

SOME OBSERVATIONS ON THE BREEDING ACTIVITIES
OF THE EASTERN KINGBIRD (TYRANNUS TYRANNUS)

by

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A report of an original field study conducted
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During the summer of 1942 a study was made of the breeding activities of the Eastern Kingbird (*Tyrannus tyrannus*) at the University of Michigan Biological Station, Cheboygan County, Michigan.

The Kingbird was an excellent subject to study as it is easily observed and is a member of an important family of birds, the Tyrannidae, or New World Flycatchers, on which little ^{life} history work has been done. Davis (1941) has written on the belligerency of the bird, which including some life history observations. In 1925 Hausman treated the utterances of the Kingbird. Some studies on this bird have also been made at the Station, chief of which is that of Goodell (1940). Aside from these three instances, I was unable to find any other comprehensive work on the Kingbird with regard to its life history.

Methods of Study

One nest, nest C, was chosen and studied intensively while supplementary data were obtained from seven other nests also at the Station. Observations at nest C extended from July 1 to August 14 and totaled 65 hours. The young at nests C and H were also observed until they disappeared. Activities at nest C were observed from a green canvas blind atop an 11-foot tower situated three feet to the side of the nest. Some observations were also made outside the blind with 8x30 binoculars. Nest H was reached by an 18-foot tower for purposes of weighing and observing the young. On July 15 the female bird at nest C was trapped at the nest by means of a hair net trap (devised by Mr. Bernard Baker) and a red celluloid band was attached so that the parent birds could be distinguished from one another. She could be told by the presence of a brood spot. Previous to this time, I could tell the birds apart at close range by the more brownish-gray head of the female and a few whitish feathers below her right eye. The male also had more of a whistle to his flight. Be-

fore leaving the nest, the two young at nest C were likewise banded, as were the three young at nest H. For purposes of identification earlier in the brooding cycle, the young at nests C and H were marked on their beaks with red and white nail polish. The young birds at the two nests were weighed every evening between 7:15 and 7:45. ✓

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Habitat

The Eastern Kingbird is considered an arboreal bird of the Transitional Zone, preferring deciduous tree growths. During the breeding season it likes the open type of woodland and in the region of the Station may be found near water sites, along roadsides, near buildings, and in sparse forest growths. Associations of Oak (Quercus rubra), Aspen (Populus tremuloides and grandidentia), Birch (Betula papyrifera), Maple (Acer rubrum), and Pine (Pinus strobus) seem to be most to its liking. Wood, Smith, and Gates (1916:12) write regarding the status of the bird in the Douglas Lake region, that it "may be found in all land habitats but it is most abundant in the aspens and open plains". Since this study was based primarily on observations on the grounds, the above conclusions with regard to the entire Douglas Lake area could not be confirmed. However, many birds with young were seen outside the grounds along roads bordering fields and plains.

In its habitat the Kingbird is one of the most common birds. Because of its consciousness and confidence in man it is easily observed and is quite well known. Roberts (1936:6) describes these traits very clearly when he

✓ All statements of time throughout the study refer to Eastern War Time.

writes, "Its habit of hawking for insects from an elevated perch and its shrill screaming notes force it on the attention of the passerby!"

The avifauna associated with the Kingbird included the Robin (Turdus migratorius), Cedar Waxwing (Bombycilla cedrorum), Chipping Sparrow (Spizella passerina), Least Flycatcher (Empidonax minimus), Purple Martin (Progne subis), Ruby-throated Hummingbird (Archilochus colubris), and Vesper Sparrow (Pooecetes gramineus).

Territory

No special attempt was made to determine the territories of the Kingbirds studied and thus only casual observations are presented. The partial territories of the birds of four nests: A, B, C, and G are shown on Map 1. The boundaries given represent the territory the birds were seen to frequent and not necessarily the true defended territory.

It will be noted that the territory at nest B was extended from its original size. This was due to the desertion of the birds at nest G. Previous to this they had prevented the birds at nest B from approaching any nearer than the top of the cliff. A difference in nest B can be seen in that it is located in the corner of the territory while the others were situated more or less near the middle of the territory. This was due to the fact that the birds at nest A restricted the birds from extending their territory lakeward while the region to the west was unsuitable consisting of thick second growth.

As Davis (1941:158) has pointed out, the defense of the territory may be divided into three types of fighting: (1) intraspecific fighting, (2) interspecific fighting, and (3) predator fighting. No predatory fighting was observed at nest C but in the other times the male played the most conspicuous part. It seemed to be his duty to perch up on some exposed place as the top of a tree and watch for any possible intruders. At times he was not observed to be near the nest but the call for the female would bring him back very quickly.

The fighting against members of the same species (interspecific) was the most fierce and both/^{male}and female partook, as was observed/^{by}Davis (1941:158). After the fighting the male either performed a tumbling display in the sky or returned to a perch near the nest where he gave many notes similar to kit or kitter. They were run together rapidly and given excitedly with a seemingly victorious tone to them.

Interspecific fighting, or the fighting against other species except predators, occurred near the nest and usually the male alone participated. Species always attacked were the Purple Martin, Baltimore Oriole (*Icterus galbula*), and Cowbird (*Molothrus ater*). But the male did not always drive off all intruders. The Chipping Sparrow, Red-eyed Vireo (*Vireo olivaceus*), and Goldfinch (*Spinus tristis*) were never attacked and Robins were usually let alone. On two occasions the female was observed to drive a Baltimore Oriole and a young Cowbird away. In the first instance the female, which was off the nest, called as an inquisitive female Baltimore Oriole approached too near the nest. The male came when he heard the female calling and then the female darted out and drove the oriole away. In the second instance a Red-eyed Vireo was feeding a young Cowbird in the nest tree and the female drove the latter away, the male not being around.

No predatory fighting was observed at any of the nests, probably because of the lack of predators near the Station. One Kingbird south of camp was seen to attack a Red-tailed Hawk as it soared above the woods.

Nests

The nests of the Kingbird were found in varied situations and locations. As seen in Table 1. 75% of the nests were in Red Oak^(*Quercus rubra*), indicating a decided preference for this tree in the campus area. One (nest A) was found in an American Elm (*Ulmus americana*) and another (nest H) in a Jack Pine (*Pinus banksiana*), the only specimen of this tree near the Station. The latter location is described as rare (Forbush, 1927:327) or occasional (Barrows, 1912:395).

Goodell (1940:3-4) found only one nest at the station in a Red Oak and one each in a American Elm, White Birch (Betula alba), and Soft Maple (Acer rubrum).

The nest in seven instances was situated at the fork of a branch but one was placed in a crotch of the trunk. However, all the nests were situated so that there was easy access to the open. This permitted unobstructed observation against intruders. In cases where other trees grew next to the nest tree, the nest was placed on a side away from the neighboring trees. About half of the nests were exposed more or less directly to the sun's rays. This is in agreement with what Goodell (4) found. Most of the nests were easily visible but the one in the Jack Pine was rather well hidden from below. It is to be noted that of eight nests five were situated between 19 and 21 feet above the ground.

There is a noticeable discrepancy in the measurements of the outside diameter and the inside depth of the nests as compared with those taken in Goodell's (5) study. His nests averaged 11.3 cm. in outside diameter and 5.4 cm. in inside depth as compared to 12.7 cm. outside diameter and 3.8 cm. inside depth found in the present study. However, the figures found in this study compare favorably with those in the literature (Bendire, 1895:239, and Todd, 1940:341).

The Kingbird's nest is characterized by its bulky and loose outward appearance. But viewed on the inside it is a firm, well woven structure, slightly oval in shape. Small roots and weed and grass stems, sometimes wound with string, form the outside of the nest. Pieces of rope, string, cloth, paper, cotton, feathers, strips of bark, or cocoons are usually placed or woven in on the underside of the nest. The inside of the nest is of the same material as the outside but of a finer quality and may contain some grasses. The lining varies from cedar fibers, plant down, cotton, pearly everlasting, and fine fibery string to fine rootlets, hairs, snell, pine needles, small pieces

of bark, and grass.

Eggs

Only three nests were found with eggs. Two contained three eggs, while the other had four. The coloration of all these eggs was very similar, a ground color of creamish white marked with spots varying from chestnut to umber. These spots were of different sizes and more numerous on the larger end. The eggs at nest G were collected July 5, two days after the birds deserted. Two eggs measured 18x23 mm. and weighed 3.5 and 3.36 grams respectively while the third measured 18x22 mm. and weighed 3.49 grams. Measurements and weights of eggs were not taken at the other two nests for fear of breaking the eggs or causing the parents to desert.

The incubation period could not be determined with accuracy. Nest C was the only one found while the eggs were still being laid. On June 30 it contained two eggs (Johnson) and on July 1 at 7 p.m. there still were only two eggs. On July 2 at 8:30 p.m. there were three eggs and on July 3 at 7:30 p.m. there were four eggs. Unfortunately the eggs were not marked and as a result it could not be told which two of the four eggs subsequently hatched.

The incubation period has been given variously from 12 to 16 days (Forbush, 1927:328). Davis (1941:163) noted that in two instances it was 16 days. Oberholser (1938:384) states that 12-13 days are required to hatch the young. Will (1930) observed a nest at the camp in which the incubation period was apparently 15 days. One egg was present on July 1 when the nest was discovered and eggs were laid on July 3 and 5. Incubation was thought to have started after the second egg was laid. On July 18 two eggs hatched while the third never hatched. It was pined on the noon of July 19 and removed on July 21.

It was not noted how the egg shells and the unproductive eggs were disposed of, but Davis (1941:164) observed that the female carried them off. None were found under the nest or in its immediate vicinity.

Incubation

Table 2. gives a summary of the nesting events at nests C and H. The female bird did all the incubating and at no time was the male observed to assist. But occasionally the male incubates (Bent, 1942: 17, Forbush, 1927: 328, and Oberholser, 1938: 384). The male, however, is a very interested observer and an ardent guardian of the nest. He usually stayed within sight of the nest as the female incubated and would pass the time catching insects, preening, driving off intruders, or guarding. At intervals he would come and relieve the female at the nest, allowing her a chance to exercise, feed, and preen. The usual procedure was as follows. The male flew to the nest uttering call notes resembling those given after a fight but not run together so rapidly. The female looked up and chirpered or twittered softly and then left, calling at times, while the male guarded from one of two dead twigs about three feet above the nest. Twice he was observed to fly down to the edge of the nest to examine it more closely. When the female came back she flew directly to the nest and twittered softly. However, if someone was near the nest tree she was more hesitant and flew from limb to limb before settling on the nest. The male usually called then and flew away but sometimes he guarded for several minutes longer before leaving.

The sleeping place of the male was not determined. In the evening between 9:30 and 9:45 he would fly off toward Ladyville but the exact location could not be ascertained. Davis (1941: 165) records that the male at one of his nests roosted in a nearby tree each evening from June 10 to August 16.

No instances of attempted copulation were observed. A few times the male was seen to pursue the female, but she paid little attention to him or just flew with him calling.

The female was seen to bathe only once. This was done by flying over the lake and dipping in it much in the manner of swallows picking insects from the water in flight. After repeating this several times the bird proceeded to the

nest tree to preen her feathers. Forbush (1927:329) and Stone (1937:671) record another method of bathing in which the bird stands in shallow water and dips and flutters.

Table 3. shows the attentiveness (the time when the bird's feet are actually on the nest) of the female during incubation. The male is not included, as he was observed to be attentive in only two instances. It will be noticed that the attentiveness of the female remained at a high level from the first day of observation (July 8) until the day of hatching (July 16), around 80%. During periods of hot weather, as on July 12, the bird was attentive fewer times than usual (1.2 times per hour as compared to the average of 2 times per hour), but averaged longer for each time (33.3 min. per sitting instead of the average 23.1 min. per sitting). She was also inattentive for longer periods during hot weather (13 min. at a time compared to the average 8.5 min. absence). On July 15 she was very nervous, presumably from being banded in the morning, and was inattentive longer than normally (36% of the time).

The behavior of the parents due to my presence at the blind was much the same throughout the brooding cycle. The birds put up a mild fuss and called kit and kitter notes similar to the call notes but given more sharply and excitedly. There was also a b-zee note. Almost as soon as I disappeared in the blind the birds stopped calling except for a few kits and in from two to seven minutes the female appeared at the nest although she was still a little distrustful and kept a sharp lookout at the deep hole.

Young

In Tables 4. and 5. are shown the attentiveness and inattentiveness of the parents during the brooding period. The first young was hatched between 5:30 and 8:05 p.m. and was still damp when first observed. The female brooded almost constantly (97%) the first evening and throughout the cycle was the only bird ever observed to brood. Brooding gradually decreased and on the

sixth day¹ the female was attentive only 28% of the time. During periods of inclement weather, as when it rained on July 17, the female sat very much (91% during 3 hr. and 10 min) as compared to the afternoon and evening of the same day when the rain ceased and she was attentive only 75% during 3 hr. and 53 min.

Throughout observations the female fed the young about three times as often as the male (an average of 6.4 feedings per hour during the period for the female as compared to 2.1 for the male). The male fed oftener than the female on only two days, July 24 and 25, which, as noted above, were very hot and humid. The number of feedings per hour gradually increased as the cycle progressed but fell off a little near the end (see Table 5.). The birds were not consistent at all in their feeding of the young. There might not be any feeding for 30 minutes and then a series of closely spaced feedings would occur. The frequency of feeding usually dropped down between 4 and 4:30 p.m., at which time the day was the warmest.

Feeding on the day of hatching and on part of the first day was by regurgitation and was done entirely by the female. During this period, however, she sometimes fed the young very small insects held in her bill. The male was not observed to feed the young before the afternoon of the first day. On several occasions on the first and second days he was seen to feed the female on the nest, who in turn would raise up and feed the young. If an insect was too large for the young to handle, the parent worked it in its bill and offered it to the young again. The male usually brought larger insects and several times had to eat food which the young were unable to handle.

The following insects were observed to be fed to the young at the nest: beetles (Coleoptera), House Fly (Mus domestica), small moths (Heterocera), May Fly (Ephemeroidea), Damselfly (Zygoptera), Cicada (Cicadidae), two species of Yellow-jackets (Vespa), grasshoppers (Acrididae), and Black Fly (Simuliidae).

¹ The day when the young were six days old figuring the hatching day as zero.

lidae). The Cicadas formed a very important part of the diet on the last day in the nest. Not all the insects are captured in the air, as several times the parents were seen to take insects from the ground ^{or} ~~and~~ to pick them off from the blind covering.

Both the parent birds ate the fecal sacs of the young up to the sixth day. On that day the male commenced to carry them off, but the female did not do so until the ninth day. On the twelfth day she ate the small sac of one of the young just before she settled down to brood for the night. The parents usually waited expectantly after each feeding for the fecal sac to appear. As the young became bolder and more lively, they backed up to the side of the nest, requiring the parents to cling to the underside of the nest in order to get the sacs. The male usually carried them over the lake and dropped them, while the female placed them on the beach and sometimes pecked at them. On the first day the female was twice noticed to eat the fecal sacs and then apparently feed the young but it could not be told with certainty if she fed them fecal material or not.

Neither the parents nor the young birds were ever seen to regurgitate indigestible parts of food as witnessed by Goodell (1940:11-12) and other observers. However, the author saw a Kingbird along a road near camp cough up and drop something which was probably indigestible material.

As the brooding cycle progressed, the parents became more alarmed at the presence of passing people and especially at the observer's, whom they apparently recognized. Whenever the observer approached the nest or walked by on the sidewalk near the nest, the parents hovered over him and called excitedly. This behavior was not shown to any other passersby. The parents became even more disturbed when the young were taken from the nest to be weighed and the female swooped down at the intruder, clicking her bill and showing her orange ^{crown} ~~crest~~. Near the end of the cycle the female became so bold as to strike the observer's head. The male never displayed the same fearlessness and made only half-hearted dives. While the young were being weighed, the parents qui-

eted down and often only sat and watched.

Usually either the male or the female or both were guarding the nest. The male sometimes guarded from a neighboring tree when the female was on the nest and from the nest tree when she was gone. At times the female guarded too, especially before a brooding period. There were times when neither bird could be seen in the vicinity of the nest, but these were seldom.

The growth and development of the young with regard to their behavior, feathering, and weight is listed in Tables 6. and 7. Table 8. shows the nesting success of two nests, C and H.

The length of nestling life was 14 and 16 days respectively in nests H and C. The young at C seemed a little more fearful than those at H. They were able to fly on the fourteenth day. Table 7 shows that there was a steady weight increase up to the thirteenth day, when only a slight gain or a loss occurred. Nestling No. 1. at H was caught by hand after two days out of the nest but showed little fear.

Post-nesting Activities

The birds at nest C were observed up to August 14, when they were 29 days old, after which date they were not seen by the author. However, they were reported seen in Ladyville three days later. As the young left the nest on August 1, the parents stayed with the birds at least 16 days. The actual nest leaving was not observed but the young were seen when not more than 30 minutes out, about two feet from the nest. They made short flights of 10 to 30 feet and usually stayed close together since they followed each other about. The afternoon the birds left the nest the parents were observed to make 10 feedings in 41 minutes between 1:09 and 1:52 p.m. or 14.6 feedings per hour. One young was observed to excrete a fecal sac which fell to the ground. However, on the next day the female was seen carrying a fecal sac to the ground. Miss Muirhead, who has been studying the Least Flycatcher, informs me that in that bird the parents watch for fecal sacs after feeding birds out of the nest

and swoop down, catch them in mid-air, and carry them away. This behavior lasts only a day or so after the ^{young} have abandoned the nest. Such is probably also the case in the Kingbird because several times the parents waited expectantly after a feeding as they had previously done at the nest.

The family stayed within the territory until they left it on August 15. Davis (1941:164) states that they usually stay near the territory but by no means within it after leaving the nest. The location of the young could always be told from the kit-like calls the young uttered. These were similar to the adult's call notes but were not so loud. The young were never seen to catch insects on the wing, but on the sixth day out one of the young, which was 21 days old, was observed picking insects off a branch. Between 9:39 and 10:56 a.m. the same day, the young were fed 15 times or at an average of 11.6 times an hour. They now followed the parents a little and flew with a stronger flight. When 28 days of age the young were almost as large as their parents but still followed them about, calling nearly as loud as the adults. They even descended to the ground once and picked up insects but never were seen to catch insects on the wing. Goodell (1940:13) noted that in two cases the young were catching their own food on the tenth and twelfth days out of the nest but does not tell the manner in which they obtained it.

The adults remained about as irritable as they were during the brooding period but did not object to my presence at a distance of 100 feet or so. Other birds were seen in the tree that the young were inhabiting at the time. Orioles were driven off by the male, as were Cedar Waxwings if they approached too closely. But a Least Flycatcher was not bothered. The female did not object to a young Robin or two Red-eyed Vireos in the same tree. Both adult birds, especially the male, engaged in fights with other Kingbirds.

Several other families of Kingbirds moved into the Station area about the second week in August. These consisted of young birds able to fly accompanied by their parents. The birds were very noisy and belligerent toward other species,

always chasing the Martins, while two were seen to force a Barn Swallow (Hirundo erythrogaster) to the ground. One was continually singing a song very similar to the matin song given by the breeding male between dawn and sunrise. It consisted of several kitters followed by a kit-weet-weet. Pin-cherry trees were frequented by some of the birds. By the following week most of these birds had moved on.

Parasites

Mites similar to the common Chicken Mite (Dermanyssus) were present on the young birds in nests C and H, the only two nests that were examined each day. The young of Nest H were severely infested with them, as was the nest itself. Other arachnids and insects found in different nests included a few spiders (Arachnida), several bird lice (Mallophaga), one spring-tail (Collembola), and a few ants (Formicidae).

Summary

1. The Kingbird is typically a transitional bird and during the breeding season inhabits open deciduous growths. It is a common bird in the Douglas Lake area and is well known because of its conspicuous habits and its trust in man.
2. It has a definite territory which it guards against the intrusions of other Kingbirds, other species, and predators. Some species of small birds were never attacked.
3. The nest is characterized by its loose, bulky outward appearance and its firm, well woven inner structure. In the vicinity of the Station it is composed mainly of rootlets.
4. Only the female incubates, but the male guards while she leaves the nest. A high level of attentiveness is maintained throughout the incubation period.
5. Both parents assist in the feeding of the young, but the female usually does more except in hot weather, when the reverse is true. The female broods entirely. During hot weather she is more attentive and shades the young. Feeding mainly by regurgitation the first day gives way to feeding of material held exposed in the bill thereafter. At the beginning of the cycle the male sometimes brought food to the female, who in turn fed it to the young. Attentiveness drops rather low by the sixth day and gradually decreases until the female stops brooding the day the young leave the nest. The belligerency of the

parents increased as the period progressed. In two instances the young remained in the nest 14 and 16 days. The male ate the fecal sacs up to the sixth day and the female up to the ninth. Thereafter they were carried away.

6. The young are blind and almost naked when born. On the fourth day the shafts first break through the skin and on the sixth day the sheaths break open. The eyes open on the fifth day. By the sixteenth day the young are completely covered by feathers and call very much like the parents. They are able to fly very short distances when fourteen days old.
7. Nesting success was 57% for two nests.
8. The family travels in a group and the parents feed the young at least until the thirteenth day out of the nest. The young birds obtain some food for themselves as early as the sixth day out.
9. In the late summer many families may be seen in the Station vicinity. They are very noisy and belligerent at this time.
10. Bird lice, spring-tails, ants, spiders, and mites were found in different nests after the young had left. The latter were also present on the young of two nests and in one case were very numerous.

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Table 1

Comparison of Nests.

Nest	Situation	Location	Height from ground	Distance from trunk	Inside Diameter	Outside Diameter	Inside Depth	Total Depth
A	Horizontal branch of Amer. Elm	Lake shore near boat house	33 ft.	20.5 ft.	↓			
B	50 diagonal branch of Red Oak	Next to laboratory	20.5 ft.	6.5 ft.	8.3 cm.	12 cm.	4.6 cm.	8 cm.
C	Horizontal branch of Red Oak	Lake shore near cab- ins	12 ft.	8.5 ft.	8.8 cm.	14 cm.	3.9 cm.	7.8 cm.
D	Horizontal branch of Red Oak	Lake shore near cab- ins	21 ft.	6 ft.	8.4 cm.	12.2 cm.	3.6 cm.	7.5 cm.
E	Next to trunk of Red Oak	Roadside near cab- ins	14 ft.	0 ft.	7 cm.	13.2 cm.	3.2 cm.	7.9 cm.
F	50 diagonal branch of Red Oak	Along fire line	21 ft.	5.5 ft.	9.1 cm.	12.6 cm.	3.8 cm.	7 cm.
G	50 diagonal branch of Red Oak	Open woods of picnic grounds	20 ft.	4.5 ft.	8.5 cm.	12.5 cm.	4 cm.	6.2 cm.
H	Horizontal branch of Jack Pine	Along roadside	19 ft.	13 ft.	8.5 cm.	12.3 cm.	3.6 cm.	7.2 cm.

↓ Nest A was blown out of the tree so no size measurements are available for it.

Table 2.

Summary of Nesting Events

Nest C

June 27	Birds noted near vicinity of nest but nest not actually seen.
June 30	Two eggs (Johnson).
July 1, 7 p.m.	Two eggs.
July 2, 8:30 p.m.	Three eggs.
July 3, 7:30 p.m.	Four eggs.
July 6,	Tower and blind put up.
July 15, 10 a.m.	Female banded.
July 16, 5-8 p.m.	First young hatched.
July 16, 9:30 p.m. to 17, 8:20 a.m.	Second young hatched.
July 19, 4:30 p.m.	One egg missing.
July 19, 7:30 p.m.	Second egg disappeared.
Aug. 1, 11-11:30 pm	Young left nest.
Aug. 14.	Young still in vicinity of nest and being fed by parents.
Aug. 17	Family reported in Ladyville. (Vickroy).

Nest H

July 8	Nest found with three eggs; female incubating.
July 10	Tower erected.
July 11	Young hatched.
July 24	One young jumped out of nest; died later.
July 25	Two young out of nest; one dead in nest.
July 31	Parents and young seen near nest.
Aug. 1	Birds left vicinity of nest.

Table 3

Attentiveness and Inattentiveness of the Female
at Nest C during the Incubation Cycle

Date	7-8-42	7-10-42	7-12-42	7-15-42	7-16-42
Time of day	1:07 p.m.	7:55 a.m.	3:24 p.m.	1:52 p.m.	5:59 a.m.
Time observed	4 hrs. 36 min.	3 hrs. 52 min.	2 hrs. 19 min.	2 hrs. 39 min.	41 min.
Temperature at beginning	57	65	85	75	42
Temperature at ending	60	72	--	78	45
Weather conditions	Clear	Overcast to clear	Clear	Clear	Cloudy
<u>Attentive periods</u>					
Number	8	8	3	7	2
Average no. per hr.	1.7	2	1.2	2.6	2.9
Extremes (min.)	37 & 23	48 & 10	55 & 17	42 & 1	20 & 14
Average length	27.8	23.2	33.3	14.4	17
Percentage of total time	80	80	71	63	82
<u>Inattentive periods</u>					
Number	8	7	3	6	1
Extremes	8 & 5	10 & 3	16 & 11	16 & 3	7
Average length	6.6	6.5	13	9.5	7
Percentage of total time	19	19	28	36	17

Table 4

Attentiveness of Female at Nest C during the Brooding Cycle.

Date	July 16	July 17	July 17	July 17	July 18	July 22	July 24	July 25	July 29	July 30	July 31	July 31
Age of nestlings	0	1	1	1	2	6	8	9	13	14	15	15
Time of day	8:15 p.m.	8:22 a.m.	2:52 p.m.	8:36 p.m.	7:39 a.m.	9:22 a.m.	1:06 p.m.	12:42 p.m.	1:32 p.m.	8:18 p.m.	8:12 a.m.	2:38 p.m.
Time observed	49 min	3 hr. 10 min	1 hr. 39 min	56 min	2 hr. 2 min	2 hr. 32 min	3 hr. 6 min.	1 hr. 12 min	4 hr. 27 min	54 min	3 hr. 31 min	2 hr. 27 min
Temperature at beginning and end	63 58	50 53	55 75	65 55	70 79	68 74	81 83	81, 83	80 --	70 67	66 71	71 71
Weather conditions	Over- cast	Rain	Over- cast	Clear to rain	Cloudy	Clear to hazy	Clear	Clear	Cloudy	Sprink- ling to dry	Clear to cloudy	Cloudy to clear
<u>Attentive periods</u>												
Number	2	6	8	9	6	23	20	10	25	6	32	19
Number of brooding periods	2	4	6	6	5	4	13	6	6	0	4	0
Extremes	31-17	75-28	26-4	11-4	25 $\frac{1}{2}$ -7 $\frac{1}{2}$	19-10	30-1	18-5	26-2	---	13-4	---
Average length	24	43.2	12.3	6.8	18.2	10.7	8.6	8.6	10.8	---	9	---
Percentage of total time	97	91	74	73	74	28	61	63	24	0	17	0

Table 5

Attentiveness and Inattentiveness of Female and Male at Nest C during the Brooding Cycle

Date	July 16	July 17	July 17	July 17	July 18	July 22	July 24	July 25	July 29	July 30	July 31	July 31
Age of nestlings	0	1	1	1	2	6	8	9	13	14	15	15
Other conditions	As on preceding table											
<u>Attentive periods of female</u>												
Number	2	6	8	9	6	23	20	10	25	6	32	19
Number of feeding visits per hour	3.6	1.9	4.8	10.7	2.9	8.8	4.1	6.7	5	7.7	9.1	8.1
<u>Attentive periods of male</u>												
Number	0	0	3	2	8	10	22	7	7	0	5	4
Number of feeding visits per hour	0	0	.9	2.1	4	4	6.9	5.2	1.5	0	1.4	1.6
<u>Inattentive periods of female</u>												
Number	2	5	7	9	6	22	20	10	25	6	32	19
Extremes	1-f \checkmark	7-1	6-1	4-1	12- $\frac{1}{2}$	18-f	14-f	9-f	39-1	27-1	23-f	20-1
Average length	.5	3.4	3.5	1.6	5.1	4.9	3.6	3	8	12.3	5.4	7.7
Percentage of total time	2	8	25	26	25	71	39	36	75	100	82	100

\checkmark f indicates a fraction of a minute less than one-fourth.

Table 6.

Growth and Development of Young at Nest C

- Day 0 Young blind and naked except for grayish-white down, mainly on the dorsal tracts. Skin a fleshy-red color, the beak and legs yellow. The young raise their heads when their bill is touched and cling to the nest bottom. Otherwise they lay in the nest.
- Day 2 Feather tracts appearing under the skin.
- Day 3 Beaks turning darker.
- Day 4 Young make faint chips. Down off on underparts. Shafts breaking through skin on the posterior ventral and femoral tracts.
- Day 5 Spinal and caudal shafts break through the skin. Eyes beginning to open.
- Day 6 Capital and throat shafts appear. Young hold necks up for longer periods of time. One young flutters wings a little.
- Day 7 Ventral shafts breaking open. Skin browner; bill and legs darker.
- Day 8 Shafts of alar and dorsal tracts break open. Beaks blacker with yellow ricti. One young preens his feather with his bill.
- Day 9 Capital and caudal shafts opening. Young respond to calls of parents.
- Day 10 Jugular shafts appearing. Down still attached to tips of feathers on the head, wing coverts, and tail.
- Day 12 Feathers of back overlap one another.
- Day 13 Ventral apertium completely covered. Grayish brown breast-band; wing coverts tipped brown. Only a few underwing coverts. Young flutter wings and are wide awake. They call more loudly, much like parents.
- Day 14 Neck shafts break open. Young can fly about five feet.
- Day 15 Body almost completely covered by feathers. Few downy feathers on head, scapulars, and rump. Young can fly about 10 feet.
- Day 16 Young leave nest. Make flights of 15 feet or so and can fly upwards.

Table 7

Weights of Young

<u>Nest H</u>				Day	<u>Nest C</u>		
Date	<u>Nestling</u>				Date	<u>Nestling</u>	
	No. 1	No. 2	No. 3		No. 1	No. 2	
7-12-42	5.6 ✓	4.6	3.1	1	7-17-42	5.1	4.2
7-13-42	8.2	7.4	4.7	2	7-18-42	7.2	6.4
7-14-42	11.5	10.4	7.8	3	7-19-42	9.9	8.9
7-15-42	15.3	13.3	9.9	4	7-20-42	13.2	11.6
7-16-42	18.8	17.1	13.6	5	7-21-42	18.9	16.8
7-17-42	21.4	19.2	15.9	6	7-22-42	21.3	20.1
7-18-42	22.9	21.2	18.3	7	7-23-42	26.1	24.4
7-19-42	28	26.1	22.6	8	7-24-42	28.6	26.8
7-20-42	29.9	28.2	26.4	9	7-25-42	32.6	31.2
7-21-42	31.9	30.5	30	10	7-26-42	34.6	32.4
7-22-42	32.5	30.9	29.8	11	7-27-42	36.5	35
7-23-42	34.4	32.1	32.9	12	7-28-42	36.4	36.4
7-24-42	33	31	33.7	13	7-29-42	36.6	36.9
7-25-42	Left	Left	Died	14	7-30-42	37.2	38.3
7-26-42	32.6	----	----	15	7-31-42	37.5	38
7-27-42	----	----	----	16	8-1-42	Left	Left

✓ All weights are given in grams.

Table 8

Nesting Success of Nests C and H

	Nest C	Nest H
Number of eggs in clutch	4	3
Number hatched	2	3
Number of young fledged	2	2
Fate of nest	2 eggs unproductive	1 young jumped out of the nest
Percent success of clutch	50%	66.6%
Total percent of all clutches	57%	

MAP I
TERRITORIES OF NESTS A, B, C, + G

