. I did not see either bird and was not scolded. Nest 2 I did not examine. Along the easternmost edge of Fishhook Marsh I watched two Warbling Vireos for a time and located their nest (No. 3) about forty feet from the ground in a slender seven-inch (d.b.h) aspen which was fifty feet high. Nest 3 was on a slender horizontal branch about five feet out from the main trunk and plainly visible from one point under the tree. A male vireo was singing in the aspens, maples, and elms close by. I did not see a female bird and did not climb to the nest.

On June 1, a bird was sitting on Nest 1 at 7:15 A.M., but I heard no singing in the immediate vicinity. This may have been because the morning was cold and wet. At 1:30 P.M., there were three eggs in the nest. The birds did not scold me while I was examining the nest. I did not inspect Nests 2 and 3.

On June 2 a bird was sitting in Nest 1 at 1:30 P.M. The nest held four eggs. The birds scolded me very little while I was at the nest. At Nest 2 I found two eggs at 4:30 P.M. At this nest the birds gave fierce battle, continuing to dive at me and scold loudly while I was descending and wading to shore.

On June 3 I did not climb to Nest 1, for I felt reasonably sure that the clutch was complete and I did not want to disturb the birds more than was necessary. In Nest 2 I found three eggs at 5 P.M. The birds fought me hard, as usual, this time actually pecking my hair.

On June 4 I saw a bird on Nest 1 at 1 P.M. I did not visit Nest 2. In Nest 3, after a slippery climb, I found one egg. I did not see nor hear the birds at this nest.

On June 5 and 6 I visited Nest 1 twice daily, seeing a bird on the nest at each visit. Nests 2 and 3 I did not visit during this period.

On June 7 a Warbling Vireo scolded me at the extreme north end of Southwest Swamp from a group of trees in which I had heard a male singing persistently on May 29. Believing that this scolding indicated a nest territory, I followed the bird and soon discovered its favorite haunt was a fringe of elms, maples, and aspens at the southernmost end of Fishhook

Marsh. Presently, a second bird appeared and scolded a little but did not sing. If these two birds were a pair, were they an entirely new pair which had just moved in from somewhere outside the Reserve, or one which I had overlooked day after day?

I now believe that they were the "Lab elm" pair, for when I visited Nest 1 the following day (June 8) I neither saw nor heard a Warbling Vireo anywhere in the immediate vicinity. I was not scolded when I climbed the ladder, and all that I found in the nest was a broken egg. The territory had been deserted some time between 1:30 P.M. on June 6 and 6 A.M. on June 8.

On June 9 I spent some time watching the male vireo which now seemed to be well established at the south end of Fishhook Marsh. I did not see his mate. But when I observed him lunging at a Redwing which chanced to alight near him, I felt that a nest had been, or was being, built close by. In this I was correct. Four days later, early in the afternoon, I noticed, as I walked northwestward between Southwest Swamp and Fishhook Marsh, that the male vireo was singing somewhat farther east than I had heard him. The song seemed to come from a twenty-five-foot-high elm, the easternmost of a fringe of trees along the south shore of Fishhook Marsh. When I returned about 6 P.M., I found the pair of vireos scolding and diving at a Blue Jay, which was preening itself vigorously just after a bath. When the jay had been driven off and the scolding had stopped, both vireos flew straight to the elm in which I had heard the male singing four hours earlier. As I walked toward this tree the singing started again. After several minutes of bewildered searching, I found the male sitting in the nest, singing loudly. The female scolded me mildly from a maple not far away. Her manner called to mind instantly that of the female at Nest 1. The new nest (No. 4) was eighteen feet above the ground, four feet from the end of an upward-sloping branch. It was seven feet out from one of the main stems of the elm, over water ten inches deep, and fairly well hidden among leaves. The male was not in the least reticent about his singing. He turned his head from side to side while peering out and down, but eyed me and my raised binocular without evincing suspicion. I did not climb to the nest that day.

Near Nest 3 I heard singing from June 7 to 9, but I did not see a bird on the nest during this period. On June 14, I climbed up to find the nest empty. No bird sang or scolded in the immediate vicinity while I was in the nest tree.

At Nest 2 I continued to hear singing and to see one or two birds about until June 11. On June 11 I did not actually see a bird on the nest. The territory was abandoned some time between June 11 and 17. On June 17 I found the nest empty.

On Nest 4 the male vireo sang a great deal from June 14 to 17. On June 15 I ascertained that the singing was actually from the nest. During three brief visits to the nest tree that day (6:25, 7:30, and 11:55 A.M.) the male sang repeatedly from the nest. I was not scolded by the female even when I was about twenty-five feet from the nest.

On June 17 I visited Nest 4 at 3:30 P.M. The male was on the nest, singing as usual. As there was more singing to the southwest, I made my way southward past the deserted Nest 3 and marked carefully the place from which the singing came. The closer I drew the surer I was that only one bird was singing and that it was staying in one spot. Wading out through water about knee-deep, and using the glass constantly, I found the singer. There he was, in a nest as I had expected, singing full songs at ten- to twenty-second intervals.

The nest (No. 5) was about thirty feet above water eighteen inches deep, in a forty-five-foot-high ash standing about fifteen yards from the edge of the marsh. The nest was toward the end of a somewhat upward-sloping branch, eight feet from the main trunk. It was well hidden by leaves, though the whole branch was separate from the tree's principal crown. As I stood under the tree I was not scolded by the female, and the male continued to sing.

On June 21 I made a round of the Reserve looking especially for Warbling Vireos. In the southwest quarter I heard a singing male at each of the following places: at Nest 4; at Nest 5; in the very middle of Southwest Swamp among living elms, maples, and ashes, and dead trees of several kinds; at the extreme south end of Southwest Swamp; and on the east side of the Big Cattail Marsh in aspens. There was no indication that young were being fed anywhere.

On June 22 I spent some time watching the bird on Nest 4. Between 5:30 and 5:45 A.M. it did not sing, whereas another bird sang repeatedly in trees ten to twenty yards to the west. The bird on the nest was almost certainly the female, and the singing bird her mate.

On June 23, I again heard a Warbling Vireo singing in the "Lab elm." Singing there was virtually continuous from 5:15 to 6:15 A.M., and for a considerable period (perhaps twenty minutes) late in the evening. From June 24 to 28 a male bird sang hundreds of songs daily from this tree, and I believe a pair nested there in latter June and July, but I did not find the nest.

On June 27 I failed to see a bird at or near Nest 4 and wondered if the pair there, possibly the same pair that built Nest 1, had deserted and returned to the "Lab elm."

On June 29 I went to Nest 5 and found that the singing had practically stopped and the feeding of the young had begun. I saw one of the parent

birds come to the nest with a small green caterpillar. When a Redwing alighted in the nest tree both vireos attacked fiercely and drove it off. I went to this nest again on July 1 and found one parent on the nest brooding the young. The only singing in the vicinity was from two males on other territories, one far to the southeast, the other at the "Lab elm."

On July 3 I climbed to Nest 4 for the first time and found four well-developed young, one of which stood up, lifted its wings high, and stretched. The parent vireos came close while I was at the nest and scolded me sharply. The cry of the largest young one, which I took with me in order to paint it direct from life, was much like one of the cries given frequently by the adult at the nest. The mouth lining of the young bird was bright straw yellow, the feet pale blue-gray and flesh color, the eyes very dark brown. The plumage was surprisingly pale and was almost wholly without olive or yellow tones. I made paintings of two of the young from Nest 4. The other two left the nest in good order on July 4. I believe the brood at Nest 5 left on the same day. I am not sure how many there were in that brood.

On July 5 I heard a commotion just west of the Camburn Laboratory. Two Warbling Vireos were darting at and scolding a Blue Jay which, on seeing me, promptly changed its role from that of a methodical nest-finder to that of a timid, if not persecuted, creature and darted off. The behavior of the vireos toward the jay convinced me that they had a nest close by, but I never discovered it. The rest of the summer Warbling Vireos continued to sing about Southwest Swamp and Fishhook Marsh. One of these singing males Alfred Brandt collected on July 11. It was not fat and weighed 14 grams. The testes were greatly enlarged; it had not yet started to molt.

On July 25, I collected near the south gate a young bird in the middle of the postjuvinal molt. From the estimated age and the nearness to Fishhook Marsh, I thought it might be one of the young birds from Nest 4 (see above).

On July 29, a pair of vireos and several stub-tailed young, possibly a second brood for the year, appeared in an elm tree just north of the laboratory. Their food cry, as they fluttered their wings, was a lisped "ti, ti, ti," or "chi, chi, chi."

In 1947, I recorded Warbling Vireos almost daily from July 14 to 29, noting that one or two males sang full songs throughout that period along the edges of Southwest Swamp and Fishhook Marsh. On July 29, I saw a family group (the young with somewhat stubby tails) in aspens near the south end of Fishhook Marsh.

In 1948, four or five pairs of Warbling Vireos summered in and about Southwest Swamp and one pair summered in the woods just west of

Big Cattail Marsh. On June 1, H. B. Tordoff and I found a nest with three fresh-looking eggs in a large living silver maple near the middle of the north end of Southwest Swamp. Most of the trees thereabouts were dead, but living maples, elms, red ashes, and wild cherries stood within a radius of about seventy-five yards. The nest was eight feet from the main trunk and four feet from the tip of a horizontal branch and was rather well sheltered by leaves, though the branch as a whole was not well shaded. The nest was about eighteen feet above water two feet deep. We had heard Warbling Vireos scolding from that tree earlier in the day. The incubating bird stayed on her eggs until I grasped the branch from which the nest was suspended.

The young female in complete first-winter plumage which I collected on July 28, 1936, furnished good evidence that the postjuvinal molt may be completed in some individuals long in advance of migration. An adult male in beautiful fresh feather, collected August 16, 1936 (see p. 27), had not quite completed the postnuptial molt. The large outer primaries were still somewhat in sheath and the tiny, spurious, outermost primary had not yet appeared.

#### SUMMARY

1. This study of the vireos (Vireonidae) which breed on the Edwin S. George Reserve, near Pinckney, Livingston County, Michigan, was many times interrupted, but covers a period of fourteen years (1934-1948). The water level of a low-lying tract known as Southwest Swamp was raised during the course of the study and most of the trees of the middle part of the tract died. The following shifts in Vireo population took place, probably as a direct result: the Red-eyed Vireo disappeared wholly from that tract, the Yellow-throated Vireo withdrew from the middle part, and the Warbling Vireo established itself, principally in trees along the edge.

2. Throughout the rest of the Reserve the breeding population of the three species did not fluctuate noticeably. Many pairs of Yellow-throated and Red-eyed Vireos bred regularly in the five major tracts of oak-hickory woodland, and a pair of Warbling Vireos bred more or less regularly in a small oak-poplar tract at the edge of a cattail marsh.

3. Yellow-throated Vireos nested high and low in open oak-hickory woodland. Red-eyed Vireos nested high and low (most nests which I actually saw were low) in open to dense oak-hickory woodland. Warbling Vireos nested in fringes of trees (elms, maples, ashes, and aspens) which bordered low, wet areas.

4. Some Yellow-throated Vireo nests were in exposed positions but in shade most of the time. Red-eyed Vireo nests were usually more or less hidden by leaves and in well-shaded parts of the woods. Warbling Vireo

nests were among leaves on branches which were in direct sunlight part of the time.

5. The Red-eyed Vireo was heavily parasitized by the Cowbird, but the Yellow-throated Vireo was not. Only once did I find a Yellow-throated Vireo caring for a fully fledged Cowbird out of the nest. One parasitized Yellow-throated Vireo nest was wholly unsuccessful; one nonparasitized nest was wholly successful. Several broods of Yellow-throated Vireos which I encountered had no Cowbirds among them. As for the Warbling Vireo, not once did I see that species caring for a young Cowbird, nor did I find a parasitized nest. One nest was broken up, however, either by a predator or by a Cowbird.

6. During the fourteen-year period I never observed any vireo chasing a vireo of another species as if in defense of a nest territory. This I regard as evidence that among the vireos on the Reserve singing constitutes adequate defense of nest territory. If this is the case, it may account in part for the almost continuous singing of male vireos during much of the summer.

7. Young male Yellow-throated, Red-eyed, and Warbling Vireos all learn to sing fairly well before leaving for the south in the fall. Their singing at this time is probably not territory defense of any sort, but practice for future nest-territory defense.

8. The young of the Yellow-throated Vireo are readily identifiable by their yellow throat, yellow eye ring, and two white wing bars at the time of leaving the nest. The young of the Red-eyed and Warbling Vireos at the same plumage stage are far browner above than are the adults. They are not readily identifiable by color, but their behavior and call notes have an unmistakably vireo-like character.

9. Yellow-throated, Red-eyed, and Warbling Vireos may occasionally rear two broods in one season on the Reserve, as they are believed to do elsewhere, but color banding of adult birds and careful observation are needed to confirm or disprove this. Late nestings which I observed could have been the result of predation or of Cowbird parasitism. Pairs of vireos whose first nests are broken up undoubtedly make other attempts, possibly several, to rear a brood, and this would oblige them to nest late.

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PLATE I

Young Yellow-throated Vireo (*Vireo flavifrons*) just after leaving the nest. Painted direct from life, June 30, 1946, at the Edwin S. George Reserve.

PLATE I



PLATE II

Yellow-throated Vireo and nest containing a young Cowbird  
and two Yellow-throated Vireo eggs.

Photograph taken on the Edwin S. George Reserve by Eliot  
Porter, June 16, 1946.

PLATE II



PLATE III

Yellow-throated Vireo about to feed young the thorax and abdomen of a large dragonfly.

Photograph taken on the Edwin S. George Reserve by Alfred E. Brandt, June 29, 1946.

PLATE III



PLATE IV

Oak-hickory woodland on the Edwin S. George Reserve.  
The Yellow-throated Vireo often nests high, and the Red-eyed  
Vireo low, in this habitat.

Photograph taken by J. Speed Rogers, July 26, 1938.

PLATE IV



PLATE V

Aerial photograph of the Edwin S. George Reserve, showing  
the principal Vireo habitats.

- |                          |                               |
|--------------------------|-------------------------------|
| 1. Southwest Swamp       | 11. Big Woods                 |
| 2. Southwest Woods       | 12. Buck Hollow               |
| 3. Fishhook Marsh        | 13. Hidden Lake               |
| 4. Dollar Tamarack Swamp | 14. Big Island                |
| 5. West Woods            | 15. Big Cattail Marsh Woods   |
| 6. Kirtland Woods        | 16. South Woods               |
| 7. Fawn Hill             | 17. Juniper Hill              |
| 8. Northwest Woods       | 18. Kelly Woods               |
| 9. Big Cassandra Bog     | 19. Tract south of Crane Pond |
| 10. North Woods          | 20. Burt Woods                |

PLATE V





(Continued from inside front cover)

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