THE STUDY OF LATE NESTING CONDITIONS OF SOME MICHIGAN BIRDS

Thesis for the Degree of M. S.

MICHIGAN STATE COLLEGE
Edward Henry Graper

1948

THESIS

This is to certify that the

thesis entitled

The Study Of Late Nesting Conditions Of Some Michigan Birds

presented by

Edward H. Graper

has been accepted towards fulfillment
of the requirements for

M.S. degree in **Zoology**

P. J. Tack for H. R. Hunt
Major professor

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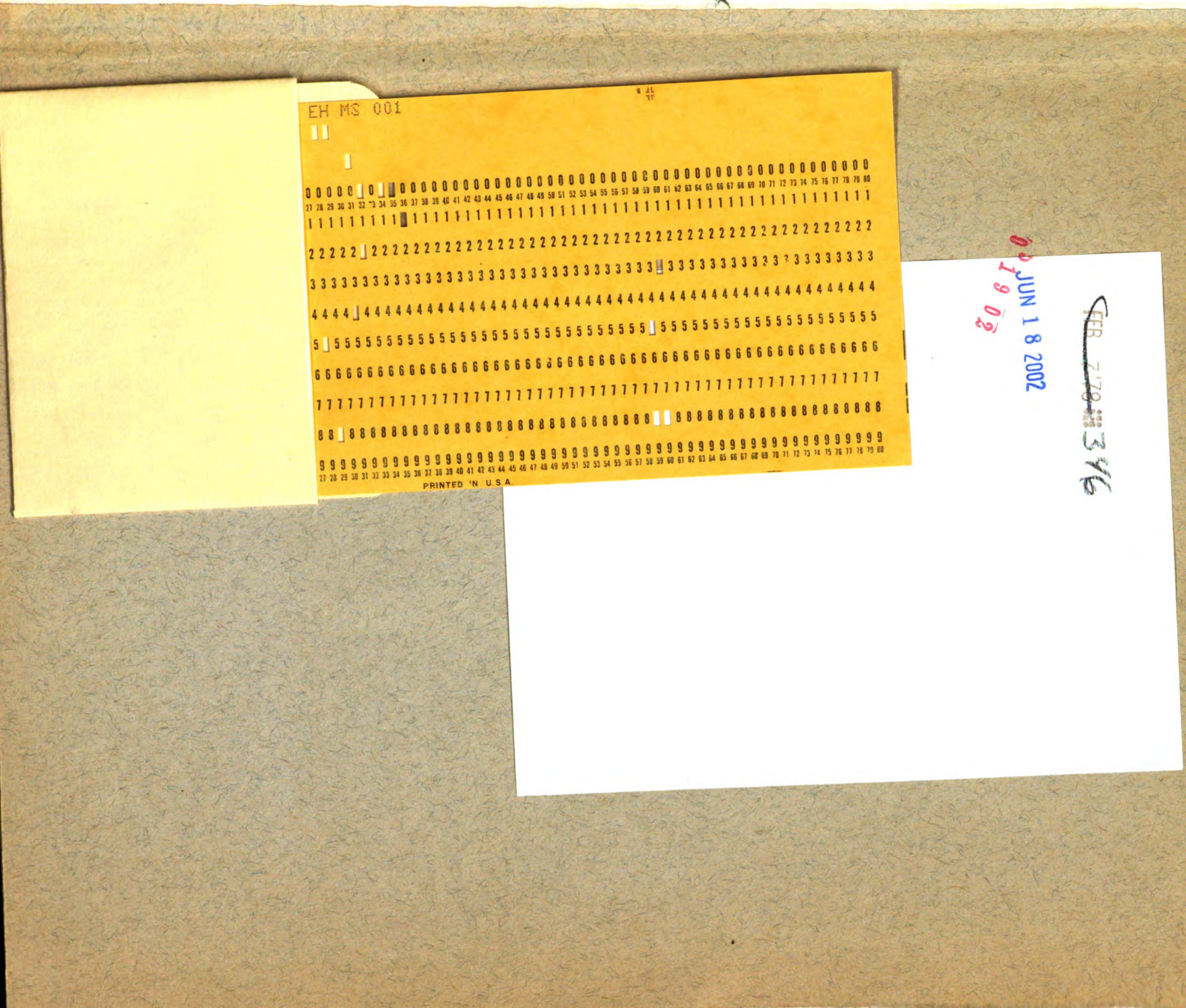
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THE STUDY OF LATE NESTING CONDITIONS OF SOME MICHIGAN BIRDS

By

Edward Henry Graper

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Submitted to the Faculty of Michigan State College
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The Study of Late Nesting Conditions of Some Michigan Birds

Introduction

This study of late seasonal nesting conditions was made in order to learn more about the nesting habits and conditions of the particular species present, concentration of species in special areas, mortality, and incubation period. The time involved in this study was June 18th to August 17th, 1934; June 17th to August 29th, 1935; June 20th to July 30th, 1936; and June 25th to August 25th, 1937. During this time two-hundred ninety-three nests, representing thirty species and subspecies, were studied in part or in full. A nest that was studied in full was closely observed from the time that the nest was started until the yound birds were on the wing or until the life of the individual ceased. The number of nests varied per species from one to one-hundred twenty-one.

Method of Study

An eight-power binocular fieldglass was used throughout the study. The method of procedure employed in locating the nests was as follows; by watching the move-

ments of the birds with the aid of binoculars, by listening to the song, by moving grass back and forth and opening the foliage on trees and shrubs with a four foot staff, and, in one case, one hundred feet of wire was used to drag through the grass. The latter method was used in locating ground nesting birds in the open field. It was found that many more nests could be located by close observations and hunting with a staff than by any other method. A part of each day was usually taken for hunting nests and the balance for checking information on nests that were already under observation.

When a nest had been located, it was numbered by a tag that was placed on the vegetation surrounding the nest or on a nearby landmark. A corresponding number would be placed on a sheet in a field notebook in which daily observations were recorded until information concerning the nest was completed. If the species were known, the common and scientific names were recorded; otherwise, later observations were made until the bird was definitely identified. The third part of the information sheet was the date of discovery, namely the day and the year. Location was signified by the use of the words "upland" or "lowland". In all cases the scientific name of the vegation in which the nest was located; the height of the nest above

the ground; the inside and outside diameters; and the depth of the nest were recorded in each case. In computing the diameter, two measurements were made across the nest with the two lines crossing each other above the center of the nest, thus making four 90 degree angles. These two numbers were averaged. This was done to make the measurements more exact. The thickness of the wall of the nest was obtained by subtracting the inside diameter from the outside and dividing the answer by two. If the nest had eggs or young birds in it the number was recorded. The data consisted of recording information concerning the nest from day to day.

Information on incubation was taken on nests that were observed from the time the first egg was found. The task of securing information on incubation proved to be very difficult because of the small number of nests that came through safely and produced young birds on the wing. The young birds were checked each day to determine the time required for them to get safely on the wing from the time they were hatched plus a few observations on the feeding of the young. Notations were also made on the mortality rate of the young birds.

Table I

Nests Studied

Species and Subspecies*	Number of Nests Per Year 1934	1935	1936	1937	Totals
Eastern Goldfinch Spinus tristis tristis	34	35		51	121
Eastern Robin Turdus migratorius migratorius	2	1		26	29
Eastern Field Sparrow Spizella pusilla pusilla	6	11	1	11	29
Eastern Mourning Dove Zenaidura macroura carolinensis		4		14	18
Mississippi Song Sparrow Melospiza melodia beata	3	4	1	5	13
Catbird Cumetella carolinensis	4	2		6	12
Eastern Chipping Sparrow Spizella passerina passerina	1	2		9	12
Alder Flycatcher Empidonaz trailli trailli	5	2		2	9
Eastern Kingbird Tyrannus tyrannus	2	5	1		8
Eastern Henslow's Sparrow Passerherbulus henslowi susurrans	4	1		1	6
Cedar Waxwing Bombycilla cedrorum	3	2			5
Eastern Meadowlark Sturnella magna magna	3	2			5
Eastern Red-wing Agelaius phoeniceus phoeniceus	2	1			3
Eastern Phoebe Sayoris phoebe	2	1			3
Eastern Yellow Warbler Dendroica aestiva aestiva	1			1	2
Barn Swallow Hirundo erythrogaster	1	1			2
Red-eyed Towhee Pipilo erythrophthalmus erythrophthalmus	1			1	2
Northern Flicker Colaptes auratus luteus	1				1
Eastern Bluebird Sialia sialis sialis	1				1
Maryland Yellow-throat Geothlypis trichas trichas	1				1
Northern Crested Flycatcher Myiarchus crinitus boreus	1				1
Eastern Vesper Sparrow Pooecetes gramineus gramineus	1				1
Starling Sturnus vulgaris vulgaris	1				1
Eastern Cardinal Richmondena cardinalis cardinalis	1				1
Killdeer Oxyechus vociferus vociferus				1	1
Eastern Warbling Vireo Vireo gilvus gilvus				1	1
Black-billed Cuckoo Coccyzus erythropthalmus				1	1
Eastern Bob-white Colinus virginianus virginianus	1				1
Indigo Bunting Passerina cyanea				1	1
Ring-necked Pheasant Phasianus colchicus torquatus		1			1
Grand Totals	80	75	5	132	292

*A. O. U., Fourth Edition, 1931, Check List.

Location of Plots

The W. K. Kellogg Reforestation Tract is made up of a parcel of land in the Township of Ross, County of Kalamazoo and the State of Michigan, and described as follows, to-wit:

"The Southwest quarter of section twenty-two (22) and the Southeast quarter of the Southeast quarter of section Twenty-one (21), together with a right-of-way two (2) rods in width over that part of the West twenty-two (22) lying between the Southerly line of Stong Lake Road and the South line of said quarter section, all of the above described premises being in Town one (1) South of Range nine (9) West and comprising two hundred (200) acres, more or less;

Also, all that part of the West half of the Northwest quarter of section twenty-two (22) Town one (1) South, Range nine (9) West, lying South of the highway running Easterly and Westerly through said West half of the Northwest quarter".

The W. K. Kellogg Bird Sanctuary is made up of about 150 acres of land surrounding Wintergreen Lake which is located in the Township of Ross, County of Kalamazoo and the State of Michigan. It is in the Northwest corner of section eight (8) Township one (1) South, Range nine(9) West.

The Wilcox Farm is situated in the Township of Meridian, County of Ingham, and State of Michigan. The description is as follows; "The South one-half (½) of the North one-half (½) of the Southeast one-fourth (¼), also the North one-half (½) of the South one-half (½) of the Southeast one-fourth (¼) of section nineteen (19) of the Township four (4) North, Range one (1) West"

Description of the Plots

W. K. Kellogg Reforestation Tract

The W. K. Kellogg Reforestation Tract is made up of a woodlot, orchard, upland, and a narrow strip of lowland on both sides of Augusta Creek. At the north end the lowland widens considerably. The lowland did not have a very heavy growth of grass during 1934 and 1935 due to the dry weather, but in 1937 the heavy rains caused a dense ground cover over the entire tract including the low area. In 1937 the lowland was covered with so much free water that growth of shrubs was somewhat retarded and the tall grasses and sedges have taken the lead. Scattered among the grasses and sedges are clumps of various species of dogwoods (Cornus amonum, Cornus stolonifera, Cornus canadensis), Hawthorne (Crataegus Sp.), blue beech (Carpinus caroliniana), American Elm (Ulmus americana), and slippery Elm (Ulmus fulva), ninebark (Physocarpus opulifolius),

and common elder (Sambucus canadensis).

When this work started in 1934 the fields of the W. K. Kellogg Reforestation Tract were mostly covered with timothy (Phleum pratense), blue grass (Poa pratensis), alfalfa (Medicago sativa) and many kinds of weeds. Patches of Canada thistles (Cirsium arvense) were scattered over most of the upland and have increased considerably during the three years of study. More and more of the tract is being reforested with both evergreen and deciduous trees. Many of the young trees were as much as six feet tall in 1937. About twenty acres of the area is covered with a second growth of oaks (Quercus velutina, rubra and alba). These trees have been thinned but the land has never been cleared and used for cultivation.

Five acres of orchard comprises part of the upland. It is not used for the production of fruit and for this reason no spraying is done. This makes suitable conditions for nesting in the orchard trees and furnishes food. Many blackberries (Rubus allegheniensis and villosus) bushes in the orchard furnish berries for certain species of birds.

W. K. Kellogg Bird Sanctuary

The W. K. Kellogg Bird Sanctuary is made up of a twenty acre lake (Wintergreen)and about eighty acres of lowland. Two swales come into the lake on the west

and one on the north side. The water level was relatively very high in the swales during 1937, but it was much lower in 1934 and 1935. During the dry years the swales had almost dried up and for this reason much vegetation grew in on the sides. This made an ideal place for nesting of the Florida Gallinule (Gallinula Chloropus Cachinnous), Virginia Rail (Rallus limicola limicola), and Least Bittern (Ixobrychus exilis exilis). In 1937 these species were not present probably because of the high water in the swales.

The upland cover changed considerably during the time of this study. Many of the evergreens such as the spruce (Picea Sp.), pine (Pinus Sp.), Cedar (Juniperus Sp.) and arbor vitae (Thuja Sp.) have made considerable growth, and during 1937, made an excellent nesting place especially for the Eastern Robin (Turdus migratorus migratorus), and the Eastern Mourning Dove. The juniper species is used by many low nesting birds such as the Eastern Chipping Sparrow, Eastern Field Sparrow, and the Mississippi Song Sparrow. These trees and shrubs do not only furnish excellent nesting places in summer, but also protection in winter for species that may be present.

There were many fruits and berries for birds during the summer. They included cherries (Prunus Sp.), black raspberries (Rubus occidentalis), red raspberries (Rhus idaeus), blackberries (Rubus alleghenienses,

cuneifolius and villosus), strawberries (Fragaria virginiana), mulberries (Morus Sp.) Dogwood berries (Cornus amomum, stolonifera and canadensis), Common Elderberry (Sambucus canadensis), and blueberries (Vaccinium pennsylvanicum). In the fall and winter the berries and fruits from the sumacs (Rhus typhina and glabra), mountain ash (Pyrus americana), and grapes (Vitis bicolor and vulpina) are eaten. Small food patches with various kinds of grains and other seed-bearing plants are being tried. Most of these means of providing food are in the experimental stage and sufficient study has not been made to know just what part these food patches will play in supplying the nourishment of birds during the fall and winter.

Wilcox Farm Plot of Michigan State College

This plot is somewhat different from the W. K. Kellogg Reforestation Tract and the W, K. Kellogg Bird Sanctuary in that no special effort has been made to provide for special nesting and feeding of birds. In 1936, when the investigation was carried on, the plot was used for the pasturing of cattle and horses. The grasses and weeds were closely eaten thus depleting the necessary cover for ground nesting birds. The low vegetation was composed of about one half daisies and the rest of different types of grasses. The topography is gently rolling with no hills or swamps. There

is no water on the tract, but a small creek runs through the woodland providing enough water for song birds. The stream is artificial and new, and for this reason does not have any plants that make suitable cover for nesting birds. The trees and shrubs are mostly hawthorne(Crataegus Sp.) prickly ash (Zanthoxylum americana), hickorys (Carya ovata and cordiformis), maples (Acer saccharum and rubrum), poplars (Poplus tremuloides and deltoides), elms (Ulmus fulva and americana), oaks (Quercus alba and velutina), and wild black cherry (Prunus sertina). A row of black willows (Salix nigra) is so located as to make good places for the Eastern Mourning Dove (Zenaridura macronia carolinensis) to nest. Very few birds nested on this plot judging from the nests that were in use and the few old nests that were located by the observer. Few old nests were located that were not in use. One was an Eastern Field Sparrow (Spizella pusilla pusilla) and the other four could not be identified because they had not been used the year that the observations were made. In comparison to plots that had been worked recently it seems that birds do not nest in nearly as great a number where the land is being pastured. Birds probably tend to choose sites where they are not being disturbed by grazing animals.

The preceeding descriptions of the different plots gives some idea of why the first two plots were espe-

cially well suited for nesting birds while the third was less suitable because of grazing animals. The study seems to indicate that cover is more important than food in determining the nesting in a given area. If the nesting sites are available the adult birds will range over a large enough area to secure food for themselves and their young.

In the foregoing pages an effort has been made to lay the foundation for an intense study of all nesting species. The Eastern Goldfinch leads with the greatest number of nests and for this reason it is the first species for which detailed information has been compiled.

Description of the Eastern Goldfinch
(Spinus tristis tristis)

Synonyms: American Goldfinch, Thistle-bird, Wild Canary and Yellowbird.

The Eastern Goldfinch is often called "Wild Canary" by many people due to its close resemblance to this species. It is both a common resident and migrant. Those birds that stay with us during the winter are usually not recognized by most people due to their change in plumage. In the winter they often associate with flocks of Pine Siskins (Pinus pinus) and Redpolls (Acanthis lineria lineria).

The adult Eastern Goldfinch is about 4.45 to 6.00 inches in length and weighs nearly .50 ounce according.

to B. H. Warren. C.L. Whittle gives the average weight as .51 ounce. During the breeding season the male is colored bright lemon-yellow with the crown, forehead, wings and tail mostly black. There are slight traces of white in the tail and wings. The female is yellow, with dusky wings and tail, and no black cap. After the mating season the male becomes much like the female in color for he begins to show more brown, less yellow, and the white markings become more distinct. The Eastern Goldfinch flies with a very pronounced undulating movement through the air and frequently sings in flight.

Study of The Eastern Goldfinch

One-hundred and twenty-one nests were observed during the four years of study. It was rather difficult for the writer to follow the progress of many nests from the time that nest building began until the young birds were safely on the wing. Of the one-hundred and twenty-one nests, twenty-one or 18.18 per cent had young in them, ninety-seven or 80.18 per cent had eggs and two or 1.65 per cent showed no development after they were found. The work was started early enough each year to follow the nest building, egg laying, incubation and caring of the young to valid conclusions. Not all of the late nests were observed to their final conclusions.

In the year 1935 the research was made in an area

which differed from the one where most of the information was gathered in that it was pastured and there was practically no thistle-down for the Eastern Goldfinch to use in its nest construction. Only one nest was located and it was very small, showing the lack of thistle-down material.

It is fairly certain that temperature and rainfall are important factors in determining the time of nesting of the Eastern Goldfinch. In 1934 (Table II) the mean temperature for June was 75.88 degrees F., July 77.97 degrees F., and August 70.52 degrees F., and with rainfall of .94, .92, and 2.3 inches respectively. The average rainfall for the three months period was 4.16 inches (see Table II). In 1935 (Table III) the mean average temperature for June was 64.05 degreesF., for July 74.81 degrees F., and for August 70.63 degrees F. The rainfall was 4.86 inches for June, 2.72 inches for July and 7.31 inches for August. The peak of nesting for 1934 (Graph V) came July 19th and August 13th in 1935 (Graph VI). This shift may be due to higher temperature which affects the birds as well as the development of the thistle-down. Since the Eastern Goldfinch uses mostly thistle-down for nests there must be a close relation between nesting time and the development of the thistle-down.

In 1937 (Table IV) the rainfall and temperature were more closely related to that of 1935 with lower

temperature and more rainfall especially during June and July. Under these conditions the peak of nesting came August 3rd (Graph VII), ten days earlier than in 1935 but fifteen days later than in 1934. More research needs to be done on both of the above factors, but we might conclude that both temperature and rainfall are important in determining the nesting time of the Eastern Goldfinch.

The climatological table for the three years was obtained from the weather station at the W. K. Kellogg Farm which is located within four miles of the areas. These tables are given here to show high, low and mean temperatures and also the rainfall for June, July and August for the years 1934, 1935 and 1937. The average mean temperature and monthly rainfall were determined from the daily data.

Table II

Climatological Data 1934

June Day	High	Low	Mean	Rainfall
1.	102	68	85	
2.	100	73	86.5	
3.	96	64	80	
4.	99	66	82.5	
5.	95	64	79.5	.08
6.	85	67	76	
7.	78	52	65	
8.	90	50	70	
9.	89	61	75	
10.	99	56	77.5	.16
11.	89	54	71.5	
12.	78	52	65	.09
13.	79	50	64.5	
14.	87	48	67.5	
15.	89	59	74	
16.	98	58	78	
17.	93	56	74.5	
18.	92	64	78	.23
19.	87	58	72.5	
20.	94	60	77	
21.	91	63	77	.08
22.	74	50	62	.17
23.	93	57	75	
24.	91	66	78.5	
25.	87	67	77	
26.	93	61	77	.13
27.	90	66	78	
28.	101	69	85	
29.	101	69	85	
30.	96	69	82.5	

Mean average 75.88 degrees F.
Total rainfall for June .94 in.
Average daily rainfall .13 in.

July Day	High	Low	Mean	Rainfall
1.	93	63	78	
2.	95	58	76.5	
3.	91	67	79	
4.	84	53	68.5	
5.	92	73	82.5	
6.	93	71	82	.43
7.	78	52	65	
8.	81	51	66	
9.	87	54	70.5	
10.	89	60	74.5	
11.	92	66	79	
12.	93	65	79	
13.	92	71	81.5	
14.	94	60	77	
15.	96	73	84.5	
16.	93	57	75	
17.	88	57	72.5	
18.	96	62	79	
19.	92	75	83.5	
20.	103	69	86	
21.	107	70	88.5	
22.	105	75	90	
23.	103	65	84	
24.	106	69	87.5	
25.	104	72	88	
26.	101	69	85	.41
27.	83	57	70	
28.	85	57	71	
29.	90	54	72	
30.	87	58	72.5	.08
31.	87	51	69	

Mean average 77.97oF.
Total rainfall July .92"
Average daily rainfall
.03 in.

August Day	High	Low	Mean	Rainfall
1.	91	57	74	
2.	93	65	79	.02
3.	84	60	72	.19
4.	87	58	72.5	
5.	88	63	75.5	
6.	86	56	71	.01
7.	91	66	78.5	.13
8.	96	70	83	
9.	100	66	83	
10.	96	69	82.5	1.19
11.	84	60	72	
12.	88	69	78.5	
13.	88	67	77.5	
14.	80	51	65.5	
15.	77	60	68.5	.27
16.	85	64	74.5	.14
17.	89	59	74	
18.	92	62	77	.07
19.	89	65	77	.02
20.	85	49	67	
21.	78	44	61	
22.	79	62	70.5	
23.	81	50	65.5	
24.	77	51	64	.26
25.	72	47	59.5	
26.	75	49	62	
27.	76	52	64	
28.	70	48	59	
29.	70	41	55.5	
30.	75	41	58	
31.	79	50	64.5	

Mean average 70.52 degrees F.
Total rainfall for August 2.3 in.
Average daily rainfall .074 in.

Table III

Climatological Data 1935

June Day	High	Low	Mean	Rainfall
1.	74	48	61	
2.	80	50	65	1.10
3.	76	61	68.5	.16
4.	71	52	61.5	
5.	73	44	58.5	.01
6.	57	46	51.5	.1
7.	61	48	54.5	
8.	71	43	57	
9.	76	45	60.5	
10.	75	52	63.5	.02
11.	77	57	67	
12.	78	47	62.5	
13.	83	60	71.5	.1
14.	84	63	73.5	
15.	80	59	69.5	
16.	83	63	73	
17.	78	57	67.5	1.05
18.	60	54	57	.4
19.	65	52	58.5	.83
20.	72	43	57.5	.08
21.	72	53	62.5	
22.	70	52	61	
23.	70	52	61	
24.	79	48	63.5	
25.	78	52	65	
26.	76	62	69	.45
27.	80	55	67.5	.35
28.	81	55	68	
29.	82	61	71.5	.16
30.	84	63	73.5	.02

Mean average 64.05 degrees F.
Total rainfall for June 4.86 in.
Average daily rainfall .162 in.

July Day	High	Low	Mean	Rainfall
1.	84	63	73.5	
2.	78	59	68.5	.17
3.	83	64	73.5	.54
4.	87	64	75.5	.03
5.	89	66	77.5	
6.	84	71	77.5	.2
7.	78	61	69.5	
8.	83	59	71	
9.	84	62	73	
10.	89	61	75	
11.	91	63	77	
12.	89	74	81.5	
13.	83	62	72.5	
14.	85	57	71	
15.	82	60	71	.6
16.	82	52	67	
17.	86	57	71.5	
18.	92	60	76	
19.	97	70	83.5	
20.	92	65	78.5	.62
21.	85	65	75.	.02
22.	86	68	77	.19
23.	85	69	77	
24.	83	65	74	
25.	87	63	75	
26.	87	66	76.5	.35
27.	88	62	75	
28.	90	70	80	
29.	88	62	75	
30.	88	61	74.5	
31.	87	65	76	

Mean average 74.81°F.
Total rainfall for July 2.72 in.
Average daily rainfall .088 in.

August Day	High	Low	Mean	Rainfall
1.	93	71	82	
2.	87	68	77.5	2.32
3.	86	70	78	
4.	83	63	73	
5.	89	65	77	
6.	84	69	76.5	.32
7.	84	70	77	
8.	79	65	72	
9.	81	59	70	
10.	86	65	75.5	.17
11.	91	63	77	
12.	87	72	79.5	
13.	80	61	70.5	
14.	83	52	67.5	
15.	84	65	74.5	
16.	81	67	74	.75
17.	79	67	73	2.5
18.	76	67	71.5	.77
19.	82	66	74	.07
20.	80	68	74	.11
21.	78	61	69.5	.2
22.	74	50	62	
23.	77	52	64.5	
24.	78	50	64	
25.	79	51	65	
26.	82	64	73	
27.	77	60	68.5	.1
28.	68	48	58	
29.	67	45	56	
30.	66	47	56.5	
31.	71	46	58.5	

Mean average 70.63 degrees F.
Total rainfall for August 7.31 in.
Average daily rainfall .236 in.

Table IIII

Climatological Data 1937

June Day	High	Low	Mean	Rainfall
1.	88	60	74	
2.	74	47	60.5	
3.	73	55	64	
4.	71	49	60	.04
5.	82	57	69.5	.12
6.	75	57	66	.02
7.	73	51	62	
8.	73	46	59.5	.01
9.	69	45	57	.72
10.	72	42	57	.12
11.	75	43	59	
12.	78	50	64	
13.	78	58	68	.11
14.	75	61	68	1.12
15.	80	54	67	
16.	78	56	67	
17.	84	61	67.5	.94
18.	75	59	67	.03
19.	75	51	63	
20.	87	61	74	.32
21.	86	67	76.5	1.75
22.	80	55	67.5	
23.	77	55	66	.01
24.	87	61	74	1.1
25.	87	69	78	.26
26.	89	64	76.5	
27.	83	62	72.5	
28.	80	56	68	
29.	73	56	64.5	
30.	67	44	55.5	

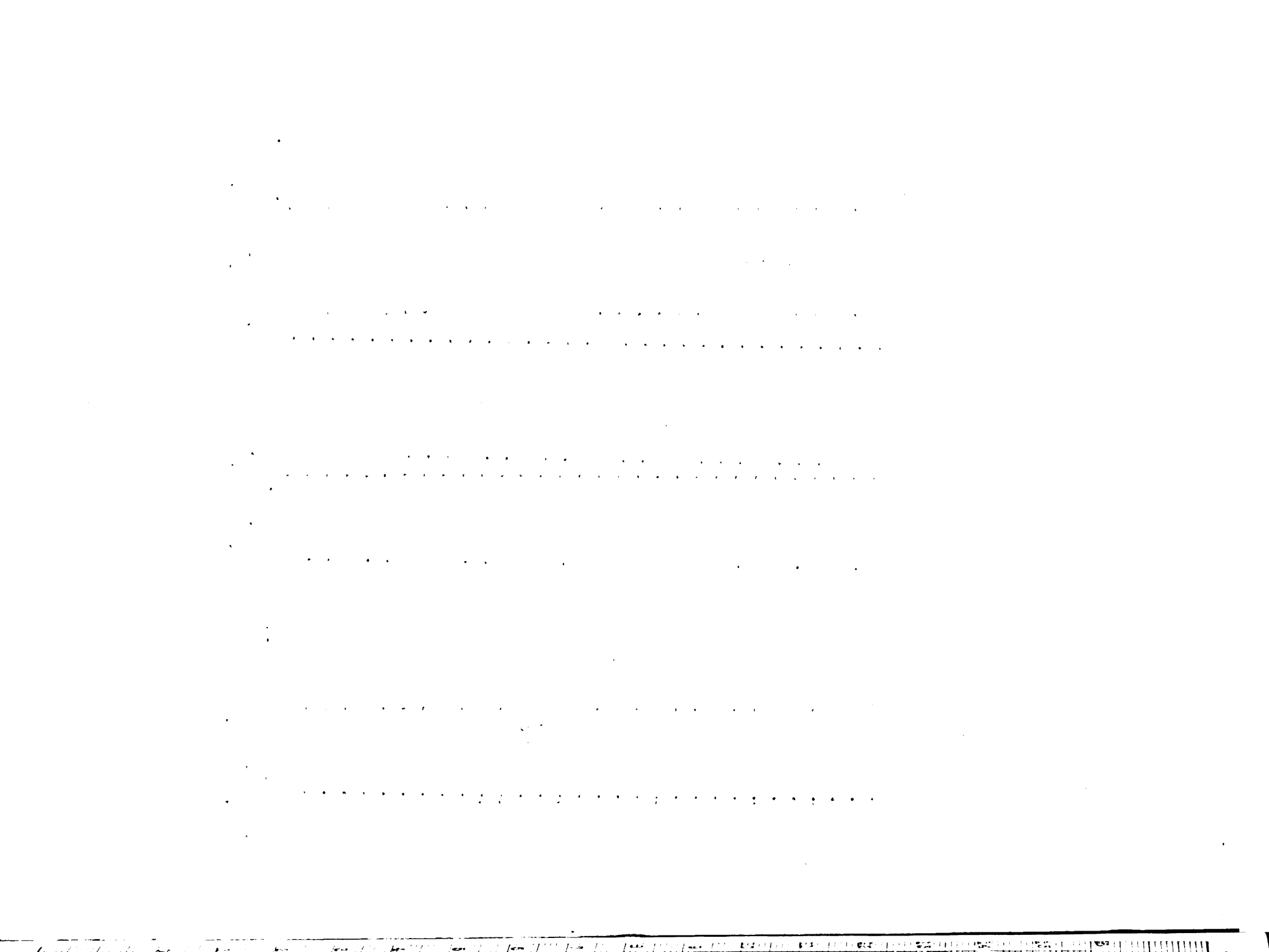
Mean average 66.43 degrees F.
Total rainfall for June 6.67 in.
Average daily rainfall .222 in.

July Day	High	Low	Mean	Rainfall
1.	74	44	59	
2.	77	54	65.5	.11
3.	86	56	71	
4.	86	65	75.5	.18
5.	86	57	71.5	.16
6.	91	63	77	
7.	92	65	78.5	
8.	94	67	80.5	
9.	91	67	79	
10.	90	70	80	.66
11.	92	71	81.5	.02
12.	90	67	78.5	.33
13.	81	65	73	.11
14.	86	70	78	.05
15.	87	70	78.5	.14
16.	90	70	80	
17.	86	58	72	
18.	77	53	65	
19.	77	51	64	
20.	82	54	68	
21.	87	54	70.5	
22.	87	56	71.5	
23.	88	63	75.5	
24.	87	63	75	.02
25.	84	64	74	.16
26.	70	54	62	.06
27.	75	49	62	
28.	84	50	67	
29.	83	54	68.5	.11
30.	87	53	70	
31.	83	54	68.5	

Mean average 72.27°F.
Total rainfall for July 2.11 in.
Average daily rainfall .068 in.

August Day	High	Low	Mean	Rainfall
1.	82	50	66	
2.	86	52	69	
3.	88	59	73.5	
4.	87	68	77.5	.08
5.	88	56	72	
6.	89	63	76	
7.	85	64	74.5	.18
8.	85	62	73.5	
9.	86	66	76	
10.	91	64	77.5	
11.	87	62	74.5	
12.	79	69	74	.43
13.	84	55	69.5	
14.	86	56	71	
15.	89	62	75.5	
16.	93	59	76	
17.	95	67	81	1.2
18.	83	61	72	
19.	95	69	82	
20.	89	64	76.5	1.6
21.	82	62	72	1.75
22.	72	53	62.5	
23.	77	51	64	
24.	81	54	67.5	
25.	83	68	75.5	
26.	86	57	71.5	
27.	88	60	74	
28.	89	62	75.5	
29.	88	62	75	
30.	91	62	76.5	
31.	88	64	76	

Mean average 73.47 degrees F.
Total rainfall for August 5.24 in.
Average daily rainfall .169 in.

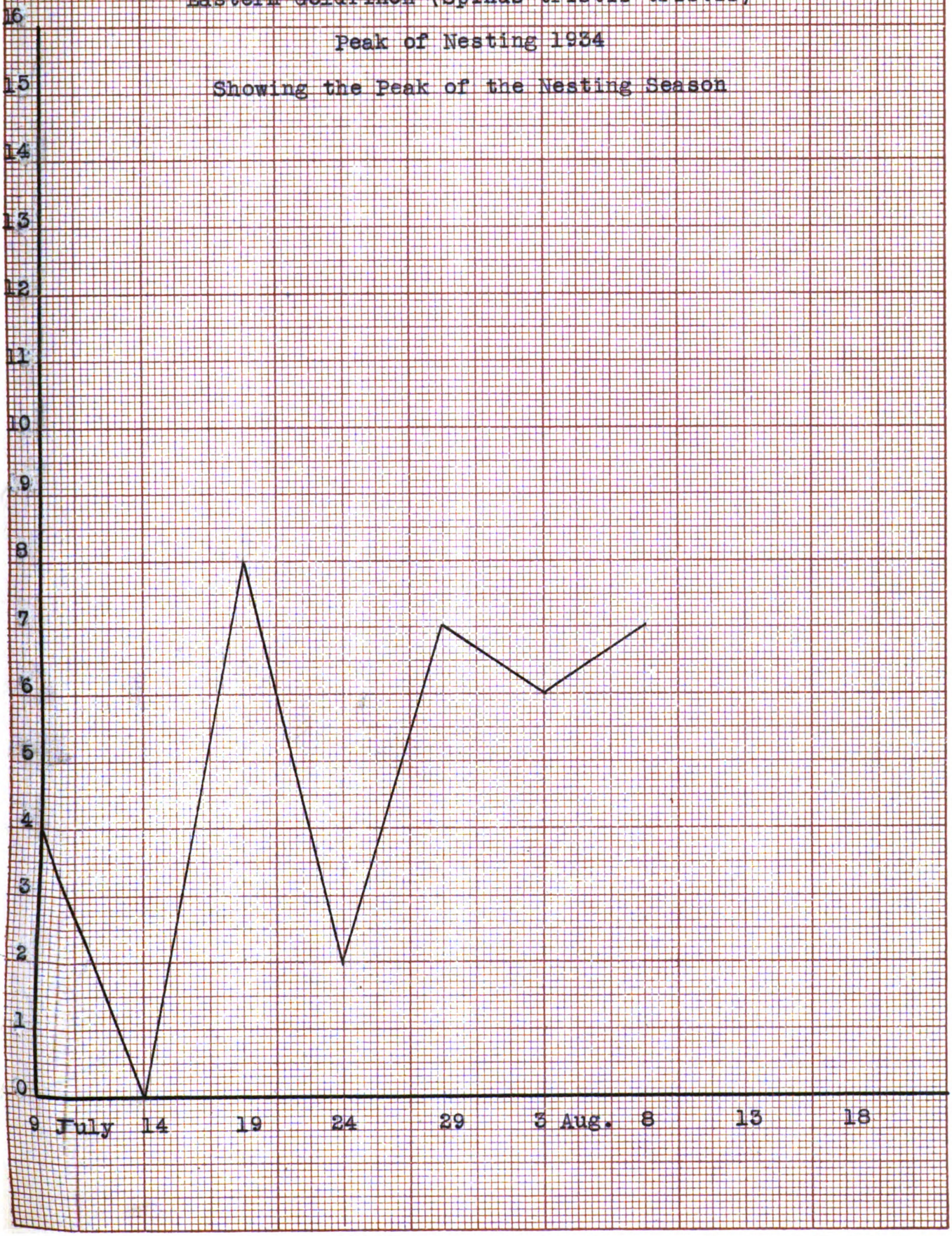


Graph V

Eastern Goldfinch (Spinus tristis tristis)

Peak of Nesting 1934

Showing the Peak of the Nesting Season

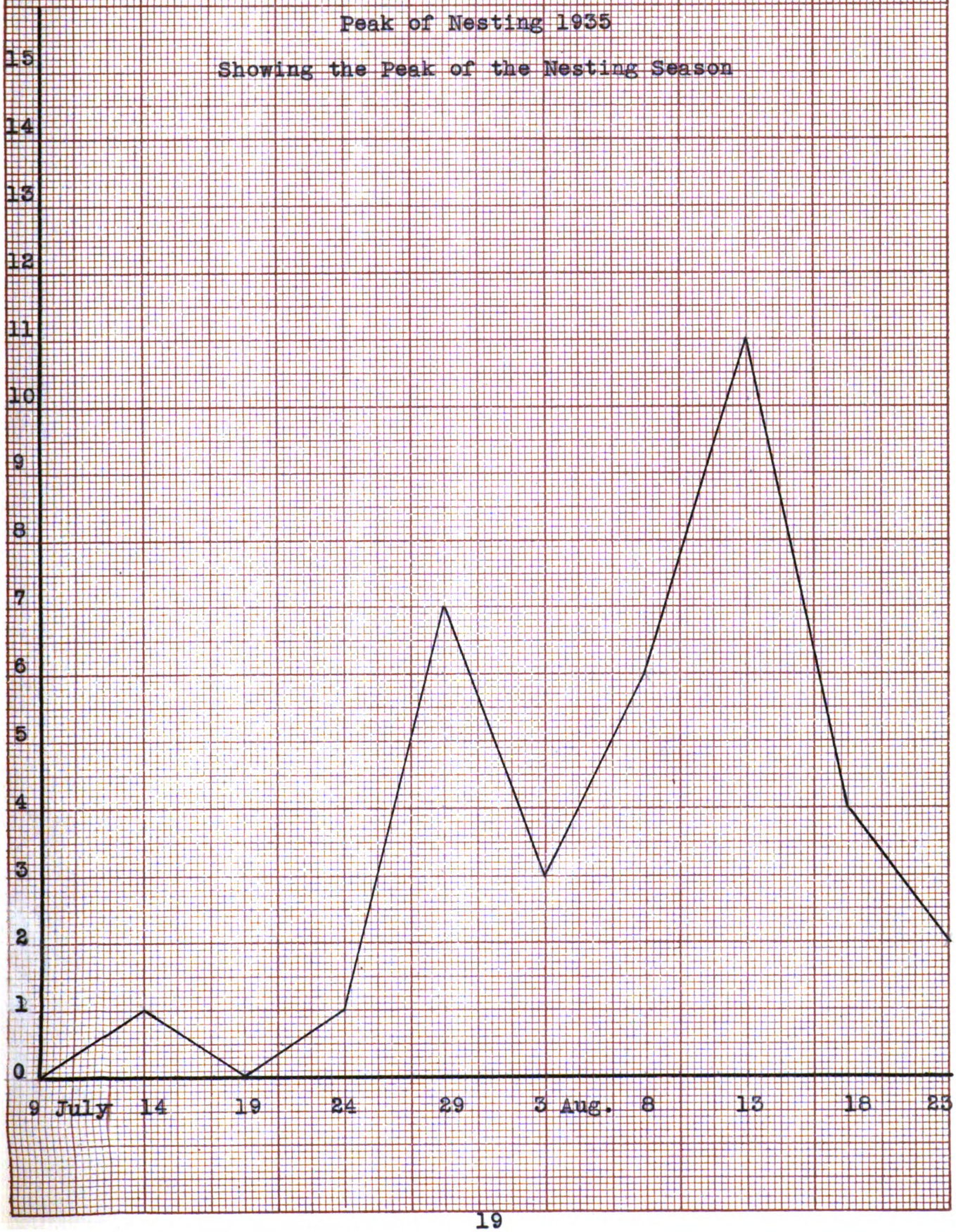


Graph VI

Eastern Goldfinch (Spinus tristis tristis)

Peak of Nesting 1935

Showing the Peak of the Nesting Season




Graph VII
Eastern Goldfinch
(Spinus tristis tristis)
Peak of Nesting 1937
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
9 July 14 19 24 29 3 Aug. 8 13 18 23

Correlations

The following correlations were made:

I. Correlating the height of the nest with the number of birds that got safely on the wing.

II. Correlating the height of the nest above the ground with the thickness of the nest.

III. Correlating the thickness of the nest with the number of young birds that got safely on the wing.

IV. Multiple correlation of the height, thickness and number of young birds that got safely on the wing.

V. Correlating the depth of the nest with the number of eggs in the clutch.

VI. Correlating the thickness of the nest with the number of eggs in the clutch.

VII. Correlating the depth of the nest with the number of eggs in the clutch.

VIII. Correlating the inside diameter with the depth of the nest.

IX. Correlating the outside diameter with the depth of the nest.

X. Correlating the outside and the inside diameters of the nest.

XI. Multiple correlation of inside and outside diameters and depth.

The following formula were used in making the single and multiple correlations respectively:

$$Ryx = \frac{\Sigma xy - \frac{(\Sigma x)(\Sigma y)}{n}}{\sqrt{\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]\left[\Sigma y^2 - \frac{(\Sigma y)^2}{n}\right]}}$$

$$Ry.xz = \sqrt{\frac{rxy^2 - rxy.ry^2.rxz + ry^2}{1 - r^2x^2}}$$

Correlations of The Eastern Goldfinch

A correlation was made between the height of the nest above the ground and the number of birds that got safely on the wing in twenty-nine nests, see Table VIII, The linear correlation coefficient obtained was .114±190, which was not significantly different from zero; that is the highness or the lowness of the nest are not factors in determining how many young birds would get safely on the wing. A correlation coefficient of .367 at a five per cent level or greater would point to a definite relation between the height of the nest and the number of young that got safely on the wing.

The correlation between the height of the nest above the ground and the thickness, Table IX, gave a result of .11±.190, probable error, which again is

not large enough to indicate a significant difference to say that we can expect to find certain thickness of nests at a certain height. We could expect to find thickness within a certain range at any height above the ground.

A correlation coefficient of −.867 was obtained in correlating the thickness of the nest with the number of birds that got safely on the wing, Table X. This indicates that the thicker the nest the less birds get safely on the wing, which is reasonable because a thick nest is more conspicuous to enemies from all sides. This would only be considered as one factor and not true under all conditions.

In the multiple correlation the letter "Y" in Table XI represents the number of birds that got safely on the wing, "X" the height of the nest above the ground and "Z" the thickness of the nest's wall. The multiple correlation coefficient between the number of birds that got safely on the wing and the(height and thickness) of the nest is .867. From this we conclude that the union of height and thickness does not play a very important part on placing young birds securely on the wing. Since the addition of .0002 to .8667 is not considered large enough to be significant.

Table XII shows a correlation between the depth of the nest with the number of eggs in a clutch, Table XIII contains the correlation between the thickness of the next and the number of eggs in clutch and Table

XIV takes into consideration depth and thickness of the nest. The respective correlation coefficients were .0654-.1557 and .0532 on sixty-two nests which may not be great enough to be considered important. It is not to be expected that a bird which builds a thick or deep nest will lay a clutch of four, five or six eggs. The result might be negative or positive but with no degree of certainty for either of the two. Thickness possibly is influenced to a certain extent by available nesting material. The single nest that was located in 1936 on a pastured plot was not of average thickness. It took ten days for the construction which might have been due to the lack of sufficient thistle-down at hand, time required in carrying nesting material for a great distance or a delay in mating. All of these factors need further investigation.

The correlation coefficient of .262 I obtained from Table XV is significantly different from zero at the five per cent level to indicate a relation between the inside diameter and the depth of the Eastern Goldfinch nest. There are variations but the cup is pretty much the same shape. With a certain diameter we can predict with a degree of accuracy the depth of the nest. In Table XVI the result on eighty-six nests indicates that there is no correlation between the outside diameter and the depth of the nest. The same

is also true of inside diameter and thickness of the wall (Table XVII). In taking depth outside and inside diameters into consideration a multiple correlation of .5 was found which points to a fair degree of correlation (Table XVIII).

Correlation Table VIII

Eastern Goldfinch (Spinus tristis tristis)

Height and Success On Wing

Nest Number	Height in Feet(H)	Number of birds that got safely on the wing (W)
20	6	4
44	7	3
46	5.5	3
50	6	4
55	5.5	6
62	3	3
64	77	6
1 S	10	4
6 S	4.5	6
7 S	6.5	3
59	5.5	5
61	7	6
65	7	5
68	5	3
72	6	5
74	9	5
75	6.5	5
76	7	5
88	3.75	3
91	6	3
95	5.25	5
100	6	5
101	5	5
103	7	3
106	5.5	5
107	5.5	5
108	5.5	5
112	2.5	3
121	3	6
	169.0	129
Mean	5.83	4.45
Standard Error	± .298	± .208

Correlation Coefficient r=.114
H.W.

Probable standard error of correlation coefficient ±.190

Correlation Table IX

Eastern Goldfinch (Spinus tristis tristis)

Height and Thickness of Nest Wall		
Number of Nest	Height in Feet (H)	Thickness of nest wall in Inches (Th)
20	6	.75
44	7	.75
46	5.5	.5
50	6	.5
55	5.5	.5
62	3	.5
64	7	.5
1 S	10	.5
6 S	4.5	.625
7 S	6.5	.625
59	5.5	.562
61	7	.5
65	7	.437
68	5	.437
72	6	.625
74	9	.625
75	6.5	.562
76	7	.437
88	3.75	.937
91	6	.75
95	5.25	.686
100	6	.686
101	5	.625
103	7	.625
106	5.5	.625
107	5.5	.5
108	5.5	.5
112	2.5	.625
121	3	.437
Mean	5.83	.584
Standard Error	± .298	±.022

Correlation Coefficient $r_{H.Th} = -.11$

Probable standard error of correlation coefficient ±.190

Correlation Table X

Eastern Goldfinch (Spinus tristis tristis)

Thickness of Nest Wall and Success On Wing

Nest Number	Thickness of nest wall in inches(Th)	Number of birds that got safely on the wing (W)
20	.75	4
44	.75	3
46	.5	3
50	.5	4
55	.5	6
62	.5	3
64	.5	6
1 S	.5	4
6 S	.625	6
7 S	.625	3
59	.562	5
61	.5	6
65	.437	5
68	.437	3
72	.625	5
74	.625	5
75	.562	5
76	.437	5
88	.937	3
91	.75	3
95	.686	5
100	.686	5
101	.625	5
103	.625	3
106	.625	5
107	.5	5
108	.5	5
112	.625	3
121	.437	6
Mean	.584	4.45
Standard Error	±.022	±.208

Correlation Coefficient $r_{Th.W} = -.867$

Probable standard error of correlation coefficient ± .048

Correlation Table XI

Eastern Goldfinch (Spinus tristis tristis)

Success On Wing With Height and Thickness of Nest Wall

$$R_{y.xz} = \sqrt{\frac{r_{xy}^2 - 2r_{xy}\, r_{yz}\, r_{xz} + r_{yz}^2}{1 - r_{xz}^2}}$$

Ryx .114 (wing and height)

Ryx −.867 (wing and thickness)

Rxz −.11 (height and thickness)

$$R_{y.xz} = \sqrt{\frac{(.114)^2 - 2(.114)\quad(-.867)\ (-.11) + (-.867)^2}{1-(-.11)^2}} = .867$$

RW.H.Th = .867 ± .049

Y represents the number of birds that got safely on the wing.
X represents the height of the nest.
Z represents the width of the nest or the wall thickness.

Correlation Table XII

Eastern Goldfinch (Spinus tristis tristis)

Depth of Nest With The Number of Eggs In a Clutch

Nest Number	Depth of nest in inches (D)	Number of eggs in a clutch (N)
1935		
20	1.75	6
29	1	5
30	1.25	5
31	1.25	5
35	1.5	4
36	1	5
42	1.5	6
43	1.25	5
48	1.5	4
52	1.5	5
54	1.25	4
56	1.5	5
57	1.5	6
58	1.5	4
59	1.5	5
60	1.25	5
61	1.25	4
63	1.5	5
65	1.25	5
67	1.25	5
68	1.25	5
1937		
69	1.25	6
65	1.5	5
68	1.25	6
70	1.125	4
71	1.25	4
72	1.5	5
73	1.25	5
74	1.25	5
75	1.5	5
76	1.5	5
77	1.5	6
78	1.25	6
80	1.25	5
82	1.5	5
83	1.125	5
85	1.25	5
88	1.5	5
89	1.25	5
90	1.5	6
91	1.5	4
92	1.5	5
94	1.125	6
95	1.25	5
103	1.25	5
106	1.25	5
109	1.25	6
113	1.5	5
114	1.5	5
117	1.5	6
118	1.5	5
119	1.375	5
123	1.25	5
124	1.25	6
125	1.5	5
126	1.5	5
127	1.25	6
128	1.25	5
129	1.25	4
130	1	5
132	1.375	5
Mean	1.34	5.06

Standard Error $\pm .063$ $\pm .204$

Correlation Coefficient $r = \pm .065$ $D.N$

Probable standard error of correlation coefficient $\pm .129$

Correlation Table XIII

Eastern Goldfinch (Spinus tristis tristis)

Thickness of Nest Wall
and Number of Eggs In a Clutch

Nest Number	Thickness of nest wall in inches (Th)	Number of eggs in a clutch (N)
1935		
20	.75	6
29	.5	5
30	.5	5
31	.75	5
35	.5	4
36	.5	5
42	.25	6
43	.5	5
48	.5	4
52	.625	5
54	.5	4
56	.5	5
57	.5	6
58	.5	4
59	.5	5
60	.625	5
61	.625	4
63	.5	5
65	.5	5
67	.625	5
68	.5	5
69	.5	6
1937		
59	.562	5
65	.437	5
68	.437	6
70	.625	4
71	.5	4
72	.625	5
73	.625	5
74	.562	5
75	.562	5
76	.437	5
77	.5	6
78	.625	6
80	.625	5
82	.625	5
83	1.	5
85	.687	5
88	.937	5
89	.625	5
90	.5	6
91	.75	4
92	.75	5
94	.687	6
95	.687	5
103	.625	5
106	.625	5
109	.5	6
113	.5	5
114	.437	5
117	.625	6
118	.5	5
119	.875	5
123	.812	5
124	.375	6
125	.562	5
126	.625	5
127	.375	6
128	.625	5
129	.562	4
130	.5	5
132	.5	5
Mean	.576	5.06
Standard error	± .017	± .024

Correlation Coefficient $r_{Th.N.} = -.156$

Probable standard error or correlation coefficient ± .126

Correlation Table XIV

Eastern Goldfinch (Spinus tristis tristis)

Depth of Nest With Thickness of Wall		
Nest Number	Depth of nest in inches (D)	Thickness of the nest wall in inches (Th)
1935		
20	1.75	.75
29	1.	.5
30	1.25	.5
31	1.25	.75
35	1.5	.5
36	1.	.5
42	1.5	.25
43	1.25	.5
48	1.5	.5
52	1.5	.625
54	1.25	.5
56	1.5	.5
57	1.5	.5
58	1.5	.5
59	1.5	.5
60	1.25	.625
61	1.25	.625
63	1.5	.5
65	1.25	.5
67	1.25	.625
68	1.25	.5
69	1.25	.5
1937		
59	1.25	.562
65	1.5	.437
68	1.25	.437
70	1.125	.625
71	1.25	15
72	1.5	.625
73	1.25	.625
74	1.25	.562
75	1.5	.562
76	1.5	.437
77	1.5	.5
78	1.25	.625
80	1.25	.625
82	1.5	.625
83	1.125	1.
85	1.25	.687
88	1.5	.937
89	1.25	.625
90	1.5	.5
91	1.5	.75
92	1.5	.75
94	1.125	.687
95	1.25	.687
103	1.25	.625
106	1.25	.625
109	1.25	.5
113	1.5	.5
114	1.5	.437
117	1.5	.625
118	1.5	.5
119	1.375	.875
123	1.25	.812
124	1.25	.375
125	1.5	.562
126	1.5	.625
127	1.25	.375
128	1.25	.625
129	1.25	.562
130	1.	.5
132	1.375	.5
Mean	1.34	.576
Standard Error	±.063	±.017

Correlation Coefficient $r_{D.Th} = -.052$

Probable standard error of correlation coefficient ±.129

Correlation Table XV

Eastern Goldfinch (Spinus tristis tristis)

Inside Diameter and Depth

Nest No.	N Depth in inches (D)	Inside diameter in inches (Id)
1935		
20	1.75	2.25
29	1.	2
30	1.25	2
31	1.25	2
35	1.5	2
36	1.	2
37	1.25	2.25
41	1.5	2.5
42	1.5	2.5
43	1.25	2
44	1.5	2
46	1.25	2
48	1.5	2
50	1.5	2
52	1.5	2
54	1.25	2
55	1.5	2.25
56	1.5	2
57	1.5	2
58	1.5	2
59	1.5	2
60	1.25	2
61	1.25	1.75
62	1.5	2.5
63	1.5	2
64	1.5	2.5
65	1.25	2
66	1.75	2.25
67	1.25	2
68	1.25	1.75
69	1.25	1.875
1S	1.5	2.125
5S	2	2
6S	1.25	1.875
7S	1.5	2.25
1937		
59	1.25	1.875
61	1.25	2
65	1.5	2.5
68	1.25	2
70	1.125	2.25
71	1.25	2
72	1.5	2
73	1.25	1.75
74	1.25	2
75	1.5	2
76	1.5	1.875
77	1.5	1.875
78	1.25	2
79	1.125	1.875
80	1.25	2
81	1.25	1.875
82	1.5	2
83	1.125	2.5
85	1.25	2
88	1.5	2.25
89	1.25	2
90	1.5	2
91	1.5	1.75
92	1.5	1.75
94	1.125	1.875
95	1.25	2.125
96	1.25	2
100	1.25	1.875
101	1.5	2.25
103	1.25	2
106	1.25	1.875
107	1.5	2
108	1.5	2.5
109	1.25	2
112	1.5	2.25
113	1.5	2
114	1.5	1.875
116	.5	1.875
117	1.5	2
118	1.5	2
119	1.375	1.75
121	1.25	1.875
123	1.25	1.875
124	1.25	2
125	1.5	1.875
126	1.5	1.75
127	1.25	1.75
128	1.25	2
129	1.25	1.875
130	1	2
132	1.375	1.75
Mean	1.35	2.01
Standard Error	± .019	± .021

Correlation Coefficient $r_{Id.D} = .262$

Probable standard error of correlation coefficient ±.102

Correlation Table XVI

Eastern Goldfinch (Spinus tristis tristis)

Outside Diameter and Depth

Nest No.	Depth in inches(D)	Outside diameter in inches(Od)	Nest No.	Depth in inches(D)	Outside diameter in inches (Od)
1935					
20	1.75	3.75	68	1.25	3
29	1	3	69	1.25	3.25
30	1.25	3	1S	1.5	3.25
31	1.25	3.5	5S	2	3.5
35	1.5	3	6S	1.25	3.25
36	1	3	7S	1.5	3.5
37	1.25	3.25	1937		
41	1.5	3.25	59	1.25	3
42	1.5	3	61	1.25	3
43	1.25	3	65	1.5	3
44	1.5	3.5	68	1.25	3.5
46	1.25	3	70	1.125	3
48	1.5	3	71	1.25	3.5
50	1.5	3	72	1.5	3
52	1.5	3.25	73	1.25	2.75
54	1.25	3	74	1.25	3
55	1.5	3.25	75	1.5	3.25
56	1.5	3	76	1.5	3
57	1.5	3	77	1.5	3.5
58	1.5	3	78	1.5	3.25
59	1.5	3	79	1.25	3
60	1.25	3.25	80	1.125	3.5
61	1.25	3	81	1.25	3.25
62	1.5	3.5	82	1.25	3.5
63	1.5	3	83	1.5	3
64	1.5	3.5	85	1.125	3
65	1.25	3	88	1.25	3.5
66	1.75	3.5	89	1.5	3
67	1.25	3.25	90	1.25	3
			91	1.5	3.5
			92	1.5	3.25
			94	1.5	3.25
			95	1.125	3.5
			96	1.25	3.5
			100	1.25	3.25
			101	1.25	3.5
			103	1.5	3.25
			106	1.25	3
			107	1.5	3
			108	1.5	3.5
			109	1.25	3
			112	1.5	3.5
			113	1.5	3
			114	1.5	2.75
			116	.5	3
			117	1.5	3.25
			118	1.5	3
			119	1.375	3.5
			121	1.25	2.75
			123	1.25	3.5
			124	1.25	2.75
			125	1.5	3
			126	1.5	3
			127	1.25	2.5
			128	1.25	3.25
			129	1.25	3
			130	1	3
			132	1.375	2.75
			Mean	1.35	3.14
			Standard Error	±.021	±.029

Correlation Coefficient $r = .107$ (Od.D)

Probable standard error of correlation coefficient ±.108

Correlation Table XVII

Eastern Goldfinch (Spinus tristis tristis)

Inside Diameter and Thickness of Nest Wall

Nest No.	Thickness of Nest wall in inches (Th)	Inside Diameter in inches (Id)	Nest No.	Thickness of nest wall in inches (Th)	Inside diameter in inches (Id)
1935					
20	.75	2.25	68	.5	2
29	.5	2	69	.5	1.75
30	.5	2	1S	.5	1.875
31	.75	2	5S	.5	2.125
35	.5	2	6S	.625	2
36	.5	2	7S	.625	2.25
37	.5	2.25	1937		2
41	.375	2.5	59	.562	1.875
42	.25	2.5	61	.5	2
43	.5	2	65	.438	2.5
44	.75	2	68	.438	2
46	.5	2	70	.625	2.25
48	.5	2	71	.5	2
50	.5	2	72	.625	1.875
52	.625	2	73	.625	2
54	.5	2	74	.562	2
55	.5	2.25	75	.562	1.75
56	.5	2	76	.438	1.875
57	.5	2	77	.5	1.875
58	.5	2	78	.625	2
59	.5	2	79	.625	1.875
60	.625	2	80	.625	1.75
61	.625	1.75	81	.625	1.75
62	.5	2.5	82	.5	2
63	.5	2	83	1.	1.875
64	.5	2.5	85	.687	1.875
65	.5	2	88	.937	2
66	.625	2.25	89	.625	1.75
67	.625	2	90	.5	
			91	.75	2
			92	.75	1.75
			94	.687	1.875
			95	.687	2.125
			96	.75	2
			100	.687	1.875
			101	.625	2.25
			103	.625	2
			106	.562	1.875
			107	.5	2
			108	.5	2.5
			109	.5	2
			112	.625	2.25
			113	.5	2
			114	.437	1.875
			116	.562	2
			117	.625	2
			118	.5	1.75
			119	.875	1.875
			121	.437	1.875
			123	.812	2
			124	.375	1.875
			125	.562	1.75
			126	.625	1.75
			127	.375	2
			128	.625	1.875
			129	.562	1.875
			130	.5	2
			132	.5	1.75
			Mean	.57	2.01

Standard Error ±.013 ± .019

Correlation Eodfficient r = .225
Id.Th

Probable standard error of correlation coefficient ±.104

Correlation Table XVIII

Eastern Goldfinch (Spinus tristis tristis)

Outside and Inside Diameter With Depth

Y represents the inside diameter.

X represents the outside diameter.

Z represents the depth.

The multiple correlation coefficient of the inside and outside diameter and depth is .5

$$R_{Id.O.D.} \quad .5$$

Probable standard error of correlation coefficient

This correlation is highly significant. With the outside diameter and depth we can predict with a fair degree of accuracy the inside diameter.

Nesting Sites

During the four years that this study was carried on, the Eastern Goldfinch used twenty-seven different kinds of trees and shrubs for nesting sites. Most of the nests were in shrubs with twenty-five of them located in Kinnikinnik (Cornus amomum). There were ten located in the Red Osier Dogwood (Cornus stolonifera) and ten more in the Panicled Dogwood (Cornus candidissima). Of the one-hundred twenty-one nests there were forty-five in the Cornus genius of shrubs. A probable reason why the Eastern Goldfinch used this shrub so often was possibly due to its wide distribution over the areas studied and because of the suitable crotches for the placing of the nests. The shrub Ninebark (Physocarpus opulifolius) had fourteen nests and was second highest of all the shrubs used over the four years. This shrub was well distributed over the plots and also had ideal branching for the placing of nests.

The nests seemed to be somewhat grouped in different spots in the area,but, at no time did the observer find two nests in the same shrub nor was the same plant used more than one time during the four years. Nests that were placed in trees showed a much wider distribution over the areas because of the small number and position of the trees.

The range of height from the ground was from two feet to twelve. The lowest nests were in the Red Osier Dogwoods (Cornus stolonifera) at a distance of two feet above the ground and the highest was in a Slippery Elm (Ulmus fulva). The weighted average height for all trees and shrubs was 4.9887 feet for the four years. The height above the ground was low due to the high percentage of shrubs in the area. During the four years that this study was carried on the weighted average height of the nest was somewhat higher in 1937 than in 1934. The increase in height can be attributed to the growth in the vegetation over the entire areas.

Table XIX

Eastern Goldfinch (Spinus tristis tristis)

The Types of Vegetation Used For Nesting Sites

Common and Scientific Name of Plant Species	Year and Number of Times Used 1934	1935	1936	1937	Total
Kinnikinnik (Cornus amomum)	8	9		8	25
Ninebark (Physocarpus opulifolius)	7	1		6	14
Red Osier Dogwood (Cornus stolonifera)	3	5		2	10
Panicled Dogwood (Cornus candidissima)	3	6		1	10
Slippery Elm (Ulmus fulva)		3		5	8
Common Elder (Sambucus canadensis)	3	2		3	8
Wild Black Cherry (Prunus serotina)		2		4	6
Sugar Maple (Acer saccharum)		1		4	5
Hawthorne (Crataegus Sp.)	1		1	3	5
Norway Pine (Pinus resinosa)				4	4
American Elm (Ulmus americana)	1			2	3
Filbert (Corylus Sp.)		1		2	3
Pussy Willow (Salix discolor)	3				3
Black Ash (Fraxinus nigra)	3				3
Basswood (Tilia americana)		1		1	2
Blue Beech (Carpinus caroliniana)	1				1
Hazelnut (Corylus americana)		1			1
Sassafras (Sassafras officinale)	1				1
Cherry Sp. (Prunus Sp.)		1			1
Butternut (Juglans cinerea)		1			1
Black Walnut (Juglans nigera)		1			1
Common Apple (Malus pumila)				1	1
Cut-leaf Sumac (Rhus pyphina)				1	1
Common Locust (Robina pseudo-acacia)				1	1
American Ash (Fraxinus americana)				1	1
Nanny Berry (Virburnum lentago)				1	1
Pear (Pyrus communis)				1	1
Total Species 27 Totals	34	35	1	51	121

Table XX

Eastern Goldfinch (Spinus tristis tristis)

Variation in Height of Nest
According to Plant Species

Scientific Name of Vegetation	Range in Height 1934	1935	1936	1937
Cornus amomum	4'-6'	3'-5.5'		3'-4'
Physocarpus opulifolius	2'-4'	4.5'		3'-5.5'
Cornus canadensis	3'-7'	3'-4.5'		2'-3'
Cornus canadensis	3'-4'	2.5'-6.54'		3'
Ulmus fulva		3.75'-6'		5.25'-12'
Sambucus canadensis	4'-5'	3.75'-6'		3'-5.5'
Prunus serotina		6'		5.5'-6.5'
Acer saccharum		7'		2.5'-5.5'
Crataegus Sp.	7'		3'	2.75'-5.5'
Pinus resinosa				4'-10'
Ulmus americana	6'			3.75'-7'
Corylus Sp.		6.5'		5.5'-7'
Salix discolor	3'-5'			
Fraxinus nigra	7'-10'			
Tilia americana		4.5'		5'
Carpinus caroliniana	6'			
Corylus americana		4'		
Sassafras officinale				10'
Prunus Sp.		10'		
Juglans cinerea		6.5'		
Juglans nigra		7'		
Malus pumila				7'
Rhus typhina				7'
Robinia Pseudo-acacia				6'
Fraxinus americana				9'
Virburnum lentago				4.5'
Pyrus communis				6'
Total Species 27	2'-10'	2.5'-10'	3'	2'-12'

The range in height for the four years was from 2' to 12'.

Table XXI

Eastern Goldfinch (Spinus tristis tristis)

Plant Species Used For Nesting Sites

Scientific Name of Plant Species	Average Height 1934	1935	1936	1937	Weighted Av.
Cornus amomum	4.75'	3.75'		3.5'	3.99'
Physocarpus opulifolius	3.1429	4.5		4.5	3.8214
Cornus stolonifera	4.3333	3.6		2.5	3.6
Cornus canadensis	3.3333	4.0833		3.	3.75
Ulmus fulva		5.5833		7.45	6.75
Sambucus canadensis	4.3333	4.875		4.5833	4.5625
Prunus serotina		6.		5.875	5.9167
Acer saccharum		7.		4.	4.6
Crataegus Sp.	7.		5.	3.75	4.65
Pinus resinosa				7.	7.
Ulmus americana	6.			5.375	5.5833
Corylus Sp.		6.5		6.25	6.3333
Salix discolor	4.				4.
Fraxinus nigra	9.				9.
Tilia americana		4.5		5.	4.75
Carpinus carolinana	6.				6.
Corylus americana		4.			4.
Sassafras officinale	10.				10.
Prunus Sp.		10.			10.
Juglans cinerea		6.5			6.5
Juglans nigra		7.			7.
Malus pumila				7.	7.
Rhus typhina				7.	7.
Robinia pseudo-acacia				6.	6.
Fraxinus americana				9.	9.
Virvurnum lentago				4.5	4.5
Pyrus communis				6.	6.
	4.8235	4.7071	5.	5.1078	4.9887

Nests With Eggs of the Eastern Goldfinch

During the four years that this study was carried on, a total of one-hundred and twenty-one nests were located of which ninety-seven had eggs at some time, Table XXIII; twenty-two had young, Table XXIV; and two were completed but did not show any development. In the ninety-seven nests there was a grand total of 466 eggs or an average of 4.8 eggs per clutch. The clutches that were located varied from one to eight eggs, but nests with such extreme numbers would not be considered normal. Clutches of four to six were normal and very common as indicated in Table XXII. In the one-hundred and twenty-one nests there were fifty-nine that had five eggs indicating that that number would be considered the average clutch.

There were 466 eggs, Table XXV, in ninety-seven nests. Of these 196, Table XXVI, or 42.6% were destroyed by unknown factors. In most cases the eggs were completely removed from the nest while others had shell remains. This indicated that different factors may have been responsible for taking the eggs. There were 16 or 3.435% infertile eggs. The eggs were opened by the observer and there were no signs of embryos developing. In most cases the contents showed decay.

Of the 466 eggs there were 254 or 54.51% that hatched or were left in the nest when this work came to a close. It is certain that sixty-seven or 26.38%

of the 254 eggs produced young that fledged safely on the wing, while thirteen or 5.12% were questionable. In most cases the young left the nest before they could fly. When this work came to a close there was a total of 74 or 29.13% of the young still left in the nest. Possibly a goodly number of these got safely on the wing. Eighteen or 7.08% of the young birds were taken from the nest during the period of development by unknown factors. When observations ceased there were 75 or 29.55% of the 254 eggs left in the nests. (Since most of these nests had eggs present the latter part of August, it is questionable if many produced young birds on the wing by fall.) Seven eggs or 2.76% contained dead birds.

Nests With Young

Twenty-two nests had a total of 99 young birds in them when the first observations were made. Some unknown factors were responsible for taking 23 or 23.23% of the above 99 yound birds. No animal was ever seen in the act of taking a young bird from the nest which is rather interesting since so many people are ready to condemn many animals for taking young birds. This is a problem that could be given considerable research. Five or 5.05% of these young were left in the nest when this work came to a close and 71 or 71.71% got safely on the wing.

In the foregoing study it is certain that 138

young got safely on the wing and 18 were questionable. Since several of the other nests were not studied until the eggs or young were taken by some factors, or the young got safely on the wing, it is difficult to draw accurate conclusions on the status of the Eastern Goldfinch in these areas. From the fore-going figures we may predict that this species is not holding its own on these areas. The year 1937 seemed to be a more successful year than 1934 as far as the number of young birds that were produced. This success was partly due to the fact that a longer time was spent on the study of the problem, thus allowing the observer to carry more nests to completion. If the time had been extended in 1934 it seems as if more young could have been accounted for and, in this way, a more successful condition may have been found to exist.

The foregoing conclusion is based on one year as a unit of study. It is fairly certain that this species produces only one brood of young per year. The number of years the adults are capable of reproducing single broods of young is unknown. Until banding records are made available to give us an answer to the length of reproductivity, it is impossible to forecast how many young are produced from an average pair. It is most certain that other factors enter into the picture or, from the above data, the species would become extinct which obviously is not true.

Table XXII

Eastern Goldfinch (Spinus tristis tristis)

Summary of Egg Clutches			
No. of Egg Per Clutch	No. of Nests	Total	Per Cent
8	1	8	1.71
6	15	90	19.31
5	59	295	63.3
4	13	52	11.16
3	4	12	2.57
2	4	8	1.71
1	1	1	.21
	97	466	100.00

Table XXIII

Eastern Goldfinch (Spinus tristis tristis)

Success of Nesting

1. Nest number and year.
2. The number of young birds that got safely on the wing.
3. The number of young birds that were questionable as to whether they got safely on the wing.
4. The number of young birds that were left in the nest when this work came to a close.
5. The number of young birds that were taken by some factor from the nest.
6. The number of eggs that were left in the nest when this work came to a close.
7. The number of eggs that contained dead birds.
8. Total of first six columns.
9. Miscellaneous.

1	2	3	4	5	6	7	8	9
1934								
39								5 infertile
42								No development
45	5						5	
47				6			6	
50			5				5	
52			3			1	4	
61			4				4	
62	5						5	
63								No development
64					5		5	
65					5		5	
66					5		5	
68					5		5	
71				5			5	
72			3			2	5	
73			2		2		4	
74					5		5	
75					4		4	
76					5		5	
80					3		3	

1	2	3	4	5	6	7	8	9
1935								
20	4						4	2 infertile
29		4					4	1 infertile
35		3		1			4	
42		6					6	
56			4				4	1 infertile
57			5	1			6	
58			3			1	4	
59					5		5	
63					5		5	
67					5		5	
68					5		5	
69					6		6	
1936								
No#					5		5	
1937	5						5	
59	5							
65	5						5	
72	5						5	
74	5						5	
75	5						5	
76	5						5	
81				2			2	
88	3						3	2 infertile
91	3						3	1 infertile
92			4				4	1 infertile
94					4	2	6	
95	5						5	
103	3						3	2 infertile
106	5						5	
109			4	1	1		6	
113	4					1	5	
114			5				5	
117			6				6	
118			5				5	
123			5				5	
126			5				5	
128			4				4	1 infertile
129			2	2			4	
132			5				5	
99	67	13	74	18	75	7	254	16

Table XXIV

Eastern Goldfinch (Spinus tristis tristis)

Success of Nesting From Young Birds

1. Nest number and year.
2. The number of young birds that were in the nest when it was located.
3. The number of young birds that were taken by some factor from the nest.
4. The number of young birds that got safely on the wing.
5. The number of young birds that were questionable as to whether they got safely on the wing.

1	2	3	4	5
1934				
60	4		4	
1935				
37	4	4		
41	5			5
44	3		3	
46	3		3	
50	4		4	
55	6		6	
62	3		3	
64	6		6	
66	4	4		
1-S	4		4	
5-S	5	5		
6-S	6		6	
7-S	3		3	
1937				
79	4	4		
100	5		5	
101	5		5	
107	5		5	
108	5		5	
112	3		3	
116	6	6		
121	6		6	
22	99	23	71	5

Table XXV

Eastern Goldfinch (Spinus tristis tristis)

Number of Eggs Per Clutch

Nest Number	Number of eggs	Nest Number	Number of eggs	Nest Number	Number of eggs
1934		30	5	77	6
34	5	31	5	78	6
36	6	35	4	80	5
38	5	36	5	81	2
39	5	42	6	82	5
43	5	43	5	83	5
44	1	48	4	85	5
45	5	52	5	88	5
47	6	54	4	89	5
48	2	56	5	90	6
49	3	57	6	91	4
50	5	58	4	92	5
52	4	59	5	94	6
53	5	60	5	95	5
58	2	61	4	96	3
59	5	63	5	103	5
61	4	65	5	106	5
62	5	67	5	109	6
64	5	68	5	113	5
65	5	69	6	114	5
66	5	1936		117	6
68	5	No#	5	118	5
69	2	1937		119	5
71	5	59	5	123	5
72	5	61	8	124	6
73	4	65	5	125	5
74	5	68	6	126	5
75	4	70	4	127	6
76	5	71	4	128	5
77	5	72	5	129	4
79	3	73	5	130	5
80	3	74	5	132	5
1935		75	5	97 Total	466 Total
20	6	76	5		
29	5				

Table XXVI

Eastern Goldfinch (Spinus tristis tristis)

Egg Fatality

Nest Number	Number of Eggs	Nest Number	Number of Eggs
1934		1937	
34	5	61	8
36	6	68	6
38	5	70	4
43	5	71	4
44	1	73	5
48	2	77	6
49	3	78	6
53	5	80	5
58	2	82	5
59	5	83	5
69	2	85	5
77	5	89	5
79	3	90	6
1935		96	3
30	5	119	5
31	5	124	6
36	5	125	5
43	5	127	6
48	4	130	5
52	5	Total	196
54	4		
60	5		
61	4		
65	5		

Nesting Observations Eastern Goldfinch

During the time that this study was carried on the observer tried to find out what effect the handling of eggs, painting eggs, flushing the female from the nest etc. would have on incubation and the regular cycle in the Eastern Goldfinch. It was a very common practice to check the nest two times a day for development. There were a few nests where a check was made every hour of the day beginning at eight A.M. and ending at 8 P.M. The observer painted three eggs of a clutch of five black, in order to see what would happen. In all the observations there was not a time where a female deserted the nest because of this type of disturbance. The females would usually leave the nest singing and return in from five to sixty-five minutes. There was a quicker return to the eggs on a cool and cloudy day then on a warm and sunny.

All nests were checked after two severe rain storms. Not one nest that contained eggs or young was wet. Females were on most of the nests when the observations were made. Only two nests were observed during their early development that contained water after a severe rain. They were well enough constructed from plant fiber and thistle down to hold water.

The nests vary somewhat but most of them are rather well built. After this fine construction the Eastern

Goldfinch never cleans the nest after the young hatch. The female spends little time on the young after the third day unless it is cool or rainy weather. The waste accumulates until the nest is flat. This may be one reason why the young birds are heavily infested with parasites.

Table XXVII

The Types of Vegetation Used for Nesting Sites

Eastern Robin (Turdus migratorius migratorius)

The following table gives the names of the vegetation in which the Eastern Robin (Turdus migratorius migratorius) built its nest and the frequency of use of each species.

Common Name	Scientific Name	Frequency
Norway Pine	Pinus resinosa	12
Norway Spruce	Pinus Abies	3
Filbert	Corylus Sp.	2
Black Willow	Salix nigra	1
Swamp Hickory	Carya cordiformis	1
White Oak	Quescus alba	1
White Pine	Pinus strobus	1
Panicled Dogwood	Cornus canadissima	1
Austrian Pine	Pinus nigra	1
Common Elder	Sambucus canadensis	1
Cherry	Prunus Sp.	1
Scotch Pine	Pinus sylvestris	1
Red Cedar	Sabina	1
Highbush cranberry	Virburnum trifolium	1
Basswood	Tilia americana	1
Pignut Hickory	Carya glabra	1
	Total	30

Table XXVIII

Measurements for Correlations

Eastern Robin (Turdus migratorius migratorius)

The following table gives the measurements from which the correlations were made:

1. Nest number.
2. Height of the nest above the ground.
3. Outside diameter of the nest.
4. Inside diameter of the nest.
5. Thickness of the nest wall.
6. Inside depth of the nest.

1.	2.	3.	4.	5.	6.
12	10'				
46	12				
26	13	5.5"	3.75"	.875"	2.75"
4	4.5	4.75	3.5	.375	1.75
5	5.5	5.25	4.25	.5	2.25
7	3	5.25	4	.625	2.25
11	6	5	3.5	.875	2.
12	8	5.5	3.5	1.	2.
13	5	5	3	1.	2.
14	8	5	3.5	.875	1.75
17	6	6	3	1.5	1.75
18	5	6	3	1.5	2.
19	5	5.25	3.75	.75	2.
22	5.5	5	3.5	.875	2.
24	7.5	5.5	3.25	1.125	2.
30	5.5	6	3.25	1.375	2.
32	3	5	4	.5	2.5
34	7	5.5	3.5	1.	2.
35	4.5	5.5	3.5	1.	2.
36	8.5	5.75	3.5	1.125	2.
41	4	5	3.5	.875	2.
45	11	5.5	3.75	.875	2.
46	4.5	5.	3.5	.75	2.
47	4.	6.	3.75	1.125	2.
49	5	5.5	3.75	.875	2.
50	6	5	3	1.	2.
51	2	5.75	3.75	1.	1.75
55	4.5	5.25	3.75	1.	1.75
57	4.5	5.75	3.5	1.125	2
99	35				
Mean	7.1'	5.39"	3.53"	.94"	2.02"

Correlations

Eastern Robin (Turdus migratorius migratorius)

Correlating the Outside and Inside Diameters of the Nest.

Correlating the Outside Diameters With the Thickness of the Nest Wall.

Correlating the Thickness of the Wall With the Diameter of the Nest.

Correlating the Depth With the Thickness of the Nest Wall.

Correlating the Depth With the Outside Diameter of the Nest.

Correlating the Depth With the Inside Diameter of the Nest.

The correlation coefficient of .7682 (Table XXX) between the outside diameter and the wall thickness of the nest in the Eastern Robin is significant. The outside diameter appears to a certain extent to determine the thickness of the nest wall. In Table XXXI the relation between the inside diameter and thickness of the nest wall as indicated by the correlation coefficient is -.6912, which again is rather high. The correlation coefficient between the inside diameter and depth of the nest as shown in Table XXXIV is .4806 which is not as great as the ones given in Tables XXX and XXXI.

In Tables XXIX XXXII and XXXIII there is no correlation as shown by the correlation coefficients -.1419, -.3087 and -.0787 respectively. The outside and inside diameters (Table XXIX) are not influenced by each other in any way. Each may vary greatly from the other in different nests. The thickness is not influenced by the depth as shown in Table XXXII. No certain depth is to be expected since the thickness of the different nests vary. The correlation coefficient between the outside diameter and the depth of the nest is the smallest coefficient found(Table XXXIII).

Correlation Table XXIX

Eastern Robin (Turdus migratorius migratorius)

The Outside and Inside Diameters of the Nest		
Nest Number	Outside Diameter	Inside Diameter
26	5.5"	3.75"
4	4.75	3.5
5	5.25	4.25
7	5.25	4
11	5	3.5
12	5.5	3.5
13	5	3
14	5	3.5
17	6	3
18	6	3
19	5.25	3.75
22	5	3.5
24	5.5	3.25
30	6	3.25
32	5	4
34	5.5	3.5
35	5.5	3.5
36	5.75	3.5
41	5	3.5
45	5.5	3.75
46	5	3.5
47	6	3.75
49	5.5	3.75
50	5	3
51	5.75	3.75
55	5.25	3.25
57	5.75	3.5
Mean	5.39"	3.52"

The correlation coefficient for the above measurements is -.1419.

Correlation Table XXX

Eastern Robin (Turdus migratorius migratorius)

The Outside Diameter
With the Thickness of the Nest Wall

Nest Number	Outside Diameter	Thickness of Nest Wall
26	5.5"	.875
4	4.75	.375
5	5.25	.5
7	5.25	.625
11	5	.875
12	5.5	1.
13	5	1.
14	5	.875
17	6	1.5
18	6	1.5
19	5.25	.75
22	5	.875
24	5.5	1.125
30	6	1.375
32	5	.5
34	5.5	1.
35	5.5	1.
36	5.75	1.125
41	5	.875
45	5.5	.875
46	5	.75
47	6	1.125
49	5.5	.875
50	5	1.
51	5.75	1.
55	5.25	1.
57	5.75	1.
Mean	5.39"	.94"

The correlation coefficient of the above measurements is .768.

Correlation Table XXXI

Eastern Robin (Turdus migratorius migratorius)

The Thickness of the Wall
With the Inside Diameter of the Nest

Nest Number	Thickness of Nest Wall	Inside Diameter
26	.875"	3.75"
4	.375	3.5
5	.5	4.25
7	.625	4.
11	.875	3.5
12	1.	3.5
13	1.	3.
14	.875	3.5
17	1.5	3.
18	1.5	3.
19	.75	3.75
22	.875	3.5
24	1.125	3.25
30	1.375	3.25
32	.5	4
34	1.	3.5
35	1.	3.5
36	1.125	3.5
41	.875	3.5
45	.875	3.75
46	.75	3.5
47	1.125	3.75
49	.875	3.75
50	1.	3
51	1.	3.75
55	1.	3.25
57	1.125	3.5
Mean	.94"	3.52"

The correlation coefficient of the above measurements is -.6912.

Correlation Table XXXII

Eastern Robin (Turdus migratorius migratorius)

The Depth With the Thickness of the Nest Wall

Nest Number	Depth	Thickness of Nest Wall
26	2.75"	.875"
4	1.75	.375
5	2.25	.5
7	2.25	.625
11	2.	.875
12	2.	1.
13	2.	1.
14	1.75	.875
17	1.75	1.5
18	2.	1.5
19	2.	.75
22	2.	.875
24	2.	1.125
30	2.	1.375
32	2.5	.5
34	2.	1.
35	2.	1.
36	2.	1.125
41	2.	.875
45	2.	.875
46	2.	.75
47	2.	1.125
49	2.	.875
50	2.	1.
51	1.75	1.
55	1.75	1.
57	2.	1.125
Mean	2.02"	.94"

The correlation coefficient of the above measurements is -.3087.

Correlation Table XXXIII

Eastern Robin (Turdus migratorius migratorius)

The Depth With the Outside Diameter of the Nest

Nest Number	Depth	Outside Diameter of Nest
26	2.75"	5.5"
4	1.75	4.75
5	2.25	5.25
7	2.25	5.25
11	2.	5.
12	2.	5.5
13	2.	5.
14	1.75	5.
17	1.75	6.
18	2.	6.
19	2.	5.25
22	2.	5.
24	2.	5.5
30	2.	6.
32	2.5	5.
34	2.	5.5
35	2.	5.5
36	2.	5.75
41	2.	5.
45	2.	5.5
46	2.	5.
47	2.	6.
49	2.	5.5
50	2.	5.
51	1.75	5.75
55	1.75	5.25
57	2.	5.75
Mean	2.02"	5.39"

The correlation coefficient of the above measurements is -.0787.

Correlation Table XXXIV

Eastern Robin (Turdus migratorius migratorius)

The Depth With the Inside Diameter of the Nest

Nest Number	Depth	Inside Diameter of Nest
26	2.75"	3.75"
4	1.75	3.5
5	2.25	4.25
7	2.25	4.
11	2.	3.5
12	2.	3.5
13	2.	3.
14	1.75	3.5
17	1.75	3.
18	2.	3.
19	2.	3.75
22	2.	3.5
24	2.	3.25
30	2.	3.25
32	2.5	4.
34	2.	3.5
35	2.	3.5
36	2.	3.5
41	2.	3.5
45	2.	3.57
46	2.	3.5
47	2.	3.75
49	2.	3.75
50	2.	3.
51	1.75	3.75
55	1.75	3.25
57	2.	3.5
Mean	2.02"	3.52"

The correlation coefficient of the above measurements is .4806.

Eastern Robin (Turdus migratorius migratorius)

Nest Structure

The base and outer portion of the nest is usually made of some coarse material such as sticks, bark, string and some of the more common weeds. Most nests seemed to be considerably influenced by the nesting material that was available or ground cover plus man made material. In one instance the base, or outside layer, was made of cotton, a large white rag and bark from a grapevine. The second basket, or middle layer, was made of mud and coarse material, mainly grasses. The last part, or inner layer, was made of fine grass.

The writer at one time supplied many colors of yarn for a pair of Eastern Robins while they were constructing the nest. The colors supplied were red, white, black and blue. The white colored yarn was the first taken by both birds and there seemed to be no choice of the other four colors. The yarn was used in the base and mud layers of the nest. Many of the yarn strands could be seen after the nest was completed. Obviously, the above illustration shows that this pair of Robins used fabrics put out by man for nesting material.

Location of Nests

Most of the nests observed were placed in a crotch near the trunk of a tree or shrub. The distance above the ground varied from two to thirty-five feet. The mean was slightly over seven feet. There seemed to be a tendency for the nests to be placed higher above the ground as the nesting season went on. This was due to a general shifting of nesting from the small evergreens to the taller deciduous trees.

The tree that was used most often for a nesting site was the Norway Pine (Pinus resinosa) with a total of twelve times out of a possible thirty. The evergreen trees were used eighteen times and the deciduous twelve. This is possibly due to the predominance of the evergreen trees and shrubs on the areas observed.

Nests With Young and Eggs

Twenty-nine nests of the Eastern Robin were observed, of which eight had young birds in them when they were located and twenty-one had eggs. The eight nests had a total of twenty-one birds, of which fifteen or 71.43% got safely on the wing and six, or 28.57% were taken by some unknown factor from the nest. The average young from the eight nests that got safely on the wing was 2.625. Twenty-one nests had a total of sixty-five eggs or an average of 3.09 eggs per nest

with a range from one to four eggs per clutch. The two clutches that had only one egg each might have been disturbed by some factor previous to the observations. Thirteen of the nests had three eggs in a clutch and six had four. It appears that the Eastern Robin lays less eggs per clutch as the seasonal nesting comes to a close. Twenty-one nests had a total of sixty-five eggs, of which seven,or 10.77%, did not hatch, eight,or 12.31%,produced young that were taken by some factor from the nest, thirty-one, or 47.69%, produced young that got safely on the wing, eleven, or 16.92%, of the eggs were taken by some factor from the nest, six, or 9.23%, produced young birds that were questionable as to whether or not they got safely on the wing, and two, or 3.07%, produced young that died in the nest.

In the twenty-nine nests that were observed it is pretty certain that forty-six young got safely on the wing which is an average of 1.58 birds per nest. The six young that were questionable would possibly raise this number and per cent somewhat. Considering that this is at the end of the seasonal nesting the writer concludes that 1.58 young per nest is rather high. Most of the adults certainly were responsible for other young at an earlier date in the nesting season because the Eastern Robin nests very early in the spring.

Most of the young left the nest in ten to twelve days after hatching. The size of the brood did not have any influence on the time required for development.

One nest was found to be heavily infested with ants. The writer placed a few drops of Black-leaf 40 in the nest and found that no ants were present the following day. It was not to be seen that this treatment had any influence on the activities of the adult birds.

Table XXXV

Eastern Field Sparrow (Spizella pusilla pusilla)

Types of Vegetation Used For Nesting Sites

Nest No.	Vegetation	Distance Above Ground
1934		
11	Timothy (Phleum pratense)	None
21	" " "	"
23	" " "	"
30	Black Raspberry (Rhus occidentalis)	1 Foot
31	Hawthorne (Crataegus Sp.)	1 "
70	Slippery Elm (Ulmus fulva)	3 Feet
1935		
15	Wild Black Cherry (Prunus serotinal)	1 Foot
17	White Pine (Pinus strobus)	⅛ "
23	Hawthorne (Crataegus Sp.)	1 "
24	" " "	1½ Feet
28	" " "	1 Foot
38	" " "	1⅛ Feet
39	" " "	1 Foot
40	Norway Pine (Pinus resinosa)	1 "
45	Hawthorne (Crataegus Sp.)	1 "
51	" " "	1 "
4-S	Norway Spruce (Picea Abies)	1 "
1936		
No #	Hawthorne (Crataegus Sp.)	1 "
1937		
6	Spirea alba	⅛ "
9	Cedar Sp. (Juniperus Sp.)	1½ Feet
54	Timothy (Phleum pratense)	⅛ Foot
86	Common Apple (Malus pumila)	1 "
87	Norway Spruce (Picea Abies)	¼ "
97	" " " "	1 "
98	Common Elder (Sambucus canadensis)	1⅛ Feet
102	Norway Pine (Pinus resinosa)	3 Feet
104	Wild Black Cherry (Prunus serotina)	⅛ Foot
105	Norway Spruce (Picea Abies)	⅛ "
111	Hawthorne (Crataegus Sp.)	2 Feet
	Mean	1.026 Feet

Table XXXVI

Eastern Field Sparrow (Spizella pusilla pusilla)

The Number of Eggs per Clutch and Egg Fatality

Nest Number	Eggs per Clutch	Egg Fatality
1934		
11	5	5
21	3	
23	4	4
30	3	3
31	3	
70	3	3
1935		
15	4	4
24	3	
38	3	
40	3	3
45	3	3
1936		
No #	2 2 Cowbird eggs	
1937		
86	4	
97	3	
98	5	
102	3	
104	3	
111	3	
	58	25
	3.2	3.57

Table XXXVII

Eastern Field Sparrow (Spizella pusilla pusilla)

Success of Nesting From Eggs

1. Nest Number and year.
2. The number of young birds that got safely on the wing.
3. The number of young birds that were questionable as to whether they got safely on the wing.
4. The number of young birds that were left in the nest when this work came to a close.
5. The number of young birds that were taken by some factor from the nest.
6. The number of eggs that were left in the nest when this work came to a close.
7. The number of eggs that contained dead birds.
8. Total of the first six columns.
9. Miscellaneous.

1	2	3	4	5	6	7	8	9
1934								
21	2						2	1*
31	1						1	2*
1935								
24	3						3	
38	3						3	
1936								
No#	2						2	
1937								
86				4			4	
97	3						3	
98	3						3	
102				3			3	
104				2			2	1*
111					3		3	
	17			9	3		29	4

* Infertile eggs.

Table XXXVIII

Eastern Field Sparrow (Spizella pusilla pusilla)

Success of Nesting From Young Birds

1. Nest number and year.
2. The number of young birds that were in the nest when it was located.
3. The number of young birds that were taken by some factor from the nest.
4. The number of young birds that gor safely on the wing.
5. The number of young birds that were questionable as to whether they got safely on the wing.
6. Number of young birds that died in the nest.
7. Infertile eggs located in nests with young birds.

1	2	3	4	5	6	7
1935						
17	3		3			
23	3		3			
28	3		3			1
39	2		2			1
51	3	3				
4-S	3	3				
1937						
6	4		4			
9	4			1	3	
54	3			3		1
87	4	4				
105	4		4			
	36	10	19	4	3	3

Eastern Field Sparrow (Spizella pusilla pusilla)

Nest Structure and Location In Various Types of Vegetation

The nest structure varies considerably depending upon the material that is available in the nesting site. Most nests contained a considerable quantity of grass and usually some hair. Two were found that were so poorly made that the eggs fell through the center and on to the ground. The ones that were located in timothy were placed on the ground and mostly made of this grass with a little hair on the inside lining. Nests that were placed in shrubs a foot or more above the ground usually contained fine weeds of various types. As a whole this species of bird does not construct a very good nest.

The nests ranged in height from no distance above the ground to three feet although most of them were slightly over one foot. They were placed near the main stem and supported by many small twigs underneath. Most of them did not have a very smooth base.

The hawthorne was selected ten times for a nesting site in the twenty-nine nests that were studied. This was possibly due to the many small hawthorne shrubs distributed over the areas. Timothy ranked second with four nests placed in it. The deciduous trees and

shrubs and the herbaceous plants were used twenty-one times as compared to eight times for the evergreen trees and shrubs.

Nesting

The study covers twenty-nine nests that were located over the four year period of which number eighteen or 62.15% had eggs and eleven or 37.95% had young birds. The number of eggs per clutch varied from two to five with the greater number having three. The nest that had only two eggs also had two cowbird eggs indicating that the Eastern Field Sparrow is also a victim of such parasitism. Of fifty-eight eggs that were observed through the period of development, twenty-five or 43.15% were destroyed by some factor before hatching. Of the other thirty-three eggs, or 56.9%, four eggs, or 12.1% were infertile, seventeen or 51.5% produced young that got safely on the wing, nine or 27.2% of the young were taken from the nest by some factor and three or 9.1% of the young were left in the nest when this work came to a close.

There were eleven nests with thirty-six young that were in various stages of development when they were observed for the first time. In these nests a total of thirty-six young birds were studied of which ten or 27.7% were taken by some factor from the nest, nineteen or 52.8% got safely on the wing, four or 11.1%

were questionable as to whether or not they got safely on the wing, and three or 8.3% died in the nest. The crops of the three that died in the nest were empty indicating that they had starved to death. The adult birds possibly left the nest because of the red ants that were present in great numbers.

Three infertile eggs were also found in the nests that had young. In all nests a total of seven infertile eggs were found which seems rather high.

The adult bird spends considerable time on the nest while the young are developing. It takes about eight to ten days for most young to leave the nest. These young are then cared for by the adults in the surroundings of the nesting site. In checking nests for information it was important to leave the young in the nest after the third day. If handled the young would often leave the nest beginning with the fourth day of their development. When this occurred it was naturally more difficult for the adults to take care of the young.

Many factors were involved in the taking of young birds from nests and eggs as indicated by the nests. In two cases shell remains were left but in all others the eggs and young were taken out leaving no trace as to what had taken place. Most all of the young and eggs were removed from the top but in two nests a hole

was made from underneath. This may have been due to the thin nest base thus making it possible for a ground predator to see the eggs.

Table XXXIX

Eastern Mourning Dove (Zenaidura macroura carolinensis)

Nesting Vegetation and Distance Above the Ground

Nest No.	Vegetation	Distance Above Ground
1935		
6	Black Willow (Salix nigra)	13 feet
18	Black Willow (Salix nigra)	9
19	Black Oak (Quercus velutina)	16
3-S	Norway Spruce (Picea Abies)	6.5
1937		
3	Norway Spruce (Picea Abies)	3.5
10	Austrian Pine (Pinus Sp.)	3
15	Norway Pine (Pinus resinosa)	7
16	Norway Pine (Pinus resinosa)	4
20	Black Oak (Quescus velutina)	12
23	Norway Spruce (Picea Abies)	4
25	Norway Spruce (Picea Abies)	3
27	Black Willow (Salix nigra)	7.5
29	Norway Pine (Pinus resinosa)	4
31	Scotch Pine (Pinus sylvestris)	3
43	Norway Spruce (Picea Abies)	3
44	Norway Spruce (Picea Abies)	4
56	Norway Pine (Pinus resinosa)	4
69	Norway Pine (Pinus resinosa)	4
	Mean	6.14 Feet

Table XL

Eastern Mourning Dove (Zenaidura macroura carolinensis)

The Number of Eggs Per Clutch and Egg Fatality

Nest Number	Eggs Per Clutch	Egg Fatality
1935		
18	2	2
3-S	2	
1937		
3	2	
10	2	
15	2	
16	2	
23	2	2
25	2	1
27	2	
29	2	
31	2	
43	2	2
44	2	2
56	2	2
69	2	
Mean	2	11

Table XLI

Eastern Mourning Dove (Zenaidura macroura carolinensis)

Success of Nesting From Eggs

1. Nest number and year.
2. The number of birds that got safely on the wing.
3. The number of young birds that were taken by some factor from the nest.
4. The number of eggs that contained dead birds.
5. Totals
6. Miscellaneous.

1	2	3	4	5	6
1935					
3-S	2			2	
1937					
3	2			2	
10	2			2	
15	2			2	
23		1		1	
25	1			1	1 Infertile egg.
27		1		1	1 Infertile egg.
29			2	2	
31		2		2	
69		2		2	
	9	6	2	17	2

Table XLII

Eastern Mourning Dove (Zenaidura macroura carolinensis)

Success of Nesting From Young Birds

1. Nest number and year.
2. Number of young birds that were in the nest when it was located.
3. The number of birds that got safely on the wing.

1.	2.	3.
1935		
6	2	2
19	2	2
1937		
20	2	2
	6	6

Eastern Mourning Dove (Zenaidura macroura carolinensis)

Nest Structure and Location In Various Types of Vegetation

The nest is usually a very flat structure and made of rather coarse material. Eight of the eighteen nests had sticks as a base and then grass was mixed with roots in the upper parts. Those that were placed in evergreen trees contained mostly needles using weeds to hold the structure together. The most common weed found in nests was the cinquefoil possibly due to the abundance of this plant on most of the areas studied. One nest was made almost entirely of oak leaves. It was located in an oak and the bird used the nesting material that was nearest at hand.

The nests ranged in height from three to sixteen feet. The nests in oak trees were the greatest distance above the ground. The average height of all nests was slightly over six feet. The evergreen trees which were more numerous in the area were young plantings and this possibly accounts for the nearness of nests to the ground. Twelve of the eighteen nests were in evergreen trees as compared to six in the deciduous. The evergreen tree is probably selected more often as a nesting site in these areas because of the abundance in numbers. Too, it usually provides

a better base for the flat nest structure and also conceals the nesting bird from intruders. Most nests were placed near the main trunk on a horizontal branch. Five were within two feet of the main trunk.

Nesting

The study covers eighteen nests of which four were located in 1935 and fourteen in 1937. The difference in the number located in the two years is due to the areas. There was a much heavier concentration of Eastern Mourning Doves on the W. K. Kellogg Bird Sanctuary than on the W. K. Kellogg Reforestation Tract. The new plantings and protection promoted the great numbers of nesting birds in the Sanctuary area.

The Eastern Mourning Dove had two eggs in fifteen nests making a total of thirty. Two eggs seems to be normal clutch of this species. Of the above thirty eggs, eleven, or 36.6%, were taken by some unknown factor from the nest. In no case was there any trace left to suggest the factor involved in the taking of eggs from the nest. There were two or 6.6% of the eggs infertile; two or 6.6% contained dead young birds. These young were almost completly developed when the adults deserted the nest. Six or 20% of the young were taken by some factor during development in the nest. In one case it may have been that the large number of carpenter ants killed

the young bird. Nine or 30% got safely on the wing.

Three nests were located with young. Each had two young and all got safely on the wing. This makes a total of fifteen young that got safely on the wing from nests that had eggs and those with young when they were first observed. Assuming that the normal clutch has two eggs a possible of fifteen young for thirty-six eggs is fairly high. Since the Eastern Mourning Dove nests more than once a year this species is more than holding its own on the two areas.

In observing the nests from day to day it was found that one of the adults is always on the nest during the early stages of growth. The young leave the nest from the twelfth to the fifteenth day. Young that were fifteen days old could always fly very well.

Table XLIII

Mississippi Song Sparrow (Melospiza melodia beata)

Nesting Vegetation and Distance Above the Ground

Nest No.	Vegetation	Distance Above Ground
1934		
2	June grass (Poa pratensis)	.5 Feet
26	In an old roll of wire.	2.
28	Red Cedar (Juniperus virginiana)	3.
1935		
7	Red Cedar (Juniperus virginiana)	2.
32	Nine-bark (Physocarpus opulifolius)	2.5
49	Norway Spruce (Picea Abies)	2.5
53	Hawthorne (Crataegus Sp.)	2.
1936		
No.#	Prickly Ash (Zanthozylum americanum)	1.
1937		
2	Norway Spruce (Picea Abies)	2.
64	Red Current (Ribes vulgare)	.5
67	Norway Pine (Pinus resinosa)	6.
110	White Pine (Pinus strobus)	2.
115	Norway Spruce (Picea Abies)	2.
	Mean	2.15

Table XLIV

Mississippi Song Sparrow (Melospiza melodia beata)

The Number of Eggs Per Clutch and Egg Fatality		
Nest Number	Eggs Per Clutch	Egg Fatality
1934		
2	5	
26	4	
1935		
7	2	2
32	3	1
53	4	
1936		
No.#	5	
1937		
2	3 1 Cowbird	
67	4	
110	4	
115	3	
Mean	3.7	3

Table XLV

Mississippi Song Sparrow (Melospiza melosia beata)

Success of Nesting From Eggs

1. The nest number and year.
2. The number of young birds that got safely on the wing.
3. The number that were questionable as to whether or not they got safely on the wing.
4. The number of young birds that were taken by some factor.
5. The number of eggs that were taken by some factor.
6. The number of young birds that were killed by some factor in the nest.
7. Totals.
8. Miscellaneous.

1	2	3	4	5	6	7	8	
1934								
2			5			5		
26			4			4		
1935								
7				2		2		
32			2	1		3		
53	4					4		
1936								
No.#					4	4	1	Infertile egg.
1937								
2	3					3	1	Cowbird egg.
67	4					4		
110		4				4		
115		2				2	1	Infertile egg.
	11	6	11	3	4	35	3	

Mississippi Song Sparrow (Melospiza melodia beata)

Nest Structure and Location In Various Types of Vegetation

The base of the nest is made of coarse grass and is rather bulky in appearance. Towards the upper part, finer grass and hair is used to complete the nest. Some few contained various types of weed material but the greater number were made of coarse and fine grasses with a few hairs. The hair was rather long indicating that it was from the tails of cattle or the manes and tails of horses. It seemed as if there was no choice of any particular color.

The nest is usually placed on a horizontal branch and fairly well concealed. In one case the nest was located in a roll of old wire that was surrounded by rather high weeds of various types. There seemed to be no particular preference for any certain type of vegetation. Six of the thirteen nests were in evergreen as compared to seven in other types. The nests were very well distributed over the areas. The Mississippi Song Sparrow is well distributed over most areas.

The nest that was one-half foot above the ground was located in June grass (Poa pratensis). The highest

was in a Norway Pine at a distance of six feet and at a place where the nest was very well concealed from enemies. The average height was slightly over two feet indicating that birds of this species prefer rather low nesting types of vegetation.

Nesting

During the four years of study thirteen nests were located in various stages of development. Ten had eggs in them and three had young birds when the study began on the various nests. Ten nests had a total of thirty-seven eggs and one had a cowbird egg. In one of the nests that contained young birds, a cowbird egg was also found making a total of two in all nests of this species. The cowbird possibly laid its eggs in the nests of the Mississippi Song Sparrow because of its wide distribution.

Of the thirty-seven eggs, only six, or 16.2%, were destroyed by some unknown factors; three, or 8.1%, were destroyed by outside factors during the incubation period. This is rather low as compared to other species studied thus far. Of the thirty-seven eggs, eleven, or 29.7%, hatched and placed young birds safely on the wing; eleven,or 29.7%, of the young were destroyed by some factor in the nest; three, or 8.1% of the eggs were taken by some factor before hatching; four, or 10.9%, of the young were

killed in the nest but the bodies were not removed indicating a new factor that had not been encountered at any other time during this study and two, or 5.4%, of the eggs were infertile.

There were eleven young birds in three nests of which eight got safely on the wing and three were taken from the nest by some unknown factor. These nests showed a high percentage of success on the wing which is possibly due to the smaller amount of time that the observer spent on them.

In the thirteen nests that were observed nineteen young birds got safely on the wing. This would be considered fairly high since this species has from two to three broods per year.

Table XLVI

Catbird (Dometella carolinensis)

Nesting Vegetation and Distance Above the Ground

Nest No.	Vegetation	Distance Above ground
1934		
18	Common Elder (Sambucus canadensis)	5 Feet
22	Slippery Elm (Ulmus fulva)	4
33	Common Elder (Sambucus canadensis)	3
37	Hazelnut (Corylus americana)	7
1935		
10	Common Elder (Sambucus canadensis)	4
22	Common Elder (Sambucus canadensis)	4
1937		
26	Norway Spruce (Picea Abies)	5.5
33	Arbor Vitae (Thuja occidentalis)	5.5
37	Common Elder (Sambucus canadensis)	5.5
38	Panicled Dogwood (Cornus canadidissima)	5
39	Common Elder (Sambucus canadensis)	4
93	Common Elder (Sambucus canadensis)	5
	Mean	4.37

Table XLVII

Catbird (Dometella carolinensis)

The Number of Eggs Per Clutch and Egg Fatality

Nest Number	Eggs Per Clutch	Egg Fatality
1934		
22	3	
33	3	
37	2	2
1935		
10	3	3
22	3	3
1937		
26	3	
33	4	
37	3	
38	3	
39	3	
	30	8
Mean	3	

Table XLVIII

Catbird (Dumetella carolinensis)

Success of Nests From Eggs

1. Nest number and year.
2. The number of birds that got safely on the wing.
3. The number of young birds that were taken by some factor from the nest.
4. The number of young that died during development.
5. Totals.

1	2	3	4	5
1934				
22	3			3
33	2		1	3
1937				
26	3			3
33	4			4
37			3	3
38		3		3
39	3			3
	15	3	4	22

Catbird (Dometella carolinensis)

Nest Structure and Location In Various Types of Vegetation

The nests were made of a variety of materials including small sticks, grapevine bark, several species of grass, oak leaves and many types of rootlets. The base is always built up of the coarser materials with finer in the middle layer and rootlets lining the inside of the nest underneath the eggs. The amount of rootlets varied from nest to nest but in no case was there an absence of this material. The nest is usually very flat and often the eggs and young have difficulty staying in it.

The catbird of these areas seemed to prefer the Common Elder (Sambucus canadensis) over all other vegetation for a nesting site. The shrub was selected seven out of a possible twelve times with all other species of vegetation being used only one time. The range in height varied from three to seven feet above the ground with an average of slightly over four feet. Nests were always placed where the trees and shrubs made for a very dense growth. In no case was a nest in the open and easy to see.

Nesting

The catbird was very successful in rearing its young on the areas that were studied. There were two nests with a total of seven young when they were first observed and all of these got safely on the wing. Of the thirty eggs that were in the nests, eight, or 26.6%, were destroyed during incubation by some unknown factor. This percentage is rather low and possibly due to the fact that the catbird keeps a very close watch over the nest. If an intruder comes near the nesting site the adult birds put up a fight. They also keep other birds out of the nesting area. Of the thirty eggs fifteen, or 68.1%, produced young birds that got safely on the wing. Most all of the young could fly on the eleventh to the thirteenth day. In two nests the young got out of the nest on the eighth day but could not fly. These young birds rested on the branches in the vegetation until the wing feathers developed sufficiently to make flight possible. Three, or 13.6%, of the young were taken from the nest by some unknown factor, which was rather low in comparison to other species studied. Four,or 18.2%, of the young died in or near the nest. One died shortly after hatching and three fell out of the nest on a very windy day. Their death was possibly due to shock and low tempera-

tures that prevailed during their stay on the ground.

From the twelve nests that were observed it is fairly certain that twenty-two young got safely on the wing. Since the species usually nests two times per year, and, in some instances, three, it is more than holding its own in the areas that were observed during this study.

Table XLIX

Eastern Chipping Sparrow (Spizella passerina passerina)

Types of Vegetation Used For Nesting Sites

Nest No.	Vegetation	Distance Above Ground
1934		
55	White Oak (Quescus alba)	7 Feet
1935		
12	White Oak (Quescus alba)	5
2-S	Norway Spruce (Picea Abies)	2
1937		
28	Austrian Pine (Pinus Sp.)	8
48	Norway Spruce (Picea Abies)	5
52	Norway Pine (Pinus resinosa)	4
53	Norway Spruce (Picea Abies)	8
58	Red Cedar (Juniperus virginiana)	4
60	Red Cedar (Juniperus virginiana)	4
62	Arbor Vitae (Thuja occidentalis)	8
63	Norway Spruce (Picea Abies)	5.5
66	Norway Pine (Pinus resinosa)	6
	Mean	5.54

Table L

Eastern Chipping Sparrow (Spizella passerina passerina)

The Number of Eggs Per Clutch and Egg Fatality

Nest Number	Eggs Per Clutch	Egg Fatality
1935		
12	4	
2-S	3 and 1 Cowbird	
1937		
48	3	1
52	3	
58	3 and 2 Cowbird	
60	3	
63	3 and 1 Cowbird	3
	21 4	4
Mean	3	

Table LI

Eastern Chipping Sparrow (Spizella passerina passerina)

Success of Nesting

1. Nest number.
2. Nests with eggs when located.
3. Nests with young when located.
4. Number of young that left the nest before being well feathered.
5. Number of young that got safely on the wing.
6. Number of eggs that were destroyed by some factor in the nest.
7. Number of cowbird eggs in various nests.
8. Number of infertile eggs.

1	2	3	4	5	6	7	8
1934							
55		3	3				
1935							
12	4		3				1
2-S	3		1	2		1	
1937							
28		2		2		1	
48	3		2		1		
52	3			3			
53		3		3			
58	3		3			2	
60	3			3			
62		3	3				
63	3				3	1	
66		4	4			1	
	22	15	19	13	4	6	1

Eastern Chipping Sparrow (Spizella passerina passerina)

Nesting

The nest of the Eastern Chipping Sparrow is made of grass, weeds, rootlets and hair. It is fairly well constructed and in no instance did the observer notice that the young did not develop in a normal way because of a frail nest. The nest is round and rather deep which gives good protection to the eggs and young.

It seems as if this species prefers evergreen trees and shrubs for the placing of the nest. Out of twelve nests ten were in evergreen and two in deciduous vegetation. Most nests were well concealed against enemies.

In the nests that were observed seven had a total of twenty-two eggs and five had fifteen young birds. The normal clutch of eggs seems to be three, although one nest had four. Of the twenty-two eggs four, or 18.1%, were destroyed in the nest. The low mortality of eggs is possibly due to the nest being well concealed in most cases. Four or 33 1/3 % of the nests had cowbird eggs in them. One was the usual number, however, one nest had two such eggs. All cowbird eggs were taken out to see if others would be placed in the same nests. In no case was this true. The

cowbird possibly places its eggs in the nest of the sparrow during the time that the sparrow is laying its clutch which time covers a period of three days. One egg is laid each day and the incubation begins as soon as the first egg is laid. The last egg of the clutch hatches in less time than the first. The hatching of all the eggs in a clutch very seldom exceeds two days at the end of the incubation period.

The young sparrows grow very rapidly and after the fifth day many will leave the nest if disturbed. These young usually perch on a nearby branch and are fed by the adults. If the young stay in the nest ten days they are well feathered and ready to fly for a short distance. In a total of thirty-two young, nineteen or 59.3%, left the nest before they could fly and the other thirteen took wing. Nineteen young were over five days old when they left the nest. It is fairly certain that there would be a rather high per cent of young getting successfully on the wing. From the foregoing study it is fairly certain that this species was on the increase in the areas.

Alder Flycatcher (Empidonax trilli trilli)

The Alder Flycatcher was found nesting over the areas studied in rather limited numbers. They nested in the thickets along the shores of Wintergreen Lake and the low surrounding swales. Nine nests were

observed during the three year period with the greatest number of five in 1934 and two in each of the succeeding years 1935 and 1937. The Common Elder (Sambucus canadensis) was used six times as a nesting site, Gray Dogwood (Cornus amomum) two and the Hawthorne (Crataegus Sp.) only once. Some of the nests were well concealed while others were in plain site of all enemies. In two instances the surrounding vegetation was removed in order to expose the nest. The height ranged from seven feet in the Hawthorne to four in the Common Elder. The average was slightly over five feet.

In the four nests that had twelve young when first observed, nine or 75% got safely on the wing and three or 25% were taken by some unknown factor. The broods ranged in number from one to four with the single young possibly not considered normal. The size of the brood of young did not seem to have any bearing on the time required to develop and get safely on the wing. The adults spend very little time on the nest after the eggs hatched. In the case of the single bird the adults were never seen around the nest until the young gave a danger cry while being handled by the observer. Positive identification was not made of this young until the adult birds were seen. The nesting material, site, etc., did not give sufficient

clues for positive identification without seeing the adult birds.

In the five nests there was a total of nineteen eggs with four having four eggs each and the other three. Seven eggs, or 36.8%, were taken from the nest by some unknown factor; three, or 15.7%, got safely on the wing; one, or 5.2%, of the eggs were infertile; four, or 21.1%, left the nest before they were ready to fly and four, or 21.1%, of the young were left in the nest when this work came to a close.

From the foregoing observations it is certain that from the nine nesting pairs of adult birds thirteen young got safely on the wing. There are indications that from the four young that were in the nest when the work came to a close and four others that left the nest early, a certain number got safely on the wing. There were not enough young produced to give any increase in the number of this species on the area.

Eastern Kingbird (Tyrannus tyrannus)

In 1934 two nests of the Eastern Kingbird were observed. They were located in a Common Elder (Sambucus canadensis) and Black Ash (Fraxinus nigra) at a distance of four and twelve feet above the ground. Three young got safely on the wing from the nest in

the Black Ash tree. The other nest had three eggs in which one young got safely on the wing, one left the nest before being fully developed and one egg did not hatch. The nest was not securely fastened and as a result fell on the ground. The observer put it back in place and the adults took care of the one young until it was large enough to fly. This is one case where assistance was given in repairing the nest and the adult did not leave it.

In 1935 five nests were located of which two were in a White Oak (Quescus alba) and one each in the Osage Orange (Maclura pomifera), Hawthorne (Crataegus Sp.) and Common Apple (Malus pumila). They ranged in height from seven and one-half to thirty-five feet with an average of eighteen and one-half feet. The five nests had a total of nine young with four having two young each and the fifth one. These nine young all got safely on the wing.

In 1936 only one nest was located but a very thorough study was made of it. It was discovered by the observer while the adults were carrying food to the young. The nest was located on a horizontal branch about fifteen feet above the ground. The Hawthorne was so dense that it was not possible for the observer to check on the nest in the beginning. It was a known fact that there were young because

the adults were carrying food. By the number of times that the adults took food to the nest the observer drew the conclusion that there must be a large brood of young. Between July second and the eighth no young were seen. On the ninth of July three young were seen on the edge of the nest. The following day the fourth young was seen.

On July tenth the adults carried food to the nest twelve times over a period of thirty minutes. At no time did any one of the young get two feedings in succession. The observer could see this because the young were resting on nearby branches and nest. The young birds were far enough apart so that they might be observed accurately. On July eleventh the young were fed twenty-two times in forty-five minutes. At no time was any young bird given more than one feeding at a time. The following day the young were fed twelve times during thirty minutes. This again carried out the idea that the young are fed about the same number of times by the adults. It would have been rather interesting to have known which of the adults did the most feeding--the male or female. Since the male and female are alike in this species, it is not possible to make observations of this fact.

The thirteenth of July the young were all in a nearby tree and waiting for food from the adults.

The following day the observer made them all move in order to see how well the young birds could fly. All could fly fairly well for a short distance. These young were seen on the plot on July 27th for the last time. At that time they were still being fed by the adults. This shows that the young birds are not able to take care of themselves as far as food is concerned upon leaving the nest. One characteristic of the Eastern Kingbird is that he takes his food on the wing and this would be difficult for the immature bird.

It was rather interesting to watch the adults guard the nest against crows. Many crows would make their way to the woodlot each evening. Everytime that a crow would try to go directly over the nest both adults would go after it and follow for some distance. It seemed as though most of the crows knew this because they would usually make their way to the woodlot quite a distance from the nesting site. Baltimore Orioles (Icterus galbula) were often seen feeding in the same tree where this nest was located but at no time did the Eastern Kingbird interfere with the feeding. Many Mississippi Song Sparrows were also seen in the tree and no trouble was caused by their presence.

It was rather interesting to note that all nests produced young birds that got safely on the wing. One reason for this success is possibly due to the

fact that the Eastern Kingbird is an excellent fighter and never permits enemies to get near the nesting site. One adult is always on the watch for intruders.

A total of seventeen young got safely on the wing from the eight nests. Considering that this species nests only once each year, they are no more than holding their own on the areas studied.

Eastern Henslow Sparrow
(Passerherbulus henslowi susurrans)

The Eastern Henslow Sparrow was scattered over the lowland area of the W. K. Kellogg Reforestation Tract. Individual birds of this species could be seen clinging to the upper grass stems and giving the note "flee-sic" for long periods of time. Unless the male was disturbed he would sometimes keep this up for hours at a time while the female was concealed in the tall grass.

The nests were very difficult to locate but over the period of three years, six were found. Most of these were located by the observer as he walked rather slowly over the area and happened to flush a female from the nest. An extensive dragging of wire with weights attached was tried out but did not produce any clues for new nests. In the year 1934 many possible nesting areas were spotted but it was impossible

to find the nests by watching the movements of the adult birds.

Over the period of three years, six nests were located on the ground in clumps of timothy. This species seemed to prefer timothy over all other grasses in this area. The nests were all in the middle of a large clump and made of fine blade material. No other nesting material was found in any of the nests.

All of the nests were located early enough to get the number of eggs in the various clutches. There were five clutches with four eggs each and one with five. Of the twenty-five eggs twelve, or 48%, were destroyed by some unknown factor in the nest; one, or 4%, were infertile; nine, or 36%, produced young that got safely on the wing; and three, or 12%, of the young were destroyed in the nest during the period of development.

The adults spend very little time near the nest after the young have hatched. The adult birds did not come near when the young were giving danger cries as they were banded.

Cedar Waxwing (Bombycilla cedrorum)

The Cedar Waxwing is one of our late nesting species. The first nest of this species was found on July 25th, 1935, and the other four the latter part of July and the first of August. The distance above

the ground ranged from six to thirty-five feet with the average of eighteen which is several feet higher than any of the other species studied thus far. The nest is rather large and must be placed in a crotch of a fair sized tree to hold it securely. The Apple tree was used two times as a nesting site, the Black Oak, Black Willow and Blue Beech all one time. The nest in the Black Willow was on a horizontal branch while all others were in crotches.

The nest is built of a number of different kinds of material. In the base, coarse sticks and grass are used. Towards the middle many kinds of grasses, weeds, bark-strips, rootlets and, in one instance, paper. The lining may contain wool and always some hairs. Most of the hairs that were found in the five nests were black. It is questionable as to whether any choice is made in color.

Of the five nests three had four eggs each, one three and one other showed no development. It was possibly due to the large number of Starlings that came to rest in this willow tree. All nests were disrupted and did not show normal development. One with four eggs had one taken out on a certain day, and two others two days later. After that the nest was deserted with the remaining one egg. A nest of four eggs hatched on the twelfth day after the last one was laid. These four young were destroyed by

some unknown factor. In another nest of three eggs, one was taken out by some factor, one was infertile and the third hatched. The young was left in the nest when this work came to a close. The last nest of four eggs had two removed without leaving any remains, one had shell remains and the last had a young that died in the shell after the adults deserted the nest.

There seemed to be a number of adult birds in the areas studied but from their nesting study they were not successful. There is only a slight possibility that one got on the wing.

Eastern Meadowlark (Sturnella magna magna)

The Eastern Meadowlark is a bird of the open fields. It was seen in great numbers on the areas but the observer was only able to locate five nests over the three year period. The dragging of parts of the area with a long wire and attached weights gave no results. Many times an adult bird was flushed from the grass and all indications pointed to a nesting site but no nest could be found. It has been observed that the adult creeps along the ground in order to lead the intruder away from the nest before taking to wing. The five nests that were found were located by the observer as he parted the grass with a staff and flushed the adult from the nest at close range.

The five nests were all located on the ground in thick grass. They were in a mixture of Kentucky Blue Grass (Poa pratensis) and Timothy (Phleum pratense) and the remaining two in a pure stand of Kentucky Blue Grass. The nests were all well arched over by the surrounding grass and a tunnel of from one to three feet leading to it. Four had their entrances from the east while the other was from the north side.

Four nests had sixteen eggs in them and all but three were destroyed before hatching. These three young were also destroyed by some unknown factor. In one nest shell remains were left and in another many feathers of the adult bird indicating that there had been a struggle. There were five birds in another nest that left immediately when the first observation was made. The young were well feathered but could not fly. From the foregoing study we might conclude that this ground nesting species is not very successful in rearing its young in these areas.

Eastern Red-wing
(Agelaius phoeniceus phoenicoeus)

There were a number of adults and young of this species on the W. K. Kellogg Bird Sanctuary area but very few on the other two tracts. Since the work started the latter part of June very little information could be secured on the nesting of the Eastern

Red-wing. The nesting takes place much earlier in the spring. The three nests that were located were possibly constructed by adults that had failed to nest successfully the first time or it could have been a second nesting.

The nests were all in vegetation above water which is very characteristic of this species. One was in a Black Willow (Salix nigra) and the other two in the Common Elder (Sambucus canadensis) at a distance of five feet above the water level. As a rule it is very difficult to get to these nests because of the muck of the swamps which makes wading very difficult. The best way is by boat if the vegetation is not too dense.

Two nests had a total of five young that got safely on the wing and the other had three eggs that hatched and these also took wing. The young all left the nest on the sixth and seventh day but remained in the vegetation for two more days. By the end of the ninth day all young could fly for a short distance. The adults keep close watch over the young while they are developing. If an intruder comes near the entire colony will become very noisy.

Judging from the few nests that were observed and the presence of great numbers of this species it is certain that the success in nesting was very high.

Eastern Phoebe (Sayorius phoebe)

The three nests were all located in a barn on the W. K. Kellogg Reforestation Tract that was not being used. Two were on a horizontal sill eight feet above the ground and the other on a post at a height of seven feet. The nests were well constructed of various types of plant fibers, wool, mud and moss. There were other old nests in the same barn indicating that this species had nested there for some time.

The female was always found on the nest during the incubation period and during the early days of development of the young. One nest had five eggs in it when it was first located. Four of these eggs hatched and the young all got safely on the wing. The one egg was found to be infertile after the young left the nest. The young all flew out of the barn when the last observation was made. A second nest had one egg but there was no further development. It was possibly abandoned before the first observation. The third nest had three eggs that hatched and all got safely on the wing. During the development the nest and young were moved for a series of pictures. After the photographs were taken the nest and young were put in the original place and all the young remained until they were able to fly.

This species was fairly successful in rearing

its young. The man-made shelter was probably responsible for at least a part of this success.

Eastern Yellow Warbler (Dendroica aestiva aestiva)

The nest that was located in 1934 was in a small willow shrub (Salix Bebbiana) at a distance of three feet above the ground. There were three eggs that some unknown factor removed before they hatched. The second nest was located in a Buttonbush (Cephalanthus occidentalis). It was four feet above the ground and within two feet of the top of the shrub. The nest was made of plant fiber and feathers. It was rather heavily lined with feathers. The female was incubating four eggs at the time the nest was located. The nest and eggs were finally taken by some factor. This was the first time that the observer had ever encountered an enemy that took the eggs as well as the nest. No young of this species got safely from the above two nests and no other young were seen on the areas.

Barn Swallow (Hirundo erythrogasta)

The Barn Swallow nested under a concrete bridge that carried a lot of traffic. There was also a rather deep hole which was filled with water underneath the bridge. The two nests were attached to

the underside of the large iron beams. It was almost impossible for the observer to check the nests. A mirror was attached to the end of a stick and held above the nest. By this method it was possible to watch the development.

The nests were made of yellow clay, hair and lined with small feathers. The feathers were all white which was possibly due to the fact that a large flock of white chickens were in a lot nearby.

One nest had four young and the other five, of which two died in the latter nest. The cause of death is unknown because each seemed to show normal development. The remaining seven were banded when they were fully feathered and all left the nest.

Red-eyed Towhee
(Pipilo erythrophthalmus erythrophthalmus)

There were a few pairs of Red-eyed Towhees scattered over the areas. One nest was located in a Gray Dogwood at a distance of three feet above the ground. The two eggs were taken by some factor and the nest was then taken over by a colony of red ants. There were no shell remains indicating that the red ants had destroyed the eggs. The second was in a Hawthorne at a distance of two feet above the ground. It was placed on a horizontal branch and against the main

trunk. The three eggs hatched and all of the young got safely on the wing. The females were always on the nest of these two pairs when a check was made during the incubation period. At no time did the males ever take any part in the incubating or resting duties.

Northern Flicker (Colaples auratus lateus)

The nest was located in an old dead tree at a distance of fifteen feet above the ground. The movement of the adults led to the discovery of this nest. The adults were carrying insects to the three young. All the young left the nest before they were able to fly but possibly got safely on the wing because the adults were seen feeding them two days later. All three young were in a Hawthorne that was near the old dead tree. These young had fallen down in the branches and managed to stay there.

Not many Northern Flickers were nesting in the areas. This was probably due to the lack of proper nesting sites.

Eastern Bluebird (Sialia sialia sialia)

The Eastern Bluebird nest was located in a hollow fence post four feet above the ground. The hole had to be cut larger in order to get any information on the nest. It was made of grass and lined with hair

and feathers. There was only one young which would not be considered a normal brood. After the hole had been cut larger the adults would not go near for some time. The female finally came down on the wire fence and slowly made her way to the hole in the post. The young bird left the nest the following day but was not able to fly.

Very few Eastern Bluebirds were seen in the areas which was also possibly due to the lack of nesting sites. There were very few old trees and most of the fences had been taken down with only a few posts remaining.

Maryland Yellow-throat
(Geothbypus trichas trichas)

The Maryland Yellow-throat nest was located on the ground in the lowland. There were two eggs of the species and two Cowbird eggs. All were left in the nest in order to check on incubation time on both species. The Cowbird eggs hatched in the morning and the Maryland Yellow-throats in the afternoon. The young Cowbirds were removed because the observer was more interested in the development of the Maryland Yellow-throats. The young were banded when they were eight days old. They soon left the nest but were not able to fly.

Banding seems to disturb young birds unless it is done at a very early date or when they are completely feathered and ready to fly.

Northern Crested Flycatcher
(Myiarchus crinitus boreus)

One nest of this species was observed in 1934. It was located in a hollow branch of an Elm tree at a distance of twenty-five feet above the ground. The young were two feet in from the end of the hollow branch. This nesting site was discovered by the observer watching the adults carrying food to the young. The four young left the nest on July 11th. All flew for some distance before resting on the branches of a tree. This would be considered a successful brood of young.

Eastern Vesper Sparrow
(Pooecetes gramineus gramineus)

The Eastern Vesper Sparrow nest was on the ground in an open space of a hillside near a clump of Shrubby Cinquefoil (Potentilla fruticosa). The three eggs were destroyed by some unknown factor while incubating. The adult was on the nest each time a check was made over a period of six days. Not many birds of this species were seen on the areas.

Starling (Sturnus vulgaris vulgaris)

The adults were carrying food to the young in a wild Black Cherry Tree when this nesting site was first observed. The young seemed to be well feathered. The following day these birds left the nest and no count was ever made of the number in the nest. There were a number of Starlings flocking on the W. K. Kellogg Reforestation Tract while this study was being carried on.

Eastern Cardinal
(Richmondena cardinalis cardinalis)

The Eastern Cardinal had built its nest in a Hawthorne about three and one-half feet above the ground. The structure was made of Oak leaves and bindweeds. The clutch contained three eggs. Two of the eggs hatched and then these young and the remaining egg were destroyed by some enemy. Both adults were seen near the nesting site but the female did all of the incubating.

Killdeer (Oxycchus vociferus)

The Killdeer nest was located on a bare hillside in a depression that was filled with pebbles. The eggs were on the pebbles and rather difficult to see. It was discovered when the observer saw

the adult leave the nest and put on the broken wing act. Some factor took the four eggs.

Eastern Warbling Vireo
(Viroesylva gilva gilva)

The Eastern Warbling Vireo nest was in a Scotch Pine. It was on a horizontal branch and about three feet away from the main trunk. The nest was made of grass on the outside and lined with feathers. This nest finally blew out during a heavy wind storm and was carried about fifty feet away from the tree. No young could be located near it. The young were possibly killed because they were not far enough along to care for themselves. This, like many other nests of this species, did not stand adverse weather conditions.

Black-billed Cuckoo
(Coccyzus erythrophthalmus)

The Black-billed Cuckoo was discovered as the observer was passing the nesting site. The adult bird left the nest and then gave many rattling notes near the nesting site. The adult would stay on the nest until the observer would come within two feet of it before the bird would leave. The two young developed very fast. As soon as they developed fright both left the nest. One was out a day sooner

than the other but both possibly stayed in the nearby vegetation until developed to the point where they could take to the wing. The adult was seen in the nesting site for many days giving warning notes indicating that the young were still being taken care of after leaving the nest.

Eastern Bob-white
(Colinus virginians virginians)

The Eastern Bob-white nested under a large clump of Burdock (Arctium Lappa) in some fine Kentucky Bluegrass. The nest was on the ground and well sheltered by overhanging blades of grass and Burdock. There was a total of ten eggs in the clutch. These were laid over a period of days and never more than one egg per day. The last observation was made on August 17th when the work for 1934 came to a close. The observer could touch the female on the nest before she would leave. She never took to the wing but always ran into the nearby grass when being disturbed at the nest. There were only five pairs of this species seen on the plots over the four years of study.

Indigo Bunting (Passerina cyanea)

The nest of the Indigo Bunting was located in the lowland on the bank of Augusta Creek. It was in a Red-osier Dogwood, two feet above the ground

and surrounded by weeds, grasses and sedges. The nest was made entirely of grasses. The female was incubating the three eggs when it was first observed. Three young hatched and left the nest on the sixth day. They were not ready to fly but possibly got safely on the wing after being cared for by the adults in the nearby grasses. As is very typical of this species the male was seen in a nearby tree each day as the observer came near the nesting site.

Ring-necked Pheasant
(Phasianus colchicus torquatus)

The Ring-necked Pheasant nest was located as the observer was walking over the plot near a small Hawthorne shrub. This nest was on the ground and lined with a little grass, leaves and feathers. The female was incubating eleven eggs when it was first discovered. This adult bird stayed on the nest until the observer touched her with a short stick. She did not prepare to take flight but took wing suddenly. The female was always facing east or west on the nest in order to fit her body. Observations were made from July sixth until the twelfth when the eggs hatched. The female was on the nest every time that an observation was made with the exception of the tenth, eleventh and twelfth. On these days the female did not occupy the nest in the early part of the evening but came later.

From this clutch of eggs one would conclude that the percentage of fertile eggs in the Ring-necked Pheasant runs rather high. Three other females were seen on the plot with fifteen, seven and eight young. This might also lead one to believe that fertility is rather high and also that adults are fairly successful in rearing their young.

Conclusions

From the standpoint of scientific importance it seems to me that an extensive research on a certain species would have greater value than getting a little information on many species. It takes much data in order to see trends for valid conclusions.

There should be studies going on in widely separated areas under different conditions in order to make some comparisons in nesting conditions. Thus the success and failure could be more accurately determined for one species of bird.

It would be rather interesting to go over the areas after a lapse of ten years and see what has taken place in the various species of birds if the cover had greatly changed.

The value that I received from these studies is that it has opened to me a field of lasting interest that I (as a public school biology teacher) can give to my students. The application of biological principles are always coming up in the classroom.

Summary

There was considerable summer nesting in the areas studied.

The working with the nests of most species does no harm.

The extent of nesting in an area is influenced by a change in the cover.

The size of the nest varies greatly from species to species and within a certain species.

Nesting materials are more or less determined by local conditions.

Ground nesting species are not as successful in rearing their young as the ones nesting in trees and shrubs.

It is almost impossible to get information on predators of eggs and young.

There is no correlation between nest sizes and the success of young on the wing.

There are infertile eggs in the nests of most species.

The number of species are greatly increased by man-made sanctuaries.

The female incubates the eggs. She is fed by the male.

After the young were three days old the female spent very little time on the nest.

The nests are well protected against rain and wind by the female while on the nest.

Waste accumilates in the nest and may cause the young to have many parasites.

Many young leave the nests before they are able to fly very well.

Temperature and rainfall are both important factors in determining the nesting time of the Eastern Goldfinch.

The Eastern Robin was willing to use colored yarn in its nest.

The size of the brood of the Eastern Robin has no bearing on the time required for development.

Cowbirds lay their eggs mostly in the nests of sparrows.

Birds such as the Eastern Kingbird that guard the nest very closely are rather successful in rearing their young.

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