

REPRODUCTION IN ENGLISH SPARROWS¹

BY RICHARD LEE WEAVER

INTRODUCTION

BARROWS (1889) indicated that the English Sparrow (*Passer domesticus*) nested somewhere in the United States in every month of the year. The Barrows report on the status of the English Sparrow was based on some field work by its author but primarily upon the reports from observers located within the range of the species at that time, which was east of the Mississippi River. Many of these records were sent in by untrained observers, including many postmasters who received the questionnaires. As has been experienced by this writer, dates of nesting of this species gathered by means of questionnaires are apt to indicate the carrying of nesting materials rather than definite egg records. Certainly the data obtained by a two-year study at Ithaca, New York, and by summarizing the citations in standard regional references, do not bear out the early assumption contained in the Barrows report. As Stone (1937) points out, "Even this familiar bird would seem to warrant further study."

SEASON OF NESTING

In an earlier statement I showed (1939a) that the season of nesting in Ithaca, New York, was from the first week of April to the beginning of September. This seems to be the average for most of the country, but as one would expect, dates in Florida and other parts of the South may be a few weeks earlier, while those in Canada in the northern limits of the range may be a few weeks later. One definite record from Florida made by Dr. Joseph Howell seems to bear this out as he found a set of eggs as early as March 2. The earliest Canadian records reported in answer to a survey made by letter were: Saunders, April 20; and Snyder, April 24, which I reported previously (1939b).

At Hanover, New Hampshire, I found that the season of nesting began about two weeks after it did in Ithaca. The Hanover Inn, which contains many suitable nesting sites, was inspected on May 9, 1939 and 1940. Nine nests were occupied in 1939; two of these contained young which were three days old. Twelve nests were occupied in 1940 of which two contained young. The oldest nestling was four

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days old while the remaining three in the same nest were three days old and those in the other nest were still younger. If twelve days are allowed for incubation and three days for egg laying, the first egg was deposited April 26 or 27.

One outstanding example of winter breeding, where the eggs and young were actually observed, has been recorded by Dr. Clarence Cottam for Utah (1929). He found a nest with five eggs hatching January 1, 1929, and observed the brood to leave the nest successfully eighteen days later. This is very unusual for this species despite the many alleged records for the species.

Forbush (1929) gives the extremes for nesting in Massachusetts as April to August and this is repeated by Bagg and Eliot (1937) for the western part of the State. This is much more nearly accurate than Minot's (1895) statement for New England that "they begin to build their nests even in winter." Stone (1937) observed birds carrying nesting materials at Cape May, March 18, but did not see flocks of young until June 30. Others including the writer have witnessed the carrying of nesting materials during most of the months of the year (1939b). This seems to be where so many people err in reporting the nesting time for this species. Bailey (1913) says for Virginia: "In favorable localities one may find nests with either eggs or young seven months out of the twelve." Wayne (1910) says for South Carolina, "the breeding season is a long one, beginning in March and ending in September, the 21st of the latter month being my latest date." Roberts (1936) states that "nesting begins in Minnesota as soon as weather conditions will permit, usually in March or early April, and continues throughout the summer and early fall." They were observed carrying nesting materials at St. Paul in December and February (Thompson), and Roberts adds, "it is not probable that eggs would be laid at that season in this country." Nice (1931) gives the following records for Oklahoma: "Nesting: Tulsa—eggs April 10—June 5 (E. Palmer); latest broods of small young August 21, 1930 (Mrs. A. E. Gilmore); Norman—young a week old found March 20 and August 21, 1930; adults carrying nesting materials from November—August (Nice); Kenton—nests from March till November (R. C. Tate)." Dawson (1923) gives the season for California as "March to September." Grinnell and Wythe (1927) restrict it to "March to August" for the San Francisco Bay region.

Niethammer (1937) gives the season for egg laying in Germany as "more by exception in March, for the most part from the first to the middle of April, throughout the summer till about the end of

August." Witherby (1938) says the breeding season in England "usually begins in May and as two or three broods are usually reared fresh eggs may be found till July or August, also exceptionally in almost every month."

RANGE OF THE SPECIES

Although I have previously discussed (1939a) what is known of the present northern range of this species, I wish to record two additional items of information which have been brought to my attention by Dr. Harrison F. Lewis. Baie Comeau, Saguenay County, Quebec, is probably one of the stations on the eastern periphery of the range in Canada. It is located on the north shore of the St. Lawrence estuary in latitude 49° 14' north, longitude 68° 9' west. Dr. Lewis found two males here on May 28-29, 1940. The birds remained in each other's company and did not appear to be attached to any restricted territories. Dr. Lewis likewise states that he has not found the birds at any point east of Baie Comeau on the north shore of the St. Lawrence estuary and gulf. There is no certainty that the species is permanently established or will succeed in establishing itself permanently at this place.

Dr. Lewis also reports that the station at Moose Factory, Ontario, which has been visited by English Sparrows at various times, no longer supports the species. He visited Moose Factory September 15-23 and October 5-6, 1940, with Harold S. Peters. They did not see any English Sparrows here or at any other place in the James Bay region.

BROODS RAISED IN ONE SEASON

Since one individual nest may be used by three or more different females in one season, the actual number of broods raised by one female in a season is questionable. Two banded females are known to have raised but two complete broods in one season while one nest site is known to have been used four times with three successful broods. Therefore, it is suspected that the large number of broods claimed by some writers may refer to clutches per nest site rather than broods per female.

Knight (1908) says "the number of broods reared in Maine in a season varies but is always at least two and in some instances certainly as many as five." Grinnell and Wythe (1927) report that "two and even three broods are reared each year" in the San Francisco Bay region. Howell (1924) states for Alabama, "three or more broods are reared in each season" and repeats the statement for Florida (1932).

Barrows (1889) says for Michigan: "Two broods at least are reared in a season and usually three, while instances of four and five have been reported by competent observers." The statements by Saunders and Clarke (1927) and by Witherby (1938) about the bird in England—"three broods are frequently reared in one season"—closely parallels the more conservative and general estimates for the United States. Niethammer (1937) says about the same for Germany, however,—“yearly brood number is apparently regularly three, sometimes said to be four, but with specimens not yet two years old perhaps there are even only two.” He also comments pertinently, “often the broods follow one another in quick succession, however, it is not thoroughly cleared up how often matings for a single brood or for a year or lasting even longer, occur.”

CLUTCHES PER NEST SITE

In the area studied at Ithaca, New York, during 1937, fifty-two nest sites were occupied. Observations were made weekly on all sites and in many instances daily checks were made. Twenty-six of these sites produced one clutch each, while sixteen sites produced two, six produced three, and four produced four clutches; none contained more than four during the season. However, in the four instances where four clutches were laid, the first sets were interrupted and the females deserted their eggs. An average of 1.68 clutches per nest site was maintained disregarding the four interrupted nests.

NUMBER OF EGGS IN THE CLUTCHES

The number of eggs laid by English Sparrows has been listed in regional references as follows: Forbush (1929), four to nine eggs; Roberts (1936), four to eight eggs; Pearson (1936), four to seven eggs; Wayne (1910), four to six eggs, five being the rule, while six are rare; Bailey (1913), four to six eggs is a full set with us; Chapman (1929), four to seven eggs; Knight (1908), four to nine eggs, generally five or six; Howell (1924 and 1932), four to seven eggs, for both Alabama and Florida; Saunders and Clarke (1927) (England), five to six eggs; Dawson (1923), four to six eggs; and Eaton (1914), six to eight eggs. Witherby (1938), (England), eggs three to five, occasionally six or even seven; eight also recorded. Niethammer (1937) (Germany), usually five or six, seldom four or seven, only exceptionally eight.

At Ithaca, New York, in the 1937 study, thirty-eight sets were selected from the total number of clutches under observation as being

free from disturbance which would affect the normal production. Only one of the thirty-eight sets had six eggs and none was ever found to have more. Twenty-seven sets had five eggs each, nine sets had four eggs and one set had but three. The average for the thirty-eight sets was 4.73 eggs per set.

In the two cases where marked females laid a second set of eggs, the same number of eggs was laid each time. A comparison of the numbers of eggs in the first half of the season with those in the latter half does not show the expected smaller number of eggs per set. In the nest sites having three or four broods, one had two sets of five eggs followed by three sets of four, one had two sets of five followed by one set of four and then finished with a set of six eggs. Another site had two sets of four eggs followed by two sets of five eggs. A fourth site had two sets of four eggs followed by two sets of five. Two others had three sets of five eggs, while still another showed this sequence: one of four eggs, one of six, and a last one of five. One site had three sets of four eggs.

It was apparent that the same females did not lay continuously in the same nest site. Some birds laying near the end of the season might have been laying for the first time. One would expect the later sets to be smaller only if the females were laying a second, third, or even fourth time. Although the general comparison as indicated in the above nest sites tends to disprove a decrease in productivity, more extensive banding and following of nesting females will be necessary before a final decision can be reached.

DESCRIPTION OF THE EGGS

Forbush (1929) presents the following description of the eggs of English Sparrows: "Ovate, dull, grayish white, spotted and speckled with reddish brown or dark brown and gray but color variable." Some eggs tend to be greenish brown. The color varies so greatly in different sets of eggs that it would be hard to give a briefer description than that of Forbush. But Niethammer (1937) gives a further account as follows: "Eggs—very variable with basic color almost pure white, greenish or bluish, less often green-gray or brownish. Marks limited to a few gray or brown dots, usually consisting of closely packed, clouded or sharply limited spots, which vary from deep black-brown through all tone ranges to bright ashy gray and can crowd in toward the blunt end (of egg), however, without forming a genuine wreath structure. Usually the last egg is abnormally colored; basic color brighter, spotting more pronounced and not so frequent. Like-

wise the next to the last egg has a darker basic color and very dense marking." The range of variation can be shown photographically from a pure white or gray to a very dark and speckled brown or a greenish brown.

Within the sets the eggs are rather homogeneous in color, size, and markings. If the eggs have a light background with contrasting spots in the pattern, each egg will generally conform and if mixed with others can usually be identified. In one instance where two types of eggs were found in one nest, it was discovered that two females were laying eggs in the same nest. Occasionally the last eggs laid are slightly lighter due to a little less pigment.

SIZE OF THE EGGS

Measurements of twelve sets of eggs were taken. There were fifty-four eggs. The greatest length recorded was 25.0 mm. and the greatest width was 16.8 mm. The smallest length was 20.2 mm. and the smallest width was 14.5 mm. The average length for the fifty-four eggs was 22.78 mm. and the average width was 15.41 mm.

The individual variation of the eggs in a set was remarkably small. The longer eggs were usually not as wide as the shorter ones, although this was not always true. Unusually small eggs, such as the ones found often in Chipping Sparrow nests, were never encountered.

The measurements in Table I were made on the different sets of eggs.

John C. Phillips (1919) reports on a lecture given by Bumpus (Biology Lecture, 1898) in which he showed, "that of 1736 sparrow eggs, one half English and one half American, the American eggs had become shorter and more spherical and much more variable in color and pattern—concluding that the American eggs had been subject to a slightly and perhaps less selective environment." He also says: "The English Sparrow has changed very little in outward appearance and gross measurement during his sojourn in America."

Saunders and Clarke (1927) give the egg size of British birds as 23.0 mm. by 15.0 mm., which is not much different from the average of 22.78 by 15.41 mm. for the eggs measured in this study. Witherby (1938) gives the average size for 100 British eggs as 22.51 mm. by 15.65 mm. with maxima of 25.3 x 15 and 23.5 x 16.5 and minima of 19.7 x 15.5 and 22.5 x 14.5 mm. Niethammer (1937) gives the average as 22.2 mm. by 15.6 mm. for 100 Saxony eggs.

Chapman (1929) records the egg size for Eastern North America as 1.86 by 0.62 inches, which is obviously a mistake and should be 0.86 x 0.62 inches which would be 21.8 mm. by 15.7 mm. Forbush

TABLE 1

<i>Family</i>	<i>No. of eggs</i>	<i>Length</i>	<i>Width</i>	<i>Average</i>
BS2Lb	4	24.0 mm. 24.5 22.5 24.0	16.0 mm. 16.0 16.0 15.5	23.75 x 15.87
BS2Lc	6	23.0 24.0 24.0 25.0 24.0 23.5	15.5 15.0 16.0 16.5 16.0 16.0	23.91 x 14.83
B1b	6	22.3 22.5 21.5 22.0 21.9 22.4	15.0 15.0 15.5 15.0 15.0 15.1	22.1 x 15.1
B4b	5	21.5 22.0 21.8 21.9 21.5	15.3 15.5 15.5 15.5 15.4	21.7 x 15.0
B5b	5	22.0 22.3 22.7 22.7 23.3	16.8 16.7 16.0 16.5 15.8	22.58 x 16.36
B7a	5	23.2 22.5 22.4 22.8 23.2	15.7 15.5 16.0 15.8 16.0	22.82 x 15.8
B16	4	21.4 20.4 22.0 21.0	15.4 14.5 15.5 15.2	21.4 x 15.15
NE1	5	22.8 23.5 23.5 23.7 23.0	15.5 15.6 15.6 15.5 15.3	23.1 x 15.5

TABLE 1—*Continued*

<i>Family</i>	<i>No. of eggs</i>	<i>Length</i>	<i>Width</i>	<i>Average</i>
Sm1a	4	24.5 mm. 22.2 24.0 25.0	16.5 mm. 16.5 16.5 16.0	23.92 x 14.9
Sm1c	2	23.6 23.6	16.7 16.0	23.6 x 16.35
SL4a	5	23.0 22.0 23.0 23.0 23.0	16.0 15.5 16.0 16.5 15.3	23.8 x 16.1
SL4c	3	22.3 20.2 22.5	15.7 15.0 15.3	21.68 x 15.5
			General average	22.78 x 15.41

(1929) sets minima of 21.3 mm. for length and 15.2 mm. for width, and maxima of 22.8 mm. for length and 15.7 mm. for width. Roberts (1936) gives the measurements as 22.3 by 15.2 mm. An average of these measurements is 22.3 by 15.4 mm. and is approximately the average of the present study, as well as that for the British birds. These figures differ widely however, from those given by Bailey (1913) 21.5 by 20.0 mm. and by Wayne (1910) 21.8 by 18.2 mm., both of which must not represent very many measurements.

LOSS OF WEIGHT IN THE EGGS

The loss of weight in the eggs during incubation was recorded for nine nests. The greatest per cent of loss of weight recorded can be

TABLE 2

<i>Family</i>	<i>No. of eggs</i>	<i>No. of days</i>	<i>Initial wgt.</i>	<i>Final wgt.</i>	<i>Grams lost</i>	<i>Grams lost/egg</i>	<i>Total %loss</i>	<i>%loss per day</i>	<i>Wgt. lost/day/set</i>
BS2Ra	5	2-10	14.15	12.5	1.65	.33	11.6	.8	.206
BS2Lb	6	2-10	18.25	17	1.25	.20	6.8	1.5	.153
BS3La	3	1-12	9.8	8.5	1.3	.43	13.3	1.3	.18
BN1La	2	1-10	5.45	4.9	.6	.3	10	.9	.06
R1W	5	1-9	14.25	12.3	1.9	.38	13.6	1.5	.21
B1a	5	1-8	13.5	12.4	1.1	.24	8.9	1.4	.13
R2W	5	5-11	13.18	12	1.18	.23	9	1.5	.19
K1W	5	1-6	13.4	11.6	1.8	.36	14.9	1.8	.3
TNW1	5	1-9	11.8	10.7	1.1	.22	9.4	1.4	.12

seen in Family K1W in Table 2 below. It was a loss of 14.9% for five eggs for a period of six days. The lowest loss of weight recorded occurred in Family BS2LB which was 6.8% for six eggs over an eight day period. An average for all of the families of the weight lost per egg per day was 1.34% or 10.8% per family per day.

Table 2 shows the data of nine nests used including the loss recorded, the time involved and the average loss.

INCUBATION

Only the female incubates the eggs. The male was never observed to sit on the eggs and no brood spot was found on that sex. Females were either caught or flushed from the nest in numerous instances. The female was also observed to leave the nest in the morning and to be the last or only one to enter it during the day. The male did not usually enter the nest but was seen to bring some nest lining materials to it several times after incubation began. Witherby (1938) says: "Incubation begins on completion of the clutch and chiefly by hen but males take turns." Niethammer (1937) says: "Brooding begins after last egg and both sexes sit and change places with fair regularity [Groebbels, Beiträge Fortpflanzung Biologie (1932)]." It might be easy to misinterpret the presence of the male at or even in the nest during incubation with actual incubation. Even though the bird might enter the nest, I do not think that it ever assists the female in incubating.

The females observed spent most of their time during incubation on the eggs. They left for rather short periods to obtain food. The males were never observed bringing them any food. In fact they were very little in evidence during most of this period and it was rather difficult to determine which males belonged to the various nests. This apparent lack of interest changed immediately when the young hatched.

The exact time that incubation began was difficult to determine, but by continuous examination of many nests and by deduction it was decided that it must have begun with the laying of the third egg in most cases. The eggs were found to be cold until that time except during the period from six to ten o'clock in the morning when the females entered the nest to deposit the egg for the day. During the first three days, however, the females often did enter the nest at night, but it is questionable whether effective incubation took place. In most cases the first three young hatched at about the same time. Jourdain (1938) believed that incubation began upon the completion

of the set and that the period extended twelve to thirteen or fourteen days. From the evidence which I obtained, I think that his statement will have to be qualified.

By using the two definite dates, the time when the first egg was laid and the time when the first young hatched, and then deducting the three days when no or little incubation took place, the incubation period was determined. The time between the laying of the last egg and the time when the last young hatched was also useful in checking the length of the incubation period.

Twenty-two nests were selected for determining the incubation period. Fifteen days were required on the average from the laying of the first egg to the hatching of the first young. Thus when the three initial days of egg laying are subtracted, the incubation period becomes twelve days. The minimum incubating time was ten days and the maximum was sixteen days, but it is possible that incubation may have started before or after the laying of the third egg. Three of the twenty-two sets required thirteen days, nine required twelve days, one required eleven days, and three sets required ten days.

Very little has been said about the incubation period of this bird in the literature. Forbush (1929) gives the period as thirteen to fourteen days and Roberts (1936) cites Forbush, while Dawson (1923) omits it entirely. Very few of the people contacted by letter could give me any information about it. Saunders and Clarke (1927) give the period for British birds as twelve to fourteen days, corresponding to Witherby's statement (1938) of twelve or thirteen to fourteen days and with Niethammer (1937) who gives it as thirteen to fourteen days. Knight (1908) makes this statement for Maine: "Incubation—fourteen days in the early part of the season and only twelve days in the summer." I have no evidence to support this statement.

HATCHING

A clicking sound usually announces the readiness of the young to start hatching. It is made by contact of the egg tooth with the shell and possibly also by a clicking together of the mandibles. The egg tooth presses against the shell and makes an upraised crease around the larger end of the egg about one-fourth the way from the end. The young bird may break the shell with the egg tooth before the crease is noticeable. In either case, a slit now appears, starting at a point where the egg tooth first pushed through the shell. The slit is made in a circular direction around the egg and meets the point where it started. The young is able to turn itself or its

head in the egg making a complete circular slit possible. The head is located in the larger end of the egg and as the slit nears completion the piece of shell around the head is broken off and the head is freed. The larger piece of shell is now kicked free and the young forces itself out. The feet are crowded into the depressions on either side of the neck while in the shell, and after hatching they have a tendency to remain doubled up for several hours. Often the shell does not come free from the young immediately and the female will help to remove it, and when so doing may often carry the young and the shell out of the nest causing early death to the unfortunate young.

Since the first two or three eggs laid are incubated about the same length of time, they often hatch at about the same time. The others usually follow within twelve to twenty-four hours and never require more than forty-eight hours. Two or three days are required, therefore, for a set of eggs to hatch completely.

The following list of families required these times to hatch, counting from the pipping of the first egg to the hatching of the last egg:

TABLE 3

<i>Family:</i>	4 young	30 hours	<i>Family:</i>	5 young	24 hours
BS1R	3 "	24 "	R2W	2 "	24 "
BN1Lb	4 "	36 "	TNW1	3 "	30 "
B1a	4 "	24 "	N2W	4 "	24 "
B1b	5 "	48 "	S1W	3 "	24 "
B6	3 "	24 "	SL5	5 "	48 "
B14	4 "	48 "			
	3 "	24 "			
	5 "	48 "			

The percentage of hatching varied from 0% to 100%. In the majority of cases all of the eggs hatched. In one case a female laid two sets of eggs, all of which were infertile, probably due to the lack of synchronization in the oestrous cycles of the male and female. In one or two instances the young broke the shell but were unable to force their way out and died before hatching. Infertile eggs were recorded in only six of the sets out of the 91 examined in the two-year period.

SUMMARY

1. The season of nesting is from April to September for most of the United States but may start as early as March 2 in the South and may be delayed until near the first of May in parts of Canada and in Europe.

2. Two and possibly three broods are raised by one female although one nest site may be used as many as four times in one season.

3. Five eggs are laid in the majority of cases, with as many as nine recorded in the literature, but not more than six were recorded in this study. Four seems to be the minimum when nests are undisturbed.

4. Eggs vary considerably from one set to another but have great similarity in size, shape, and color pattern within the sets.

5. The eggs average 22.78 by 15.41 mm. in size, which compares very closely with the average given by Witherby for English birds and by Niethammer for German birds.

6. The average loss of weight per egg per day was 1.34%.

7. Incubation requires twelve days. The difficulty of determining exactly when incubation begins accounts for some of the variation in the records and in this study.

8. Two to three young hatch at about the same time and are followed by the remainder of the brood in one day or at the most two days.

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SPREAD OF THE STARLING AND ENGLISH SPARROW

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MY studies of the forty years of Bird-Lore (now Audubon Magazine) Christmas censuses have revealed much data on the spread and abundance of the Starling (*Sturnus vulgaris*), and it seems desirable to present some of the material in advance of a report covering the census studies as a whole.