A NESTING STUDY OF THE RED-EYED VIREO

VIREO OLIVACEUS (LINNAEUS)

by

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A report of an original field study conducted as a requirement for Advanced Ornithological Studies (Zoology 231), University of Michigan Biological Station

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INTRODUCTION

The following study of the nesting habits of the Red-eyed Vireo (Vireo olivaceous, Linneus) was conducted at the University of Michigan Biological Station during the summer of 1944. The Biological Station is located on the south shore of Douglas Lake in Cheboygan county, Michigan. The territory immediately surrounding the Station consists of rather open woodland consisting largely of birch (Betula alba, var. papyrifera), aspen (Populus grandidentata, P. tremuloides), maple (Acer rubrum, A. saccharum), and white pine (Pinus Strobus). The ground cover consists largely of bracken (Pteris aquilina), blueberries (Vaccinium canadense and V. pennsylvanicum), and wintergreen (Gaultheria procumbens).

Activities and observations relating to this study were begun on July 7 and continued through August 15. During that time approximately 100 hours were spent searching for nests; 42¼ hours observing the one occupied from the ground during the incubation period; 98 hours observing from a blind the nesting activities during the nestling period of the same nest; and six hours trying to locate the young after leaving the nest. The total time spent in observation of this one nest was 146 hours.

Seven nests of the Red-eyed Vireo were located, only three of which were occupied. Of these three detailed observations were made on only one nest as it was the only one containing vireo eggs. The other two occupied nests contained cowbirds, one of which left the nest

the day after it was found. The other cowbird evidently met with disaster as the nest was empty two days after I found it at which time, the cowbird appeared to be newly hatched.

The nest upon which all data was collected contained three vireo eggs and one cowbird egg on the day it was found--July 7. Another cowbird egg was found on the ground beneath the nest. Incubation had already started.

ACKNOWLEDGEMENTS

Grateful acknowledgements are made to Dr. Olin Sewall Pettingill, Jr. for suggestions as to the methods of study and references; to Miss Peggy Muirhead also for helpful suggestions and for the location of a nest; to Mrs. Lloyd Freer for assistance in locating another nest; and to Mr. James Norman for identification of insects and larvae.

DESCRIPTION OF BIRD

As stated above only one nest of the Red-eyed Vireo was studied in detail. Consequently there was ample time to observe the coloration and markings of the pair. In distinguishing between male and female I am assuming that the female vireo does not sing. No attempt was made to trap and band the two adults for fear of causing desertion. The adult who spent the most time at the nest--presumably the female and hereafter referred to in that way--had the following coloration:

Top of head--slate gray
Medium gray line through eye
Grayish white line above the eye bordered by thin black line
Side of face--light gray
Throat--pale yellowish white

Gray of head and face blend into soft grayed olive-green of back and wings

Primaries edged with bright yellow-green and are darker gray than secondaries and retrices

Tail--slightly darker than back but has more yellow in it--especially the upper tail coverts

Underparts--yellowish white

The male of this pair was larger and somewhat darker than the female but these differences were so slight that it was possible to observe them only when both birds were present.

A juvenile vireo that was seen being fed by an adult on July 29, was scarcely distinguishable from the adult. The only differences noted were that the cheeks were more buffy than gray and the black line bordering the white one over the eye was less distinct. The young was fully as large as the adult although still being fed by the parent. Another young being fed by an adult on August 18 was noticeable lighter in color all over. The back was not as olive as the adult, but more gray; the head not as dark a gray; the line over the eye not as distinct; and the underparts a pure white except for the crissum which was pale yellow.

HABITAT

The Red-eyed Vireo seems to prefer a rather open woodland of a secondary growth of deciduous trees. For its nesting site it selects an even more open space, six out of the seven nests found being located in small clearings in the woods. In speaking of the birds of the Adirondack forests Silloway (1923:452) states that the Red-eyed Vireo "seems to require a 'margin' of some sort--usually a brook or a bog which breaks the forest canopy in some degree."

The principal trees found in the areas chosen by the vireos for nesting are: red maple, sugar maple, birch, and aspen. Other trees found in fewer numbers are: beech (Fagus grandifolia), basswood (Tilia americana), Moosewood (Acer pennsylvanicum), pin cherry (Prunus virginiana and P. pennsylvanica, service berry (Amelanchier canadensis), red oak (Quercus rubra var. borealis), white pine (Pinus Strobus), and dogwood (Cornus circinata and C. stolonifera). The chief ground cover consists of bracken, wintergreen, blueberries, and bunchberry (Cornus canadensis). Apparently it prefers this type of vegetation in other sections of the country. In southwestern New York state "it is found mainly in maple and beech woods, but also occurs in oak and chestnut, and in shade trees--particularly maples--about farms and along roads." (Saunders, 1923:298)

HABITAT RELATIONS

Birds that sang consistently in the vicinity of the vireo nest studied were: Oven-bird (Seiurus aurocapillus), Whip-poor-will (Antrostomus vociferus), Eastern Wood Pewee (Myiochanes virens), Eastern Chipping Sparrow (Spizella passerina), Black-capped Chickadee (Pentbestes atricapillus), Northern Crested Flycatcher (Myiarchus crinitus boreus), Eastern Purple Finch (Carpodacus purpureus purpureus). Of these the Wood Pewee and Crested Flycatcher were known to have nests nearby. The Oven-bird, Whip-poor-will, and Chipping Sparrow also probably nested nearby although no nests were located.

Birds that were heard singing or calling less frequently in the vicinity were: Robin (Turdus migratorius), Cedar Waxwing (Bombycilla cedrorum), Flicker (Colaptes auratus), Nighthawk (Chordeiles minor), Red-eyed Towhee

(Pipilo erythrophthalmus), Cowbird (Molothrus ater), Purple Martin (Progne subis), and Eastern Kingbird (Tyrannus tyrannus). Nests of all these birds (with the exception, of course, of the parasitic cowbird) were present in the vicinity around the Station but none were discovered immediately around the vireo nest studied except those of the Robin and Cedar Waxwing. Least Flycatchers (Empidonax minimus) nested within about 300 yards of the nest but none were ever seen feeding close to the vireo nest. A Pine Warbler (Dendroica pinus) was heard on two different occasions and seen once. A Scarlet Tanager (Piranga erythromelas) sang intermittently all one day. Neither of these birds, however, nested nearby.

OCCURRENCE IN MICHIGAN

The Red-eyed Vireo is the only member of the vireo family that has been found nesting on the Biological Station property. The nest of a Warbling Vireo (Vireo gilvus), however, was found across the Lake at Ingleside this summer, and during the summer of 1940 the nest of a Blue-headed Vireo (Vireo solitarius) was found in the woods bordering the Indian River Marsh which is located about fifteen miles from the Station on Mullet Lake. The Red-eyed is also abundant throughout the entire state of Michigan including the Upper Peninsula being listed by Barrows (1912: 565) as "our most abundant vireo." In a study of the birds of the Upper Peninsula made in 1932, Wing (1939:169) found it ranked twelfth in frequency, having a frequency of 44% and twenty-third in relative abundance. In the western part of the peninsula it ranked third in frequency (78%) and twelfth in relative abundance (Wing, 1939:172).

The Red-eyed Vireo arrives in southern Michigan from April 28 to May 7 and in northern Michigan two or three weeks later. It departs from the northern section early in September but does not leave the southern part of the state until the middle of October.(Barrows, 1912:565)

On the Station property, the Red-eye has evidently always been abundant. Compton (1914:171) found it to rank fifth in number of individuals seen and 'abundant'--'seen more than twenty times'--in a study of the birds of the Douglas Lake Region conducted during the summers of 1913 and 1914. Wood, Smith, and Gates (1916:17) listed it in 1916 as 'common' in the aspen, bogs, and hardwoods of the Lake region. Linsdale (1936:161), who made a study of the frequency of birds in northern Michigan in the summer of 1924 found a 72% frequency for it. In the summer of 1941 (White, 1941:206) I found a frequency of 100% for it and found it ranked eighth in abundance of individuals seen in a list of 80 species observed in the vicinity of the Station.

THE NEST

LOCATION

The Red-eyed Vireo builds a very neat, compact, and sturdy pensile nest in the fork of a horizontal branch of a small tree. All of the seven nests found this summer were in saplings, the diameter of the trunk of the largest one being $2\frac{1}{4}$ inches at the point of attachment of the nest branch. In this vicinity it seems to prefer the maple trees probably due to the shade and shelter given by the large leaves. Six of the seven nests found were in maple trees: four in red maple and two in sugar maple. The

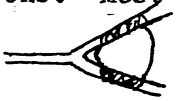
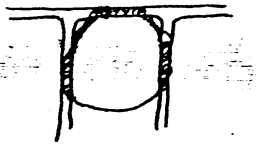
remaining nest was in a basswood, a tree which also has large leaves thus offering some protection from sun and rain. In observations on 32 nests in the east central part of Ohio, beech trees were preferred with silver maple, red maple, white elm, and slippery elm ranking next in order. (Trautman, 1940:342)

The Vireo in this vicinity nests only a few feet from the ground, the highest nest found being only 8' 9½" high and the lowest 4½'. However, in some places the Red-eyed Vireo nest much higher: occasionally 20 to 25 feet up in Michigan (Barrows, 1912:565); four to fifty feet in Massachusetts (Forbush, 1929:180); one to sixty feet in New York (Cruickshank, 1942:367); and eight to eighty feet above the ground in Ohio (Trautman, 1940:342).

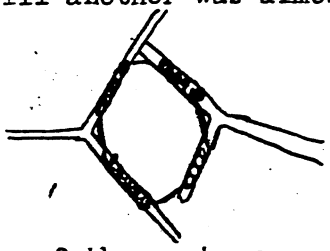
COMPOSITION

The seven nests located this summer all had substantially the same composition, the variation being principally in the amount of birch bark and spider cocoons used on the outside. The bulk of the nest consisted of thin strips of bark and similar plant fibers. The lining was of finer bark fibers, grass, leaves, an occasional grass stem and pine needles. The covering consisted of varying amounts of birch bark and spider cocoons, one nest being completely white with them. On two of the nests pieces of a hornet nest had been included in the covering.

ATTACHMENT

The nests were attached to the limbs by means of strips of bark, from three to five, plant silk from willow catkin, and spider cocoons. Most of them were attached to just two twigs of the tree thus:  However, one vireo showed great ingenuity by attaching it securely to three twigs thus:  In a group of

four nests which had been collected in previous years, one was attached in the same manner, while still another was almost completely encircled by twigs in this manner:



SIZE

The average measurements of the nests were as follows:

	least	greatest
Diameter		
Inside	46.8 mm.	60.9
Outside	61.8	77.3
Depth		
Inside	42.1	
Outside	64.6	

Table 1 gives complete data on all the nests measured. The one labeled 'F-1' is the one studied. Those labeled with small letters are ones collected in previous years and are not included in the average figures. The nests, due to their placement in a fork, are not round but slightly elongated. Consequently there are two sets of diameters for each nest.

EGGS

In the nest studied there were three vireo eggs and one cowbird egg, the measurements of which were as follows:

Vireo eggs:
1. 21mm. by 16.5
2. 21 by 15
3. 21.5 by 16

Cowbird egg:
23 by 17.5

According to Barrows (1912:565) the eggs vary from three to five, mostly four, and Forbush (1929:180) gives a variation from two to four, usually three or four. The eggs are uniformly white sparsely spotted with umber.

SUMMARY OF NESTING EVENTS

A brief summary of the nest studied in detail is given below. This nest was the highest from the ground of the ones located this summer and was placed close (11 inches away from) to the trunk of a very small red maple. The area surrounding was extremely open, there being only a few other trees near the nest tree and only one with a four-foot radius.

July 7--11:30 a.m.--nest discovered by seeing female carrying spider cocoon to it. She worked the cocoon into the nest and settled on it at once.

2:10 p.m. to3:50 p.m.--bird on nest

5:10 to 6:00 p.m.--bird on nest

7:55 to 9:00 p.m.--bird on nest

9:00--flushed bird from nest--found three vireo eggs and one cowbird egg.

July 8-15--Incubation

July 15--1:55 p.m.--found one vireo egg hatched--shell gone from nest

July 16--6:46 a.m.--second young hatching

7:07 a.m.--adult removed egg shell

1:31 p.m.--found third young hatched, shell gone

July 25--11:34 a.m.--young Number 1 (first to hatch) left the nest

8:30 p.m.--banded two remaining young with aluminum band
40-124056
40-124057
and cream yellow band on separate legs.

July 26--9:30 p.m.--weighed two remaining young--left nest afterward, but stayed upon being returned.

July 27--11:00 a.m.--nest empty. Young not present in immediate vicinity of nest.

INCUBATION

The incubation period of the Red-eyed Vireo is twelve to fourteen days (Forbush, 1929:180) (Oberholser, 1938:507). The date the laying of the eggs in this nest was not known so it was impossible to determine the exact period. The first egg hatched eight days after the nest was found; so obviously the bird had been incubating for several days.

SEX INVOLVED

According to Forbush (1929:180, 182) and Oberholser (1938:507) both male and female assist in incubation. However, in the nest observed, only one bird, presumably the female, was believed to take part in both the incubating and the brooding. At no time during observation was there any exchange of birds at the nest. During the eight days of observation of the incubation activities the male was heard singing on six days a total of 42 different times. During 36 of these serenades the other adult--the female--was on the nest. Consequently it would seem that the female did most, if not all, of the incubating.

Several attempts were made to mark the incubating bird by putting cotton or cord soaked in ink in the nest; but each time she removed the offending material before settling on the nest.

On one occasion an interesting thing happened. On July 10 at about 9:15 a.m. the female was on the nest; the male had been singing some distance from the nest but had stopped. After about five minutes of silence the female, on the nest, still sitting on the nest, gave two 'chuckling' calls and the male immediately started singing nearby. It was as though she were scolding him for not singing to her. The 'chuckling' call (which I had not heard before) consisted of a servies of three chips uttered in rapid succession--somewhat

similar to the 'chrrr' of the Baltimore Oriole but not as loud or as harsh. It was heard again--given by the female, restless on the nest on July 11 at 10:15 a.m.

Shortly after this occurrence, the female left the nest, but returned in ten minutes accompanied by her mate. They approached the nest by hopping from one small tree to another; then directly to the vicinity of the nest. The male stood on the limb directly in front of the nest and looked in. The female clung to the trunk of the tree just above the nest limb. The male retained his position until the female settled on the nest; then departed and started singing in a nearby tree.

Table 2 gives a summary of the periods of attentiveness and inattentiveness of the adult birds during incubation. From July 7 to July 9 the numbers are in parenthesis because the observation periods were rather short and so interrupted that many times a complete period of incubation was not observed. In all cases, in giving the longest, shortest, and average length of time of the periods, the period was not included unless the complete period had been observed and recorded: i. e., the time the bird came to the nest and the time it left. From the fifth day before hatching on, observation periods were such as to give a complete enough picture for relatively accurate averages. It will be noted that during that time (from July 10 to July 14) the average length of time of the periods of attentiveness remained remarkably constant (average of 35.4 minutes for the five days) as did the percent of the total time spent on the nest. On the day before hatching the percent apparently has risen (from 76.1 to 90.4) but this was due to the fact that observation was continued until 9:50 p.m. and the bird was apparently on the nest for the night having been there since 8:05 p.m.

July 10 and July 12 probably give the most accurate picture of incubation as observation was continued for eight and a half and twelve hours respectively (these periods were continuous). These two days show an increase of 'percent of total time on the nest' as the end of the incubation period approaches--from 69.8 on July 10 to 76.1 on July 13.

The five days preceding hatching show the following extremes and averages:

	Attentive periods	Inattentive periods
Shortest	10 minutes	4 minutes
Longest	70 "	25 "
Average	35.4 "	12.1 "
Average percent of time	77.5%	22.5%

ACTIVITIES OF BIRD ON NEST

The female spent her time while on the nest in various ways. Usually she merely sat still and looked around or preened herself, and raised to turn the eggs (average of 1.4 times per hour buring the entire observation period). When it became extremely warm she frequently raised on the nest--partially or completely standing up and breathing with opeh mouth. On one particularly hot day she sat on the edge of the nest for about a minute before settling back on the eggs. Six times during the eight days of incubating she returned to the nest with spider cocoon which she worked back and forth into the nest. The last time she was seen to do this was just two days before hatching. On this same day she was seen to peer down in the nest, looking the contents over carefully before she settled on it.

In returning to the nest, she nearly always approached by the same path--to a small tree southeast of the nest, then to the nest limb

close to the trunk. From there she would move out the limb to the nest, turn completely around and settle on the nest facing the trunk of the tree--north. On very few occasions did she vary this procedure or sit on the nest in any other position. When she did sit otherwise it was facing west--never east or south.

REACTION TO INTRUDERS

At no time during the incubation period did my presence seem to disturb the vireos. It was necessary for me to flush the female from the nest to see the contents. To do this I brought a step ladder, set it up under the nest and climbed up; but she did not leave until I touched the limb. Then she slipped quietly off and dropped to a nearby tree uttering no call whatever and returning soon after I descended. She also did not retreat while a large truck was driven up, a few trees were cut down, and the blind raised up about four feet from the nest. Not until the blind was shifted to get it a little closer did she leave.

Most of the time while observing I sat on the ground about fifteen feet from the nest tree but once I sat in the uncovered blind. I had put the covering on the blind but due to the wind it was flapping a lot and apparently disturbed her when she returned to the nest as she didn't go directly to the nest in her usual manner but flitted about from tree to tree. So I removed the covering and sat down in the blind. She returned at once and stayed for thirty minutes, leaving when I made some undue noise and motion in shifting my feet.

On July 15, the day the first egg hatched, a rather amusing and interesting thing happened. As mentioned before, I tried several times to mark her by putting cotton saturated with ink in the nest, but each time

she, removed it. So I decided to try marking her on the back by squeezing some ink on her back while on the nest. With the cotton held between forceps, I leaned from the blind an cautiously approached her. She allowed me to almost reach her--then turned quickly, jerked the cotton from the forceps and flew away. That dispensed with, she was back on the nest within a minute's time.

The blowing of the canvas blind seemed to disturb her more than anything else. When it was first put up, she consistently sat sideways on the nest (facing west--the blind was south of the nest) watching it inquiringly and warily. Often she stretched her neck high to study it even more closely. A few times it seemed she left the nest due to the blowing of the blind but, of course, I could not be sure of that. It is amazing that the blind did not disturb her much more as it was a huge thing towering at least five feet above the top of the nest tree.

Feathered intruders seemed to disturb her no more than human ones. On July 10 at 3:20 p.m. another vireo who was feeding a young cowbird objected quite strenuously to my presence--circling around me and scolding me for about ten minutes. The female on the nest payed little attention to this disturbance. However, an hour later, when a pair of adult vireos were feeding a nearby tree, the male chased them out, then flew back to his singing tree and sang for about a minute as though to proclaim his rights there.

At one time a Kingbird flew rather low over the nest giving his squeaky rattling call. The female, who was on the nest at the time, turned her head and looked in his direction but did not appear to be the least bit distrubed by this noisy passerby. Another time a family of Crested Flycatchers were feeding in the immediate vicinity of the nest but she gave no evidence of alarm.

YOUNG

HATCHING

On July 15 upon going to the nest at 1:55 p.m., one vireo egg had hatched and the egg shell was gone from the nest. The egg had hatched some time between that hour and 8 p.m. the evening before. The second young was found to be partially hatched when the female left the nest for the first time at 6:46 a. m. the next day, July 16. Half of the shell was gone but the other half was still holding the young. By 7:07 a.m. the bird was completely out of the shell as at that time the adult took the shell in her beak and left the nest with it. On returning a second time that day at 1:15 p.m. the female was on the nest but seemed rather restless. Twice she peered down in the nest and seemed to be making some adjustment. When she left the nest at 1:31, I discovered the third young hatched and the shell gone. Consequently, it hatched some time between 9:15 a.m. and 1:15 p.m. In speaking of the young, the first one to hatch is designated as Nestling 1, the second, Nestling 2 and the third, Nestling 3.

DEVELOPMENT

The newly hatched young are helpless except for the ability to hold the head up about five seconds. They are completely naked except for a little fine dark gray down on the head, back, and upper wing. The skin is a bright yellow-orange and the mouth bright yellow. The yolk of the egg is still very evident and quite large.

By the second day the feather tracts are becoming visible and the primaries begin to emerge on the third day. On the fifth day the feathers of the dorsal and ventral tracts start to emerge and on the sixth day the sheaths begin to open on the ventral feathers and the primaries. By the ninth day all the feathers are almost completely out of their sheaths.

On the day of hatching the young are helpless except for their ability to lift their heads and beg for food for a period of five seconds. By the first day they are strong enough to hold their heads up for seven seconds and for ten seconds on the third day. On the second day the clutching reaction of the foot had developed as they clutched at the Kleenex on which I placed them to be weighed. Nestling 1 quivered his wings when begging for food and raised his head on hearing the whir of wings before the adult alighted on the tree.

On the third day number 1 'cheeped' when picked up for weighing and kicked around a great deal while in the weighing pan. There was also a noticeable slit in the eyes. By the fifth day they were completely open but not until the eighth day did they seem to actually look at me when I weighed them. Number 1 made his first attempt at what appeared to be preening--he wiggled around and pecked at himself with his bill.

On the fifth day the young raised their heads for food before the adult had landed in the tree although it made no noise detected by me when approaching. By this time they crawled around on my hand when I took them out to weigh them.

The first actual preening by the young was done by Number 1 on his sixth day when he preened the feathers on his back. On this day he was able to cling tightly to my finger and all three opened their eyes when begging and being fed. They also seemed to look at me when I leaned out the blind to observe them. By this time the skin had become less orange and more pink in color and the bill changed to flesh color except for the corners which were still yellow. The day was quite hot and Number 1 hung his head over the edge of the nest with mouth open.

On the seventh day Number 1 was able to sit up in the weighing pan by balancing himself with his wings. The first wing-stretching was observed on the eighth day when Number 1 stood up in the nest and partially stretched his wings twice. Later he preened his wings and stretched them almost the way out. By this time also, the young begged for food by quivering not only their wings but practically their whole bodies and by 'cheeping.'

The ninth day found Number 1 moving around in the nest and preening quite violently and completely many times. He stretched high in the nest so he could stretch his wings down. He preened the wing feathers quite diligently running his bill along the entire length of the feathers. On this day all three young 'cheeped' intermittently all day. Number 1 attempted to swallow my finger when I offered it to him.

DEPARTURE FROM THE NEST

On the tenth day, the day Number 1 left the nest, he again preened himself elaborately, scratched the top of his head, stood up and stretched his wings out separating each feather. This was the first time the young were observed to eliminate the fecal sac over the edge of the nest.

On Tuesday, July 25, at ten days of age, Number 1 left the nest. About an hour before he left, he flapped his wings rapidly about six times. This he did again while standing on the edge of the nest just before leaving at 11:30 a.m. He stood on the edge of the nest for five minutes preening and stretching his wings. The other two young evidently thinking he was the adult, begged for food; he reached over and put his bill in the open mouth of one of them. Then he hopped out onto the limb right by the nest. From there he walked over to the trunk of the tree and tried his wings on the return trip. Then he left the limb and fluttered down to a pine tree adjacent to the nest tree. For an experiment, I put him back in the nest

but he immediately hopped out again and took several short flights of one to three feet from limb to limb of the nest tree and finally perched on one limb cheeping constantly for ten minutes. I left at 12:05 p.m. to get my camera to try to take a picture of him and when I returned fifteen minutes later he was still cheeping in the same tree but was sitting on a different limb. The adults scolded me furiously while I gook pictures of the young. At 1:05 p.m. I left again to obtain more film and when I returned at 1:20 Number 1 could be neithers seen nor heard. It wasn't until 4:15 p.m. that I was able to locate him twelve feet up in a birch tree about fifteen feet from the nest tree. The adult fed him while there. Then he moved around again. By this time he was able to make sustained flights of from three to five feet.

During this time the other two young still in the nest were cheeping--Number 2 constantly and Number 3 occasionally. Each young had a slightly different pitch to his 'cheep.' On one occasion Number 3 took hold of Number 2's bill as though trying to swallow him.

At 8:00 p.m. that evening Number 1 was still being fed in a nearby tree. At this time I banded Numbers 2 and 3 with aluminum and colored celluloid bands. When I returned them to the nest, the adult tried to pull the colored band off the leg of one. The band numbers are as follows:

Nestling 2
A1 band------40-124056 on left leg
creamy yellow celluloid band on right leg

Nestling 3
A1 band-------40-124057 on right leg
Yellow celluloid band on left leg

Wednesday, July 26 it rained all day and I did not go to the nest until 9:30 p.m. at which time I weighed Numbers 2 and 3. When I returned them to the nest they did not wish to stay and I had to return each one twice. By this time they had apparently become cold and wet enough from

the wet foliage to be satisfied to remain in the nest. Had it not rained all day, they would very probably have left the nest during the day. They were gone from the nest the next day when it was visited at about 11:00 a.m. I was never able to locate them again although I spent approximately six hours in the vicinity of the nest searching for them.

GROWTH RATE

Table 3 shows the growth in weight and feathers and the development of muscular coordination, eyes, and activities. Graph 1 shows the growth in weight of the three nestlings. It will be noted that growth was rapid and steady until the fourth and fifth days when it started leveling off somewhat. The peak was reached on the seventh day for Number 1 and eighth day for Numbers 2 and 3. The following day there was a decided loss, and a slight gain again the day before leaving the nest.

PARENTAL CARE

BROODING AND FEEDING

As previously stated in this paper, the female was not marked in any way. The chief basis for distinguishing the sexes was the singing of the male as he approached the nest. Consequently, the results givne in tables 4, 5, and 6 may have some percentage of error. However, from my observations it appeared that the female did all of the brooding as well as the incubating. The male, in turn, did the greater part of the feeding during the first six days of life of the young when they needed to be brooded a great part of the time. During the seventh and eighth day the female and male made approximately the same number of trips. On the ninth and tenth day, either the male had quit singing as frequently when he approached the nest, or the

female did the greater part of the feeding. The number of feedings per hour, however, remained fairly constant all during the days of feeding as will be seen in Table 6. It was always close to four feedings an hour.

Table 7 shows the variation in the rate of feeding during the day. The highest peak was between the hours of eight and ten in the morning. There was a second, but lower, peak between two and four in the afternoon.

The percentage of time spent in brooding decreased consistently each day as the young grew older from 71.6% the day of hatching to 16.9% the day before the young left the nest. There was but one day which failed to show a decrease from the preceding day: that was on July 20 when it rained intermittently all day. If the adult were off the nest when it started to sprinkle, she would be back on, almost with the first drop of rain. She spread her feathers and wings out so the entire nest was covered.

FOOD

During the first five days of feeding, the young were fed mainly on larvae, the greatest number of which were bright green in color. There were however some tan and brown ones, some yellow, and some black furry larvae. Usually the adult mashed the larvae back and forth through its bill before feeding it. Or, if both adults were present, they had a tug of war with the larvae before feeding. Sometimes, however, the larva was fed still alive and wriggling violently. Some insects were brought and a few moths. From the fifth day on, a large number of butterfly chrysalises were fed. A few black butterflies and moths were also brought and on the ninth and tenth days, even dragon flies. The adults frequently had great difficulty in getting the food down the young ones. They usually had to make several attempts and try more than one mouth before it was swallowed. On one occasion when a butterfly chrysalis was brought, twelve trials were made

before it was finally downed. On another it took fourteen attempts to succeed in feeding a dragon fly--the trouble being that it was consistently put in the mouth of the young crosswise. Finally it got turned partially lengthwise and the young was able to swallow it--but with great difficulty even then.

Some of the larvae fed were identified for me by James Norman as the rosy maple moth larva and the hawk maple moth larva. The chrysalises were those of the swallow tail butterfly.

NEST SANITATION

Both adults aided in keeping the nest clean. Up to the sixth day of age of the young, the adults ate the fecal sacs immediately following feeding. On that day they began flying away with the sacs on some occasions. From the fifth day on, there was quite a bit of competition over the fecal sacs--both adults grabbing for them at the same time regardless of which one had just done the feeding.

The female was frequently seen pecking in the nest and at the young. I assumed she was ridding them of lice and other insects.

SLEEP

The adult bird seems to sleep quite soundly on the nest. Three times on coming to the nest at 5:30 a.m. the bird was asleep with the head resting on the wing and was not distrubed by the light from a flashlight. On each of these three mornings the bird wakened at about six but did not leave the nest until around six-thirty. Bed time was apparently around 8:30 p.m. as she never left the nest after that time although I stayed till 10:30 one night.

CALL NOTES

The male usually gave several of his singing notes as he approached the nest to feed the young. The female had several notes she used. The one she used most frequently was a single soft 'cluck' that seemed deep in the throat. Very occasionally she used the 'squeeze' note and a 'chuckle'--two or three notes in rapid succession. On one occasion she gave a peculiar call. The male was singing in a nearby tree and she was on the nest. She gave a call that sounded like 'chip, chip, chweeee'--thus She immediately left the nest and the male stopped singing.

On the day it rained, the female had been on the nest for an hour without leaving when the male sang a couple of notes. She immediately gave the 'squeeze' note twice, rather insistently and the male came with a larva.

REACTION TO INTRUDERS

Very little controversy with other birds was noted during the period of observation. On one occasion while the female was off the nest, two vireos had quite a 'fight' near the nest. They flew at each other, dropped to the ground for a minute, came back up still fighting. Finally one flew off and the other came to the nest and settled on it. Whether this was a mating performance or the driving off of an intruder, I did not know.

A strange thing happened one day--on July 24--two days before the young left the nest. The female had just fed the young. As she left, a strange vireo with a dark mark on its breast arrived. For about two minutes this bird hopped nervously from limb to limb around the nest, with neck outstretched, picking occasionally at the young and singing a strangely beautiful, soft lullaby to them from way down in its throat. It flew to a nearby tree, still crooning--then back to the nest again and continued the same procedure. It had barely returned, however, when 'papa' vireo swooped in chasing the stranger away. He then returned to the nest tree, landing on the lower limb and moving up--scolding constantly with his 'squeeze'note

and an occasional warble in between them.

When I weighed the young I usually had to flush the female from the nest. Once I touched her on the back before she flew--to about one foot from the nest. Another time she was back on the nest while the young were out. She usually stayed about three or four feet from the nestwhile I was weighing them. Once while I was returning them to the nest, she flew to within six inches of my hand as if to attack me--then away again. Another time she let me almost reach her with my finger--then snapped at it actually biting my fingernail. She stayed three feet from the nest all the time the young were out.

SUMMARY

Seven nests of the Red-eyed Vireo were found in the vicinity of the University of Michigan Biological Station during the summer of 1944. One of these nests was studied in detail from July 7 through August 15. The bird was already incubating when the nest was discovered.

The Red-eyed Vireo prefers open woodland for nesting. Six of the seven nests found were located in small clearings.

The nest is a neat compact pensile nest built in a small tree, usually a maple (six out of the seven) at an average distance of 6' 5 1/3" from the ground and 33" from the trunk.

The nest studied contained three vireo eggs and one cowbird egg. Another cowbird egg was found on the ground under the nest.

The vireo eggs hatched July 15 and 16 and the young left the nest on July 25 and July 27. The cowbird egg did not hatch.

Incubation and brooding seemed to be done entirely by the female.

The young were quite helpless when first hatched but developed rapidly,

the eyes being entirely open by the fifth day and bird able to preen itself by the sixth day.

The young were fed mainly on larvae and butterfly chrysalises but some moths, insects, butterflies, and dragon flies were fed also.

Both adults shared in feeding the young. As the nestling period progresses, brooding periods decreased and the rate of feeding increased.

The nest was 100% successful.

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TABLE 1---NESTS

Number	Date found 1944	Contents when found	Fate of nest	Location							Measurements				Composition		
				Tree		Ht. from ground	Dist. from trunk	Dist. from end of limb	Dir. from trunk	D. of supporting twigs	Dia.		Depth		Lining	Framework	Covering
				Species	D. of trunk						In	Out	In	Out			
A	June 27	cowbird egg vireo egg	deserted	Red maple	34 mm	6'	39"	44"	west	4 mm 7 mm	40.4 mm 60.5 mm	70 mm 90 mm	30.5 mm	60.5 mm		Strips of bark	Piece of wasp nest
B	June 29	Cowbird vireo egg	cowbird left nest June 30	Sugar maple	57 mm	6'	45"	10½"	S.	4.5 mm 6.5 mm	45 60	60 70	40	55	grass and bark	Bark strips	Birch bark spider cocoons
C	June 30	cowbird newly hatched	nest empty July 3	Bass-wood	13	4'7"			NW		52 53	65 70	35	67			
D	July 4	unoccupied except for tree toad		Red maple	10	7'	0	34	S.	4 10	48 64	53 66	51	74			Birch bark a few cocoons
E	July 6	empty		Red maple	41	7'	70"	30	S.	7 9	50 59	70.5 80	45	55			Piece of hornet nest
F-1	July 7	3 vireo eggs 1 cowbird egg	3 vireo left nest	Red maple	19	8'9½"	11"	30	S.	5 9	47 65	54 70	50	68	Fine bark strips	Bark strips	white with birch bark & cocoons
G	July 12	cowbird egg	deserted	Sugar maple	30	4'9"	33	20	S.	6 9	45 65	60 95	35 52	65 80			spider cocoons
h				Red maple						7 8	54 54	75 82	45	76			
i		dead vireo		Red oak						3, 3.5 6	52 57	70 77	42	67			
j				Bass-wood													
k		dead young		Red maple													
Average					29	6'5"					60.9 46.8	61.8 77.3	42.1	64.6			

White

TABLE 2---INCUBATION ACTIVITIES

Date	Time of Day	Total hours obs.	Weather			Attentive Periods of Female								Inattentive Pds. of Female						Male Singing	
			Temp. F.	Sky	Wind	No.	Longest (min.)	Shortest	Ave.	Total time min.	% of total	No. turned eggs	Times per hour	No.	Longest	Shortest	Ave.	Total time	% of tot.	Time in min.	% of time
July 7	11:30-11;50A 2:10-3:50PM 5:10-6:00 7:55-9:05	4 (240")	75 82 70	part cloudy		(5)	(55) 70 (on for nite)	(20)	(44)	(220)	(91.7)	2	.5	(1)	(20)	(20)	(20)	(20)	8.3	0	0
July 8	4:15-6:00P 7:15-7:30	2 (120")	86 80			(2)	47	(33)	(40)	95	(79.2)	3	115	(1)	(25)	(25)	(25)	25	20.8	2	1.6
July 9	9:30-11:30A 7:25-9:25PM	4 (240")	70 75 70			(5)	(60)	(10)	(40)	200	(83.3)	4	1.0	(3)	(20)	(10)	(13.3)	40	16.7	28	11.7
July 10	9-12AM 1-5PM 7:25-8:55PM	8½ (510")	72 78 68			9	70	20	37	356	69.8	17	.82	10	1253	8	15.3	153	30.2	34	6.7
July 11	9-10AM 10-12 4:45-5:30PM	3 3/4 (225")	70 75 80	cloudy (rain)		3	59	23	38	167	74.2	13	3.2	5	16	8	11.6	58	25.8	28	12.4
July 12	11-12AM 2-5PM	4 (240")	70-76	cloudy	5-20	5	45	16	34.2	185	77.1	4	1.0	5	15	4	10	55	22.9	0	0
July 13	7:45AM to 7:45PM	12 (720)	65 73 67		0-15	16	60	10	31.8	548	76.1	20	1.7	17	15	4	10.1	172	23.9	131	19.2
July 14	4-5PM 5:15-6 7:35-9:50PM	4 (240")	79 65			3	48 (125 for nite)	25	36	213	90.4	6	1.5	2	22	5	13.5	27	9.6	11	4.6
Total Hours--42¼							Average		35.4		77.5		1.4				12.1		22.5		

White

TABLE 3---GROWTH AND DEVELOPMENT

Age in Days	Weight in grams Nestlings 1	2	3	Growth of Feathers	Muscular Coordination and other Development
0	3.45	3.22	2.69	Light gray down on head, back, and wings. Skin--bright yellow-orange; bill and mouth yellow.	Holds head up for food when bough shakes. Can keep it up about 5 seconds. Otherwise, helpless.
1	4.92	4.30	3.65		Able to hold head up about 7 seconds.
2	6.40	5.51	4.94	Dorsal feather tracts plainly visible.	Able to hold head up strongly for 10 seconds. Clutched at Kleenex when weighed. Quivered wings for food.
3	8.25	7.78	7.17	Primaries beginning to emerge.	No.1 called when picked up for weighing. Noticeable slit in eyes. Hold head up more than 10 sec. Able t turn over from back. Kicked around in weighing pan.
4	11.8	9.2	9.19	Primaries 5 mm. long. Feather tracts all plainly visible on body.	Eye slits larger. Turns over easily. Clings to finger.
5	12.0	11.8	10.8	Primaries 11 mm. long. Dorsal feathers emerging. Also ventral. Capital tracts visible.	Eyes open wider. Crawls around in hand.
6	13.79	12.95	12.90	Primaries 17 mm. long. Sheaths beginning to open at ends. Ventral feathers oening. Capital tract feathers just coming through. Skin, pink. Bill, flesh-colored.	Crawls around in hand a great deal. Seemed to notice me. Turns self over easily from back. Clings to fingers. First preening. Opens eyes when begging.
7	15.55	13.60	14.25	Primaries out of sheaths for 5 mm. All feathers out including those on head.	No. 1 crawled to edge of weighing pan and sat up-- almost fell out--balanced self with wings. Scrambles around in hand.
8	15.40	13.90	15.65	Primaries 30 mm. long, 8 mm. out of sheath.	Looked at me when weighing. Begged vocally. Able to crawl up my hand with ease, cling to one finger. Sit but not stand upright. Stretch wings and use for balance.
9	15.52	12.65	13.33	All feathers almost completely out of sheaths. White line over eye evident for first time.	Cheeped a lot during the day. Stood up in weighing pan. Climbed up arm. Stretched and preened during da
10	left nest	13.64	14.14	All feathers out. Wisps of down still sticking to crown.	Great deal of preening, stretching, and flapping of wings. Before leaving nest, stood on edge and stretched and flapped wings.
11	left nest				

white

TABLE 4---PARENTAL CARE

Date	Age of young	Time of Day	Total hours obs.	Weather			Brooding Periods of Female						Inattentive Pds. of Female						Male--singing			
				Temp. F.	Sky	Wind	No.	Longest	Shortest	Ave.	Total Time	% of Time	No.	Longest	Shortest	Ave.	Total Time	% of Time	No.	Totl Min.	Ave.	%o tim
July 15	0	1:55-6:05PM	4'10" (250")				8 (7)	38	16	24.4	179	71.6	8 (7)	18	2	9.4	71	28.4	1	1	1	4.
July 16	0-1	5:30-7:10 7:50-9:15 AM 1:15-7:15 8:50-9:50 PM	10'5" (605")	50		5-15	24 (19)	25 (76)	1	12.8	400	66.1	21	42	3	9.8	205	33.9	22	59	2.7	9.
July 17	1-2	1:05-6:05 7:10-8:10 PM	6 (360")	80 75	clear to hazy	0-5	9 (8)	49	2	18	186	51.7	10 (7)	38	4	19.7	174	48.3	13	29	2.2	8.1
July 18	2-3	5:50 AM-5:50 PM	12 (720")	52 88 82	clear to cloudy	0-5	18 (17)	74	1	20.5	398	55.3	17	59	1	19	322	44.7	31	46	1.3	6.4
July 19	3-4	8:15 AM-2:15 PM.	6 (360)	64 79	partly cloudy rain	0-5	19	28	10	19	171	47.5	10 (8)	55	1	19.8	189	52.5	16	46	2.9	13
July 20	4-5	7:25 AM-7:28 PM.	12'3" (723")	55 59	cloudy inter-mittent rain	5-15	23 (22)	67	1	21.4	486	67.2	24	25	2	9.9	237	32.8	11	15	1.4	2.1
July 21	5-6	2:10-6:10 PM	4 (240")	77	partly cloudy	0-8	4 (3)	44	21	33	115	47.9	4 (3)	61	23	41.6	125	5211	0			
July 22	6-7	5:30 AM to 5:30 PM	12 (720)	57 86	slightly hazy	5-15	6 (5)	46	8	32.2	165	23.	6 (5)	219	24	108.2	555	77	17	45	2.7	6.2
July 23	7-8	9:15-11:15 AM 6:25-8:25P	4 (240)	70 72	clear to cloudy occ. rain	0-10	4 (2)	10	3	6.5	47	19.6	4 (2)	80	74	77	193	80.4	2	7	3.5	2.9
July 24	8-9	6:25 AM to 10:25 PM	16 (960)	63 61 55	overcast	0-5 5-10	6 (4)	23	5	11.5	162	16.9	5	261	81	159.6	798	83.1	16	28	1.8	2.9
July 25	9-10	7 AM-6 PM 8-9 PM	12 (720)	53 86 85	clear	0-3 0 3-8											720	100	3	9	3	1.3

Total time--98 hrs. 18 min.

TABLE 5

NUMBER OF FEEDINGS FOR INDIVIDUAL NESTLINGS

Nestling	July 15	July 16	July 17	July 18	July 19	July 20	July 21	July 22	July 23	July 24	July 25
1	(0) 2	(1) 16	9	(3) 18	13	(5) 13	5	(7) 15	3	(9) 25	6 left-11:3
2		(0) 5	5	(2) 12	4	(4) 13	5	(6) 17	3	(8) 24	16
3		(0) 4	11	12	(3) 6	12	(5) 4	18	(7) 14	22	(9) 11
Undetermined		3	4	6	2	5		2	1	1	3
To Female				1		3		1	1	1	1
Total	2	28	29	49	25	46	14	53	12	73	37

(Numbers in parenthesis indicate age of nestlings)

TABLE 6

FEEDING FREQUENCY OF ADULTS

used

	No. of	July 15	Jy 16	Jy 17	Jy 18	Jy 19	Jy 20	Jy 21	Jy 22	Jy 23	Jy 24	Jy 25
Male	trips	0	12	17	31	16	29	9	27	7	35	16
	Feedings per hour	0	1.1	2.8	2.5	2.7	2.4	2.3	2.2	1.75	2.5	1.33
Fe-male	No. of trips	2	16	12	18	9	17	5	26	5	38	21
	Feedings per hour	1.5	1.5	2	1.5	1.5	1.4	1.3	2.2	1.25	2.7	1.75
Total	No. of feedings	2	28	29	49	25	46	14	53	12	73	37
	Feedings per hour	1.5	2.6	4.8	4	4.2	3.8	3.5	4.4	3	5.2	3.08

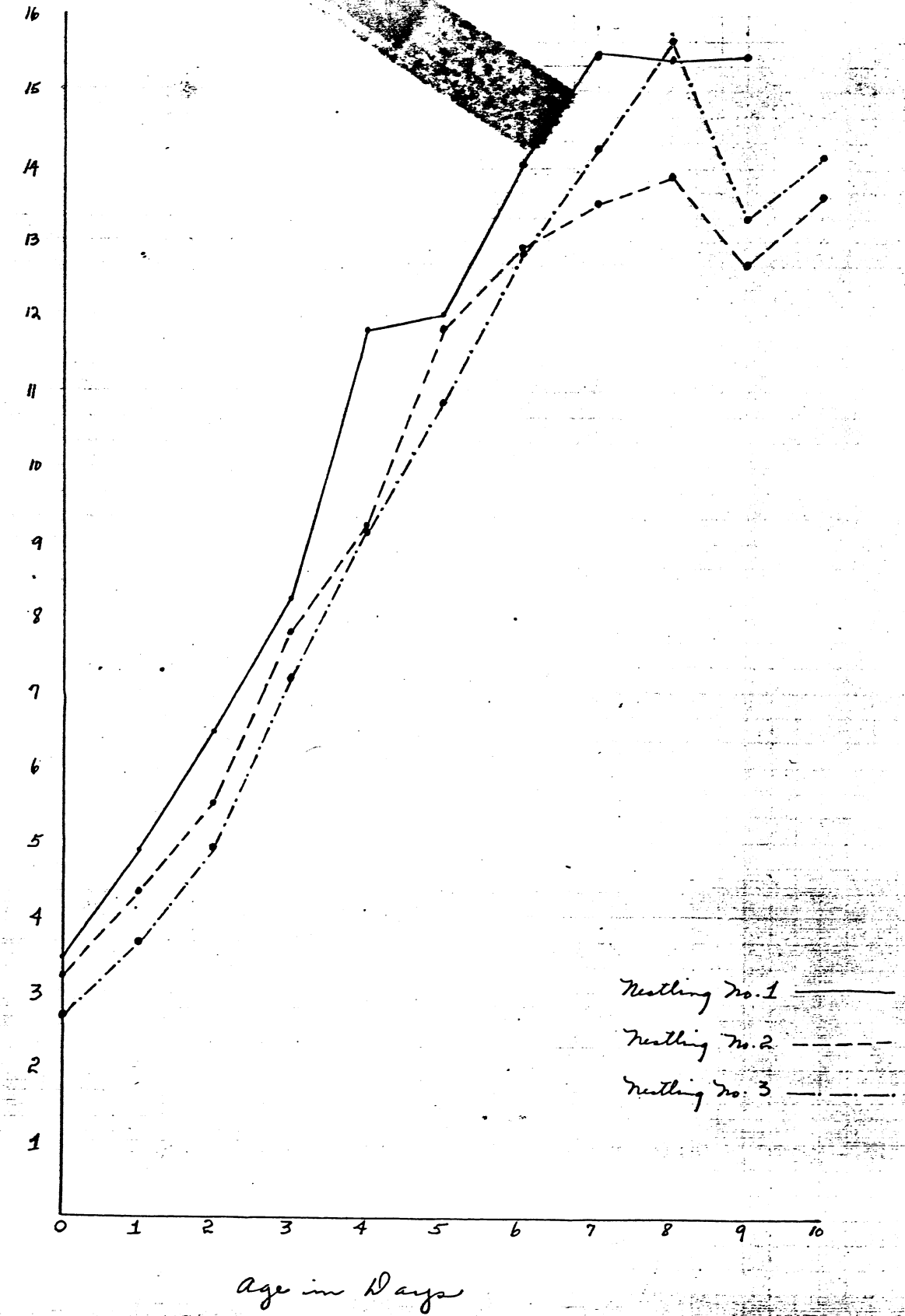
TABLE 7

VARIATIONS IN FEEDING RATE

Date 1944	A. M.						Time of Day				P. M.					
	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
July 15									1		1	1				
July 16		1	2	1												
July 18	3	3	9	6	3	3	3	2	7	3	4	3				
July 20		4	1	7	3	3	4	4	8	3	3	5	1			
July 22	5	5	9	5	11	4	3	3		4	4					
July 24	3	6	13	7	7	5	4	2	3	6	2	5	5	5	1	

1944)

1 (2)


16
15
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Age in Days
Nestling No. 1
Nestling No. 2
Nestling No. 3